2012

Sub: Rajya Sabha Provisional Admitted Question (Dy. No. S3153)

Climate smart agricultural strategies

- The results obtained from the simulation study of soybean cultivar JS 335 on the mitigatory option for reducing the negative impacts of increased temperature indicated that delaying the sowing dates to 1st week of July would be favorable for increased soybean yields in central Indian condition.
- In another study, out of the 10 cultivars of soybean tested for different sowing dates, cultivars like JS 335 and JS 9752 performed better than the other cultivars in terms of biomass and grain yield under late sowing condition. So, these types of cultivars can adapt themselves to late sowing condition very well due to delayed monsoon or drought situations.
- Strategies to save resources such as irrigation and N in the context of climate change: A simulation study was carried out to explore the possibility of efficient use of the resources such as irrigation water and N fertilizer for wheat crop in the context of climate change. Results revealed that in increased temperature scenarios, grain yield obtained from the application of 4 irrigations with 100 kg N ha^{-1} to wheat was at par with the yield obtained from 3 irrigations with 50 kg N ha^{-1}. Thus, it is suggested that in increased temperature scenarios where the crop growing period is reduced by a week or so, it is possible to save valuable and important inputs such fertilizer N and irrigation water applied to wheat.
- Under conservation agriculture experiment carried out at IISS Bhopal, it was found that retention of wheat residue coupled with reduced tillage increased soil moisture content during soybean growing season compared to the conventional practices. This further helps in withstanding the adverse effect of dry spell during crop growth/monsoon.

Sub: Rajya Sabha Provisional Admitted Question (Dy. No. U440).

The amount earmarked for scheduled caste special plan (SCSP) and Tribal Sub Plan (TSP): The information is as under:

Sr. No.	State	District	Budget Sanctioned	Expenditure
1	Gujarat	Anand	10.00	10.00
2	Andhra Pradesh	Hyderabad	12.20	12.19
3	Uttarakhand	Pantnagar	7.50	6.00
4	Madhya Pradesh	Chhindwara, Seoni, Jabalpur, Kundam block, Dindori, Mandla Shahdol	24.20	
5	Orissa	Puri, Khurda, Kandhamal, Kalahandi, Nayagarh, Bhubaneshwar	29.10	
6	Maharashtra	Akola	5.50	5.50
7	Bihar	Pusa	10.00	10.00
8	Tamil Nadu	Coimbatore	8.20	8.20
9	Assam	Jorhat	8.00	8.00
10	Jharkhand	Ranchi	14.7	
11	West Bengal	Mohanpur	5.00	5.00
12	Himachal Pradesh	Hamirpur, Bilaspur, Kinnor, Lahaspiti, Palampur	12.7	6.00
13	Kerala	Palakkad, Mallapuram	6.7	
14	Rajasthan	Udaipur, Banswada	6.7	
15	Chattishgarh	Mahasamund, Dhamtari, Durg	6.7	

(a) Whether Government has developed a comprehensive strategy for sustainable agriculture in an era of climate change

(b) If so, the details of the climate smart agriculture proposed by Government and

(c) Whether any of the climate smart agriculture strategies have been used to minimise the adverse impact of the 2012 drought

Sub: Rajya Sabha Starreed/Unstarred Dy. No. S4492 on 'Cultivable land becoming acidic'

a) **Whether Government is aware that around 1.3 million hectares of the total arable land in Karnataka has lower pH in the soil**

Detailed information about Karnataka state is not available in the institute however, literature says that there are moderately acidic soils that has pH more than 5.5 in most part of Karnataka (Table 1)

Table 1 acid soil regions (ASR) in India

State	**Area under acid soil (mha)**	**Percent area of the region**	**Area having pH less than 5.5**
Assam and the north eastern state	20.0	80	3.5
West Bengal	3.5	40	2.0
Erstwhile Bihar	5.2	33	0.4
Odisha	12.5	80	1.8
Madhya Pradesh	8.9	20	-
Andhra Pradesh	5.5	20	-
Tamil Nadu	2.6	20	-
Karnataka	**9.6**	**50**	-
Kerala	3.5	90	2.1
Maharashtra	3.1	10	0.3
Erstwhile Uttar Pradesh	2.9	10	-
Himachal Pradesh	5.0	90	0.1
Jammu and Kashmir	15.5	70	-

Source: Mandal (1975), Sarkar (2005)

b) **Whether Government also knows the fact that almost three lakh hectares of cultivable land has become acidic in coastal and hilly zones of Mangalore, Hassan, Bangaluru and Kolar districts**

Detailed information about the tehsil-wise area under acid soils is not available in the institute.

c) **If so, the statistical details thereof, district-wise**

NA

d) **The steps/preventive measures to safeguard the cultivable land form becoming acidic by Government?**

Infact soil acidity is one of the limiting factor affecting adversely crop production to a considerable extent mainly in high rainfall and light texture conditions. The degree of soil acidity varies depending upon the pH values of soils. Soils having pH in range of 5.6 to 6.0 are moderately acidic and below 5.5 are considered strongly acid. The management of acid soils aims at improving the production potential by addition of amendment to correct the acidity and manipulate the agricultural practices so as to obtain optimum crop yields under acid condition. One of the practices is to grow acid tolerant crops/ varieties and to supplement nutrients through suitable carriers. For example crops like rice, potato, aloe, millets, etc may be preferred. When the soil is highly acidicand where sensitive multi-crops are grown, application of lime is a desirable practice which is adopted. The actual amount of lime to be applied depends upon the soil pH values. It improves base saturation, availability of Ca and Mg along with other nutrients and minimize the fixation of P and Mo. The toxicity arising from excess soluble Al, Fe and Mn is also corrected and there by root growth is promoted and uptake of nutrients is improved. Liming also stimulates the microbial activity and encourage N_2 fixation and nitrogen mineralization, and hence, legumes are highly benefited from liming. When applied in high doses, much of the lime is lost by leaching from the top soil of light textured soils because of their low exchange capacity. Split application is thus recommended to minimise the leaching loss. Lime should preferably be applied in smaller doses more frequently (every alternate year) rather than in heavy dose one in three to four years. The lime requirement approximately ranges from 3.5 to 15 tonnes/ha. Lime application should be done smaller and split doses, preferably in furrows at the time of sowing. Application has to be done in every alternate year till the soil pH is brought to normal range.

Reply to Parliament question No.S5223 raised by Sh. RamJethmalani

Whether the problem of hunger of whole world can be addressed by development of agriculture through proper utilization of natural resources in agro-sector;

Reply: Yes, the food security and proper natural resource management in agriculture must go hand in hand in order to eradicate the hunger at national and global level. Nearly 870 million people still go hungry whereas nearly 1.3 billion people are living in extreme poverty at the world scale. Another global challenge is how food security and sustainable use of natural resources can be achieved, when the natural sources of food become scarcer and scarcer. This means we have to ensure sustainable food security under land, water, and energy stresses. Goal is a productive agriculture that conserves and sustains natural resources. It involves an ecosystem approach that ensures enrichment of soil organic matter, soil and water conservation, more efficient irrigation methods, insect pest management, appropriate external inputs at the right time and in the right amount, developing improved crop varieties that are resilient to climate change and use the nutrients, water and external inputs more efficiently.

Besides, "food" itself is a natural resource, which cannot be synthesized in a factory and thus need to be used still judiciously. So we must also change the way we eat and find ways to feed the world withoutwasting the food. We can do this by changing to healthier diets in the richer segments of our population and by diminishing the food loss and waste that exist in industrialized and developing countries, and that make us throw away 1.3 billion tonnes of food every year, between production and consumption.

(b) If so Government reaction thereto

Reply: In India these issues have been addressed through various centrally sponsored programmes, being implemented by Ministry of Agriculture, Ministry of Rural Development and Ministry of Environment & Forests. These programmes are namely, (i) National Watershed Development Project for Rainfed Areas (NWDPRA), (ii) Soil Conservation in the Catchments of River Valley Project & Flood Prone River (RVP & FPR), (iii) Reclamation & Development of Alkali & Acid Soil (RADAS), (iv) Watershed Development Project in Shifting Cultivation Areas (WDPSCA) (v) Drought Prone Area Programme (DPAP) (vii) Integrated Wasteland Development Programme (IWDP) and National Afforestation & Eco–Development Project (NAEP). Since inception upto Tenth Five Year Plan, an area of 50.89 million hectare of degraded land has been brought under cultivable lands (agri-horti system) with an expenditure of Rs.19251.22 crore. In addition to this, all states have their own departments of agriculture, Deptt of soil conservation, ATMAs, KVKs, SAUs, Deptt. of Horticulture etc, that are working on technology dissemination on efficient use of natural resources.

Besides, national agricultural research system (NARS) and National Rainfed Area Authority (NRAA) has been tirelessly working to address these issues.

c) Whether it is also a fact that the problems of availability of water and climate change have created crisis for agriculture sector

Reply: This is true that the problem of availability of water and climate change have created crisis for agriculture sector. The per capita availability of water in India has dropped from 5300 m^3 (1955) to 2200m^3 recently compare to world average of 7420 m^3 and Asian average of 3240 m^3 (Singh 2000). It is projected that by 2025, country's per capita availability of water may touch 1500 m^3 making the country water stressed considering the threshold value of less than1700 m^3.

At the same time, the demands for water from industrial, power and domestic sectors are emerging manifolds and competing with irrigation water. By 2050, demands for water from domestic and industrial sectors would increase by 3-4 times and for power by 7-8 times (Mohail, 2000) further worsening the situation. Climate change which perceive the increase in temperature of 1.8º to more than 5º C by 2100 under various climate scenarios. Consequently may increase demand for water. Therefore the multiple threats to water availability in agriculture sector have created crisis to production.

Global climatic changes can affect agriculture through their direct and indirect effects on the crops, soils, livestock and pests. An increase in atmospheric carbon dioxide level will have a fertilization effect on crops and thus will promote their growth and productivity but at the same time the increase in temperature, above current ambient temperature, can reduce crop production by 10-40% by the year 2100. Besides, the change in climate may increase crop respiration rates, alter photosynthate partitioning to economic products, affect the survival and distribution of pest populations, hasten nutrient mineralization in soils, decrease fertilizer-use efficiencies, and increase evapo-transpiration rate. Indirectly, there may be considerable effects on land use due to snow melt, availability of irrigation water, seasonal droughts and floods, soil organic matter transformations, soil erosion, changes in pest profiles, increase in submergence of coastal lands etc.

d) If so, the Governments reaction thereto

Recently, Indian Council of Agricultural Research (MoA) initiated several research progrmme for climate change impact, adaptation and mitigation in agriculture through different research programme such as National Initiative on Climate Resilient Agriculture (NICRA), National Agricultural Innovative Project (NAIP) andNational Agricultural Technology Project (NATP) to tackle this problem at national level; UNFCCC and IPCC at global level. This can be applied at different scales, viz., farm level, state/district level, and its valuable for practical decision-making processes by the policy makers for equitable and sustainable development

e) The proposal under consideration with the Government for proper utilization of natural resources during the twelfths Five Year Plan?

The important natural resources viz. soil and water in agriculture sector get research priority for future food security in India. During 12th fifth year plan several research programmes are under considerations for future research of ICAR, such as, precision farming, conservation agriculture, carbon sequestration, soil health cards etc.

Ref: F. No. 14 (79)/AE 2012

Sub: Provisional starred question No. 2817 – Loksabha

A) **The steps undertaken by the government to promote research and development in agriculture**

Indian Institute of Soil Science, Bhopal since inception, is actively engaged in research and development pertaining to the soil resources and their most efficient sustainable use. The mandate of the institute is "to provide scientific basis for enhancing and sustaining productivity of soil resource with minimal environmental degradation". Also, the Project Coordinating units of four AICRPs concerned with soil and nutrient management are placed at IISS, Bhopal, in order to strengthen its activities further in the national perspective and to enlarge its linkages with the national research system. The major focus of these AICRPs lies on:

Long-term effects of imbalanced fertilizers use on soil health and crop productivity, fertilizer prescription based on soil test values, delineation of micronutrient deficiency in different soils of the country and optimization of micronutrient use for various crops, and developing new innovative strains of microorganisms for bio-fertilization of crops.

B) **Whether there are various low cost innovations/new technologies development in the field of agriculture in the recent past.**

IISS, Bhopal has developed some farmers' friendly technologies that are also cost effective. These are:

Participatory INM (Integrated Nutrient Management) for soybean-wheat system
Mechanical Harvest Borne Residue Management
Soybean-based intercropping systems for sustainable productivity on deep
Vertisols of Madhya Pradesh
Conservation tillage for soybean-wheat cropping system on Vertisols of central India
Broad bed and furrow system for high productivity, improved drainage and in-situ moisture conservation
Recycling of distillery effluents in agriculture
Mixed consortium biofertilization
BGA biofertilizer for rice in eastern India
On-line soil fertility maps of different states and fertilizer recommendation system for targeted yields of crops
Enriched Compost Production

C) **The steps undertaken by the Government to increase awareness of such low cost innovation among farmenrs to increase their crop output;**

IISS, Bhopal disseminates the technologies to farmers through conduct of farmers' fair, demonstration in the farmers' field, providing training to farmers, conducting regional and national level workshops and collaboration with state department of agriculture, MP.

D) **The financial assistance provided by the Government to farmers to adopt the new technologies?**

NA

Hkkjrh; e`nk foKku laLFkku

¼Hkkjrh; d`f"k vuqla/kku ifj"kn½
uchckx cSjfl;k jksM] Hkksiky 038 462] e/;izns'k ¼Hkkjr½
Qksu% $91&755&2730946] 2730970] QSDl%
$91&755&2733310]

MkW- , lqCckjko **fnukad% 20@09@2012**

funs'kd

izfr]

mi egkfuns'kd ¼,u vkj ,e½
KAB&II iwlk dSEil
ubZ fnYyh&12

fo"k;%<u>e/;izns'k esa fofHkUu dsUnz izk;ksftr ;kstuk ds rgr vkcafVr jkf'k vkSj O;; dk fooj.k</u>

egksn;]

mijksDr fo"k; ij vkids i= dzekad 2050/VIP/AM fnukafdr 13@09@2012 ds lUnHkZ esa e/;izns'k esa fofHkUu dsUnz izk;ksftr ;kstuk ds vUrZxr vkoafVr jkf'k vkSj O;; dk fooj.k layXu gSA e/; izns'k esa tcyiqj gh ,d ek= lg lapkyu dsUnz gSA fofHkUu ifj;kstukvksa ls lacfU/kr tkudkjh fuEufyf[kr gSA

1- laLFkku }kjk fofHkUu vf[ky Hkkjrh; ifj;kstuk;sa tSls fd ,y Vh ,Q bZ] ,l Vh lh vkj] lw{e ,oa f}rh; iks"kd rRo vkSj tSo moZjd ij vf[ky Hkkjrh; usVodZ lapkfyr gSA
   nh?kZdkyhu moZjd ijh{k.k ijh;kstuk ¼I-,y Vh ,Q bZ½

2- e/; izns'k vkSj fofHkUu vf[ky Hkkjrh; ifj;kstukvksa ds vUrZxr dsUnz }kjk tkjh /ku ds O;; dk fooj.k rkfydk&1 esa izLrqr gSA

3- vuqla/kku {ks= vkSj fdlkuksa ds [ksrksa ij vuqla/kku dk;Z djus dk y{; Fkk vkSj nksuksa LFkkuksa ij lQyrkiwoZd y{; gkfly fd;k x;kA

4- ,y Vh Vh bZ ifj;kstuk ds vurZxr e-iz- ds rhu ftyksa ds fofHkUu fdlkuksa ds [ksrksa ij izn'kZu fd, x, ftlls dbZ fdlku ykHkkfUor gq,A blesa lu~ 2007&08 esa 5] 2008&09 esa 5] 2009&10 esa 10] 2010&11 esa 10 rFkk 2011&12 esa 10 fdlkuksa ds [ksrksa ij iz{ks= ijh{k.k fd, x,A lHkh LFkkuksa ij fdlkuksa dks cqykdj Qlyksa dh mit ij rduhdh dh e/;LFkrk ds izHkko dks fn[kk;k x;kA

5- fujad

6- dsUnz ds fy, vkoafVr /ku ds vuqlkj gj lky ys[kk ijh{kk mi;ksfxrk izek.k i= izkIr fd;k x;kA

,l Vh lh vkj

2- e/;izns'k esa fofHkUu vf[ky Hkkjrh; ifj;kstukvksa ds vUrZxr vkoafVr /ku vkSj mlds O;; dks rkfydk&1 esa fn;k x;k gSA

3- l;kt] vnjd vkSj pUnzklqj ds fy, moZjd uqD'kk lehdj.k fodflr djus dk y{; FkkA lks;kchu&xsagw¡ vkSj /kku&xsagw¡ Qly pdz iz.kkyh ds vUrZxr nh?kZdkyhu rd feV~Vh moZjrk ds j[k j[kko vkSj feV~Vh dh xq.koRrk ds fy, vuq'kalk nsus ds fy, Qksyks&vi Vªk;y fd, x,A blesa feV~Vh fVfid gSIywLVVZ dqy dh gkbijFkkfeZd eksUVeksfjYyksukbV FkhA /kku dh yf{kr mit ds vk/kkj ij /kku dh de y{; 3 Vu@gS- r; dh xbZ vkSj cxSj xkscj dh [kkn ds iz;ksx ds 3-37 Vu izfr gS- izkIr dh xbZA tcfd tks mPp y{; fu/kkZfjr fd;k x;k Fkk mls izkIr ugha fd;k tk ldkA ysfdu fu;a=.k vkSj lkekU; moZjd vuq'kalk dh rqyuk ls mit vFkkZiw.kZ :i ls dkQh vf/kd ikbZ xbZA xsagw¡ esa y{; 4-5 Vu@gS- dk fu/kkZfjr fd;k x;k vkSj fu;a=.k dh rqyuk ls 5 Vu@gS- xkscj dh [kkn ds iz;ksx ls vFkkZiw.kZ :i ls ik fy;k x;kA /kku ,oa xsagw¡ ds Hkwlk dh mit blh izdkj jghA vkfFkZd :i ls mPp y{; fu/kkZfjr djus ls vf/kdre ykHk izkIr gqvkA xsagw¡ ds fu/kkZfjr y{; 4-5&6-0 Vu@gS- dks vklkuh ls izkIr fd;k tk ldrk gSA /kku ds lEcU/k esa fu;a=.k vkSj lkekU; moZjd vuq'kalk dh rqyuk ls mPpre y{; }kjk vf/kdre ykHk fy;k tk ldrk gSA lR;kiu ijh{k.kksa ds vUrZxr nl Qlyksa vFkkZr lks;kchu ¼4½] eDdk ¼1½] mnZ ¼2½] puk ¼3½] vylh ¼2½] eVj ¼2½] ljlksa ¼2½] l;kt ¼4½] vnjd ¼2½] vkSj pUnzlwj ¼1½ dks fy;k x;kA mijksDr 23 ijh{k.kksa esa ls 19 ijh{k.kksa esa yf{kr mit gkfly dh xbZ tcfd l;kt dh 4 ijh{k.kkas esa y{; dks izkIr ugha fd;k x;kA bu lHkh ijh{k.kksa esa fdlkuksa ds [ksrksa ij vfxze iafDr izn'kZu dks pkj mipkjksa ,Q ih] th vkj Mh] ,l Vh lh vkSj ,l Vh lh vkj $ xkscj dh [kkn ¼vkbZ ih ,u ,l½ ds lkFk fd;k x;kA

4- dkcZfud [kknksa dk iz;ksx djrs gq, larqfyr moZjd iz;ksx dk izlkj djus ds fy, moZjd lek;kstu lehdj.kksa dk iz;ksx fofHkUu Qlyksa dh yf{kr mit izkIr djus ds fy, fd;k x;kA lR;kiu ijh{k.kksa esa pkj mipkjksa dh Hkk¡fr gh tcyiqj] ujflagiqj] dVuh] flouh vkSj fNUnokM+k ftyksa dh dkyh e`nkvksa ij fofHkUu Qlyksa tSls&mnZ] /kku] xsagw¡] puk] lks;kchu] vylh ukbxj vkSj vjgj ij 73 iz{ks= ijh{k.k fd, x,A bl izdkj fofHkUu Qlyksa ds fy, fodflr lehdj.kksa dks] jkT; ds d`f"k foHkkxksa] ds oh ds] oSKkfudksa] xSj ljdkjh laxBuksa vkSj vU; laxBuksa }kjk yksdfiz; cuk;k x;k ftlls fd fdlku moZjdksa ,oa dkcZfud [kknksa }kjk moZjdksa ds larqfyr iz;ksx djds fVdkÅ yf{kr mit izkIr dj ldsaA

5- fujad

7- dsUnz ds fy, vkoafVr /ku ds vuqlkj gj lky ys[k ijh{kk mi;ksfxrk izek.ki= izkIr fd;k x;kA

e`nk tSo fofo/krk tSo moZjd ij vf[ky Hkkjrh; tSo usVodZ ifj;kstuk

ifj;kstuk dk ts- ,u- ds- oh- oh-] tcyiqj esa ,d dsUnz gSA

2- ifj;kstuk ds vUrZxr dsUnz }kjk tkjh /ku ds O;; dk fooj.k rkfydk&1 esa fn;k x;k gSA

3- y{; D;k Fks % HkkSfrd vkSj foRrh; ifj.kke ¼o"kZ okj½

o"kZ	y{;	;kstuk ls ykHk
2005&06	1- lks;kchu jk;tksfc;k ds fy, e-iz- dk losZ{k.k 2- ikni o`f)dkjh jktksfc;k dk izFkDdhdj.k	fdlkuksa ds [ksrksa ij losZ{k.k ds ifj.kke n'kkZrs gSa fd tc QkLQksjl moZjdksa vkSj jk;tksfc;e fuos"kdksa ds lkFk xkscj dh [kkn dk iz;ksx fd;k x;k rks vR;f/kd tM+ xzfUFk;ksa ds fuekZ.k ds lkFk lokZf/kd mit izkIr gqbZA
2006&07	1- lks;kchu jk;tksfc;k ds fy, e-iz- dk losZ{k.k 2- ikni o`f)dkjh jk;tksfc;k dk ijh{k.k	fu;a=.k dh rqyuk ls fdlkuksa ds [ksrksa ij jk;tksfc;e ds fuos'ku ls nkuksa dh mit esa 4-5% dh o`f) gqbZA fuos'ku ds fy, ykHk% ykxr vuqikr 31 fefJr tSo moZjd cukus ds fy, vPNh ih th ih vkj iztkfr;ksa dks fpfUgr fd;k x;kA
2007&08	1- lw{e tSfod fofo/krk ds *gosyh* {ks= dk losZ{k.k 2- lw{e tSfod fuos'ku ds }kjk ukbVªkstu cpr dk ewY;kadu 3- vkfnoklh {ks=ksa esa	lks;kchu esa jk;tksfc;e ds fuos'ku vkSj xsagw¡ eas ,tksVksoSDVj ds fuos'ku ls 40 fdxzk- ukbVªkstu izfr gS- dh cpr gqbZA tSo moZjdksa ds ykHk dks vkfnoklh bykdksa esa Hkh igq¡pk;k x;kA

	tSo moZjd ykHk dk izn'kZu	
2008&09	1- e`nk tSfod LokLF; ds fy, gosyh {ks= dk losZ{k.k 2- vkfnoklh {ks=ksa esa tSo moZjd ykHk dk loZs{k.k	vkfnoklh bykdksa ds fdlkuksa ds [ksrksa ij ck;ksU;wfVª,UV iSdst ¼50% ,u ih ds $ xkscj dh [kkn $ tSo moZjd½ dks izn'kZu fd;k x;kA
2009&10	lks;kchu esa rjy fuos'kdksa dk [ksrksa esa ewY;kadu	jk;tksfc;e dh mRre iztkfr;ksa dk lks;kchu esa fuos'ku dk ykHk ns[kk x;kA
2010&11	lks;kchu] puk vkSj xsagw¡ ds fy, rjy fuos'kdksa dk ewY;kadu	jk;tkfc;e dh vPNh iztkfr;ksa dk puk ds lkFk fuos'ku vkSj xsagw¡ dk ih th ih vkj ds lkFk fuos'ku dk ykHk ik;k x;k
2011&12	lks;kchu] puk vkSj xsagw¡ ds fy, rjy fuos'kdksa dk ewY;kadu	[ksr esa jk;tksfc;e vkSj ih th ih vkj ds lkFk lks;kchu vkSj puk ds lgfuos'ku ls ykHk ik;k x;kA [ksr esa xsagw¡ eas ih th ih vkj lewg ds fuos'ku ls ykHk ik;k x;k

5- fujad

6- dsUnz ds fy, vkoafVr /ku ds vuqlkj gj lky ys[k ijh{kk mi;ksfxrk izek.ki= izkIr fd;k x;kA

ICAR – All India Coordinated Research Project on Micro and Secondary Nutrients and Pollutant Elements in soils and Plants
Indian Institute of Soil Science
Nabibagh, Berasia Road Bhopal – 462 038
Ph. 0755-2734487 (o) _______ ®, Fax 0755-2733310, Tele fax 0755-2734487
Email: arvindshukla2k3@yahoo.co.in, akshukla@iiss.ernet.in

Dr. Arvind K. Shukla
Project Coordinator (Micronutrient)

F.No. PCM/RTI/15
Dated:18.09.12

प्रश्न क्र.1 कौन कौन सी योजनाए संचालित है ?

उत्तर : सूक्ष्म एवं द्वितीयक पोषक तत्वों एवं प्रदूषक तत्वो की अखिल भारतीय शोध समंवित परियोजना के अन्तर्गत मध्यप्रदेश में जवाहरलाल नेहरू कृषि विश्व विद्यालय जबलपुर में परियोजना का एक सहयोगी केन्द्र कार्य कर रहा है। इस केन्द्र मे निम्न लिखित कार्यक्रमों पर कार्य किया जा रहा है।

1. मृदा में सूक्ष्म तत्वों के स्तर का आलेखन कार्यक्रम :–
इस कार्यक्रम के अन्तर्गत प्रतिवर्ष 2-3 जिलों की विभिन्न तहसीलों व ब्लाकों के विभिन्न गावों के किसानो के खेतों से मृदा नमूने एकत्रित कर उनमे सूक्ष्म तत्वों के स्तर की जाँच की जाती है। और मृदा मे सूक्ष्म सूक्ष्म तत्वों के स्तर को दर्शाने वाले मानचित्र तैयार किये जाते हैं।

2. मृदा सूचीकरण कार्यक्रम :–
इस कार्यक्रम में निश्चित स्थानो से भुगोलिक उल्लेख सहित मृदा नमूने लिये जाते है। साथ ही उन्ही स्थानो की फसलों की उपज भी देखी जातीहै अतः उपज पर पड़ने वाले प्रभावों का अध्ययन किया जाता है।

3. उर्वरक उपयोग क्षमता बढ़ाने हेतु अध्ययन :
इस कार्यक्रम के अन्तर्गत विभिन्न सूक्ष्म

एव द्वितीयक पोषक तत्वों से युक्त उर्वरकों के प्रयोग एवं उनकी प्रयोग विधीयों के माध्यम से उनकी प्रयोग क्षमता एव उपयोगिता बढाने हेतु विभिन्न प्रयोग चल रहे है जो की विभिन्न मृदाओ एवं फसलो पर अध्ययन किया जाता है इनमें विभिन्न सूक्ष्म तत्व युक्त उर्वरको से विभिन्न फसलों में 10-20% की उपज वृद्धी देखी गई है !

4. प्रदुषक तत्वों व भारी धातुओं पर अध्ययन :

इस कार्यक्रम के अन्तर्गत प्रदुषक तत्वो एव भारी धातुओं का मृदा तथा पौधों पर पड़ने वाले प्रभावो का अध्ययन किया जाता है !

प्रश्न क्र. 2 2005 से 2012 तक प्रतिवर्ष कुल कितनी राशी मध्यप्रदेश को मिली है ?

उत्तर : वर्ष 2005 से 2012 प्रतिवर्ष मध्यप्रदेश के जबलपुर केन्द्र को भा.कृ.अ. परिषद की अंशदान की राशी निम्नानुसार जारी की गई

क्र.	वर्ष	राशी (लाख रु.)	क्र.	वर्ष	राशी (लाख रु.)
1.	2005-06	27.11	5.	2009-10	29.93
2.	2006-07	22.58	6.	2010-11	26.36
3.	2007-08	19.03	7.	2011-12	50.76
4.	2008-09	27.03			

प्रश्न क्र.3 लक्ष्य क्या था ? उसकी भौतिक और वित्तीय उपलब्धि क्या रही ?

उत्तर : ग्यारवी पंच वर्षिय योजना (XI[th] Plan) मे मध्यप्रदेश के जबलपुर केन्द्र को 153.56 लाख रुपये की राशी आवंटित की गई जिसमे से 124.45 लाख रुपये की राशी का उपयोग किया गया। इस अवधि मे सूक्ष्म तत्वों की शोध हेतु विभिन्न कार्यक्रमों के लक्ष्यों को प्राप्त किया गया। मध्यप्रदेश मे सूक्ष्म तत्वो जस्ता, तांबा, लौहा, मेंगनीज गंधक, और बोरान का स्तर विभिन्न जिलों की

मृदाओं मे देखा गया, और उसके स्तर को दर्शाने वाले मान चित्र तैयार किये गये। जिससे किसानो को मृदा मे इन तत्वों के स्तर का ज्ञान प्राप्त होता है व न इन तत्वों के मृदा मे प्रयोग से उपज वृद्धी हो सकी।

प्रश्न क्र.4 इस योजनाओं से कितने लाभान्वित हुये (वर्षवार)

उत्तर : इन योजनाओं से मध्यप्रदेश के चुनिंदा जिलों के अधिसंख्य कृषक लाभान्वित हुये।

प्रश्न क्र. 5 मध्यप्रदेश द्वारा योजनाओं के क्रियान्वयन मे की गई गड़बड़िया

उत्तर : परियोजना ज. नैं. कृ. विश्व विद्यालय जबलपूर व भारतीय मृदा विज्ञान संस्थान भोपाल के मार्गदर्शन मे चल रही है। अत: किसी भी प्रकार की गड़बड़ि की कोई सम्भावना नही है।

प्रश्न क्र.6. जारी की गई राशी में से कितनी राशि का उपयोगिता प्रमाण पत्र प्राप्त हुआ तथा उपयोगिता प्रमाण पत्र न मिलने पर कितनी राशी रोकी गई ?

उत्तर: जारी की गई समस्त राशी का उपयोगिता प्रमाण पत्र प्रतिवर्ष प्राप्त होता है।

अरविन्द
19/9/12

Table 1. Details of money released to Madhya Pradesh and expenditure modify the centre under various AICRPs

Schemes/AICRP	Fund Details	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	Total (Rs)
1. LTFE	Released	626000	1148000	1050000	1271000	1380000	1230000	1002000	4380000	12087000
	Expenditure	626000	1148000	1050000	1271000	1380000	1200000	1002000	4380000	12057000
2. Micronutrient	Released	1763000	2711000	2258000	1930000	2723000	2333000	2636000	5880000	22154000
	Expenditure	1763000	2711000	2258000	1930000	2722000	1000000	2636000	5075000	20016000
3. STCR	Released	1474000	1865000	1914000	2610000	2055000	1889000	2246000	4458000	18511000
	Expenditure	1474000	1865000	1914000	2610000	2055000	1000000	2246000	4458000	17622000
4. Biofertilizer	Released	1296000	1241300	1350000	825000	1495000	1260000	945000	2590000	11002300
	Expenditure	1296000	1240000	1350000	825000	1495000	430000	945000	2590000	10171000
Grand total	**Released**	**5159000**	**6965300**	**6572000**	**6636000**	**7653000**	**6712000**	**6829000**	**17308000**	**63834300**
	Expenditure	**5159000**	**6964000**	**6572000**	**6636000**	**7652000**	**3630000**	**6829000**	**16503000**	**59945000**

Ref: Dy No. 2554/VIP/AM dated 26/11/12

Sub: Regarding setting up a organic phosphate manufacturing facility-regarding

Indian Institute of Soil Science has developed a technology "Phospho-sulpho-nitro-compost" to increase the P content of organic manure using indigenous low grade rock phosphate. The details of the technology and list of some of the firms producing P enriched organic manures is attached as annexure I.

In India the approval for license as well as subsidy policy is solely the privilege of the Government.

(A. Subba Rao)
Director

Annexure I

The details of phosphate enriched manure prepared at Indian Institute of Soil Science

Phosphate enriched compost prepared by pit and heap methods. Both, in heap (7.5 ft length x 6 ft width and 3 ft high) and in pit (10 ft length x 5 ft width and 3 ft deep) methods about 1000 kg of wastes can be used for decomposition.

The following proportions of organic and inorganic ingredients are required during composting process by heap method. Heap method consists of different layers and each layer should be around 30 cm.

- 30 kg of wastes is spread on the floor followed by 30 kg of fresh cow dung (dry weight basis).
- 430 g urea (0.5 %-N basis) dissolved in 20-liter water.
- 11 kg mussori rock phosphate (5 % P_2O_5 basis from Mussori rock phosphate containing 18 % P_2O_5)
- 4 kg Pyrites (22 % S content and added at the rate of 10 % on materials dry weight basis).
- Soil added at the rate of 5% on materials dry weight basis.
- Fungal culture was added at 500 g mycelial mat per tonne of materials where as bacterial culture was added at 50 ml kg^{-1} of material having 10^8 viable cell/ml. Initially for 1-3 days, bioinoculum was added twice in the mixture owing to a high initial temperature (55 to 70^0C) and thereafter, the frequency of addition of inoculums decreased gradually.

Subsequent layers are made in the similar way. Once different layers are made then the heap become 1.5 m high. Finally, upper side and all peripheries of heap are covered with cowdung slurry to maintain optimum moisture inside the heap. To avoid rain, wind, and to maintain the moisture and temperature, one-polythene sheet must be used to cover the heap. After 3-4 weeks of decomposition, the first tuning of heap must be done. Maintain the moisture at 60-70% of materials on dry weight basis. Compost will be ready after 3 months of decomposition and one gets about 950-1000 kg of enriched phospho-compost from the heap. For 1000 kg enriched compost, the total quantity of fresh cow dung, rock phosphate, pyrites, urea and soil will be 500, 361, 130, 14 and 50 kg, respectively.

Various studies have been carried out under All India Co-coordinated project on organic matter decomposition at different locations, different private agencies and at Indian Institute of Soil Science, Bhopal to evolve efficient ways to ensure improvement in available nutrient status of phosphor-compost in terms of NH_4-N, NO_3-N, water soluble P (WSP), citrate-soluble P (CSP) etc. as compared to conventional compost. For instance, Phospho-Sulpho-Nitro compost prepared in 110 days of decomposition process contains approximately 3.2 to 4.2% P and 1.5 to 2.3% N.

Some of Indian manufacturer's producing Phosphate enriched manures are listed below:

1. Karnataka Agro-Chemicals,
   Multiplex Group India

2. Pragati Khanij Udyog
   B-l 1, Mahalaxmi Apartment Kalewadi Phata
   Pune Maharashtra, India

3. Fertilizer Organic Private Limited
   AKS Shopping Center Rustampur
   Gorakhpur-273001 U.P.India

4. Industrial Benefication Plant (Rock Phosphate) RS MM Ltd.
   Jhamarkota-313015
   Udaipur Rajasthan

5. Vasumitra Life Energies Pvt. Ltd
   Plot No. 4, Survey No. 16/B,
   Swapna Mandir Society Behind
   Shamaprasad Mukharji Udayan
   Patwardhan Baug,
   Pune-411044, Maharashtra, India.

Subject: Lok Sabha question No. 2866 raised by Shri Baijayant Jay Panda

(a) Whether the Government has conducted any study to identify the areas where the soil is malnourished and lacks vital nutrients;

Reply Yes.

(b) If so, the details thereof, state-wise

Reply Given below is the result of the study conducted by Indian Institute of Soil Science that shows the status of three vital plant nutrients in different states of India. These nutrients are nitrogen (N), phosphorus (P) and potassium (K). These three are the primary nutrients and are essential for plants. The districts in a particular state are classified in low, medium, or high category with respect to N, P, and K, respectively. Special attention is required to be paid to the districts that are low in N, P, or K.

Andhra Pradesh

NITROGEN
Low Adilabad, Chittoor, Cuddapah, East Godavari, Guntur, Karimnagar, Khammam, Krishna, Kurnool, Mahbubnagar, Nizamabad, Visakhapatnam, Vizianagaram, Warangal, West Godavari
Medium Anantapur, Hyderabad, Medak, Nalgonda, Nellore, Prakasam, Rangareddi, Srikakulam
High -
PHOSPHORUS
Low Adilabad, Anantapur, Chittoor, Cuddapah, Guntur, Hyderabad, Karimnagar, Khammam, Krishna, Kurnool, Mahbubnagar, Medak, Nalgonda, Nellore, Nizamabad, Rangareddi, Srikakulam, Warangal
Medium East Godavari, Prakasam, Visakhapatnam, Vizianagaram, West Godavari
High -
POTASSIUM
Low -
Medium East Godavari, Nizamabad, Rangareddi
High Adilabad, Anantapur, Chittoor, Cuddapah, Guntur, Hyderabad, Karimnagar, Khammam, Krishna, Kurnool, Mahbubnagar, Medak, Nalgonda, Nellore, Prakasam, Srikakulam, Visakhapatnam, Vizianagaram, Warangal, West Godavari

Assam

NITROGEN
Low Bongaigaon, Bopeta, Chirang, Darrang, Kokrajhar, Morigaon, NC Hills, Nalbari

Medium Cachar, Dhemaji, Dhubri, Dibrugarh, Goalpara, Golaghat, Hailakandi, Jorhat, Kamrup, Karbi angling, Karimganj, Lakhimpur, Nagaon, Sivsagar, Sonitpur, Tinsukia, Udalguri
High -
PHOSPHORUS
Low Jorhat, Karbi angling, Udalguri
Medium Bongaigaon, Borpeta, Cachar, Chirang, Darrang, Dhemaji, Dhubri, Dibrugarh, Goalpara, Golaghat, Hailakandi, Kamrup, Karimganj, Kokrajhar, Lakhimpur, Morigaon, N C Hills, Nagaon, Nalbari, Sivsagar, Sonitpur, Tinsukia
High -
Low Bongaigaon, Cachar, Chirang, Golaghat, Hailakandi, Jorhat, Karimganj, **POTASSIUM** Kokrajhar, N C Hills, Nagaon, Sivsagar, Udalguri
Medium Bofpeta, Darrang, Dhemaji, Dhubri, Goalpara, Kamrup, Lakhimpur, Morigaon, Nalbari, Sonipat, Tinsukia
High Dibrugarh, Karbi angling

Chhattisgarh

NITROGEN
Low Bastar, Dantewara, Dhamtari, Durg, Kanker, Kawardha, Mahasmund, Raipur, Rajnandgaon
Medium Baikunthapur, Bilaspur, Janigir, Jashpur, Korba, Koriya, Rajgarh, Sarguja
High -
PHOSPHORUS
Low Bastar, Dantewara, Dhamtari, Kanker, Korba, Mahasmund, Raipur
Medium Baikunthapur, Bilaspur, Durg, Janigir, Jashpur, Kawardha, Koriya, Rajgarh, Rajnandgaon, Sarguja
High - POTASSIUM
Low Bastar, Dantewara, Kanker
Medium Dhamtari, Mahasmund, Raipur, Rajnandgaon
High Baikhunthapur, Bilaspur, Durg, Janigir, Jashpur, Kawardha, Korba, Koriya, Rajgarh, Sarguja

Gujarat

NITROGEN
Low Amreli, Banaskantha, Bharuch, Gandhinagar, Jamnagar, Kutch, Mahesana, Narmada, Patan, Sabarkantha, Surat, Surendranagar, Vadodara
Medium Anand, Bhawnagar, Dahod, Dang, Kheda, Navsari, Panchmahal, Valsad
High Junagadh, Porbandar, Rajkot
PHOSPHORUS
Low Banaskantha, Bharuch, Bhawnagar, Dahod, Mahesana, Narmada, Navsari, Panchmahal, Patan, Porbandar, Surendranagar, Valsad

Medium Amreli, Anand, Dand, Gandhinagar, Jamnagar, Jungadh, Kutch, Kheda, Rajkot, Sabarkantha, Surat, Vadodara
High -
POTASSIUM
Low -
Medium Banaskantha, Kutch, Sabarkantha, Vadodara
High Amreli, Anand, Bharuch, Bhawnagar, Dahod, Dang, Gandhinagar, Jamnagar, Junagadh, Kheda, Mahesana, Narmada, Navsari, Panchmahal, Patan, Porbandar, Rajkot, Surat, Surendranagar, Valsad

Haryana

NITROGEN
Low Bhiwani, Faridabad, Fatehbad, Gurgaon, Hisar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Mahendragarh, Panchkula, Panipat, Rewari, Sirsa, Sonipat, Yamuna Nagar
Medium Rohtak
High -
PHOSPHORUS
Low Bhiwani, Faridabad, Fatehbad, Gurgoan, Hisar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Panchkula, Panipat, Rewari, Sirsa, Sonipat, Yamuna Nagar
Medium Mahendragarh, Rohtak
High -
POTASSIUM
Low -
Medium Faridabad, Gurgaon, Hisar, Karnal, Panchkula, Rohtak, Rewari, Yamun Nagar
High Bhiwani, Fatehbad, Jhajjar, Jind, Kaithal, Kurukshetra, Mahendragarh, Panipat, Sirsa, Sonipat Himachal Pradesh

Himachal Pradesh

NITROGEN
Low -
Medium Hamirpur, Kangra, Mandi, Una
High Chamba, Kinnaur, Kulu, Lahaul spiti, Simla, Sirmour, Solan
PHOSPHORUS
Low Hamirpur, Kangra, Mandi, Simla, Una
Medium Chamba, Kulu, Lahaul spiti, Sirmour, Solan
High Kinnaur
POTASSIUM
Low Chamba, Hamirpur, Kangra, Kinnaur, Lahaul spiti, Una
Medium Kulu, Mandi, Simla, Sirmour, Solan
High –

Karnataka

NITROGEN
Low Kolar
Medium Bangalore (R), Bangalore (U), Bellari, Bidar, Bijapura, Chitradurga, Davanagere, Gulbura, Hassan, Mysore, Raichur, Shimoga, Tumkur
High Belagaum, Chamrajnagar, Chikkamagalore, Coorg, Dharwad, Gadag, Haveri, Kadogri, Mandya, North Kannada, Sough Kannada, Udupi
PHOSPHORUS
Low Bellari, Bijapur, Hassan, Norht Kannada, South Kannada, Udupi
Medium Bangalore (U), Belagaum, Bidar, Chikkamagalore, Chitradurga, Coorg, Dharwad, Gadag, Gulburga, Haveri, Kodagi, Kolar, Mysore, Raichur, Shimoga, Tumkur
High Bangalore (R), Chamrajnagar, Davanagere, Mandya
POTASSIUM
Low South Kannada, Udupi
Medium Chikkamagalore, Kolar, Mandya, North Kannada, Shimoga
High Bangalore (R), Bangalore (U), Belagaum, Bellari, Bidar, Bijapura, Chamrajnagar, Chitradurga, Coorg, Davanagere, Dharwad, Gadag, Gulburga, Hassan, Haveri, Kodagi, Mysore, Raichur, Tumkur

Kerala

NITROGEN
Low Kasaragod, Kollam, Thiruvananthapuram
Medium Ernakulam, Idukki, Kannur, Kottayam, Kozhikkode, Malappuram, Palakkad, Pathanamthitta, Thrissur
High Wyanadu
PHOSPHORUS
Low -
Medium Idukki, Kannur, Kasaragod, Kozhikkode, Malappuram, Palakkad, Pathanamthitta, Thrissur, Wyandu
High Ernakulam, Kollam, Kottayam, Thiruvananthapuram
POTASSIUM
Low -
Medium Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikkode, Malappuram, Pathanamthitta, Thiruvananthapuram, Thrissur, Wyanadu
High Ernakulam, Palakkad

Madhya Pradesh

NITROGEN
Low Bhind, Chhattarpur, Daria, Gwalior, Indore, Jabalpur, Mandsaur,

Neemuch, Morena, Panna, Ratlam, Sheopu, Shivpuri, Sidhi
Medium Annupur, Bagwai, Balaghat, Betul, Bhopal, Bodwani, Burhanpur, Chhindwara, Damoh, Dewas, Dindori, Harda, Jhabua, Katni, Khandwa, Mandla, Narsinghpur, Raisen, Rewa, Sagar, Satna, Seoni, Shahdol, Shajapur, Tikmgarh, Ujjain, Umaria, Vidisha
High Ashok Nagar, Guna, Hoshangabad, Rajgarh, Sehore
PHOSPHORUS
Low Ashok Nagar, Betul, Bhind, Chhattarpur, Damoh, Daria, Dewas, Gwalior, Japlpur, Jhabua, Katni, Panna, Shivpuri, Ujjain, Umaria
Medium Anuppur, Bagwai, Balaghat, Bhopal, Bodwani, Burhanpur, Chhindwara, Harda, Indore, Khandwa, Khargone, Mandla, Mandsaur, Neemuch, Morena, Narsinghpur, Raisen, Ratlam, Rewa, Sagar, Satna, Seoni, Shahdol, Shajapur, Sheopu, Sidhi, Tikmgarh, Vidisha
High Dindori, Guna, Hoshangabad, Rajgarh, Sehore
POTASSIUM
Low Dhar, Anuppur, Betul, Gwalior, Morena, Sagar, Sidhi
Medium Ashok Nagar, Balaghat, Damoh, Daria, Dindori, Guna, Harda, Japlpur, Katni, Mandla, Rewa, Satna, Shivpuri, Tikmgarh, Umaria
High Bagwai, Bhind, Bhopal, Badwani, Burhanpur, Chhattarpur, Chhindwara, Dewas, Hoshangabad, Indore, Jhabua, Khandwa, Khargone, Mandsaur, Neemuch, Narsinghpur, Panna, Raisen, Rajgarh, Ratlam, Sehore, Seoni, Shahdol, Shajapur, Sheopu, Ujjain, Vidhisha

Maharashtra

NITROGEN
Low Akola, Amaravati, Aurangabad, Beed, Bhandara, Buldhana, Gondiya, Hingoli, Jalgaon, Jalna, Latur, Nagpur, Nanded, Nashik, Parbhani, Pune, Raigad, Ratnagiri, Sangali, Satara, Solapur, Usmanabad, Wardha, Washim, Yeotmal
Medium Dhule, Kolhapur, Nandurbar, Sindhudurg, Thane **High** -
PHOSPHORUS
Low Akola, Amaravati, Aurangabad, Bhandara, Bhuldhana, Dhule, Gondiya, Hingoli, Jalgaon, Jalna, Kolhapur, Latur, Nagpur, Nanded, Nandurbar, Nashik, Parbhani, Pune, Raigad, Ratnagiri, Sangali, Satara, Sindhudurg, Solapur, Usmanabad, Wardha, Washim, Yeotmal
Medium Beed, Thane
High -
POTASSIUM
Low Raigad, Sindhudurg
Medium Kolhapur, Nashikm Sangali, Satara, Thane
HighAkola, Amaravati, Aurangabad, Beed, Bhandara, Buldhana, Dhule, Gondiya, Hingoli, Jalgaon, Jalna, Latur, Nagpur, Nanded, Nandurbar, Parbhani, Pune, Ratnagiri, Solapur, Usmanabad, Wardha, Washim, Yeotmal

Orissa

NITROGEN
Low Bhadrak, Boudh, Cuttuck, Dhenkanal, Gajapati, Ganjam, Jagatsinghpur, Kalahandi, Kendrapada, Khurda, Mayurbhanj, Naupada, Nayagarh, Bhulbani, Puri, Sundargarh
Medium Balasore, Bargarh, Bolangir, Deogarh, Jharsuguda, Keonjhar, Koraput, Malkangiri, Nawrangpur, Rayagada, Sambalpur, Sonepur
High -
PHOSPHORUS
Low Balasore, Bhadrak, Cuttack, Gajapati, Ganjam, Jharsuguda, Keonjhar, Mayurbhanj, Nawrangpur, Phulbani, Sambalpur
Medium Bargarh, Bolangir, Boudh, Deogarh, Dhenkanal, Jagatsighpur, Kalahandi, Kendrapada, Khurda, Koraput, Malkangiri, Naupada, Nayagarh, Puri, Sonepur, Sundargarh
High -
POTASSIUM
Low Cuttack, Ganjam, Nayagarh
Medium Balasore, Bargarh, Bhadrak, Deogarh, Dhenkanal, Gajapati, Jagatsinghpur, Jharsuguda, Kalahandi, Kendrapada, Khurda, Koraput, Malkangiri, Naupada, Nayagarh, Puri, Sundragarh
High Bolangir, Boudh, Keonjhar, Mayurbhanj, Phulbani, Sambalpur, Sonepur

Punjab

NITROGEN
Low Bhatinda, Faridkot, Ferozepur, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Mansa, Moga, Muktsar
Medium Fategar Sahib, Nawashahar, Patiala, Ropar, Sangrur
High - PHOSPHORUS
Low -
Medium Faridkot, Ferozepur, Mansa, Mogar, Miktasar, Nawashahar, Patiala, Sangrur
High Bhatinda, Fategar Sahib, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Ropar
POTASSIUM
Low -
Medium Hoshiarpur, Ropar
High Bhatinda, Faridkot, Fategar Sahib, Ferozepur, Gurdaspur, Jalandhar, Kapurthala, Ludhiana, Mansa, Moga, Muktasar, Nawashahar, Patiala, Sangrur

Rajasthan

NITROGEN
Low Alwar, Banswara, Baran, Bharatpur, Barmer, Bundi, Churu, Dausa, Dholpur, Durgapur, Hanumangarh, Jaisalmer, Jalore, Jhunjhun, Jodhpur, Karauli, Kota, Nagpur, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirhi, Sriganganagar, Tonk
Medium Bhilwara, Chittorgarh, Jhalawar, Udaipur
High -
PHOSPHORUS
Low Bharatpur, Barmer, Churu, Dausa, Dholpur, Durgapur, Hanumangarh, Jaisalmer, Jalore, Karauli, Sawai Madhopur, Sikar, Sirohi, Sirhi, Sriganganagar
Medium Alwar, Banswara, Baran, Bhilwara, Bundi, Chittorgarh, Jhalawar, Jodhpur, Kota, Nagpur, Pali, Rajsamand, Tonk, Udaipur
High -
POTASSIUM
Low -
Medium Banswara, Bharatpur, Bhilwara, Bundi, Dholpur, Rajsamand
High Alwar, Baran, Barmer, Chittorgarh, Churu, Dausa, Durgapur, Hanumangarh, Jaisalmer, Jalore, Jhalawar, Jhunjhun, Jodhpur, Karauli, Kota, Nagpur, Pali, Sawai Madhopur, Sikar, Sirohi, Sirhi, Sriganganagar, Tonk, Udaipur

Tamil Nadu

NITROGEN
Low Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Fudukkottai, Kanchipuram, Kanyakumari, Karur, Madurai, Nagapattinam, Namakkal, Peerambalur, Ramanathapuram, Salem, Sivagangai, Thanjavur, Theni, Thiruallur, Thiruvarur, Thoothukudi, Tiruvannamalai, Tiruvarur, Trichiraplli, Vellore, Villupuram, Virudhunagar
Medium Salem
High Nilgiri **PHOSPHORUS**
Low Kanchipuram, Sivagangai, Thoothukudi, Trichirapalli
Medium Cuddalore, Dharmapuri, Dindigul, Erode, Kanyakumari, Karur, Namakkal, Salem, Theni, Villupuram, Virudhunagar
High Coimbatore, Fudukkottai, Madurai, Nagapattinam, Nilgiri, Peerambalur, Ramanathapuram, Thanjavur, Thiruallur, Thiruvarur, Tiruvannamalai, Tiruvarur, Vellore
POTASSIUM
Low Ariyalur
Medium Cuddalore, Erode, Kanchipuram, Kanyakumari, Karur, Namakkal, Thiruallar, Villupuram
High Coimbatore, Dharmapuri, Dindigul, Fudukkottai, Madurai, Nagapattinam, Nilgiri, Peerambalur, Ramananthpuram, Salem, Sivagangai, Thanjavur, Theni, Thiruvarur, Thoothukudi, Tiruvnnamalai,

Tiruvarur, Trichirapalli, Vellore, Virudhunagar

Uttar Pradesh

NITROGEN
Low
Aazamgarh, Agra, Aligarh, Allahabad, Ambedkarnagar, Auraiya, Badanyu, Baghpat, Baharaich, Baliya, Balrampur, Banda, Barabanki, Bareli, Basti, Bijnaur, Buland Shahar, Chandouli, Chitrkut, Devariya, Eta, Etahwa, Faizabad, Farukkhabad, Fatehabad, Firozabad, Gautambudh nagar, Gazipur, Ghaziabad, Gorakhapur, Hameerpur, Hardoi, Hathras, Jalaun, Jaunpur, Jhansi, Jyotishaphool nagar, Kannauj, Kanpur Dehat, Kanpur Nagar, Kashiram Nagar, Kaushambee, Kushinagar, Lalitpur, Lucknow, Lukhimpur, Maharajganj, Mahowa, Mainpuri, Mathura, Mau, Meerut, Muradabad, Muzzafar Nagar, Peelibhit, Pratapgarh, Rampur, Raybareli, Saharanpur, Santkabeer Nagar, Shahjahapur, Sidhrth Nagar, Sitapur, Sonebhadra, Sribasti, Sultanpur, Unnav, Varanasi.
Medium Mirzapur, Santravidasnagar
High -
PHOSPHORUS
Low
Aazamgarh, Agra, Aligarh, Allahabad, Ambedkarnagar, Auraiya, Badanyu, Baghpat, Baharaich, Baliya, Balrampur, Banda, Barabanki, Bareli, Basti, Bijnour, Buland Shahar, Chandouli, Chitrakut, Devariya, Eta, Etawa, Faizabad, Farukhabad, Fatehabad, Firozabad, Gautambudh nagar, Gazipur, Ghaziabad, Gorakhpur, Hameerpur, Hathras, Jalaun, Jaunpur, Jhansi, Jyotishaphool nagar, Kannauj, Kanpur Dehat, Kanpur Nagar, Kashiram Nagar, Kaushambee, Kushinagar, Lalitpur, Lucknow, Lukhimpur, Maharajganj, Mahowa, Mainpuri, Mathura, Mau, Meerut, Mirzapur, Muradabad, Muzzafarnagar, Peelibhit, Pratapgarh, Rampur, Raybareli, Saharanpur, Santkabeer nagar, Santravidasnagar, Shahjahapur, Sidhrath Nagar, Sitapur, Sonebhadra, Sribasti, Sultanpur, Unnav, Varanasi
Medium Hardoi **High** -
POTASSIUM
Low -
Medium
Aazamgarh, Amedkarnagar, Auraiya, Baghpat, Bahraich, Baliya, Balrampur, Banda, Barabanki, Bareli, Basti, Bijnaur, Chandouli, Chitrakut, Devariya, Etawa, Faizabad, Farukkhabad, Gautambudh nagar, Gazipur, Gorakhpur, Jyotishaphool nagar, Kannauj, Kanpur Dehat, Kanpur Nagar, Kushinagar, Lukhimpur, Maharajganj, Mahowa, Mathura, Mau, Meerut, Muradabad, Muzzafar nagar, Peelibhit, Pratapgarh, Rampur, Saharanpur, Santkabeer nagar, Shahjahapur, Sidhrath nagar, Sitapur, Sribasti, Sultanpur, Varanasi
High

Agra, Aligarh, Allahabad, Badanyu, Buland Shahar, Eta, Fatehabad, Firozabad, Ghaziabad, Hameerpur, Hardoi, Hthras, Jalaun, Jaunpur, Jhansi, Kashiram nagar, Kaushambee, Lalitpur, Lucknow, Mainpur, Mirzapur, Raybareli, Santravidasnagar, Sonebhadra, Unnav

Uttarakhand

NITROGEN
Low Dehradun, Tehari Gadwal, Udhamsingh Nagar, Uttarkashi
Medium Chamoli, Champawat, Haridwar, Nainital, Paudi, Rudraprayag
High Bageswar, Pithoragad
PHOSPHORUS
Low Bageswar, Chamoli, Champawat, Dehradun, Haridwar, Paudi, Rudraprayag, Udhamsingh Nagar, Uttarkashi
Medium Nainital, Pithoragad, Tehari Gadwal
High -
POTASSIUM
Low -
Medium Dehradun, Haridwar, Paudi, Pithoragad, Rudraprayag, Tehari Gadwal, Udhamsingh Nagar, Uttarkashi
High Bageswar, Chamoli, Champawat, Nainital

West Bengal

NITROGEN
Low Midnapore E, Midnapore W, North 24- Parganas, South 24- Parganas
Medium Darjeeling, Hooghly, Jalpaiguri, Nadia, Prakama, Purulia
High -
PHOSPHORUS
Low Midanpore E, Prakama, Purulia
Medium Darjeeling, Jalpaiguri, Midanpore W, Nadia, North 24- Parganas, South 24- Parganas
High Hooghly
POTASSIUM
Low Jalpaiguri
Medium Darjeeling, Hooghly, Midnapore E, Midnapore W, Nadia, North 24- Parganas, Prakama, Purulia, South 24-Parganas
High –

(C). Whether the Government has taken any steps to replenish the quality of soil in such areas:

Reply Yes

(d) If so, the details thereof:

Reply

Government of India is promoting integrated nutrient management (INM), balanced and judicious use of chemical fertilizers, bio-fertilizers and locally available organic manures like farmyard manure, compost, vermi compost and green manure based on soil testing to maintain soil quality and productivity. Total nutrient content varies from soil to soil depending upon the nature of parent material and other soil forming processes. Only the plant available form of the nutrient in the soil is relevant for the crops and is chemically determined through appropriate testing methods which are deployed in soil testing laboratories. During 11th Five Year Plan, a National Project on Management of Soil Health and Fertility (NPMSHF) was approved during 2008-09 with an outlay of Rs. 429.85 crore. The scheme provides for setting up of new soil testing laboratories and strengthening of the existing labs with micronutrient testing facilities. Apart from this project, assistance for soil testing laboratories is also being provided to States/UTs under the Rashtriya Krishi Vikas Yojana (RKVY). There were 1,049 soil testing labs in
the country with an annual sample analyzing capacity of 107 lakh as on 31.03.2011. Based on the soil analysis, State Governments have also issued 408 lakh soil health cards to the farmers.

The Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, GOI has formulated following strategy to address the soil quality issue.

• Use of organic manures and recycling of biomass need to be promoted.
• Encourage mixed/intercrops of pulses in all major cropping systems.
• Encourage N-fixing and other useful trees/bushes as hedges on bunds for in-situ production of biomass. Wherever possible, green manure crops be promoted.
• Chemical nutrients may be used only on soil test based recommendations.
• Encourage use of mineral nutrient resources such as rock phosphate along with composts (Phosphate rich organic manure-PROM).
• Encourage integration of cattle in farming system mode.
• Use of lime, gypsum, basic slag and other soil amendments in problem soils be used so that Soil pH is brought to near neutrality to improve nutrient up take and fertilizer use efficiency.
• Biofertilisers need to be promoted on massive scale similar to chemical fertilizers but at the same time it needs to be ensured that biofertilisers of standard quality are supplied to the farmers so that they remain active till their use/ application.
• It is generally agreed that combined application of both nitrogenous and phosphatic biofertilizers can supply 25 kg N and 10 kg P2O5 per hectare.

- Based on a scientific soil test balanced and judicious use of chemical fertilizers (N,P,K) with secondary nutrient (Sulphur, Calcium, Magnesium) and micro nutrient (zinc, iron, copper, boron, molybdenum, manganese), in conjunction with organic sources of nutrients like green manures, organic manures (compost), vermi-compost etc. and biofertilizers.

(e) The financial assistance given to farmers under the National

Project on Management of Soil Health and Fertility (NPMSH&F) to improve soil health and its productivity during each of the last three years and the current year, State-wise and

Reply Information not available with us.

(f) The details of soil testing centres established so far in the country, State wise?

Reply

The number of soil testing laboratories increased to 1,049 in 2010-11 from 715 in 2009-10 while annual analyzing capacity went up to 1.07 crore samples from 0.78 crore samples. As a result, 0.74 crore soil health cards were issued to farmers during 2010-11 compared to about 0.57 crore during 2009-10. Several States including Andhra Pradesh, Gujarat, Haryana, Karnataka and Uttar Pradesh have made commendable progress in soil testing programme in various ways such as expansion of soil testing facilities, popularization of the programme in campaign mode, development of soil fertility maps and use of information technology in delivering soil nutrient status and appropriate recommendation to farmers.

State-wise Number of Soil Testing Laboratories in the country

I	**South**	**Soil Testing laboratories**
1	Andhra	118
2	Karnataka	26
3	Kerala	24
4	Tamil	47
5	Puducherry	2
6	A&N	2
	Total	219
II.	**West**	
7	Gujarat	148
8	Madhya	30
9	Maharashtra	39
10	Rajasthan	48
11	Chhattisgarh	10
12	Goa	2
	Total	277
III	**North**	
13	Haryana	32
14	Punjab	70
15	Uttarakhand	16
16	Uttar Pr	283

17	Himachal Pr	15
18	J&K	18
19	Delhi	1
	Total	435
IV	**East**	
20	Bihar	39
21	Jharkhand	8
22	Orissa	11
23	West	20
	Total	78
V	**NE**	
24	Assam	11
25	Tripura	6
26	Manipur	5
27	Meghalaya	3
28	Nagaland	3
29	Arunachal Pr	6
30	Sikkim	1
31	Mizoram	5
	Total	40
	Grand Total	**1049**

ALL INDIA COORDINATED RESEARCH PROJECT FOR INVESTIGATIONS ON SOIL TEST CROP RESPONSE CORRELATION (AICRP- STCR)

1. The details of research centres and projects under taken by the ICAR in the country including rural and backward areas of the country, State-wise

S.No.	**Name of AICRP/Network Project**	**Date of Start**
1	Dr. P K Basava Raja, Assoc. Professor, Incharge STCR centre, Department of Soil Science & Agricultural Chemistry, University of Agricultural Sciences, GKVK, Bangalore – 560065, Karnataka pujarikbraj@gmail.com (O) **080- 23622647** **® 080-23192967** **(M) 09449152884** **Fax : 080-23622547**	1970
2	Dr. S.R. Singh Incharge STCR centre Incharge STCR Centre, Central Research Institute for Jute & Allied Fibres, Nilganj, Barrackpore – 700 120, West Bengal shivramsingh22@gmail.com (O) **(033) 2535-1932** (M) **09433545903** Fax: **033-25350415**	1971
3	Dr. B Mandal, Professor (Soil science) Directorate of Research, Bidhan Chandra Krishi Vishwa Vidyalaya, Kalyani-741235, Nadia (Distt.), West Bengal mandalbiswapati@rediffmail.com (O) **033-25808601** (R) **033-25826074** (M) **09433533598** Fax: **033-25828460**	1968
4	Dr. R. Santhi Professor (SS & AC), I/c. STCR Centre Department of Soil Science & Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore-641003 Tamil Nadu santhitnau@yahoo.co.in (O) **0422-6611357(O)**	1967

	0422-6611235 (R) **0422-2438852** (M) **09865092150** Fax: **0422-6611435**	
5	Dr. J Prasad, Incharge STCR centre, Department of Soil science & Agricultural Chemistry, Rajendra Agricultural University, Samastipur, Pusa – 848125, Bihar drjprasad@rediffmail.com drjanardhanprasad@rediffmail.com (R) **06274-240463** (M) **09430046521** Fax: **06274-240255**	1967
6	Dr. Mohinder Singh Incharge STCR centre Department of Soil Science & Agricultural Chemistry Chaudhary Charan Singh Haryana Agricultural University, Hissar – 125004, Haryana msingh@hau.ernet.in (O) **01662-289278** (R) **01662-224629** (M) **09466338110** Fax: **01662 224629**	1967
7	Dr. A. Sai Ram Principal Scientist & Incharge STCR centre Agriculture Research Institute, Acharya N G Ranga Agricultural University Rajendranagar – 500 030 Hyderabad, Andhra Pradesh sairamabburi@yahoo.co.in (O) **040-24001601/ 040-24015161** (M) **09866983492** Fax: **040-24013118**	1967
8	Dr. B.Sacchidanand Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur – 482004, Madhya Pradesh drsachidanand@rediffmail.com (O) **0761-2681119** (M) **09827212201** Fax: **0761-2481074/ 2481389**	1967
9	Dr. R.K.Gupta, Sr. Soil Chemist &	1967

	Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Punjab Agricultural University, Ludhiana-141 004 Punjab rkg1103@yahoo.com (O) **0161-2401960 EXT.317** (M) **09872011940** Fax: **0161-2409257**	
10	Dr. Raghu Nath Pandey Pr. Scientist & Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Indian Agricultural Research Institute, Pusa Campus, New Delhi – 110012 rnpandeyssaciari@rediffmail.com (O) **011-25733694** (M) **09868715244** Fax: **011-25841529**	1967
11	Dr. S.P. Dixit Scientist (Soil) & Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Ch. Sharvan Kumar Himachal Pradesh Krishi Vishwa Vidyalaya, Palampur-176062, Himachal Pradesh (O) **0189 4230382** (R) **01894232359** Fax: **01894-230382**	1970
12	Dr. Sobaran Singh, Incharge STCR centre, Department of Soil Science & Agricultural Chemistry G B Pant University of Agriculture & Technology, Pantnagar – 263145, Uttaranchal Sobaran55@yahoo.co.in (O) **05944-233320/4612** (R) **05944-233123** (M) **09411791567** Fax: **05944233473/ 233608**	1970
13	Dr. P. Kadu Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Mahatma Phule Krishi Vidyapeeth, Rahuri – 413 722, Maharashtra ppk_soilchemist@rediffmail.com (O) **02426-243209** (M) **09421585436** Fax: **02426-243223**	1970

14	Dr. V N Mishra, Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Indira Gandhi Krishi Viswa Vidhyalaya, Raipur-492 012, Chattisgarh vnmishra_igau@yahoo.com (O) **0771-2442515 EXT.-131** (R) **0771-2242842** (M) **09827162401**Fax: **0771-2442131/ 2442302**	1981
15	Dr. I J Gulati, Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Rajasthan Agricultural University, Bikaner – 334002, Rajasthan ijgulati@rediffmail.com (O) **0151-2250570/ 0151-2250870** (R) **0151-2251587** (M) **09414603897** Fax: **0151-2250576**	1996
16	Dr. Betty Bastin, Department of Soil Science & Agricultural Chemistry Kerala Agricultural University, Vellanikkara (Distt), Trichur – 680656, Kerala bettywils2003@yahoo.co.uk (O) **0487-2370822** (M) **09895642148** Fax: **0487-2370019**	1996
17	Dr. Antaryami Mishra Incharge STCR centre, Department of Soil Science & Agricultural Chemistry Orissa University of Agriculture & Technology, Bhubaneswar – 751003, Orissa antar199@yahoo.co.in (O) **0674-2395036** (M) **09938315198** Fax: **0674-24007780**	1996
18	Dr. (Mrs) Anjali Basumatary, Professor and Centre I/c. STCR, Department of Soil Science, Assam Agricultural University, Jorhat-785013 Assam (M) 09435728659	2010
19	Dr. U. Bagavathi Ammal Associate Professor Incharge STCR Centre	

	Department of Soil Science and Agril. Chemistry Pandit Jawaharlal Nehru College of Agriculture and Research Institute Karaikal-609 603 U.T. of Pondichery (O) 04368-261372 (M) 9442127094 Fax: 04368-261260	
20	Dr. S.B.Kumar, Jr. Scientist cum Assistant Professor, Incharge STCR Centre, Dept. of Soil Science & Agril. Chemistry, Birsa Agricultural University Kanke, Ranchi-834 006, Jharkhand (O) 0651-2450610 (M) 09431222937 Fax: 0651-2451011	
21	Dr. Uzma Bashir Assistant Professor/Junior Scientist Incharge STCR Centre Sher-e-Kashmir University of Agriculture Sciences And Technology of Kashmir, Shalimar, Srinagar Jammu and Kasmir-191 121 (O) 9796375013 (R) 9906661507 (M) 9596224602	
22	Dr. N.B. Babaria, Incharge STCR Centre, Professor and Head, Dept. of Agril. Chemistry & Soil Science, Junagadh Agricultural University, Junagadh- 362 002, Gujarat.	
23	Dr. Y.V.Singh Lecturer Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 222 005, Uttar Pradesh (M) 09454280586	
24	Dr. Dibyendu Sarkar, Scientist, Incharge STCR centre, Division of Soil Science, ICAR Research Complex for NEH Region, Manipur, Lamphelpat, IMPHAL-795 004, Manipur State	

b) The details of expenditure incurred on the said centres and projects during the last three years.

S.No.	Centres	Expenditure during the last 3 years (Rs. in Lakhs)		
		2008-09	2009-10	2010-11
1.	Bangalore	23.40	15.80	9.88
2.	Kalyani	18.77	11.78	8.48
3.	Coimbatore	20.33	17.96	15.05
4.	Pusa	19.96	14.03	20.15
5.	Hisar	28.30	24.08	22.00
6.	Hyderabad	17.53	19.94	17.50
7.	Jabalpur	20.55	19.56	22.46
8.	Ludhiana	16.69	22.65	27.50
9.	Palampur	18.65	19.28	18.45
10.	Pantnagar	10.65	19.37	9.50
11.	Rahuri	11.75	8.78	13.88
12.	Raipur	13.00	14.15	15.50
13.	Bikaner	11.30	10.41	11.96
14.	Vellanikkara	10.17	8.45	8.48
15.	Bhubaneswar	11.15	8.45	13.25
16.	Barracpore	1.90	1.40	1.40
17.	IARI, New Delhi	2.20	1.80	1.40
18.	Pondicherry*	--	--	0.88
19.	Junagrah, Gujrat	0.00	0.00	0.88
20.	BHU, Varanasi	0.00	0.00	0.88
21.	AAU, Jorhat*	0.00	0.00	0.88
22.	SKUAT, Srinagar	--	0.00	0.88
23.	Ranchi	0.00	0.00	0.88
24.	Manipur	--	0.00	0.88
25.	IASRI, Delhi*	0.00	0.00	--
26.	PDKV, Akola	--	0.00	--
27.	MPUAT, Udaipur	0.00	--	--

c) Whether the agriculture sector particularly agricultural production have been benefitted from this

Reply: Yes, the agriculture sector particularly agricultural production have been benefitted from this project.

d) If so, the details thereof.

Reply:AICRP on STCR developed fertilizer prescription equations without IPNS for 23 field crops, 10 vegetable crops and 2 medicinal crops during the last five years. Different centres of AICRP on STCR developed fertilizer and manure prescription equations with IPNS approach for 38 field crops, 29 vegetable crops and 12 medicinal and other horticultural crops. Different centres conducted 170 verification trials, 130 field demonstrations on farmers' fields in different states. These demonstrations showed that soil test based fertilizer and manure application produced 10-25% higher yields of cereals, oilseeds, vegetables and medicinal plants. These STCR based technologies not only given higher net profits and benefit cost ratio to farmers but also maintained better soil health.

Hkkjrh; e`nk foKku LkaLFkku

Ukchckx] csjfl;k jksM+] Hkksiky & 462 038

Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462038

No. Parliament Reply/PME

Dated: August 8, 2012

To

Dr. PP Biswas

Division of NRM

KAB II, PUSA

New Delhi

Sub: Rajya Sabha Provisional admitted question Dy. No. S-2812 for 17/08/2012 regarding technique to increase of fertility of soil by Shri Jugal Kishore

a) Whether the government is considering any new techniques to make barren land in the country to arable;

Reply: It is difficult to utilize the barren land as arable land. Since such lands usually occur in arid and semi-arid climate coupled with poor soil conditions such as very shallow soil depth, rockout crops, marshy land, undulating terrain, high slope etc. Opting out agriculture (annual crops) in such land is quite uneconomical. Hence, if at all these are to be utilized, these can be best put to forestry/horti/pasture development depending upon the prevailing constraints and resource availability so that these are not degraded further. In many states the barren land in the proximity of village is generally allotted by the state government to the landless inhabitants.

b) ***The name of the states where soil is infertile and the details of the nutrients which are lacking in the said soil;***

Reply: Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status. Analysis of more than 0.25million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils. Data for 73 districts showed that almost all soils of different districts of North, South, East and West zones are deficient in available N. In North zone, majority of the soils are medium to high in available P and available K status. Only few soils (1-8%) in 3-4 districts are low in P and K. In West Zone, majority of the soils are low to medium in available P except Gujarat. About 92-100% area in Gujarat is high in available P. Altogether only 10-33% area in west zone is low in available K. Most of the soils in Gujarat and Maharashtra are high and Rajasthan are medium in available K. In East Zone, most of the area in Orissa (73-97%) is low in available P. Majority of the soils of Assam and West Bengal are medium to high in available P status of soils. Majority of the soils in East Zone are medium in available K except Kurda district in Orissa where 58% of the area is low in available K. In South Zone, majority of the soils in Andhra Pradesh, Tamil Nadu and Kerala are high in available P. In Karnataka, most of the soils are medium in available P. With regards to available K, majority soils of Tamil Nadu, Karnataka and Kerala are medium and majority of the soils of Andhra Pradesh are high in available K.

c) ***The details of agriculture institutes working for monitoring of fertility of soil in the country and***

Reply: There are about 97 institutions of ICAR apart from 47 StateAgriculturalUniversities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

i) **Central Soil and Water Conservation Research and Training Institute, Dehradun**

ii) **Central Soil Salinity Research Institute, Karnal**

iii) **Indian Institute of Soil Science, Bhopal**

iv) **National Bureau of Soil Survey and Land Use Planning, Nagpur**

d) The significant achievement made by these institutes to increase fertility of soil?

Reply: The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the StateAgriculturalUniversity. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Hkkjrh; e`nk foKku LkaLFkku

Ukchckx] csjfl;k jksM+] Hkksiky & 462 038

Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462038

No. Parliament Reply/PME

Dated: August 8, 2012

To

Dr. PP Biswas

Division of NRM

KAB II, PUSA

New Delhi

Sub: Lok Sabha Provisional starred question Dy no. 913 for 14/08/2012 regarding fertility of land by Sh. Marotrao Sainuji Kowase and others

a) ***Whether the fertility and productivity of land is decreasing constantly in the country due to non-judicious use of pesticide and substandard fertilizers for agriculture purposes;***

Reply: Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status**.** There is no much change in the soil fertility status as compared to earlier reports of 1967 and 2002 (Table 1). These results showed that the status of P was increased in some areas due to continuous application of phosphatic fertilizers. Similarly, per cent soils high in available K increased from 27% in 1976 to 49% in 2011. The per cent soils low in available N increased from 52% in 1976 to 57% in 2011 which may due to various losses of nitrogen. Analysis of more than 0.25million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils.

Table 1. Change in available N, P and K status of Indian soils with time.

Year	**% Soils in different categories**		
	Low	**Medium**	**High**
Available N Status			
1976	52 (117)	43 (97)	4 (10)
2002	63	26	11
2011	57(283)	36(182)	7(33)
Available P Status			
1969	47 (106)	49 (110)	4 (10)
1979	46 (170)	50 (184)	5 (17)
1996	49 (179)	49 (177)	2 (7)
2002	42	38	20
2011	51(257)	40(200)	9(40)
Available K Status			
1976	20 (36)	53 (98)	27 (50)
1980	22	44	34
2002	21	51	28 (Hasan 2002)
2002	13	37	50
2011	9(47)	42(212)	49(231)
Figures in parenthesis are number of districts Sources: Motsara (2002); Muralidharudu et al. (2011)			

Hence, there is no report suggesting the fertility and productivity of land due to non-judicious use of pesticides and substandard fertilizers. Moreover, pesticides in general has no role in augmenting on reducing the soil fertility.

b) If so, the details there of and the reaction of the government there to;

Not applicable

c) ***Whether the government has conducted any study over then decline in fertility of land due to use of above produces;***

Yes, ICAR (through its AICRP on LTFE) has been conducting long term study on use of fertilizer and pesticide on soil health.

d) ***If so, the details and the outcomes thereof***

Ans: The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health.

e) ***Whether the government has taken steps to save the fertility of soil and to impart training to farmers for judicious use of pesticide, chemicals and fertilizers and to promote use of bio-fertilizers; and***

Ans. Yes, The Government of India through its research, education and extension institutes has been giving training to farmers to save the fertility of soil. Also, it is mandatory for all the ICAR institutes to provide training to the farmers.

f) ***If so, the details there of?***

Ans. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programme are being conducted every year for the benefit of farmers.

Hkkjrh; e`nk foKku LkaLFkku

Ukchckx] csjfl;k jksM+] Hkksiky & 462 038

Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462038

No. Parliament Reply/PME

Dated: August 8, 2012

To

Dr. PP Biswas

Division of NRM

KAB II, PUSA

New Delhi

Ref: Lok Sabha Provisional starred / Unstarred question Dy no 2858

Dear sir,

Kindly find detailed below the reply to above query.

Queries	**Reply**
Whether the government has recently made an assessment on the quantity of Biofertilizers required in the country	About 38,000 tonnes of biofertilizer are required per year for the country.
If so, the details thereof;	Biofertilizer producing manufacturers of our country are doing.
Whether the Governemnt proposes to lunch an awareness programme amongst farmers to promote the use of Biofertilizers	AINP on Biofertilizer (ICAR) is demonstrating the use of biofertilizer through Front-line demonstration (FLD) programme in different cooperative centres of India of BNF.

Yours sincerely

(S. Kundu)

I/c Director

Hkkjrh; e`nk foKku LkaLFkku

Ukchckx] csjfl;k jksM+] Hkksiky & 462 038

Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462038

No. Parliament Reply/PME

Dated: August 8, 2012

To

Dr. PP Biswas

Division of NRM

KAB II, PUSA

New Delhi

Ref: RS QuestionNo.83021

Dear Sir,

Kindly find reply to the above referred question as detailed below:

Sl. No	Queries	Reply
a)	Whether it is a fact that cultivation of Bt cotton is increasing the toxicity in soil;	Studies showed the presence of Bt toxin in soil deposited by root exudates of Bt cotton or incorporation of biomass of Bt cotton. The study conducted at IISS, Bhopal found that there is no reduction of soil microbial activities such as in soil microbial biomass carbon(SMBC), Dehydrogenase activitiy (DHA) and Fluorescein Diacetate hydrolysis (FDA) assay as compared to non Bt cotton.
b)	If so, the details thereof;	The data presented in the Table 1 revealed that there was no adverse effect of Bt cotton based cropping system compared to non bt cotton on soil microbial activities.

c)	Whether it is also fact that cultivation of Bt cotton significantly increases the use of pesticides and	Cultivation of Bt cotton reduces the use of insecticides because the gene incorporated in this plant is toxic to the insect feeding on it.
d)	If so, the reasons therefor?	Since the transferred bt genes in the cotton plant produces toxin which kills the Lepidopteran larvae. This feature is inherent in the Bt-cotton plant and hence farmers need not apply insecticides repeatedly.

Table 1

Experimental site	**SMBC (mg kg^{-1} soil)**		**DHA (µg TPF g^{-1} h^{-1})**		**FDA(µg fluorescin g^{-1} h^{-1})**	
Cropping system	Bt	Non Bt	Bt	Non Bt	Bt	Non Bt
Cotton- soybean	225	198	32.04	31.32	27.20	19.40
Cotton- redgram	177	159	25.48	22.42	18.80	17.20
Cotton – wheat	159	153	19.66	18.34	14.72	14.80
Cotton-vegetables	210	191	17.96	16.20	17.70	17.30
Cotton- fallow	195	174	22.60	17.46	16.20	13.48

Yours sincerely

(S. Kundu)

I/c Director

Indian Institute of Soil Science

Bhopal

Reference: Parliament Question *132 Shri E.T. Mohammed Basheer: Dr P. Venugopal

a) Yes, there is a greater need of technological intervention.
b) The technologies developed by IISS, Bhopal are given below:

Some technologies developed by the institute to meet the challenges

(i) Participatory INM for soybean-wheat system
Nutrient management is a crucial issue with resource poor small farmers. More often there exists a mismatch between the farmers' resource and farmers' practices. Therefore a need was felt for participatory nutrient management at farmers' fields. Seven Integrated nutrient management modules were tested for two years at the institute for their effectiveness vis a vis farmers resources. Out of these seven modules, two best modules were identified along with farmers' practice to be proved efficient at the farm scale. These included A) Balanced Fertilization (BF) i.e., 100% Recommended rate of NPKSZn to soybean and 100% Recommended rate of NPKS to wheat; B) Integrated Nutrient Management (INM) i.e., 50% Recommended rate of NPKS + 5 t FYM/ha +*Rhizobium* to soybean and75% of Recommended rate of NPKS + PSB.

(ii) Mechanical Harvest Borne Residue Management
Mechanical harvesting of wheat by using combine harvester leaves behind almost all the crop residue in-situ. The residue so left in the field cannot be utilized for any of the traditional uses, the common practice in vogue is to burn the residues in the field itself to facilitate easy land preparation for the succeeding *kharif* crop. The field burning of crop residues is undoubtedly a wasteful practice as it results in loss of valuable organic matter, and associated nutrients. Soil microbial population in surface layer may also get affected. A suitable alternative residue management strategy has been evolved at the Indian Institute of Soil Science Bhopal through years of experimentation. Wheat residue incorporation or retention coupled with application of 28 kg N ha^{-1} through fertilizer or organic manures is more beneficial than burning in terms of enhanced crop productivity and soil fertility.

(iii) Soybean-based intercropping systems for sustainable productivity on deep Vertisols of Madhya Pradesh	
Description and salient technical features	This technology gives different cropping system options to the farmers depending upon their resources and soil condition. The resource poor farmers (no capacity to apply chemical fertilizers) can also harvest good yields under soybean+maize (kharif) followed by wheat in rabi with only 5 t/ha FYM application in kharif. However, with the application of 100% N maize-wheat system will give the highest profitability. Farmers could consider for intercropping where soils are susceptible to erosion.
Performance results	Soybean + Maize intercropping (2:1 ratio) in *kharif* followed by Wheat in

	rabi was highly productive (3546 kg/ha of Soybean equivalent yield, SEY) and economical (2.37 B: C ratio) with the application of FYM @ 5 t/ha without nitrogen application. Sole Maize – Wheat cropping system was more productive (5195 kg/ha of SEY) and economical (3.01 B: C ratio) at the recommended dose of fertilizers (100 % N). Intercropping systems were more sustainable as they resulted in lower runoff and soil losses compared to the sole crops of sorghum and maize.

Cropping System	Total productivity* (kg/ha)		Benefit: Cost Ratio		Runoff (mm)	Soil loss (t/ha)
	N_0	100 % N	N_0	100 % N		
Soybean - Wheat	3339	3972	2.27	2.64	27.4	1.007
Sorghum – Wheat	2846	4502	1.90	2.82	60.2	4.823
Maize – Wheat	3216	5195	2.08	3.01	62.4	5.817
Soybean + Sorghum - Wheat	3278	4095	2.16	2.70	40.1	2.001
Soybean+Maize – Wheat	3546	4640	2.37	2.91	40.2	1.991
CD (P= 0.05)	320		0.22			

* Expressed in terms of soybean equivalent yield (SEY)

(iv) Conservation tillage for soybean-wheat cropping system on Vertisols of central India

Removal or burning of wheat residues and excessive tillage operations results in loss of carbon and nutrient from the soil system, pollution of atmosphere, degradation of soil through runoff and soil loss and decline in soil quality. From the long-term tillage management experiment, suitable conservation tillage management options for soybean-wheat cropping system have been developed for Vertisols which reduces loss of carbon from the system and also improves the energy utilization efficient of the system. Conservation tillage practices tested for soybean-wheat system includes no tillage and reduced tillage system. In no tillage system during the *kharif* season soybean crop was sown directly with a no-till seed drill while wheat residues were kept on the surface. Under reduced tillage system soybean was sown using a no-till seed drill in wheat residue retainted field after one pass ploughing by duck foot sweep cultivator. Reduced tillage system was found more efficient in controlling weeds and ease of sowing operation. Weeds in both the conservation tillage systems were controlled by herbicide Glyphosate as pre-emergence herbicide and *Persuit* as post-emergence herbicide. One hand weeding is required in some heavy rainfall years for controlling weeds. Similarly wheat in *rabi* season was sown directly with no-till seed drill in no tillage system while in reduced tillage wheat was to be sown after one-pass of tillage operation by duck-foot tyne sweep cultivator. Recommended dose of NPK fertilizer is required to be applied to both the crops.

(v)Broad base and furrow system for high productivity, improved drainage and in-situ moisture conservation

Description and salient technical features	Excessive loss of rainwater through runoff, loss of fertile topsoil through sediment loss and problem of water congestion during the heavy rainfall period are the major contraints for low productivity in Vertisols of central India under rolling topography. An improved land management system viz. broad bed and furrow tested on Vertisols has showed promising results to address these constraints. The BBF system consists of semi-permanent broad beds of approximately 100 cm wide, separated by furrow of about 50 cm wide. The BBFs are to be made along a key line keeping a rolling

	slope of 0.4-0.7% for safe drainage of excess water. BBF are made with a tractor drawn BBF former. Bullock drawn BBF formers are also available. On BBF, sole maize or intercropping of pigeon pea with maize crop in rainy season and chickpea in the winter season is grown with application of recommended doses of fertilizer and farm-yard manure @ 5 t/ha. Two rows of maize at 60 cm interval or two rows of maize intercropped with one row of pigeon pea could be sown on a bed and four rows of chickpea at an interval of 30 cm could be grown on a bed in winter season. The BBF system is particularly suitable for the Vertisols. The technique works best on deep black soils in areas with intense rainfall averaging 750 mm or more per annum. The BBF system reduced the runoff (20-24%) and consequent soil losses (30-45%) from the Vertisols. It increased the amount of water that infiltrates in the profile by increasing the opportunity time of water to infiltrate and also increases storage of water in the profile for their use by crops during the dry spell. When rainfall is very heavy, the furrows safely carry runoff water away without causing excess soil loss and drain the excess water to the water harvesting ponds which is used for irrigating chickpea during the winter season. BBF also makes heavy soils more workable by improving drainage and extending the opportunity time for infiltration.
Performance results	The technological package gave a yield advantage of 20-25% on soybean-equivalent weight basis over soybean-chickpea system grown on traditional flat on grade system. This will add to the income of a farmer proportionally. Other intangible benefits of the technology include the reduction in the runoff (20-24%) and reduction of soil loss by 30-35% in comparisons to conventional system of flat on grade sowing of *kharif* crops in Vertisols of central India. The increased income of the farmers will improve their quality of life and social status. This technology reduces the runoff and soil losses from the field which otherwise would have contributed to the siltation and eutrophication of water bodies and degradation of the arable land. The extra runoff water safely passed through grassed waterways was stored in farm ponds which were utilized as life saving irrigating to the winter season crop.

(vi) Recycling of distillery effluents in agriculture
Spent wash, which is often termed as 'distillers' distress', happens to be a potential source of renewable energy. When treated anaerobically, this 'liquid gold' releases millions of kilocalories in the form of methane rich biogas that can be fed into boiler or biogas engines to generate electricity. The total effluent generated by distilleries in a year amounts to nearly 40 billions liters which has a potential of producing 1100 millions cubic meter of biogas annually. This biogas normally contains 60% methane gas which is a well recognized fuel gas with minimum air pollution potential. If this source of energy is tapped, it will fetch additional energy units worth 5 trillion kilo calories annually. Besides, the post-methanation effluent (PME) can provide 2,44,000 tonnes of potassium, 12,200 tones of nitrogen and 2,000 tonnes of phosphorus annually. Thus the manurial potential of the effluent can be measured by the fact that one year effluent can meet the potassium requirement of 1.5 million hectare land, nitrogen requirement of 0.12 million hectare land and phosphorus requirement of 0.02 million hectare land if two crops are taken in a year. On the face of scarcity of water in semi arid regions of the country a new process of composting has been developed using distillery effluents to save precious little water and to enrich the compost with essential nutrients like N,P,K and S. Yield performance of the spent wash amended compost showed promising results in maize-chickpea system in deep black soil of M.P. and was at par with or better than FYM and conventional composts. Based on five years of experimentation under field, pot-culture and laboratory conditions on application

of distillery effluents on soybean-wheat productivity and consequent effects on soil physical, chemical and biological properties of soil, the following prescription has been formulated for soybean-wheat sequence in deep black soils of Madhya Pradesh.

Sl. No.	Soybean (rainfed)	Wheat (one pre-sowing plus 2-3 post-sown irrigations)
1.	2.5cm Spent wash (SW)*	N & P Fertilizers only
2.	2.5 cm Spent wash	1.25 cm SW + two top-dressings of N (1/4N +1/4N)
3.	2.5 cm Post-methanation Effluents (PME)*	NP
4.	2.5 cm Post-methanation Effluents	1.25cm PME + two top-dressings of N (1/4N +1/4N)
6.	5 t ha^{-1} Lagoon Sludges (LS)*	N & P Fertlizers only
7.	5 t ha^{-1} Lagoon Sludges	10 t ha^{-1} LS + two top-dressings of N (1/4N +1/4N)

*SW, PME and LS to be applied 7-15 days before sowing.

(vii) Mixed consortium biofertilization	
Description and salient technical features	Mixed biofertilizers (BIOMIX) containing a consortium of N fixers, P solubilizers and PGPR found to promote the growth of cereals, legumes and oilseeds better and save 25% NP fertilizers in crops in various regions. The response of biofertilizers was better when used along with 75% chemical fertilizers and was seen even when full dose of chemical fertilizers were applied. There was marked improvement in nutrient use efficiency and quality of produce when biofertilizers were applied.
Performance results	Application of AM fungi and Azophos bioinoculants along with 75% recommended dose of chemical fertilizers enhanced the grain yield of aerobic rice by 10-12% in Tamilnadu. Application of concentrated AM fungi along with *Azospirillum* bioinoculant in seed bed of SRI nursery with 100 % NPK fertilizer recorded 20.7 % increased grain yield over fertilizer control. Inoculation of *Azotobacter* + *Gluconacetobacter* to sweet sorghum gave additional green stalk yield of 4.4t/ha; grain yield of 1.3 q and 500 L juice/ha in Vertisols of Maharashtra. Combination of PSB (*Pseudomonas* sp. ACC10 + *B. megaterium*) and groundnut rhizobia (TAL1000 + NRCG22) improved yield of groundnut significantly in both *rabi*-summer and *kharif* (11-21%) over 3 years in Saurashtra. Inoculation of liquid formulations of elite strains of PGPR increased soybean yield by 18% (9 no.), chickpea by 33% (3 strains) and wheat by 17% (3) in Vertisol field. Elite rhizobial strains increased soybean yield by 16% (2 no.) and chickpea by 12% alongwith significant improvement in BNF.

(viii) BGA biofertilizer for rice in eastern India

Technology developed by RAU, Pusa centre has three major components: enriched mycostraw (spent

residue of mushroom production + *Pseudomonas* sp.), liquid *Azospirillum* inoculant and tobacco/neem/bael based blue green algae inoculant. Rice straw is converted into mycostraw through cultivation of oyster mushroom. 400-450 g mycostraw and 600-700g mushroom can be obtained from 1 kg dry paddy straw. The mycostraw is enriched with plant growth promoting rhizobacteria i.e., *Pseudomonas* sp. and applied during puddling of rice field at the rate of 2 t/ha. The rice seedling was dipped into boiled rice water (Maur) for 20 minutes followed by 30 minutes dipping in *Azospirillum* liquid formulation. Blue green algae cultures harvested, mixed with tobacco/neem/bael waste and dried. This BGA biofertilizer is applied @ 1 kg/ha dry mix, three to four days after rice transplanting. Tobacco/neem waste as carrier can control the population of snails and nematodes, a potent BGA grazers and help in establishment.

(ix) On-line soil fertility maps of different states and fertilizer recommendation system for targeted yields of crops	
Description and salient technical features	The soil fertility data on N, P, and K index values at district level for the states of Andhra Pradesh, Maharastra, Chhattisgarh, West Bengal, Haryana, Orissa, HP, Karnataka, Panjab, Tamil Nadu and Biharof India has been developed in MS-Access. From the attribute database, the different thematic layers have been reclassified to generate various thematic maps on N, P and K index values (IVs). The calculated soil test values were incorporated into the developed fertility maps to prescribe nutrients for targeted yields. This application software was developed to recommend fertilizer doses for the targeted yield at the district level. This system has the facility to input actual soil test values at the farmers' fields to obtain optimum doses. The application is a user-friendly tool. It will aid to the farmer in improving the efficiency (appropriate dose) of fertilizer use to achieve a specific crop yield. The system is explained with the example of Tamil Nadu state. The system works as a ready reckonner to give prescription in the form of fertilizer available (eg. Urea, SSP, MOP etc.).
Performance results	This decision support system provides real use of fertility maps to the users. It can be used up to field level also, if the farmer has the knowledge of his field fertility status and the yield target. It can be further narrowed down to block/village level depending on the availability of information. The experiments conducted at different locations in the states under STCR scheme suggest that a considerable amount of fertilizer can be saved if the fertilizers are prescribed using soil test values.

(x) Predicting soil C and N pools using Walkley and Black carbon value
Globally, there is problem of computing soil carbon stock due to prevalence of Walkley-Black method which gives only an approximation of soil organic carbon content. We developed relationship between WBC and TOC by taking into account the soil properties and climate parameter(s). The developed system gives an easy approach to measure TOC by easily analyzable soil parameters thereby generating the total carbon values without the availability of sophisticated instrument like TOC/CHNS analyzer. It also predicts amount of carbon in resistant and mineralizable pool. The model thus developed predicts total organic carbon, carbon in resistant and mineralizable pool, total nitrogen, available N and C: N ratio of soils at high level of significance. The model could be the useful for soil test based fertilizer recommendations.

(xi) Enriched Compost Production	
Description	Most of the Indian soils are deficient in Phosphorus. Also, yearly removal of P is more than its

and salient technical features	addition through P fertilizers under continuous and intensive cropping. Bio-solids produced in cities, agro-industries and at farms normally have low nutrient value, particularly of P content. Compost production from these bio-degradable wastes is presently not an economically viable proposition. The traditional technology of composting, if improved in terms of nutrients content, may help in arresting trends of nutrient depletion to a greater extent. Further, the uses of mineral additives such as rock phosphate and pyrites during composting have been found beneficial. A phosphor compost/N-enriched phospho sulpho compost technology has, thus, been developed using phosphate solubilizing microorganisms, namely, *Aspergillus awamori*, *Pseudomonas straita* and *Bacillus megaterium*; phosphate rock, pyrite and bio-solids to increase the manurial value compared to ordinary FYM and compost.
Performance results	Application of 5 t/ha of Phosphosulpho-nitro-compost (PSNC) + 75% of recommended fertilizer dose gave yield comparable to the full recommended fertilizer dose in soybean-wheat, maize-wheat and sorghum-wheat systems (ii)The impact of a given rate of PSNC on yield varied from crop to crop.(iii) Yield response/tonne of PSNC applied was 42.4 kg in soybean, 146 kg in sorghum, 166 kg in wheat after sorghum and 180 kg in wheat after soybean. This technology led to increase in benefit to farmers more than Rs. 5800 per annum per ha under soybean/sorghum-wheat system and Rs. 4660 per annum per ha under soybean-wheat system assuming Rs.2500/q grain of soybean, Ps.980/q for sorghum and Rs.2000 /q for wheat grain produce cost.

Transfer of technology

AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer's practice	STCR- IPNS recommended practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

The estimated food grain requirement for 2020 is: 280 million tonnes.

The SOC stock in these physiographic regions has been compiled by Dr. Tapas Bhattacharya. The has been developed as soil organic carbon stock in differ physiographic regions viz. Northern mountains, The great plains, The peninsular India, The peninsular plateau and The Indian coasts and islands based on 40 soil series . The study indicated that the soils under hot humid and per humid climates are deficient in soil organic carbon due to intensive agricultural practices. However most part of humid and sub-humid regions of the Great plains has sufficient soil organic carbon. Also, soils of arid and semi-arid climates occupying more than one-third area of Indo Gangetic Plains are poor in soil organic carbon. In Northern mountains the carbon content status is better owing to predominance of forest land use system in most part. About 39 per cent of carbon stock in surface 30 cm soil depth in the country resides in the northern mountains followed by almost equal quantities in the great plain, peninsular India and peninsular plateau. The least soil carbon stock is in coastal plains and islands.

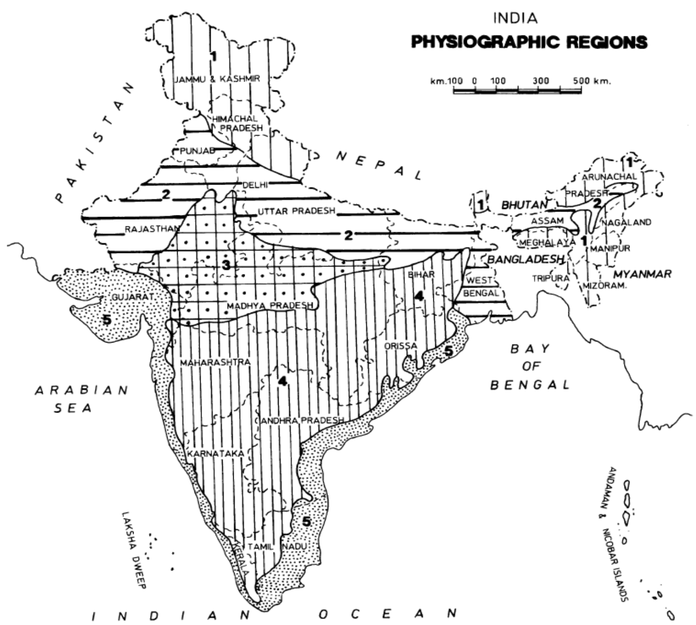


Figure 1. SOC stock in different physiographic regions of India, based on 1800 soil samples.

Symbol	Physiographic regions	SOC stock (Pg) Soil depth (cm) 0–30	SOC stock (Pg) Soil depth (cm) 0–150	Area (m ha)
1	Northern Mountains	7.89 (39)[1]	18.31	55.3 (17)[2]
2	The Great Plains	3.281 (18)	10.53	72.4 (22)
3	Peninsular India	3.64 (17)	13.34	54.7 (17)
4	Peninsular Plateau	3.62 (17)	10.11	105.7 (32)
5	Coastal Plains and the Islands	2.24 (11)	10.90	40.9 (12)
	Total	20.99 (100)	63.19	

[1]Figures in parentheses indicate per cent of total SOC stock.
[2]Figures in parentheses indicate per cent of total geographical area of the country.

Table 1. General characteristics of a few representative soils in various physiographic regions of India (in first 30 cm depth)

Soil series*	Soil subgroup**	OC (100 g)	pH (water)	CEC cmol $p^+ kg^{-1}$
The Northern Mountains				
Kibber	*Typic Cryorthids*	1.4	7.8	9.0
Sukna	*Typic Haplumbrepts*	2.9	4.5	9.6
Yakimoli	*Typic Hapludalfs*	2.7	4.4	16.0
Digingru	*Typic Palendalfs*	1.9	4.5	11.0
Dialong	*Ultic Hapludalfs*	1.7	4.5	14.4
The Great Plains				
Thar	*Typic Torripsamments*	0.1	8.0	2.3
Zarifa viran	*Typic Natrustalfs*	0.3	10.3	11.5
Itwa	*Aeric Ochraqualfs*	0.3	6.6	12
Pantnagar	*Aquic Hapludolls*	2.7	6.5	19
Haldi	*Typic Hapludolls*	0.7	7.1	8
Peninsular India				
Bijapur	*Udic Ustochrepts*	0.2	6.7	6.6
Sarol	*Typic Haplusterts*	0.4	8.0	53.2
Jambha	*Typic Haplusterts*	0.5	8.5	53
Bhubaneswar	*Typic Haplustulfs*	0.6	4.7	6.2
The Peninsular Plateau				
Raichur	*Typic Pellusterts*	0.8	8.0	71.8
Nimone	*Typic Haplusterts*	0.4	8.1	56.9
Kasireddipalli	*Sodic Haplusterts*	0.7	8.8	73
Coimbatore	*Vertic Ustropepts*	0.4	8.7	39
Amgaon	*Typic Plinthustalfs*	0.6	6.1	5.8
The Coastal Plains and Islands				
Lakhpat	*Typic Natrargids*	0.2	8.7	27.0
Kalathur	*Sodic Haplusterts*	0.6	9.4	41.0
Sagar	*Typic Haplaquepts*	0.7	6.6	22.0
Thiruvananthapuram	*Oxic Dystrochrepts*	1.1	4.5	6.2
Minicoy 1	*Typic Ustipsamments*	4.2	7.9	3.3
AP Coast	*Typic Ustifluvents*	0.8	8.4	33

The state-wise soil organic status was calculated on the respective soil series of each states based on low, medium and high categories. The area in percentage fall under low, medium and high categories for soil organic carbon and weighted mean are also mentioned in Table-2. The state-wise mean organic carbon in soil indicate a better situation in hill and mountain region as well as coastal region.

Table – 2 State- wise area (%) and weighted mean of low, medium and high categories of Soil Organic Carbon

States	Status	SOC (%)	Area (%)	Weighted mean
A.P				
	Low	0.35	42.22	**0.58**
	Med	0.60	41.56	
	High	1.12	16.22	
Kerala	Low	0.45	1.08	**1.99**
	Med	0.73	1.12	
	High	2.02	97.79	
Assam	Low	0.41	6.82	**1.04**
	Med	0.63	14.05	
	High	1.17	79.13	
Goa	Low	0.26	7.85	**2.00**
	Med	0.62	7.05	
	High	2.28	85.10	
Nagaland	Low	0.00	0.00	**1.64**
	Med	0.71	6.22	
	High	1.71	93.78	
West Bengal	Low	0.33	69.97	**0.49**
	Med	0.58	24.97	
	High	2.25	5.06	
Maharastra	Low	0.30	53.52	**0.73**
	Med	0.62	16.61	
	High	1.57	29.86	
Orissa	Low	0.31	62.63	**0.59**
	Med	0.62	22.95	
	High	1.75	14.43	
Bihar	Low	0.33	83.25	**0.38**
	Med	0.56	13.97	
	High	0.86	2.78	
Rajasthan	Low	0.26	89.62	**0.33**
	Med	0.63	6.76	
	High	1.33	3.63	
MP &Ch	Low	0.40	7.57	**0.98**
	Med	0.64	21.58	
	High	1.14	70.86	
Delhi	Low	0.30	53.10	**0.43**
	Med	0.57	46.90	
	High	0.00	0.00	
Manipur	Low	0.00	0.00	**1.89**
	Med	0.00	0.00	
	High	1.89	100.00	
Sikkim	Low	0.00	0.00	**2.74**
	Med	0.00	0.00	

	High	2.74	100.00	
Tripura	Low	0.42	8.20	**1.06**
	Med	0.65	8.74	
	High	1.16	83.06	
Meghalaya	Low	0.45	1.86	**1.70**
	Med	0.59	7.93	
	High	1.82	90.22	

Status of mean soil organic carbon in surface 0-15 cm soil depth in different states

S.No.	State	Organic carbon ±Standard deviation (%)
1	Orissa	0.77± 0.73
2	Bihar	0.37±0.18
3	Rajasthan	0.39±0.71
4	MP and Chhatisgarh	0.93 ±0.38
5	Delhi	0.38 ±0.19
6	Manipur	1.94 ±1.11
7	Sikkim	2.79 ±1.10
8	Tripura	1.04 ±0.47
9	Meghalaya	1.67 ±0.99
10	UP and Uttrakhand	0.38 ±0.23
11	Andhra Pradesh	0.66 ±0.45
12	Goa	1.81 ±1.54
13	Kerala	1.93 ±1.20
14	Assam	1.01 ±0.58
15	Nagaland	1.85 ±1.07
16	West Bengal	0.61 ±0.79
17	Maharashtra	1.03 ±1.23

Subject: Information for **Rajya Sabha Question (Dy. No. U 1928 for 22/03/2013) on Action Plan to improve soil health and productivity - regarding**

(a) Whether Government has assessed the health of soil including the quality after continued use of chemical fertilizers, Pesticides etc. and its likely impact on the overall food production;

Reply: Yes,

(b) If so, the details thereof along with the plan of action initiated to improve soil health and productivity;

Reply: All India Coordinated Research Project on Long Term Fertilizer Experiments (LTFE) has been initiated by ICAR, New Delhi in 1972 to assess the Quality of Soil due to different scenario of nutrient management. It has been proved that balance as well as integrated nutrient management either stabilized or enhanced the crop productivity of different crops Continuous use of chemical fertilizers in proper not only resulted increase in productivity but also improved soil properties like soil Organic Carbon, status water stable aggregate and maintained soil microbial population. At all the LTFE sites, combined use of chemical fertilizer and FYM found highly encouraging with maximum attainable yield.

The study showed that the residues of pesticide (butachlor) found at below detectable level (BDL) 30h days after application. The application of this pesticide (herbicide) did not affect adversely the soil microbial.

Studies on Soil Quality carried out indicated that continues use of chemical fertilizer resulted better soil quality index compared to control and uncultivated fallow.

(c) Whether Government proposes to promote sustainable growth in agriculture in the country;

Reply: Attempts are made to implement the better management practices through demonstration at farmers' field.

(d) If so, the steps taken by government in the direction;

Reply: Not applicable

(e) The number of soil testing laboratories in each State/U.T. at present; and

Reply: Not applicable

(f) The steps taken by Government to set up more such laboratories?

Reply: Not applicable

2013

Sub: Lok Sabha Question Dy. No 60/Parl/Q.no. 2013 dated 16.04.2013.

a) Whether the Indian Council of Agricultural Research (ICAR) has classified soil into 25 major soil groups in the country;

   Answer: NBSSLUP, Nagpur deals with this aspect.

b) If so, the details thereof.

   Answer: NBSSLUP, Nagpur deals with this aspect.

c) Whether fertility of soil is decreasing in drought affected areas in the country.

   Answer: The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

   Punjab with 243 kg per hectare fertilizer consumption is one of the largest consumers of fertilizers in India. Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

   Results of long-term fertilizer experiments from drought affected areas like Maharashtra, Punjab, Karnataka, Rajasthan, etc. indicated that that continuous use of balanced fertilization has not declined fertility of soil. The crop failure or declining crop productivity in due to moisture stress, which in the most important abiotic stress and not due to decline in soil fertility.

   Declining soil health year after year has been one of the major reasons responsible for reduced response of crops to applied nutrients and lower profits to farmers. Sincere efforts have been made by the institute to assess soil quality and develop strategies to improve soil quality. Systematic studies have been conducted in on-going long-term experiments in different regions of the country to understand the soil fertility dynamics as influenced by intensive cropping with different fertilizer and manure inputs. Minimum data sets (MDS) of soil quality parameters suitable for different groups of soils for periodic evaluation of soil quality under different production systems have been identified.

d) If so, the details thereof along with the funds allocated to the States to maintain the fertility of soil in the country, State-wise.

Answer: Department of Agriculture and co-operation, ministry of agriculture sponsored a project on GPS and GIS Based Soil fertility maps 171 selected districts of the country with and outlay of Rs/- 10.32 crores which was allocated to the following states: Karnataka (UAS, Bangalore), West Bengal (BCKVV, Kalyani), Tamil Nadu (TNAU, Coimbatore), Bihar (RAU, Pusa), Haryana (HAU, Hisar), Andhra Pradesh (ANGRAU, Hyderabad) Madhya Pradesh (JNKVV, Jabalpur), Punjab (PAU, Ludhiana), Himachal Pradesh (CSHPKVV, Palampur), Maharashtra (MPKV, Rahuri), Rajasthan (RAU, Bikaner), Kerala (KAU, Vellanikkara), Orissa (OUAT, Bhubaneswar), Gujarat (AAU, Junagarh) Uttar Pradesh (CSAUAT, Kanpur) Assam (AAU, Jorhat) Maharashtra (PDKV, Akola) Chattisgarh (IGKVV, Raipur) Uttarakhand (GBPAUT, Pantnagar), Uttar Pradesh (BHU, Varanasi) and Manipur (ICAR Res. Complex, Goa).

e) The steps taken/proposed to be taken by the Government to increase the fertility of soil in the country.

Answer: There are about 97 institutions of ICAR apart from 47 State Agricultural Universities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

v) Central Soil and Water Conservation Research and Training Institute, Dehradun

vi) Central Soil Salinity Research Institute, Karnal

vii) Indian Institute of Soil Science, Bhopal

viii) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Reply to Rajya Sabha provisional admitted Question No. S1657 raised by Dr. K.V.P. Ramachandra Rao

Ref: F.No. 2(2) 2013-SW& DF dated 19/2/13

Sl. No.	Quarries	Reply
(a)	**Whether ICAR has developed technology for preparation of compost including enriched/vermicompost from different wastes if so the details thereof**	**Detail has been given in ANNEXURE-I.**
(c)	**The steps being taken to popularize the technology?**	**(i) Popularized through field demonstrations at various districts of Madhya Pradesh such as Raisen, Vidisha, Bhopal, Sehore etc.** **(ii) Training has been given to the farmers of Rajasthan, Bihar and Madhya Pradesh under ATMA programme.** **(iii) Dissemination through Bulletins, pumplet, books, TV & Radio Talksand farmer fairs.**

ANNEXURE-I

A. PHOSPHO-SULPHO-NITRO-COMPOST: PRODUCTION AND USE

Composting

Most of the crop residues are used as feed and fuel, and only one third of the total residue is used as source of organic matter in agriculture.It is, therefore, extremely important that large quantity of agro-based industrial wastes, solid city garbage and natural weed biomass needs to be recycled/used in arable crops for maintaining soil fertility.However, the direct application of the crop residues is possible only in the presence of sufficient amount of soil moisture. Therefore, composting is a microbiological, non-polluting and safe method for waste recycling and an alternative to direct incorporation in soil.

Preparation of enriched Phospho-Sulpho-Nitro compost

Compost can be prepared by heap method. Different crop residues (soybean, wheat and mustard residues) and city garbage can be recycled through this technique. In heap method of composting about 1000 kg of wastes can be accommodated in 12. ft length x 7.5 ft width and 3.5 ft height. About 30 kg of wastes (dry wt. basis) is spread on the floor followed by 30 kg of cow dung (dry weight basis). Urea solution (660g urea dissolved in water 20 lit water) is sprayed on wastes. Also, 17 kg moussori rock phosphate (5 % P_2O_5 basis from Mussori rock phosphate containing 18 % P_2O_5), 6 kg Pyrites (22 % S content) and finely powder soil at the rate of 5% on materials dry weight basis is spread. Water is sprayed to moist the material (60-70 %). This process is repeated till the heap attain height of 3-4 feet. Finally, the upper side and all peripheries of heap are covered with cow dung slurry to maintain optimum moisture content inside the heap. After 3-4 weeks of decomposition, the material is mixed again. Compost will be ready after 3-4 months of decomposition and one gets about 950-1000 kg of enriched phospho-compost from the heap. For 1000 kg enriched compost, the total quantity of fresh cow dung (dry weight basis), rock phosphate, pyrites, urea and soil will be 200, 333, 120, 13 and 50 kg, respectively.

B. VERMICOMPOSTING FOR RECYCLING OF ORGANIC WASTES

A technology for vermicomposting of different organic wastes has been developed. Earthworms species which are waste decomposer and predominant in Central India were identified namely *Eisenia foetida,Perionyx excavatus* and *Eudrillus eugeniae.* Vermicomposting reduces the period of decomposition from 180 to 110days. In this technology, methods have been standardized to decompose agro-based wastes by worm alone or P-enriched earthworm compost (vermicompost) using rock phosphate @ 2.5% P_20_5 to obtain phosphorus rich vermicompost. By adopting the enriched and vermicomposting techniques effective recycling of organic wastes into valuable organic manures is increased, which can bridge the gap between demand and supply of fertilizers. Vermicompost and P-enriched vermicompost are becoming important alternative to conventional compost and FYM sources for organic farming due to shortage in supply of dung.

The vermicomposting can be done by pits or heap method. In vermicomposting, organicwastes/crop residues (wheat, soybean, chickpea, mustard etc.), fresh dung (Wastes: dung ratio of 1:1 on dry weight basis) and earthworm (about 1 kg per quintal of waste material) are used for vermicomposting. Moisture content is maintained at 60-70% through out the decomposition period. Jute bags (gunny bags) are spread uniformly on the surface of the materials to facilitate maintenance of suitable moisture regime and temperature conditions. Watering by sprinkler is often done. The materials is allowed to decompose for 110 days. The forest litter is decomposed much earlier (75 to 85 days) than farm residue (110-115 days). In the case of phosphorus-enriched vermicompost, rock phosphate is used @ 2.5%P_2O_5 of waste material with the same dimension of pit or heap. During first year of vermicompost production, the cost of per kg vermicompost production has been found to be Rs 6.50 / kg. Since, second year the cost of vermicompost production has been found to be Rs. 1.50-2.00/kg vermicompost. Since the required quantity of earthworms is met from the vermicompost generated itself.

Technology transfer:

Different efficient wastes recycling composting techniques have been dessiminated to the farmers field through demonstration on farmers field, technology exhibition in farmers fair and also trained to the farmers by giving training on various composting techniques in the institute. Farmers from different states viz; Bihar (Gaya, Banka, Madhepura, Supoul, Katihar, Shekhpura, Areriya, Paschim Champaran and Jamui distt of Bihar) and Madhya Pradesh (Indore, Dewas, Raisen, Vidisha, Sehore, Hoshangabad and Bhopal distt. Of Madhya Pradesh) were provided training under ATMA Project. Apart from this, documentary video film on organic farming for profitability and sustainability and vermicomposting for biofertilization has been made in English, Hindi and Telgu languages of 15 minutes duration each and submitted to ICAR for telecast on Doordarshan krishi Channel.

Economic advantages of Phospho-sulfo-nitro compost

1. **In a three-years field study on soybean-wheat system, application of 100 % NPK through enriched compost to soybean and 50 % NPK to succeeding wheat produced the highest yield and saved 25 kg N and 39.2 Kg P/ha.**
2. **A five years-field study on Vertisols revealed that compost application @ 5 t ha-1 in combination with 75% NPK to soybean followed by 75 % NPK applied to wheat produced higher productivity in soybean-wheat, sorghum-wheat and soybean+ sorghum-wheat system compared to 100 % NPK treatment and saved 37 kg N, 30 kg P and 15 kg K.**
3. **To improve soil biological activities phospho-sulpho-nitro compost along with chemical fertilizer application is the best option compared to inorganic fertilizer alone.**
4. **Phospho-sulpho-nitrocompost contains relatively higher amounts of available plant nutrients compared to conventional compost.**

Thus, phospho-sulpho-nitro compost helps to produce higher yields of crops, quality of produce and maintain fertility status of soils. The use of enriched manure in field crops is also

Rajya Sabha Starred Question Dy No. 149 regarding Technology to prepare organic manures from organic wastes"

Q a. **Whether the Government has developed technologies to prepare various types of organic wastes:**

Ans. a, Yes, at IISS, has developed technologies to prepare various types of organic manures from organic wastes such as crop residues, agro based industrial waste, city garbage and forest litter have wide C/N ratios ranging from 80 to 110, and low concentration of available plant nutrients particularly N, P and K.

Q. b. If so, the details thereof:

Ans b: The following composting technologies have been developed for various types of organic wastes to prepare organic manures

i) Technology for Enriched Compost Production

Most of the Indian soils are deficient in Phosphorus. Also, yearly removal of P is more than its addition through P fertilizers during continuous and intensive cropping. Bio-solids produced in cities, agro-industries and at farms normally have low nutrient value, particularly of P content. The traditional technology of composting, if improved in terms of nutrients content, may help in arresting trends of nutrient depletion to a greater extent. Further, the use of mineral additives such as rock phosphate and pyrites during composting have been found beneficial. A phosphocompost production technology has, thus, been developed using phosphate solubilizing microorganisms, namely, *Aspergillus awamori*, *Pseudomonas straita* and *Bacillus megaterium*; phosphate rock, pyrite and bio-solids to increase the manurial value as compared to ordinary FYM and compost.

Raw material used

For the production of one tonne of phosphocompost, materials such as 1900 kg organic/ vegetable wastes/straw, 200 kg cow-dung (dry weight basis) and 250 kg phosphate rock (18% P_2O_5) are used.

Methods

- Prepare a base of the heap out of hard, woody materials such as sticks, bamboo sticks etc. This base should be 15 cm thick and 3 m width and 3 m length depending upon the quantity of materials to be composted.
- Place bio-solids over the base made above. The layer should be around 30 cm ± 10 cm thick.

- Sprinkle slurry prepared by mixing cow dung and rock phosphate over the crop residues to moisten the material.
- Make another layer of crop residue and moisten it with slurry.
- Continue with alternate layer of crop residue (30 cm) and slurry until the heap is 1.5 m height. Reduce the area of each layer so that the heap tapers by about 0.5 m high.
- Cover the heap with soil or polythene and mix the material after 15 days. Give two turnings after 30 & 45 days. Add water at each turning to maintain the moisture content to about 60-70%.
- The compost becomes ready for field application within 90-100 days period.

ii) **Technology for Recycling of Organic Wastes through Vermicomposting:**

Vermicomposting is a method of composting with worms and differs from conventional composting in several ways. In vermicomposting, there is a saving of nearly two months in composting time as compared to conventional compost. Vermicompost isrich in nutrients, microbial activity and enzymes. There are two methods of vermicomposting under field conditions.

1. Vermicomposting of wastes in field pits 2. Vermicomposting of wastes on Heaps

Materials Required for Vermicomposting

- Farm wastes (straw from wheat, soybean, chickpea, mustard etc.) were used for vermicomposting.
- Fresh cow dung.
- Rock phosphate (Jhabua RP 30-32% P_2O_5).

  (Note: In the case when vermicompost is to be prepared by P-enrichment technique)

- Wastes: dung ratio (1:1 on dry weight basis).
- Earthworm: 1000-1200 adult worms (about 1 kg per quintal of waste material).
- Water: 3-5 liters / week per heap or pit.

Vermicomopost Preparation under Tree shade by Pit and Heap Methods

Open permanent pits of 10 feet length 3 feet width and 2 feet deep were constructed under the tree shade, which was about 2 feet above ground to avoid entry of rainwater into the pits Brick walls were constructed above the pit floor and perforated into 10 cm diameter 5-6 holes in the pit wall for aeration. The holes in the wall were blocked with nylon screen (100 mesh) so that earthworms may not escape from the pits. Partially decomposed dung (dung about 2 month old) was spread on the bottom of the pits to a thickness of about 3-4cm. This was followed by addition of layer of litter/residue and dung in the ratio of 1:1 (w/w). A second layer of dung was then applied followed by another layer of litter/crop residue in the same ratio up to a height of 2 feet. Two species of epigeic earthworms viz., *Eisenia foetida* and *Perionyx excavatus* were inoculated in the pit. Moisture content was maintained at 60-70% through out the decomposition period. Jute bags (gunny bags) were spread uniformly on the surface of the materials to facilitate maintenance of suitable moisture regime and temperature conditions. Watering by sprinkler was often done. The material was allowed to decompose for 15-20 days to stabilize the temperature because to reach the mesophilic stage, the process has to pass the thermophilic stage, which comes in about 3 weeks. Earthworms were inoculated in the pit or heap with 10 adult earthworms per kg of waste material and a total of 500 worms were added to each pit or heap. The materials were allowed to decompose for 110 days. The forest litter was decomposed much earlier (75 to 85 days) than farm residue (110-115 days).

In the heap method the waste materials and partially decomposed dung (1:1 w/w) are made in heaps of dimension; 10 feet length x 3 feet width x 2 feet high and during inoculation channels are made by hand and earthworm @ 1 kg per quintal of waste are inoculated and then watering is done by sprinkler method. Jute cloth pieces are used as covering material.

P-enriched Vermicompost by Pit and Heap Methods

In the case of phosphorus-enriched vermicompost, Jhabua rock phosphate (30-32% P_2O_5) is used @ 2.5% P_2O_5 of waste material with the same dimension of pit or heap as mentioned earlier.

iii) Technology for Phospho-Sulpho-Nitro Compost Production

In this method, use of suitable minerals, fertilizers and microbial cultures to fortify the compost so that the end product contains more nutrients per unit volume or weight. It also makes use of compost accelerating culture and biofertilisers for further nutrient enrichment. This reduced the bulk which has to be transported and applied per unit of nutrients delivered. In this respect, this method employs both the fortification and the acceleration strategy. Like conventional compost, PSNC can be prepared by the heap or pit method for which a bright sunny site is selected. For the heap method, the floor should be temporarily cemented about 1.5 feet above the floor so that nutrients will not leak in to the soil. About 1000 kg of wastes can be accommodated in a 12′ x 7.5′ x 3.5′ (Lx Wx H) heap.

Method of preparation: 30 kg of wastes (dry wt .basis) are spread on the floor followed by 30 kg of cow dung (fresh cow dung), 660 g urea (0.5 % N basis) is then added. For this, dissolve urea 20 liter water and spray a part of solution of urea over the layer. 17 kg Mussouri rock phosphate or MRP (5% P_2O_5 basis) is spread over the layer. As MRP not now mined, another suitable rock phosphate can be used. Then 6 kg of pyrites (22% S content) is added at the rate of 10 % on materials dry weight basis. A portion of finely powdered soil is then spread at the rate of 5% on materials dry weight basis.

Water is sprayed over the layer to attain 60-70 % moisture. All above steps are repeated in the stated sequence until the heap is 3-4 feet high.

To accelerate the decomposition process, fungal culture is added at the rate of 500 g mycelial mat/tonne of material where as bacterial culture having 10^8 viable cells/ml is added (50 ml/kg of material). To further accelerate the process, the multi-bio-inoculum containing cellulose decomposers (*Paecilomyces fusisporus* and *Aspergillus awamori*), P-solubilizers (*Bacillus polymyxa* and *Pseudomonas striata*) and N-fixer (*Azotobacter chroococcum*) etc. were added 5 and 30 days of decomposition @ 500 g mycelial mat/1000 kg material on dry weight basis. After 3-4 weeks of decomposition, the first turning is done which is followed by a second turning two weeks later. Moisture is to be maintained at 60-70% of materials on dry weight basis. Finally, the upper side and all boundaries of the heap are covered with cow dung slurry to maintain optimum moisture content inside the heap. To avoid rain, wind, and to maintain the moisture and temperature the heap should be covered with a polythene sheet.

iv) Microbially Enriched Compost production technology:

Method of preparation:

This methodology was developed at Indian Institute of Soil Science. Compost was prepared by pit method. The pit should be concrete so that the nutrients may not percolate in to the soil. About 2000 kg of wastes can be accommodated for decomposition in a pit (10 ft length x 5 ft width and 3 ft deep) method.Waste materials (segregated material is preferable), Fresh cow dung, urea, water, bioinoculum and polythene sheets.200 kg of fresh waste is spread on the floor followed by 40 kg of fresh cow dung (on dry weight basis). 2.64 kg urea (0.5 % N basis) is dissolved in 20 liter water and is sprayed over the layer. Bioinoculum is added in the form of slurry on the layer (8 layers). These steps are repeated till the heap attains 3-4 feet high. Fungal culture is added at 500 g mycelial mat/tonne of material. Initially, at 1-5 days, bioinoculum such as *Aspergillus heteromorphus*, *Aspergillus terrus, Aspergillus flavus* and *Rhizomucor pusillus* is added and owing to a high initial temperature (55 to 70^0C) at the thermophilic stage, the bioinoculum is again added after 30 days of decomposition. Finally, the upper side of the pit is covered with cow dung slurry. To avoid rain, wind, and to maintain the moisture and temperature, one-polythene sheet must be used to cover the heap. After 3-4 weeks of decomposition, the first tuning of heap must be done. Maintain the moisture content at 60-70% of materials on dry weight basis. Compost will be ready after 2.5 months. For 1000 kg microbial enriched compost production, the total quantity of fresh waste material, cow dung, urea required will be 1600, 320 and 21 kg, respectively .

Q (c) whether Government considers to disseminate the technologies among farmers; and

Ans c:

Different efficient waste recycling composting techniques have been dessiminated to the field through demonstration on farmers fields , technology exhibition in farmers fair and also trained the farmers on various composting techniques in the institute. Farmers from different states viz; Bihar (Gaya, Banka, Madhepura, Supoul, Katihar, Shekhpura, Areriya, Paschim Champaran and Jamui distt of Bihar) and Madhya Pradesh (Indore, Dewas, Raisen, Vidisha, Sehore, Hoshangabad and Bhopal distt. of Madhya Pradesh) under ATMA Project. In each district 25 progressive farmers participated in the training for 6 days. Apart from this, documentary video film on organic farming for profitability and sustainability and vermicomposting for biofertilization has been made in English, Hindi and Telgu languages of 15 minutes duration each and submitted to ICAR for telecast on Doordarshan krishi Channel**.**

Sub: Reply of Lok Sabha provisional starred question Dy. No. 12020 regarding Fertility of Soil by Honourable Members Sh. Jitender Singh Malik, Sh. Gorakh Prasad Jaiswal, Sh. Ratan Singh, Sh. Bhoopendra Singh to be put down for 27.08.2013.

a) The average fertility rate of soil during the green revolution and at present in the country;

Reply: Soil test data reveals that soils of about 52% districts were low in available N, 43% medium and 4% were high during 1976. There is not much variation observed with respect to nitrogen as the respective figures are 57, 36 and 7 percent during 2011. Similarly, soils of about 47 percent districts were low, 49% districts medium and 4 percent districts high with respect to available P status. There has been a slight increase in P deficient districts with 51% districts having low, 40% were medium and 9% were high available P status in 2011. Available K status has increased to some extent as the number of districts having low status has decreased from 20 to 9 only and number of districts in high category increased from 27 to 49. So we can say there is not much change in N and P status however there is some increase in the available K status in the country.

…………………………………………….. *above is sent repeated*

Date: August 21, 2013

Sub: Reply of Lok Sabha provisional starred question Dy. No. 12020 regarding Fertility of Soil by Honourable Members Sh. Jitender Singh Malik, Sh. Gorakh Prasad Jaiswal, Sh. Ratan Singh, Sh. Bhoopendra Singh to be put down for 27.08.2013.

b) The average fertility rate of soil during the green revolution and at present in the country;

Reply: It has been observed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status**.** There is not much change in the soil fertility status as compared to earlier reports of 1967 and 2002 (Table 1). These results showed that the status of P was increased in some areas due to continuous application of phosphatic fertilizers. Similarly, per cent soils high in available K increased from 27% in 1976 to 49% in 2011. The per cent soils low in available N increased from 52% in 1976 to 57% in 2011 which may due to various losses of nitrogen. Analysis of more than 0.25million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils.

Table 1. Change in available N, P and K status of Indian soils with time.

Year	**% Soils in different categories**		
	Low	**Medium**	**High**
Available N Status			
1976	52 (117)	43 (97)	4 (10)
2002	63	26	11
2011	57(283)	36(182)	7(33)
Available P Status			
1969	47 (106)	49 (110)	4 (10)
1979	46 (170)	50 (184)	5 (17)
1996	49 (179)	49 (177)	2 (7)
2002	42	38	20
2011	51(257)	40(200)	9(40)
Available K Status			
1976	20 (36)	53 (98)	27 (50)

1980	22	44	34
2002	21	51	28 (Hasan 2002)
2002	13	37	50
2011	9(47)	42(212)	49(231)
Figures in parenthesis are number of districts Sources: Motsara (2002); Muralidharudu et al. (2011)			

Long-term fertilizer experiments in major cropping system under different agro-ecological region clearly demonstrated that balanced use of N, P and K fertilizers with or without FYM has either maintained or improved the fertility of the soil. On the other hand, imbalanced use of N, P and K fertilizers has resulted in decline in soil fertility with regard to one or other nutrients.

c) **Whether the Government proposes set up more soil testing centre/soil testing mobile laboratories to check the quality of soil in the country;**

Reply: Information with DAC.

d) **If so, the details thereof along with the number of such centre/laboratories established in the country during each of the last three years and the current year, State-wise;**

Reply: Information with DAC

e) **Whether samples for soil testing in different parts of the country have shown adverse results of soil fertility; and**

Reply: As indicated earlier, the long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. Punjab with 243 kg per hectare fertilizer consumption is one of the largest consumers of fertilizers in India. Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

f) **If, so the details thereof and the steps taken by the Government to protect the soil fertility and restricts use of fertilizers?**

Reply: There are about 97 institutions of ICAR apart from 47 StateAgriculturalUniversities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

ix) Central Soil and Water Conservation Research and Training Institute, Dehradun

x) Central Soil Salinity Research Institute, Karnal

xi) Indian Institute of Soil Science, Bhopal

xii) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the StateAgriculturalUniversity. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Sub: Reply of Rajya Sabha provisional starred question Dy. No. S2680 on "Increasing desertification and its impact on agriculture" by Smt. Jaya Bachchan, Member of Parliament to be put down for 30.08.2013.

g) Whether Government has taken note of the increasing desertification and its impact on agriculture, If so, the details thereof;

Reply: CAZRI, Jodhpur deals with this aspect.

h) Whether Government has taken any step to improve the soil healthand its nutrient value;

Reply: Yes.

i) If so, the details thereof; and

Reply: There are about 97 institutions of ICAR apart from 47 StateAgriculturalUniversities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xiii) Central Soil and Water Conservation Research and Training Institute, Dehradun

xiv) Central Soil Salinity Research Institute, Karnal

xv) Indian Institute of Soil Science, Bhopal

xvi) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the StateAgriculturalUniversity. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer's practice	STCR- IPNS recommended practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

j) If not, the reasons therefor?

Reply: NA

Sub: Reply of Rajya Sabha provisional admitted question Dy. No. S2680 regarding "Increasing desertification and its impact on agriculture" due for reply on 30/8/2013 raised by Smt. Jaya Bachchan, Member of Parliament (RS) - regarding

A. Whether government has taken note of the increasing desertification and its impact on agriculture, if so, the details thereof:

Reply – Nil

B. Whether Government has taken any step to improve the soil health and its nutrient value;

C. If so, the details thereof; and

Reply: There are about 97 institutions of ICAR apart from 47 State Agricultural Universities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

i) Central Soil and Water Conservation Research and Training Institute, Dehradun
ii) Central Soil Salinity Research Institute, Karnal
iii) Indian Institute of Soil Science, Bhopal
iv) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer's practice	STCR- IPNS recommended

			practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Sub: Reply to Parliament question (Provisional starred) raised by Shri Ashok Tanwar, Shri Subhash Bapurao Wankhede, Shri M K Raghavan, and Shri Sanjay Dhotre

a. Yes
b. Land degradation can be natural as well as man induced. The man induced activities such as mining, roads, industries, deforestation, overgrazing, cultivation beyond the permissible slopes, cultivation in uncultivable land capability classes, poor management of the irrigation and rainwater, and unscientific nutrient management are the main causes. Some economic backwardness may accentuate the reasons thereof.
c. Yes
d. Land degradation is of many kinds. Physical land degradation is due to water erosion (82.57 m ha), wind erosion (12.40 m ha), compaction, crusting and water logging. Chemical degradation is due to process of salinization and alkalization (6.74 m ha), acidification (17.94 m ha) and nutrient depletion. Biological degradation is caused by the reduction of soil biota and organic matter, degradation of vegetation and impairment of activities of micro-flora and fauna, however, estimates of biological degradation are not available.
e. The National Wasteland Development Board is a nodal agency for combating problems of land degradation and restoration of ecology. Besides, every state has its own Department of Soil Conservation working in different watersheds. There is separate budgetary provision for specified targets of land reclamation in every state. The department under the Ministry of Rural Areas and Employment has been mainly responsible for reclaiming wastelands in the non-forest areas, where government acts as a facilitator and rural people as executors of the programme.

   A set of 100 districts have been identified by the Planning Commission of India as the most backward. These are geographically concentrated in the regions with either inhospitable terrain and/or are identified as degraded lands.

   In fact, out of the total geographical area (328.73 m ha), barren and uncultivated land was 38.16 m ha in 1951 which has been reduced to 17.02 m ha in 2008. Similarly, area under cultivable wasteland was 22.94 m ha in 1951 which has been reduced to 12.76 m ha in 2008 (Agricultural Research Data Book, 2012).

   Indian Council of Agricultural Research (ICAR) through its natural resource management (NRM) based institutes, namely, IISS, Bhopal, CSWCRTI, Dehradun, NBSS&LUP, Nagpur, CSSRI, Karnal, CAZRI, Jodhpur and CRIDA, Hyderabad are also engaged in R&D activities for restoration and improvement of soil health. IISS, Bhopal in particular is engaged in following activities for finding remedial measures to improve soil health and productivity.

   i) Restoring soil quality

   It is known that agricultural intensification can have negative effects at different scales, such as, increased soil erosion, soil fertility decline and reduced biodiversity at the local level, depletion and pollution of groundwater and eutrophication of surface waters at the regional level, and changes in atmospheric composition and climate on a global scale. Enhancing sustainable food production will require integrated strategies for the use of land and water resources: a) agricultural intensification on the best arable land, b) rational utilization of marginal lands for agriculture, and c) prevention and restoration of soil degradation. Soil degradation is a severe problem in countries like India with high demographic pressure. For preventing and restoring soil degradation, the main issues will be controlling soil erosion and sedimentation with the associated risks of eutrophication of surface water and contamination of groundwater, combating desertification and enhancing soil carbon sequestration to improve soil quality/productivity and mitigate the greenhouse effect.

For sustaining better soil quality under intensive systems of agriculture, the emphasis should be on developing workable soil quality indicators and methods to assess and monitor soil quality, assessment of soil quality under different land use management systems (cropping system, tillage, water and nutrient use practices) and to identify the effect of management practices aggrading/ degrading/ sustaining soil quality. Also strategies need to be formulated to decide the amount of organic matter to be in the form of organic manures/organic waste/residue each year to maintain or build up the soil organic matter (SOM) level in various soil types.

(ii) Organic solid waste recycling

Organic solid wastesgenerated in large quantities by domestic, commercial and industrial activities are often indiscriminately disposed off the soils. In recent survey (2011), it has been estimated that more than 5100 towns and 380 urban agglomerations of India, inhabiting 27.8% of country's population generate more than 70 million tonnes of municipal solid wastes (MSW). Cities with more than one lakh population contributed 72.5% of the waste generated in the country as compared to other 3955 urban centers that produce only 17.5% of that total waste (MOUD 2005). Considering an average collection efficiency of about 70%, country has the potential of producing about 5 - 14 million tonnes of compost annually from municipal solid wastes depending on the method of composting which is expected to reach about 12 - 35 million tones per year by the year 2030 as a result of phenomenal increase in urban population and ever increasing industrialization. This, however, is possible by improving the composting technology of city wastes that is also cost effective. By following the proper composting techniques, the municipal solid wastes can provide an amount of 1.2 to 2.5 lakhs tonnes of N, Pand K that could be increased to about 2.1 to 4.4 lakh tonnes per year by 2030. The currency value of fertiliser savings through MSW compost can be about 367 crores at the current level of solid waste generation and can go up to 653 crores by the year 2030 through the involvement of improved technology in compost making.

(iii) Efficient nutrient management

The institute has developed strategic framework for efficient nutrient management, the salient features are given below:

(a) Choose suitable crops and cropping systems

Different crops tap different soil layers for meeting their nutrient and water requirement depending upon their root and shoot system. For example cereals tap surface layer for plant nutrients while legumes tap plant nutrients from surface and sub surface both.

(b) Region specific nutrient management

It is through concerted efforts that nutrient management practices suitable for different regions have been developed and tested over the last three decades. For example, top dressing, liming, gypsum application, matching nutrient application with crop demand, use of urea super granules, neem coated urea nitrification inhibitors, use of phosphocompost, residue management etc. These need to be popularized.

(c) Promoting Integrated plant nutrient supply (IPNS) strategies

The basic objective of IPNS are to reduce the inorganic fertiliser requirement, restore organic matter in soil, enhance nutrient use efficiency and maintain soil quality. Such technologies have been compiled by the institute and need to be popularized.

(d) Balanced fertilization involving micronutrients

In the areas where micronutrient deficiencies are emerging, we need to ensure the availability of them to farmers. Also, demonstrations on the benefits of micronutrient application need to be done in farmers' fields in order to popularize their use among them. Micronutrient recommendations for several crops on Indian soils have been compiled by the institute.

(e) Soil test based fertiliser recommendations

Besides low per unit area consumption and imbalances in the NP&K use, deficiency of micro nutrients like zinc, iron, sulphur, etc. is increasing, especially in areas where intensive cultivation and multiple cropping are adopted. In addition to increased use of organic manures and biofertilisers, it is necessary to promote need based use of fertilisers on the basis of soil tests by adopting Integrated Nutrient Management (INM) approach. Tested technologies are available to fertilize all the important crops based on soil test results. The institute has compiled a compendium of soil test based recommendations for all important crops countrywide.

(f) Promoting Good agronomic practices (GAP)

These have been compiled. Some of the important ones are: Reduced tilled wheat, direct dry seeded rice, residue retention instead of residue burning, diversified agriculture, and intercrop in bed planting, etc.

As far as providing subsidies for production of vermicompost are concerned, Govt, of India has the scheme of providing loan and subsidies to individual farmers, farmer groups, cooperatives, NGOs, Fertilizer Industry, etc for production of vermicompost through its subsidiary Bank, NABARD in which about 25% of total cost in given as subsidy. Most of the State Government have also their own schemes of providing subsidies for encouraging production of vermicompost and other composts and practicing organic agriculture in high value crops, especially, fruits, vegetable, spices and condiments and cole crops.

References

Agricultural Research Data Book 2012. Indian Agricultural Statistics Research Institute, New Delhi-12.

Degraded and Wastelands of India. 2010. Directorate of Information and Publication in Agriculture, Indian Council of Agricultural Research, Krishi Anusandhan Bhavan I, New Delhi-12.

Sub: Reply to Rajya Sabha Question no. 70 (Dy. No. S1156) due for answer on 1.1.2013

a) Whether it is a fact that the Anand Agricultural University has produced Liquid Bio Fertilizers (LBF) which has been tested and found eco-friendly and economical for improved production of potato and ginger.

LBF produced by the AAU, Anand improved the production of Potato but information on ginger is not available (neither being mentioned in the booklet nor on the web of AAU).

(b)Whether it is also a fact that the said LBF was developed in 2005 and established its efficacy.

Liquid Biofertilizers are known to maintain higher efficacy, are free from contamination when produced under sterile conditions and have long shelf life of one year.

(c) If so, the step Government proposes to take to encourage the utilization of LBF so as to benefit the farmers and the consumers of the country?

The ICAR has supported the research and development of liquid biofertilizers in the All India Network Project on Soil Biodiversity-Biofertilizers at ANGRAU, Amaravathi. These formulations have been released for biofertilizer production through the DOAC-ICAR technology interface. Govt. of Gujarat has supported the production of Liquid Biofertilizers under RKYV and established production unit at AAU, Anand and GSFC, Ahmedabad.

Supplementary Note

Biofertilizers

Biofertilizers are preparations of living microorganisms that are useful for promotion of plant growth through a variety of mechanisms like biological nitrogen fixation, solubilization of insoluble phosphates and other nutrients, oxidation of sulfur, production of growth hormones and combating plant diseases. These include specific strains of bacteria, fungi and blue-green algae. Biofertilizers are useful agricultural input because of the following reasons:

1. Eco-friendly way of augmenting nutrient supply and promoting plant growth.
2. Biofertilizers can supplement about 25% of chemical fertilizers through biological nitrogen fixation and solubilization of unavailable phosphates.
3. Cheap and an efficient source of nutrients.
4. Promotes plant growth through hormones and vitamin production.
5. Control and suppress soil borne diseases through various mechanisms.
6. Helps in mineralization of other plant nutrients in crop rhizosphere.
7. Increases crop yields by 10-20%.
8. Improve soil properties and sustain soil fertility.

The efficacy of various microbial inoculants in increasing the yields and saving nitrogen and phosphorus for pulses, oilseeds, cereals etc., has been convincingly proved in farmers' fields in most agro-eco-zones. Mixed biofertilizers (BIOMIX) containing a consortium of N fixers, P solubilisers Plant growth promoting rhizobacteria (PGPR) and VAM fungi were found to promote the growth of cereals, legumes and oilseeds better and saved 25% NP fertilizers in crops. The effects are more beneficial if used along with fertilizers and organic fertilizers.

Types of Biofertilizers

The biofertilizers that are most widely recommended for crops and produced in significant quantities are follows:

RhizobiumSymbiotic nitrogen fixing bacteria of legumes which convert atmospheric nitrogen into available forms in the root nodules of legumes; recommended for seed inoculation.

Azotobacter Non-symbiotic nitrogen fixing bacteria recommended for seed inoculation/ seedling dip of all cereals, oilseed, pulses, vegetable and horticultural crops.

Azospirillum Associatively symbiotic, nitrogen fixing and plant growth promoting bacteria recommended for rice, maize, sugarcane, millets and vegetables for seed inoculation/ seedling dip.

Phosphate Solubilising Bacteria (PSB) Various strains of *Bacillus* and *Pseudomonas* are known to solubilize insoluble soil phosphates and are recommended for seed and soil inoculation for all crops.

Plant growth promoting rhizobacteria (PGPR) They promote plant growth through a variety of mechanisms like fixation of nitrogen, solubilisation of phosphate, production of growth hormones like auxins and gibberellins, antibiotics, siderophores, ammonia and HCN production and some of them also exhibit ACC deaminase activity. Examples include *Bacillus* and *Pseudomonas, Azotobacter, Azospirillum etc.* listed above. *Rhizobium* is also known to exert PGPR action on crops.

Blue green algae (BGA) Non symbiotic nitrogen fixing cyanobacteria, recommended for rice, e.g., *Nostoc, Anabaena, Aulosira, Tolypothrix* etc.

AzollaWater fern that has nitrogen fixing *Anabaena* as a micro-symbiont, recommended both as a green manure and as inoculant for rice paddies.

VAM (Vesicular-Arbuscular Mycorhiza) are fungi which are associated with the roots of most higher plants and helps the plants in mobilizing macro- and micro-nutrients.

In fact there are a number of other microorganisms that are useful as biofertilizers-for example *Thiobacillus* for S oxidation, *Aspergillus* and *Penicillium* for P solubilization, Silicon and potassium mobilizers, a number of newly reported PGPR like *Burkholderia, Gluconacetobacter etc.*

In fact most of the microorganisms listed above are poly-functional in nature. Many of them can solubilize phosphorus as well as act as PGPR. Even BGA are known to solubilize phosphate and produce growth promoting hormones.

Liquid Inoculant Formulations

The widely used carrier based inoculants have a short shelf-life of upto 6 months and are of poor quality. Liquid cultures containing cell protectants not only give high cell titre but also promote the formation of resting cells like cysts and spores which result in better resistance to abiotic stresses and high shelf life.

In India, under NATP state agricultural universities started working on liquid inoculants technology including UAS, Bangalore. They shared the knowledge of NIFTAL liquid inoculants Technology, USA. and Niftal gave trials to conduct in India. Biofertilizer technology itself whether it is liquids or solids are eco-friendly and economical.

LBF Technology has been introduced much before 2005 (the claim of AAU, Anand that they developed it in 2005 should be seen in this light). Around 2001-2 there was a review on the progress of liquid inoculants work and UAS, Bangalore was recognized as leading centre for the NATP project. In the ICAR project- All India Network Project on Soil Biodiversity-Biofertilizers at ANGRAU, Amaravathi work was is going on since 2004 on liquid inoculants. Nobody disclosed the formulations until AINP Network project released this technology in 2008 at Solan workshop for the benefit of farmers and it was also released for biofertilizer production through the DOAC-ICAR technology interface and published in NCOF Newsletter. No doubt efficacy of LBF is good when compared to solid biofertilizers.

In the ICAR project- All India Network Project on Soil Biodiversity-Biofertilizers at ANGRAU, Amaravathi media supporting the growth of three biofertilizers organisms *Rhizobium, Azospirillum* and P-solubilising *Bacillus megaterium* using different concentrations of cell protectants like arabinose, trehalose, glycerol, polyvinyl pyrrolidone (PVP) were devised (LM1, LM2, LM3). These were tested and compared with normal basal medium (control) and solid lignite base culture packs for different biofertilizer organisms like Blackgram *Rhizobium (*strain RBG 314), *Azospirillum (*strain AZS 303) and *Bacillus megaterium* strain AMT 1001 (PSB). In all cases the liquid formulations maintained good counts even after 360 days whereas they had drastically reduced in normal broth and solid carrier lignite.

Liquid inoculants were free of contamination in the one year study period. A dose of 4-5 ml of liquid inoculum having a population of $3x10^9$ cells per ml is enough to coat one kg seed and could satisfactorily retain the maximum number of viable cells on the seeds up to 24 hrs of bacterization at room temperature. Different media compositions were formulated to support the growth of three biofertilizer organisms namely *Azospirillum*, PSB (*Bacillus*) and *Pseudomonas* together in a single medium. The medium, GM3 supported maximum number of cell population of all the three organisms.

Application of liquid inoculants in alfisol to pigeonpea in Andhra Pradesh resulted in profuse plant growth and nodulation and saving 50% N. In maize, there was an over all 15% grain yield increase by liquid inoculants over solid carrier based inoculants. Liquid inoculants of *Azospirillum* + PSB along with 75% RDF gave significantly higher grain yields than 100% RDF in Alfisol. There was a grain yield increase of 450 kg/ha by liquid inoculants with 100% RDF over 100% RDF in Alfisols. Application of liquid biofertilizers of *Azospirillum* and PSB along with 200 kgs of FYM gave best response. *Rhizobium* and PSB liquid biofertilizer along with organic manure also gave positive visible response during kharif 2012. Wilt incidence reduced wherever biofertilizers were applied in pigeonpea. Microbial analysis of rhizosphere soil samples showed that liquid inoculants with 100% RDF gave maximum population counts in all microbial groups

In Parbhani,*Baradyrhizobium* + PSB inoculation of soybean increased the yield by 23% over control. However, the yield with liquid inoculants was at par with the high quality lignite based inoculant. In summary, the liquid inoculants give about 10-15% higher performance over solid inoculants due to the poorer quality of the latter (resulting from the lesser shelf life of solid carrier biofertilizers and greater contamination due to unsterile methods of manufacturing). But since liquid biofertilizers are produced directly from the fermentation broth by adding additives to improve shelf life, and are produced under completely sterile conditions, they are better in quality from the point of view of low or nil contaminants and higher microbial counts ($>10^8$ CFU/ml) and shelf life upto one year. Therefore LBF Technology should be encouraged because of the above reasons. Now many states have developed their own liquid biofertilizer technology with their locally available microbial strains and aregetting good results. Crop wise formulations are also available with changing the strains in the formulation in different states. Government should take stringent steps to set up LBF producing units with the help of local state agricultural universities. so that local and more efficient microbial strains will be supplied in LBF for obtaining assured results. However, quality is the main issue whether they prefer solid or liquid. In liquids we can give and can get good results. Strict quality control measures are required. Microbiologists only should monitor this technology. Ultimately farmers will be benefited without any doubt.

Sub: Reply of Rajya Sabha provisional admitted question Dy. No. U630, U640 regarding On-line advise on fertilizer use by Smt. T. Ratna Bai to be put down for 16.08.2013.

a) Whether Government has opened any online advice on fertilizer use;

Reply: Yes.

b) If so, the details thereof; and

Reply: AICRP on STCR in collaboration with National Informatics Centre (NIC), Pune has developed Decision Support System for on-line fertilizer recommendation to different crops grown in various states using the fertilizer prescription equation developed by different centres. On-line fertilizer recommendation system has been completed for 10 states namely; Maharashtra, Andhra Pradesh, Karnataka, Chhattisgarh, Kerala, Orissa, Himachal Pradesh, West Bengal, Jharkhand and Tamil Nadu. This on-line fertilizer recommendation system has been uploaded on STCR website (http://www.stcr.gov.in). Farmers and other end users can get a STCR based fertilizer recommendations to different crops by feeding the soil test values and target yield.

c) If not, by when such proposal will be implemented

Reply: NA

Dy No.789 dated 02/12/2013

Q a. Whether the Government is carrying out any research to prepare manure for crops from organic wastes?

Ans. a, Yes, at IISS and other research institutes have developed technologies to prepare various types of organic manures from organic wastes such as crop residues, agro based industrial waste, city garbage and forest litter that have wide C/N ratios ranging from 80 to 110, and low concentration of available plant nutrients particularly N, P and K.

Q. b. If so, the details thereof

Ans b: The following composting technologies have been developed for various types of organic wastes to prepare organic manures

i) Technology for Enriched Compost Production

Most of the Indian soils are deficient in Phosphorus. Also, yearly removal of P is more than its addition through P fertilizers during continuous and intensive cropping. Bio-solids produced in cities, agro-industries and at farms normally have low nutrient value, particularly of P content. The traditional technology of composting, if improved in terms of nutrients content, may help in arresting trends of nutrient depletion to a greater extent. Further, the use of mineral additives such as rock phosphate and pyrites during composting have been found beneficial. A phosphocompost production technology has, thus, been developed using phosphate solubilizing microorganisms, namely, *Aspergillus awamori*, *Pseudomonas straita* and *Bacillus megaterium*; phosphate rock, pyrite and bio-solids to increase the manurial value as compared to ordinary FYM and compost.

Raw material used

For the production of one tonne of phosphocompost, materials such as 1900 kg organic/ vegetable wastes/straw, 200 kg cow-dung (dry weight basis) and 250 kg phosphate rock (18% P_2O_5) are used.

Methods

- Prepare a base of the heap out of hard, woody materials such as sticks, bamboo sticks etc. This base should be 15 cm thick and 3 m width and 3 m length depending upon the quantity of materials to be composted.

- Place bio-solids over the base made above. The layer should be around 30 cm ± 10 cm thick.
- Sprinkle slurry prepared by mixing cow dung and rock phosphate over the crop residues to moisten the material.
- Make another layer of crop residue and moisten it with slurry.
- Continue with alternate layer of crop residue (30 cm) and slurry until the heap is 1.5 m height. Reduce the area of each layer so that the heap tapers by about 0.5 m high.
- Cover the heap with soil or polythene and mix the material after 15 days. Give two turnings after 30 & 45 days. Add water at each turning to maintain the moisture content to about 60-70%.
- The compost becomes ready for field application within 90-100 days period.

ii) Technology for Recycling of Organic Wastes through Vermicomposting:

Vermicomposting is a method of composting with worms and differs from conventional composting in several ways. In vermicomposting, there is a saving of nearly two months in composting time as compared to conventional compost. Vermicompost isrich in nutrients, microbial activity and enzymes. There are two methods of vermicomposting under field conditions.

1. Vermicomposting of wastes in field pits 2. Vermicomposting of wastes on Heaps

Materials Required for Vermicomposting

- Farm wastes (straw from wheat, soybean, chickpea, mustard etc.) were used for vermicomposting.
- Fresh cow dung.
- Rock phosphate (Jhabua RP 30-32% P_2O_5).

  (Note: In the case when vermicompost is to be prepared by P-enrichment technique)
- Wastes: dung ratio (1:1 on dry weight basis).
- Earthworm: 1000-1200 adult worms (about 1 kg per quintal of waste material).
- Water: 3-5 liters / week per heap or pit.

P-enriched Vermicompost by Pit and Heap Methods

In the case of phosphorus-enriched vermicompost, Jhabua rock phosphate (30-32% P_2O_5) is used @ 2.5% P_2O_5 of waste material with the same dimension of pit or heap as mentioned earlier.

iii) Technology for Phospho-Sulpho-Nitro Compost Production

In this method, use of suitable minerals, fertilizers and microbial cultures to fortify the compost so that the end product contains more nutrients per unit volume or weight. It also makes use of compost accelerating culture and biofertilisers for further nutrient enrichment. This reduced the bulk which has to be transported and applied per unit of nutrients delivered. In this respect, this method employs both the fortification and the acceleration strategy. Like conventional compost, PSNC can be prepared by the heap or pit method for which a bright sunny site is selected. For the heap method, the floor should be temporarily cemented about 1.5 feet above the floor so that nutrients will not leak in to the soil. About 1000 kg of wastes can be accommodated in a 12′ x 7.5′ x 3.5′ (Lx Wx H) heap.

Method of preparation: 30 kg of wastes (dry wt .basis) are spread on the floor followed by 30 kg of cow dung (fresh cow dung), 660 g urea (0.5 % N basis) is then added. For this, dissolve urea 20 liter water and spray a part of solution of urea over the layer. 17 kg Mussouri rock phosphate or MRP (5% P_2O_5 basis) is spread over the layer. As MRP not now mined, another suitable rock phosphate can be used. Then 6 kg of pyrites (22% S content) is added at the rate of 10 % on materials dry weight basis. A portion of finely powdered soil is then spread at the rate of 5% on materials dry weight basis. Water is sprayed over the layer to attain 60-70 % moisture. All above steps are repeated in the stated sequence until the heap is 3-4 feet high.

To accelerate the decomposition process, fungal culture is added at the rate of 500 g mycelial mat/tonne of material where as bacterial culture having 10^8 viable cells/ml is added (50 ml/kg of material). To further accelerate the process, the multi-bio-inoculum containing cellulose decomposers (*Paecilomyces fusisporus* and *Aspergillus awamori*), P-solubilizers (*Bacillus polymyxa* and *Pseudomonas striata*) and N-fixer (*Azotobacter chroococcum*) etc. were added 5 and 30 days of decomposition @ 500 g mycelial mat/1000 kg material on dry weight basis. After 3-4 weeks of decomposition, the first turning is done which is followed by a second turning two weeks later. Moisture is to be maintained at 60-70% of materials on dry weight basis. Finally, the upper side and all boundaries of the heap are covered with cow dung slurry to maintain optimum moisture content inside the heap. To avoid rain, wind, and to maintain the moisture and temperature the heap should be covered with a polythene sheet.

iv) Microbially Enriched Compost production technology:

Method of preparation:

This methodology was developed at Indian Institute of Soil Science. Compost was prepared by pit method. The pit should be concrete so that the nutrients may not percolate in to the soil. About 2000 kg of wastes can be accommodated for decomposition in a pit (10 ft length x 5 ft width and 3 ft deep) method.Waste materials (segregated material is preferable), Fresh cow dung, urea, water, bioinoculum and polythene sheets.200 kg of fresh waste is spread on the floor followed by 40 kg of fresh cow dung (on dry weight basis). 2.64 kg urea (0.5 % N basis) is dissolved in 20 liter water and is sprayed over the layer. Bioinoculum is added in the form of slurry on the layer (8 layers). These steps are repeated till the heap attains 3-4 feet high. Fungal culture is added at 500 g mycelial mat/tonne of material. Initially, at 1-5 days, bioinoculum such as *Aspergillus heteromorphus, Aspergillus terrus, Aspergillus flavus* and *Rhizomucor pusillus* is added and owing to a high initial temperature (55 to 70^{0}C) at the thermophilic stage, the bioinoculum is again added after 30 days of decomposition. Finally, the upper side of the pit is covered with cow dung slurry. To avoid rain, wind, and to maintain the moisture and temperature, one-polythene sheet must be used to cover the heap. After 3-4 weeks of decomposition, the first tuning of heap must be done. Maintain the moisture content at 60-70% of materials on dry weight basis. Compost will be ready after 2.5 months. For 1000 kg microbial enriched compost production, the total quantity of fresh waste material, cow dung, urea required will be 1600, 320 and 21 kg, respectively .

Q (c) the details of the research organization engaged in the said research;

Ans c: During 2004, Government of India has initiated a National Net Work Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) is one among the 13 centers with the following objective of encouraging the use of organic manures for boosting agricultural production in the country. The results of the experiments have shown the boosting of agricultural production through organic manure usage. Thirteen centers spread across the country have developed organic package of practices for various crops with the use of organic manures available in each state. The results are communicated to the farming community through print media as well as farmers training at various institutes.

Q (d) The cost of the production of manure as compared to chemical fertilizers and

Ans d: farmers are normally preparing own compost/manure on their farms as per the availability of the resources. The cost of the organic manures prepared by the farmers on their farms becomes cheaper as compared to chemical fertilizers. For producing one tonne of enriched phosphocompost, the total cost of raw materials is Rs. 976. In addition a one time cost has to be incurred for the preparation of Kacha heap (12'x7.5'x3.5') which is equal to Rs. 1250. It is estimated that 100 kg phosphocompost is equivalent to 3.3 to 5.1 kg urea and 20.2-26.2 kg SSP. The approximate cost of urea-5.4/kg, Diammonium phosphate-Rs 22.5/kg and muriate of potash-Rs 16/kg.

Q (e) The effective steps taken /proposed to be taken by the Government to prepare manure from organic waste?

Ans(e): Institute -farmer knowledge exchange is done through the extension and advisory unit of the institute. Different efficient waste recycling composting techniques have been dessiminated to the field through demonstration on farmers fields , technology exhibition in farmers fair and also trained the farmers on various composting techniques in the institute. Farmers from different states viz; Bihar (Gaya, Banka, Madhepura, Supoul, Katihar, Shekhpura, Areriya, Paschim Champaran and Jamui distt of Bihar) and Madhya Pradesh (Indore, Dewas, Raisen, Vidisha, Sehore, Hoshangabad and Bhopal distt. of Madhya Pradesh) under ATMA Project. In each district 25 progressive farmers participated in the training for 6 days. Apart from this, documentary video film on organic farming for profitability and sustainability and vermicomposting for biofertilization has been made in English, Hindi and Telgu languages of 15 minutes duration each and submitted to ICAR for telecast on Doordarshan krishi Channel. In addition, different state government provide incentives for production of different organic manure from organic wastes like vermicompost, phosphocompost and NADEP compost etc.

Sub: Reply on query dated 02/07/2013 from Shri Abhay Kumar, Addl PS to Hon'ble MOS (Agri & FPI), on Chattisgarh State w.r.t. AICRP (STCR) at Raipur Centre

(i) Developmental activities undertaken in the State with respect to AICRP (STCR)

Reply: During the last 12 years of research under AICRP on STCR at Raipur centre has developed soil test based balanced fertilizer prescription equations for rice (hybrid, scented, Swarna, Mahamaya, MTU 1010, Karma Mahsuri), oilseed crop (sunflower and safflower), wheat (Sujata, HI-1077, GW-273), vegetable crops (Brinjal, cauliflower, tomato), cash crop (like sugarcane and potato) and chickpea as pulse crop in various crop suitable soil types. These crops have been successfully tested on farmer's fields through follow-up trials, fronline demonstrations with the help of directorate of oilseeds, AICRP on STCR, DAC, TSP and NFL for their validity and suitability of balanced fertilization based on soil test results of the farmer's farm. There is 30 to 50 % increase in the yield of the tested crops that resulted higher crop resonse as kg/kg fertilizer use, net profit and net return as Rs/Re spent on fertilizers. The equations were also developed using IPNS approach (FYM as organic source), cropping system like rice-vegetable, rice-chickpea, maize-potato covering CG plains, Sarguja Hills and Bastar plateau region of the state. More than 500 FLD's were conducted on farmer's fields covering the whole state with major crops like soybean, rice, mustard, sunflower, safflower, chickpea and wheat with more than 85 % success rate. The project scientists have organized more than 100 Kisan Mela, farmer's day, farmer's Training program on soil test technology, balanced fertilization, Integrated Nutrient Management based on soil testing, efficient plant nutrient management covering the whole state.

Looking to the poor services and need of soil testing facility in the state, a rapid soil testing kit is also designed by the IGKV, Raipur. Farmer to test their soil can use this user-friendly kit. The soil test based fertilizer recommendations generated in STCR project is linked with this kit. After testing soils farmer can obtain fertilizer dose themeself. The easy and simple designed soil testing kit is very popular not only in the state but in whole country due to its cheaper, simple testing and provision of refill. About 10,000 soil testing kits have been supplied to the farmer's of CG, AP,Bihar, Jharkhand, UP, Haryana, Maharastra and MP through Govt. agencies, KVK's, private enterpreners and NGO's and RAAWE students. A feed back study from 200 potential farmers showed a possibility of saving (20-40%) phosphatic and potasssic fertilizer without affecting the crop yields.

Under DAC supported project, the STCR centre has prepared GIS-GPS based fertility maps for 11 districts (Raipur, Mahasamund, Durg, Balod, Balodabazar, Bemetara, Koriya, Korba, Bastar, Kabeerdham and Raigarh) for major and micro nutrients which can assist nutrients plan and balanced fertilization for different crops of the state.

AICRP (STCR) centre at Raipur also facilitated preparation of village level fertility maps for Janjgir and Dhamtari districts of the state under RKVY which can help judicious, efficient and balanced fertilizer use for each farmer of the village. These maps have been made available to every concerned village and Panchyat to monitor the nutrient level of the farmer's field and use of balanced fertilizer for a definite yield goal of the crop to be taken by the farmers.

(ii) Allocation of funds, released and expenditure incurred by the State Government of Chhattisgarh under the schemes being dealt by Department under the schemes being dealt by Department of Agriculture Research & Education (DARE) and Indian Council of AgriculturalResearch (ICAR).

Reply:

Year	**Fund amount (Rs. In lakhs)**
2000-01	9.64
2001-02	10.01
2002-03	11.05
2003-04	8.51
2004-05	11.29
2005-06	17.04
2006-07	14.82
2007-08	17.47
2008-09	13.00
2009-10	14.15
2010-11	15.50
2011-12	37.29
2012-13	43.00
Total	**213.13**

(iii) Details of project sanctioned/ approved/ proposed.

Reply: Sanctioned and approved project are:

(a) All India Coordinated Research Project onSoil Test Crop Response

(b) GPS and GIS Based Model Soil Fertility Maps for Selected Districts for Precise Fertilizer Recommendations to the Farmers of India

Dy No. 52/Parl.Qns/2013 dated 16/04/2013

Research Work on Organic Fertigation

As such research work on organic fertigation is not being do in the institute. Research work on various organic manures and organic formulations effects on soil health as well as crop productivity in different cropping systems particularly soybean based cropping systems (Soybean-wheat, soybean –chick pea, soybean-mustard and soybean-linseed) has been done in the institute. Use of different organic manures and organic preparations (like panchagavya, biodynamic preparations etc.) and their effect on crops was done under organic farming. Under organic management system there was an overall improvement in soil quality parameters, indicating better soil health and crop productivity compared to inorganic management system alone.

Hkkjrh; e`nk foKku LkaLFkku

Ukchckx] csjfl;k jksM+] Hkksiky & 462 038

Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462038

No. Parliament Reply/PME

Dated: August 8, 2012

To

Dr. PP Biswas

Division of NRM

KAB II, PUSA

New Delhi

Sub: **Rajya Sabha Provisional admitted question Dy. No. S-2812 for 17/08/2012 regarding technique to increase of fertility of soil by Shri Jugal Kishore**

e) ***Whether the government is considering any new techniques to make barren land in the country to arable;***

Reply: It is difficult to utilize the barren land as arable land. Since such lands usually occur in arid and semi-arid climate coupled with poor soil conditions such as very shallow soil depth, rockout crops, marshy land, undulating terrain, high slope etc. Opting out agriculture (annual crops) in such land is quite uneconomical. Hence, if at all these are to be utilized, these can be best put to forestry/horti/pasture development depending upon the prevailing constraints and resource availability so that these are not degraded further. In many states the barren land in the proximity of village is generally allotted by the state government to the landless inhabitants.

f) ***The name of the states where soil is infertile and the details of the nutrients which are lacking in the said soil;***

Reply: Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status. Analysis of more than 0.25million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils. Data for 73 districts showed that almost all soils of different districts of North, South, East and West zones are deficient in available N. In North zone**,** majority of the soils are medium to high in available P and available K status. Only few soils (1-8%) in 3-4 districts are low in P and K. In West Zone, majority of the soils are low to medium in available P except Gujarat. About 92-100% area in Gujarat is high in available P. Altogether only 10-33% area in west zone is low in available K. Most of the soils in Gujarat and Maharashtra are high and Rajasthan are medium in available K. In East Zone, most of the area in Orissa (73-97%) is low in available P. Majority of the soils of Assam and West Bengal are medium to high in available P status of soils. Majority of the soils in East Zone are medium in available K except Kurda district in Orissa where 58% of the area is low in available K. In South Zone, majority of the soils in Andhra Pradesh, Tamil Nadu and Kerala are high in available P. In Karnataka, most of the soils are medium in available P. With regards to available K, majority soils of Tamil Nadu, Karnataka and Kerala are medium and majority of the soils of Andhra Pradesh are high in available K.

g) ***The details of agriculture institutes working for monitoring of fertility of soil in the country and***

Reply: There are about 97 institutions of ICAR apart from 47 StateAgriculturalUniversities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

v) **Central Soil and Water Conservation Research and Training Institute, Dehradun**

vi) **Central Soil Salinity Research Institute, Karnal**

vii) **Indian Institute of Soil Science, Bhopal**

viii) **National Bureau of Soil Survey and Land Use Planning, Nagpur**

h) The significant achievement made by these institutes to increase fertility of soil?

Reply: The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the StateAgriculturalUniversity. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Hkkjrh; e`nk foKku LkaLFkku

Ukchckx] csjfl;k jksM+] Hkksiky & 462 038

Indian Institute of Soil Science

Nabibagh, Berasia Road, Bhopal – 462038

No. Parliament Reply/PME

Dated: August 8, 2012

To

Dr. PP Biswas

Division of NRM

KAB II, PUSA

New Delhi

Sub: Lok Sabha Provisional starred question Dy no. 913 for 14/08/2012 regarding fertility of land by Sh. Marotrao Sainuji Kowase and others

g) ***Whether the fertility and productivity of land is decreasing constantly in the country due to non-judicious use of pesticide and substandard fertilizers for agriculture purposes;***

Reply: Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status**.** There is no much change in the soil fertility status as compared to earlier reports of 1967 and 2002 (Table 1). These results showed that the status of P was increased in some areas due to continuous application of phosphatic fertilizers. Similarly, per cent soils high in available K increased from 27% in 1976 to 49% in 2011. The per cent soils low in available N increased from 52% in 1976 to 57% in 2011 which may due to various losses of nitrogen. Analysis of more than 0.25million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils.

Table 1. Change in available N, P and K status of Indian soils with time.

Year	% Soils in different categories		
	Low	**Medium**	**High**
Available N Status			
1976	52 (117)	43 (97)	4 (10)
2002	63	26	11
2011	57(283)	36(182)	7(33)
Available P Status			
1969	47 (106)	49 (110)	4 (10)
1979	46 (170)	50 (184)	5 (17)
1996	49 (179)	49 (177)	2 (7)
2002	42	38	20
2011	51(257)	40(200)	9(40)
Available K Status			
1976	20 (36)	53 (98)	27 (50)
1980	22	44	34
2002	21	51	28 (Hasan 2002)
2002	13	37	50
2011	9(47)	42(212)	49(231)
Figures in parenthesis are number of districts Sources: Motsara (2002); Muralidharudu et al. (2011)			

Hence, there is no report suggesting the fertility and productivity of land due to non-judicious use of pesticides and substandard fertilizers. Moreover, pesticides in general has no role in augmenting on reducing the soil fertility.

h) If so, the details there of and the reaction of the government there to;

Not applicable

i) ***Whether the government has conducted any study over then decline in fertility of land due to use of above produces;***

Yes, ICAR (through its AICRP on LTFE) has been conducting long term study on use of fertilizer and pesticide on soil health.

j) ***If so, the details and the outcomes thereof***

Ans: The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health.

k) ***Whether the government has taken steps to save the fertility of soil and to impart training to farmers for judicious use of pesticide, chemicals and fertilizers and to promote use of bio-fertilizers; and***

Ans. Yes, The Government of India through its research, education and extension institutes has been giving training to farmers to save the fertility of soil. Also, it is mandatory for all the ICAR institutes to provide training to the farmers.

l) ***If so, the details there of?***

Ans. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programme are being conducted every year for the benefit of farmers.

Indian Institute of Soil Science, Bhopal

Ref: Email dated Oct 25, 2013 (5.57 pm) from rajbirsingh.nrm@gmail.com
Sub: Urgent and time bound information/Information for submission to hon'ble AM

Activities/achievement during X Five year plan (2002-2007)

The total X-Plan allocation/expenditure of the institute including 4 AICRPs was 3201 lakhs including 811.94 lakh for the institute.

During this period (2007-2012), the institute executed 15 in-house projects, one AP Cess funded project, four sponsored (FAO, ACIAR, TMC, ICRISAT) and eight world bank (under NATP) projects.

The institute generated Rs. 266.73 lakhs through externally aided projectsand Rs. 55.78 lakhs from other resources. The institute also organized 4 courses, trained 68 persons in research and allied activities. A total of 56 new equipments were purchased by the institute.

Some of the salient technologies developed by the institute during X plan are Low cost integrated nutrient management for soybean-wheat system, mobilization and utilization of P from low grade rock phosphates, mechanical harvest borne wheat residue management, technology for assessing carbon pools and soil quality, vermicomposting, online fertilizer recommendation system, integrated nutrient management technologies for pulses and oilseeds, use of sewage water for crop production, use of distillery effluents in agriculture, and organic farming technologies for different crops.

As per the target in the X plan the institute developed 12 IPNS packages, three soil fertility maps, developed standards for city compost/biofertilizers//mainures and organized 12 farmers' training programmes.

Activities/achievement during XI Five year plan (2007-20012)

The total XI-Plan expenditure of the institute including 4 AICRPs was Rs. 6741.48 laks including Rs. 1213.32 lakh for the institute and total non plan expenditure was Rs. 2844.27 lakhs including Rs. 2581.39 lakhs for the institute.

During this period the institute generated some important technologies viz., micro and secondary nutrient recommendations for Indian soils, technologies for preparation of phosphor-sulpho-nitro composts, spentwash amended composts, enriched organo-mineral composts, and microbial rich municipal solid waste compost.

The institute also developed some mixed consortium biofertilizers, conservation tillage technology for soybean-wheat cropping system, GIS based soil fertility maps of different states, and district-wise database of different sources of plant nutrients.

During this plan the institute a new building was constructed for hosting soil biodiversity and biotechnology laboratory and soil, water, and produce quality laboratory with a total outlay of Rs. 200 lakhs.

Sub: **Lok Sabha Provisional Starred Question Dy. No 5680 for 04.12.2012 regarding Adverse Impact of Chemicals Fertilizers by Shri Dhananjay Singh & others**

f) Whether the Government has recently conducted a study to assess the adverse impact of chemical fertilizers on soil, water and other natural resources in the country;

Answer: Yes.

g) If so, the outcome thereof;

Answer: There are about 97 institutions of ICAR apart from 47 State Agricultural Universities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

ix) Central Soil and Water Conservation Research and Training Institute, Dehradun

x) Central Soil Salinity Research Institute, Karnal

xi) Indian Institute of Soil Science, Bhopal

xii) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soils, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the StateAgriculturalUniversity. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Long-term studies have indicated that raising of crops with the use of balanced fertilization have not affected soil fertility. Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available

K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status.

Summary of soil fertility (N, P and K) status of soils of different states of India

State	% Area								
	Available Nitrogen			Available Phosphorus			Available Potassium		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
U.P.	98	2	0	97	3	0	0	61	39
Uttarakhand	43	37	20	68	32	0	0	67	33
Punjab	73	27	0	0	47	53	0	11	89
Haryana	96	4	0	92	8	0	0	39	61
H.P.	0	24	76	33	55	12	65	35	0
M.P.	27	63	10	31	56	13	17	29	54
Maharashtra	88	12	0	93	7	0	4	17	79
Rajasthan	88	12	0	55	45	0	0	24	76
Gujarat	68	21	11	34	66	0	0	37	63
Chhattisgarh	59	41	0	50	50	0	29	30	41
Bihar	36	58	6	29	68	3	23	73	4
W.B.	40	60	0	30	60	10	10	09	0
Orissa	57	43	0	44	56	0	11	58	31
Assam	27	73	0	17	83	0	38	44	18
Jharkhand	7	93	0	75	23	2	3	76	21
Andhra Pradesh	44	56	0	55	45	0	0	58	42
Tamil Nadu	94	4	2	15	47	38	1	31	68
Karnataka	20	61	19	27	69	4	8	14	78
Kerala	17	77	6	0	76	24	0	82	18

h) The States/UTs where the adverse impact has reduced the agricultural production during each of the last three years; and;

Answer: Punjab with 243 kg per hectare fertilizer consumption is one of the largest consumers of fertilizers in India. Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also encourage higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

i) The remedial steps taken/ proposed to be taken by the Government to reduce the adverse impact of chemical fertilizers and the success achieved so far in this regard?

Answer: The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. Indian Institute of

Soil Science has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers.

All India Coordinated Research Project on Soil Test Crop Response Correlations (ICAR) has a centre at Punjab Agricultural University. The major mandate of this project is to develop soil test based fertilizer calibration relationships. These relationships help compute precise fertilizer doses based on compensating the nutrient requirements of the targeted crop yield. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer's practice	STCR- IPNS recommended practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

With reference to email date 22th July 2014, regarding commercialization of ICAR technology related to fertilizer coating with different micronutrients, PGR and nutrient solubilizing bacteria;

Technology to coat chelated micronutrient onto regular NPK-complex fertilizers, to arrive at more complete nutrient solutions for specific crops and geographies.

Comments: We do not have such technology to coat chelated micronutrients on to complex NPK fertilizer.

Can we coat specific plant growth regulators products on to bulk fertilizer products like NPK complex, aimed at enhancing root development, root surface area and there by improve fertilizer use efficiency? Could you specify the best solutions (For example, sea weed extracts, or mycorrhizha etc), and more important process to coat it on bulk fertilizers.

Comments: We do not have the required technology for coating of various chelated micronutrients, PGR and nutrients solubilizing bacteria with complex NPK fertilizer. Further, we do not recommend mixing/coating of bio-fertilizers with chemicals fertilizers.

Do you provide technology to coat nutrient solubilizing bacteria onto bulk fertilizer products – like P solubilizing bacteria or sulphur solubilizing bacteria or say zinc solubilizing bacteria etc. We look for specific microbial culture (including scalability for large scale) and also the coating process such that microbes should survive on the fertilizer for reasonable time during product storage, transport and till it reaches farmer field.

Comment: No

2014

Sub: Lok Sabha admitted unstarred question No. 3604 raised by Shri Bheemrao B Patil regarding "Judicious use of Fertilizers" due for answer on 5 August, 2014.

Ref: Edn. 12(42)/2014-A&P dated 31st July, 2014

Point wise reply is provided below:

(a) Whether the agricultural universities in many states including Telangana are conducting campaign to create awareness among the farmers about the judicious use of fertilizers and

Yes, the AICRP on STCR through its centres is conducting the campaign to create awareness among the farmers about the judicious use of fertilizers. Similarly, AICRP –MSN is working in 15 State Agricultural Universities including Telengana on promotion of judicious use of micronutrient fertilizer along with NPK.

(b) If so, the details thereof along with the response received by the Government so far;

Indian Institute of Soil Science is engaged in research and extension on balanced fertilizer use along with its AICRPs. It is conducting model training courses, winter and summer schools, Farmers Trainings etc. In addition Farmers Fair, Field Days Farmers Visits to the Institute etc. are also conducted for farmers of nearby districts and states.

The AICRP (STCR) is conducting Front line demonstrations (FLDs) and capacity building programmes in collaboration with 21 State Agricultural universities spread across India to create awareness among the farmers about the judicious use of fertilizers. Under Tribal Sun Plan also, AICRP (STCR) is demonstrating through FLDs and sensitizing through capacity building programmes of tribal farmers about the judicious use of fertilisers on the basis of soil test based fertilizer and manure recommendations for getting higher return of applied nutrients through the fertilizers and manures application based on targeted yield approach.

Regarding Telangana the same is being administered through ANGRAU centre of AICRP (STCR). Training programmes are also organised by AICRP (STCR) in collaboration with State Agriculture Department, Govt. of Telengana on various issues such as GPS & GIS based soil fertility mapping of four districts of Telangana, viz., Karimnagar, Mahbubnagar, Nizamabad and Rangareddy as well as STCR based fertiliser recommendations and judicious use of fertiliser. The awareness is also being created through on-farm demonstration, farmers fair and field day. On an average about 200 – 250 demo trials are conducted on crop response to micronutrient application every year across the country. The crop response varied from 5 to 65% depending on nutrient deficiency status and type of crop. A report is sent to the State Government by SAUs on status of micronutrients and its importance in crop production for promotion of use of micronutrients.

Sub: Rajya Sabha Question starred/unstarred Dy. No. 623 on "Decline in fertility of soil" due for answer on 28-11-2014

Reference: Parliament Question received from Dr. P.P. Biswas, Pr. Scientist (Soils), ICAR, New Delhi

(d) Whether fertility of soil has declined owing to use of pesticides and if so, the details thereof; and

There is no report suggesting that the fertility of soil has declined owing to judicious use of pesticides. However, indiscriminate and non-judicious use of pesticides may cause soil pollution problems.

(e) the corrective measures taken by government in this regard;

There are institutes in Indian Council of Agricultural Research like IARI (Indian Agricultural Research Institute) and NCIPM (National Centre for Integrated Pest Management), New Delhi which carryout research and advisory on the use of pesticides in agriculture.

With reference to Lok Sabha Admitted Starred Question Dy. No. 18151 for 23.12.2014 regarding Fertility of Soil

Deficiency status of available Sulphur in soils of different states of India		
State	No. of samples	Percent samples deficient
Andhra Pradesh	3216	28.9
Assam	5216	16.7
Bihar	3597	42.8
Gujarat	5470	42.0
Haryana	5673	35.8
Himachal Pradesh	161	0.0
Madhya Pradesh	6499	27.7
Maharashtra	8278	26.5
Odisha	2349	31.1
Punjab	300	52.3
Tamil Nadu	28153	14.3
Telangana	2776	31.8
Uttar Pradesh	3950	32.5
Uttarakhand	2375	11.2
West Bengal	1849	37.4
All India	79862	24.7

Subject: **Performance of agricultural scientists/-------Shri. A.T. Nana Patil and Shri Sunil Kumar Singh.**

(a) The number of agricultural scientists working at present with ICAR, IARI and other institutions being funded by Union Government.

At present there are 49 scientists including the Director of the institute.

(b) The notable achievements made during last one year by these scientists especially in field of dryland farming.

The ICAR has established various institutes, to cater the needs of different agro-eco-region on specific commodity crops, resource management etc. The IISS is a national institute established with mandate, "to provide scientific basis for enhancing and sustaining productivity of soil resources with minimal environmental degradation". The institute has generated various technologies in the past for the benefit of farmers of the country. The notable achievements during last year in rainfed/dryland/irrigated conditions have been given as under:

I. Development of Targeted Equations:

- **Pantnagar:** Okra (Parbhani Kranti), Chilli (Pant Jwala) and Sorghum (CSV-15).
- **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).
- **Vellanikkara:** Chilli (Athulya).
- **Raipur:** Rice (Karma Masuri & Swarna) and Tomato (Pant-3).
- **Rahuri:** Garlic (G-14), Okra (Arka Anamika), Potato (Kufri Jyoti), Brinjal (Krishna), Bt. Cotton (Mallica), Sorghum (Phule Chitra) and Wheat (NAIW 304 & Trymbak).
- **Pusa:** Barseem (Mascavi).
- **Coimbatore:** Rice (ASD 16) and Bt. Cotton (Hybrid RCH 530 BG II).

II. Use of Targeted Yield Equations and Development of Prediction Equations for Cropping Sequences:

- **Palampur:** Maize (PG 2474)-Wheat (HPW 155).
- **New Delhi:** Rice (PRH-10)-Wheat (HD-2894).
- **Coimbatore:** Maize (CO 1)-Bt. Cotton (Hybrid RCH 530 BG II).
- **Bikaner:** Wheat (Raj-3077)-Groundnut (ICGS 5).

III. Fertilizer Prescription Equations under Integrated Plant Nutrient Supply Systems:

- **Coimbatore:** Rice (ASD 16) and Bt. Cotton (Hybrid RCH 530 BG II).
- **Bikaner:** Onion (RO 252) and Fenugreek (RMP-1).
- **Barrackpore:** Jute (JRO 2407) and Rice (MPU 1010).
- **Hisar:** Pearl Millet (HHB 223), Wheat (DPW 621-50) and Maize (HM 5).
- **Vellanikkara:** Chilli (Athulya).
- **Palampur:** Okra (P-8) and Gobhi Sarson (HPN-1).
- **Pantnagar:** Okra (Parbhani Kranti), Chilli (Pant Jwala) and Sorghum (CSV-15).
- **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).

- **Hyderabad:** Sunflower (Sunbred), Bt. Cotton (KH-112), Castor (PCH 222) and Sugarcane (2001 A 63)**.**
- **New Delhi:** Wheat (HD-2894 & HD-2851) and Rice (PRH-10).
- **Jorhat:** Rice (Ranjit).
- **Bangalore:** Sugarcane (Ratoon III) and Ragi (GPU-28).
- **Kalyani:** Onion (Suksagar).
- **Varanasi:** Maize (Asha).
- **Bhubaneswar:** Sesamum (Uma).

IV. Follow up trials conducted

- **Coimbatore:** Cotton (RCH 530), Maize (NK 6240), Rice (ADT-43) and Tomato (Lakshmi 5005).
- **New Delhi:** Wheat (HD-2851).
- **Jabalpur:** PadDy (MR-219), Wheat (GW-273), Soybean (JS-9752), Chandrasur (HI-4), Garlic (G-323) and Onion (Agrifound Light Red).
- **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).
- **Vellanikkara:** Chilli (Ujwala).
- **Palampur:** Maize (PG 2474), Wheat (HPW 155) and Potato (Kufri Jyoti 2).
- **Bikaner:** Cluster Bean (RGC 986) and Wheat (Raj-3077).
- **Barrackpore:** Jute (JRO 128), Rice (MPU 1010) and Vegetable Pea (Azad P 3).
- **Hisar:** Pearl Millet (HHB 197), Wheat (WH 711, WH 283 & PBW 550) and Bt. Cottn (MRC 6304).
- **Jorhat:** Rice (Luit & Ranjit).
- **Bangalore:** Hybrid Maize (Hema) and Ragi (GPU-28).
- **Kalyani:** Potato (Kufri Jyoti).
- **Varanasi:** Rice (Super Moti).

V. FLDs conducted

- **Hisar:** Pearl Milet (HHB 197 & HHB 223), Wheat (PBW 502 & WH 711) and Raya (Laxmi).
- **Bangalore:** Sunflower (KBHS-53).
- **Palampur:** Soybean (Brag) and Toria (Bhawani).
- **New Delhi:** Mustard (Pusa Bold) and Wheat (HD-2894).
- **Jabalpur:** Soybean (JS-9752), Pady (Sahbhagi, Kranti & MR-219), Pea (Azad Pea-1), Wheat (JW-273) and Gram (JG-319 & JG-311).
- **Coimbatore:** Groundnut (JL-24, VRI-2 & CO-6), Sunflower (Sunbred 275) and Gingelly (TMV 3 & TMV 7).
- **Pusa:**Rice (6444 & PT 71), Wheat (PBW 348, HD 2733 & PBW 502), Maize (10 B 10), Sesame (Krishna), Mustard (45521, 66157 & Voruna), Linseed (Subhra), Potato (Jyoti) and Turmeric (Rajendra Soniya).

VI. FLDs conducted under Tribal Sub Plan

- **Coimbatore:** Maize (CO 6), Groundnut (CO 6), Onion (CO 4), Carrot (Tokito) and Tomato (PKM 1).

- **Manipur:** Garden Pea (Arkel), Field Pea (Rachna) and Rape Seed (M-27).
- **Bhubaneswar:** Chilli (Bamra Local), Brinjal (BV-45 C) and Tomato (BT-20).
- **Barrackpore:** Mustard (B-9) and Lentil (B 256).
- **Jabalpur:** Gram (Jaki 9218, JG 14, JG 16, JG 130 & JG 315), Wheat (JW 273, JW 321, JW 3269, Lok 1 & Sujata) and Lentil (JL 3).
- **Raipur:** Wheat (Amar, DL788-Vidisha, GW-273 and Sujata-HI1077), Maize (30V92) and Chick pea (JG11-Vaibhav and Jaki).

Regarding darylad farming, AICRP on STCR at ANGRAU, Hyderabad and GKVK, Bangalore centres are engaged and have developed soil test based balanced fertilizer prescription equations for cotton, ragi and sunflower.

VII Soil Fertility Evaluation

- Analysis results of 63,243 geo-referenced samples from 12 states of the country revealed that 27.8% of Indian soils are deficient in available S. Among the states, 46.5% soils of delineated districts of West Bengal were low in available S, marginally followed by Bihar (46.4%), Gujarat (43.3%), Haryana (35.8%) and Uttar Pradesh (32.5%). Overall, 39.9% of 70,759 samples collected from 174 districts of 13 states across the country were deficient in available Zn. The Fe deficiency in India stayed close to 13% and that of Mn was 6.0% while Cu deficiency (4.3%) was little less than Mn.
- In the tribal dominated dryland of Jhabua and Alirajpur districts in Madhya Pradesh, the soil fertility maps were assessed with respect to micro and macro nutrients. The overall fertility was found to be in low to medium category.
- To determine the degree of phosphorus saturation (DPS) threshold values for crop yield and environmental pollution for the Vertisols, Inceptisols, Alfisols and Ultisols, Mehlich 3 and Ammonium oxalate extractants can be preferred over the routine soil test procedures like Bray and Olsen. The results obtained with the extractant Mehlich 3 revealed that the Inceptisol are most vulnerable for P leaching because they have the minimum environmental threshold. This is followed by Alfisol, Ultisol and Vertisol which are less susceptible to P leaching.

VII Improving Input Use Efficiency

- Field experiment conducted to evaluate the dose of nano rock phosphates, taking maize as a test crop showed that crop utilization of P from nano rock phosphate was at par with that of P from DAP while yield response to P from nano rock phosphate was marginally lower than the P from DAP but much more economical. Experimental result of the field trial also revealed that application of nano rock phosphate @ 45kg ha^{-1} for maize crop was as effective as @ 60kg ha^{-1}.

- A protocol developed to coat the nano rock phosphate (~48.8 nm, 34% P_2O_5) with POR coated urea and experimental results showed that the coated materials are useful to coat the naked NRP and the products are promising alternatives of conventional phosphatic fertilizer for crops like wheat, maize, etc.
- Long – term application of integrated plant nutrient supply modules influenced the grain and stover yield of maize. Grain yield and total dry matter yield of maize was the highest for STCR based recommended dose of fertilizers which was at par with GRD and FYM based INM modules. Maize yield of 6.85 t ha^{-1} and chickpea yield of 1.87 t ha^{-1} were achieved against the targets of 5 and 1.5 t ha^{-1}, respectively.
- Yield performance of wheat, mustard, chickpea and linseed under organic management practice (soybean based cropping system) was better followed by integrated nutrient management. In organic management, the yield of all *rabi* season crops were found to be higher in 100% organic nutrient management practices than 75% organic + 25% innovative practices.
- Significant response to multi-nutrients application was recorded in several crops at Akola, Ludhiana, Hisar and Palampur, Jabalpur, Pusa, Hyderabad, Pantnagar, Anand, although percent response varied significantly with crops and nutrients. Besides Zn being the most crucial nutrient for crops, increased responses were recorded when it was applied along with S, B and Mo. Different soil specific amelioration techniques for micro- and secondary nutrients deficiency were developed successfully at all the centres catering to the specific conditions of the corresponding state.

VIII Monitoring Long Term Productivity, Soil Quality and Resilience

- The physical indicators of resilience were the highest in the treatments with FYM + fly ash (2.79% and 28.88 MPa, respectively) followed by poultry manure + fly ash (2.25% and 23.28 MPa, respectively) depicting their higher strength due to addition of fly ash. Application of Cu stress significantly reduced the soil microbial biomass carbon and dehydrogenase enzyme activity from 0 to 6 week in un-amended soil and from 0 to 4 week in soil amended with various amendments such as FYM, biochar, poultry manure and fly ash.
- Factors affecting potential carbon mineralization (PMC) in soils were identified using soil samples of different soil and climatic conditions. It was observed that silt, clay and C: N ratio are the main factors which are affecting potential carbon mineralization in Indian soil. Subsequently, a model for computation of PMC in soil was developed.
- The soil carbon sequestration rate and carbon pool dynamics in permanent manurial trial of Ranchi revealed that application of FYM invariably increased total organic C and carbon in mineralizable and passive pool in all the treatments wherever FYM was applied.

IX Conservation Agriculture and Climate Change

- A simulation study indicated that an increase in temperature by 1.5˚C will reduce the grain yield of soybean by 20%. Decreasing the temperature from the current climate by 1˚C and increasing the rainfall by more than 10% favours the soybean yield the most. Increasing the temperature to 1.5°C along with increase in rainfall up to 50% during soybean growth reduces the soybean yield to the tune of 5 to 10% which can be considered a tolerable limit. Beyond 1.5°C increase in temperature, the increase in rainfall doesn't show any positive impact on soybean yield.
- Different tillage practices such as conventional tillage (CT) and reduced tillage (RT) had no effect on soybean grain equivalent yield after three years of crop cycle. Among the cropping systems studied, maize-gram recorded higher yield followed by soybean+ pigeon pea (2:1) and soybean-wheat cropping system.
- Among the tillage systems, no-tillage (383 mg kg^{-1}) and reduced tillage (360 mg kg^{-1}) recorded higher active carbon compared to conventional tillage (335 mg kg^{-1}) in 0-5 cm, similar trend was observed for 5-15 cm soil depth.

X Microbial Diversity and Bio-fertilizers

- Differences in eubacterial diversity and species richness were higher under organic management in soybean and maize compared to inorganic but the differences were subtle rather than dramatic. Arthropods in soil reduced under chemical farming in paddy soils as compared to INM paddy, organic vegetable soils and forest soils in NEH.
- Promising actinomycetes strains for maize and chickpea identified. Actinomycetes A10 performed well in dry land conditions and saved 25% NP for maize.
- DAPG producing fluorescent pseudomonads suppressed incidence of stem rot in groundnut by half and increased the yields.
- Bio-fertilizers for jute found effective in NEH and coastal soils. Bio-fertilizers improved yield and capsicain and Vitamin C content in hot chilli.
- Microbiology of rhizospheric soils of hill crops in progress for PGPR isolates characterization in maize, sweet cherry and seabuck thorn.
- Molecular characterization of arid zone rhizobia of cluster bean, pigeon pea was done and temperature tolerance and PGPR characteristics quantified. Arid zone rhizobia were also highly salt tolerant. Five rhizobial isolates antagonistic to chickpea fungal pathogens identified. Multiple Rhizobium strains inocula (3 strains) giving best response on black gram in A.P.
- Functional microbial groups associated with bioenergy crop belonging eubacteria, ammonium oxidizers and phosphate solubilizers quantified by real time PCR from the rhizosphere of bioenergy crop J curcas. Diversity of rhizospheric bacteria of bioenergy crop was estimated by terminal restriction fragment length polymorphism. Restriction fragments indicative of uncultured deltaproteobacteria, and betaproteobacteria were identified as predominant species in the rhizosphere of bioenergy crop.

- Complex medium for growing microbial consortia as liquid Bio-fertilizer under further refinement, shelf life up to 9 months obtained. 0.1% bentonite improved the shelf life of liquid formulations. Liquid inoculants and good quality semi solid carrier inoculants of rhizobia for soybean were at par. Rhizobia could induce synthesis of Cd-Te quantum dot Nano-particles.
- Bio-fertilizer packages demonstrated for upland and low land rice and in tribal areas in eastern India. Bio-fertilizer production at 3 centres of the SB-BF project was to the tune of 114.5 lakhs during 2013-14 (project budget 190 lakhs) (76.3% ROI).
- Medium for cultivation of PGPR-Bacillus was modified to obtain high counts which improve the quality. Consortia of PGPR, Rhizobium and Actinomycetes performed extremely well on chickpea in Vertisol.

XI Amelioration of contaminated Soils

- Compost prepared from un-segregated municipal solid wastes contains high amount of heavy metals restricting its use in agricultural land as amendment material. A laboratory experiment showed that removal of finer size fraction and extraction of metals through wet sieving method using acidic distillery effluent containing dilute EDTA may lesson hazardousness of such composts.
- A study was carried out to develop bio-filtration method for removal of heavy metals from poor quality of municipal solid waste compost using isolated mesophilic fungi. Six mesophilic fungi were isolated and identified viz. *Trichoderma viride; Aspergillus heteromorphus; Rhizomucor pusillus; Aspergillus flavus; Aspergillus terrus* and *Aspergillus awamori*. All the fungal growth was not affected up to 400 ppm of Pb and Zn. However, except T. viridi.
- Laboratory studies were conducted at some of the LTFE centres for examining the residual effects of herbicides in soil. The results indicated that the half-life of isoproturon in field ranged from 9.9 to 20.8 days. The maximum half-life was observed in control while the minimum half-life was found in 100% NPK+ FYM+ lime followed by 100% NPK+ FYM and 100% NPK (S-free).
- Accumulation and translocation behavior of heavy metals in crops irrigated with contaminated water were studied. Characterization of heavy metals in peri-urban areas of Nagpur and Aurangabad districts of Maharashtra continuously irrigated with sewage water along with profile distribution of these metals was also studied. Threshold toxic limits for heavy metals in different crops like buckwheat were established and effect of organic amendments in minimizing the toxicity was investigated successfully.

XII On-Farm research and Impact Assessment

- Follow up/Verification trials were conducted on jute, rice, vegetable pea, garlic, chandrasur, soybean, onion and chilli by the Barrackpore, Jabalpur and Vellanikkara centres, respectively. In all the trials, the targeted yield was achieved with the adoption of IPNS-STCR fertiliser prescription eqation within permissible yield deviation limit (±10%) with higher nutrient response ratio, greater B: C ratio and better net return.

- Long-term IPNS-STCR demonstrations have been conducted on pearl millet-wheat and rice-rice cropping sequence at New Delhi and Coimbatore STCR centre, respectively. The results showed significant improvement of soil health as indicated by physical, chemical and biological parameters with STCR-IPNS treatment.
- Under frontline demonstrations (FLDs) on oilseeds, the Coimbatore centre has conducted 10 FLDs on groundnut, sunflower and gingelly. In all the demonstrations, the targeted yield was achieved with the adoption of IPNS-STCR fertiliser prescription equation within permissible yield deviation limit (±10%) with the highest nutrient response ratio, B: C ratio and maximum net return.
- A farmers' field demonstration project was conducted with five technologies (IPNS, STCR, Phospho-Sulpho-Nitro Compost, Broad Bed and Furrow technique (developed by ICRISAT) with Reduced Tillage, and application of Bio-fertilizers developed by the institute). It was found that in soybean yield increased by 14.3% with IPNS, 25.9% with Phospho-Sulpho-Nitro Compost, and 15.2% with STCR based fertilizer recommendations over farmers' practices in the selected Agro-ecosystem. However, in the following wheat crop the percentage yield increases with the IPNS, Phospho-Sulpho-Nitro Compost, and STCR over farmers' practice were 12.0, 16.3, and 12.8 respectively.
- The institute technologies Integrated Plant Nutrient Supply System (IPNS); Use of Phospho-Sulpho-Nitro Compost; Soil Test based Fertilizer Recommendation (STCR); Broad Bed and Furrow Technique with Reduced Tillage; and application of Bio-fertilizers were demonstrated in MeghraKalan village about 50 km away from institute, revealed 14.3% increase in soybean seed yield with IPNS, 25.9% with phospho-sulpho-nitro compost, and 15.2% with STCR based fertilizer recommendations over farmers' practice. In the following wheat crop the percentage yield increases with the IPNS, phospho-sulpho-nitro compost, and STCR over farmers' practice were 13.7, 19.5, and 14.7%, respectively.

(c) Whether the Government proposes to make changes in curriculum of agricultural universities to bring about rapid advancement of technologies in the field of agriculture.

NA

(d) if so, the details thereof; and

NA

(e) The steps taken/propose to be taken by the Government to bring scientist nearer to farmers for transfer of latest technologies to farmers?

Scientists are delivering their research outcomes to the farmers in many ways such as: organizing farmer's trainings, farmer-scientist interaction meetings, on farm demonstration, frontline demonstrations, organizing field days, delivering radio/TV talks on latest issues etc. Last year following training programmes have been conducted by the scientists.

Trainings organized

Following training were organized for the farmers of the M.P. on various issues

Sponsoring department/ organization	No. of participants	Duration	Particulars
Farmer Welfare and Agriculture Development under ATMA, Distt. Hoshangabad, Madhya Pradesh.	25 farmers	January 9-13, 2014	Organic farming and Soil health
Farmer Welfare and Agriculture Development under ATMA, Distt. Morena, Madhya Pradesh.	30 farmers	March, 10-14, 2014	Organic farming and Soil health
Farmer Welfare and Agriculture Development under ATMA, Distt. Morena, Madhya Pradesh.	30 farmers	March, 24-28, 2014	Organic farming and Soil

Farmers'/Agriculture Officer visit to institute

Farmers/scientists/agriculture officers /extension workers visited in the institute and were provided the information on technologies generated by the institute.

S. No.	Department	Number of participants	Period
1.	Soil testing Evam Improve Agriculture Technology scheme Distt Damoh (M. P).	80 Progressive farmers	14/08/2013
2.	Bhopal under ATMA project.	100 Progressive farmers	30/08/2013
3.	Dharampuri Madhya Pradesh under ATMA project.	30 Progressive farmers	13/09/2013
4.	Farmer Welfare and Agriculture Development Distt-Shyopur, Madhya Pradesh.	30 Progressive farmers	17/09/2013
5.	Vaishali Nagar Distt Damoh (M. P) under IWMP-II	38 Progressive farmers	30/09/2013
6.	Farmer Welfare and Agriculture Development Distt Damoh (M. P) under IWMP-III	50 Progressive farmers	01/10/2013
7.	Project Directorate, Sagar (M. P) under ATMA Project	30 Farmers	07/10/2013
8.	Project Directorate, ATMA, Agriculture	45 Progressive farmers	24/12/2013

	Department Ajmer, Rajasthan		
9.	Bhopal under ATMA project	100 Progressive farmers	30/08/2013.
10.	Project Directorate ATMA, Distt Vidisha (M. P	40 Progressive farmers	07/01/2014
11.	Project Directorate ATMA, Distt - Khargone (M. P)	25 Progressive farmers	17/01/2014
12.	Training Centre Indore (M. P)	30 Officers	24/01/2014
13.	B. Sc. /M. Sc. Chemistry Students from Institute of Excellence In Higher Education, Bhopal.	55 Students	01/02/2014
14.	Agriculture Extension & Training Centre Bhopal (M. P)	30 Officers	05/02/2014
15.	Project Directorate, ATMA, Jalour, Rajasthan.	50 farmers	08/2/2014
16.	Project Directorate, ATMA, Tonk Rajasthan	48 farmers	09/02/2014
17	Project Directorate, ATMA, Jhalawar, Rajasthan.	50 farmers	09/2/2014
18	Sawai Madhupur Distt. Rajasthan under ATMA, project	45 farmers	11/02/2014
19	Project Directorate, ATMA, Bharatpur, Rajasthan	45 farmers	12/02/2014
20	Agriculture Extension & Training Centre Pawarkheda Hoshangabad (M. P)	30 Officers	19/02/2014
21	Agriculture Extension & Training Centre Satrati Distt Khargone (M. P)	35 Officers	22/02/2014
22	Project Director ATMA Distt. Khargone , Madhaya Pradesh	20 farmers	9/01/2014
23	University of Horticultural Science, Bagalkot, College of Horticulture, Bagalkot Karnataka	45 B. Sc. Students	26/02/2014
24	Project Director, Farmer Welfare & Agriculture Development ATMA Distt. Mansour (M.P.)	20 Farmer	01/03/2014
25	Organic farming promotion Group, Phanda Block, Distt Bhopal.	20 Farmers	06/03/2014
25	Vidhya Peeth Institute of Science and Technology, Bhopal (M.P.)	50 Students of Civil Engineering	06/03/2014

Sub: Rajya Sabha Provisional Admitted Question (Dy. No.S-5118)

(a) Whether excessive use of chemical fertilizer has harmful effects on fertility of soil and human health. If so, the details thereof.

Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status**.** There is no much change in the soil fertility status as compared to earlier reports of 1967 and 2002 (Table 1). These results showed that the status of P was increased in some areas due to continuous application of phosphatic fertilizers. Similarly, per cent soils high in available K increased from 27% in 1976 to 49% in 2011. The per cent soils low in available N increased from 52% in 1976 to 57% in 2011 which may due to various losses of nitrogen. Analysis of more than 0.25million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils.

Table 1. Change in available N, P and K status of Indian soils with time.

Year	**% Soils in different categories**		
	Low	**Medium**	**High**
Available N Status			
1976	52 (117)	43 (97)	4 (10)
2002	63	26	11
2011	57(283)	36(182)	7(33)
Available P Status			
1969	47 (106)	49 (110)	4 (10)
1979	46 (170)	50 (184)	5 (17)
1996	49 (179)	49 (177)	2 (7)
2002	42	38	20
2011	51(257)	40(200)	9(40)
Available K Status			
1976	20 (36)	53 (98)	27 (50)
1980	22	44	34
2002	21	51	28 (Hasan 2002)
2002	13	37	50
2011	9(47)	42(212)	49(231)
Figures in parenthesis are number of districts Sources: Motsara (2002); Muralidharudu et al. (2011)			

Hence, there is no report suggesting the fertility and productivity of land due to excessive use of fertilizers.

(b) Whether Government proposes to educate farmers regarding its balanced use of and to adopt organic farming to improve the quality of soil and reduce input costs of production and if so, the details thereof;

(c) Whether Government proposes to identify the areas where the soil is malnourished and lacks vital nutrients and if so, the details thereof and

(d) The details of soil testing centres established and soil health cards issued to farmers to replenish the quality of soil. State-wise.

Sub: Rajya Sabha Provisional Admitted Question (Dy. No.S-5122)

(a) Initiatives taken by the Central Government to enclave research in agriculture sector and biotechnology in the State of West Bengal in last five years.

IISS does not have any information in this regards.

(b) Whether in spite of high production of crops, there is no new Agricultural University has been established in the State of West Bengal since last five years and IISS does not have any information in this regards.

(c) The fund allocated and spent for agricultural research purpose in the State of West Bengal during last five years.

IISS has been

Sub: Material for answering Lok Sabha Admitted Starred Question Dy. No. 18151 for 23.12.2014 regarding Fertility of Soil

a) Whether the Government has conducted any scientific study/survey to identity the extent of loss of fertility of soil/damage to agriculture land across the country including coastal areas;

Yes, please.

b) If so, the details thereof and outcome of the study in this regard.

ICAR - Indian Institute of Soil Science, Bhopal has compiled soil test data of available N, P and K status from different soil testing laboratories located in 19 states which showed that the soils of about 59% area were low in available N, 36% were medium and 5% were high. Similarly, soils of about 49% area were low, 45% were medium and 6% were high in available P. Available K status showed that the soils of about 9% area were low, 39% were medium and 52% were high in available K status**.**

Summary of soil fertility (N, P and K) status of soils of different States of India

State	% Area								
	Available Nitrogen			Available Phosphorus			Available Potassium		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Uttar Pradesh	98	2	0	97	3	0	0	61	39
Uttarakhand	43	37	20	68	32	0	0	67	33
Punjab	73	27	0	0	47	53	0	11	89
Haryana	96	4	0	92	8	0	0	39	61
Himachal Pradesh	0	24	76	33	55	12	65	35	0
Madhya Pradesh	27	63	10	31	56	13	17	29	54
Maharashtra	88	12	0	93	7	0	4	17	79
Rajasthan	88	12	0	55	45	0	0	24	76
Gujarat	68	21	11	34	66	0	0	37	63
Chhattisgarh	59	41	0	50	50	0	29	30	41
Bihar	36	58	6	29	68	3	23	73	4
W.B.	40	60	0	30	60	10	10	09	0
Orissa	57	43	0	44	56	0	11	58	31
Assam	27	73	0	17	83	0	38	44	18
Jharkhand	7	93	0	75	23	2	3	76	21
Andhra Pradesh	44	56	0	55	45	0	0	58	42
Tamil Nadu	94	4	2	15	47	38	1	31	68
Karnataka	20	61	19	27	69	4	8	14	78
Kerala	17	77	6	0	76	24	0	82	18

The State-wise deficiency of micronutrients in soils are given in Table below. The deficiency of DTPA- micronutrients varies widely among soil types, agro climatic conditions, types of crops grown and other agronomic practices. Overall, 39.9% Zn, 12.9% Fe, 6.0% Mn and 4.3% Cu samples out of 72,159 samples analysedwere deficient across the country.

Table: Current status of DTPA-micronutrients deficiency in different states

State	% Samples Deficient			
	Zn	Fe	Mn	Cu
Andhra Pradesh	22.8	17.3	2.9	1.5
Assam	27.4	8.6	0.0	3.9
Bihar	44.2	5.8	2.9	2.7
Gujarat	34.2	23.6	6.6	0.4
Haryana	15.3	21.6	6.1	5.2
Himachal Pradesh	9.6	6.'3	3.7	1.2
Madhya Pradesh	60.3	9.8	1.6	0.2
Maharashtra	53.7	22.8	4.0	0.2
Odisha	20.5	1.7	1.0	0.3
Punjab	21.9	5.8	26.8	3.5
Tamil Nadu	62.2	9.5	8.9	13.1
Uttar Pradesh	33.1	7.6	6.5	6.3
Uttarakhand	9.8	1.7	5.5	1.4
West Bengal	8.5	0.8	1.7	1.1

Recently, GPS & GIS based soil fertility maps of 171 districts comprising of primary, secondary and micronutrients have been done through a DAC Sponsored project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for farmers of the country". The same has been uploaded in Institute website under the link: http://www.iiss.nic.in/districtmap.htmlfor the benefit of stakeholders.

Long terms studies have indicated that raising of crops with the use of balanced fertilization have not affected soil fertility.

c) The details of cultivable area affected due to saline water near the coastal areas in the country during course of the last three years and the current years, State-wise;

ICAR-CSSRI, Karnal is the nodal Institute for such studies.

ICAR-CSSRI, Karnal has prepared a first approximation of groundwater quality map on 1:6 million scales. Problems of poor water quality are generally associated with arid and the semi-arid regions and in coastal aquifers. 32 to 84 % area under arid and semiarid states is covered under saline/sodic groundwater.
(http://www.cssri.org/index.php?option=com_content&view=article&id=122&Itemid=126)

Stae-wise extent of salt affected soils in India is given in the table below. The table is downloaded from CSSRI website on 17.12.2014.

http://www.cssri.org/index.php?option=com_content&view=article&id=122&Itemid=126

Extent and distribution of salt affected soils in India

Sr. No.	State	Saline soils (ha)	Alkali soils (ha)	Coastal saline soil (ha)	Total (ha)
1	Andhra Pradesh	0	196609	77598	274207
2	A & N islands	0	0	77000	77000
3	Bihar	47301	105852	0	153153
4	Gujarat	1218255	541430	462315	2222000
5	Haryana	49157	183399	0	232556
6	J & K	0	17500	0	17500
7	Karnataka	1307	148136	586	150029
8	Kerala	0	0	20000	20000
9	Maharashtra	177093	422670	6996	606759
10	Madhya Pradesh	0	139720	0	139720
11	Orissa	0	0	147138	147138
12	Punjab	0	151717	0	151717
13	Rajasthan	195571	179371	0	374942
14	Tamil Nadu	0	354784	13231	368015
15	Uttar Pradesh	21989	1346971	0	1368960
16	West Bengal	0	0	441272	441272
	Total	**1710673**	**3788159**	**1246136**	**6744968**

d) Whether the government has launched several programmes for reclamation and development of such land in the country, and

The details may be available at ICAR-CSSRI, Karnal.

e) If so, the details thereof along with the funds allocated/utilized for the purpose and the success achieved thereunder during the said period?

The details may be available at ICAR-CSSRI, Karnal. Two recent publications available at their website are given below:

- Coastal saline Soils of Gujarat: Problems and their Management : Tech Bull.01/2013 by G.Gururajarao, Anil R. Chinchmalatpure, sanjay Arora, M.K.Khandelwal and D.K.Sharma (From RRS, Bharuch)
- Land Shaping- A unique Technology for improving productivity of Coastal Land : Tech Bull. 02/2013 by D. Burman, B.K.Bandyopadhyay, Subhasis Mandal, et al (From Canning Town)

Ref: Email from Dr. P.P Biswas dated Dec 16, 2014 12.43 P.M.
Sub: Material for answering Lok Sabha Admitted Starred Question Dy No. 18151 for 23.12.2014 regarding Fertility of Soil

a) **Yes, the Government has conducted scientific study/survey to identify the extent of loss of fertility of soil/damage to agricultural land across the country including coastal areas.**

b) **The details are summarized below:**

Earlier studies

First systematic soil fertility map of Indian soils was published in 1967 by Ramamurthy and Bajaj (1969). At that time around 4% samples were high in available P. The soil fertility map published in 2002 (Motsara, 2002) indicated that around 20% of soil samples were high in available P.

Based on the Nutrient Index values the districts falling in low, medium, or high categories are classified. Some studies are summarized in Table 1 on a time scale from 1969 to 2002[1-4]. The data clearly shows that most of the Indian soils were either low or medium in soil P fertility till 1996. Motsara (2002)[4] reported almost 20% districts in high P status. While some deviation in the different estimates could be explained due to different time of sampling, differences in sample sizes as well as variability in the sample loci, the data consistently shows that almost 80% of the soils are either in low or medium P fertility categories which reinforces the need of adequate external supply of P through fertilizers.

Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status. The three estimates (Ramamurthy and Bajaj, 1969; Ghosh and Hasan, 1980; Motsara, 2002) of soil fertility for K indicated an increase in the percentage of samples testing high over the years.

Recent studies

The Nutrient index based district-wise soil fertility maps of India (Muralidharudu et al. 2011) showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P.

According to one study, the percent samples falling under deficient category on pan Indian scale 89% for N, 80% for P, 50% for K, 49% for Zn, 41% for S, 33% for B, 13% for Mo, 12% for Fe, 5% for Mn, and 3% for Cu.

Outcome

The deficiency of nitrogen is most widely prevalent in Indian soils, as they are low to medium in organic matter content. This is followed by the deficiency of phosphorus. The deficiency of S, Zn, and B are also coming up in recent years in a big way.

Table 1.Phosphorus fertility index of different states over the years

Year	No. of samples (million)	Districts in P fertility classes (%)			Reference
		Low	Medium	High	
1969	1.3	47	49	4	1
1979	9.2	46	52	2	2
1996	9.6	49	49	2	3
2002	3.7	42	38	20	4

c) the details of the cultivable area affected due to saline water near the coastal areas during course of last three years and the current year; State-wise;

ICAR-IISS so far has not worked on saline water. The information may be available with ICAR-CSSRI, Karnal.

ICAR-CSSRI, Karnal has prepared a first approximation of groundwater quality map on 1:6 million scales. Problems of poor water quality are generally associated with arid and the semi-arid regions and in coastal aquifers. 32 to 84 % area under arid and semiarid states is covered under saline/sodic groundwater.

Stae-wise extent of salt affected soils in India is given in the table below. The table is downloaded from CSSRI website on 17.12.2014.
http://www.cssri.org/index.php?option=com_content&view=article&id=122&Itemid=126

Extent and distribution of salt affected soils in India

Sr. No.	**State**	**Saline soils (ha)**	**Alkali soils (ha)**	**Coastal saline soil (ha)**	**Total (ha)**
1	Andhra Pradesh	0	196609	77598	274207
2	A & N islands	0	0	77000	77000
3	Bihar	47301	105852	0	153153
4	Gujarat	1218255	541430	462315	2222000
5	Haryana	49157	183399	0	232556
6	J & K	0	17500	0	17500
7	Karnataka	1307	148136	586	150029
8	Kerala	0	0	20000	20000
9	Maharashtra	177093	422670	6996	606759
10	Madhya Pradesh	0	139720	0	139720
11	Orissa	0	0	147138	147138
12	Punjab	0	151717	0	151717
13	Rajasthan	195571	179371	0	374942

14	Tamil Nadu	0	354784	13231	368015
15	Uttar Pradesh	21989	1346971	0	1368960
16	West Bengal	0	0	441272	441272
	Total	**1710673**	**3788159**	**1246136**	**6744968**

d) Whether the government has launched several programmes for reclamation and development of such land in the country, and

The details may be available at ICAR-CSSRI, Karnal.

e) If so, the details thereof along with the funds allocated/utilized for the purpose and the success achieved thereunder during the said period?

The details may be available at ICAR-CSSRI, Karnal. Two recent publications are downloaded from their website.

- Coastal saline Soils of Gujarat: Problems and their Management : Tech Bull.01/2013 by G.Gururajarao, Anil R. Chinchmalatpure, sanjay Arora, M.K.Khandelwal and D.K.Sharma (From RRS, Bharuch)
- Land Shaping- A unique Technology for improving productivity of Coastal Land : Tech Bull. 02/2013 by D. Burman, B.K.Bandyopadhyay, Subhasis Mandal, et al (From Canning Town)

References

1. Ramamoorthy, J. B. and Bajaj, C., Available nitrogen, phosphorus and potassium status of Indian soils. *Fert. News*, 1969, **14**, 24-36.
2. Ghosh, A.B. and Hassan, R., Phosphorus fertility status of soils of India, Bulletin No. 12, 1979, ISSS, 1-8.
3. Hasan, R., Phosphorus status of soils in India. *Better Crops Int.*, 1996, **10**, 4-5.
4. Motsara, M. R., Available NPK status of Indian soils as depicted by soil fertility maps, *Fert. News*, 2002, **47**, 15-21.
5. Muralidharudu, Y., Sammi Reddy, K., Mandal, B.N., Subba Rao, A., Singh, K.N. and Sonekar, Shailendra, *GIS based soil fertility maps of different states of India*. All India Cordinated Project on Soil Test Crop Response Correlation, Indian Institute of Soil Science, Bhopal, 2011, p. 224.

Lok Sabha question Dy. No. 126

a) The mechanism put in place to evaluate and monitor the fertility of soil across the country;

AICRP-LTFE through its 17centers located across the country monitoring soil fertility under different nutrient management option which is generally followed by the farmers of the region.

b & C **Whether the Government has launched any schemes/projects to check the declining fertility of soil in all the States in the country including Jharkhand**

Through following centres of AICRP soil fertility status is monitored regularly. Among the 17 centres (Bangalore USK GKVV, Bhubneshwer OUAT, Coimbatore TNAU, Hyderabad, Jabalpur JNKVV, Ladhiana PAU, Palampur CSK, Ranchi BAU, Pantnagar GBPUA&T, Pattambi KAU, Junagadh JAU, Udaipur MPUAT, Parbhani, Akola PDKV, Raipur IGKVV, IARI, New Delhi, Barrackpore, CRIJAF) In Jharkhand, Ranchi is the centre located in Birsa Agriculture University, Ranchi. Through these centres soil fertility status on farm and off are monitored continuously.

(d.) Whether the Central Government proposes to train/educate farmers on balanced use of fertilizers in crop productivity; and

Balanced and integrated use of nutrient One of the most important outcome of AICRP-LTFE and proved only option to enhance and sustained productivity. So to take the technology to the farmers fields demonstrations are being done in both the Kharif and rabi season. The details are given below:

Sl. No.	State	Demonstration (District)
1.	Bangalore, USK GKVV	Bangalore, Tumkur
2.	Bhubneshwer OUAT	Khurda (Durgapur, Bolaghar, Begunia)
3.	Coimbatore, TNAU	Coimbatore (Lakshiminagar, Vattamalai palayam, Kareecha-palayam)
4.	Hyderabad	Warangal, Karimnagar
5.	Jabalpur JNKVV	Jabalpur, Chindwada & Seoni
6.	LadhianaPAU	SBS Nagar, Hosiarpur & Ropar
7.	Palampur CSK	Hamirpur, Bilaspur, Palampur
8.	Ranchi BAU	Gumla, Chabasa & Ranchi

9.	Pantnagar GBPUA&T	Rudrapur, Kicha
10.	Pattambi KAU	Thrisur, Palghat
11.	Junagadh JAU	Junagadh (Hadmatia, Chokali-2, Mendapara, Ranpur, Parab)
12.	Udaipur MPUAT	Udaipur, Palli
13.	Parbhani	Parbhani, Nanded
14.	Akola PDKV	Akola, Buldhana, Amaravati
15.	Raipur IGKVV	Durg, Dhamtari, Janjgir-Champa
16.	IARI, New Delhi	Gurgaon (Lohtaki, Kumbhawas)
17.	Barrackpore, CRIJAF	Nadia, Basirhat

To train the farmers of village on nutrient management, farmers are invited to field where the demonstration in being carried out and live demonstration is given.

Regular training programme since last two years is being organized on balanced use of nutrient in the village its self and by calling the farmer's at university. The scientists are going to village and providing the training to the farmers and extension workers at number of places. Some of them are given below:

e) if so, the details thereof including the schemes run by the Government for the purpose?

During last year 356 farmers were provided training on integrated use of nutrient to sustain the productivity by Ranchi, Bhubneshwar, Jabalpur and Palampur centres of AICRP. Demonstration of technology and training programme is continuing this year also. Details of schedule of demonstration programme training programme of some of the centres of AICRP **LTFE for 2014-15**

OUAT, Bhubneshwar centre

Name of the Scheme	Year of commence-ment	Brief objective	Total allocation (2014-15	TSP allocation (2014-15	Mechanism Planning Implementation and monitoring of TSP (Tentative)	ST beneficiaries
ICRP on LTFE, Bhubaneswar Centre	2014-15	Testing of the findings generated in LTFE project in tribal farmers' fields in different agro ecological regions	35.40 lakhs	1+9= 10 lakhs	**Mechanism:** Through contact with Agriculture Deptt and direct visit , villages have been identified and tribal farmers have been selected for undertaking TSP programs with 4 treatments(FP, RD, RD+ FYM and Soil test based Recommendation),The programme will start in Kharif, 2014 on rice as test crop. Observations on growth and Yield will be monitored and finally Field demonstration oriented trainings will be organized in these villages. **Location and details of TSP:** 1. Village: Durgapur GP: Gopalpur Block: Bolagarh Dist: Khurda No. of farmers: 4 No. of training: 1 Crop: Rice 1. Village: Dovapatna GP: Botlama Block: Begunia Dist: Khurda No. of farmers: **2** No. of training: 1 Crop: Rice 2. Village: Marangapal GP:Govindapur	To be decided at the time of training and demonstration

					Block: sadar Dist: Dhenkanal No. of farmers: 5 No. of training: 1 Crop: Rice 3. Village: Deokupli GP: Kumudabali Block: Muniguda Dist: Rayagada No. of farmers: 6 No. of training: 1 Crop: Rice 4. Village: Sanadhandra GP: Hatmuniguda Block: Bissam cuttack Dist: Rayagada No. of farmers: 6 No. of training: 1 Crop: Rice	

BAU Ranchi centre

S.No.	Months Year 2014-15	Tentative monthly plan/ programme training / demonstration/ lecture	Tentative Number of individual/ families to be benefited	Full address Name of Village, District & State
1.	April, 2014	Training to selected village farmers on – Method of composting and its use in maintaining soil health Collection of Plant and soil sample for analysis	40	1. **KVK, Gumla** 2 **KVK, Jaganathpur** **3. Panchyat : Chandalso , Block kuru, Dist. Lohardaga** **4.Block ; Village : Nagrabera, Block : Angara, District : Ranchi**
2.	May, 2014	Tour to collect samples and yield data from demonstrations/ on-farm trials.		-do-
3.	June, 2014	Tour to impart training to the farmers of adopted village on Integrated nutrient management (INM) and balanced fertilization in maize crop/Arhar crop	40	-do-
4.	July, 2014	Selection of new sites for trials and distribution of inputs for maize./Arhar Training on concept of balanced fertilization and improved cultivation for Maize / Arhar cultivation	40	-do-
5.	August, 2014	Training on concept of balanced fertilization and methods of application of fertilizers	40	-do-
6.	September, 2014	Field visit to observe crop conditions and distribution of inputs for rabi trials.	40	-do-

7.	October, 2014	Tour to collect samples and yield data from demonstrations/ on-farm trials.	40	-do-
8.	November, 2014	Sowing of demonstrations/on-farm trials and distribution of inputs for wheat and Training on improved cultivation of wheat.	40	-do-
9.	December, 2014	Field visit to observe crop conditions and distribution of inputs for top dressing in wheat trials.	40	-do-
10.	January, 2015	Tour to impart training to the farmers of adopted village on Integrated nutrient management (INM) and balanced fertilization in wheat crop	40	-do-
11.	February, 2015	Training on Use of micronutrient in vegetable crops & discussion on insect and pest management of Rabi crops.	40	-do-
12.	March , 2015	Training on improved method of preparation of FYM and compost including vermin compost. Lecture on importance of summer ploughing.	40	-do-
		Total	**440**	**-do-**

CSKHPKV Palampur

S. No.	Months (2014-15)	Tentative monthly plan/programme	Tentative number of individual/ families to be benefitted	Full address Name of Village, District & State
1	June/July	1. Training on balanced fertilization	100	Village:Goshal Distt. Lahaul & Spiti (HP)
		2. Training on balanced fertilization	100	Village: Sisoo Distt. Lahaul & Spiti (HP)
		3. Training on balanced fertilization	100	Village: Gondhla Distt. Lahaul & Spiti (HP)
2	July/ August/ September	1. Training on balanced fertilization	100	Village: Bhavanagar Distt. Kinnaur HP)
		2. Training on balanced	100	Village: Ponda

		fertilization		Distt. Kinnaur HP)
		3. Training on balanced fertilization	100	Village: Kilba Distt. Kinnaur HP)

Reference to letter IISS No. 6282 dated 16.12.14 regarding material for answering Lok Sabha admitted starred question Dy No. 18151 for 23.12.2014 regarding fertility of soil

a) **Whether the Government has conducted any scientific study/survey to identity the extent of loss of fertility of soil/damage to agriculture land across the country including coastal areas;**

AICRP-MSN have not conducted any such studies.

AICRP on Micro- and Secondary Nutrients and Pollutant Elements in Soils and Plants (AICRP-MSN) conducts soil delineation work of different districts of the country to assess the deficiency level of micro- and secondary nutrients in soils through its centres in 16 states of the country. Depending upon the size of district, about 100-500 geo-reference based soil samples are collected from each district and analysed for different nutrients. Based on the analysis results the districts/ areas are categorized under different categories like deficient and sufficient etc. So far, we have delineated database of about 200 districts of the country. In addition, nutrient response trials are also conducted for different nutrients in order to verify their deficiency status as noticed from the analysis of soils collected from different districts. The soil and crop specific amelioration strategies for the deficient micro- and secondary nutrients have been developed by the centres of the AICRP-MSN in 16 states.

b) **If so, the details thereof and outcome of the study in this regard;**

Under AICRP-MSN, 97464 soil samples have been analysed for DTPA-extractable micronutrients and 73630 samples for boron availability. The status is given in table below.

Deficiency status of available (DTPA-extractable) micronutrients and hot water soluble B (HWS-B) in soils of different states of India

State	DTPA-extractable micronutrients					Hot water soluble B	
	No. of samples	Percent samples deficient				No. of samples	Percent samples deficient
		Zn	Fe	Cu	Mn		
Andhra Pradesh	6723	22.3	16.8	1.0	1.7	3216	2.8
Assam	5216	25.5	0.0	3.8	0.0	5216	11.9
Bihar	7304	41.4	12.3	1.8	7.8	3597	33.3
Gujarat	5470	23.1	23.9	0.4	6.3	5470	17.9
Haryana	5673	15.3	21.6	5.2	6.1	5673	3.3
Himachal Pradesh	642	1.4	7.8	0.2	22.1	161	8.7
Jharkhand	443	20.3	0.0	0.5	0.0	443	56.0
Madhya Pradesh	7580	61.7	9.6	0.2	1.6	3330	2.4
Maharashtra	8278	54.0	21.5	0.2	3.8	489	54.8
Odisha	2349	22.7	1.8	0.3	1.1	2349	52.5
Punjab	2181	16.6	6.2	3.6	15.2	1083	17.5
Tamil Nadu	31080	65.5	10.6	13.0	7.9	31080	19.9
Telangana	4799	26.9	17.0	1.4	3.8	2776	16.1
Uttar Pradesh	4788	33.1	7.6	6.3	6.5	4323	16.2

Uttarakhand	2575	9.6	1.4	1.4	4.7	2575	7.0
West Bengal	2363	11.9	0.0	1.2	0.9	1849	46.9
All India	**97464**	**43.0**	**12.1**	**5.4**	**5.5**	**73630**	**18.3**

c) **The details cultivable area affected due to saline water near the coastal areas in the country during coach of the last three and the current year, state-wise;**

NA

d) **Whether the Government has launched several programmes for reclamation and development of such land in the county; and**

NA

e) **If so, the details thereof along with the funds allocated/utilized for the purpose and the success achieved there under during the said period?**

NA

Subject: Rajya Sabha Question Starred/Unstarred Dy. No. S5098 sitting on the 12/12/2014 regarding Impact of climate change on crops by Shri A.U. Singh Deo

Ref.: Your fax dated 02-12-2014

(a) Whether the government has made any estimation of the likely impact of climate change on Indian agriculture and food security in the country, if so the details there of,

The ICAR-Indian Institute of Soil Science, Bhopal has initiated a project on "Impact of climate change on productivity of major crops of central India". The project deals with different crop adaptation strategies to counter future climatic change scenarios on grain yield of crops. The socio-economic impacts of climate change in this region shall be considered at end of the study period. The project is under progress. Using models, the study indicated that in central India, increase in temperature by 1 °C will results in around 10% decrease in grain yield of major crops (soybean and wheat).

(b) The progress made on National Mission on Sustainable Agriculture and Initiatives being taken by the government to promote climate resilient crop varieties and

Not pertaining to this institute.

(c) Whether the government is taking any initiative to encourage the farmers to adopt low carbon agriculture techniques, if so, the details there of?

The ICAR has initiated the Consortia Research Platform (CRP) on Conservation Agriculture (CA) in XII plan. In the project reduced or minimum tillage option, crop residues recycling and varietal change to conservation agriculture will be carried out in Farmers' fields. The CA is a low carbon input agricultural techniques where the diesel consumption through tillage operations is reduced thus, emitting less CO_2 to the atmosphere. The crop residue recycling and crop rotation techniques will serve more carbon sequestration in soils.

Subject: Lok Sabha Question Dy. No. 1946 due for answer on 26/11/2014 regarding international patents

Ref: File NO. IP&TM-9(4)/2014-IPR dated 20-11-2014

Point-wise reply is provided below:

(c) **The number of research findings which bagged international patents**

Nil

(d) **Whether the private sector accorded recognition to these research findings and utilization the technology and if so, the details; and**

NA

(e) **the income earned as a result.**

NA

Reply of Rajya Sabha Starred Question No. S473 by Shri P Bhattacharya

LTFE

Starred/Unstarred Diary No. S473

(a) Whether Government proposes to take steps to make farming a profitable activity through scientific practices and agro-technology;

Yes

(b) If so, the details of such scientific practices and agro-technology in this regard; and

A step which reduces the input cost and increase productivity will lead benefit of farmers. So to curb the expenditure especially on Fertilizer and increase the profit of small farmers following steps are taken in AICRP LTFE by demonstrating the technology at the fields.

i) Judicious use fertilizer input using integrated and balanced form.

ii) In acid soils, amendments (manure / Lime) are recommended before applying any fertilizer to soil to make best use of applied fertilizer nutrients.

iii) Agro-ecological zone where moisture in available, green manuring is recommended to reduce input cost on fertilizer along with increase in crop productivity. All these practices will not only reduce the input cost but increase the productivity.

(c) How far the small and marginal farmers would be benefitted by these improved practices?

On implementation of above techniques, there is increase productivity and profit of the farmers.

Reply to Rajya Sabha Question No.S473 for discussion on 11/7/2014

Making Farming a Profitable Activity

*Shri P. Bhattacharya: Will the Minister of AGRICULTURE be pleased to state:

(a) Whether Government proposes to take steps to make farming a profitable activity through scientific practices and agro-technology;

Yes

(b) If so, the details of such scientific practices and agro-technology in this regard; and

- Adopting new high yielding varieties of crops, adoption of improved agro-techniques including vermicomposting, use of biofertilizer, acid soil amelioration with paper mill sludge (PMS) etc., have all been found to improve the livelihood of small farmers. In acid soils of Orissa, outreach programme of All India Network Project on Soil Biodiversity-Biofertilizers, OUAT, Bhubaneswar centre has shown in the farm of a subsistence farmer tilling 1 ha in village Nilkanteswar in Gop block in District Puri that for vegetables, cereals, pulses and oil seeds using biofertilizers like *Azotobacter*, *Azospirillum* and Phosphate Solubilizing yield advantage ranging from 10-19.4 % was obtained in different crops.
- A step which reduces the input cost and increase productivity will lead benefit of farmers. So to curb the expenditure especially on Fertilizer and increase the profit of small farmers following steps are taken in AICRP LTFE by demonstrating the technology at the fields.
  i) Judicious use fertilizer input using integrated and balanced form.

  ii) In acid soils, amendments (manure / Lime) are recommended before applying any fertilizer to soil to make best use of applied fertilizer nutrients.

  iii) Agro-ecological zone where moisture in available, green manuring is recommended to reduce input cost on fertilizer along with increase in crop productivity. All these practices will not only reduce the input cost but increase the productivity.

(c) How far the small and marginal farmers would be benefitted by these improved practices?

- On implementation of above techniques, there is increase productivity and profit of the farmers.
- In a I ha farm, total bio-inoculation benefit was Rs. 8,300/- (over the expenditure of Rs.600/ annum on bio-fertilizers) during 2013-14. There was savings in chemical fertilizers use to the extent of 30 %. The total yearly income from his farm was Rs.1,08,860/-. His total yearly investment was Rs. 33,270/-. The yearly benefit was Rs.

75,590/- of which the bio-inoculation benefit was Rs. 8,300/-, thus representing 11 % of the total benefit.

Subject: Lok Sabha Provision Starred/Unstarred Question No. 11115 due for answer on 12.08.2014 raised by Shri B.S. Yediyurappa and Shrimati Jayshreeben Patel regarding Organic Farming – reg.

(a) Whether the Government has launched any campaign to increase awareness about organic farming;

Ans : Government of India has initiated a National Net Work Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) is one among the 13 centers of India, to study the effect of different management practices and cropping systems for long term sustainable productivity. Thirteen centers spread across the country have developed organic package of practices for various crops with the use of organic manures available in each state. The results are communicated to the farming community through print media as well as farmers training at various institutes.

(b) If so, the details thereof; N A

Institute -farmer knowledge exchange is done through the extension and advisory unit of the institute. Awareness created among farmers through demonstration on farmers fields, technology exhibition in farmers fair and also trained the farmers on various composting techniques in the institute. Farmers from different states viz; Bihar (Gaya, Banka, Madhepura, Supoul, Katihar, Shekhpura, Areriya, Paschim Champaran and Jamui distt of Bihar) and Madhya Pradesh (Indore, Dewas, Raisen, Vidisha, Sehore, Hoshangabad and Bhopal distt. of Madhya Pradesh) under ATMA Project. In each district 25 progressive farmers participated in the training for 6 days. Apart from this, documentary video film on organic farming for profitability and sustainability and vermicomposting for biofertilization has been made in English, Hindi and Telgu languages of 15 minutes duration each for telecast on Doordarshan krishi Channel. In addition, different state government provide incentives for production of different organic manure from organic wastes like vermicompost, phosphocompost and NADEP compost etc.

(c) Whether some Non-Government organization (NGO) have suggested several ways and means to improve soil health and organic farming in the country;

Yes

(d) If so, the details thereof; and

Some of the Non-Government organization like Agricultural Processed Food Products Export Development Authority (APEDA), Coffee Board Spies Board Tea Board, Coconut Development Board, Directorate of Chew and Cocoa Development Agencies and APEDA has recognized for organic certification bodies all over world. However, Eleven inspection certification bodies exist in different part of the country such as BVQI (Mumbai), Ecocert SA (Aurangabad), IMO (Bangalore), IOCA (Kerala), IRFT(Mumbai), LQCPT (Kerala), NOCA (Pune), OCAACPL (Rajasthan), SGSI PL(Haryana) SI (Bangalore) and USOCA (Uttaranchal). All of these are able to certify based on the National Programm for Organic Production (NPOP). Such corporations are providing platform to the organic grower by giving them proper guidance in the growing of crops.

(e) The action taken by the Government thereon?

The experiments, world over including India, have proved that to sustain the productivity application of chemical fertilizers is inevitable. Since in India, demand of food is increasing and we shall have to produce more with fewer resources (land and water). So we shall have to be more dependent on external supply of nutrient through chemical fertilizer or organic materials. But the sustainability of system exclusively with organic is debatable and appears to be possible only for a limited area in most of cropping systems. Therefore to test the sustainability of organic farming a treatment on organic farming was introduced in long term fertilizer experiment at Udaipur, Raipur, Junagadh, Jagtail and Delhi centres10 years back. The results poured in so far at all the centers revealed that the yield obtained under organic farming are always less than chemical fertilizer and integrated use of chemical and organic manure. Among the three, integrated nutrient management(INM) has shown an edge as far as soil health and productivity is concerned.

Sub.: Reply to Lok Sabha Question/Dy No. 8960 on Promotion of Organic Farming:

Ref. : F.No. 5-17/2014-Org.Fmg. dated 02-12-2014

a) Whether the Government proposes to accord priority for the promotion and development of organic farming across the country including hilly States;

Ans (a) : Yes, Government of India has launched the National Programme for Organic Production (NPOP) in the year 2001 for the promotion and development of organic farming across the country including hilly states like Sikkim, Mizoram, Uttarakhand and Himachal Pradesh;

b) If so, the details thereof along with the funds sanctioned and allocated to incentivize organic farming during each of the last three years and the current year, state wise,

Ans (b) : The Details of fund allocated to the different centres

S.No.	Name of University	Year		
		2011-12 (lakhs)	2012-13 (lakhs)	2013-14 (lakhs)
1.	HAREC, Bajaura (H. P)	11.00	9.00	8.63
2	GBPUA&T, Pantnagar (Uttrakhand)	11.00	9.00	10.05
3	BAU, Ranchi (Jharkhand)	11.00	11.00	10.78
4	PAU, Ludhiana (Hariyana)	10.00	8.00	3.00
5	JNKVV, Jabalpur (M. P)	10.00	10.00	9.85
6	IGKV, Raipur (Chhatishgarh)	10.00	10.00	3.20
7	KKV, Dapoli (Maharashtra)	8.00	8.00	5.52
8	UAS, Dharwad (Karnatka)	9.00	9.00	8.10
9	TNAU, Coimbatore (Tamilnadu)	11.00	9.00	13.05
10	PDFSR, Modipuram (U. P)	11.00	8.00	4.70
11	IISR, Calicut (Kerala)	10.00	9.00	7.95
12	IISS, Bhopal (M. P)	11.00	9.00	8.52
13	ICAR Res. Complex Umiam (Sikkim)	13.00	11.00	16.65

The detailed expenditure and fund allocation can be obtained from Director, PDFSR. Modipuram, Meerut (UP)

(c) Whether the Indian Council of Agricultural Research (ICAR)/Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS) have undertaken research and development work on organic farming in the country; and if so, the details and the out-come thereof;

Ans c) : During 2004, Indian council of Agricultural Research has initiated a National Net Work with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) is one among the 13 centers of India., to study the effect of different management practices and cropping systems for long term sustainable productivity. Thirteen centers spread across the country have developed organic package of practices for various crops with the use of organic manures available in each state. The results are communicated to the farming community through print media as well as farmers training at various institutes. Around two hundred (farmers) human resource have been developed in organic farming through eight (8) training programs at the Institute through ATMA, Madhya Pradesh/Bihar/Rajasthan states. A book on "Organic Farming and Soil Health "(in Hindi) covering major issues in organic agriculture has been released and best organic management practices for soybean, chickpea and Linseed crops have been developed.

(d) The details and status of existing demand, supply and consumption of organic food products in the country including the volume and value of organic cash and food crops grown in the country during each of last three years and the current year; and

Ans (d) : Information not available

(e) The name of the countries which are leading producers of organic crops and India's position in this regard and the action plans and projections of the Government to improve the varieties of organic food crops/products in the country?

Ans (e): Oceania has the largest share of agricultural land (37 %) followed by Europe (24 %) and Latin America (20%). Currently, India ranks 10th among the top ten countries in terms of cultivable land under organic certification. The certified area includes 10 % cultivable area with 0.50 million hectares and rest 90 % (4.71 million hectare) is forest and wild areas for collection of minor forest produces. The ICAR has initiated in 12th plan a project on evaluation of organic package of practices for different crop varieties suitable for various agro-climatic regions. More detail information can be obtained from Director, PDFSR. Modipuram, Meerut (UP)

Subject:**-** Lok Sabha Provisional Question/Dy. No**. 13762** due for answer on **16/12/2014** raised by Shri Feroze Varun Gandhi, and others MPs (LS), regarding **Promotion of Organic Manure -** reg.

******

Re-produced below is the Lok Sabha Question/Dy. No**13762** due for answer on **16/12/2014** raised by Shri Feroze Varun Gandhi, and others MPs (LS), regarding **Promotion of Organic Manure**, which may read as under:-

a) the details of the organic fertilizers which are used in agriculture in the country;

b) whether the Government plans to involve the private sector in development of the use of organic manure;

c) if so, whether the Government has launched certain schemes in the country to promote the production and use of bio-fertilisers/ organic fertilizer in the country;

Yes

d) if so, the details thereof along with the funds allocated under various schemes for the purposes during the Eleventh and Twelfth Five Year Plan Period, State/UT-wise; including Rajasthan;

The All India Network Project on Soil Biodiversity-Biofertilizers was launched by ICAR in XI plan with 17 centres across the country to give R & D base to biofertilizers in the country. The major facets of work are on: Diversity of Rhizobium, Plant Growth Promoting Rhizobacteria, Formulation and Testing of Mixed Biofertilizers, Biofertilizer Technology, Diversification of Biofertilizer usage into disadvantaged areas-tribal, drylands, hill and NEH region and finally frontline demonstrations in farmer fields.

The budget in 11th plan was 754.62 lakhs and in 12th plan it is: Rs 1763.64 lakhs.

State-Wise distribution of Budget 12th Plan

S.no.	Centre	ICAR Share	
1	AAU, Jorhat	149.25	
2	ANGRAU, Amaravathi	123.38	
3	BAU, Ranchi	98.63	
4	HAU, Hisar	142.13	
5	JNKVV, Jabalpur	143.40	
6a	KAU (Trichur)	47.18	
6b	KAU (Vellayani)	49.43	
7	MAU, Parbhani	125.63	
8	MPUAT, Udaipur	53.25	
9	OUAT, Bhubaneswar	140.03	
10	RAU, Pusa	59.63	
11	TNAU, Coimbatore	203.25	
12	YSPUHF, Solan	156.45	
13	CRRI, Hazaribagh	33.50	
14	Delhi University	34.75	
15	GBPUAT, Pantnagar	29.90	
16	IARI, New Delhi	29.90	
17	NRCG, Junagarh	31.50	
18	UAS, Dharwad	31.50	
19	Coordinating Unit, IISS, Bhopal	80.99	
	Total	**1763.64**	

e) the number of farmers benefited under the various schemes in various States details thereof state-wise;

OFT trials with DAATT in Andhra Pradesh (ANGRAU)

Conducted 110 OFT trials on rabi paddy crop with liquid biofertilizers of *Azospirillim* and phosphate solubilizing bacteria through 22 DAATT centres of ANGRAU during 2012-13.

f) the details of production of major crops achieved during the last one year using bio-fertilizers/organic fertilizer vis-à-vis chemical fertilizers in the country, State/UT-wise;

On the basis of last five years results in major field crops in farmers fields (rice, soybean, groundnut, pulses, oilseeds cotton, millets, vegetables etc) it is concluded that 75% recommended dose of fertilizers (RDF) along with biofertilizers gives yields at par with 100% RDF. Hence, recommended dose of fertilizers can be reduced by 25% through biofertilizers.

MAHARASHTRA

However the use of biofertilizers even at 100% recommended dose of chemical fertilizers (RDF) is quite beneficial and leads to appreciable yield increase. Some examples of trials in Vertisols in Maharashtra during 2010-13 are illustrative of this and are given in table below.

Crop	Yield with RDF (kg/ha)	Yield with RDF + bioinoculants (kg/ha)	% increase with bioinoculants
Soybean	1663	2050	23
Safflower	1640	1922	17
Sorghum	1959	2770	41
Chickpea	1408	1752	24
Cotton	2124	2593	22
Sweet sorghum (Green Stalk)	2640	3080	17

GUJARAT

Fluorescent pseudomonads inoculum for control of stem rot of groundnut improved pod yields in Gujarat by 7-20%.

JHARKHAND

Arbuscular mycorrhizal fungi (AMF) inoculum for upland rice in Jharkhand improved rice yields by 7-20%.

Use of biofertilizers in field demonstrations in upland crops (rice and pigeon pea) in Jharkhand gave 10-30% yield increase

Demonstration of Biofertilizers in Upland Rice

Field demonstration of Biofertilizers in upland crops (rice and pigeon pea) were conducted during wet seasons (WS) of 2012 and 2013 in villages of Jharkhand as detailed below.

<u>2012</u>

1. AMF (source: CRURRS, Hazaribag) under direct seeded upland rice (cv Sahabhagi Dhan) in village Tilra (Block Myurhant, Dist. Chatra, Jharkhand) in 0.2 ha: Yield advantage 27.4% with inoculation.
2. *Azotobacter* (source: BAU, Ranchi) under direct seeded upland rice (cv. CR Dhan 40 and Virendra) in village Tilra (Block Myurhant, Dist. Chatra, Jharkhand) in 0.8 ha: Yield advantage 8.5% with inoculation.
3. Microbial consortium (*Azotobacter* + *Azospirillum* + PSB) (source: OUAT, Bhubaneswar) under direct seeded upland rice (cv. Sahabhagi Dhan) in village Parsawa (Block Myurhant, Dist. Chatra, Jharkhand) in 0.2 ha: Yield advantage 31.8% with inoculation.

4. *Rhizobium* (source: BAU, Ranchi) in pigeon pea (cv. Bahar) in village Tilra (Block Myurhant, Dist. Chatra, Jharkhand) in 1.5 ha: Yield advantage 48.8% with inoculation.

2013

5. AMF (source: CRURRS, Hazaribag) under direct seeded upland rice (cv CR Dhan 40) in village Tilra (Block Myurhant, Dist. Chatra, Jharkhand) in 0.30 ha: Yield advantage 30.6% with inoculation.
6. *Azotobacter* (source: BAU, Ranchi) under direct seeded upland rice (cv. CR Dhan 40) in village Tilra (Block Myurhant, Dist. Chatra, Jharkhand) in 0.15 ha: Yield advantage 17.4% with inoculation.

MADHYA PRADESH

Actinomycetes strains isolated from arid and semi-arid soils improved maize yields in Vertisols of M.P., by 15-30%. In chickpea, yield increases ranged from 20-35%. Formulations of rhizobia and actinomycetes gave high yield increase in chickpea (65%) over uninoculated control.

In Mandla and Chindwara districts of Madhya Pradesh., inoculation gave additional yield of 10-20% in pulse crops and 15% in soybean and maize.

Madhya Pradesh (JNKVV)

60 families benefited under the programme during 2011-12 and 12-13 (43+17). In addition to these demonstrations, 500 families benefited through distribution of 4250 biofertilizer packets during 2012-13 in villages Tamia, Harrai, Junnardev, Mohkhedh, Chourai, Pandurna and Chindwara in District Chhindwara covering an area of 375 ha. 15 tribal families in 5 villages of Mandla and Chhindwara districts are cultivating chickpea, wheat and lentil crops using Biofertilizers (*Rhizobium*, *Azotobacter*, PSB and *Trichoderma*) prepared and supplied by JNKVV, Jabalpur centre of the All India Network Project on Soil Biodiversity-Biofertilizers to demonstrate the response of low-input-cost Biofertilizers. Nodulation in inoculated pulse crops is better as compared to uninoculated ones and farmers get 10-20% additional crop yields due to use of biofertilizers. During early cropping season our demonstrations on soybean and maize reflected 15% additional yields to the tribal farmers due to use of Biofertilizers.

Table 47 Front line demonstrations on the field of tribal farmers (2012-14), Madhya Pradesh

S. No.	Crops	No. of demonstrations	Districts	Average yield (kg/ha)		
				F. P.	R. D. F.	R. D. F. + B. F.
1.	Soybean (Var. 9752)	15	Jabalpur Mandla Chhindwara	1462	-	1966 **(34)**
2.	Maize (Var. JM-216)	5	Chhindwara	760	-	1300 **(71)**
3.	Wheat (Var. JW-366)	6	Mandla Chhindwara	2788	5013	5130 **(84)**
4.	Chickpea (Var. JG-11)	8	Mandla Chhindwara	980	1800	1612 **(64)**

5.	Pea (Var. AP-3)	3	Mandla	1221	-	2266 **(85)**
6.	Lentil (Var. local)	3	Mandla	1396	-	1783 **(28)**
Total		40 demonstrations				

Figures in parenthesis indicate per cent increase over farmer's practice

Biofertilizer technology for soybean and wheat was demonstrated in nine farmers fields of Mengra Kalan village, Berasia Tehsil, Bhopal District. Biofertilizers comprised of *Rhizobium* and Plant growth promoting bacteria consortium (mixture of three PGPR strains) for soybean; and PGPR only for wheat. The Biofertilizers were applied on the seeds as carrier based inoculants in two treatments of Integrated Plant Nutrient Supply System. In soybean these were i) Biofertilizers + 50%NPKS + 5t FYM/ha; ii) Biofertilizers + 50%NPKS + 2t/ha of Phospho-Sulpho-Nitro Compost. In wheat it was Biofertilizers + 75%NPKS application in both the above treatments. Soybean seed yield increased by 14.3% with Biofertilizer + FYM and 25.9% with Biofertilizer + phospho-sulpho-nitro compost over the yield obtained with farmer's practice (980 kg/ha). In the following wheat crop there was a yield increase of 13.7% with the FYM treatment and 19.5% with phospho-sulpho-nitro compost, over farmers' practice (2870 kg/ha).

ODISHA

Bioinoculation of vegetables- *knol khol* and pointed gourd in acid soil in Odisha increased yields by 8-12% and 10-15% respectively and increased NPKS uptake efficiency significantly. In bitter gourd yield increased by 12%, along with increase in vitamin C by 8% and protein content by 11%. There was extra recovery of NPKS of 11, 20, 13 and 3% resepctively.

In Jute-rice-green gram system in Odisha, jute yield increased by 19% due to biofertilization over soil test dose, in rice by 8% and in green gram by 12%. NPK recovery increased from 62.0 to 74.0% in STD + BF (extra nutrient uptake of 42 kg/ha). In Jute in Assam, application of biofertilizers decreased the consumption of chemical fertilizers by 50%.

Livelihood improvement of a small farmer owing 1ha land in coastal acid soil of Odisha was demonstrated by cultivation of vegetables, cereals, pulses, oilseeds, resulting in an additional income of Rs 8300/ha. In term of cost inputs B: C ratio of biofertilizers was 14:1 and overall B:C ratio of cultivation increased from 2.1: 1 (without usage) to 2.5:1 due to biofertilizer usage.

4.5. Demonstrations on Biofertilizers to tribal farmers

Odisha (OUAT)

Site - I: Chianpadar (Dt. Kalahandi, Orissa)

In Odisha, 29 families benefited under the programmeunder tribal sub-plan during 2011-2 and 12-13. At site-1 in Chianpadar in Dt. Kalahandi, Orissa, hybrid cotton crop (cv. Tulsi Takat) was grown in twelve (12) farmers fields with two sets of treatments: (1) farmers practice (FP) and (2) FP + BF. The source of BF was *Azotobacter* + *Azospirlllum* + PSM (1:1:1) 4 kg each ha^{-1}, inoculated to 5 % pre-limed vermicompost in 1.25 ratio, incubated for 7 days at 30 % moisture, under shade applied at the time of seed sowing and 1^{st} earthing up operation. Use of BFs with farmers practice resulted in 30, 13, 14.7 and 16.0% increase in lint, seed, stover and total biomass production of cotton crop compared to the yields in

FP. (Table 44). The average monetary benefit due to BF use was Rs.11520/- ha^{-1}. Biofertilizer use also improved the nutrient uptake (Table 45). The N, P, K and S uptake by the cotton crop increased by 28.0, 22.9, 18.6 and 21.5% compared to the uptake in FP alone.

Fig 34. Cotton crop in tribal area in Dt. Kalahandi, village Chianpadar, Tolbrahamani using biofertilizer as a component INM. Coordinator with farmers at Village Chianapadar.

Table 44. Productivity of cotton (mean) with the intervention

Treatments	Production (q ha^{-1}) mean of 12 farmers				Response (%)	Monetary benefit due to BF
	Lint	Seed	Stover	Total		
FP	4.7	7.7	32.6	45.0	-	-
FP + BF	6.1(30)*	8.7(13)*	37.4(14.7)	52.2	16	11520

* Data in the parenthesis indicate per cent increase over FP

Table 45. Nutrient uptake and recovery by cotton crop

Treatment	Nutrient uptake (kg ha^{-1})							
	N	Response (%)	P	Response (%)	K	Response (%)	S	Response (%)
FP	51.6	-	5.5	-	54.8	-	5.1	-
FP + BF	66.1	28	6.8	22.9	65.0	18.6	6.2	21.5

*FP dose 120-26.2-48 kg N-P-K- ha^{-1}

Site -II: Ghantmal, Block Narla (Dt. Kalahandi, Orissa)

At the site 2 in village Ghantmal, Block Narla in Kalahandi district 8,10, 8 and 5 number of farmers had grown cabbage, cauliflower, broccoli and capsicum with two sets of treatments namely (i) FP and (ii) FP + BF. The BF source were *Azotobacter* + *Azospirlllum* + PSM as above. Use of BF resulted in 15, 13.1, 20.1 and 10.2% increase in crop productivity with monetary gain of Rs.10,000, Rs.8,000, Rs.6,000 and Rs.9,600/- ha^{-1} in case of cabbage, cauliflower, broccoli and capsicum respectively (Table 46).

Table 46. Productivity of vegetable crops, with BF response and benefit.

Sl. No.	Crops	No. of farmers	Mean yield (q ha^{-1}		Response (%)
			FP	FP + BF	
1	Cabbage	8	228	262	15.0
2	Cauliflower	10	238	268	13.1
3	Broccoli	8	149	179	20.1
4	Capsicum	5	216	238	10.2
	Total	**31**	**-**	**-**	**-**

ASSAM

Application of microbially enriched compost @20t/ha gave best yields and capsaicin content of hot chilli in NE India. Microbially enriched compost (5t/ha) with biofertilizer or green manure with biofertilizer or *Azolla* @0.5t/ha with biofertilizer gave highest rice grain yield. Application of K along with enriched compost saved 25-50% dose of NP in NE India.

BIHAR

Mycostraw enriched with *Pseudomonas*, *Azospirillum*, Cyanobacteria gave rice yield increase of 10-20% in resource poor and 6-10% increase in resource rich farmers in Bihar. Lentil yields increased by 10-20% due to *Rhizobium* inoculation.

g) whether it is a fact that many organic fertilizer are sold at exorbitant prices in the market, if so, the steps taken by the Government to control the prices of organic fertilizers; and

h) the other various steps taken by the Government to popularize the use of bio-fertilizers/organic fertilizers amongst the farmers in the country?

Farmer days/Kisan melas, Front line demonstrations, Free inputs along with biofertilizers in tribal areas, literature in vernacular language, Radio and TV talks are regularly conducted by state agricultural universities and ICAR institutions.

Subject: Lok Sabha Question No. 11337 'Research Organic Farming' to be answered on 12.08.2014 by Sh. Prem Das Rai –Providing information.

a) Whether the Government has implemented a scheme to promote research on organic farming in agricultural research institutions;

During 2004, Government of India has initiated a National Net Work Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) is one among the 13 centers in India., to study the effect of different management practices on cropping systems for studying the long term sustainable productivity. Thirteen centers spread across the country have developed organic package of practices for various crops with the use of organic manures available in each state. The results are communicated to the farming community through print media as well as farmers training at various institutes.

b) If so, the details thereof including the details of research projects undertaken and funds allocated /spent/utilized during the last three years and current year Centre and State /UT-wise

Under Organic farming project, the following experiments are conducted in different centres spread throughout the country.

Experiment I : Evaluation of organic, inorganic and integrated production systems

Objectives:

1) To study the impact of organic, conventional and integrated management practices on crop productivity and soil health

2) To study the impact of various management practices o microbial population of soil and economics

Experiment II: Evaluation of response of different varieties of major crops for organic farming

Objectives

1) To evaluate the response of varied duration and nutrient requiring varieties of major crops to organic production system

2) To identify the suitable varieties of crops for organic management practices

Experiment III: Evaluation of bio-intensive complimentary cropping systems under organic production systems

1) To evaluate the various land configuration and intercropping options for managing the soil nutrient and pests under organic production system

2) To assess the infestation level of insect, disease and weeds under bio-intensive complimentary systems.

Experiment IV: Development of Integrated Organic Farming System Models

Objective

1) To evaluate the modules of organic production system to develop organic integrated farming system.

Experiment V: Evaluation of farm waste recycling techniques for organic farming

Objective:

1) To develop need-based and cost-effective new techniques for farm-waste recycling.

The detailed expenditure and fund allocation can be obtained from Director, PDFSR. Modipuram, Meerut (UP)

Table:The Details of fund allocated to the different centres

S.No.	Name of University	Year		
		2011-12	2012-13	2013-14
1.	HAREC, Bajaura	11.00	9.00	8.63
2	GBPUA&T, Pantnagar	11.00	9.00	10.05
3	BAU, Ranchi	11.00	11.00	10.78
4	PAU, Ludhiana	10.00	8.00	3.00
5	JNKVV, Jabalpur	10.00	10.00	9.85
6	IGKV, Raipur	10.00	10.00	3.20
7	KKV, Dapoli	8.00	8.00	5.52
8	UAS, Dharwad	9.00	9.00	8.10
9	TNAU, Coimbatore	11.00	9.00	13.05
10	PDFSR, Modipuram	11.00	8.00	4.70
11	IISR, Calicut	10.00	9.00	7.95
12	IISS, Bhopal	11.00	9.00	8.52
13	ICAR Res. Complex Umiam	13.00	11.00	16.65

c) Whether the Government has implemented various schemes to ensure availability of organic seeds and improve access to biofertilizers particularly in the North-Eastern region and if so, the details thereof, and

Under network organic farming, one of the centres has (ICAR RC Sikkim Centre gangtok) developed organic farming to ensure availability of organic seeds and improve access to bio-fertilizers particularly in the North-Eastern region.

d) The other steps taken/proposed to be taken by the Government in this regard?

Few firms producing organic manures are Agro Phos India Ltd (Indore), Divya Pruthvi Agronomics P Ltd (Pune), Gujarat Fertiliser trading co. (Vadodara), Bagia nursery (Chandigarh), Global enterprise (Ahmedabad), Humiphos –Vasumitra life energy Pvt Ltd (Pune) and Jay enterprise (Mumbai), etc.

Reference to Dy. No. 27/PQ dated 8th July 2014 and Lok Sabha Question (Unstarred Diary No. U779) Dy. No. 126 for regarding Soil Fertility by Dr. T. N. Seema

a) **Whether the Government has conducted any study to evaluate the fertility of soil across the country.**

Yes.

b) **If so, the details of such studies and the data regarding deficiency of micronutrients in soil, State/ UT wise.**

Soil fertility assessment has been one of the major concerns for nutrient management and crop production. Many attempts have been made by the scientists in the past to assign productivity classes to soils. Over the time, soil fertility assessment continued with variations in sampling size and representation of the area. Motsara et al (2000) assessed the soil fertility of 307 districts of the country. A compilation of data of 3.65 million soil samples analysed during 1997-99 by different soil testing laboratories indicated that 63, 42 and 13 percent soil samples are low in available N, P and K respectively. Recently Murlidharudu et al (2011) also prepared soil fertility maps of 18 states using geomatics 9.0 software while using the data of 1995-2003 generated by various soil testing laboratories. The assessment revealed that about 59, 49, 9% soils are low in available N, P and K respectively. DAC (Division of INM) sponsored anthor study "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country" through which soil fertility maps of 171 districts from geo-referenced soil samples have been completed and the digital maps have been uploaded in the website of Indian Institute of Soil Science (http://www.iiss.nic.in/districtmap.html).

Several schemes are launched by the Govt. of India; some schemes are running through Indian Council of Agricultural Research (ICAR). In Indian Institute of Soil Science (IISS), Bhopal four AICRPs are working on evaluation and improvement of soil fertility.

The AICRP on Micro and Secondary Nutrients is having 15 centers in Assam, Bihar, Jharkhand, Odisha, Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal, Madhya Pradesh, Gujarat, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Punjab and Haryana. Soil fertility is being evaluated through soil and plant analysis. Depending upon the size of district, about 100-500 geo-reference based soil samples are collected from each district and analysed for different nutrients. About 35-50 districts are covered in a year. In addition, nutrient response trials are also conducted for different nutrients (Zinc= Zn, Iron= Fe, Copper= Cu, Manganese= Mn, and Boron= B in order to verify their deficiency status as noticed from the analysis of soils collected from different districts.

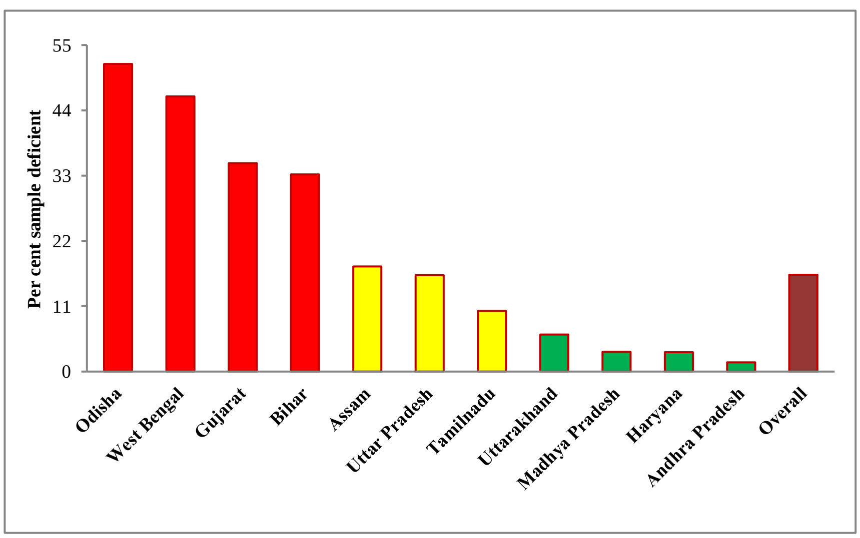
The State/ UT wise deficiency of micronutrients in soils are given in Table below. The deficiency of DTPA- micronutrients varies widely among soil types, agro climatic conditions, types of crops grown and other agronomic practices. Overall, 39.9% of 72,159 samples collected across the country during the last 4 years were found to be deficient in available Zn. Deficiency of Zn in different states varied among states with a minimum of 8.5% in West Bengal to as high as 62.2% in Tamil Nadu. Besides Tamil Nadu, Zn deficiency in states like Madhya Pradesh (60.3), Maharashtra (60.3) and Bihar (44.2), was reported more than 40%. Almost one third of the soils of Gujarat and Uttar Pradesh were found to be deficient in available Zn while about every fourth sample was low in available Zn content in states like Assam, Andhra Pradesh and Punjab. Deficiency of Zn was less than 10 per cent reported in Uttarakhand and West Bengal.

Table: Current status of DTPA-micronutrients deficiency in different states

State	No. of soil samples	Percent Samples Deficient			
		Zn	Fe	Mn	Cu
Andhra Pradesh	9,780	22.8	17.3	2.9	1.5
Assam	5,146	27.4	8.6	0.0	3.9
Bihar	2,963	44.2	5.8	2.9	2.7
Gujarat	5,218	34.2	23.6	6.6	0.4
Haryana	5,673	15.3	21.6	6.1	5.2
Himachal Pradesh	1,400	9.6	6.’3	3.7	1.2
Madhya Pradesh	6,713	60.3	9.8	1.6	0.2
Maharashtra	7,819	53.7	22.8	4.0	0.2
Odisha	2,621	20.5	1.7	1.0	0.3
Punjab	1,098	21.9	5.8	26.8	3.5
Tamil Nadu	14,557	62.2	9.5	8.9	13.1
Uttar Pradesh	4,788	33.1	7.6	6.5	6.3
Uttarakhand	2,212	9.8	1.7	5.5	1.4
West Bengal	2,171	8.5	0.8	1.7	1.1
Total	**72,159**	**39.9**	**12.9**	**6.0**	**4.3**

Though overall Fe deficiency in India stayed close to 13% but in some of the states like Gujarat (23.6%), Maharashtra (22.8%), Haryana (21.6%) and Andhra Pradesh (17.3%) its deficiency is increasing rapidly. Manganese deficiency in the country was found to be 5.0% but its deficiency is alarming in Punjab (26.8%), Tamil Nadu (8.9%). While, overall Cu deficiency (4.3%) is close to the Mn however, it is a cause of concern in the states like Tamil Nadu and Uttar Pradesh where 13.1 and 6.3%, samples were found deficient in Cu.

Owing to B deficiency in soils, yield of almost all the crops grown in states like Odisha, West Bengal, Gujarat and Bihar is generally low despite application of recommendation N, P, K and Zn (See figure below). From the results of 52,423 samples analyzed for available B, deficiency of B in highly calcareous soils of Bihar, Odisha and Gujarat are more common. Little more than half of the samples analyzed from Odisha state fell in the category of low B availability followed by West Bengal (46.3%), Gujarat (35.1%), Bihar (33.2%), and Assam (17.7%). Interestingly, in Uttar Pradesh also 16.2% soils were found to be low in B availability which was little higher than another intensively cultivated state Tamil Nadu (10.2%).



Deficiency current status of Boron in soils of different states of country

c) **The details along with success rate of schemes and projects under implementation to check the declining fertility of agricultural land and improve the fertility of soil during each of the last three years and current year.**

In last three years, soil samples from 111 districts have been collected and analyzed for available micro and secondary nutrients status. The details of deficiencies are already given in table above. During the current year 2013-14, soil samples have been collected from 45 districts of the country and analysis is in progress**.**

The response to application of deficient micro- and secondary nutrients varies from crop to crop and soil to soil as well. However, based on the hundreds of the response trials conducted on Farmers' field the response to zinc application varies from 8 to 30% while same for boron varied from 10 to 40%.

Due to regular use of Zn fertilizers, particularly Zinc Sulphate the status of Zn in soil has improved in Northern part of the country resulting in reduced deficiency in crops and improvement in yield of crops.

In addition, thousands of farmers are being educated for practicing balanced fertilizer use by inclusion of micronutrients in fertilizer schedule depending upon soil test value and crop response trials. *Kisan Melas*, *Kisan* Schools and Frontline Demonstrations are also conducted to educate/demonstrate the farmers the impact of balanced fertilization. Several trainings on secondary and micronutrients nutrients have also been conducted by AICRP centres working in the State Agricultural Universities (SAUs) of respective states.

d) **Whether the Government has any plan to incorporate use of science and technology to find out techniques for improving the fertility of soil, and**

Yes. It is always there.

e) **If so, the details thereof?**

All the activities used in soil fertility assessment and for improving the fertility of soils have scientific basis only and all the tools and techniques utilized thereof are in accordance to the scientific methods established in different laboratories and institutions. Mapping of soil fertility has improved over the previous manual methods to modern techniques such as use of GPS & GIS softwares, use of geoinformatics etc. For soil fertility improvement, newer research interventions such as site specific nutrient management, nanotechnology, soil genomics etc. are also finding place.

The soil assessment and fertility improvement studies are conducted under the aegis of ICAR and are carried out by professionally trained scientific personnel, which are verified on farmers' field too through Demonstration and Validation trials.

AICRP on STCR in collaboration with National Informatics Centre (NIC), Pune has developed a Decision Support System for on-line fertilizer recommendation to different crops grown in various states using the fertilizer prescription equation developed by different centres. This on-line fertilizer recommendation system has been uploaded on STCR website (http://www.stcr.gov.in). Farmers and other end users can get a STCR based fertilizer recommendations to different crops by feeding the soil test values and target yield besides maintaining soil fertility.

Subject: **Provisional Starred Question for the Lok Sabha Dy. No. 126 for 08/07/2014 regarding soil Health Cards by Shri Nishikan Dubey and Shri Dhananjay Mahadik**

Ref: Letter No. 4-5/2014 Fert. Use, dated 30th June, 2014 Govt. Of India, Ministry of Agriculture, Department of Agriculture & Cooperation, Krishi Bhavan, New Delhi

(a) Whether the Government has launched several l schemes and project to check and improve the fertility of soil in the country including Jharkhand.

Yes.

(b) If so, the mechanism put in place thereunder to evaluate the fertility of soil across the country.

There are about 97 institutions of ICAR apart from 47 State Agricultural Universities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xiii) Central Soil and Water Conservation Research and Training Institute, Dehradun

xiv) Central Soil Salinity Research Institute, Karnal

xv) Indian Institute of Soil Science, Bhopal

xvi) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

In order to check soil fertility status, under DAC (Division of INM) Sponsored Project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country", GPS and GIS based soil fertility maps of 171 districts (list provided separately) from geo-referenced soil samples completed and the digital maps have been uploaded in the Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html). For Jharkhand, soil fertility mapping was done by NBSSLUP; in order to avoid duplication, the same was not taken up by IISS.

For improvement of soil fertility status,

(c) The details of Soil Health Cards distributed to the farmers by the State Government during the current year, State-wise.

Info available with DAC.

(d) Whether the Union Government is considering to launch a comprehensive plan to provide Soil Health Card to all the farmers across the country, and

Info available with DAC.

(e) If so, the details thereof and the time by which such cards are likely to be provided in the country?

Info available with DAC.

Subject: **Provisional Starred Question for the Lok Sabha Dy. No.126 for 08/07/2014 regarding Fertility of Soil by Shri Nishikan Dubey and Shri Dhananjay Mahadik.**

Ref: Letter No. 4-6/2014 Fert. Use dated 30th June, 2014 Govt. Of India, Ministry of Agriculture, Department of Agriculture & Cooperation, Krishi Bhavan, New Delhi

(a) The mechanism put in place to evaluate and monitor the fertility of soil across the country.

There are about 97 institutions of ICAR apart from 47 State Agricultural Universities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

i) Central Soil and Water Conservation Research and Training Institute, Dehradun

ii) Central Soil Salinity Research Institute, Karnal

iii) Indian Institute of Soil Science, Bhopal

iv) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

(b) Whether the Government has launched any schemes/projects to check the declining fertility of soil in all the State in the country including Jharkhand

Yes.

(c) If so, the details thereof.

In order to check soil fertility status, under DAC (Division of INM) Sponsored Project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country", GPS and GIS based soil fertility maps of 171 districts (list provided separately) from geo-referenced soil samples completed and the digital maps have been uploaded in the Indian Institute of Soil Science website

(http://www.iiss.nic.in/districtmap.html). For Jharkhand, soil fertility mapping was done by NBSSLUP; in order to avoid duplication, the same was not taken up by IISS.
For improvement of soil fertility status,

(d) Whether the Central Government proposes to train/educate farmers on balanced use of fertilizers in crop productivity, and

Yes

(e) If so, the details thereof including the schemes run by the Government for the purpose?

Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Recently, AICRP (STCR) has taken up Front Line Demonstration (FLDs) and capacity building programmes for the benefit of tribal farmers.

Subject: **Provisional Starred Question for the Lok Sabha Dy. No 185 for 08/07/2014 regarding performance of agricultural scientists by Shri A.T. Nana Patil and Shri Sunil Kumar Singh**

Ref: E-mail dated 1/7/2014

(a) The number of agricultural scientists working at present with ICAR, IARI and other Institutions being funded by Union Government;

IISS: 49 scientists.

(b) The notable achievements made during last one year by these scientists especially in field of dry-land farming.

Under AICRP (STCR), the achievements made during last one year are given below:

I. Development of Targeted Equations:

- **Pantnagar:** Okra (Parbhani Kranti), Chilli (Pant Jwala) and Sorghum (CSV-15).
- **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).
- **Vellanikkara:** Chilli (Athulya).
- **Raipur:** Rice (Karma Masuri & Swarna) and Tomato (Pant-3).
- **Rahuri:** Garlic (G-14), Okra (Arka Anamika), Potato (Kufri Jyoti), Brinjal (Krishna), Bt. Cotton (Mallica), Sorghum (Phule Chitra) and Wheat (NAIW 304 & Trymbak).
- **Pusa:** Barseem (Mascavi).
- **Coimbatore:** Rice (ASD 16) and Bt. Cotton (Hybrid RCH 530 BG II).

II. Use of Targeted Yield Equations and Development of Prediction Equations for Cropping Sequences:

- **Palampur:** Maize (PG 2474)-Wheat (HPW 155).
- **New Delhi:** Rice (PRH-10)-Wheat (HD-2894).
- **Coimbatore:** Maize (CO 1)-Bt. Cotton (Hybrid RCH 530 BG II).
- **Bikaner:** Wheat (Raj-3077)-Groundnut (ICGS 5).

III. Fertilizer Prescription Equations under Integrated Plant Nutrient Supply Systems:

- **Coimbatore:** Rice (ASD 16) and Bt. Cotton (Hybrid RCH 530 BG II).
- **Bikaner:** Onion (RO 252) and Fenugreek (RMP-1).
- **Barrackpore:** Jute (JRO 2407) and Rice (MPU 1010).
- **Hisar:** Pearl Millet (HHB 223), Wheat (DPW 621-50) and Maize (HM 5).
- **Vellanikkara:** Chilli (Athulya).
- **Palampur:** Okra (P-8) and Gobhi Sarson (HPN-1).
- **Pantnagar:** Okra (Parbhani Kranti), Chilli (Pant Jwala) and Sorghum (CSV-15).
- **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).
- **Hyderabad:** Sunflower (Sunbred), Bt. Cotton (KH-112), Castor (PCH 222) and Sugarcane (2001 A 63).

- **New Delhi:** Wheat (HD-2894 & HD-2851) and Rice (PRH-10).
- **Jorhat:** Rice (Ranjit).
- **Bangalore:** Sugarcane (Ratoon III) and Ragi (GPU-28).
- **Kalyani:** Onion (Suksagar).
- **Varanasi:** Maize (Asha).
- **Bhubaneswar:** Sesamum (Uma).

IV. Follow up trials conducted

- **Coimbatore:** Cotton (RCH 530), Maize (NK 6240), Rice (ADT-43) and Tomato (Lakshmi 5005).
- **New Delhi:** Wheat (HD-2851).
- **Jabalpur:** PadDy (MR-219), Wheat (GW-273), Soybean (JS-9752), Chandrasur (HI-4), Garlic (G-323) and Onion (Agrifound Light Red).
- **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).
- **Vellanikkara:** Chilli (Ujwala).
- **Palampur:** Maize (PG 2474), Wheat (HPW 155) and Potato (Kufri Jyoti 2).
- **Bikaner:** Cluster Bean (RGC 986) and Wheat (Raj-3077).
- **Barrackpore:** Jute (JRO 128), Rice (MPU 1010) and Vegetable Pea (Azad P 3).
- **Hisar:** Pearl Millet (HHB 197), Wheat (WH 711, WH 283 & PBW 550) and Bt. Cottn (MRC 6304).
- **Jorhat:** Rice (Luit & Ranjit).
- **Bangalore:** Hybrid Maize (Hema) and Ragi (GPU-28).
- **Kalyani:** Potato (Kufri Jyoti).
- **Varanasi:** Rice (Super Moti).

V. FLDs conducted

- **Hisar:** Pearl Milet (HHB 197 & HHB 223), Wheat (PBW 502 & WH 711) and Raya (Laxmi).
- **Bangalore:** Sunflower (KBHS-53).
- **Palampur:** Soybean (Brag) and Toria (Bhawani).
- **New Delhi:** Mustard (Pusa Bold) and Wheat (HD-2894).
- **Jabalpur:** Soybean (JS-9752), Pady (Sahbhagi, Kranti & MR-219), Pea (Azad Pea-1), Wheat (JW-273) and Gram (JG-319 & JG-311).
- **Coimbatore:** Groundnut (JL-24, VRI-2 & CO-6), Sunflower (Sunbred 275) and Gingelly (TMV 3 & TMV 7).
- **Pusa:**Rice (6444 & PT 71), Wheat (PBW 348, HD 2733 & PBW 502), Maize (10 B 10), Sesame (Krishna), Mustard (45521, 66157 & Voruna), Linseed (Subhra), Potato (Jyoti) and Turmeric (Rajendra Soniya).

VI. FLDs conducted under Tribal Sub Plan

- **Coimbatore:** Maize (CO 6), Groundnut (CO 6), Onion (CO 4), Carrot (Tokito) and Tomato (PKM 1).
- **Manipur:** Garden Pea (Arkel), Field Pea (Rachna) and Rape Seed (M-27).
- **Bhubaneswar:** Chilli (Bamra Local), Brinjal (BV-45 C) and Tomato (BT-20).

- **Barrackpore:** Mustard (B-9) and Lentil (B 256).
- **Jabalpur:** Gram (Jaki 9218, JG 14, JG 16, JG 130 & JG 315), Wheat (JW 273, JW 321, JW 3269, Lok 1 & Sujata) and Lentil (JL 3).
- **Raipur:** Wheat (Amar, DL788-Vidisha, GW-273 and Sujata-HI1077), Maize (30V92) and Chick pea (JG11-Vaibhav and Jaki).

Regarding darylad farming, AICRP on STCR at ANGRAU, Hyderabad and GKVK, Bangalore centres are engaged and have developed soil test based balanced fertilizer prescription equations for cotton, ragi and sunflower.

(c) Whether the Government proposes to make changes in curriculum of agricultural universities to bring about rapid advancement of technologies in the field of agriculture;

NA

(d) If so, the details thereof; and

NA

(e) The steps taken/proposes to be taken by the Government to bring scientist nearer to farmers for transfer of latest technologies to farmers?

Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2

Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Recently, AICRP (STCR) has taken up Front Line Demonstration (FLDs) and capacity building programmes for the benefit of tribal farmers.

Subject: Lok Sabha question Dy. No. 9451 sitting on the 09/12/2014 regarding Soil Map

Reference: No. 4-1/2014 Fert. Use dated 2nd December, 2014

(a) Whether the government has prepared a district wise soil map to analyse the soil condition and assist and encourage to the small farmers for farming activities in the country.

Yes, please.

(b) If so, the details and the farming guidelines thereof;

GPS & GIS based soil fertility maps of 171 districts comprising of primary, secondary and micronutrients have been done through a DAC Sponsored project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for farmers of the country". The same has been uploaded in Institute website under the link: http://www.iiss.nic.in/districtmap.htmlfor the benefit of stakeholders.

ICAR through All India Coordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University

The Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Besides the farmers are also educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. of farmers in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer's practice	STCR- IPNS recommended practice
Rice	120	11.4	16.8

Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

(c) Whether there has been any effect of soil mapping on the production of agricultural crops in the country; and

Yes, please.

(d) If so, the details thereof?

The experiences of soil mapping helped to segregate the districts based on nutrient availability and advisory based on present nutrient status. Besides, the All India Coordinated Research Project on Soil Test Crop Response through its Cooperating centres conducts frontline demonstrations on soil test based fertilizer applications in farmers' fields. This is to show the farmers the benefits of soil testing and motivate them for soil testing. A specific example of Punjab is given below:

The knowledge of soil fertility maaping was coupled with the experienes of FLDs conducted by AICRP(STCR) in planning to regulate the costly P fertilizer use duly considering the P-built up soils in Punjab state. STCR centre at Ludhiana has generated an agronomic recommendation on economizing phosphorus fertilizer use in maize-wheat sequence. The recommendation has been included in biannual package of practices of PAU. The new recommendation states that there is no need to use P fertilizer in maize-wheat sequence as long as the available P status remains more than 40 kg/ha without any adverse effect on crop productivity.

Sub: Rajya Sabha Question Starred/Unstarred Dy. No. S1443 for 5/12/2014 regarding soil testing institute in Uttarakhand by Shri Mahendra Singh Mahra

Reference: Parliament Question received from Dr. P.P. Biswas, Pr. Scientist (Soils), ICAR, New Delhi

(a) Whether the Government has made efforts to explore the possibilities to open soil testing in Uttarakhand

Yes, please.

(b) If so, the names of the places;

There is no fully fledged institute on soil testing in Uttarakhand from ICAR. However, ICAR has funded one AICRP-STCR main centre at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand w.e.f. 1/4/1970 for taking up work related to soil testing and soil fertility of Uttarakhand. As per the information available on the official website of Agriculture Department, Govt. of Uttarakhand the details of the soil testing laboratories are given under:

1 {ks=h; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] #nziqj] Å/keflag uxj	6 izHkkjh tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] uSuhrky	11 tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] ubZ&fVgjh
2 izHkkjh tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] vYeksM+k	7 {ks=h; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] Jhuxj ¼x<+oky½	12 tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] #nziz;kx
3 izHkkjh tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] ckxs’oj izHkkjh tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] fodkl[k.M&dBSrckM+k] ckxs’oj	8 tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] gfj}kj	13 tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] peksyh ¼xksis’oj½
4 izHkkjh tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] fiFkkSjkx<+	9 tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] nsgjknwu	
5 izHkkjh tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] pEikor	10 tuinh; e`nk@Hkwfe ijh{k.k iz;ksx’kkyk] mRrjdk’kh	

(c) **Whether Government consider it justifiable to open soil testing institute in the State; and**

It is a matter of policy decision.

(d) **If so, the reasons for delay in the opening of Soil Testing Institute in the State**

Not applicable.

Sub: Lok Sabha Question Dy. No. 5120 for 2/12/2014 regarding soil testing by Shri Chandrakant Khalre

(a) whether the Government has undertaken soil testing of cultivable and non cultivable land in the country.

Yes please.

(b) if so, the details and the provisions and rules thereof:

There are soil testing laboratories in different districts which carry out the work of soil testing at nominal charge. Besides, there are soil testing laboratories linked with Krishi Vigyan Kendra which also perform soil testing in farmers' fields.

(c) whether the Government has note of shortcomings in conducting soil testing resulted in low production and productivity of crops than the capacity of land and if so, the details thereof:

There are certain shortcomings in conducting soil testing. Inadequate number of soil testing laboratories. There are 1049 soil testing laboratories according to DAC (2012) report. These are not sufficient to analyze 141 million hectares of cultivable and other land. Besides, soil sample collection is also labour intensive operation requiring technical know-how. Poor and non representative soil sample is a cause of failure of soil testing.

(d) whether stakeholders and farmers are not getting optimum benefits of testing of fertility of land; and if so the reaction of the Government thereof; and

Farmers and stakeholders are not getting optimum benefits of testing of fertility of lands. The Government has taken scores of measures to overcome this problem. With the grant from DAC, MOA, GOI, the Indian Institute of Soil Science located at Bhopal is preparing geo-referenced soil fertility maps of the country. Under DAC (Division of INM) Sponsored Project on "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country", GPS and GIS based soil fertility maps of 171 districts from geo-referenced soil samples completed and the digital maps have been uploaded in the Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html). These soil fertility maps will aid the stakeholders in taking right decisions on fertilizing their soils. Besides, the All India Coordinated Research Project on Soil Test Crop Response through its Cooperating centres conducts frontline demonstrations on soil test based fertilizer applications in farmers' fields. This is to show the farmers the benefits of soil testing and motivate them for soil testing.

(e) the details of the centrally sponsored scheme introduced to improve the fertility of soil in the country.

Govt. has launched a scheme of providing soil health card to every farmer in a mission mode. Fourteen crore farmers will be covered under the plan during the next three years. Besides, hundred mobile soil testing laboratories will be established during the current financial year.

Indian Institute of Soil Science has developed technologies of Integrated Plant Nutrient Supply system. IPNS improves and maintains the soil fertility. Such technology is also demonstrated in farmers' fields.

There are about 99 institutions of ICAR apart from 53 State Agricultural Universities and about 638 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xvii) Central Soil and Water Conservation Research and Training Institute, Dehradun

xviii) Central Soil Salinity Research Institute, Karnal

xix) Indian Institute of Soil Science, Bhopal

xx) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice**
Rice	120	11.4	16.8

Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Reply to Lok Sabha Question No. 18283 dated 23-12-2014 raised by Shri Dusyant Singh

..

Please find the information as desired.

S.No.	**PUBLICATIONS**	**2011-12**	**2012-13**	**2013-14**	**Total**
1.	Number of research reports presented	12	10	13	35
2.	Number of papers published	32	64	78	174
3.	Number of popular articles published	16	13	32	61

Subject:Material for answering Lok Sabha Provisional Admitted Question No. 3743 for 16.07.2004 regarding use of fly ash in agriculture.

(a) Whether the Govt. is aware of the report that fly ash is useful in boosting agricultural output?

Ans.: Yes

(b) If so, detail thereof;

Ans.: Short-term field and small container experiments both in India and abroad indicated that fly ash generated from thermal power plants has several benefits which collectively can increase crop yields. As majority of the coal-fired thermal power plant generated fly-ash in India is alkaline in nature due to higher content of Ca, this fly ash can be used for reclamation of acid soils and can increase agricultural productivity considerably. Besides, fly-ash contains essential major nutrient elements like K, Ca, and Mg (but does not contain C and N) and several micronutrients in significant quantity (significantly higher than the levels present in soil but not at the levels present in fertilisers). As a result, this material has been demonstrated to enhance yields of several crops. On the contrary, studies have also indicated that fly-ash application has deleterious effect on crop yield particularly when applied at very high doses /rates. Fly-ash also contains several toxic heavy metals like As, Cd, Cr, Ni, Pb, Hg, Se and some radionuclides which have the potential to contaminate soil and environment. However, long-term study is required to understand the impact of repeated application of fly-ash to handle the problems of radioactivity and heavy metal content as well as to assess the impact of changes in soil quality on crop production and its quality in the long run.

(c) Whether any steps have been taken/proposed to be taken by the Government to boost agricultural production by applying fly ash.

Ans. -------

(d) if so the details thereof and if not, the reasons thereof?

Ans.: -----

Sub: Use of space technology for conservation of natural resources.

Space technologies are of great use in agriculture for prediction and estimation of crop yield, vegetation cover, geo-referenced soil sampling and generation of GIS based maps for nutrient availability or deficiency and quick estimation of crop damages from natural disaster over a large area. Remote sensing techniques and geo-information are in use for estimation of biotic and abiotic stress in crops, prediction of yield and estimation of soil properties like salinity, texture, carbon status and nutrient status of soil.

Work done or being under taken at IISS, Bhopal

Use of space technology

- Prediction of nitrogen stress in crops like maize and wheat, estimation of crop biophysical growth parameters and early estimation of yield through a institute in-house project. For estimation of nitrogen stress and prediction of yield using hyper-spectral vegetative indices.
- Geo-referenced based soil quality evaluation at farmers' fields has been carried out in Bhopal district. Soil Health card has been developed and distributed to farmers.

Future proposal

- A project under Precision farming platform has been proposed for development of techniques for estimation of soil properties using spectral characteristics and soil electro-chemical properties over a large area using remote sensing, GIS and GPS tools. Protocol will be developed for estimation of soil physic-chemical properties, and organic matter content and vegetation cover delineation in-situ and nondestructively. The information will be used for site specific management of nutrients for different predominant cropping systems.
- Coupling of Geospatial tools with crop growth simulation modeling to monitor crop growth and yield predictions under different climatic scenarios at regional scale will be carried out.
- Estimation of coverage quality and mass of surface residues, estimation of soil water nutrient status under different conservation agricultural management practices though HSRS approach in Vertisols.

Sub: Use of space technology for conservation of natural resources.

Space technologies are of great use in agriculture for prediction and estimation of crop yield, vegetation cover, geo-referenced soil sampling and generation of GIS based maps for nutrient availability or deficiency and quick estimation of crop damages from natural disaster over a large area. Remote sensing techniques have been used for estimation of biotic and abiotic stress in crops, prediction of yield and estimation of soil properties like salinity, texture, carbon status and nutrient status of soil.

A) Present use of space technology at IISS

- Prediction of nitrogen stress in crops like maize and wheat, estimation of crop biophysical growth parameters and early estimation of yield using different hyper-spectral vegetative indices.
- Geo-referenced based soil quality evaluation at farmers' fields in Bhopal district.
- Space technology has been used for collection of geo-referenced soil samples using GPS for soil fertility mapping of 171 districts through a DAC sponsored project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for farmers of the country". The same has been uploaded in Institute website under the link: http://www.iiss.nic.in/districtmap.html

B) Future proposal for use of space technology

- Development of techniques for estimation of soil properties using spectral characteristics and soil electro-chemical properties over a large area using remote sensing, GIS and GPS tools for site specific management of nutrients for different predominant cropping systems.
- Coupling of Geospatial tools with crop growth simulation modeling to monitor crop growth and yield predictions under different climatic scenarios at regional scale.
- Estimation of coverage, quality & mass of surface residue, and estimation of soil & water nutrient status under different conservation agricultural management practices though HSRS approach in Vertisols.
- In the second phase of the DAC project in XII Plan, a proposal for collection of GPS and GIS based geo-referenced soil samples of 370 districts for soil fertility mapping has already been submitted to DAC and approval is awaited.

Division of Soil Physics

IISS, Bhopal

Space technologies are of great use in agriculture for prediction and estimation of crop yield, vegetation cover, geo-referenced soil sampling and generation of GIS based maps for nutrient availability or deficiency and quick estimation of crop damages from natural disaster over a large area. Remote sensing techniques have been used for estimation of biotic and abiotic stress in crops, prediction of yield and estimation of soil properties like salinity**,** texture, carbon status and nutrient status of soil.

Work done or being under taken at IISS, Bhopal

Remote sensing technique based space technology has been utilized in this institute for prediction of nitrogen stress in crops like maize and wheat, estimation of crop biophysical growth parameters and early estimation of yield through a institute in-house project. For estimation of nitrogen stress and prediction of yield of maize and wheat different hyper-spectral vegetative indices has been developed and tested.

To continue work in this area a Project under Precision farming platform has been proposed for development of techniques for estimation of soil properties using spectral characteristics and soil electro-chemical properties over a large area using remote sensing, GIS and GPS tools. Protocol will be developed for estimation of soil physic-chemical properties, and organic matter content and vegetation cover delineation in-situ and nondestructively. The information will be used for site specific management of nutrients for different predominant cropping systems.

Geo-referenced based soil quality evaluation at farmers' fields has been carried out in Bhopal district. Soil Health card has been developed and distributed to farmers.

Apart from development of spectral indices to estimate N stress in crops, efforts are being made to use hyper-spectral remote sensing (HSRS) approaches for assessing soil quality under different management practices in central India and monitoring crop growth and yield due to abiotic stress using HSRS and crop simulation modeling.

Coupling of Geospatial tools with crop growth simulation modeling to monitor crop growth and yield predictions under different climatic scenarios at regional scale will be carried out.

A work plan is conceived to estimate coverage quality and mass of surface residues, estimation of soil water nutrient status under different conservation agricultural management practices though HSRS approach in Vertisols.

STCR

Use of space technology for conservation of natural resources

a) Present use of space technology:

Space technology has been used for collection of geo-referenced soil samples using GPS for soil fertility mapping of 171 districts through a DAC sponsored project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for farmers of the country". The same has been uploaded in Institute website under the link: http://www.iiss.nic.in/districtmap.html

b) Future (potential) use of space technology.

In the second phase of the project in XII Plan, collection of geo-referenced soil samples for soil fertility mapping of 370 districts has already been submitted to DAC and approval is awaited.

2015

Sub.: Information asked by Dr. Satyapal Singh, MP (Lok Sabha) in respect of ICAR

Annexure-I

Year	Funds received from parent agency (1)	Funds received from other (CSIR, DBT, ICMR) (2)	Funds utilized for salary of the regular, temp. and hired employee (3)	Funds utilized for electricity and maintenance (4)	R & D expenditure instrumentational and +Chemical+Consumable items (5)
1988-89	19.05				
1989-90	94.91				
1990-91	55.63				
1991-92	100.25				
1992-93	105.00				
1993-94	156.72				
1994-95	248.56				
1995-96	162.55				
1996-97	333.26				
1997-98	566.45				
1998-99	710.00				
1999-2000	720.71				
2000-01	846.57				
2001-02	886.80				
2002-03	957.46				
2003-04	1125.13				
2004-05	1096.86				
2005-06	1294.06				
2006-07	1208.68				
2007-08	1257.16				
2008-09	1638.76				
2009-10	1869.43				
2010-11	1902.98				
2011-12	3300.58				
2012-13	3224.61				
2013-14	3277.03				
2014-15	3153.17				
2015-16	4164.41				

Revenue generated from technology transfer, consultancy, royalty, service as provided (6)

Annexure-VI

Annexure - I

Column 1 of Annexure II (B) Funds received from parent agency - ICAR, New Delhi

Year	Amount received in lakhs (Rs)
1988-89	19.05
1989-90	94.91
1990-91	55.63
1991-92	100.25
1992-93	105.00
1993-94	156.72
1994-95	248.56
1995-96	162.55
1996-97	333.26
1997-98	566.45
1998-99	710.00
1999-2000	720.71
2000-01	846.57
2001-02	886.80
2002-03	957.46
2003-04	1125.13
2004-05	1096.86
2005-06	1294.06
2006-07	1208.68
2007-08	1257.16
2008-09	1638.76
2009-10	1869.43
2010-11	1902.98
2011-12	3300.58
2012-13	3224.61
2013-14	3277.03
2014-15	3153.17
2015-16	4164.41

Annexure-II

Column 2 of Annexure II (B) Funds received from other (CSIR, DBT, ICMR)

Years	Amount
1988-89	*

1989-90	*
1990-91	*
1991-92	*
1992-93	*
1993-94	*
1994-95	*
1995-96	*
1996-97	*
1997-98	*
1998-99	30.08
1999-2000	21.24
2000-01	109.73
2001-02	84.36
2002-03	22.11
2003-04	12.29
2004-05	22.08
2005-06	24.03
2006-07	19.61
2007-08	19.90
2008-09	21.92
2009-10	424.60
2010-11	211.23
2011-12	528.78
2012-13	56.58
2013-14	61.69
2014-15	15.64
2015-16	140.85

***** Record are maintained manually. This will be supplied once compilation is completed.

Annexure-III

Column 3 of Annexure II (B) Funds utilized for salary of the regular, temp. and hired employee

Year	Amount in lakhs (Rs)
1988-89	*
1989-90	*
1990-91	*
1991-92	*
1992-93	*
1993-94	*
1994-95	*
1995-96	*
1996-97	*
1997-98	*
1998-99	*
1999-2000	*
2000-01	*
2001-02	*
2002-03	*
2003-04	*
2004-05	189.90
2005-06	221.50
2006-07	222.40
2007-08	250.93
2008-09	424.14
2009-10	706.43
2010-11	665.68
2011-12	776.22
2012-13	803.57
2013-14	895.69
2014-15	1014.81
2015-16	1008.20

***** Record are maintained manually. This will be supplied once compilation is completed.

Annexure-IV

Column 4 of Annexure II (B) Funds utilized for electricity and maintenance

Year	Amount in lakhs (Rs)
1988-89	*
1989-90	*
1990-91	*
1991-92	*
1992-93	*
1993-94	*
1994-95	*

1995-96	*
1996-97	*
1997-98	*
1998-99	*
1999-2000	*
2000-01	*
2001-02	*
2002-03	*
2003-04	*
2004-05	*
2005-06	21.82
2006-07	11.79
2007-08	21.68
2008-09	30.16
2009-10	41.10
2010-11	159.52
2011-12	102.05
2012-13	61.52
2013-14	13.33
2014-15	10.76
2015-16	14.48

***** Record are maintained manually. This will be supplied once compilation is completed.

Annexure -V

Column 5 of Annexure II (B) R & D expenditure instrumentational and + Chemical + Consumable items

Year	Amount in lakhs (Rs)
1988-89	*
1989-90	*
1990-91	*
1991-92	*
1992-93	*
1993-94	*
1994-95	*
1995-96	*
1996-97	*
1997-98	*
1998-99	740.08
1999-2000	741.95
2000-01	956.30
2001-02	971.16
2002-03	979.57
2003-04	1137.42
2004-05	929.04
2005-06	1074.77

2006-07	994.10
2007-08	1004.45
2008-09	1206.38
2009-10	1546.50
2010-11	1289.01
2011-12	2951.09
2012-13	2416.10
2013-14	2429.70
2014-15	2143.24
2015-16	3282.58

***** Record are maintained manually. This will be supplied once compilation is completed.

Annexure-VI

Column 6 of Annexure II (B) Revenue generated from technology transfer, consultancy, royalty, service as provided

Year	(Rs. in lakhs)
1988-89	*
1989-90	*
1990-91	*
1991-92	*
1992-93	*
1993-94	*
1994-95	*
1995-96	*
1996-97	*
1997-98	*
1998-99	*
1999-2000	*
2000-01	*
2001-02	*
2002-03	*
2003-04	13.69
2004-05	14.52
2005-06	12.56
2006-07	21.74
2007-08	43.16
2008-09	77.63
2009-10	33.59
2010-11	49.05
2011-12	57.95
2012-13	63.27
2013-14	51.85
2014-15	10.82

***** Record are maintained manually. This will be supplied once compilation is completed.

Output/achievement in the national interest (7)	Patent commercialized (8)	Birth place of all the scientist (9)	Number and name of the scientists who do not credit granted patents as inventor (10)	Name of the scientists who have H index less than 10.0 based on research publication (11)
Annexure-VII	Annexure-VIII	Annexure-IX	Annexure-X	Annexure-XI

Annexure-VII

Column 7 of Annexure II (B) Output/achievement in the national interest

- For assessment of soil health, a quantitative digital mini lab 'Mridaparikshak', which can measure 15 soil parameters and give nutrient recommendation, has been developed.
- Developed GIS-GPS based digital soil fertility maps of 173 districts of India. These maps are available on the website of IISS Bhopal.
- Developed soil test based fertilizer prescription equations for major crops based on targeted yield for different agro-ecological regions of India.
- Delineated micronutrients deficiency in 210 districts using GIS-GPS tools. Rampant micronutrients deficiency (Zn-43.4%, Fe-14.4%, Cu-6.1%, Mn-7.9% and B-20.3%) has been observed.
- Developed State-wise micronutrients recommendation for different crops and cropping systems.
- Balanced and integrated use of nutrients resulted in increase in soil organic carbon across the soils of the country, and on an average 150-250 kg ha^{-1} carbon is sequestered yearly.
- Identified genetically and agronomically efficient cultivars of rice, wheat, maize and Chickpea and pigeon pea to enrich the micronutrients density (Zn/Fe content) in food grains.
- Developed farmers' resource based Integrated Nutrient Management (INM) practices for dominant rain-fed pulse and oilseed based cropping systems including Broad Bed and Furrow (BBF) systems for water logged conditions.
- A user friendly visual basic model has been developed for predicting soil carbon and nitrogen pools with simple measurable parameters.
- Developed rapo-compost technique using consortia of mesophilic and thermophilic organisms to enhance the decomposition process. In this technique manures can be produced within 30-45 days of decomposition.

- Developed mineral enriched phospho-sulpho-nitro-potassium compost that may improve about 3-5% of total phosphorus content in enriched compost.
- "Nano-rock phosphate'' using low grade rock phosphate as P carrier has been prepared, which have similar efficiency to normal sized single superphosphates.
- Strategy developed to reutilize P accumulated in soil by reducing the P dose to half, has the potential to save P fertilizer worth Rs. 5000 crores (Punjab, Haryana & W. UP).
- A rapid method of soil testing (along with their critical levels) to detect potentially toxic heavy metals in soil has been developed.
- Soil testing protocol for organic farming system including characterization and quantification of microbiologically exploited organic phosphorus-pools in organic farming systems has been developed.
- A protocol for compost quality evaluation and utilization of different quality of composts has been developed. Safe concentration limits of heavy metals in MSW compost have also been computed.
- Soil genomics studies in high chemical input and organically cultivated soils in various regions in India showed increased actinobacteria in healthy soils which is a good indicator of biological soil quality.
- Rhizobial diversity characterized for major legumes characterized all over India including arid zone.
- INM Package with Biofertilizers developed and demonstrated for various crops all over India.
- Developed liquid biofertilizer formulations for maize, blackgram and pigeonpea.
- Maximum safe concentration limits of heavy metals in soil have been determined for sensitive agro-ecosystems in India. Also developed safe prescription limit for application of distillery effluents.
- Nitrate contamination of ground water of six heavily fertilized and intensively cultivated districts of the country has been mapped and delineated.
- A new rapid and interference free ion-chromatographic method of available fluoride determination in soil was developed; and colorimetric method of boron determination in soil and water using azomethine-H was modified to improve its accuracy and sensitivity.
- Developed physical & chemical methods of reducing heavy metals from municipal solid waste compost.
- Package of suitable land management (BBF, conservation tillage and residue), moisture conservation practices and optimum nutrition for improved water use efficiency, soil health, better rooting and nutrient use efficiency in maize-chickpea, maize + pigeonpea-chickpea and cotton based cropping system were developed.
- Intensive researches on microbial biofertilizers in BNF project resulted in the identification of superior strains of nitrogen fixing rhizobial strains and plant growth promoting bacteria which are deployed in biofertilizer production all over India leading to savings of 25% N and P fertilizers and ~10% increase in productivity besides improving soil and plant health and reducing the incidence of plant disease. For example for soybean Rhizobium strains R33 and R34 and Plant growth promoting bacterial strains P3, P10 and P25 for soybean, chickpea and wheat isolated at IISS, Bhopal are under biofertilizer production at JNKVV centre of BNF

project and utilized by farmers all over central India leading to minimum 10% improvement in productivity and besides fertilizer savings.

- Strip intercropping for augmenting pulse production.
- The district wise applicability of fertiliser prescription equations under different agroecological regions have been documented and transferred to DAC, Ministry of Agriculture and Farmers Welfare which was included in the online DSS developed under soil health scheme of Govt. of India (http://soilhealth.dac.gov.in/).
- As Executive PI of DAC sponsored project entitled, "GIS and GPS based foil fertility evaluation for precise fertilizer recommendations", developed GIS and GPS based soil fertility maps of 173 districts and the same has been uploaded at Institute website (http://www.iiss.nic.in/districtmap.html) for use by different stakeholders.
- Developed multitier system involving aonla, mango and litchi as main crop for purely rainfed, limited water availability and assured water availability situations. The technology has been made as bankable project by NABARD for implementation in Jharkhand.
- Developed technology for in-situ water harvesting involving half moon terracing coupled with mulching which has improved the yield of litchi besides reducing the sun burning of fruits.
- Enumeration of spatial variability and bio-amelioration of salt affected soil of semiarid region: Critical evaluation of spatial variation in salt affected soil under agroforestry system involving Prosopis juliflora, Casuarina equisetifolia, Delbargia sissoo and Acacia nilotica established higher bio-ameliorative effect of Prosopis juliflora in reducing SAR and RSC besides improving soil organic carbon and enhancing availability of plant nutrients in sodic soil.. Step down regression analysis revealed that EC and CaCO3 explained 34.7% variation in cane yield; inclusion of available K improved the coefficient of determination significantly (P= 0.05) from 0.387 to 0.712. Regression model of silicon-phosphorus relationship developed which can effectively describe the high variations of Olsen-P in sodic
- ***Mechanism and amelioration of lime induced iron chlorosis in sugarcane ratoon:*** Ortho-phenanthroline extracted acxtive-Fe in LTM leaves together with Chalorophyll-a/ Chalorophyll-b ratio was found to describe the variations in yield of chlorotic sugarcane ratoon. The index was accepted superseding the earlier index of Fe/Mn ratio**.** The yield and quality of chlorotic sugarcane ratoon improved significantly by foliar application of $FeSO_4$.
- ***Resource conservation technologies in rice-wheat cropping system under reclaimed sodic soil*:** Maximum yield of wheat was recorded when wheat was sown in zero tillage (Sesbania green manuring before rice) and zero tillage (Sesbania brown manuring in rice) (5.04 and 4.97 t ha^{-1}, respectively) followed by conventional sowing after rice residue incorporation (4.78 t ha^{-1}) under semiarid condition. The maximum rice yield was obtained in conventional transplanting with residue incorporation (7.88 t ha^{-1}). The maximum water saving of applied water was recorded in direct seeded rice + sesbania (32.8%). The water saving in raised bed transplanting was 24.0%.
- ***Developed technolgy for waste water use in non-food crops***: Technology developed for safe uae of waste water for medicinal/ aromatic plants viz., Tukham Malanga, Nirgundi and Lemon grass under semiarid condition. Oil analysis indicated that Cu, Zn and Fe contents was higher in Nirgundi compared to Lemon grass. The levels of Ni, Cd, Cr and Pb in the oil of both the crops were very low and below the permissible limit.
- ***Developed mathematical algorithm for prediction of cane yield in salt affected soil and pol in cane***: Step down regression analysis revealed that EC and $CaCO_3$ explained 34.7% variation in cane yield.

Inclusion of available K improved the coefficient of determination significantly (P= 0.05) from 0.387 to 0.712. Developed mathematical algorithms for prediction of pol in cane from easily analysed quality parameters which was adoped by Mawana and Titawi sugar factories.

- ***Developed fertiliser prescription equation for different crops:*** Developed fertiliser prescription equations for different crops under different agroecological regions.
- Research on crop root dynamics under diffeent management practices.
- Research on climate change effects on crop productivity in central India
-

Annexure-VIII

Column 8 of Annexure II (B) Patent commercialized

Filed Patent No. 2522/DEN/2015 dated August 14, 2015 of *Mridaparikshak* which was commercialised through a private agency.

Annexure-IX

Column 9 of Annexure II (B) Birth place of all the scientist

S.No.	Name of the Scientist	Designation	Date of Birth	Home Town	
				City	State
1	DR. ASHOK K. PATRA	DIRECTOR	07.09.1960	Bankura	West Bengal
2	DR.D.L.N. RAO	PS & NC (BF)	26.11.1954	Godawari	Andhra Pradesh
3	DR.MUNESWAR SINGH	PS & PC (LTFE)	24.08.1958	Bijnor	Uttar Pradesh
4	DR. PRADEEP DEY	PS & PC (STCR)	15.03.1965	Raniganj	West Bengal
5	Dr. ARVIND KUMAR SHUKLA	PS & PC (MSN)	03.01.1966	Kanpur	Uttar Pradesh
6	DR.M.C. MANNA	PS & I/c Head	01.11.1960	Midnapur	West Bengal
7	DR.A.K.BISWAS	PS & I/c Head	05.05.1963	Pargamas	West Bengal
8	DR.J.K. SAHA	PS & Head	06.04.1963	Madia	West Bengal
9	Dr. R.S. CHAUDHARY	PS & Head	05.02.1966	Palampur	Himachal Pradesh
10	DR. S. KUNDU	Pr. Scientist	03.01.1957	Purilia	West Bengal
11	DR. A.K. TRIPATHI	Pr. Scientist	01.01.19	Etavvah	Uttar Pradesh

			65		
12	DR. AJAY	Pr. Scientist	07.05.1963	New Delhi	New Delhi
13	DR. TAPAN ADHIKARI	Pr. Scientist	06.08.1966	Pargamas	West Bengal
14	DR.BRIJLAL LAKARIA	Pr. Scientist	01.02.1968	Mandi	Himachal Pradesh
15	DR. R. ELANCHZHIAN	Pr. Scientist	10.04.1971	Sivagangai	Tamil Nadu
16	DR.A.B.SINGH	Pr. Scientist	02.07.1961	Sultan Pur	Uttar Pradesh
17	DR. SANJAY SHRIVASTAVA	Pr. Scientist	23.08.1967	Varanasi	Uttar Pradesh
18	Dr. K.M. HATI	Pr. Scientist	28.05.1969	Hooghly	West Bengal
19	DR. S. RAMANA	Pr. Scientist	05.03.1967	Khammam	Andhra Pradesh
20	DR. N. K. LENKA	Pr. Scientist	22.05.1974	Nayagarh	Orissa
21	DR. R.H. WANJARI	Sr. Scientist	04.05.1970	Nagpur	Maharashtra
22	DR. J.SOMA SUNDARAM	Sr. Scientist	30.07.1974	Thiruvallore	Tamil Nadu
23	DR. PRAMOD JHA	Sr. Scientist	29.06.1973	Ranchi	Jharkhand
24	DR.K.RAMESH	Sr. Scientist	28.06.1974	Trichirapalli	Tamil Nadu
25	Dr. N.S. BHOGAL	Pr. Scientist	17.08.1955	Bina	Madhya Pradesh
26	DR.S.R. MOHANTY	Sr. Scientist	01.09.1971	Bhubaneshwar	Orissa
27	Dr. KOLLAH BHARATI	Sr. Scientist	02.07.1970	Shrikakum	Orissa
28	Dr. RAKESH KUMAR SINGH	Sr. Scientist	08.08.1965	Firozabad	Uttar Pradesh
29	Dr. ANAND KUMAR VISHWAKARMA	Sr. Scientist	16.08.1971	Bhopal	Madhya Pradesh
30	Dr. M. MOHANTY	Scientist (SG)	18.03.1972	Cuttck	Orissa
31	Dr. ABHISHEK RATHORE	Scientist (SS)	14.08.1976	Haridwar	Uttaranchal
32	Dr.(Mrs) SANGEETA LENKA	Scientist	02.11.1974	Nayagarh	Orissa
33	SH. ASIT MANDAL	Scientist	06.01.1981	Jal Paiguri	West Bengal

34	DR. M.VASSANDA KOUMAR	Scientist	07.09.1976	puducherry	Andhra Pradesh
35	DR. NISHANT KUMAR SINHA	Scientist	04.02.1980	Nalanda	Bihar
36	DR. MOHAN LAL DOTANIYA	Scientist	30.06.1982	Jaipur	Rajasthan
37	DR. JYOTI KUMAR THAKUR	Scientist	06.06.1980	Samasthipur	Bihar
38	DR. ASHA SAHU	Scientist	29.09.1982	Bhilai	Chhatishgarh
39	Dr. RAJENDERAN S.	Scientist	20.04.1984	Namakkal	Tamil Nadu
40	Dr. SHINOGI K. C.	Scientist	22.03.1982	Kasargod	Kerala
41	SHRI HIRONMAY DAS	Scientist	12.02.1987	Jal Paiguri	West Bengal
42	DR. BHARAT PRAKASH MEENA	Scientist	04.12.1983	Baran	Rajasthan
43	SHRI VASUDEV MEENA	Scientist	01.02.1984	Karauli	Rajasthan
44	SHRI PANKAJ KUMAR TIWARI	Scientist	23.11.1985	Kushinagar	Uttarpradesh
45	Dr. SHIRALE ABHAY OMPRAKASH	Scientist	04.09.1986	Nagpur	Maharashtra
46	Dr. SUDESHNA BHATTACAARJYA	Scientist	03.07.1985	Darjeeling	West Bengal

Annexure-X

Column 10 of Annexure II (B) Number and name of the scientists who do not credit granted patents as inventor

Filed Patent No. 2522/DEN/2015 dated August 14, 2015 of Mridaparikshak; however, yet to be granted.

Annexure-XI

Column 11 of Annexure II (B) Name of the scientists who have H index less than 10.0 based on research publication

Scientist having H index below 10 are: Pradip Dey, A.K. Shukla, R.S. Chaudhary, S. Kundu, Brij Lal Lakaria, A.B. Singh, Sanjay Srivastava, S. Ramana, N.K. Lenka, J. Somasundaram, K. Ramesh, N.S. Bhogal, R.K. Singh, A.K. Vishwakarma, Abhishek Rathore, Sangeeta Lenka, Asit Mandal, M. Vassanda Coumar, N.K. Singha, M.L. Dotaniya, J.K. Thakur, Asha Sahu, Rajendiran S., Shinogi K.C., Hiranmoy Das, B.P. Meena, Vasudev Meena, Pankaj Kumar Tiwari, A.O. Shirale, Sudeshna Bhattacharjya.

Name of the scientists having H index above 10 base on research publication

Drs. Ashok K. Patra, DLN Rao, Muneshwar Singh, AK. Biswas, MC Manna, JK Saha, K.M. Hati, AK Tripathi, R. Elanchezhian, Pramod Jha, SR Mohanty, Manoranjan Mohanty, RH Wanjari, Kollah Bharati, PN Takkar, A. Subba Rao, DD Reddy, K Sammi Reddy, Ch. Srinivasa Rao, PK Ghosh, Kalikinkar Bandopadhyay, KG Mandal, AK Mishra, A.N. Ganeshamurhy, TR Rupa

Whether reservation policies has been implemented, if no then please write the reason (12)	Product developed and in the market for health (mentioned those products/process only which are under in market) (13)	Product developed and in the market for environment (mentioned those products/process only which are in market) (14)	Product developed and in the market for agriculture (mentioned those products/process only which are in market) (15)	Product developed and in the market for defence (mentioned those products/process only which are in market) (16)
Annexure-XII	Annexure-XIII	Annexure-XIV	Annexure-XV	Annexure-XIV

Annexure-XII

Column 12 of Annexure II (B) Whether reservation policies have been implemented, if no then please write the reason

Yes

Annexure-XIII

Column 13 of Annexure II (B) Product developed and in the market for health (mentioned those products/process only which are under in market)

NA

Annexure-XIV

Column 14 of Annexure II (B) Product developed and in the market for environment (mentioned those products/process only which are in market)

NA

Annexure-XV

Column 15 of Annexure II (B) Product developed and in the market for agriculture (mentioned those products/process only which are in market)

- **Mridaparikshak a mini lab technology: D**eveloped a technology named "Mridaparikshak", a mini-lab for the estimation of soil fertility parameters. The mini-lab, at present, is capable of estimating 10 soil health parameters viz., pH, EC, Organic C, available N, P, K, S, Fe, Zn, and B.

The license to commercialize the technology has been given to M/s Nagarjuna Agrochemicals Pvt., Ltd., Hyderabad.

- **Microbial Cultures:** Biofertilizer Rhizobium for Soybean prepared from strain R-33 and PGPR prepared from Bacillus strain P-3 in commercial production at JNKVV, Jablapur Biofertilizer production centre
- **Liquid Bio-fertilizer Technology:** Liquid inoculants for *Rhizobium*, *Azospirillum* and P-solubilising bacteria (*Bacillus*) were developed using normal basal medium of each along with incorporation of several cell protectants like Trehalose, Polyvinyl Pyrrolidone (PVP), Glycerol, Arabinose etc.

Annexure-XVI

Column 16 of Annexure II (B) Product developed and in the market for defence (mentioned those products/process only which are in market)

NA

Product developed and in the market for industrial (mentioned those products/process only which are in market) (17)	Product developed and in the market for social development (mentioned those products/process only which are in market) (18)	Product developed and in the market for rural development (mentioned those products/process only which are in market (19)	Product developed and in the market for urban development (mentioned those products/process only which are in market) (20)	Product developed and in the market for transport development (mentioned those products/process only which are in market) (21)	Product developed and in the market for new technologies development (mentioned those products/ process only which are in market) (22)	Book written by any scientist referred in any book for school education or higher education (23)
Annexure-XVII	Annexure-XVIII	Annexure-XIX	Annexure-XX	Annexure-XXI	Annexure-XXII	Annexure-XXIII

Annexure-XVII

Column 17 of Annexure II (B) Product developed and in the market for industrial (mentioned those products/process only which are in market)

Mridaparikshak a mini lab technology

Annexure-XVIII

Column 18 of Annexure II (B) Product developed and in the market for social development (mentioned those products/process only which are in market)

NA

Annexure-XIX

Column 19 of Annexure II (B) Product developed and in the market for rural development (mentioned those products/process only which are in market

Mridaparikshak a mini lab technology

Annexure-XX

Column 20 of Annexure II (B) Product developed and in the market for urban development (mentioned those products/process only which are in market)

NA

Annexure-XXI

Column 21 of Annexure II (B) Product developed and in the market for transport development (mentioned those products/process only which are in market)

NA

Annexure-XXII

Column 22 of Annexure II (B) Product developed and in the market for new technologies development (mentioned those products/ process only which are in market)

Liquid Biofertilizer technology at ANGARU, Amaravathi Biofertilizer production centre; Mridaparikshak a mini lab technology

Annexure-XXIII

Column 23 of Annexure II (B) Book written by any scientist referred in any book for school education or higher education
List

Category	Tilte	Authors	Year	Publishe
Books Authored	>kj[kaM jkT; esa lCth ,oa lCth cht mRiknuA	**Dey, P.**, Singh, R.V., Rai, Mathura, Kumar, S., Singh, A.K., Pan, R.S. and Sharma, J.P.	2003	Departme Developm

	Soil Test and Yield Target Based Fertilizer Prescriptions (in Tamil), AICRP- STCR, Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore,	Santhi, R., Maragatham, S., Sellamuthu, K.M., Natesan, R., Duraisami, V.P., **Dey, P.** and Subba Rao, A.	2012	Tamil Na
	GPS and GIS Based Soil Fertility Appraisal for Selected Districts of Tamil Nadu (ISBN 978-81-904337-9-2)	Santhi, R., Stalin, P., Arulmozhiselvan, K., Muthumanickam, D., Chitdeshwari, T., Maragatham, S., Elayarajan, M., Sellamuthu, K.M., Natesan,R., Duraisami, V.P., **Dey. P.** and Subba Rao, A.	2013	Tamil Na
	GPS and GIS based model soil fertility maps for precise fertilizer recommendations to the farmers of Kerala. Kerala Agricultural University, Thrissur, Kerala	Bastin, B., Beena, V.I., Sreelatha, A.K. and Dey, P.	2014	Kerala A
Books Edited	*Litchi – Plant Genetic Resources, Production, Protection and Post harvest management*. Central Horticultural Experiment Station, Ranchi	Rai, Mathura, Nath, Vishal and **Dey,P.**	2001	ICAR
	Enhancing Nutrient Use Efficiency in Problem Soils. Central Soil Salinity Research Institute, Karnal, India	Singh, Gurbachan, Qadar, Ali, Yaduvanshi, N.P.S. and **Dey, P.**	2009	Director,
	Improving Sodic Soil Qualit, Input Use Efficiency and Crop Productivity through Integrated Nutrient Management. Central Soil Salinity Research Institute, Karnal, India	Yaduvanshi, N.P.S., **Dey, P.** and Singh, Gurbachan	2009	Director,
	Methods of Soil, Plant and Climatic Analysis. Central Soil Salinity Research Institute, Karnal, India,	Yaduvanshi, N.P.S., Chaudhari, S.K., Lal, K., Bundela, D.S., **Dey, P.** and Singh, Gurbachan	2009	Director,

	Satat Krishi Utpadan, Sambardhan Evam Sarkshan Hetu Prakritik Sansadhano Ka Pravandhan, published by Bharatiya Krishi Anusandhan Samiti and CSSRI, Karnal,	Tripathi, R.S., Modi, B.S., Goel, R.D., **Dey, P**., Yadav, R.K., Singh, S.K., Menna, R.L., Kulshresth, N.	2010	Director,
	Salinity management for sustainable agriculture in canal commands. Central Soil Salinity Research Institute, Karnal, India	**Dey, P**. and Gupta, S.K.	2011	Director,
	Climate Change Effects on Natural Resources Management	Mohanty, M., Chaudhary, R.S., Sinha, N.K.	2013	Agro-Tec
	Crop Growth Simulation Modelling: Theory and Practices	Mohanty, M., Chaudhary, R.S., Sinha, N.K., Reddy, K.S., Dey, P., Subba Rao, A.	2013	ICAR-IIS
	Crop Growth Simulation Modelling and climate change	Mohanty, M., Sinha, N.K., Chaudhary, R.S., Hati, K.M., Patra, A.K.	2015	Scientific
	Conservation Agriculture for Carbon Sequestration and Sustaining Soil health	Somasundram, J., Chaudhary, R.S., Subba Rao, Hati, K.M., Sinha, N.K., Vassanda Coumar, M.	2014	New Indi Delhi

Sub: Lok Sabha Question No 112 for 24.02.2015 regarding Use of chemical fertilizers in agriculture by Dr. Virendra Kumar & others

Ref. Letter No.4-3/2015 Fert Use dated 19th February 2015

j) Whether usage of chemical fertilizers/urea in agriculture has adverse impact on the fertility of soil, water, human and environment in the country;

Reply: AICRPs on LTFE, STCR and Micro and Secondary Nutrients works with macro, micro and secondary nutrients containing fertilizers. There is no evidence of their adverse impact on the fertility of soil, water, human and environment in the country when applied at optimum rate. Forty years long term fertilizer experiment results revealed that application of chemical fertilizer in right amount and right time in balanced way did not have any adverse effect on soil health rather have beneficial effect on soil health. However, imbalance use of fertilizer or use of urea alone in acid soils (Alfisols) without organic manure or lime as soil amendments declined the soil pH only in upland situation.

k) If so, the details thereof and the remedial measures taken by Government in this regard;

Reply:The long term experiments have indicated no adverse effect of fertilizer or pesticides on soil health. Punjab with 243 kg per hectare fertilizer consumption is one of the largest consumers of fertilizers in India. Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab in contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause monetary loss.

There are 100 institutions of ICAR apart from 69 State Agricultural Universities, 2 Central Agricultural Universities and 641 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xxi) Indian Institute of Soil and Water Conservation, Dehradun

xxii) Central Soil Salinity Research Institute, Karnal

xxiii) Indian Institute of Soil Science, Bhopal

xxiv) National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/

management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations. Also, a long term experiment is in progress at 17 locations across the country to study the impact of chemical fertilizer on soil health and crop productivity. Soil health is continuously monitored across the country at 17 locations covering all types of soils (Alluvial, Vertisols and Alfisols).

l) Whether the Government has launched awareness programme to educate the farmers regarding rational utilization of chemical fertilizers in agriculture and to save the farmers from the adverse effect of chemical fertilizers, if so, the details thereof;

Reply: The Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertilizer. Since, it is mandatory for all the ICAR institutes to provide training to the farmers, they are trained to make them aware of the soil health through kisan mela, frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer’s practice	STCR- IPNS recommended practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Also AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Tribal Sub Plan (TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

To create awareness for rational use of fertilizers, farmers are being brought to on farms to show them impact of various combinations of fertilizer on crop productivity and soil health at different centres. Farmers are regularly educated through electronic media like television and radio. The help of print media is also taken to tell them about the rational use of chemical fertilizers by writing notes in news paper and agricultural magazines and distributing small bulletin on different meets of farmer being organized by Institutes and SAUs.

m) Whether the Government proposes to encourage investment in producing bio-fertilizers in the country; and

Reply: Yes

n) if so, the details thereof?

Reply: The All India Network Project on Biofertilizers was initiated in 2004 with 11 cooperating centres in various geographical regions of the country. The scope of the project was expanded in XI plan to include work on soil biodiversity; 6 more centres were added and the project was renamed in 2007 with the beginning of the XI plan period as the All India Network Project on Soil Biodiversity-Biofertilizers. The project is now operational at 17 centres (13 universities, 4 ICAR institutes). The functions of the project are to conduct basic, strategic and applied research on various aspects of soil biodiversity and biofertilizers for cropping systems all over India, test the superior cultures of biofertilizers in experimental stations, transfer the technology to farmers through demonstrations, supply mother cultures to manufacturing units in the universities and in private sector and popularize the biofertilizer technology. The achievement of the project is given below:

- Characterized the genetic diversity of rhizobia of major legumes in Indian Soils.
- Mixed Consortium Biofertilization
- INM package with Biofertilizer enriched Compost
- Bionutrient Package For Rice In Eastern India
- High Quality Liquid Biofertilizer Inoculants
- Biocontrol of Diseases in Apples
- Biofertilizer interventions for crops grown in tribal areas

Sub.: **Lok Sabha Unstarred Question No. 3627 on "Agricultural Wastes" due for reply on 11-08-2015 raised by Shri Pralhad Joshi, Member of Parliament (LS) - requested for providing inputs-reg.**

Ref.: **File No. 15-12/2015-NRM-I dated 05/08/2015**

a) **The amount of agricultural wastes produced in the country during the last three years and the current year:**

State wise waste production, surplus and burning in India is summarised in Table-1.

Table 1 Generation, surplus and burned of CR (in Mt yr^{-1}) in various states of India

States	Residue generation	Residue surplus	Residue burned
Andhra Pradesh	43.89	6.96	2.73
Arunachal Pradesh	0.4	0.07	0.04
Assam	11.43	2.34	0.73
Bihar	25.29	5.08	3.19
Chhattisgarh	11.25	2.12	0.83
Goa	0.57	0.14	0.04
Gujarat	28.73	8.9	3.81
Haryana	27.83	11.22	9.06
Himachal Pradesh	2.85	1.03	0.41
Jammu and Kashmir	1.59	0.28	0.89
Jharkhand	3.61	0.89	1.10
Karnataka	33.94	8.98	5.66
Kerala	9.74	5.07	0.22
Madhya Pradesh	33.18	10.22	1.91
Maharashtra	46.45	14.67	7.41
Manipur	0.9	0.11	0.07
Meghalaya	0.51	0.09	0.05
Mizoram	0.06	0.01	0.01
Nagaland	0.49	0.09	0.08
Orissa	20.07	3.68	1.34
Punjab	50.75	24.83	19.62
Rajasthan	29.32	8.52	1.78
Sikkim	0.15	0.02	0.01
Tamil Nadu	19.93	7.05	4.08
Tripura	0.04	0.02	0.11
Uttarakhand	2.86	0.63	21.92
Uttar Pradesh	59.97	13.53	0.78
West Bengal	35.93	4.29	4.96
India	**501.76**	**140.84**	**92.81**

b) **whether it is a fact that the farmers tend to burn this agricultural waste (e.g. straw) causing high level of pollution and if so, the details thereof:**

Please see the Table-1.

c) **the measures taken by the Government to address the issue of air pollution due to agricultural wastes: and**

Burning of residues emits a significant amount GHGs. It is estimated that 70, 7 and 0.66% of C present in rice straw is emitted as CO_2, CO and CH_4, respectively, while 2.09% of N in straw is emitted as N_2O upon burning. Residue burning has been reported to cause emission of 379 Gg C equivalents for India and 14 Gg C equivalents for Madhya Pradesh. Burning of agricultural generates trace gases and aerosols such as CH_4, CO, N_2O, NOX and other hydrocarbons which cause radiative forcing to the atmosphere affecting the atmospheric composition and in turn radiation balance. It also emits large amount of particulates that are composed of wide variety of organic and inorganic species. One ton straw on burning releases 3 kg particulate matter, 60 kg CO, 1460 kg CO_2, 199 kg ash and 2 kg SO_2. Besides other light hydrocarbons, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) and SOx, NOx are also emitted. These gases are important for their global impact and may lead to a regional increase in the levels of aerosols, acid deposition, increase in tropospheric ozone and depletion of the stratospheric ozone layer.

d) **whether the Government has issued any guidelines to State pollution Control Boards to monitor the local emission sources and limit them and if so, the details thereof:**

There is no policy exists to monitor the local emission sources and their limits.

Sub: Rajya Sabha Question No. S2572 due for answer on 20/03/2015 regarding Al toxicity by Shri Motilal Vora

a) Whether it is a fact that according to the research done by Bio-technology Department of Ch. Charan Singh Agriculture University, Meerut, the Aluminium toxicity present in the earths crust in causing the extinction of several crop species;

- Aluminum is a natural constituent of soil and its solubility under neutral soil is low enough that it does not normally cause any toxicity to plants. However, in areas receiving high rainfall, leaching of basic cations such as Ca, Mg and Na take place thereby resulting in an increase in the dominance of cations such as Al and Fe. The soils of such region become acidic to highly acidic (pH <5). It results in aluminum toxicity conditions in these soils. There are number of agricultural crops that can be successfully grown in these soils with some management for ensuring sustainable crop production. Besides, agricultural crops there are many plants species that are capable enough to grow even under high concentration of Al in the soils. Under high Al toxicity leads to decrease in soil pH that can be increased by application of liming materials such as lime, basic slag etc. Even application of FYM has been found to decrease the effect of Al toxicity. IISS, Bhopal has not conducted any study that substantiates the extinction of crop species.

b) If so, the names of the places where such situations persists.

N. A.

c) The steps taken by Government to tackle this situations

N.A.

d) Whether Government has made available any information to the farmers of the aluminium toxicity affected area in this regards so that farmers can have good harvest; and

Yes

e) If so, the details there of?

The SAUs and ICAR institutions in the acid regions have developed package of practices for sustainable crop production involving use of lime, basic slag and other organic amendments such as FYM, poultry manure, green manure etc.

Sub: **Rajya Sabha Question No 502 for 27.02.2015 regarding degradation in fertility of soil by Shri C.M. Ramesh**

Ref. **F. No. NRM/2/5/2014-SW&DF dated 23rd Feb. 2015**

~~o)~~ **Whether the Government has undertaken any study for assessing the extent and nature of degradation particularly of soil fertility, across the country, particularly in Andhra Pradesh, is so, the details thereof; and**

Reply: Yes

The Government has taken scores of measures to overcome this problem. ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) Sponsored Project on "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country", GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts from geo-referenced soil samples completed and the digital maps have been uploaded in the Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders. With reference to Andhra Pradesh, GPS and GIS based soil fertility maps of six districts, viz., Kurnool, Kadap, Guntur, Anantpur, Krishna, Westgodavari has been prepared and uploaded in the same link.

All India Coordinated Research Project on Long Term Fertilizer Experiments (LTFE) has been initiated by ICAR, New Delhi in 1972 to assess the quality of soil as influenced by different imbalanced, balanced and integrated nutrient management options over the years. It has been proved that balance as well as integrated nutrient management either stabilized or enhanced the crop productivity of different crops. Continuous use of chemical fertilizers in balanced proportion not only resulted increase in productivity but also improved soil properties like soil organic carbon, status of water stable aggregate and maintained soil microbial population. At all the LTFE sites, combined use of chemical fertilizer and FYM found highly encouraging with maximum attainable yield. Studies on soil quality carried out indicated that continues use of chemical fertilizer in balanced and integrated manner resulted in better soil quality index compared to control and uncultivated fallow.

p) **Whether Government has initiated any remedial measures to restore the fertility of soil, and if so, the details thereof?**

Reply: ICAR - Indian Institute of Soil Science, Bhopal has compiled soil test data of available N, P and K status from different soil testing laboratories located in 19 states which showed that the soils of about 59% area were low in available N, 36% were medium and 5% were high. Similarly, soils of about 49% area were low, 45% were medium and 6% were high in available P. Available K status showed that the soils of about 9% area were low, 39% were medium and 52% were high in available K status**.**

Summary of soil fertility (N, P and K) status of soils of different States of India

State	% Area								
	Available Nitrogen			Available Phosphorus			Available Potassium		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Uttar Pradesh	98	2	0	97	3	0	0	61	39
Uttarakhand	43	37	20	68	32	0	0	67	33
Punjab	73	27	0	0	47	53	0	11	89
Haryana	96	4	0	92	8	0	0	39	61
Himachal Pradesh	0	24	76	33	55	12	65	35	0
Madhya Pradesh	27	63	10	31	56	13	17	29	54
Maharashtra	88	12	0	93	7	0	4	17	79
Rajasthan	88	12	0	55	45	0	0	24	76
Gujarat	68	21	11	34	66	0	0	37	63
Chhattisgarh	59	41	0	50	50	0	29	30	41
Bihar	36	58	6	29	68	3	23	73	4
W.B.	40	60	0	30	60	10	10	09	0
Orissa	57	43	0	44	56	0	11	58	31
Assam	27	73	0	17	83	0	38	44	18
Jharkhand	7	93	0	75	23	2	3	76	21
Andhra Pradesh	**44**	**56**	**0**	**55**	**45**	**0**	**0**	**58**	**42**
Tamil Nadu	94	4	2	15	47	38	1	31	68
Karnataka	20	61	19	27	69	4	8	14	78
Kerala	17	77	6	0	76	24	0	82	18

AICRP on Micro- and Secondary Nutrients and Pollutant Elements in Soils and Plants (AICRP-MSN) conducts soil delineation work of different districts of the country to assess the deficiency level of micro- and secondary nutrients in soils through its centres in 16 states of the country. Depending upon the size of district, about 100-500 geo-reference based soil samples are collected from each district and analysed for different nutrients. Based on the analysis results the districts/ areas are categorized under different categories like deficient and sufficient etc. So far, we have delineated database of about 200 districts of the country. In addition, nutrient response trials are also conducted for different nutrients in order to verify their deficiency status as noticed from the analysis of soils collected from different districts. The soil and crop specific amelioration strategies for the deficient micro- and secondary nutrients have been developed by the centres of the AICRP-MSN in 16 states. Under AICRP-MSN, 97464 soil samples have been analysed for DTPA-extractable micronutrients and 73630 samples for boron availability as well as 79862 sample for sulphur. The status is given in tables below.

Deficiency status of available (DTPA-extractable) micronutrients and hot water soluble B (HWS-B) in soils of different states of India		
State	**DTPA-extractable micronutrients**	**Hot water soluble B**

	No. of samples	Percent samples deficient				No. of samples	Percent samples deficient
		Zn	Fe	Cu	Mn		
Andhra Pradesh	**6723**	**22.3**	**16.8**	**1.0**	**1.7**	**3216**	**2.8**
Assam	5216	25.5	0.0	3.8	0.0	5216	11.9
Bihar	7304	41.4	12.3	1.8	7.8	3597	33.3
Gujarat	5470	23.1	23.9	0.4	6.3	5470	17.9
Haryana	5673	15.3	21.6	5.2	6.1	5673	3.3
Himachal Pradesh	642	1.4	7.8	0.2	22.1	161	8.7
Jharkhand	443	20.3	0.0	0.5	0.0	443	56.0
Madhya Pradesh	7580	61.7	9.6	0.2	1.6	3330	2.4
Maharashtra	8278	54.0	21.5	0.2	3.8	489	54.8
Odisha	2349	22.7	1.8	0.3	1.1	2349	52.5
Punjab	2181	16.6	6.2	3.6	15.2	1083	17.5
Tamil Nadu	31080	65.5	10.6	13.0	7.9	31080	19.9
Telangana	4799	26.9	17.0	1.4	3.8	2776	16.1
Uttar Pradesh	4788	33.1	7.6	6.3	6.5	4323	16.2
Uttarakhand	2575	9.6	1.4	1.4	4.7	2575	7.0
West Bengal	2363	11.9	0.0	1.2	0.9	1849	46.9
All India	**97464**	**43.0**	**12.1**	**5.4**	**5.5**	**73630**	**18.3**

Deficiency status of available Sulphur in soils of different states of India

State	**No. of samples**	**Percent samples deficient**
Andhra Pradesh	3216	28.9
Assam	5216	16.7
Bihar	3597	42.8
Gujarat	5470	42.0
Haryana	5673	35.8
Himachal Pradesh	161	0.0
Jharkhand	0	-
Madhya Pradesh	6499	27.7
Maharashtra	8278	26.5
Odisha	2349	31.1
Punjab	300	52.3
Tamil Nadu	28153	14.3
Telangana	2776	31.8
Uttar Pradesh	3950	32.5
Uttarakhand	2375	11.2
West Bengal	1849	37.4
All India	**79862**	**24.7**

Recently, GPS & GIS based soil fertility maps of 171 districts comprising of primary, secondary and micronutrients have been done through a DAC Sponsored project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for farmers of the country". The same has been uploaded in Institute website under the link: http://www.iiss.nic.in/districtmap.htmlfor the benefit of stakeholders.

Long term studies have indicated that raising of crops with the use of balanced fertilization have not affected soil fertility.

Recently, Govt. has launched a scheme of providing soil health card to every farmer in a mission mode. Fourteen crore farmers will be covered under the plan during the next three years. Besides, hundred mobile soil testing laboratories will be established during the current financial year.

Besides, ICAR - Indian Institute of Soil Science has developed technologies of Integrated Plant Nutrient Supply system. IPNS improves and maintains the soil fertility. Such technology is also demonstrated in farmers' fields.

Also, there are about 100 institutions of ICAR apart from 69 State Agricultural Universities, 2 Central Agricultural Universities and 641 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. In addition to ICAR - Indian Institute of Soil Science, Bhopal, there are three institutes listed below that are solely working on various issues related to soil management.

xxv) ICAR – Indian Institute of Soil and Water Conservation, Dehradun

xxvi) ICAR - Central Soil Salinity Research Institute, Karnal

xxvii) ICAR - National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are also engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Coordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages (kg grain/kg nutrient) of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Farmer's practice (kg grain/kg nutrient)	STCR- IPNS recommended practice (kg grain/kg nutrient)
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Also AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Tribal Sub Plan (TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Sub: Rajya Sabha Unstarred Question No. 515 due for answer on 24.07.2015 regarding "Farm Technologies for Farmers" asked by Shri Ambeth Rajan, Hon'ble MP (RS).

(a) Whether the Government has developed many farm technologies meant for farmers, if so the details thereof;

Yes, the technologies developed by ICAR-IISS, Bhopal are given below.

Technologies to Enhance Soil Fertility through Input/Nutrient Management

1. **Integrated Plant Nutrient Supply (IPNS) System for Soybean-Wheat Cropping System:** The general fertilizer recommendation for Soybean is 20:60:20 kg NPK/ha and that of Wheat is 120:60:40 kg NPK/ha to gain a profitable yield from the Soybean-Wheat cropping system. Realizing the low soil fertility status of the Malwa and Vindhyan plateau regions of Madhya Pradesh where the Soybean-Wheat cropping system is being practiced, the Institute has developed specific IPNS recommendation to make the cropping system more profitable. The recommendation consists of the application of 50% recommended rate of NPKS (Urea 1.75 kg, DAP 65 kg, MOP 16.5 kg, and Gypsum 55 kg/ha) + 5t FYM/ha + *Rhizobium* (750 g/ha) to soybean and 75% of recommended rate of NPKS (Urea 158 kg, DAP 98 kg, MOP 25 kg, and Gypsum 83 kg/ha) + Phosphate Solubilizing Bacteria (PSB) (3.5 kg/ha) to Wheat. The technology is found viable since many of the farmers can produce 5t FYM per annum. But, for some farmers it may not be possible to cover the entire holdings with complete INM every year as the FYM available may not be sufficient. These farmers can go for 100% NPKSZn to soybean and 100% NPKS to wheat to those parts of their fields where FYM is not applied, to get higher productivity in the Soybean-Wheat system.

2. **Soybean based Intercropping Systems for Sustainable Productivity on Deep Vertisols of Madhya Pradesh:** Intercropping systems are sustainable as these lower runoff and soil losses compared to sole crops. Field trials conducted at IISS conveyed that *Kharif* intercropping of Soybean with Maize (2:1 ratio) without any nitrogen application but with 5 t/ha FYM; followed by Wheat in *Rabi* is found to be more productive and economical with a benefit-cost ratio of 2.37 compared to the mono-cropped Soybean – Wheat System. However, the application of 100% NPK in maize-wheat system will give the highest profitability. Farmers could consider intercropping where soils are susceptible to erosion.

3. **Mechanical Harvest Borne Residue Management:** The field burning of crop residues is undoubtedly a wasteful practice as it results in loss of valuable organic matter, and associated nutrients. An experiment conducted for five years has established that soil incorporation of wheat residue plus N supplementation through FYM at the rate of 28 kg N ha-1 (approx. 4 t FYM ha-1) along with 25 kg P ha-1 for rainfed soybean and 68 kg N + 30 kg P ha-1 for irrigated (1+ 2 irrigations) wheat was more effective and profitable. Wheat residue incorporation resulted in 20–22% higher yields in soybean and 15-25% higher yields in wheat as compared to residue burning.

4. **Micro and Secondary Nutrients Recommendation for Indian Soils:** A systematic procedure to diagnose and correct the micro and secondary nutrient deficiencies of Indian soils has been

developed by the Institute through its AICRP on micro and secondary nutrients. A micro and secondary nutrients recommendation chart for the application of various micro and secondary nutrients for different crops and cropping systems has been developed *(Research Bulletin No.1/2012, IISS, Bhopal).*

5. **Enriched Compost Production:** Ordinary homemade compost usually has an average NPK value 0.5:0.27:0.8 and enriched composting is the process where the ordinary compost is fortified with the necessary plant nutrients so that it becomes more or less complete food for the plant. Different types of enriched composts developed by the institute are:

a. **Phospho Compost:** Thetechnology has been developed using phosphate solubilizing microorganisms (*Aspergillus awamori*, *Pseudomonas straita* and *Bacillus megaterium)* phosphate rock, pyrite and bio-solids to increase the manurial value compared to ordinary FYM and compost. The average P content of this compost is 2-3.50 % and the cost incurred to obtain one kg P_2O_5 through phosphocompost is around Rs.9.00 as compared to Rs.16.0-17.0 supplied through single super phosphate or Diammonium phosphate *(Technical Bulletin (Hindi), Nov. 2000).*

b. **Phospho-Sulpho-Nitro Compost:** In this composting process urea @ 0.5-1% (w/w), rock phosphate @12.5% (w/w) and pyrite @ 10% (w/w) are added into the composting mixture. The average nutrient value of this compost is 1.5-2.3% N and 3.2-4.2% P. Application of phospho-sulpho-Nitro compost @ 5 t/ha can replace 25% of recommended fertilizer dose in Soybean-Wheat Cropping system *(Technical Bulletin No.2/2006, IISS, Bhopal).*

c. **Spent Wash amended Compost:** This compost is prepared by heap method but water requirement for the composting is met by spent wash, the major waste material from the distillery industry. Spent wash is rich in organic matter content and a good source of plant nutrients like N, P, K, S etc. After preparation, the nutrient value of spent wash amended compost is 1.37% N, 1.30% P and 1.82% K. The field demonstrations showed that the yield increase by the application of spent wash amended compost is almost equal to that of two other treatments (FYM, Ordinary Compost) in maize. In chickpea the yield increase was on par with the application of recommended dose of NPKSZn, and that of FYM + 50% of NS top dressing *(IISS Research Bulletin.No.2, 2012).*

d. **Enriched Organo - Mineral Compost:** In this method of composting, crop residues are mixed with cow dung, low-grade rock phosphate, waste mica and mineral gypsum and the composting period is nearly four months. The nutrient value of enriched organo-mineral compost is 1% N, 10% P, 2.1% K, 1.7% S and the addition of 1 tonne compost can supply 10 kg N, 10 kg P, 21 kg K, and 17 kg S to the crop. Field demonstrations conducted by the Institute proved that yield performance of organo-mineral compost is promising when used as a part of Integrated Nutrient Management (INM) *(ACIAR Project Technical Paper (Folder): Phosphorus, Potassium & Sulphur enriched Organo-Mineral Compost Production Technology, IISS, Bhopal).*

e. **Microbial enriched Municipal Solid Waste (MSW) Compost:** The Institute has developed microbial enriched compost technology to make use of the untapped nutrient value of the municipal solid waste as well as to manage the environmental pollution issues related to that. For making 1000 kg microbial enriched compost, 1600 kg waste material, 320 kg fresh cow dung and 21kg Urea are required. To enhance the decomposition process bioinoculum need to be added twice during the composting period; initially in the first five days and then after 30 days of decomposition. The composting period for this method is around 2.5 months and the nutrient value of microbial enriched MSW compost is 0.73% N, 0.79% K with 11.3% total organic carbon content *(Institute Publication (Folder): Microbial Enriched Compost Production from Municipal Solis Waste, IISS, Bhopal).*

f. **Biofertilizers:** Biofertilizers are preparations of living organisms that are useful for promoting plant growth through a variety of mechanisms like biological nitrogen fixation, solubilization of insoluble phosphates, oxidation of sulphur, production of growth hormones, and also help plants to fight against diseases.

g. **Mixed Consortium Biofertilizers:** Mixed biofertilizers (BIOMIX) containing a consortium of N fixers, P solubilizers and Plant Growth Promoting Rhizhobacteria (PGPR) to promote crop growth of cereals, legumes and oilseeds was developed through the Network Project on Soil Biodiversity and Biofertilizers. Field trials conducted at various centers of the Network Project showed that use of BIOMIX could save 25% of N and P fertilizers. Field trials of BIOMIX in various states showed a yield increase of 13% in rice, 9% in wheat, 10% in millets, 13% in pulses, 14% in oil yielding crops, and 10% in vegetables.

h. **Enhancement of Biofertilizer Efficacy**: Bioinoculants (*Azospirillum, Azotobacter*, PSB) mixed with well decomposed FYM/Vermicompost in 1:25 ratio and incubated at 30% moisture for a week improved the microbial population 2-15 fold. Demonstrations revealed an yield increase of 8-12% in above ground vegetables and 25-30% in below ground vegetables with the use of this formulation.

i. **Liquid Biofertilizer Formulations:** Technology was developed by ANGRAU, Amaravathi center of Network Project on Biofertilizers. Liquid biofertilizer formulations were found to be ideal to increase the shelf life of different biofertilizers. In an evaluation period of 360 days Liquid *Rhizobium* medium (LM3) maintained log 8.433 viable cells/ml, Liquid PSB medium (LM3) maintained log 8.208 cells, and *Azospirillum* liquid medium (LM2) maintained log 8.643 CFU/ml even after 360 days. Liquid inoculants found to be free of contamination during the study period and dose of 4-5 ml of liquid inoculum (population of 3x109 cells/ml) is enough to coat 1 kg seed. (*Research Progress Report : Network Project on Soil Biodiversity-Biofertilizers (2007-2011) IISS, Bhopal)*

j. **Oleoresin Coated Urea Fortified with Nano-particles:** To manage the micro-nutrient requirement of the crop a protocol has been developed for the fortification of urea with a consortium of nano-particles of Zinc, Copper, Iron, and Silicon by using oleoresin. This product contains 0.438g N, and 2.2 mg Zn, 1.10 mg Fe, 0.66 mg Cu and 1.06 mg Si per gram of urea. Application of this fortified urea @ 200 kg/ha will supply 87.68 kg N, 440g Zn, 220g Fe, 132g Cu, and 212g Si to the crops.

k. **Nano-Rock Phosphate:** Development of Nano Rock Phosphate is an effort towards the commercial utilization of the low grade rock phosphate available in India as a direct phosphatic fertilizer. Experiments conducted in four soils (Vertisols of Bhopal, Alfisols of Betul, Inceptisols of Ludhiana, and Aridisols of Jodhpur) revealed that crop utilization of P from nano-rock phosphate is on par with that of normal sized SSP in Vertisol and Inceptisol; and biomass growth of maize could be enhanced with the application of nano-rock phosphate. The institute has tested two types of rock phosphate materials SRP (Sagar Rock Phosphate) and HGRP (High Grade Rock Phosphate, Udaipur) and found that nano-rock phosphate (size: 110.1 nm) prepared from SRP had showed an yield advantage of 20% in vertisols, 61% in alfisols, 31% in inceptisols, and 14% in aridisols over the application of normal sized rock phosphate (size: 13.4 µm) from SRP. Further, nano-rock phosphate (size: 70.89 nm) prepared from HGRP had showed a yield advantage of 31% in vertisols, 88% in alfisols, 27% in inceptisols, and 15% in aridisols over the application of normal sized rock phosphate (size: 12.9 µm from HGRP *(IISS Technical Bulletin, 2010).*

l. **Nano Zinc Oxide:** Results of the experiments conducted at IISS revealed that Nano ZnO can be used as a direct source of Zn to crops. Application of nano Zn particles at relatively lower level (0.28ppm) enhanced the growth of maize compared to normal ZnSO4 (0.5ppm); further, seed treatment with nano-ZnO found to be a successful method to meet the Zn requirement of the crop and there was no toxic effect on the seed germination and further plant growth *(IISS Technical Bulletin, 2010).*

Technologies to Enhance and Sustain Soil Health

1. **Conservation Tillage for Soybean-Wheat Cropping System:** Conservation tillage means any tillage system that maintains at least 30% of the soil surface covered by residue after planting primarily to reduce water erosion. The institute has tested different conservation tillage practices (No Tillage and Reduced Tillage) for soybean-wheat system. In no tillage system during the *kharif* season soybean crop was sown directly with a no-till seed drill while wheat residues were kept on the surface. Under reduced tillage system soybean was sown using a no-till seed drill in wheat residue retained field after one pass ploughing by duck foot sweep cultivator. An increase in soil water retention and soil properties were observed in both systems compared to that of field with conventional tillage but yield advantage was visible in the soybean crop grown in the reduced tillage system. *(IISS Publication: Two Decades of Soil Research,2009)*

2. **Broad Bed Furrow (BBF):** The BBF system consists of semi-permanent broad beds of approximately 100 cm wide, separated by furrow of about 50 cm wide and 15 cm deep with a rolling slope of 0.4-0.7% for safe drainage of excess water; crops can be grown on the beds in 2-4 rows in this system. The system is a good option for cultivating crops in waterlogged areas; beneficial for high productivity, improved drainage, and also for in-situ moisture conservation. During heavy rainfall the furrows safely carry runoff water away without any excess soil loss and can drain the excess water to the water harvesting pond so that it can be used for irrigating the winter crop. On BBF, sole maize or intercropping of pigeon pea with maize crop (rainy season), chickpea (winter season) can be grown with application of recommended doses of fertilizer and FYM @ 5 t/ha. There was a yield increase of 11-18% in BBF system compared to that of flat bed system in the field demonstration among five cropping systems viz., soybean-chickpea, maize-

chickpea, soybean/maize-chickpea, soybean/pigeonpea, and maize/pigeonpea. *(IISS Publication: Two Decades of Soil Research,2009)*

3. **Organic Farming Practices for Various Crops and Cropping Systems:** Organic farming, the form of agriculture that is becoming famous for its nature friendly technology package such as crop rotation, green manuring, compost and biological control of pest and diseases. The institute has developed specific package of practices for organic farming for crops like soybean, wheat, isabgol, chickpea, pomegranate, mustard, and pigeonpea *(IISS Publications: Folder for Soybean, Isabgol, Pigeonpea, Wheat, Chickpea, Mustard, and Pomegranate, 2012; Extension Bulletin 1/2006)*

4. **Bioremediation of Heavy Metal Contaminated Sites:** Bioremediation is an emerging technology that uses microorganism/living plants to reduce and/or remove pollutants or contaminants from soil, water, sediments, and air. Phytoremediation is a tool of bioremediation where the green plants are used in situ for cleaning the contaminated sites. The institute has screened and identified some floriculture plants like marigold, chrysanthemum, gladiolus, tuberose and bio-agents like *Trichoderma viridie* for the management of heavy metal contaminated areas.

Database, Maps and Software to Support the Management of Soil Health

1. **GIS based Soil Fertility Maps of Different States:** The soil fertility data on N, P, and K index values at district level for the states of Andhra Pradesh, Maharashtra, Chhattisgarh, West Bengal, Haryana, Orissa, HP, Karnataka, Punjab, Tamil Nadu and Bihar of India has been developed in MS-Access. From the attribute database, the different thematic layers have been reclassified to generate various thematic maps on N, P and K index values (IVs). The calculated soil test values were incorporated into the developed fertility maps to prescribe nutrients for targeted yields.

2. **Online Fertilization Recommendation System:** This application software was developed to recommend fertilizer doses for the targeted yields of various crops. This system has the facility to input actual soil test values at the farmers' fields to obtain optimum fertilizer doses for nitrogen, phosphorus, and potassium. The application is a user-friendly tool. It will aid the farmer in improving the efficiency (appropriate dose) of fertilizer use to achieve a specific crop yield. The system works as a ready reckonner to give prescription in the form of fertilizer available (eg. Urea, SSP, MOP etc.). The software can be accessed at *http://www.iiss.nic.in*. The software is compatible with Internet Explorer. On entering the site one has to click "Run the software" shown in bold green colour. (please enable pop ups before clicking). After that one has to feed the information as directed (*Technology Bulletin No. IISS/GIS/01, 2007).*

3. **Database of Different Sources of Plant Nutrients:** The database has been generated in MS access. This database can be accessed by user friendly queries. To access the data one has to open the file Nutrientdatabase.mdb and then click queries. The user will find several queries which when clicked will ask the name of state, district, crop, manure type for which the information is desired. When user feeds the desired name, he will get the nutrient data.

4. **Soil Carbon and Nitrogen Turnover Model:** A new soil carbon and nitrogen turnover model has been developed by using the soil and crop dataset of long term fertilizer experiments of India. Soil carbon and nitrogen prediction model is controlled primarily by net primary production (yield), mean annual rainfall and temperature, texture (sand, silt, clay content), bulk density and soil initial carbon content. The model works on the principle of soil carbon saturation theory, which suggests soil carbon sequestration rate decreases as the soil carbon content increases and vice-versa. The model computes total organic carbon, Walkley & Black C content, carbon in resistant (passive) and mineralizable (active+slow) pools, carbon stocks, total N, and available N. Soil carbon and nitrogen prediction model uses a yearly time step and the users have to define only initial soil carbon content. The model automatically computes the carbon and nitrogen turnover based upon these parameters and output is displayed in excel sheet.

5. **Software for Evaluating Municipal Solid Waste (MSW) Compost:** Municipal Solid Wastes have considerable potential to contaminate the environment but recycling of this waste material through composting can generate valuable resources for augmenting crop productivity. IISS has developed a new method that enable the grading of MSW compost based on its quality and with this grading can be done for Marketable class on a four point scale or for Restricted Use class on a three point scale based on the *Fertilizing Index* and *Clean Index* of the MSW compost. The Fertilizing Index is calculated with the Weighing factors assigned to the compost quality parameters while Clean Index is calculated based on the weighing factor assigned to different heavy metals as well as their content in the prepared compost. The software developed with this method is available in the institute in a CD format *(Institute publication: Grading of Municipal Solis Waste Compost for Safe and Maximum Recycling in Agriculture).*

6. The ICAR- All India coordinated Research Project on Micro and Secondary nutrients in soil and plant (ICAR-AICRP on MSN) have 16 centers in Assam, Bihar, Jharkhand,, Odisha, Maharashtra, Telengana, Tamil Nadu, West Bengal, Madhya Pradesh, Gujarat, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Punjab and Haryana. Large number of recommendations for micronutrients and sulphur requirements in different crops and cropping systems has been developed. However, concrete information on micronutrients recommendation based on critical limits, soil types/situation and cropping system based is hardly available at one place. Hence, the different reports, bulletins, leaflets, folders and publication were brought out to deliver compiled information on recommendations to farmers on sulphur and micronutrients uses in different crops/cropping systems practiced in the country.

(b) The details of the steps taken by Government to take these farm technologies up to the farmer, particularly farmers in Uttar Pradesh

ICAR-IISS is demonstrating these technologies in farmers' fields in Madhya Pradesh in the form of front-line demonstrations. Besides, the AICRPs viz., AICRP on STCR, AICRP on MNS, AICRP on LTFE, and AINP on BF are also demonstrating the technologies in farmers' fields including the farmers in tribal area in different states including Uttar Pradesh.

- **Fertilizer Adjustment Equations Under Integrated Plant Nutrient Supply System (IPNS) developed for Uttar Pradesh:** The following fertilizer adjustment equations for hybrid maize and barley crops were developed under integrated plant nutrient supply system (IPNS) to recommend nutrients through locally available organic sources and inorganic sources:

Crop	Fertilizer Prescription Equation
	With FYM
Maize (cv. Asha Hybrid)	$FN = 13.69T - 1.27\ SN - 0.59\ ON$ $FP_2O_5 = 4.92\ T - 4.25\ SP - 0.67\ OP$ $FK_2O = 7.25\ T - 0.76\ SK - 0.39\ OK$
Barley (cv. PL-172)	$FN = 4.53T - 0.40\ SN - 0.19\ ON$ $FP_2O_5 = 1.09\ T - 0.74\ SP - 0.06\ OP$ $FK_2O = 3.25\ T - 0.38\ SK - 0.31\ OK$

For popularizing technology, the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice (kg grain/kg nutrient)**	**STCR- IPNS recommended practice (kg grain/kg nutrient)**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Verification Trials and FLDs conducted in Uttar Pradesh: Under the Tribal Sub-Plan project five Front line demonstrations (FLDs) were conducted with rice and ten with wheat in two villages of district Chandauli of Uttar Pradesh were conducted by AICRP (STCR). Seven follow up trials were conducted on farmer's field Khewashipur, Bhatshar, Loharpur and Shravanpur villages of Arajiline block in

Varanasi district during kharif season Significant increase was recorded in STCR technology over Farmers' practice.

The centers of AICPR-MSN evaluated Soil fertility through soil and plant analysis. Geo reference based 250-350 soil samples (depending upon size of the district) are being collected from various districts of Uttar Pradesh to verify the status of different nutrient analyzed in soils collected from different districts. In addition nutrient response trials are also conducted. The recommendations to micro and secondary nutrients for farmers and uses in different crops/cropping systems practiced in the state of Uttar Pradesh. The recommendations for Uttar Pradesh are given below:

Uttar Pradesh

S.No	nutrient	crops or cropping	critical limit	Source of fertilizer	recommendations
1.	Zn	Pearl Millet-Wheat	1.0	Zn sulphateheptahydate (21%)	Application of 10 kg Zn ha^{-1}(50 kg $ZnSO_4.7H_2O$ ha^{-1}) to Pearl millet crop in alternate year. Or Application of 2.5 kg Zn ha^{-1}(12.5 kg $ZnSO_4.7H_2O$ ha^{-1}) + 5 t FYM ha^{-1} to first crop and 2.5 kg Zn ha^{-1} (12.5 kg $ZnSO_4.7H_2O$ ha^{-1}) at third year in Pearl millet crop in neutral, sandy loam soils (with low in organic C) of western U.P. Plain region.
2.	Zn	Rice-Wheat	1.2	Zn sulphateheptahydate (21%)	Application of 5 kg Zn ha^{-1}(25 kg $ZnSO_4.7H_2O$ ha^{-1}) to rice in rice-wheat system is recommended once for 2-3 years in soils of medium organic C and silt loam texture in western U.P. Plain region. Or Application of 2.5 kg Zn ha^{-1}(12.5 kg $ZnSO_4.7H_2O$ ha^{-1}) + 5 t FYM ha^{-1} to first and third year rice crop. In slightly acidic with high organic carbon soils of *Tarai* region, apply 30 days incubated mixture of 2.5 kg Zn ha^{-1}(12.5 kg $ZnSO_4.7H_2O$ ha^{-1})(20-21% Zn) + 200 kg fresh cow dung before transplanting of rice. OR Incorporate 1.5 t wheat straw + 20 kg urea + 5 kg Zn ha^{-1} (25 kg $ZnSO_4.7H_2O$ ha^{-1})at least 30 d before rice transplanting. And incorporate 1.5 t rice straw +20 kg urea ha^{-1} at least 30 d before the sowing of wheat. In alkali soils, application of 10 kg Zn ha^{-1}(50 kg $ZnSO_4.7H_2O$ ha^{-1}) is recommended in rice crop under rice-wheat cropping system for two years. OR Apply 1.5 kg chelated Zn to every rice crop in rice-what system
3.	Zn	Hybrid rice-Wheat	1.2	Zn sulphateheptahydate (21%)	Application of 10 kg Zn ha^{-1} (50 kg $ZnSO_4.7H_2O$ ha^{-1}) to the first Hybrid rice crop and then 5 kg Zn ha^{-1}(25 kg $ZnSO_4.7H_2O$ ha^{-1}) to third year Hybrid rice in *Tarai* region soils with neutral to slightly

					acidic soil reaction and high organic carbon content.
4.	Zn	Rice-berseem/Rice-mustard/Rice-pulses	0.6	Zn sulphateheptahydate (21%)	Apply 3.75 kg Zn ha^{-1} (18.75 kg $ZnSO_4.7H_2O$ ha^{-1}) in rice under different rice based cropping system grown in sandy loam slightly alkaline soils of Uttar Pradesh.
5.	Zn	Mustard/ Toria	1.0	Zn sulphateheptahydate (21% Zn)	Apply 7.5 kg Zn ha^{-1}(37.5 kg $ZnSO_4.7H_2O$ ha^{-1}) once in three years, before planting in loamy sand, slightly alkaline and low organic carbon content soils of western U.P. Plain region. *In* loamy texture, neutral soil reaction with high OC content soils of *Tarai* region, application of 5 kg Zn ha^{-1} (25 kg $ZnSO_4.7H_2O$ ha^{-1}) before sowing is recommended in alternate year. If soil application of Zn sulphate has been missed, foliar spray of 0.5% Zn sulphate (20-21% Zn) + 1.0% urea solution on the standing crop at 30 and 45 d after sowing is useful in mitigating Zn deficiency in Mustard and Toria.
6.	Zn	Groundnut	1.0	Zn sulphate (20-21% Zn)	In alkaline sandy loam soils of western U.P. Plain region, apply 5 kg Zn ha^{-1}(25 kg $ZnSO_4.7H_2O$ ha^{-1}) as basal before sowing. Or Seed treatment with 8 ml Teprosyn-Zn kg^{-1} groundnut seed. Or Foliar spray of 0.5% Zn sulphate + 0.25% lime at 30 and 45 d after emergence is recommended.
7.	Zn	Moong/Urd	1.0	Zn sulphate (20-21% Zn)	Apply 5 kg Zn ha^{-1} (25 kg $ZnSO_4.7H_2O$ ha^{-1}) before sowing every third year in *Tarai* region neutral soils having loam texture, high organic C content.
8.	Zn	Sugarcane-ratoon	1.0	Zn sulphate (20-21% Zn)	*In* loamy texture, neutral soil reaction with high OC content soils of *Tarai* region, apply 10 kg Zn ha^{-1}(50 kg $ZnSO_4.7H_2O$ ha^{-1}) as basal before planting for sugarcane plus ratoon crop. Or Apply 5 kg Zn ha^{-1} (50 kg $ZnSO_4.7H_2O$ ha^{-1}) + 2.5 t press mud compost ha^{-1} before planting.
9.	Zn	Mexican marigold (*Tagetesminuta*)	1.0	Zn sulphate (20-21% Zn)	Apply 5 kg Zn ha^{-1} (50 kg $ZnSO_4.7H_2O$ ha^{-1}) before planting in loamy textured organic carbon rich soil of *Tarai* region of Uttarakhand.
10.	S	Rice-wheat system	10.0	SSP/gypsum/ bentonite S	Apply 45 kg S ha^{-1} to wheat in rice wheat system in sandy loam/loam soils of Uttar Pradesh
11.	S	Mustard/toria/ sesamum/groundnut	10.0	SSP/gypsum/ bentonite S	Apply 40 kg S ha^{-1} to each crop in sandy loam/loam soils of Uttar Pradesh
12.	S	Moong/urd/ pigeon pea/gram	10.0	SSP/gypsum/ bentonite S	Apply 30 kg S ha^{-1} to each crop in sandy loam/loam soils of Uttar Pradesh
13.	S	Onion/garlic	10.0	SSP/gypsum/ bentonite S	Apply 50 kg S ha^{-1} to each crop in sandy loam/loam soils of Uttar Pradesh

14.	S	Lentil	10.0	Gypsum	Apply 215 kg Gypsum ha^{-1} as basal before sowing in sandy loam soils of Tarai region.
15.	B	Hybrid rice/hybrid rice- Wheat system	0.50	Borax (10%)	In Mollisols of tarai region, apply 10.0 kg borax/ha to hybrid rice crop or apply 975 g B ha^{-1} as basal and 130g B ha^{-1} as foliar spray at 55 d after transplanting in hybrid rice.
16.	B	Maize (cv. Amar)	0.50	Granubor II (15% B)	Application of 0.30% B as foliar spray at 30 d after planting is recommended for getting higher yields of the crop in sandy loam hill Soil
17.	B	Soybean	0.50	Granubor II (15% B)	Apply 10 kg Granubor ha^{-1} before sowing in sandy loam soils of *Tarai* region. In sandy loam hill Soil having high organic C application of 1.5 kg B ha^{-1} before sowing is recommended.
19.	B	Okra/ Green pea	0.50	Granubor II (15% B)	Apply 1.5 kg B ha^{-1} as basal in sandy loam organic matter rich hill Soils.
20.	B	Tomato	0.50	Granubor II (15% B)	Foliar spray of 0.15% B at 30 and 45 d after planting can be recommended for getting higher yields of the crop in organic matter rich sandy loam hill Soils.
21.	B	Cabbage/ French bean	0.50	Borax (10% B)	Soil application of 10 kg borax ha^{-1} is recommended in organic matter rich sandy loam hill Soil.
22.	Zn+ S	Gram, Sesame, Groundnut, Soybean	1.0 10.0	Zn sulphate (20-21% Zn), Gypsum	Apply 2.5 kg Zn ha^{-1} (12.5 kg $ZnSO_4$. $7H_2O$ ha^{-1})+ 40 kg S ha^{-1} (215 kg gypsum) before sowing in organic matter rich loamy textureMollisolsof *Tarai* region.
23.	Zn + S	Sugarcane-ratoon	1.0 10.0	Zn sulphate (20-21% Zn), Gypsum	Apply 5 kg Zn ha^{-1} (25 kg $ZnSO_4$. $7H_2O$ ha^{-1}) + 45 kg S ha^{-1} (250 kg gypsum) before planting in organic matter rich loamy textureMollisolsof *Tarai* region.
24.	Zn+B	Tomato	1.0 0.50	Zn sulphate (20-21% Zn), Borax (10%B)	Application of 10 kg borax + 3 kg Zn ha^{-1} (15 kg $ZnSO_4$. $7H_2O$ ha^{-1}) and 0.2% Borax solution at pre-flowering and early fruiting/heading stage is recommended in organic matter rich sandy loam hill soils.
25.	Zn+S+B	Lobia, Moong, Urd	1.0 10.0 0.50	Zn sulphate (20-21% Zn), Gypsum, Borax (10%B)	Apply 2.5 kg Zn ha^{-1} (12.5 kg $ZnSO_4$. $7H_2O$ ha^{-1}) + 30 kg S +0.5 kg B ha^{-1} in organic matter rich sandy loam hill soils.
26.	Zn+S+B	Potato based systems	0.6 10.0 0.50	Zn sulphate (20-21% Zn), Gypsum, Borax (10%B)	Apply 5 kg Zn ha^{-1} (25 kg $ZnSO_4$. $7H_2O$ ha^{-1}) + 45 kg S + 1.0 kg B ha^{-1} in potato in potato based systems in organic matter poor sandy loam soils of Uttar Pradesh.

(c) the details of the response to these farm technologies from farmers?

There is good response of these technologies in farmers' fields. Large number of demonstration on major and micronutrients has been conducted at farmers' field. Farmers of Uttar Pradesh have adopted the recommendation/technologies for improvement in yield and quality of farm produce.

Sub: Rajya Sabha Question No. 488 for 27.02.2015 regarding fertility of agricultural land by Shri B.K. Hariprasad

Ref. F. No. 5-2/2015 Fert Use dated 23rd Feb. 2015

q) **Whether Government has evaluated the fertility of soil/arable land across the county if so, the norms adopted for the purpose and the extent of micronutrients deficiency noticed in Karnataka, district-wise;**

Reply: Depending upon the size of district, about 100-500 geo-reference based soil samples are collected from each district and analysed for different nutrients. Based on the analysis results the districts/ areas are categorized under different categories like deficient and sufficient etc. So far, we have delineated database of about 200 districts of the country. In addition, nutrient response trials are also conducted for different nutrients in order to verify their deficiency status as noticed from the analysis of soils collected from different districts. The soil and crop specific amelioration strategies for the deficient micro- and secondary nutrients have been developed by the centres of the AICRP-MSN in 16 states. Under AICRP-MSN, 97464 soil samples have been analysed for DTPA-extractable micronutrients and 73630 samples for boron availability as well as 79862 samples for sulphur. The status is given in tables below.

Deficiency status of available (DTPA-extractable) micronutrients and hot water soluble B (HWS-B) in soils of different states of India							
State	**DTPA-extractable micronutrients**					**Hot water soluble B**	
	No. of samples	**Percent samples deficient**				**No. of samples**	**Percent samples deficient**
		Zn	**Fe**	**Cu**	**Mn**		
Andhra Pradesh	6723	22.3	16.8	1.0	1.7	3216	2.8
Assam	5216	25.5	0.0	3.8	0.0	5216	11.9
Bihar	7304	41.4	12.3	1.8	7.8	3597	33.3
Gujarat	5470	23.1	23.9	0.4	6.3	5470	17.9
Haryana	5673	15.3	21.6	5.2	6.1	5673	3.3
Himachal Pradesh	642	1.4	7.8	0.2	22.1	161	8.7
Jharkhand	443	20.3	0.0	0.5	0.0	443	56.0
Madhya Pradesh	7580	61.7	9.6	0.2	1.6	3330	2.4
Maharashtra	8278	54.0	21.5	0.2	3.8	489	54.8
Odisha	2349	22.7	1.8	0.3	1.1	2349	52.5
Punjab	2181	16.6	6.2	3.6	15.2	1083	17.5
Tamil Nadu	31080	65.5	10.6	13.0	7.9	31080	19.9
Telangana	4799	26.9	17.0	1.4	3.8	2776	16.1
Uttar Pradesh	4788	33.1	7.6	6.3	6.5	4323	16.2
Uttarakhand	2575	9.6	1.4	1.4	4.7	2575	7.0
West Bengal	2363	11.9	0.0	1.2	0.9	1849	46.9
All India	**97464**	**43.0**	**12.1**	**5.4**	**5.5**	**73630**	**18.3**

Deficiency status of available Sulphur in soils of different states of India

State	No. of samples	Percent samples deficient
Andhra Pradesh	3216	28.9
Assam	5216	16.7
Bihar	3597	42.8
Gujarat	5470	42.0
Haryana	5673	35.8
Himachal Pradesh	161	0.0
Jharkhand	0	-
Madhya Pradesh	6499	27.7
Maharashtra	8278	26.5
Odisha	2349	31.1
Punjab	300	52.3
Tamil Nadu	28153	14.3
Telangana	2776	31.8
Uttar Pradesh	3950	32.5
Uttarakhand	2375	11.2
West Bengal	1849	37.4
All India	**79862**	**24.7**

AICRP on Long Term Fertilizer Experiments (LTFE) was initiated by ICAR, New Delhi in 1972 to assess the quality and sustainability of soil as influenced by different imbalanced, balanced and integrated nutrient management options over the years. Results from this project proved that balance as well as integrated nutrient management either stabilized or enhanced the crop productivity of different crops. Continuous use of chemical fertilizers in balanced form resulted increase in productivity but also improved soil properties like soil organic carbon, status of water stable aggregate and maintained soil microbial population and enzymatic activities. Combined use of chemical fertilizer and FYM found highly beneficial with maximum attainable crop productivity.

Please see Annexure I (for detail data and interpretation)

ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) Sponsored Project on “GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country”, has completed GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts from geo-referenced soil samples and the digital maps have been uploaded in the ICAR-Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders. With reference to Andhra Pradesh, GPS and GIS based soil fertility maps of six districts, viz., Kurnool, Kadap, Guntur, Anantpur, Krishna, Westgodavari has been prepared and uploaded in the same link.

A stratified complete randon sampling process was followed. Six samples per village based on farmer’s resource with two farmers each from rich, middle income and poor category with the premises that the farmers’ resource base is having direct bearing on use of resources which subsequently results in differences in fertility where more resources are used. The sampling strategy followed in DAC project is taken from the IISS experience with an earlier Institute project conducted at Guna district in the project entitled, “Development of suitable methodology for soil fertility mapping using GIS and GPS tools for precise fertiliser recommendations based on spatial variability" (IISS Project no. 4.1.1).

Extent of micronutrients deficiency noticed in Karnataka, district-wise

District	Zn	Fe	Cu	Mn	B
Mandya	90	0	0	0	51
Ramnagaram	23	0	0	0	48
Banglore Rral	18	0	0	0	77
Chikballapura	57	0	0	0	67
Chitradurga	86	1	0	0	87
Kolar	13	0	0	0	100
Mysore	56	2	0	0	89
Tumkur	88	0	0	0	98
Hassan	68	0	0	0	100

r) the details of the schemes and projects under implementation to check the declining fertility of agricultural land and improve the fertility of soil for increasing agricultural production in the country including Karnataka; and

Reply: Over the years of long term fertilizer experimentation the physical, chemical and biological constraints were identified by evaluating soil quality indices. Based on these observations key factors controlling declining of soil fertility were identified and planned accordingly.

For instance, superimposition of treatments was done by adding FYM, lime and adjustment of doses of nutrient application to arrest the declining productivity. It is noted that superimposition of FYM and lime on imbalance treatment like 100% N and 100% NP did miracle as far as yields are concerned in both the crops. It could be due to supply of nutrients through FYM and increase in availability of native P and K with lime application. Reduction in P dose to half in the plot having high P due to continuous P application in the past did not have any adverse effect on productivity of both the crops. Thus results indicated that application of nutrient in balance form is the best option to get the potential yield.

The Government has taken scores of measures to overcome this problem. Govt. has launched a scheme of providing soil health card to every farmer in a mission mode. Fourteen crore farmers will be covered under the plan during the next three years. Besides, hundred mobile soil testing laboratories will be established during the current financial year.

ICAR - Indian Institute of Soil Science has developed technologies of Integrated Plant Nutrient Supply system. IPNS improves and maintains the soil fertility. Such technology is also demonstrated in farmers' fields.

There are about 100 institutions of ICAR apart from 69 State Agricultural Universities, 2 Central Agricultural Universities and 641 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xxviii) ICAR – Indian Institute of Soil and Water Conservation, Dehradun

xxix) ICAR - Central Soil Salinity Research Institute, Karnal

xxx) ICAR - Indian Institute of Soil Science, Bhopal

xxxi) ICAR - National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Coordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice (kg grain/kg nutrient)**	**STCR- IPNS recommended practice (kg grain/kg nutrient)**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Also AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Tribal Sub Plan (TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

s) the success achieved there under during the current year?

Reply:During recent yearssuperimposition of treatments with FYM, lime and nutrient application gave many fold increase in yield of finger millet and maize when there was imbalance nutrient application (100% N and 100% NP). The addition of FYM, lime also improved soil fertility as well (Table 2)

Table 1 Grain yield (kg ha^{-1}) of finger millet and maize in superimposition treatments at GKVK Bangalore (Karnataka) (2011-12)

Treatments	Finger millet	Maize
150% NPK	3612	5142
150% NPK, 5 t ha^{-1} FYM	3847	6025
150% NPK, 10 t ha^{-1} FYM	4047	6549
100% NPK	3199	4476
100% N, 50% P, 100% K, FYM	3319	5439
100% N, 50% P, 100% K, FYM, lime	3570	6040
100% NP	949	1926
100% N, 50% P, 100% K, FYM	2693	4561
100% N, 50% P, 100% K, FYM, lime	3016	5549
100% N	927	1355
100% NPK, FYM	2769	3964
100% NPK, FYM, lime	3158	4510

Perusal of data (Table 2) revealed that application of both FYM and lime resulted in improvement of soil properties and moderated soil condition. Data further indicated that little increase in soil organic carbon (SOC) on balanced application of nutrient. However, application of FYM and lime did not show any additional favorable effect on SOC. This is probably due to loss of carbon through respiration due to increase in activity of microbes due to improvement in soil environment. Soil amendment with lime or addition of FYM significantly improved the micronutrient status of soils (Table 3).

Table 2 Soil properties after harvest of maize in super imposed treatments (2011 -12) at Bangalore (Karnataka)

Treatments	pH	EC dSm^{-1}	OC (gkg^{-1})	Av. N (kg/ ha)	Av. P (kg/ ha)	Av. K (kg/ ha)	Av. S (kg/ ha)
T_3 (Imposed in 2005-06)							

150% NPK	5.15	0.14	5.35	366.50	121.88	209.20	83.50
150% NPK, 5t/ha FYM	5.30	0.13	5.49	398.05	132.38	210.85	108.50
150% NPK, 10t/ha FYM	6.09	0.11	5.43	398.50	132.23	211.00	123.00
T_4(Imposed in 2002-03)							
100% NPK	6.16	0.12	5.02	394.00	75.92	151.10	82.00
100% N+50%P+100K, FYM	6.16	0.11	5.26	418.50	88.25	167.50	88.25
100% N+50%P+100K, FYM, lime	6.18	0.16	5.27	395.00	94.26	172.50	84.25
T_6(Imposed in 2002-03)							
100% NP	5.02	0.11	4.97	296.10	81.50	62.75	79.50
100% N+50%P+100K, FYM	5.34	0.14	5.27	320.25	85.10	113.15	87.00
100% N+50%P+100K, FYM, lime	5.55	0.15	5.29	331.30	98.34	114.00	96.00
T_7(Imposed in 2002-03)							
100% N	5.22	0.12	5.10	290.65	49.60	58.00	61.00
100% NPK, FYM	5.75	0.10	5.26	314.50	114.00	104.75	65.50
100% NPK, FYM, lime	5.77	0.08	5.33	292.27	128.95	109.00	73.00
LSD ($P \leq 0.05$)	0.20	0.030	0.10	4.53	3.87	3.47	3.45

Table 3 Soil properties after harvest of maize in super imposed treatments (2011 -12) at Bangalore (Karnataka)

Treatments	Fe (mg/kg)	Mn (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
T_3 (Imposed in 2005-06)				
150% NPK	34.25	62.00	2.45	2.25
150% NPK, 5 t/ha FYM	35.50	64.00	3.00	2.25
150% NPK, 10 t/ha FYM	38.50	66.50	3.95	2.40
T_4 (Imposed in 2002-03)				
100% NPK	25.95	56.07	2.05	2.55
100% N+50% P+100K, FYM	31.05	62.00	2.15	2.55
100% N+50% P+100K, FYM, lime	36.35	64.00	3.25	2.70
T_6 (Imposed in 2002-03)				
100% NP	29.55	55.00	2.70	2.15
100% N+50% P+100K, FYM	32.90	56.00	3.75	2.45
100% N+50% P+100K, FYM, lime	34.45	64.50	3.90	3.10
T_7 (Imposed in 2002-03)				

100% N	28.75	63.50	2.16	2.10
100% NPK, FYM	31.70	65.00	2.85	3.40
100% NPK, FYM, lime	32.05	69.50	3.70	3.45
LSD ($P \leq 0.05$)	3.31	3.58	0.083	0.036

Sub: Rajya Sabha Provisional Admitted Question Dy. No. U 197, S 220 due for answer on 24/04/2015 regarding loss in fertility of Soil by Shri Darshan Singh Yadav ji.

Ref. File No. NRM/1/10/2015-SW&DF dated 17 April 2015

(d) Whether Government has conducted any study/survey to identify the extent of loss of fertility of soil/damage to agriculture land across the country including coastal areas;

Yes, please.

(e) If so, the details and outcome thereof;

ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) Sponsored Project on "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country", has completed GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts from geo-referenced soil samples and the digital maps have been uploaded in the ICAR-Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders.

The Government has taken scores of measures to overcome this problem. Govt. has launched a scheme of providing soil health card to every farmer in a mission mode. Fourteen crore farmers will be covered under the plan during the next three years. Besides, hundred mobile soil testing laboratories will be established during the current financial year.

ICAR - Indian Institute of Soil Science has developed technologies of Integrated Plant Nutrient Supply system. IPNS improves and maintains the soil fertility. Such technology is also demonstrated in farmers' fields.

There are about 100 institutions of ICAR apart from 69 State Agricultural Universities, 2 Central Agricultural Universities and 641 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xxxii) ICAR – Indian Institute of Soil and Water Conservation, Dehradun

xxxiii) ICAR - Central Soil Salinity Research Institute, Karnal

xxxiv) ICAR - Indian Institute of Soil Science, Bhopal

xxxv) ICAR - National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Coordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice (kg grain/kg nutrient)**	**STCR- IPNS recommended practice (kg grain/kg nutrient)**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Also AICRP (STCR) has undertaken large number of demonstrations and field day–cum–capacity building programmes under Tribal Sub Plan (TSP) to promote balanced use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

(f) The details of the cultivable area affected due to salinity in the country including coastal areas and Vildarbha region of Maharashtra during each of the last three years and the current year, State-wise; and

ICAR-CSSRI, Karnal is the lead Institute for this aspect.

(g) The programme Government has launched for reclamation and development of such land and to improve the fertility of soil in the country.

ICAR-CSSRI, Karnal is the lead Institute for this aspect.

Sub: **Lok Sabha Question No. 5477 for 03.03.2015 regarding Manure from organic waste by Shri Subhash Bhamre**

Ref. **F. No. NRM/2/5/2014 dated 23rd Feb. 2015**

~~t)~~ **Whether the Government conducting any research for developing manure for crops from organic waste;**

Reply: Yes, at IISS, has developed technologies to prepare various types of organic manures from organic wastes such as crop residues, agro based industrial waste, city garbage and forest litter have wide C/N ratios ranging from 80 to 110, and low concentration of available plant nutrients particularly N, P and K.

u) **if so, the details thereof;**

Reply: The following composting technologies have been developed for various types oforganic wastes to prepare organic manures

i) Technology for Enriched Compost Production

Most of the Indian soils are deficient in Phosphorus. Also, yearly removal of P is more than its addition through P fertilizers during continuous and intensive cropping. Bio-solids produced in cities, agro-industries and at farms normally have low nutrient value, particularly of P content. The traditional technology of composting, if improved in terms of nutrients content, may help in arresting trends of nutrient depletion to a greater extent. Further, the uses of mineral additives such as rock phosphate and pyrites during composting have been found beneficial. A phosphocompost production technology has, thus, been developed using phosphate solubilizing microorganisms, namely, *Aspergillus awamori*, *Pseudomonas straita* and *Bacillus megaterium*; phosphate rock, pyrite and bio-solids to increase the manurial value as compared to ordinary FYM and compost.

Raw material used

For the production of one tonne of phosphocompost, materials such as 1900 kg organic/ vegetable wastes/straw, 200 kg cow-dung (dry weight basis) and 250 kg phosphate rock (18% P_2O_5) are used.

Methods

- Prepare a base of the heap out of hard, woody materials such as sticks, bamboo sticks etc. This base should be 15 cm thick and 3 m width and 3 m length depending upon the quantity of materials to be composted.
- Place bio-solids over the base made above. The layer should be around 30 cm $\pm$ 10 cm thick.
- Sprinkle slurry prepared by mixing cow dung and rock phosphate over the crop residues to moisten the material.
- Make another layer of crop residue and moisten it with slurry.

- Continue with alternate layer of crop residue (30 cm) and slurry until the heap is 1.5 m height. Reduce the area of each layer so that the heap tapers by about 0.5 m high.

- Cover the heap with soil or polythene and mix the material after 15 days. Give two turnings after 30 & 45 days. Add water at each turning to maintain the moisture content to about 60-70%.

- The compost becomes ready for field application within 90-100 days period.

ii)Technology for Recycling of Organic Wastes through Vermicomposting:

Vermicomposting is a method of composting with worms and differs from conventional composting in several ways. In vermicomposting, there is a saving of nearly two months in composting time as compared to conventional compost. Vermicompost is rich in nutrients, microbial activity and enzymes.**T**here are two methods of vermicomposting under field conditions.

1. Vermicomposting of wastes in field pits 2. Vermicomposting of wastes on Heaps

Materials Required for Vermicomposting

- Farm wastes (straw from wheat, soybean, chickpea, mustard etc.) were used for vermicomposting.

- Fresh cow dung.

- Rock phosphate (Jhabua RP 30-32% P_2O_5).

(Note: In the case when vermicompost is to be prepared by P-enrichment technique)

- Wastes: dung ratio (1:1 on dry weight basis).

- Earthworm: 1000-1200 adult worms (about 1 kg per quintal of waste material).

- Water: 3-5 liters / week per heap or pit.

Vermicomopost Preparation under Tree shade by Pit and Heap Methods

Open permanent pits of 10 feet length 3 feet width and 2 feet deep were constructed under the tree shade, which was about 2 feet above ground to avoid entry of rainwater into the pits Brick walls were constructed above the pit floor and perforated into 10 cm diameter 5-6 holes in the pit wall for aeration. The holes in the wall were blocked with nylon screen (100 mesh) so that earthworms may not escape from the pits. Partially decomposed dung (dung about 2 months old) was spread on the bottom of the pits to a thickness of about 3-4cm. This was followed by addition of layer of litter/residue and dung in the ratio of 1:1 (w/w). A second layer of dung was then applied followed by another layer of litter/crop residue in the same ratio up to a height of 2 feet. Two species of epigeicearthworms viz., *Eiseniafoetida* and *Perionyxexcavatus* were inoculated in the pit. Moisture content was maintained at 60-70% throughout the decomposition period. Jute bags (gunny bags) were spread uniformly on the surface of the materials to facilitate maintenance of suitable moisture regime and temperature conditions. Watering by sprinkler was often done. The material was allowed to decompose for 15-20 days to stabilize the temperature because to reach the mesophilic stage, the process has to pass the thermophilic stage, which comes in about 3 weeks. Earthworms were inoculated in the pit or heap with 10 adult earthworms per kg of waste material and a total of 500 worms were added to each pit or heap. The materials were allowed to decompose for 110 days. The forest litter was decomposed much earlier (75 to 85 days) than farm residue (110-115 days).

In the heap method the waste materials and partially decomposed dung (1:1 w/w) are made in heaps of dimension; 10 feet length x 3 feet width x 2 feet high and during inoculation channels are made by hand and earthworm @ 1 kg per quintal of waste are inoculated and then watering is done by sprinkler method. Jute cloth pieces are used as covering material.

P-enriched Vermicompost by Pit and Heap Methods

In the case of phosphorus-enriched vermicompost, Jhabua rock phosphate (30-32% P_2O_5) is used @ 2.5% P_2O_5 of waste material with the same dimension of pit or heap as mentioned earlier.

iii) Technology for Phospho-Sulpho-Nitro Compost Production

In this method, use of suitable minerals, fertilizers and microbial cultures to fortify the compost so that the end product contains more nutrients per unit volume or weight. It also makes use of compost accelerating culture and biofertilisers for further nutrient enrichment. This reduced the bulk which has to be transported and applied per unit of nutrients delivered. In this respect, this method employs both the fortification and the acceleration strategy. Like conventional compost, PSNC can be prepared by the heap or pit method for which a bright sunny site is selected. For the heap method, the floor should be temporarily cemented about 1.5 feet above the floor so that nutrients will not leak in to the soil. About 1000 kg of wastes can be accommodated in a 12′ x 7.5′ x 3.5′ (Lx Wx H) heap.

Method of preparation: 30 kg of wastes (dry wt .basis) are spread on the floor followed by 30 kg of cow dung (fresh cow dung), 660 g urea (0.5 % N basis) is then added. For this, dissolve urea 20 liter water and spray a part of solution of urea over the layer. 17 kg Mussouri rock phosphate or MRP (5% P_2O_5 basis) is spread over the layer. As MRP not now mined, another suitable rock phosphate can be used. Then 6 kg of pyrites (22% S content) is added at the rate of 10 % on materials dry weight basis. A portion of finely powdered soil is then spread at the rate of 5% on materials dry weight basis. Water is sprayed over the layer to attain 60-70 % moisture. All above steps are repeated in the stated sequence until the heap is 3-4 feet high.

To accelerate the decomposition process, fungal culture is added at the rate of 500 g mycelial mat/tonne of material where as bacterial culture having 10^8 viable cells/ml is added (50 ml/kg of material). To further accelerate the process, the multi-bio-inoculum containing cellulose decomposers (*Paecilomycesfusisporus* and *Aspergillusawamori*), P-solubilizers (*Bacillus polymyxa* and *Pseudomonas striata*) and N-fixer (*Azotobacter chroococcum*) etc. were added 5 and 30 days of decomposition @ 500 g mycelial mat/1000 kg material on dry weight basis. After 3-4 weeks of decomposition, the first turning is done which is followed by a second turning two weeks later. Moisture is to be maintained at 60-70% of materials on dry weight basis.Finally, the upper side and all boundaries of the heap are covered with cow dung slurry to maintain optimum moisture content inside the heap. To avoid rain, wind, and to maintain the moisture and temperature the heap should be covered with a polythene sheet.

iv) Microbially Enriched Compost production technology

Method of preparation:

This methodology was developed at Indian Institute of Soil Science. Compost was prepared by pit method. The pit should be concrete so that the nutrients may not percolate in to the soil. About 2000 kg of wastes can be accommodated for decomposition in a pit (10 ft length x 5 ft width and 3 ft deep) method.Waste materials (segregated material is preferable), Fresh cow dung, urea, water, bioinoculum and polythene sheets.200 kg of fresh waste is spread on the floor followed by 40 kg of fresh cow dung (on dry weight basis). 2.64 kg urea (0.5 % N basis) is dissolved in 20 liter water and is sprayed over the layer. Bioinoculum is added in the form of slurry on the layer (8 layers). These steps are repeated till the heap attains 3-4 feet high. Fungal culture is added at 500 g mycelial mat/tonne of material. Initially, at 1-5 days, bioinoculum such as *Aspergillusheteromorphus, Aspergillusterrus, Aspergillusflavus* and *Rhizomucorpusillus* is added and owing to a high initial temperature (55 to 70^0C) at the thermophilic stage, the bioinoculum is again added after 30 days of decomposition.Finally, the upper side of the pit is covered with cow dung slurry. To avoid rain, wind, and to maintain the moisture and temperature, one-polythene sheet must be used to cover the heap. After 3-4 weeks of decomposition, the first tuning of heap must be done. Maintain the moisture content at 60-70% of materials on dry weight basis.Compost will be ready after 2.5 months. For 1000 kg microbial enriched compost production, the total quantity of fresh waste material, cow dung, urea required will be 1600, 320 and 21 kg, respectively .

(c) the details of research bodies involved in such research;

Reply: Natural Management division of Indian council of Agricultural Research is the apex body conducting this type of research. Institutes such as Indian Institute of Soil Science, Indian Institute of Framing System Research are actively involved in the technology generation.

(d) the comparative cost of producing such manure against the chemical fertilizers; and

Reply:Compost price calculation:

For 100 kg phospho-sulpho-nitro compost cost is Rs. 300=00 (Rs.3/kg)

Equivalent to 2.2 kg urea (1% N content in enriched compost), 50 kg SSP (8% P2O5 content in enriched compost) and 1 kg MP (0.8 % K2O in enriched compost) . The total cost of chemical fertilizer is (urea 2.2 kg + SSP 50 kg +1 kg MP) Rs. 362.00.

So we may save Rs. 62 / 100 kg of enriched compost.

(e) the effective steps taken/proposed to be taken by the Government to produce manure from organic waste?

Reply:Different efficient waste recycling composting techniques have been disseminated to the field through demonstration on farmers fields, technology exhibition in farmers fair and also trained the farmers on various composting techniques in the institute. Farmers from different states viz; Bihar (Gaya, Banka, Madhepura, Supoul, Katihar, Shekhpura, Areriya, PaschimChamparan and Jamuidistt of Bihar) and Madhya Pradesh (Indore, Dewas, Raisen, Vidisha, Sehore, Hoshangabad and Bhopal distt. of Madhya Pradesh) under ATMA Project. In each district 25 progressive farmers participated in the training for 6 days. Apart from this, documentary video film on organic farming for profitability and sustainability and vermicomposting for biofertilization has been made in English, Hindi and Telgu languages of 15 minutes duration each and submitted to ICAR for telecast on Doordarshankrishi Channel.

Sub: Lok Sabha Provisional Admitted Question Dy. No. 28563 answered on 05/05/2015 tabled by Shri Ram Kumar Sharma regarding “Manure prepared from human – reg.

(h) Whether the requirement of fertilizers can be met with the manure prepared with human excreta in a traditional manner in the country;

Yes, please.

(i) If so, the reaction of the Government thereto;

ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) Sponsored Project on “GPS and GIS Based Soil Fertility Maps for Precise Fertilizer

(j) Whether the quantity of human excreta has been access to be received from old and new toilets under Swachhata Abhiyan in the country and

ICAR-CSSRI, Karnal is the lead Institute for this aspect.

(k) If so the total quantity of human excreta likely to be available under Swachhata Abhiyan and the quantity of fertilizer to be produced therefrom.

ICAR-CSSRI, Karnal is the lead Institute for this aspect.

Sub: Lok Sabha Question No. 1322 regarding neem coated urea

- Research on NCU has been carried out by many institutions. At IARI, the neem coated urea application to rice improved the grain yield by 6.3 to 11.9%
- Similarly, National Fertilizer Limited has report 6-11% increase in yield of crops based on 200-250 frontline demonstrations on different crops and locations.
- The improvement in yield is obviously due to reduction in losses of N from urea and the increased use efficiency than prilled urea and thereby it economizes the use of urea.

References:

Ten year achievements of IARI, New Delhi (online)
http://www.iari.res.in/?option=com_content&view=article&id=644&Itemid=1614

Singh, S. and Shivay, Y.S. (2003) Coating of prilled urea formulations for efficient nitrogen use in hybrid rice. *Acta agronomica hungarica*, 51 :53-59.

R. Prasad, S. Singh, V. S. Saxena, C. Devkumar (1999) Coating of Prilled Urea with Neem (Azadirachta Indica Juss) Oil for Efficient Nitrogen Use in Rice.*Naturwissenschaften*. November 1999, Volume 86, Issue 11, pp 538-539

Sub.: Lok Sabha Question No. 1313 due for answer on 28.07.2015 raised by Sh. Subhash Chandra Baheria, MPs (LS) regarding Production of Fertilizer/Manure -Reg.

a. the details of the quantum of manure produced in various States of the country including Rajasthan;

The detail of state wise production of manures produced in the country is given below.

STATE-WISE PRODUCTION OF URBAN AND RURAL COMPOST (2011-12)					
Sl. State/UTs	**Production (lakh tonnes)**				
No.	**Rural compost**	**Urban compost**	**FYM**	**Vermi**	**Other manures**
1 Andhra Pradesh	48.00	0.11	25.00	1.20	-
2 Arunachal Pradesh	0.005	-	0.002	0.0053	_
3 Assam	0.95	0.55	_	1.35	_
4 Bihar	16.50	2.75	45.00	2.00	_
5 Chhattisgarh	80.30	3.15	36.00	2.00	5.00
6 Goa	1.57	0.02	_	0.015	0.007
7 Gujarat	_	_	358.00	0.50	5.00
8 Haryana	10.05		7.85	0.50	-
9 Himachal Pradesh	23.00	0.05	12.00	5.50	_
10 Jammu & Kashmir	12.35	0.13	9.603	0.008	0.0761
11 Jharkhand	6.41	0.80	15.41	209.94	0.49
12 Karnataka	256.33	98.22	625.40	5.88	16.58
13 Kerala	0.45	0.60	75.00	0.15	4.02
1 4 Madhya Pradesh	45.00	3.50	85.50	2.00	-
15 Maharashtra	-	-	-	0.17	0.65
16 Manipur	-	-	0.50	-	-
17 Mizoram	-	-	0.045	0.036	-
18 Meghalaya	_	-	0.004	10.57	-
19 Nagaland	0.06	-	-	0.0125	-
20 Odisha $	10.77	0.081	_	0.33	0.04
21 Punjab	307.50	0.08	-	0.60	-
22 Rajasthan	**19.752**	**15.06**	**252.54**	**0.036**	-
23 Sikkim	0.005	-	-	0.0008	-
24 Tamil Nadu	5.02	0.56	1.29	1.48	-
25 Uttar Pradesh	7.93	7.50	275.00	2.306	-
26 Uttarakhand	9.20	0.40	-	0.470	0.57
Total	939.85	140.86	1860.64	268.51	35.43
Source: 1. Ministry of Agriculture, GOI, New Delhi. 2. Annual Report 2011-12, National Project on Organic Farming.					

b. whether the country is self reliant in the production of quality manure and is fully able to cater to the demand of the domestic market;

No, it was observed that 2/3 part of crop residues are being used for cattle feed, burning and other purpose. Only $1/3^{rd}$ of crop residues are being used for composting. Similarly $2/3^{rd}$ part of manure is being used for fuel cake and less than $1/3^{rd}$ cattle dung is being used for manure. Therefore, the availability of crop residues or waste is very less.

c. if so, the details thereof; and

Not Applicable

d. the steps taken by the Government to increase the domestic production of manure and deal with the problem of shortage of supply of manure reported from various States of the country including Rajasthan during the last year?

ICAR-Indian Institute of Soil Science has initiated to recycle domestic wastes such as vegetable waste and kitchen in small scale at Institute level. However, upscaling of such technology is required for further improvement

Sub: Lok Sabha D. No. 6177 due for answer on 28.07.2015 raised by Shri P. P. Sundaram regarding Quality of Soils – reg.

(a) The main classification of soil in the country

The soils in India have been classified by NBSSLU&P. The soils mainly belong to Inceptisols, Alfisols, Vertisols, Entisols, Mollisols, Ultisols etc. of which the first three orders occupy the maximum area in the country.

(b) the State/UTs where the soil is malnourished and lacks vital nutrients;

The soils in most of the state requires some amount of fertilizers as the continuous cropping without fertilizer additions does not sustain the crop yields. It is even required for soils having normal status of nutrients and health as well. In most the states the soils have been under the crops since generations and hence need external nutrient supplies.

GPS & GIS based soil fertility maps of 171 districts comprising of primary, secondary and micronutrients have been done through a DAC Sponsored project entitled, "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for farmers of the country". The same has been uploaded in Institute website under the link: http://www.iiss.nic.in/districtmap.htmlfor the benefit of stakeholders.

(c) the schemes being run to replenish the soil in these States/UTs;

The Government has launched a scheme of providing soil health card to every farmer in a mission mode which will also help in identifying the areas where the soil has been malnourished and lacks vital nutrients. Fourteen crore farmers will be covered under the plan during the next three years.

(d) the agriculture Research Institute/Universities engaged in monitoring the health of soil in the country; and

There are about 99 institutions of ICAR apart from 53 State Agricultural Universities and about 638 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

- Central Soil and Water Conservation Research and Training Institute, Dehradun
- Central Soil Salinity Research Institute, Karnal
- Indian Institute of Soil Science, Bhopal
- National Bureau of Soil Survey and Land Use Planning, Nagpur

(e) the notable achievements made by the universities and institutes in replenishing the health of soil during the last three years and the current year?

The AICRPs located at the IISS, have developed site specific nutrient management strategies to replenish the health of soil in different agro-eco-regions of the country on various cropping systems. The information is also available at institute website.

Sub.: **Lok Sabha Question Diary No. 10399 due for answer on 11/08/2015 regarding Research on Bio/Organic Fertilizer raised by Shri K. Parasuraman – reg.**

Ref.: **File No. NRM/1/10/2015-SW&DF dated 04 August 2015**

(a) **Whether the Government proposes to send our scientists to foreign countries to study and research of bio/organic fertilizers so as to improve the quality as well as the quantity of the bio-fertilizer production in the country;**

Information not available

(b) **if so, the details thereof;**

NA

(c) **Whether the Government has also initiated any action to encourage research activities for development of organic farming in the country; and**

Yes.

(d) **if so, the details thereof along with the actions taken by the Government to reduce use of chemical fertilizers and bring larger areas of land under bio/organic fertilizers in the country?**

The Government of India has launched the National Programme for Organic Production (NPOP) in the year 2001**.** During 2004, Government of India has initiated a National Network Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and Indian Institute of Soil Science (IISS) as one among the 13 coordinating centers with the objective of encouraging the use of organic manures for boosting agricultural production in the country. Thirteen coordinating centers spread across the country have developed organic package of practices for various crops using organic manures available in each state. These practices are communicated to the farming community through print media as well as farmers training at various institutes. The different research experiments which are going on in various states Uttar Pradesh, Madhya Pradesh, Rajasthan, Karnataka, Himachal Pradesh, Jharkhand, Uttrakhand, Sikkim and Chhattisgarh etc. of India are as follows.

Exp. I: Evaluation of organic, inorganic and integrated production systems

Exp.II: Evaluation of response of different varieties of major crops for organic farming

Exp. III: Evaluation of bio-intensive complimentary cropping systems under organic production systems

Exp. IV: Development of Integrated Organic Farming System Models

Exp.V: Evaluation of farm waste recycling techniques for organic farming

Besides, in AICRP-LTFE, an organic treatment have been introduced at Akola, (Maharastra), IARI, (Delhi), Parbhani, (Maharastra), Udaipur (Rajasthan) Jagtial (Andhra Pradesh), Pattambi (Kerala) to study the impact on soil heath and productivity of crop. At two centers green manuring has been introduced to supplement nutrient. It was observed that 30 to 50 percent nitrogen can be supplemented through green manuring in rice-wheat (Raipur) and rice-rice (Pattambhi, Kerala). On the basis of results, demonstrations are being conducted at farmer's field to show the farmers of that region (Kerala and Chhattisgarh)

At IISS Bhopal, efficient waste recycling composting techniques have been disseminated to the field through demonstration on farmer's fields, technology exhibition in farmers fair and also trained the farmers on various composting techniques in the institute. Apart from this, documentary video film on organic farming for profitability and sustainability and vermicomposting for bio-fertilization has been made in English, Hindi and Telugu languages of 15 minutes duration for telecasting on Doordarshan Krishi Channel. In addition, different State Government provides incentives for production of different organic manure from organic wastes like vermicompost, phosphocompost and NADEP compost etc. State wise Organic farming area is given below;

State wise Organic Farming Area in 2013-14 (APEDA 2013-14)

S.No.	State Name	Organic Area (in Ha)	S.No.	State Name	Organic Area (in Ha)
1	Andaman & Nicobar Islands	321.28	17	Madhya Pradesh	232887.36
2	Andhra Pradesh	12325.03	18	Maharashtra	85536.66
3	Arunachal Pradesh	71.49	19	Manipur	0
4	Assam	2828.26	20	Meghalaya	373.13
5	Bihar	180.60	21	Mizoram	0
6	Chhattisgarh	4113.25	22	Nagaland	5168.16
7	Delhi	0.83	23	Odisha	49813.51
8	Goa	12853.94	24	Pondicherry	2.84
9	Gujarat	46863.89	25	Punjab	1534.39
10	Haryana	3835.78	26	Rajasthan	66020.35
11	Himachal Pradesh	4686.05	27	Sikkim	60843.51
12	Jammu & Kashmir	10035.38	28	Tamil Nadu	3640.07
13	Jharkhand	762.30	29	Tripura	203.56
14	Karnataka	30716.21	30	Uttar Pradesh	44670.10
15	Kerala	15020.23	31	Uttaranchal	24739.46
16	Lakshadweep	895.91	32	West Bengal	2095.51
Total					**723039.00**

- Cultivated area under certified organic farming has grown almost 17 fold in last one decade (42,000 ha in 2003-04 to 7.23 lakh ha in 2013-14).

Subject: Lok Sabha question Dy. No. 51 sitting on the 24/02/2015 regarding research on crops

Reference: No. 21 dated 13th February, 2015

(a) Whether the government have launched a campaign called "Grow Safe Food" in the country;

No such campaign is being undertaken at IISS, Bhopal

(b) the salient features of the campaign;

NA

(c) The research institutes involved in this campaign along with flats allocated to them;
NA

(d) Whether the campaign has been successful; and

NA

(e) if so, the number of crops grown under the campaign?
NA

Sub: **Rajya Sabha Starred/Unstarred question S4793/S1527 on Yogic Farming by Shri Palvai Govardhan Reddy**

Ref. **Dy. No. 37 dated 8th Dec. 2015**

a) **What is Yogic farming?**

The institute has worked on organic farming but not on yogic farming.

b) **Whether it is a fact that Government is pushing Yogic farming in the country if so, the details thereof, and**

The institute does not have any expertise on yogic farming.

c) **The scientific justification that yogic farming will increase productivity of land?**

The institute has not carried out any research on yogic farming.

Sub: Lok Sabha Question No 775 for 24.02.2015 regarding Skill development & training to farmers by Shri Sharad Tripathi, Shri Om Birla and Shri Sumedhanand Saraswati

Ref. Letter No.11-7/2015-edn.Tech dated 19th February 2015

~~v)~~ **The details of the schemes/programmes being run by the Government for Skill Development and training of farmers in agriculture and allied sectors:**

Reply: IISS has given farmers training under "ATMA" programme sponsored by different states like Bihar and Madhya Pradesh during 2014 and 2015. About 125 farmers took training on organic farming and use of compost in agriculture. They learned about compost making process and benefit of organics in agriculture.Skill development & trainings on 'Balanced and integrated nutrient management in crops for sustainable productivity and improving soil health' were carried out to improve skill of the farmers and extension worker in different parts of the country through 17 centres of AICRP on Long Term Fertilizer Experiments.

w) **The number of farmers who have been trained through these schemes/programmes and the extent to which have been benefitted;**

Reply:Around 8546 farmers were trained during 2011-14 under AICRP LTFE including TSP in different states through cooperative centres. Due to intervention by the scientist in terms of balanced and integrated nutrient management in crops, increase in average crop yield was to the extent of 15–45% in different states.

x) **Whether the Government has earmarked any funds for this purpose under various schemes;**

Reply: Yes. The funds were allocated for conducting demonstration on farmers' field including Satellite Experiments and TSP by ICAR. The year wise details are given in the attached proforma.

y) if so, the details of funds earmarked and expenditure incurred for this purpose during each of the last three years and current year, State/UT-wise including Rajasthan; and

Reply:

1) The expenditure details under AICRP (LTFE) scheme is as follows (details on budget allocation, expenditure and physical achievements are given in Annexure 1)

Year :	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**Total**
Expenditure (Rs in lakh)	**16.0**	**31.0**	**57.8**	**33.4**	**138.2**

2) The expenditure details under various other schemes

S. No.	Name of Scheme	Skill training component for farmers	State/ UTs including Rajasthan	Fund allotted & Expenditure (Rs. in lakh)												Gross total (Rs. in lakh)		
				2011-12			2012-13			2013-14			2014-15 (Till date)					
				A	E	P	A	E	P	A	E	P	A	E	P	A	E	P
1	Farmers welfare & Agri. Development Dept., Raisen	Soil Health Management	M.P.	0.92	0.92	30	0.75	0.75	25	0	0	0	0	0	0	1.67	1.67	55
2	Integrated watershed management project III, Khandawa	Soil Health Management	M.P.	0	0	0	0.9	0.9	50	0	0	0	0	0	0	0.9	0.9	50
3	PD, Agricultural technology management agency,)Sehore, Guna and Shivpuri)	Soil Health Management	M.P.	0	0	0	0	0					1.36	1.36	67	1.36	1.36	67
4	PD, ATMA, East Champaran	Soil Health Management	Bihar	0.75	0.75	0	0.9	0.9	0	0	0	0	1.06	1.06	25	2.71	2.71	25
Total				1.67	1.67	30	2.55	2.55	75	0	0	0	2.42	2.42	92	6.64	6.64	197

The farmers were trained for the technologies generated by the institute on soil health management related aspect.

z) The details of the success achieved under these schemes/programmes and the efforts made by the Govt. to ensure that the innovative research reach to the farmers?

Reply: The technologies on balanced and integrated nutrient management were demonstrated to the farmers including tribal farmers through Satellite Experiments, Front Line Demonstrations, Farmers Fair, Exhibition etc. The farmers are adopting the agricultural technologies and they are getting 15-45 percent higher crop yield compared to the farmers' practice. Demonstrations were conducted for various major crops like rice, wheat, soybean, maize, finger millet, groundnut, sorghum, safflower, etc in the tribal area as well as general farmers field of various states namely, Madhya Pradesh, Himachal Pradesh, Chhattisgarh, Rajasthan, Jharkhand, Andhra Pradesh, Tamil Nadu, Karnataka, Odisha, Punjab, Uttarakhand, Kerala, Gujarat, Rajasthan, Maharashtra, New Delhi and West Bengal etc.

Annexure 1

DIVISION: AICRP on Long Term Fertilizer Experiment (LTFE), IISS, Bhopal

(a) Details of the Schems/ Programmes being run by the Government for Skill development & Training of Farmers in Agriculture & Allied sectors.

(b, c & d) Number of farmers who have been trained through these schemes/programmes & funds earmarked, utilized & persons benefitted States/Uts wise including Rajasthan for the purpose under various schemes.

A= Allocation of Funds, E = Expenditure of Funds & P = Physical Achievements (No. of Farmers Trained)

S. No.	Name of Scheme	Skill Training component for farmers	States/UTs including Rajasthan		Fund Allotted & Expenditure (Rs. in Lakh)												Gross Total (Rs. in Lakh)		
					2011-12			2012-13			2013-14			2014-15 (Till date)					
			State/ UT	LTFE Center	A	E	P	A	E	P	A	E	P	A	E	P	A	E	P
1	AICRP LTFE	'Balance and integrated nutrient management in crops for sustainable productivity and improving soil health'	Karnataka	UAS, Bangalore	1.0	1.0	20	1.0	1.0	30	0.5	0.5	12	3.0	3.0	107	5.5	5.5	169
2			Odisha	OUAT, Odisha	1.0	1.0	22	3.0	3.0	100	4.0	4.0	246	2.0	2.0	92	10.0	10.0	460
3			Tamil Nadu	TNAU, Coimbatore	1.0	1.0	21	1.0	1.0	40	0.7	0.7	44	1.0	1.0	32	3.7	3.7	137
4			Andhra Pradesh	APAU, Hyderabad	1.0	1.0	14	1.0	1.0	20	0.7	0.7	56	1.0	1.0	27	3.7	3.7	117
5			Madhya Pradesh	JNKVV, Jabalpur	1.0	1.0	30	3.0	3.0	160	8.0	8.0	426	4.0	4.0	401	16.0	16.0	1017
6			Punjab	PAU, Ludhiana	1.0	1.0	32	1.0	1.0	36	0.6	0.6	52	1.0	1.0	59	3.6	3.6	179
7			Himachal Pradesh	HPKV, Palampur	1.0	1.0	40	3.0	3.0	260	8.0	8.0	541	3.0	3.0	271	15.0	15.0	1112
8			Jharakhand	BAU, Ranchi	1.0	1.0	60	3.0	3.0	186	9.0	9.0	536	4.0	4.0	650	17.0	17.0	1432
9			Uttarakhand	GBPUAT, Pantnagar	1.0	1.0	70	1.0	1.0	37	0.5	0.5	42	1.0	1.0	45	3.5	3.5	194
10			Kerla	KAU, Vellanikkara	1.0	1.0	40	1.0	1.0	42	0.6	0.6	27	1.0	1.0	52	3.6	3.6	161
11			Gujarat	GAU, Junagarh	1.0	1.0	32	1.0	1.0	34	0.7	0.7	66	1.0	1.0	61	3.7	3.7	193
12			Rajasthan	RAU, Udaipur	1.0	1.0	26	3.0	3.0	87	7.0	7.0	666	1.0	1.0	72	12.0	12.0	851
13			Maharashtra	MAU, Parbhani	1.0	1.0	40	1.0	1.0	42	7.0	7.0	371	1.0	1.0	20	10.0	10.0	473
14			Maharashtra	PDKV, Akola	1.0	1.0	36	1.0	1.0	25	0.5	0.5	47	4.0	4.0	102	6.5	6.5	210
15			Chhattisgharh	IGKVV, Raipur	1.0	1.0	60	5.0	5.0	1047	9.0	9.0	303	4.0	4.0	210	19.0	19.0	1620
16			New Delhi	IARI, New Delhi	0.5	0.5	10	1.0	1.0	13	0.5	0.5	29	0.7	0.7	57	2.7	2.7	109
17			West Bengal	CRIJAF, Barrackpore	0.5	0.5	14	1.0	1.0	20	0.5	0.5	31	0.7	0.7	47	2.7	2.7	112
				Total	16.0	16.0	567.0	31.0	31.0	2179	57.8	57.8	3495	33.4	33.4	2305	138.2	138.2	8546

The beneficiaries includes the farmers benefitted from technologies on balanced and integrated nutrient management were demonstrated to the farmers including tribal farmers through Satellite Experiments, Front Line Demonstrations, Farmers Fair, Exhibition etc.

Sub: Rajya Sabha Question Dy. No. S-3618 for 31/07/2015 regarding soil testing of cultivable land in Bihar by Shri Ram Nath Thakur

(l) Whether it is a fact that cultivable land in Bihar is more fertile, if so, the action plan of Government of carry out soil testing and supply seeds on time, details thereof;

The ICAR-IISS has prepared GPS-GIS based soil fertility maps of 9 districts of Bihar, viz., Samastipur, Muzaffarpur, Arwal, Nawada, Nalanda, Darbhanga, Patna, Jehanabad and Vaishali. These Fertility maps have been uploaded in the website of the institute: http://www.iiss.nic.in/districtmap.html. In the terms of available nutrients, namely N, P, K soil of these districts are medium to low in fertility (table below).

Per cent areas deficient for nutrients in the districts of Bihar are given below:

District	N			P			K		
	L	M	Total	L	M	Total	L	M	Total
SAMASTIPUR	61	39	100	4	25	29	12	80	92
MUZAFFARPUR	39	61	100	11	88	99	4	95	99
ARWAL	27	73	100	18	66	84	0	48	48
NAWADA	90	10	100	0	33	33	0	24	24
NALANDA	84	16	100	0	37	37	0	30	30
DARBHANGA	5	95	100	6	92	98	18	77	95
PATNA	67	33	100	0	26	26	0	39	39
JEHANABAD	39	61	100	46	54	100	1	65	66
VAISHALI	73	27	100	29	69	98	0	79	79

AICRP on micro and secondary (MSN) nutrients is working on evaluation of micro and secondary nutrients status of soil and plants of the country. In Bihar AICRP-MSN centre is working at RAU, PUSA, Bihar. Till now nineteen districts have been delineated for micro and secondary nutrients deficiency status in Bihar. In addition, crop response trials are also conducted to verify the status of different nutrient sanalyzed in soils collected from different districts. The status of Micro and secondary nutrients in various districts of Bihar is given below:

District	Secondary and micronutrients deficiency (%)					
	S	Zn	Fe	Cu	Mn	B
Araria	20.9	40.3	0.0	2.5	4.5	19.9
Arwal	49.6	49.3	6.3	16.3	4.1	36.4
Begusarai	24.6	50.5	29.8	0.7	12.5	21.8

Dharbhanga	9.7	17.7	8.9	0.6	20.5	47.3
Gaya	22.6	45.8	6.4	0.8	0.8	36.1
Jehanabad	23.5	81.1	12.8	2.7	2.7	36.9
Katihar	32.5	72.4	0.0	0.9	1.1	25.9
Kishanganj	86.4	39.4	0.0	0.0	6.3	35.3
Madhepura	32.7	46.7	4.0	2.5	12.4	35.9
Madhubani	27.2	58.8	2.3	2.3	3.8	43.2
Muzafarpur	10.7	23.2	6.0	0.3	1.3	48.1
Nalanda	25.1	23.1	0.7	4.4	2.9	35.8
Nawada	28.5	31.0	6.8	1.1	4.6	33.5
Patna	35.4	38.9	5.5	0.4	1.4	35.5
Purnea	46.4	33.9	0.0	2.2	5.8	12.5
Rohtas	88.4	27.4	0.5	0.7	0.5	42.1
Samastipur	16.6	33.5	27.6	1.7	5.9	31.1
Sheikhpura	29.1	30.0	0.0	0.0	0.0	25.2
Vaishali	6.8	9.6	62.4	1.6	44.2	36.3
Bihar	**27.66**	**37.97**	**9.95**	**1.92**	**7.42**	**36.27**

A wide spread S and micronutrients deficiencies have been observed in Bihar. Hence, it is essential to manage these micronutrients deficiencies for optimum crop productivity.

Sub.: Rajya Sabha Starred/Unstarred Diary No. U1916 due for answer on 07/08/2015 raised by Smt. Wansuk Syiem regarding Standard for nutrient application – reg.

(a) Whether Most of the Government publications, including the annual report of economic surveys have been using 4:2:1 ratio of nutrients as the yardstick for assessing imbalance in fertiliser application

Earlier it was used as sole yardstick for adhoc fertiliser application. Now-a-days balanced application of fertiliser is recommended based on soil test results and crop demand

(b) Whether the ICAR has now acknowledged the mistake of treating 4: 2:1 as the standard for the nutrient application in its Annual report 2014-15 and feel the existing norm cannot be generalized for the entire country:

Earlier in view of paucity of soil testing facilities earlier, this was used as a yardstick for fertiliser application. However, currently application of fertiliser is recommended based on soil test results and crop demand.

(c) Whether according to recent ICAR finding the ratio 4:2:1 applies only to wheat-rice crop rotation system in Punjab and Haryana; and

Yes, this ratio was mostly propagated during green revolution era mainly for rice-wheat system in Indo-Gangetic Plan which is still in practice in these areas where soil testing facilities are not adequate.

(d) Whether the ICAR has worked out a more appropriate and national all India average normative nutrient mix at 2.5 : 1.4 :1 ?

Since the nutrient demand varies with crop and soil type, it is difficult to propose a single nutrient ratio for all crops and for all regions of the country.

Sub: **Lok Sabha admitted unstarred Question No. 3468 due for answer on 17/03/2015 regarding study on land/soil pollution by Shri Ramesh Chander Kaushik.**

Ref. **File No. H-11016/32/2015-CPA dated 12 March 2015**

f) Whether any study has been conducted by the Government on the impact of land and soil pollution in the country;

Based upon some sporadic studies carried out in India, it is indicative to the adverse impact of land and soil pollution on groundwater quality, crop productivity, produce quality and animal and human health. Based on available information, CPCB evaluated pollution status of the environment in 88 industrial areas of the country (CPCB 2009), where considerable land pollution at various degrees has been suspected. Also, Limited study on heavy metal pollution through sewage sludge and industrial of effluent in peri-urban areas of selected cities have been conducted under AICRP MSPE.

g) If so, the details there of including the impact in urban and rural areas; and

- The widespread arsenic contamination in groundwater in different parts of West Bengal, distributed over 111 blocks, located primarily in five districts adjoining the river Bhagirathi, is of great concern. Even beyond the Bengal delta basin, the widespread arsenic contamination in groundwater above the permissible limit has also been detected in several places in the country, for instance at Chandigarh, Bihar, Uttar Pradesh, Jharkhand and Punjab. Rice grains grown with arsenic contaminated groundwater in West Bengal has been found to be contaminated and indicated as one important route of arsenic entry into human through food.
- On agricultural land surrounding industrial areas of Ratlam, Nagda, Pithampur, Pali, Tiruppur, Coimbatore, and many other cities, crop productivity has been severely affected due to increased soil salinity. As a result of industrial activities, groundwater has been found to be contaminated with heavy metals in some places.
- Although some urban (sewage-sludge) and industrial wastes are being used as a source of plant nutrients in agricultural land; however, their indiscriminate use may increase the risk of heavy metal accumulation in soil plant system, if proper care is not taken. The heavy metal content in sewage sludge and factory effluents and its impact on plant growth has been studied around some selected cities of the country. A large variation has been reported in heavy metal content of different factory effluents, for example nickel content is usually more in painting and foundry industries effluents while cadmium content is usually higher in gold processing industry and sewage-sludge.
- Though continuous use of contaminated/ polluted water may have detrimental effect on the soil health in long run; however, the farmers normally use the contaminated water along with canal and tube well water in different proportions. These results into better crop growth and yield with little accumulation of heavy metals which is much below the permissible limits. Thus intermittent irrigation with contaminated water does not affect the soil health and crop in most of the studies.

- The micronutrients content reported in produce from farmer's field where intermittent irrigation with different industrial effluents and sewage-sludge along with tube well/ canal water has been found in non- toxic range for plants.
- Studies conducted in food and non-food crops to screen their ability to accumulate heavy metals revealed that plants have diverse ability to extract heavy metals from the contaminated soils. Large number of hyper accumulator plant species has been identified too.
- Certain amendments like Farm Yard Manures has the capability to reduce the toxic effects of heavy metals as it was found that nickel toxicity was reduced in buckwheat with its application.
- 100 samples of basmati and non-basmati rice grains, collected from different areas of Punjab were analysed for their nutrients and heavy metals content. Lead, Cadmium and Arsenic contents in Basmati and non-basmati rice grains were well below the maximum permissible limits 2.5, 1.5 and 1.1 milligram per kilogram, respectively [as proposed by Prevention of Food Adulteration Act (PFA)]. Contents of Iron and Manganese which are very useful in human health were relatively higher in Basmati (Pusa 1121 and Basmati 2 varieties) than in non-basmati rice (PR-116, PAU 201 varieties) grains.
- Study on impact of land and soil pollution on animal and human health is quite meager. There is possibility of decrease of productivity and quality of the produce by soil pollution and pathogens caused due to excessive use of fertilizers and other sources such as sewage sludge/city compost etc.

h) if not, the steps being taken by the Government to undertake such study in the country?

Comprehensive study on impact of land and soil pollution on animal and human health surrounding areas of industrial clusters of the country is very few and indicative and therefore, such studies are required.

Sub: Lok Sabha D. No. 6639 due for answer on 28.07.2015 raised by Shri Prahlad Joshi, MP (LS) regarding Subsidy on Bio-Fertilizers– reg.

a. **whether the Government has recently introduced certain schemes to promote the use of organic fertilizers due to adverse effect of chemicals fertilizers on human beings and if so, the details thereof;**

Yes, Government of India has launched the National Programme for Organic Production (NPOP) for the promotion and development of organic farming across the country including hilly states like Sikkim, Mizoram, Uttarakhand and Himachal Pradesh. Government of India has initiated a National Net Work Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) as one among the 21 centers of India aiming to, study the effect of different organic management practices and cropping systems for long term sustainable productivity. These twenty one centers spread across the country have developed organic package of practices for various crops with the use of organic manures available in each state.

b. **whether the Government is considering to increase in the subsidy of bio-fertilizers;**

The increasing and continued use of synthetic fertilizers and pesticides is starting to cause environmental deterioration and health problems. Therefore, there is an increasing need for organically farmed produce, as consumer awareness and environmental regulations continues to evolve. Organic farming requires biological and organic inputs in lieu of chemical inputs and there is a need to augment the production of bio-fertilizers or organic fertilizers in India. Accordingly, the Government of India under National Project on Organic Farming provides capital investment subsidy for commercial production units manufacturing organic fertilizers / bio-fertilizers. Capital cost of a model biofertiliser unit with a capacity of 150 TPA will be 73.473 lakhs. Ministry of Agriculture, Department of Agriculture and Cooperation, Government of India is implementing a central sector scheme viz., "National Project on Development and use of Biofertilisers". Under this project, a subsidy up to 20 lakhs is provided for setting up a biofertiliser production unit of 150 TPA capacities. It is proposed to release the subsidy through back ended subsidy procedure. If the units are getting the subsidy, the amount will be adjusted to the last few instalments of bank loan. NABARD will release the subsidy to the units financed by Commercial Banks, Regional Rural Banks and other institutions which are eligible for refinance from NABARD. The subsidy will be release in two installments. NABARD will release 50% of the subsidy amount to the financing institution on submission of project profile and claim form – after sanction and disbursement of first installment of loan. The remaining 50% would be disbursed to the financing institution on conduct of an inspection and as per recommendations made by the officials from the financing institutions, NABARD/NCDC and NCOF/DAC. As the subsidy is back-ended, the subsidy will be kept by the financing institution in a subsidy reserve fund account, to be finally adjusted against loan amount of the bank at the end of the repayment period.

Under the National Project on Organic Farming (NPOF), Government is promoting production of various organic inputs in the country including biofertilizers. NPOF provides financial assistance upto 25% of total financial outlay upto a ceiling of Rs.40 lakhs as credit linked back-ended subsidy for setting up Bio-fertilizers production units.

Details of funds allocated under various schemes for use of biofertilizers are as under:

(Rs. in Lakh)

Scheme	11th Five Year Plan					12th Five Year Plan	
Year	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14*
NPOF	250.00	118.33	-	150.00	-	109.7426	300.00
INSIMP**	-	-	-	-	300.00	175.00	100.00
ISOPOM	454.83	604.27	427.41	850.63	854.47	554.04	433.73
NFSM***	531.20	4600.25	5966.72	4390.26	3088.42	3537.81	3919.66

*Upto 30.11.2013

**INSIMP Scheme was launched w.e.f. 2011-12

***Under NFSM Pulses, the fund is allocated for Integrated Nutrient Management (INM) components including biofertilizers. Separate record for bio-fertilizers component is not maintained.

(https://www.nabard.org/english/ld_biofertilizer7.aspx;
http://www.indiafilings.com/learn/subsidy-for-organic-farming-in-india/;
http://pib.nic.in/newsite/PrintRelease.aspx?relid=104064)

c. **If so, the details thereof along with the funds allocated under various schemes during the 12th Five Year Plan period; and**

Development of biofertilizer technologies using a wide variety of bioinoculants is carried out under AINP- Soil Biodiversity and Biofertilizers. The studies on biofertilizer technologies are being carried out at IARI, New Delhi, ANGRAU, Amaravati, DGR, Junagarh, CRURRS, Hazaribagh, IISS, Bhopal, JNKVV, Jabalpur, TNAU Coimbatore, YSPUHT, Solan, OUAT, Bhubaneswar, AAU, Jorhat, MAU, Parbhani. The total funds allocated for the work on soil biodiversity as well as biofertilizers during the 12th five year plan for the year 2014-15 is 185.00 lakhs under the project AINP-Soil biodiversity and Biofertilizers.

d. the various steps taken/ being taken by the Govt. to promote the use of organic fertilizers among the farmers;

Institute -farmer knowledge exchange for promotion of organic fertilizers is done through the extension and advisory unit of the IISS. Demonstration of various manure production techniques are being carried out through various farmers' training programs under ATMA programme. In addition, different state governments provide incentives for production of different organic manure from organic wastes like vermicompost, phosphocompost and NADEP compost etc.

e. whether the Government has taken sponsoring various research programmes in various States to provide conventional organic alternate to the farmers, if so the details thereof; and

Yes, Government has sponsored following two research programmes which are currently undertaken at IISS, Bhopal.

(1) National Network Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) as one among the 21 centers of India.

(2) All India Network Project on Bio-fertilizers.

Several indigenous organic preparations (Panchagavya, Beejamrutha, Jeevamrutha, Amritpani and Sanjeevak) used in organic farming were practiced by farmers of the different States as organic sources under organic farming. Improvement in yield with these preparations is to be tested at selected locations before recommending for all over the nation since chemical analysis showed low plant nutrient content in these preparations.

f. the other steps taken by the Government to promote the use of bio-fertilizer in the country?

Information is not available

Subject: Lok Sabha question Dy. No. 09 sitting on the 24/02/2015 regarding vacant post of scientists

Reference: No. 06 icar qns 120/5 dated 12nd February, 2015

(e) Whether several posts of scientists and researchers are lying vacant in ICAR and IARI despite efforts made by government to fill these post

Yes

(f) if so, the details of existing posts lying vacant in these research institutions and the steps taken by the government to fill up these posts;

The following Scientific posts are vacant in IISS, Bhopal

Sl. No.	Discipline	Head of Division	Pr. Scientist	Sr. Scientist	Scientist	**Total**
1	Agricultural Economics	-	-	1	1	**2**
2	Agricultural Statistics	-	-	1	-	**1**
3	Agronomy	-	1	-	1	**2**
4	Computer Application	-	-	-	1	**1**
5	Plant Biochemistry	-	-	-	1	**1**
6	Soil Science	2	-	1	-	**3**
	Total	**2**	**1**	**3**	**4**	**10**

(g) Whether the Government has also taken steps to revitalize these research institutions so that the farmers are provided with latest technology in the field of agriculture;

Yes

(h) if so, the details thereof; and

Requisition sent to the Council vide letter No. 4-18/2010-Rectt. Dated 14.03.2014 and also sent reminder letters of even no dated 05.01.2015, 20.01.2015 and 12.02.2015 to fill up the vacant posts.

(i) The details of notable achievements made during the last one year by these research Institutions

A. Manpower

The post of Director, a Senior Scientist (on transfer) and the Finance & Account Officer were filled up during the last year.

B. Research achievements

The salient research achievements of the institute are also presented below:

- In a study on carbon saturation and stabilization different prediction models developed for maximum attainable SOC, different pools of carbon and TOC from WBC.

- Effect of engineered micronutrient nano metalic products viz ZnO, CuO, and Fe_2O_3 are being studies for their internalization and effects on plant growth.
- Effect of levels of carbon in clay loam and sandy loam soils and its relevance of crop growth and resilience has been studied. POM has been found to be better index for assessing soil resilience.
- P saturation indices of inceptisols, vertisols and alfisols developed through use of different extractants. The productivity and environment threshold of DPS (degree of P saturation) have been established for these soils.
- Five products (Urea pastilles, NP1, Nualgi, LIMUS, Polysulphate) of different private concerns have been evaluated through contractual projects.
- A mini soil test lab is being developed in collaboration with a private concern.
- No-till (NT) and reduced tillage (RT) also recorded relatively higher available nutrients as compared to conventional tillage (CT) system along with at par soybean equivalent grain yield.
- In soil resilience assessment study it was found that fly ash along with organic amendments like FYM or poultry manure can be used for better physical resilience in vertisols.
- The VAM infections were found to be similar varied between Bt and non-Bt cotton based cropping system. Although the different enzyme activities in soil were 15, 23 and 6 % greater in Bt-cotton based cropping systems than non- Bt cotton system in Vertisols.
- A proto- type for rapid compost (within a month) preparation developed.
- Identified six fungi viz., *Trichoderma viride, Aspergillus heteromorphus; Rhizomucor pusillus; Aspergillus flavus; Aspergillus terrus and Aspergillus awamori for* biofiltration of heavy metals from MSW compost.
- Castor plant was found to be more sensitive to Cr contaminated soil as compared to Pb and Cd
- Interaction among tannery effluents' constituents on heavy metal uptake by spinach revealed that increasing the Cr, Cd and Zn application enhanced the uptake of the respective metal ions in root and shoot. Although Cd levels in soil had no significant effect on Cr concentration in control treatment.
- Study initiated on impact of long-term use of sewage water for irrigation on soil and crop quality in Bhopal region of M.P.
- Soil Quality Assessment of Some Tribal Districts (Jhabua, Alirajpur and Dhar) of Madhya Pradesh was carried out for Enhancing Crop productivity
- Water pollution through P loss from the agriculture field was found to be mainly through soil associated sediment P/particulate P (PP).
- Technique (extraction-cum-wet sieving) identified for removal of heavy metals from municipal solid waste composts through

Sub: **Rajya Sabha Starred/Unstarred question S4793/S1527 on Yogic Farming by Shri Palvai Govardhan Reddy**

Ref. **Dy. No. 37 dated 8th Dec. 2015**

a) **What is Yogic farming?**

Yogic farming is to empower the seeds with the help of positive thinking. Regular yoga meditations are conducting in the fields with specific thought practices designated to support each phage of the crop growth cycle, from empowering seeds and seed germination through sowing, irrigation and growth to harvest and soil replenishment.

b) **Whether it is a fact that Government is pushing Yogic farming in the country if so, the details thereof, and**

Details not available

c) **the scientific justification that yogic farming will increase productivity of land?**

Scientists of G B Pant University of Agriculture, Science and Technology and Sardar Krushinagar Dantivada, Agriculture University conducted studies at different stages of crop growth to understand the effect of Raja Yoga Meditation on crop yield, quality and costs. Preliminary findings indicate that organic and meditation has the greatest soil microbial population and that seeds germinate up to a week earlier. Subsequent crop reveal higher amounts of iron, energy, protein and vitamins compared to organic and chemical, offering low-cost high –benefit method for low communities.

2016

Sub: **Starred/unstarred question for the Rajya Sabha Dy no. S2408 for 04.03.2016 regarding "Adoption of Low Carbon Agricultural Techniques"**

Ref. **F.No. NRM/1-1/2016-AFC dated 24 February 2016.**

Point wise information for preparing reply to the questions

a. Whether Government has assessed the likely impact of climate change on Indian agriculture and food security, if so the details thereafter and if not, the reasons there for:

The Indian Institute of Soil Science Bhopal has started working on likely impact of climate change (increase/decrease in temperature/rainfall) on productivity of major crops grown in central India. The results of the study indicated that there would be likely decrease in grain yield of field crop with increase in temperature in case of both irrigated and rainfed crops. Increase in rainfall favored grain yield of crops but decrease in rainfall reduced the crop yield of rainfed crops. Over all there would be negative impact of climate change on yield of field crops. The Institute has also undertaken green house gas emission studies from different tillage and nutrient management trials to evaluate the potential for reduction of the GHG emissions of various crop management systems, to promote low carbon emission from agricultural fields.

b. Whether Government has undertaken measures to promote climate resilient crop varieties, is so the details thereof, measure through which the same has been undertaken and coverage of programme and such crops; and

The institute works on soil research and study on resistant variety development is not under its mandate.

c. Whether Government has taken initiatives/plans to take initiatives to encourage farmers to adopt low carbon agricultural techniques, if so, the details thereof and if not, the reasons there for?

The institute has undertaken initiatives to encourage farmers to adopt low carbon agricultural techniques through adoption of conservation agricultural practices, recycling of crop and farm residues in situ or though composting, and promoting integrated use of organic manures along with balanced fertilizer application. The institute is fine tuning different conservation agricultural practices for major cropping systems through Consortium research platform on Conservation Agriculture. Conservation agricultural practices reduce the emission of carbon to the atmosphere through reduction in fossil fuel use by farm machineries through reduced tillage operation, sequestering carbon in the soil through recycling of crop residues in situ and reduction in nitrogen use by nutrient recycling. Conservation agriculture also addresses problem of residue burning induced carbon emission to the atmosphere. Institute is actively promoting in awareness development among the farmers for low carbon agriculture through conservation agriculture, integrated nutrient management. Besides this through composting of crop residues and farm wastes and their application to the field, the carbon emissions from agricultural activities are reduced.

A. BURNING OF CROP RESIDUE

Burning of crop residue in agricultural is banned by the order of Supreme Court of India.

I. Whether above mentioned orders of Supreme Court of India is being followed across the country?

- Information is not available.

II. Whether the ICAR has made any assessment of crop residue which is being burnt in fields? If so, please furnish details thereof.

- ICAR has made assessment of crop residue which is burnt in the fields. Crop residues generated in India are around 679 million tonne (Mt) out of which 226 Mt residues are available in surplus. The nutrient potential (N, P_2O_5, K_2O) of these crop residues is about 5.6 Mt. But, instead of using it as potential source of plant nutrients, a large portion of the residues (approximately 130-140 Mt) is burnt annually in field. Rice straw contributed 40% of the total residue burnt followed by wheat straw (22%) and sugarcane trash (20%). Burning of crop residues emitted 8.57 Mt of CO, 141.15 Mt of CO_2, 0.037 Mt of SO_x, 0.23 Mt of NO_x, 0.12 Mt of NH_3.

III. Whether ICAR has made any technique/method whereby crop residue can be converted into useful farm manure in shortest possible time? If so, please furnish details thereof.

- ICAR-Indian Institute of Soil Science has developed a technique called "Rapo-compost Technology" for faster decomposition of biodegradable waste. This technology converts biodegradable waste to quality compost in 30-45 days with the help of bio-inoculum consortia (bacteria, fungi and actinomycetes) having ligno-cellulolytic potential. *In-situ* decomposition technique is also doing in farmers field.

IV. What alternative uses can be made of crop residue?

- Crop residues are used as cattle feed, for burning, for making cupboard in small scale industries. However, the residues can be used in conservation agriculture (as mulching, retention, incorporation, no tillage). *In-situ* decomposition of crop residues is the best alternative. This eco-friendly practice will enhance crop productivity and also improve soil physical, chemical and biological health.

Sub: Reply to Lok Sabha question Dy. No. 14214 due for answer on 15/03/2016 regarding excessive use of chemical fertilizers -reg.

(e) Whether the government has conducted any research to find out whether excessive use of chemical fertilizers is destroying fertility of the land and causing many diseases, if so, the report of the said research;

Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status. There is not much change in the soil fertility status as compared to earlier reports of 1976 and 2002 (Table 1). These results showed that the status of P was increased in some areas due to continuous application of phosphatic fertilizers. Similarly, per cent soils high in available K increased from 27% in 1976 to 49% in 2011. The per cent soils low in available N increased from 52% in 1976 to 57% in 2011 which may due to various losses of nitrogen. Analysis of more than 0.25 million soil samples revealed the deficiencies of Zn in 49% soils followed by S in 41% soils, Fe in 12% soils, Cu & Mn in 3% - 4% soils.

Table 1. Change in available N, P and K status of Indian soils with time.

Year	**% Soils in different categories**		
	Low	**Medium**	**High**
Available N Status			
1976	52	43	4
2002	63	26	11
2011	57	36	7
Available P Status			
1969	47	49	4
1979	46	50	5
1996	49	49	2
2002	42	38	20
2011	51	40	9
Available K Status			
1976	20	53	27
1980	22	44	34
2002	21	51	28
2002	13	37	50
2011	9	42	49
Sources: Motsara (2002); Muralidharudu et al. (2011); Hasan (2002)			

Hence, there is no report suggesting the decline in soil fertility and productivity due to excessive use of chemical fertilizers. The experience from long term fertilizer experiment trials (LTFE) also revealed that balanced use of fertilizers doesn't affect soil fertility. In LTFE, recommended dose of fertilizers are used since inception of the experiment and till date no adverse effect on soil heath was recorded even after 40 years. On the contrary continuous use of balanced application of fertilizers resulted in improvement of soil quality compared to no use of fertilizer or suboptimal or imbalance use of fertilizer

(f) the step taken by the Government;

NA

(g) the proportion of the Indian and Foreign chemical fertilizers utilized in the country during each of the last three years and the current year; and

Not related to ICAR-IISS Bhopal

(h) Whether the Government has conducted any awareness campaign to train the farmers regarding the use of traditional fertilizers so that the farmers may get incentives in money terms, if so, the details thereof?

The ICAR-Indian Institute of Soil Science Bhopal through its campaign on Mera Gaon Mera Gaurav (MGMG) program has adopted 55 villages. The farmers in these villages are not only advised how to reduce use of chemical fertilizers through inclusion of organic sources of nutrients like compost, vermin-compost, and farmyard manures etc but also on balanced nutrition to plants through soil testing approach.

In the year 2004, Government of India has initiated a National Network Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Indian Institute of Farming System Research, Modipuram (UP) as the lead centre and the Indian Institute of Soil Science (IISS) is one among the 13 centers with the objectives of encouraging the use of organic manures for boosting agricultural production in the country. Thirteen centers spread across the country have developed organic package of practices for various crops with the use of organic manures available in each state. The results are communicated to the farming community through print media as well as farmers training at various institutes.

Institute-farmer knowledge exchange program are being conducted through the extension and advisory unit of the institute. Demonstration on production techniques of various organic manures like vermi-composting and phospho-sulfo-nitro-composting is being carried out through various farmers' training programs by the Institute. The published literatures and production manuals in Hindi and English on these manures are available at the Institute and also are distributed to farmers through various Institute-farmers' interface meetings.

Sub: Reply to Lok Sabha question Dy. No. 5828 due for answer on 03/05/2016 regarding Farming Technology from ICAR-IISS, Bhopal-reg.

(a) Whether the Government has conducted any study on the penetration of farming techniques and technology amongst the farmers in the country and if so the findings there of:

At ICAR-IISS Bhopal

With the introduction of improved nutrient management technologies in soybean crop such as IPNS, Phospho-sulpho-nitro compost and STCR approach into farmers' crop management programs in Bhopal district of Madhya Pradesh, the grain yield was increased by 15%, 24% and 16% in IPNS, Phospho-sulpho-nitro compost and STCR approach, respectively over farmers' practices. Similarly, the wheat yield was increased by 12%, 21% and 15% in IPNS, Phospho-sulpho-nitro compost and STCR approach over farmers' management practices.
Under AICRP-MSN various centers (21) are working in various aspects of micronutrients and developed several on farm techniques and technologies across the country. These technologies are verified by extension agencies and validated on-farm.

Under Tribal Sub-Plan (TSP) project more than 1000 demonstrations were conducted in farmers' field during April 2015-March 2016 on different crops under the AICRP on Soil Test Crop Response (STCR).

Sl No.	State	Number of Field Demonstration	Crops	No. of beneficiaries
1	Chhattisgarh,	213	paddy, wheat, maize, tomato, brinjal, potato, mustard and chickpea	852
2	Maharashtra	136	paddy and finger millet	544
3	Karnataka	109	maize and *ragi*	436
4	West Bengal,	81	jute, paddy, lentil, potato, cabbage, cauliflower, onion and boro rice	324
5	Odisha	79	tomato and lady finger	316
6	Tamil Nadu	75	fourteen crops	300
7	Assam	70	rapeseed, summer green gram and rice	280
8	Madhya Pradesh	67	paddy, wheat, gram, chickpea and lentil	268
9	Uttar Pradesh	58	maize, barley and wheat	232
10	Bihar	--	cauliflower, wheat, onion, rajmash and sugarcane	304
11	Himachal Pradesh	33	maize and wheat	132
12	Telangana	---	*rabi* groundnut	80
	Total	1041		4068

Apart from the above demonstrations, a large number of soil samples collected from farmers' fields in the state Manipur and Jammu and Kashmir were analyzed for different soil properties.
In all 53 capacity building programmers were conducted for upgradation of knowledge of the farmers on soil testing and fertilizer recommendation including eleven exhibitions to benefit 3590 people.Fifty two field day programmes were organized in the states of Odisha (15), West Bengal (8) Madhya Pradesh (6), Chhattisgarh (5), Bihar (4), Kerala (4), Uttar Pradesh (4), Telangana (3), Tamil Nadu (2) and Assam (1) where 2291 farmers participated in the events**.** Over all the Technology given by

AICRP (STCR) on soil testing and fertilizer recommendation for different crops improved the yield in the farmers' field by 15 to 20%.

Introduction of integrated plant supply nutrient management systems (IPNS), STCR and composting technologies improved crop yields in farmers' fields in soybean wheat cropping systems in Madhya Pradesh.

(b) Whether the Government has taken substantial steps to transfer the recently developed technological innovations and researches conducted by various agricultural research institutions to the farmers growing pulses and other crops in the country, if so the details thereof:

Under All India Coordinated Research Project on Soil Test Crop Response (STCR), various centers have developed fertilizer prescription equations for different crops including Cereals, Pulses, Oilseeds and Vegetable crops and for some of the important crops and cropping systems and even under integrated plant nutrient supply. These developed equations have been validated under research farms and under farmers' field conditions. In most of the follow-up trials, the yield deviation was found to be within acceptable deviation of 10%. After validation, the frontline demonstrations were organized in actual farmers' fields under real farm situations to demonstrate the benefit of STCR technology to the large number of farmers of those areas. Many of the centers have also developed ready reckoners for the easy adoption of STCR technology.

I. Development of Targeted Equations

(2010-2015): During the period under report, the STCR centres have developed fertilizer adjustment equations for a number of crops as given below:

a. **Hyderabad:** Rice (BPT-5204), Maize (BH 1576) and Rice (Tellahamsa).
b. **New Delhi:** Wheat (HD-2894), Wheat (HD-2851) and Aromatic hybrid rice (PRH-10).
c. **Bhubaneswar:** Sesamum (Nirmala).
d. **Rahuri:** Garlic (G-14), Okra (Arka anamika), Potato (Khupari Jyoti), Brinjal (Krishna), Rabi Sorghum (Phule Chitra), Marigold (Yellow) and Sorghum (Chitra).
e. **Coimbatore:** Rainfed Bt Cotton (Hybrid BRAHMA BG II), Rice under SRI (ADT43), Rice under SRI (CO-R-49), Maize (Hybrid NK 6240) and Tomato (Hybrid Lakshmi 5005).
f. **Ludhiana:** Bt Cotton (RCH 134) and Wheat (PBW 509).
g. **Pantnagar:** Sugarcane (Ratoon), Barley (UPB-1008) and Cowpea (Pant lobia 2).
h. **Imphal:** Upland rice (RC Maniphou 6).
i. **Karaikal:** Rice (CR. 1009).
j. **Kalyani:** Carrot (Early Nantin) and Onion (Suksagar).
k. **Vellanikkara:** Tomato (Anagha).
l. **Vellanikkara:** Chilli (Athulya).
m. **Rahuri:** Garlic (G-14), Okra (Arka Anamika), Potato (Kufri Jyoti), Brinjal (Krishna), Sorghum (Phule Chitra, Chitra), *Rabi* Sorghum (Phule Chitra), Bt cotton (Mallika), Bitter gourd (Phule green gold, Samrat), Sunflower (Phule Raviraj),Banana (Grand nine), Maize Grain (Rajashree), Marigold (Arow gold) and Onion (Baswant 780).

n. **Pantnagar :** Okra (Parbhani Kranti), Chilli (Pant Jwala), Sorghum (CSV-15), Turmeric (Pant Peetabh), Chickpea (Pusa 262) Tomato (Heemsohna) and Pigeon pea (UPAS-120).
o. **Coimbatore:** Rice (ASD 16), Bt. Cotton (Hybrid RCH 530 BG II), Maize (TNAU Maize Hybrid CO 6), Glory lilyRice (White Ponni, Paiyur 1), Brinjal (CO2) and Groundnut (TMV 7).
p. **Karaikal:** Rice (CR 1009), Blackgram (Vamban 3) and Rice (ADT 37).
q. **Ludhiana:**Garlic (PG-17), Maize (PMH 1,Pioneer 3396), Potato (Kufri Chandra- mukhi), Onion (Punjab Naroya), Fodder maize (J1006), Rice (Pusa Basmati 1121) and Wheat (HD 2967).
r. **New Delhi:**Cabbage (Golden Acre) and Cowpea (Pusa Sukomal).
s. **Hyderabad:***Kharif* rice (BPT -5204) and *rabi*Rice (Tellahamsa).
t. **Junagarh:**Bt. Cotton (Vikram 5) andPigeon pea(AGT 1).

II. Use of Targeted Yield Equations and Development of Prediction Equations for Cropping Sequences

During 2010-2015the STCR centres have developed post-harvest soil test prediction equations for recommending fertilizers to the crops in different cropping systems as given below:

a. **Hyderabad:** Rice (BPT-5204)-Rice (Tellahamsa) and Rice (BPT- 5204)-Maize (BH-1576).
b. **New Delhi:** Rice (PRH-10)-Wheat (HD-2581).
c. **Jorhat:** Autumn Rice (Luit)-Winter Rice (Ranjit).
d. **Coimbatore:** Maize (Hybrid NK-6240)-Tomato (Hybrid Lakshmi-5005), Brinjal, Maizeand **Tomato (hybrid).**
e. **Pantnagar :** Tomato - Chickpea (Pusa 262).

III. **Fertilizer Prescription Equations under Integrated Plant Nutrient Supply Systems:** During 2010-2013the followingIPNS-STCR adjustment equations have been generated

a. **Pusa:** Rice (Prabhat), Winter Maize (Deoki) and Sugarcane (BO137).
b. **New Delhi:** Wheat (HD-2894), Wheat (HD-2851) and Rice (PRH-10).
c. **Palampur:** Okra (P-8) and Potato (Kufri Jyoti 2).
d. **Coimbatore:** Bt Cotton (Hybrid BRAHMA BH II), Rice (ADT 43), Rice (CO (R) 49), Maize (Hybrid NK 6240) and Tomato (hybrid Lakshmi 5005).
e. **Bhubaneswar:** Chilli (Utkal Abha), Sesamum (Nirmala) and Cowpea (Utkal Manika).
f. **Vellanikkara:** Tomato (Anagha).
g. **Karaikal:** Rice (CR. 1009).
h. **Jorhat:** Autumn Rice (Luit) and Winter Rice (Ranjit).
i. **Raipur:** Rice (Karma masuri) and Rice (Swarna).
j. **Barrackpore:** Jute (JRO 204), Rice (NDR-97) and Garden pea (Azad P-3).
k. **Bangalore:** Sugarcane (Ratoon II) and Ragi (GPU -28).
l. **Hyderabad:** Sunflower (Sunbred), Bt Cooton (KH 112), Castor (PCH-2) and Sugarcane (2001A63).

m. **Hisar:** Bt. Cotton (MRC 6304).
n. **Varanasi:** Rice (Saryu-52).
o. **Bikaner:** Egg Plant (F1 hybrid Kanhaya), Bottle gourd (MGH-4), Onion (RMO252) and Fenugreek (RMP-1).
p. **Pantnagar:** Sugarcane (Ratoon), Barley (UPB-1008) and Cowpea (Pant Lobia2).

During 2013-15 the following IPNS-STCR prescription equations have been generated

a. **Jorhat :** Rice (Ranjit), winter rice (Ranjit),Summer green gram (Pratap SG-1),Rapeseed (TS-38) and Late sown rapeseed (JT-90-1).
b. **Hyderabad:** Sunflower (Sunbred), Bt. Cotton (KH-112), Castor (PCH 222), Sugarcane (2001 A 63, 2003V46), Sugarcane (2001A 63-ratoon) and Sesamum (YML 66).
c. **Kalyani :** Onion (Suksagar) Broccoli (CSH-1) and Chick Pea (Pusa-364).
d. **Varanasi :** Maize (Asha) and Barley (PL-172).
e. **Hisar:** Winter Maize (HM 5) and Wheat (DPW 621-50).
f. **Barrackpore:** Rice hybrid (MTU 1010), Jute (JRO 2407), Sunnhemp (Suin 037) and Rice (GS3).
g. **Palampur :** Okra (P-8) and Gobhi Sarson (HPN-1).
h. **Pantnagar :** Okra (Parbhani Kranti), Chilli (Pant Jwala), Sorghum (CSV-15),Turmeric (Pant Peetabh), Chickpea (Pusa 262) Tomato (Heemsohna) and Pigeon Pea (UPAS-120).
i. **Raipur:**Rice (Karma Masuri, Swarna, MTU-1010), Maize (Hyseal), Tomato (Pant 3), Wheat (Sujata, GW273), Potato (Kufri Pukhraj, Pukhraj Jyoti), Soybean (JS-9752), Chickpea (JG 130),Chilli (JG 130) and Mustard.
j. **Vellanikkara :** Chilli (Athulya).
k. **Rahuri:** Garlic (G 14), Okra (*Arka anamika*), Potato (Khufri Jyoti), Sorghum (Phule Chitra, Chitra), dryland *rabi* Sorghum (Phule Chitra),Bt. Cotton (*Mallika*), Bitter gourd (Phule green gold, Samrat), Sunflower (Phule Raviraj), Banana (Grand nine), Maize Grain (Rajashree), Marigold (Arow gold) and Onion (Baswant 780).
l. **Bhubaneswar:** Sesamum (Uma), Black gram (B-388) and Green Gram (OBGG-52) .
m. **Karaikal:** Rice (CR 1009, ADT 37) and Blackgram (Vamban 3).
n. **Bikaner:** Onion (RO 252), Fenugreek (RMP-1), Bottle gourd, Cabbage (hybrid) Radish and Clusterbean (RGC1017) and Pearl Millet (RHB-177,Fodder).
o. **Pusa:** Pigeon Pea, Barseem (Mascavi), Lentil, Jowar (Fodder), Black gram, Sesame, Cheena, Mangraila and Faba bean (Bakla) .
p. **Coimbatore:***rabi* Rice (ASD 16, CO(R)50,), Bt. Cotton (Hybrid RCH 530 BG II).*Kharif*rice (ADT 43), *Rabi* rice (), Maize (Hybrid CO 6), Glory lily Rice (White Ponni, Paiyur 1), Brinjal (CO-2) and Groundnut (TMV 7).
q. **Bangalore:** Sugarcane (Ratoon III), Dryland *Ragi* (GPU 28), Brinjal, Brinjal Hybrid, Beans, Tomato, dryland Red gram and Bhendi.
r. **Ludhiana:**Garlic (PG-17), Maize (PMH 1, Pioneer 3396), Potato (Kufri Chandramukhi), Onion (Punjab Naroya), Fodder maize (J1006), Rice (Pusa Basmati 1121) and Wheat (HD 2967).
s. **New Delhi:** Cabbage (Golden Acre) and Cowpea (Pusa Sukomal).

t. **Srinagar:** Brown Sarson (KS 101) and Rice (Jhelum).
u. **Junagarh:** Pigeon Pea (AGT-1).

IV. Multilocation Follow up Trials

During 2010-2013 the following follow up trials conducted by different centres

a. **Bangalore:** Soybean (MAUS-20), Maize (Hema) and Bhindi (Arka Anamika).
b. **Barrackpore:** Jute (JRO 128), Rice (MTU-1010) and Vegetable pea (Azad P-3).
c. **Hisar:** Pearl millet (HHB 197) and Wheat (WH 711).
d. **Jabalpur:** Paddy (MR-219) and Wheat (GW-273).
e. **Palampur:** Maize (HQPM-1) and Wheat (HPW 42).
f. **Ludhiana:** Rice (PR-120) and Wheat (PBW 621).
g. **Hyderabad:** Foxtail millet (Krishnadevaraya), Muskmelon (Maduras) and Soybean (JS-335).
h. **Coimbatore:** Plains Wheat (CO(W)1), Beetroot (Ram F1), Radish (Pusa chetkishot), Hybrid Maize (NK 6240), Hybrid tomato (Lakshmi 5005) and Rainfed Bt. Cotton (BRAHMA BG II).

During 2013-15 following follow up trials were conducted by different centres:

a) **Jabalpur:** Paddy (MR-219, Kranti), Wheat (GW-273), Soybean (JS-9752), Chandrasur (HI-4), Garlic (G-323) and Onion (Agrifound Light Red).
b) **Vellanikkara:** Chilli (Ujwala) and Bhindi (Arka Anamika).
c) **Karaikal:** Rice (CR 1009) and Blackgram (Vamban 3).
d) **Hisar:** Pearl Millet (HHB 197, HHB 223, BH 393, BH 885 and BH 902), Wheat (WH 711, WH 283, PBW 550 & PBW 502) and Bt. Cotton (MRC 6304, Bioseed 6588).
e) **Barrackpore:** Jute (JRO 128, JRO 204), Rice (MTU 1010) and Vegetable Pea (Azad P 3).
f) **Bangalore :** Maize (Hybrid Hema) and Ragi (GPU 28).
g) **Varanasi :** Rice (Super Moti, 27p31 (Hybrid)).
h) **Kalyani:** Potato (Kufri Jyoti).
i) **Palampur:** Maize (PG 2474, Kanchan), Wheat (HPW 155, HPW 236), Potato (Kufri Jyoti 2) and Pea (P-89).
j) **Jorhat:** Rice (Luit, Ranjit), Summer green gram (Pratap) and Rapeseed (TS-38, JT-90-1).
k) **Ludhiana:** Cotton, Rice, Maize, Bt cotton, Maize (PMH- 1), and Wheat (PBW-621).
l) **Coimbatore:** Cotton (RCH 530, Rasi XL 708 BG II, MRC 7929 BG II), Rainfed transgenic cotton (BRAHMA BG II), Maize (NK 6240), *kharif* and *rabi* Rice (ADT-43), Tomato (Lakshmi 5005, Sivam). Rice (White Ponni, Bhawani) rainfed Maize(hybrid-CO-6) and Ashwagandha (JA 20), Brinjal (CO 2) and Glory lily (Local).
m) **Pantnagar :** Turmeric and Chick Pea.
n) **Rahuri:** Garlic, Okra, Potato, Brinjal, Bt Cotton (Mallica), Grain maize (Rajshree), Marigold (Yellow maxima) and Banana (Grand Nine).
o) **Junagarh:** Cotton.
p) **Raipur :** Wheat (Sujata, GW 273).

V. Frontline Demonstrations on Farmer’s Fields (2010-2015):

Frontline demonstrations were organized on farmers' fields to demonstrate the value of soil test based fertilizer and manure recommendations in different states. In these demonstrations, farmers could obtain higher returns of applied nutrients through the fertilizers and manures application based on targeted yield approach. Long term demonstration trials are in progress at Coimbatore, Jabalpur and Palampur centres to demonstrate the value of targeted approach in terms of yield sustainability and soil fertility maintenance.

a. **Jabalpur:** Soybean (JS-9752), Arhar (JKM-189 and Asha), Niger (PCN-8), Paddy (Kranti and MR-219) and Wheat (JW-273, JW-3211 and JG-319).
b. **Bhubaneswar:** Sesamum (Nirmala).
c. **Vellenikkara:** Amaranthus (Arun) and Cucumber (Soubhagya).
d. **Hisar:** Pearl millet (HHB 197 and HHB 223),Wheat (PBW 502 and WH 711) and Raya (Laxmi).
e. **Barrackpure:** Mustard (B-9).
f. **Hyderabad:** Groundnut (Narayani and JL-24) and Sunflower (Sunbred).
g. **New Delhi:** Mustard (Pusa Bold) and Wheat (HD 2894).
h. **Coimbatore:** Rice (APT 43), Groundnut (VRI 5, TMV 7 and VRI 2), Sunflower (Sunbred 275) and Gingelly (TMV 3).
i. **Raipur:** Soybean (JS 305) and Sunflower (Jwalamukhi).
j. **Pusa:** Rice (Hybrid, 6444, PB 73 and Parwal), Wheat (HD-2733, 2824, 711 and PBW 343), Winter Maize (Laxmi, Ganga Kaberi, Deoki, 10B10 and 31Y45), Sesame(Krishna), Mustard (Mashina gold and Karanti), Linseed (Mira), Pigeon pea (T-1), Lentil (DPL-15), Potato (Jyoti and Kufari arun) and Brinjal (Santury).
k. **Palampur:** Soybean (Bragg) and Toria (Bhawani).
l. **Bikaner:** Gram (RGC 1581).
m. **Hisar:** Raya (Laxmi).
n. **Bangalore :** Sunflower (KBHS-53).
o. **Palampur:** Soybean (Bragg, PK 472) and Toria (Bhawani).
p. **Jabalpur:** Soybean (JS-9752), Paddy (Sahbhagi, Kranti ,MR-219), Pea (Azad Pea-1), Wheat (JW-273, JW 3211) and Gram (JG-319 & JG-311) .
q. **Pusa:** Rice (6444, PT 71, Rajshree, Prabhat), Wheat (PBW 343, HD 2733, PBW 502, Anil), Winter Maize (10 B 10), Sesame (Krishna), Mustard (45J21, 66157 & Varuna), Linseed (Subhra), Potato (Khufri Jyoti, TPS, Pukhraj), Turmeric (Rajendra Sonia), Brinjal (Gulabia), Cauliflower (Sangrow-626) and Cabbage.
r. **Ludhiana:** Raya.
s. **Coimbatore:** Groundnut (JL-24, VRI-2 & CO-6), Sunflower (Sunbred 275) and Gingelly (TMV 1 & TMV 7).
t. **Vellanikkara:** Rice (Uma).

VI. Frontline Demonstrations under Tribal Sub Plan (2010-2015):

Under the Tribal Sub Plan, frontline demonstrations were organized on farmers' fields of tribal areas in different states to demonstrate the value of soil test based fertilizer and manure recommendations for getting higher return of applied nutrients through the fertilizers and manures application based on targeted yield approach.

a. **Jabalpur:** Gram (Jaki 9218, JG 130 & JG 315, JG 16,JG 14), Wheat (JW 3211, JW 3269, Sujata, JW 3020, JW273,Lok-1) and Lentil (JL 3).
b. **Bhubaneswar:** Chilli (Bamra Local), Brinjal(BV-45C),Tomato(BT-10), Groundnut (TMV-2) and Mustard (Sushree).
c. **Raipur:** Wheat (Amar, DL788,Vidisha, GW-273, Sujata-HI1077, Lok-1, MP -2923, Kanchan, Raj 4238), Maize (30V92,Vedanta, Hysel, Advanta 751), Chick pea (JG11-Vaibhav, JG 74 and Jaki), Rice (Karma Masuri, MTU 1010, Hybrid, Swarna, Mahamaya, IR-36, IR-64, Maheshwari, Bambleshwari), Potato(Kufri Pukraj, Tomato (S-22) and Brinjal (VNR-16).
d. **Barrackpore:** Mustard (B-9), Lentil (B 256**),** Potato(Khufri Jyoti), Onion (Sukhsagar), Boro Rice (Minikit) and Cabbage (cv. Green express).
e. **Kanke :** Wheat.
f. **Varanasi :** Rice (Saryu 52, Nati Masuri), Maize (Jaunpury white), Chickpea (Pusa-364) and Wheat (Malviya-234).
g. **Bangalore :** Maize (Hema) and Groundnut.
h. **Kalyani:** Potato(Kufri Jyoti), Onion(Sukhsagar),Boro rice (Minikit) and Cabbage (Green Express).
i. **Coimbatore :** Maize (CO 6 ,CP 808), Groundnut (CO 6, local), Onion (CO 4, local), Carrot (Tokito, Ashoka) Tomato (PKM1,Jeevan, Panneer), Turmeric (Hybrid BSR 1, Eraiyur-1), Rainfed Tapioca (Mulluvadi), Irrigated Tapioca (Kungumarose), Gingelly (TMV 3), Cotton (Surabhi), Bhindi (Kaveri 909, TNAU-Co BH1, Venus F1 Hybrid), Rice (ADT(R)45), Sugarcane(Co86032), Cabbage (Harirani),Carrot (Ashoka)Chilli (US 404, Amanya),Radish(Pusa Chitka long), Green gram (CO(Cg) 8), rainfed Maize (Kanagagold) and Ragi (GPU 67).
j. **Hyderabad :** Maize (Nuziveedu, DHM-117, DKC-9127, 30 V 92, Kargil, Pro Agro), Rice (MTU-1010) and Groundnut (K-6, Local).
k. **Pusa:** Wheat(PBW 343,Anil),Mustard (Varuna) and Potato (Pukhraj, C-40, C140).
l. **Jorhat:** *Sali* rice (Ranjit).
m. **Rahuri:** *Kharif* Soybean (JS 9305), *Kharif* Sorghum (CSH-7), Pigeon Pea(ICPL-87), Drilled Paddy (Phule Radha), *rabi* Wheat, Chick Pea, *rabi* Sorghum and maize.
n. **Imphal :** Garden Pea (Arkel), Field Pea (Rachna) and Rape Seed (M-27). Rice (RC Maniphou 6) and Groundnut (ICGS 76).
o. **Vellanikkara:** *Kharif* rice (Uma), Tomato (Anagha) and Rice.

VII. New Initiatives (2010-2015):

Algorithms for the relationship between values obtained from leaf colour chart, SPAD and field scout CM 1000 meter for N management and yield at critical crop growth stages were developed in aromatic hybrid rice and wheat. The study of critical C input and potential C sequestration level under INM system reveals that for sustenance of SOC level, a minimum quantity of 2.94 Mg C is required to be added per hectare per annum as inputs.

a. **Kalyani :**Development of soil Testing Protocol for Organic Farming System
b. **Palampur**: Comparative effectiveness of vermicompost and FYM in maize (HPQM-1) – wheat (HPW 155) under STCR approach

c. **Ludhiana**: Refinement of phosphorus fertilizer recommendations in maize (PMH 1) - wheat (PBW 621) cropping sequence.
d. **Bangalore:** Yield Maximization in Hybrid Maize (Hema) through different forms and Approaches of Nutrient application

A total of 105 demonstrations on soil test and crop response to fertilizer application on pulse crop were conducted during 2015-16 by different centers of AICRP (STCR) under TSP programme:

S.No.	State	Demonstrations	Crop (Variety)
1.	Chhattisgarh	25	Chickpea (JG-11)
2.	Assam	20	Summer Green Gram (SG-1)
3.	Madhya Pradesh (Mandla)	12	*Rabi* Gram (JG-63)
4.	Madhya Pradesh (Dindori)	12	Chickpea (JG-63)
5.	Madhya Pradesh (Dindori)	12	Lentil (JL-3)
6.	Kerala	1	Cow pea (CO-3)
7.	West Bengal	21	Lentil (B-256)
8.	Bihar	2	Rajmash (PDR-14)
	Total	105	

In all 49 capacity building programmers were organized for upgrading the knowledge of farmers through exhibitions on target specific nutrient management of pulse crops.This programme has benefitted more than 3000 farmers.

Forty five field day programmes were organized including Odisha (15), Madhya Pradesh (6), Chhattisgarh (5), Bihar (4), Kerala (4), Uttar Pradesh (4), Telangana (3), Tamil Nadu (2), Assam (1) and West Bengal (1) where 1956 people were sensitized about importance of pulse crop.

AICRP (BNF)

Transfer of technology on biofertilizers for pulses and microbially enriched compost for other crops is being vigorously pursued by ICAR. Details are as follows:

- Biofertilizer technology for soybean and wheat was demonstrated in nine farmers' fields of Mengra Kalan village, Berasia Tehsil, Bhopal District. *Rhizobium* and Plant growth promoting bacteria consortium (mixture of three PGPR strains) for soybean; and PGPR only for wheat. Soybean and wheat yield increased in INM mode with Biofertilizer by ~10-15% with FYM and ~20-25% with enriched compost over farmers' practice.
- Biofertilizer technology (*Rhizobium* and *Bacillus* co-inoculation) intervention among farmers of Bhagalpur and Katihar Dt. for black gram and among Vaishali and Samatipur Dt. for lentil gave grain yield increase of 10-14% for lentil and 6-9% for blackgram.
- Microbial consortium based bionutrient package for rice in farmer's fields in Samastipur, Muzaffarpur and Vaishali resulted in 5-15 % increase in grain yield over farmers' practice. Imbalance use of chemical fertilizers and higher doses of fertilizer application was common among poor farmers' due to fragmented land holdings.
- In TSP in Kalahandi and Rayagada on vegetable crops, cotton and banana (125 farmers) increase in yields ranging from 8-20% were obtained with biofertilizers, generating an income ranging from Rs.6000 to 12,000 ha^{-1} with the investment of Rs.1000-1500 ha^{-1} on BFs. The construction of small vermicompost units enabled farmers to save 25% cost on chemical fertilizers.

- In nine tribal settlements in Wayanad district, 1400 kg of biofertilizers Azotobacter chroococcum, Azospirillum and PGPR mix-1 were distributed to 125 farmers for application in ginger and black pepper. Two training classes were conducted at two places.
- In tribal settlements of Attapady, Kerala 312 kg of PGPR mix I were distributed to tribal farmers engaged in the cultivation of vegetables, pulses, banana, sorghum, groundnut, ragi etc. Training programmes on application of Biofertilizers were given to 312 tribal farmers from 3 locations in which 54 extension officers participated.

AICRP (MSN)

- Under the delineation programme large number of GPS based soil samples were collected and analyzed for micro and secondary nutrients and different deficiency maps were prepared and uploaded to institute website for information to farmers and researchers.
- Training organized in Tribal areas and other areas on use of micronutrients for enhancing crop productivity (Subject of trainings: Micronutrient management in vegetable crops, Importance of Zn and Fe in soils, plants and human nutrition, Role of B in crop nutrition for higher production, Methods and application of different micronutrient fertilizers, Role of S and B in oil seed crops for higher oilseed production and quality Livelihood promotion of tribal farmers through value base agricultural technique). the details of training organizing in various states of the country.

State (Centre)	No. of trainings conducted	No. of Trainees/ Beneficiaries
Maharashtra	8	825
Madhya Pradesh	05	150
West Bengal	05	110
Tamil Nadu	15	1025
Bihar	10	400
Jharkhand	05	120
Assam	25	625
Himachal Pradesh	04	200
Odisha	07	125

- Front line demonstrations were conducted in more than 500 OFTs during the last five years at farmers' fields to show the response of various crops of micro and secondary nutrients.
- Soil Health Cards, Micronutrient Kit and Publication/Extension materials distributed in tribal areas to sensitize them regarding the use of micro and secondary nutrients for enhancing crop productivity.

State/ Centre	No. of Beneficiaries

	Soil Health Card	Micronutrients Kit	Publication/ Extension materials
Maharashtra (Akola)	250	250	430
Tamil Nadu (Coimbatore)	200	150	450
Gujarat (Anand)	164	105	1250
Jharkhand (Ranchi)	-	120	-
Andhra Pradesh (Hyderabad)	928	200	400
Madhya Pradesh (Jabalpur)	1100	300	300
Assam (Jorhat)	**	80	250
West Bengal (Kalyani)	**	65	150
Odisha (Bhubaneswar)	500	125	500
Uttarakhand (Pantnagar)	2000	-	-
Himachal Pradesh	**	-	-
Bihar	320	150	100
** Work on progress			

- Farmers day / Field day / On Spot Advice / Krishi Melas conducted in tribal areas to increase the awareness regarding use of micro- and secondary nutrients for enhancing crop productivity

State/ Centre	No. of Programmes	No. of Beneficiaries
Andhra Pradesh (Hyderabad)	-	-
Assam (Jorhat)	4	117
Gujarat (Anand)	12	1250
Himachal Pradesh	4	35
Jharkhand (Ranchi)	25	450
Madhya Pradesh (Jabalpur)	3	300
Maharashtra (Akola)	3	370
Odisha (Bhubaneswar)	5	300
Tamil Nadu (Coimbatore)	5	205
Uttarakhand (Pantnagar)	3	20
West Bengal (Kalyani)	4	90
Bihar (Pusa)	10	400

c. Whether the Government has incentivized these Institutions to develop such path breaking innovations which can revolutionize the farming, if so the details there of: N/A

d. Whether the Government is proposed to provide SIM enabled energy efficient agricultural water pumps to the farmers and replaces the age-old ones. And if so, the details there of: N/A

e. The details there of: N/A

Basic information on Agriculture Status of Parbhani District

Most of the agriculture is rainfed in the Parbhani district and the productivity is low because of availability of water and imbalance use of nutrients. To increase the productivity during kharif there is need to manage the rain water, and for kharif attempt should be made to harvest rainwater.

Land Use

The total geographical area of Parbhani district is 631115 ha. (0.6 million ha) and the net sown area is 518775 ha (0.5 million ha) (82.5 per cent). The cropping intensity in the district is 134.2 per cent. The land use pattern of Parbhani district has been compared with the land use pattern of Maharashtra state and is presented in table 1.

Table 1: Land utilization statistic of Maharashtra (2011)

('000' ha)

Sr. No.	Particular	Maharashtra		Parbhani	
		Area	%	Area	%
1	Geographical Area	30758	100.0	631.115	100.0
2	Area under forest	5216	17.0	6.306	1.0
3	Land not available for cultivation a. Barren & uncultivable b. Land put to non agric. uses	 1721 1374	 6.0 4.4	 39.495	 6.3
4	Other uncultivated land a) Cultivable waste land b) permanent pastures and grazing lands c) land under miscellaneous tree	 914 1249 246	 2.8 4.0 0.8	 24.443 8.956 3.977	 3.9 1.4 0.6
5	Current fallows	1216	3.9	29.163	4.6
6	Other fallows	1192	3.8	-	-
7	Net area sown	17631	57.3	518.775	82.2
8	Area sown more than once	4773	15.5	177.238	28.1
9	Gross cropped area	22405	72.8	696.013	110.3

Soil Health

On perusal of soil status, it is observed that N, P and Zn are limited nutrient in the soils of Parbhani district (table 2). The soils are rice in K. Amongst the micro-nutrients, the soils are sufficient in Cu and Fe. Zn and Mn are deficient in most of the soils (table 3).

Table 2: Soil Fertility Indicators of Parbhani district

Sr. No.	Taluka	No. of Soil Samples Analyzed	pH			EC (dsm)			Organic Carbon (%)			Available Nitrogen (kg/ha)			Available Phosphorus (kg/ha)			Available Potassium (kg/ha)		
			Acidic	Normal	Alkaline	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Parbhani	4205	-	4196	9	4088	112	-	1102	2413	690	1283	2922	-	62	234	3909	-	-	4205
2	Purna	1876	-	1872	4	1821	55	-	429	1044	403	626	1350	-	21	87	1768	-	-	1876
3	Palam	1344	-	1343	1	1309	35	-	307	787	250	308	1036	-	12	49	1283	-	-	1344
4	Gangakhed	2150	-	2134	16	2112	33	-	499	1275	376	774	1376	-	43	188	1919	-	-	2150
5	Sonpeth	581	-	580	1	576	5	-	131	337	113	169	412	-	3	36	542	-	-	581
6	Selu	2006	-	1958	8	1986	20	-	571	1161	274	590	1416	-	10	51	1945	-	-	2006
7	Pathri	1255	-	1247	8	1196	59	-	309	797	149	447	808	-	36	38	1181	-	-	1255
8	Manvat	1109	-	1167	2	1152	17	-	289	681	199	335	834	-	68	81	1020	-	-	1109
9	Jintur	2314	-	2304	10	2284	30	-	636	1305	373	740	1574	-	81	160	2073	-	-	2314
	Total	16900	-	16841	59	16534	366	-	4273	9800	2827	5172	11728	-	336	924	15640	-	-	16900

Table 3: Micro Nutrient Status of Parbhani district

Sr. No.	Taluka	No. of Soil Samples Analysed	Cupper (Cu)		Iron (Fe)		Manganese (Mn)		Zinc (Zn)	
			Sufficient	Deficient	Sufficient	Deficient	Sufficient	Deficient	Sufficient	Deficient
1	Parbhani	1991	1991	0	1836	155	1861	130	1088	903
2	Purna	1241	1241	0	1113	128	1144	97	711	530
3	Palam	668	668	0	610	58	617	51	377	291
4	Gangakhed	913	913	0	829	84	844	69	552	361
5	Sonpeth	292	292	0	272	20	265	27	163	129
6	Selu	542	542	0	505	37	493	49	289	253
7	Pathri	372	372	0	327	45	333	39	193	179
8	Manvat	607	607	0	543	64	546	61	370	237
9	Jintur	896	896	0	835	61	858	38	490	406
	Total	7522	7522	0	6870	652	6961	561	4233	3289

The major soil related constraints of the districts which need to be taken care of are reported below.

- Low hydraulic conductivity leading water stagnation impairs root growth.
- Occurrence of Calcium carbonate induces imbalance in nutrient supply and availability.
- Shallow soil poses a problem of low water retention capacity and low organic matter.
- Deficiency of major and micro-nutrients in soils.

Suggestion for improvement in productivity

The following action may be taken to enhance the productivity of the district.

Since most of the area is rainfed and proper management of deficiency of overall nutrients is important for crop productivity. So, soil test based fertilizer recommendation is essential. This can be obtained from the State Agricultural University of the state. It has been observed that targeted yield concepts wise STCR equations is better for crop yield not only in Maharashtra but also in other state of India.So the equations that have been found useful in improving crop yield are given below.

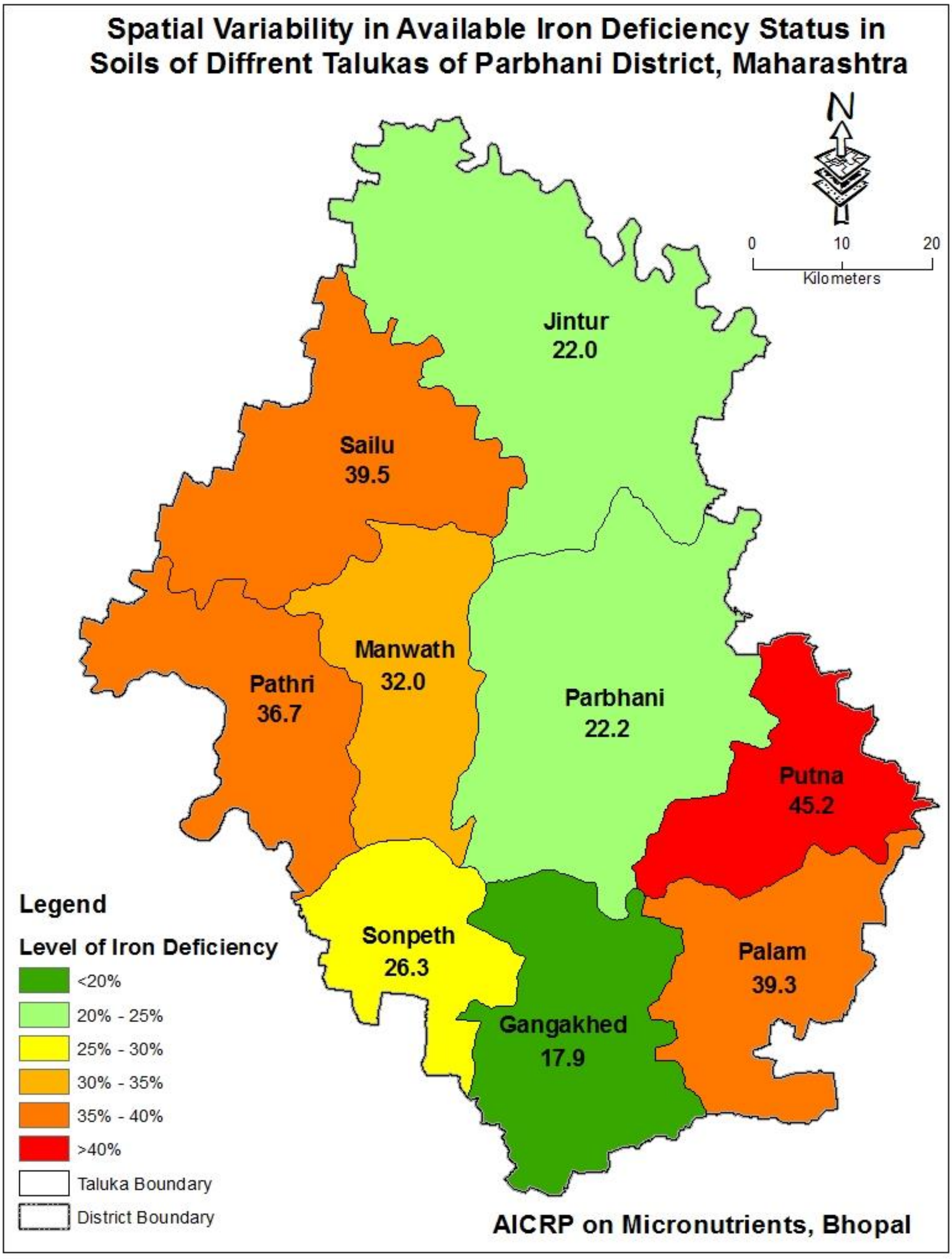
The following fertilizer prescription equations applicable for Parbhani district of Maharashtra was developed by ICAR-AICRP (STCR) at MPKV Centre, Rahuri (Maharashtra)

Crop	Fertilizer Prescription Equation*	Yield Target
Sorghum (*rabi*) dryland	FN = 5.57 T - 0.51 SN - 1.12 ON FP_2O_5 = 2.79 T - 2.29 SP - 1.21 OP FK_2O = 2.90 T - 0.09 SK - 2.27 OK	20 qha^{-1}
Sorghum (*rabi*) Irrigated	FN = 4.7 T – 0.77 SN FP_2O_5 = 2.00 T – 4.29 SP FK_2O = 3.35 T – 0.33 SK	60 qha^{-1}
Sugarcane (Seasonal)	FN = 4.76 T – 1.34 SN FP_2O_5 = 1.24 T – 1.55 SP FK_2O = 2.73 T – 0.21 SK	120 tha^{-1}
Sorghum (*Kharif*)	FN= 4.58 T – 0.96 SN FP_2O_5 = 2.21 T – 6.94 SP FK_2O = 3.34 T – 0.22 SK	45 qha^{-1}
Groundnut (*kharif*)	FN = 4.16 T – 0.37 SN FP_2O_5= 4.96 T – 4.36 SP FK_2O= 3.14 T – 0.16 SK	25 qha^{-1}
Sunflower (*kharif*)	FN = 13.94 T – 0.61 SN FP_2O_5 = 7.18 T – 6.82 SP FK_2O = 4.82 T – 0.12 SK	18 qha^{-1}
Pigeon pea	FN = 5.61 T – 0.54 SN FP_2O_5 = 5.72 T – 4.73 SP FK_2O = 6.33 T – 0.17 SK	20 qha^{-1}

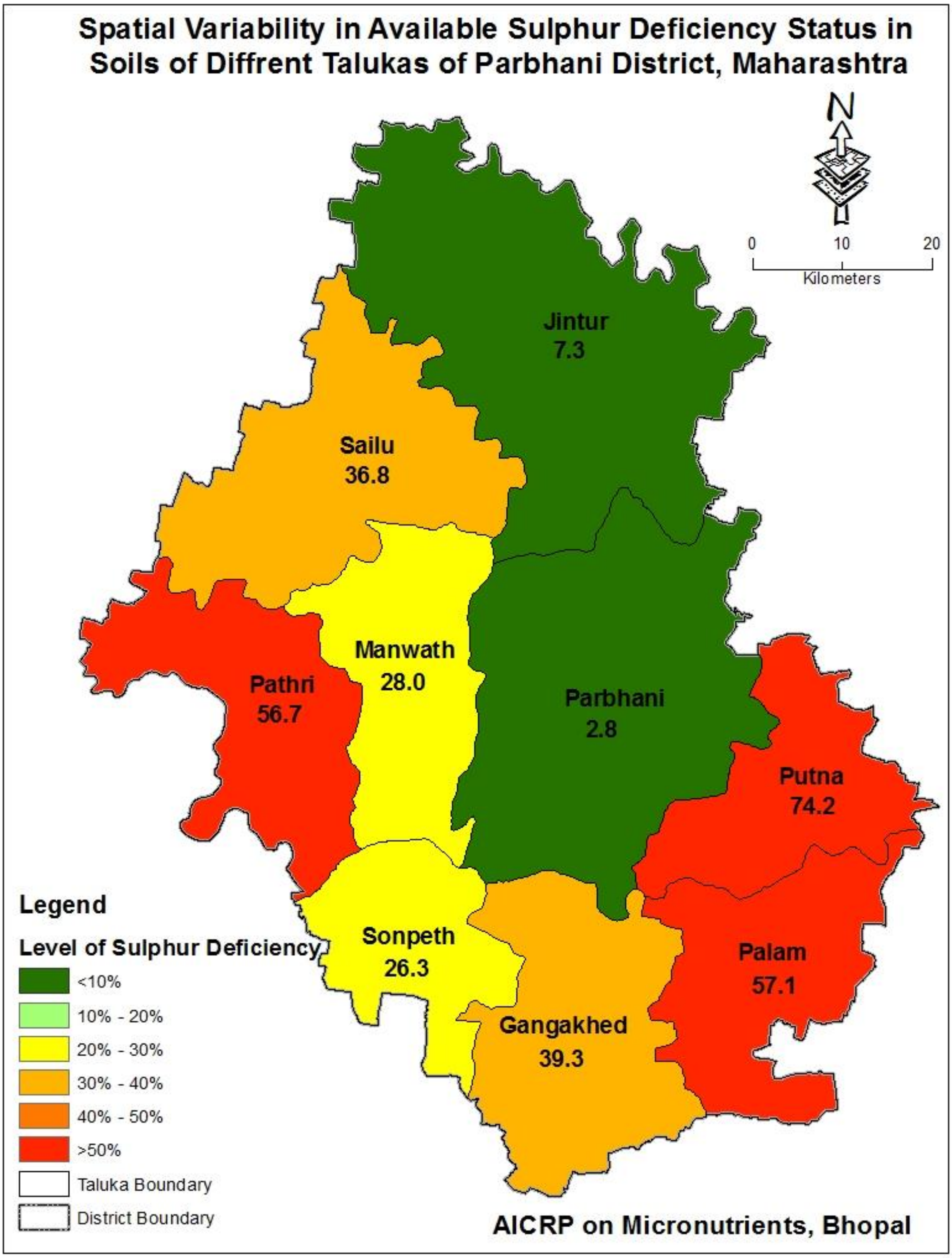
*FN, FP_2O_5 and FK_2O are required fertilizer doses, T is theyield target; SN, SP and SK are initial soil test values of available N, P and K; ON, OP and OK are concentration of N, P and K of manure.

- Dr. A.D. Kadlag, STCR Centre-in-Charge of MPKV, Rahuri has been deputed to attend the meeting at Parbhani.
- AICRP-micronutrients have performed soil analysis for micro and secondary nutrients for Parbhani districts. The soil map has been prepared for S, Zn, and Fe status (file attached). There is very high deficiency of Zn and Fe. S deficiency is limiting crop productivity in some blocks.

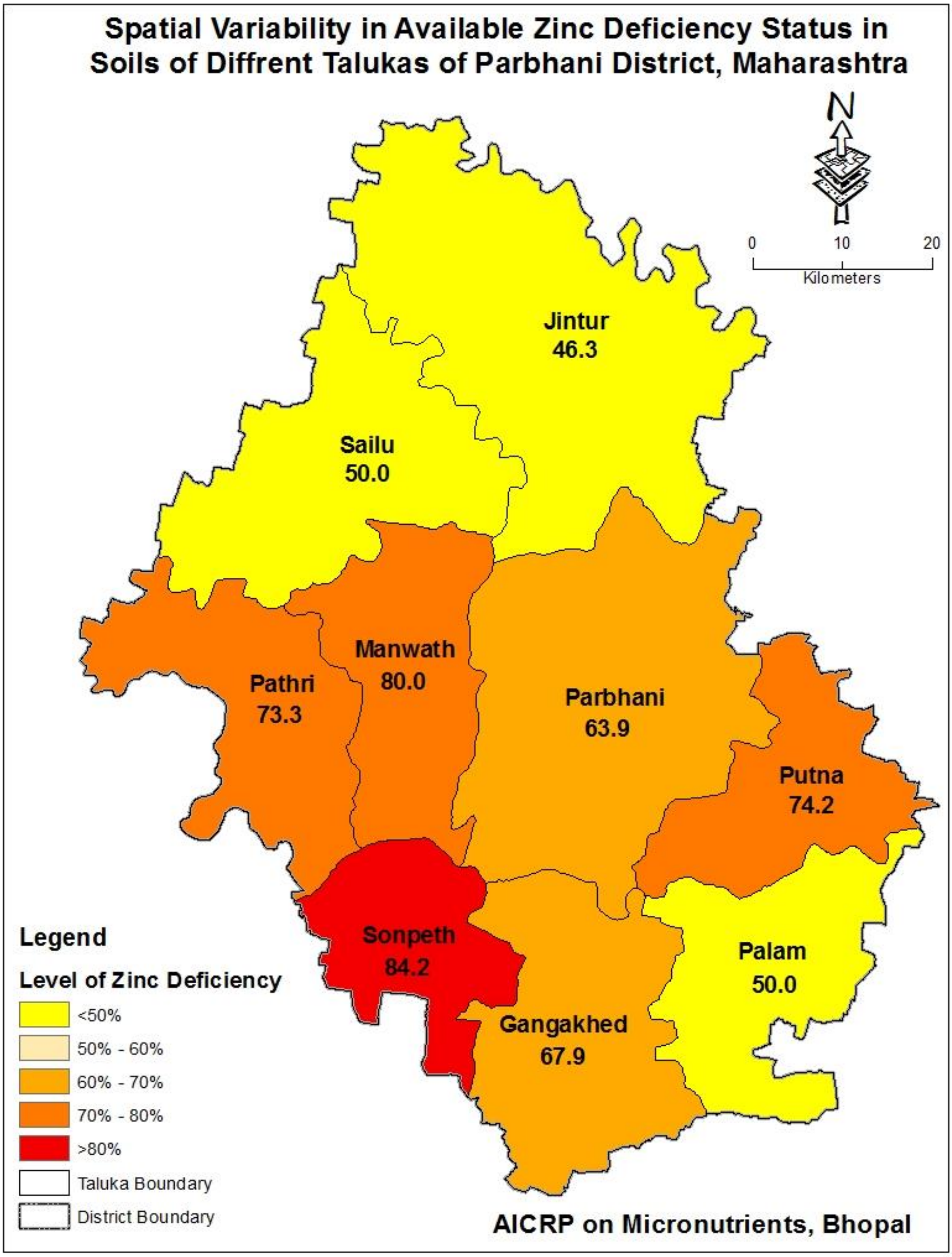
Available Iron (Fe)



Available Sulphur (S)



Available Zinc (Zn)



Basic information on Agriculture Status of Parbhani District

Most of the agriculture is rainfed in the Parbhani district and the productivity is low because of availability of water and imbalance use of nutrients. To increase the productivity during kharif there is need to manage the rain water, and for kharif attempt should be made to harvest rainwater.

Land Use

The total geographical area of Parbhani district is 631115 ha. (0.6 million ha) and the net sown area is 518775 ha (0.5 million ha) (82.5 per cent). The cropping intensity in the district is 134.2 per cent. The land use pattern of Parbhani district has been compared with the land use pattern of Maharashtra state and is presented in table 1.

Table 1: Land utilization statistic of Maharashtra (2011)

('000' ha)

Sr. No.	Particular	Maharashtra		Parbhani	
		Area	%	Area	%
1	Geographical Area	30758	100.0	631.115	100.0
2	Area under forest	5216	17.0	6.306	1.0
3	Land not available for cultivation a. Barren & uncultivable b. Land put to non agric. uses	 1721 1374	 6.0 4.4	 39.495	 6.3
4	Other uncultivated land a) Cultivable waste land b) permanent pastures and grazing lands c) land under miscellaneous tree	 914 1249 246	 2.8 4.0 0.8	 24.443 8.956 3.977	 3.9 1.4 0.6
5	Current fallows	1216	3.9	29.163	4.6
6	Other fallows	1192	3.8	-	-
7	Net area sown	17631	57.3	518.775	82.2
8	Area sown more than once	4773	15.5	177.238	28.1
9	Gross cropped area	22405	72.8	696.013	110.3

Soil Health

On perusal of soil status, it is observed that N, P and Zn are limited nutrient in the soils of Parbhani district (table 2). The soils are rice in K. Amongst the micro-nutrients, the soils are sufficient in Cu and Fe. Zn and Mn are deficient in most of the soils (table 3).

Table 2: Soil Fertility Indicators of Parbhani district

Sr. No.	Taluka	No. of Soil Samples Analyzed	pH			EC (dsm)			Organic Carbon (%)			Available Nitrogen (kg/ha)			Available Phosphorus (kg/ha)			Available Potassium (kg/ha)		
			Acidic	Normal	Alkaline	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Parbhani	4205	-	4196	9	4088	112	-	1102	2413	690	1283	2922	-	62	234	3909	-	-	4205
2	Purna	1876	-	1872	4	1821	55	-	429	1044	403	626	1350	-	21	87	1768	-	-	1876
3	Palam	1344	-	1343	1	1309	35	-	307	787	250	308	1036	-	12	49	1283	-	-	1344
4	Gangakhed	2150	-	2134	16	2112	33	-	499	1275	376	774	1376	-	43	188	1919	-	-	2150
5	Sonpeth	581	-	580	1	576	5	-	131	337	113	169	412	-	3	36	542	-	-	581
6	Selu	2006	-	1958	8	1986	20	-	571	1161	274	590	1416	-	10	51	1945	-	-	2006
7	Pathri	1255	-	1247	8	1196	59	-	309	797	149	447	808	-	36	38	1181	-	-	1255
8	Manvat	1109	-	1167	2	1152	17	-	289	681	199	335	834	-	68	81	1020	-	-	1109
9	Jintur	2314	-	2304	10	2284	30	-	636	1305	373	740	1574	-	81	160	2073	-	-	2314
	Total	16900	-	16841	59	16534	366	-	4273	9800	2827	5172	11728	-	336	924	15640	-	-	16900

Table 3: Micro Nutrient Status of Parbhani district

Sr. No.	Taluka	No. of Soil Samples Analysed	Cupper (Cu)		Iron (Fe)		Manganese (Mn)		Zinc (Zn)	
			Sufficient	Deficient	Sufficient	Deficient	Sufficient	Deficient	Sufficient	Deficient
1	Parbhani	1991	1991	0	1836	155	1861	130	1088	903
2	Purna	1241	1241	0	1113	128	1144	97	711	530
3	Palam	668	668	0	610	58	617	51	377	291
4	Gangakhed	913	913	0	829	84	844	69	552	361
5	Sonpeth	292	292	0	272	20	265	27	163	129
6	Selu	542	542	0	505	37	493	49	289	253
7	Pathri	372	372	0	327	45	333	39	193	179
8	Manvat	607	607	0	543	64	546	61	370	237
9	Jintur	896	896	0	835	61	858	38	490	406
	Total	7522	7522	0	6870	652	6961	561	4233	3289

The major soil related constraints of the districts which need to be taken care of are reported below.

- Low hydraulic conductivity leading water stagnation impairs root growth.
- Occurrence of Calcium carbonate induces imbalance in nutrient supply and availability.
- Shallow soil poses a problem of low water retention capacity and low organic matter.
- Deficiency of major and micro-nutrients in soils.

Suggestion for improvement in productivity

The following action may be taken to enhance the productivity of the district.

Since most of the area is rainfed and proper management of deficiency of overall nutrients is important for crop productivity. So, soil test based fertilizer recommendation is essential. This can be obtained from the State Agricultural University of the state. It has been observed that targeted yield concepts wise STCR equations is better for crop yield not only in Maharashtra but also in other state of India. So the equations that have been found useful in improving crop yield are given below.

The following fertilizer prescription equations applicable for Parbhani district of Maharashtra was developed by ICAR-AICRP (STCR) at MPKV Centre, Rahuri (Maharashtra)

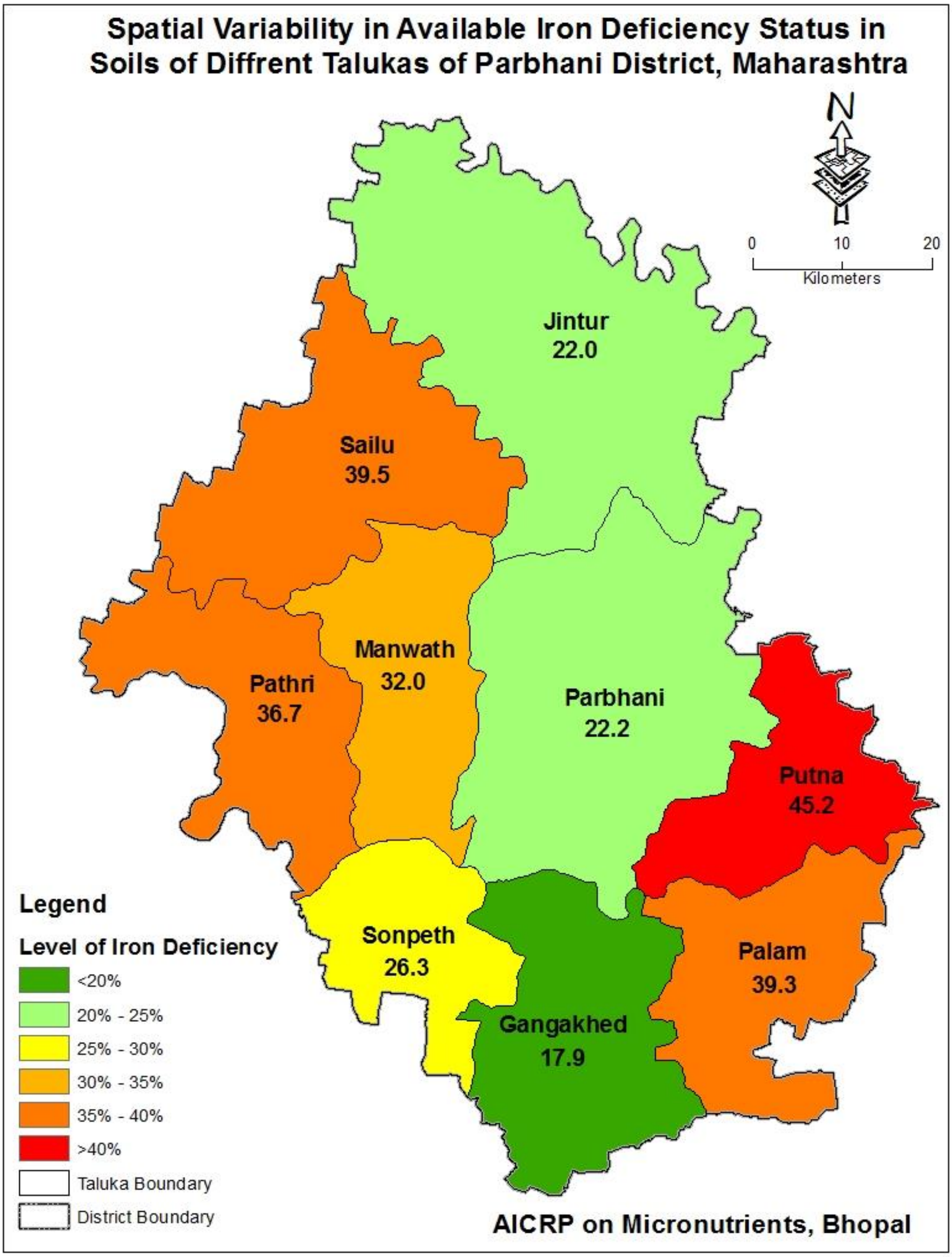
Crop	Fertilizer Prescription Equation*	Yield Target
Sorghum (*rabi*) dryland	FN = 5.57 T - 0.51 SN - 1.12 ON FP_2O_5 = 2.79 T - 2.29 SP - 1.21 OP FK_2O = 2.90 T - 0.09 SK - 2.27 OK	20 qha^{-1}
Sorghum (*rabi*) Irrigated	FN = 4.7 T – 0.77 SN FP_2O_5 = 2.00 T – 4.29 SP FK_2O = 3.35 T – 0.33 SK	60 qha^{-1}
Sugarcane (Seasonal)	FN = 4.76 T – 1.34 SN FP_2O_5 = 1.24 T – 1.55 SP FK_2O = 2.73 T – 0.21 SK	120 tha^{-1}
Sorghum (*Kharif*)	FN= 4.58 T – 0.96 SN FP_2O_5 = 2.21 T – 6.94 SP FK_2O = 3.34 T – 0.22 SK	45 qha^{-1}
Groundnut (*kharif*)	FN = 4.16 T – 0.37 SN FP_2O_5= 4.96 T – 4.36 SP FK_2O= 3.14 T – 0.16 SK	25 qha^{-1}
Sunflower (*kharif*)	FN = 13.94 T – 0.61 SN FP_2O_5 = 7.18 T – 6.82 SP FK_2O = 4.82 T – 0.12 SK	18 qha^{-1}
Pigeon pea	FN = 5.61 T – 0.54 SN FP_2O_5 = 5.72 T – 4.73 SP FK_2O = 6.33 T – 0.17 SK	20 qha^{-1}

* FN, FP_2O_5 and FK_2O are required fertilizer doses, T is the yield target; SN, SP and SK are initial soil test values of available N, P and K; ON, OP and OK are concentration of N, P and K of manure.

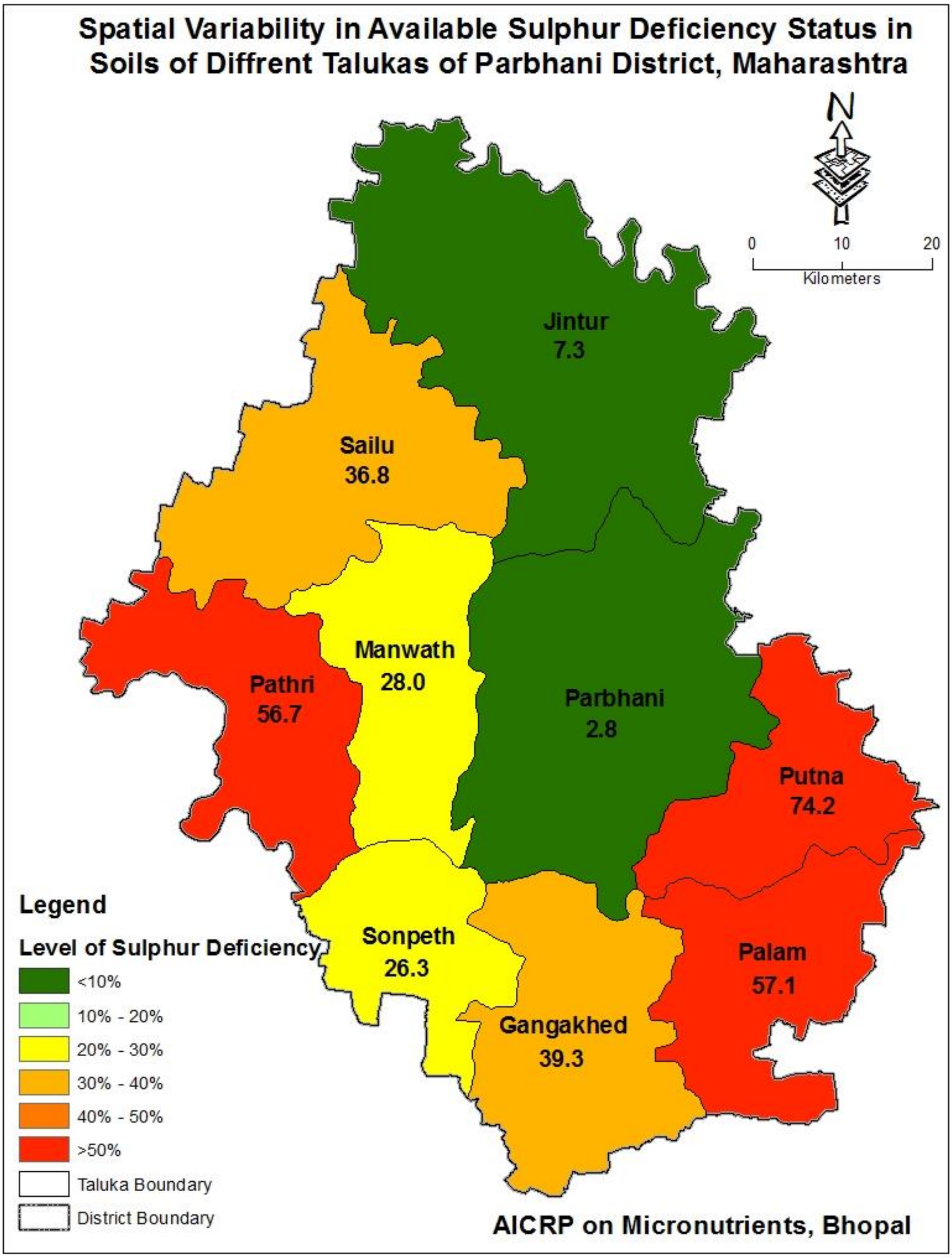
- Dr. A.D. Kadlag, STCR Centre-in-Charge of MPKV, Rahuri has been deputed to attend the meeting at Parbhani.

- AICRP-micronutrients have performed soil analysis for micro and secondary nutrients for Parbhani districts. The soil map has been prepared for S, Zn, and Fe status (file attached). There is very high deficiency of Zn and Fe. S deficiency is limiting crop productivity in some blocks.

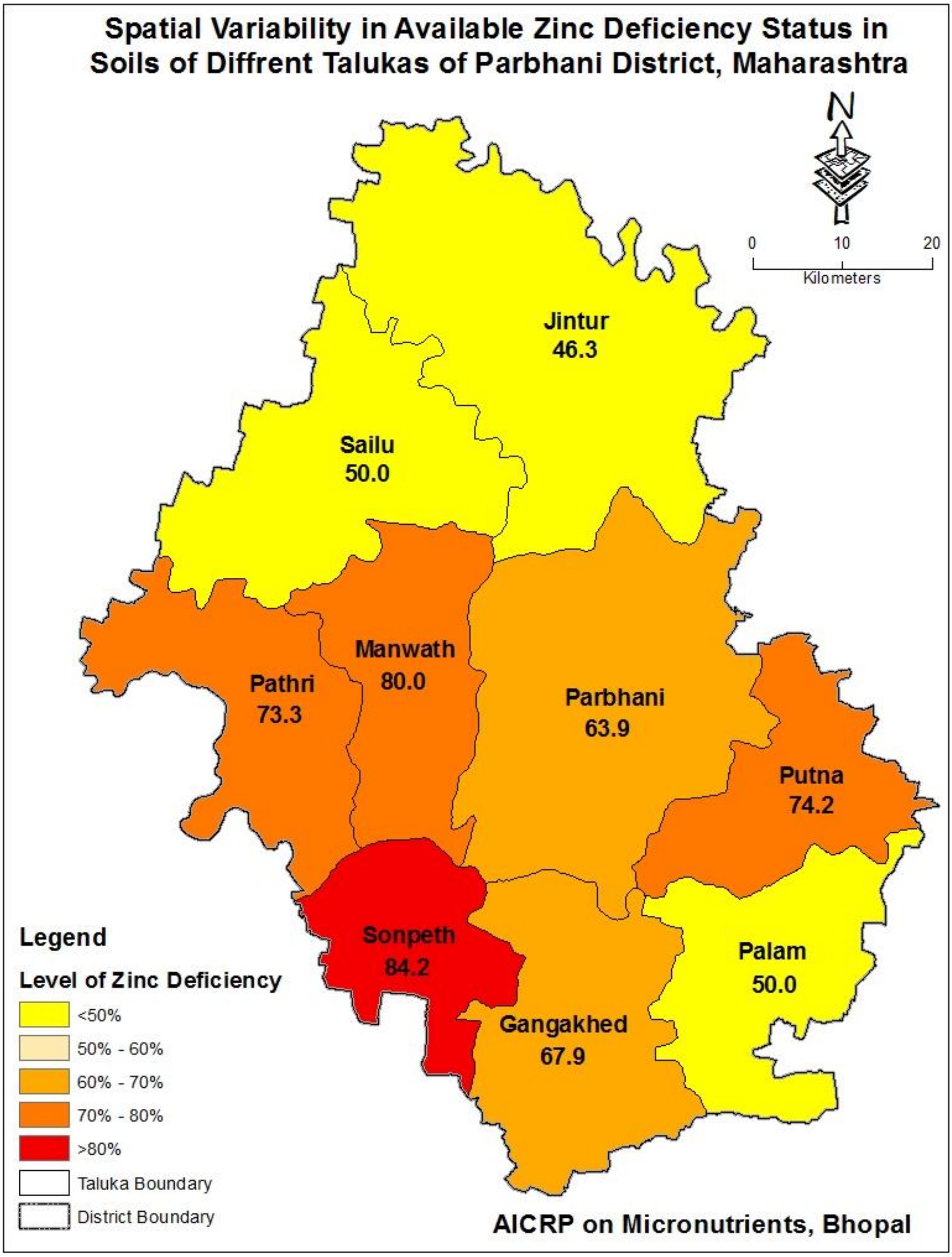
Available Iron (Fe)



Available Sulphur (S)



Available Zinc (Zn)


Spatial Variability in Available Zinc Deficiency Status in Soils of Diffrent Talukas of Parbhani District, Maharashtra
N
0
10
20
Kilometers
Jintur 46.3
Sailu 50.0
Manwath 80.0
Pathri 73.3
Parbhani 63.9
Putna 74.2
Sonpeth 84.2
Palam 50.0
Gangakhed 67.9
Legend
Level of Zinc Deficiency
<50%
50% - 60%
60% - 70%
70% - 80%
>80%
Taluka Boundary
District Boundary
AICRP on Micronutrients, Bhopal

Sub: Information related to Bidar district by Shri Bhagwanth Khuba, Hon'ble Member of Parliament (Lok Sabha)

Ref. Your letter dated 12th May, 2016

Suggestion for development of Agriculture in Bidar district

From the information collected from Karnataka state site and from the literature, the following issues may be presented.

Constraint

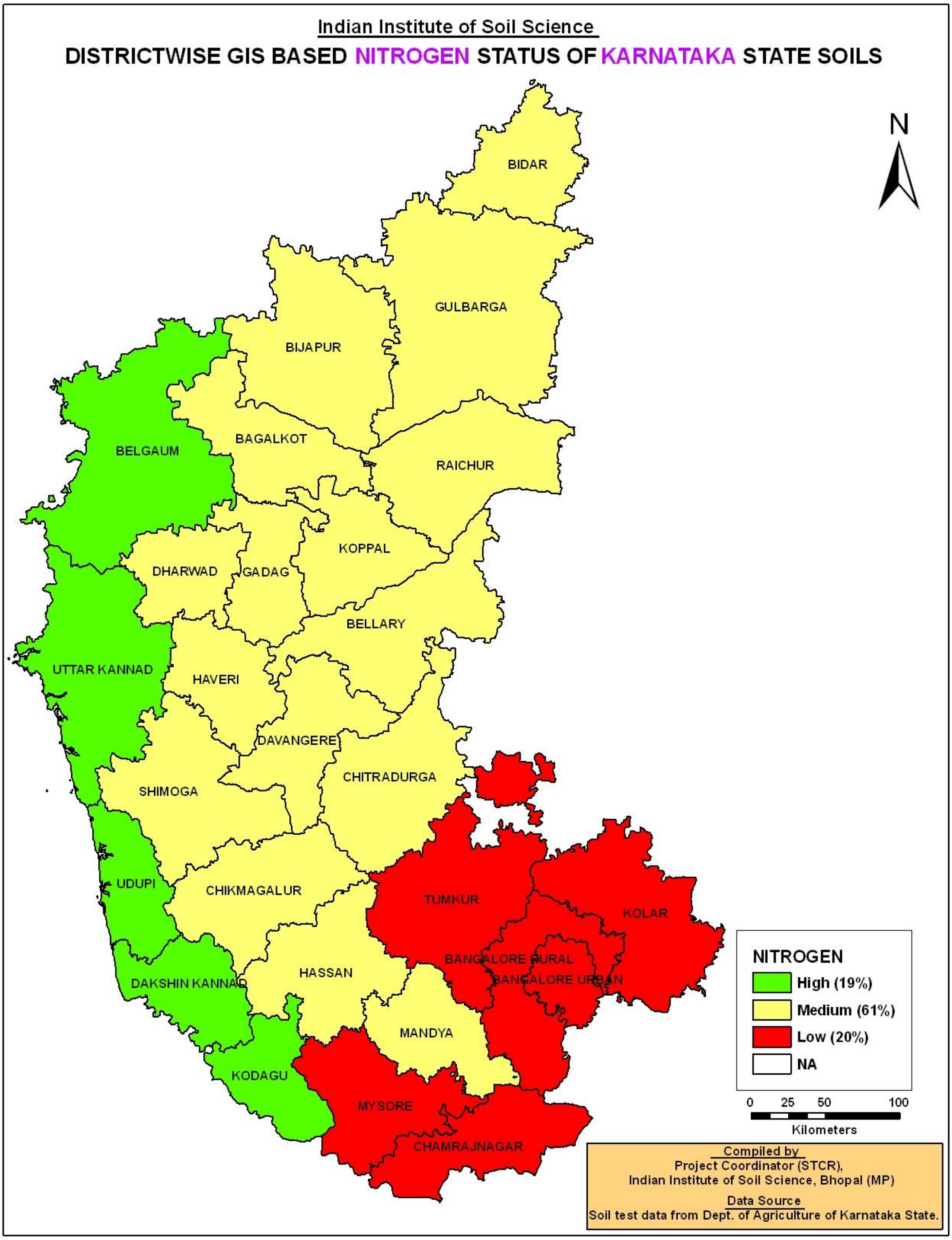
1. The rainfall of the district is around 880 to 1000 mm which is considered to be good as far as agriculture is concerned but the area under irrigation is around 14% against the state average of 32%. The area sown during *rabi* season is one third of *kharif* which means water is not available during *rabi*. Because of nonavailability of work in farm during *rabi*, the people migrate to Hyderabad and places nearby in search of work and livelihood.

Suggestion:

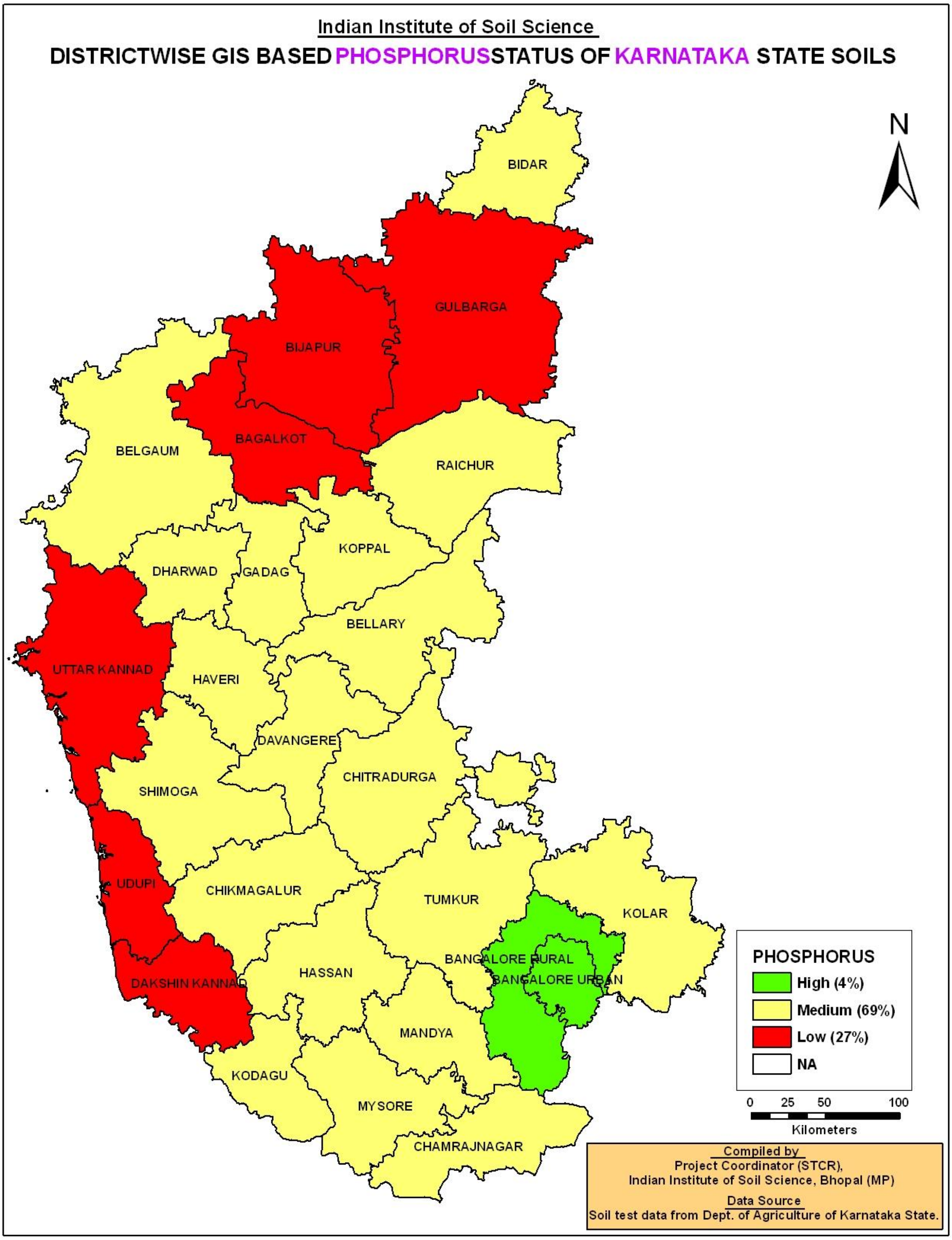
1. To increase area under *rabi* there is an urgent need to harvest rain water for the *rabi* crops. This could be done though construction of small check dams in rainy season or though collection of water in ponds at individual farmer or village level. This will help in increasing the crop area in *rabi* season and thus cropping intensity will increase and the availability of water will increase the productivity. Growing of two crops in a year will increase carbon in soil and improve soil health. Increase in rabi crop area will certainly provide more working days for farm labour and to some extent check the migration.
2. Sugarcane is one of the most important crops of the district but the average productivity of sugarcane in the district is 40 -50 t/ha which is very low. This is due to nonavailability of water after the monsoon. The stored water may help in increasing the productivity of this crop.
3. In general fertilizer consumption is low and Bidar is one of the lowest fertilizer consuming districts of Karnataka and phosphorus is used in larger quantity without any additional benefit to farmer. The ratio of NPK is 4.2:4.3 :1. Since the large area is under red and laterite soil which are hungry for K therefore attention should be given to increase K use. This will increase the use efficiency of N and P and save the fertilizer and improve the economy of the farmers. For this, soil testing could be one of the tools to increase the productivity and efficiency of nutrients.
4. Since area is rain-fed and number of small holdings are large, raising of goat and sheep could be one of the alternative to increase the income of farmers.
5. STCR centre at UAS, Bengaluru had earlier provided technical backstopping to the scientists of UAS, Raichur for soil fertility evaluation of Bidar district. In this regards, the ICAR-Indian Institute of Soil Science, Bhopal can further support to enhance the capacity building of UAS, Raichur.

6. AICRP (STCR) at ICAR-IISS, Bhopal in collaboration with RKVY conducted project demonstrations on red gram in farmers field at 7 villages namely, Chandapur, Kanaji, Markal, kapalapur, Nowbad, Janawad and Nimboor villages of Bidar district covering 14 farmers. The results clearly indicated the benefit of balanced use of fertilizer nutrients through STCR approach as compared to nutrient application package of practices prevalent for red gram.

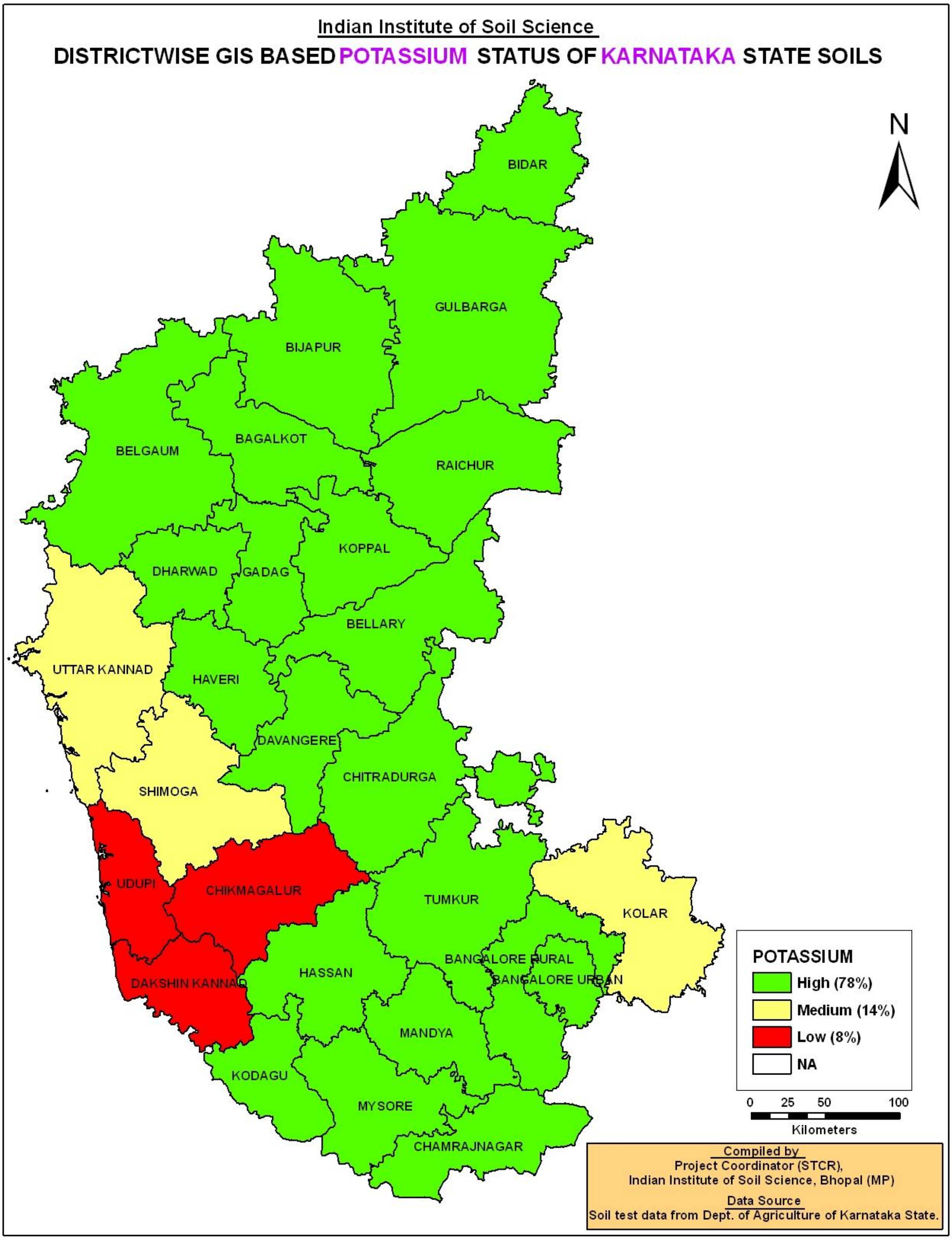
7. ICAR-IISS, Bhopal developed soil fertility maps based on nutrient index for Bidar district. These maps are available at website of http://www.stcr.gov.in/Farmer/HTML/Fertility_Maps_Macro/StateProfile/Karnataka.html. As per the soil fertility maps the soils in Bidar district are medium in available N and P and high in K.



Website address: http://www.stcr.gov.in/Farmer/HTML/Fertility_Maps_Macro/StateProfile/Karnataka.html



Website address: http://www.stcr.gov.in/Farmer/HTML/Fertility_Maps_Macro/StateProfile/Karnataka.html



Website address: http://www.stcr.gov.in/Farmer/HTML/Fertility_Maps_Macro/StateProfile/Karnataka.html

Sub.: Rajya Sabha Starred Question No. 101 due for reply on 26/07/2016 asked by Shri Rajeev Shukla regarding Expenditure incurred on International Yoga Day 2016.

Ref.: F.No. GAC/14-1/2016-CDN dated 22 July, 2016

(a) How much amount was spent by Government for organizing and promotion of the International Yoga Day 2016;

ICAR-IISS, Bhopal had not incurred any expenditure. However, Yoga day was celebrated with help of Maharshi Vedic Sanskritic Kendra and expenditure of Rs. 1000/- was borne by Staff Recreation Club of ICAR-IISS, Bhopal.

(b) Whether any private agency was hired for organizing and promotion of the said event; and

Nil

(c) if so, the details thereof, including the payment made to the agency.

Nil

Sub: **Lok Sabha provisional admitted parliament question Dy. No. 3254 due reply on 01.03.2016 regarding Krishi Melas**

Ref. **Your mail dated 26 Feb. 2016**

Information Related to Parliament Question

ICAR-Indian Institute of Soil Science, Bhopal-462038 (Madhya Pradesh)

Year	**Krishi Mela/Exhibitions organised***	**No. of Farmers Participated/Benefitted**
2013-14	Western Region Agriculture Fair-2013 (28-31, January, 2013)	2000
2014-15	-	-
2015-16	-	-

*(*Please **don't** include the Krishi Mela/Exhibition which is organised at Krishi Vigyan Kendra)*

Sub.: Lok Sabha Question No. 1580 regarding neem coated urea to be answered on 03/05/2016

(c) Whether the government has conducted any research on neem coated urea and if so the details of the results thereof,

Research on NCU has been carried out by many institutions. At IARI, the neem coated urea application to rice improved the grain yield by 4 to 36%.

References:

1. Ten year achievements of IARI, New Delhi (online) http://www.iari.res.in/?option=com_content&view=article&id=644&Itemid=1614
2. Singh, S. and Shivay, Y.S. (2003) Coating of prilled urea formulations for efficient nitrogen use in hybrid rice. *Acta agronomica hungarica*, 51 :53-59.
3. R. Prasad, S. Singh, V. S. Saxena, C. Devkumar (1999) Coating of Prilled Urea with Neem (Azadirachta Indica Juss) Oil for Efficient Nitrogen Use in Rice. *Naturwissenschaften.* November 1999, Volume 86, Issue 11, pp 538-539.
4. Agrawal et al (1990) Ind. J. Agron, 35: 337-340

Item-9 Query Shri Raju Shetti, Member of Parliament expressed his concerns about use of organic manure (Khad) in our soils. He desired that the composition of organic manure requires standardization and methods for certification need to be worked upon.

Reply:

The composition of manure has already been standardized and method of certification have been also worked out for organic manure, city compost amd vermicompost (Reference**: Fertilizer Control Order (1985, amended November, 2013 page 220-238) (Published by FAI, New Delhi)**

Sub: **Lok Sabha Starred/Unstarred Question Dy. No. 4545 regarding Productivity of Soil due for answer on 22.11.2016**

Ref.: **Fax dated 10.11.2016**

(a) **whether there has been a sluggish progress in utilization and improving the yield potential of various crops and legumes in the country and if so, the details thereof and the reasons therefor;**

NA

(b) **the details of financial support extended to farm/food projects for the purpose during the last three years and the current year, state-wise;**

During the last three years institute conducted research on various issues of soil fertility & crop productivity through 40 research projects. During this period institute conducted 18 nos. of farmer visits, 11 nos. of trainings to farmers, 28 nos. of demonstration trials at farmers field and 20 nos. of trainings to state department officials on soil health. Besides this farmers were provided regular technical support through Mera Gaon Mera Gaurav programme.

(c) **Whether the Indian Council of Agricultural Research (ICAR) and other institutions has undertaken any research works to protect and preserve the existing fertility of soils and increase their fertility and**

ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) sponsored project on "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country" has completed GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts from geo-referenced soil samples and the digital maps have been uploaded in the ICAR-Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders.

The Government has taken scores of measures to overcome this problem. Govt. has launched a scheme of providing soil health card to every farmer in a mission mode. Fourteen crore farmers will be covered under the plan during the next three years.
ICAR - Indian Institute of Soil Science has developed technologies on Integrated Plant Nutrient Supply system (IPNS) to improve and maintain soil fertility. Such technology has also been demonstrated in farmers' fields.

There are about 102 institutions of ICAR apart from 69 State Agricultural Universities, 2 Central Agricultural Universities and 651 KVKs in the country. All these institutions work on soil fertility assessment and management as one of the objectives in their research programme. There are four institutes listed below that are solely working on various issues related to soil management.

i) ICAR – Indian Institute of Soil and Water Conservation (IISWC), Dehradun

ii) ICAR - Central Soil Salinity Research Institute (CSSRI), Karnal

iii) ICAR - Indian Institute of Soil Science (IISS), Bhopal

iv) ICAR - National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring soil fertility status of respective states, providing best nutrient management practices for different soils crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping systems prevailing in those states. The ICAR institutes, especially the above mentioned ones through All India Coordinated Research Projects (AICRP) and in-house projects are providing solutions to national issues. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility maps with respect to major and micro-nutrients to give suitable nutrient recommendations through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertilizers. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. The farmers are also educated during the *Kisan Mela*. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) through various themes such as soil testing, organic farming and conservation agriculture. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technologies over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice (kg grain/kg nutrient)**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

AICRP (STCR) has undertaken large number of demonstrations and field day –cum–capacity building programmes under Tribal Sub Plan (TSP) to promote balance use of fertilizers and soil test based fertilizer recommendations amongst tribal farmers of the counting.

d. the details of Soil Research Centres (SRCs) established in the country and the agencies and stakeholders who have sought financial and logistic support for establishing more SRCs during the current year, state-wise

The ICAR-IISS, Bhopal was established in 16 April, 1988 with the object "to Provide Scientific Basis for Enhancing and Sustaining Productivity of Soil Resources with Minimal Environmental Degradation".

Sub: **Provisionally admitted question for the Rajya Sabha Dy. No. S588 regarding "Projects under ICAR"**

Ref. **F.No. 8(1)/2016/PIM dated 16 February 2016.**

a) **the details of allocation and utilization of funds for the Indian Council of Agricultural Research (ICAR) during last five years, year-wise and project-wise;**

A. Institute projects (In lakhs)

Year	**2011-12**		**2012-13**		**2013-14**		**2014-15**		**2015-16**	
	Allocation	Expenditure incurred	Allocation	Expenditure incurred	Allocation	Expenditure incurred	Allocation	Expenditure incurred	Allocation	Expenditure incurred
Plan	354.00	393.97	250.00	249.93	160.00	149.46	180.00	179.94	295.00	159.09
Non - plan	689.97	715.37	778.00	755.55	793.00	873.37	1001.00	1000.21	1019.00	916.54

B. NAIP/AMAAS/NICRA/NASF/ICAR Extra Mural Projects/CRP on Nano-technology

S.No.	**Project titles**	**Allocated funds (in lakhs)**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
1.	Soil organic carbon dynamics and climatic changes and crop adaptation strategies Funded by NAIP, ICAR (May 2008- March 2013)	15.47	10.02	6.90	-	-	-
2.	Assessment of quality and resilience of soils in diverse agro-ecosystems Funded by NAIP, ICAR (July 2008 – March 2012)	99.71	95.42	4.29	-	-	-
3.	Understanding the mechanism of variation in status of a few nutritionally important micronutrients in some important food crops and the mechanism of micronutrient enrichment in plant parts (NAIP project) (Feb 2009- March 2014)	583.34	97.16	15.37	0.00	0.00	0.00
4.	Nano-technology for Enhanced Utilization of Native-Phosphorus by Plants and Higher Moisture Retention in Arid Soils (NAIP Project) (July 2008- March 2014)	327.60	60.75	0.00	0.00	0.00	0.00
5.	Evaluating Conservation Agriculture for Stabilizing Crop Productivity and Carbon Sequestration by Resilient Cropping Systems/Sequences under aberrant Climatic Conditions in Black Soils of Central India. Funded by NICRA, ICAR (Sept. 2011- 2014)	75.00	13.61	29.95	27.69	-	-
6.	Integrated assessment of soil and crops for enhancing productivity and C-sequestration potential of Vertisols of central India under	24.93	-	-	-	0.20	-

	changing climate scenarios Funded by NICRA (Feb 2015 to March 2018)						
7.	Archaea and Actinobacteria in Vertisols of Central India-Assessment of Diversity, Bigeochemical Processes and Bioinoculant Potential Funded by AMAAS (July, 2014 - March 2017)	27.06	6.00	5.27	2.35	4.77	-
8.	Simulating the effect of elevated CO_2 and temperature on water productivity and nutrient use in soybean-wheat cropping system Funded by NASF, ICAR (June 2015- June 2018)	139.85	-	-	-	-	-
9.	Determination of critical limits for identifying heavy metals contamination and their threats in major soil types of India Extra Mural project, ICAR (2016-2018)	23.40	-	-	-	-	-
10	In-situ residue decomposition of rice-wheat and sugarcane for enhancing crop productivity and soil health Extra Mural project, ICAR (2016-2018)	29.70	-	-	-	-	-
11	Use of nano sensors network for field detection of temperature and moisture stress in plant and soil Funded by CRP on Nano-technology (April 2015- March 2016)	318.18	-	-	-	2.61	-
12	Conversion of naturally occurring plant nutrient containing minerals into nano form by top down approach to enhance the availability of plant nutrients in soil and faster reclamation of problem soils soil Funded by CRP on Nano-technology (April 2015- March 2016)	318.18	-	-	-	2.61	-
13	CRP on CA	5.00	-	-	-	4.99	-

b) **whether government is aware that completion deadlines of several projects under ICAR have been extended midway during project execution;**

Project at ICAR-IISS has been completed as per schedule.

c) **if so, the details of such project along with the reasons for extension of their completion period the cost overrun thereof, project-wise; and**

NA

d) **the details of projects initiated but not completed till date along with the date of initiation and expected date for its completion, project-wise.**

NA

Sub: Rajya Sabha Starred/Unstarred Question Dy. No. S4195 regarding Protecting and enhancing fertility of soil due for answer on 12.08.2016

Ref.: F.No. 1(9)2016/SW&DF dated 02.08.2016

(a) What the ICAR is doing to protect the existing fertility of soil as also to increase its fertility for better productivity;

ICAR - Indian Institute of Soil Science has developed technologies of Integrated Plant Nutrient Supply system. IPNS improves and maintains the soil fertility. Such technology is also demonstrated in farmers' fields.

There are about 100 institutions of ICAR apart from 69 State Agricultural Universities, 2 Central Agricultural Universities and 641 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

i) ICAR – Indian Institute of Soil and Water Conservation, Dehradun

ii) ICAR - Central Soil Salinity Research Institute, Karnal

iii) ICAR - Indian Institute of Soil Science, Bhopal

iv) ICAR - National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Coordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro-nutrients and giving suitable nutrient recommendations through soil test crop response prescription equations.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain soil fertility through judicious use of fertilizers. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make themselves aware of the soil health through frontline demonstrations, training on soil sampling and testing and biofertilizer use for efficient crop production. The farmers are educated during the *Kisan Mela* to use advance soil technologies in soil and crop production. The institute has conducted about 30 training programmes for farmers under various themes such as soil testing, organic farming and technology demonstrations. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted several on-farm trials / field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and vegetables which have shown advantages of STCR technology over general fertilizer recommendations. The details are given below.

Crop	**No. of trials**	**Farmer's practice**	**STCR- IPNS recommended practice (kg grain/kg nutrient)**
Rice	120	11.4	16.8

Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Mustard	45	8.0	8.2
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

AICRP (LTFE) is engaged to monitor soil fertility in different crops and cropping systems due to application of nutrients from various sources. Application of balanced chemical fertilizer not only increased crop productivity but also improved soil organic carbon and fertility of tested locations.

(b) The status of soil fertility in various states, particularly Andhra Pradesh and Telangana

ICAR - Indian Institute of Soil Science, Bhopal has compiled soil test data of available N, P and K status from different soil testing laboratories located in 19 states which showed that the soils of about 59% area were low in available N, 36% were medium and 5% were high. Similarly, soils of about 49% area were low, 45% were medium and 6% were high in available P. Available K status showed that the soils of about 9% area were low, 39% were medium and 52% were high in available K status**.**

In a recent study on "GPS and GIS based soil fertility maps for precise fertilizer recommendations for the farmers of the country", ICAR-IISS has completed GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts of the country from the reo-referenced soil samples have been developed. The digital maps have been uploaded in the ICAR-Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders.

With reference to Andhra Pradesh, GPS and GIS based soil fertility maps of six districts, viz., Kurnool, Kadap, Guntur, Anantpur, Krishna, West Godavari have been prepared; for Telangana soil fertility maps of four districts, viz., Mahaboobnagar,Karimnagar, Rangareddy and Nizamabad have been prepared and uploaded in the link: http://www.iiss.nic.in/mapd_10.htm

The fertility status of the A.P. and Telangana with respect to N, P, K has been given in table 1. Micro- and secondary nutrients status of country have been given in Table 2. The micro- and secondary nutrient status (deficiency) for the state Andhra Pradesh and Telangana have been reported in Table 3 and Table 4.

(c) Whether any research is underway on soil health of the country by ICAR and other institutions, if so, the details thereof?

ICAR as well as the Government has taken scores of measures to protect the existing soil fertility. Govt. of India has launched a scheme to provide soil health card to every farmer of the country in a mission mode in which ICAR has participated in the activity for formulation of guidelines. Fourteen crore farmers will be covered under the plan. Project funded by ICAR entitled “Soil quality assessment and developing indices for major soil and production regions of India” is underway at ICAR-IISS, Bhopal to address the issues of soil health in the Indo-Gangetic plains of the country.

Apart from taking up research projects the Institute is working towards capacity building of all stakeholders namely farmer, technician, researchers, etc. involved in soil health assessment and management. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, bio-fertilizer use as well as soil management for efficient crop production. These training programmes are being conducted every year for the benefit of farmers. The institute has also conducted more than 15 training programme on soil testing for preparation of soil health card under soil Health Mission of Govt. of India.

All India Coordinated Research Project of Micro and Secondary Nutrients & Pollutant Elements in Soils & Plants is addressing GIS based delineation and reassessment of micro and secondary nutrients deficient areas and updating soil fertility maps, amelioration of micro and secondary nutrient deficiency in crops and cropping systems and monitoring of heavy metal toxicity in soil-plant system.

ICAR-IISS, Bhopal is also engaged in a major flagship programme to enhance input use efficiency. The Institute has taken up an inter-institutional project for assessment and management of soil health in major crop growing regions of the country. It has also undertaken a NAIP project for development of methodology to evaluate soil health of major soils of India.

Table 1: NPK Fertility status (% deficient area) in different districts of Andhra Pradesh and Telangana

State/Districts	N	P	K
Andhra Pradesh			
Kurnool	100	42	5
Kadapa	100	18	15
Guntur	100	0	3
Anantpur	100	60	37
West Godavari	100	0	43
Krishna	100	4	0
Telangana			
Mahboobnagar	100	24	27
Karimnagar	100	0	1
Rangareddy	100	39	12
Nizamabad	100	0	12

Table 2. Micronutrients and secondary nutrients in different states of India

State	Samples analysed	Samples deficient (%)	Samples deficient (%)	Samples deficient (%)	Samples deficient (%)	Samples analysed	Samples deficient (%)	Samples analysed	Samples deficient (%)
		Zn	**Fe**	**Cu**	**Mn**		**B**		**S**
Andhra Pradesh	**7292**	**23.5**	**17.9**	**1.4**	**1.7**	**3787**	**4.3**	**5200**	**35.5**
Assam	7208	28.1	0.0	2.8	0.1	7208	10.5	5798	18.4
Bihar	14487	45.4	12.4	3.2	9.1	14219	38.9	18250	37.7
Chhattisgarh	4731	20.2	6.8	3.2	14.1			751	30.5
Goa	680	55.3	3.5	3.1	9.1			-	-
Gujarat	7587	36.6	25.9	0.4	0.5	7587	18.7	6234	42.1
Haryana	5637	15.4	21.7	5.2	6.2	5637	3.2	5673	35.8
Himachal Pradesh	10586	8.0	0.5	1.2	7.3			3437	24.2

Jammu & Kashmir	597	7.4	0.2	0.0	2.0			-	-
Jharkhand	995	11.3	0.0	0.2	0.3	995	61.4	1593	49.3
Karnataka	7987	43.1	10.9	3.6	0.2	520	28.5	8996	36.5
Kerala	894	18.3	1.2	0.4	3.6	894	31.2	1144	31.8
Madhya Pradesh	14236	65.9	8.8	0.5	2.4	5643	1.8	14019	36.7
Maharashtra	13663	39.3	23.7	0.1	3.1	6968	44.6	10825	36.0
Manipur	1860	18.3	0.0	0.0	0.0	60	9.9	-	-
Odisha	4591	29.2	8.0	8.3	2.6	4565	45.7	7358	39.5
Punjab	6166	21.2	11.06	4.8	25.2	5068	20.1	4500	38.0
Rajasthan	6320	56.5	34.4	9.2	28.3	1094	22.0	8172	54.0
Tamil Nadu	34315	63.2	12.6	12.1	7.5	34315	20.61	29753	15.3
Telangana	**4939**	**26.8**	**16.7**	**1.38**	**3.6**	**2773**	**11.9**	**4032**	**31.8**
Uttar Pradesh	8072	32.4	10.2	5.0	8.7	6088	21.73	15365	37.0
Uttarakhand	2575	9.6	1.4	1.5	4.8	2575	7.5	2669	12.7
West Bengal	3872	13.8	0.1	1.76	1.0	3358	40.2	2903	53.0
India (Average)	**169290**	**39.9**	**12.6**	**4.6**	**6.0**	**113354**	**22.9**	**156672**	**32.9**

Table 3. Micronutrients and secondary nutrients in different district of Andhra Pradesh

District	Samples analysed	Samples deficient (%)				Samples analysed	Samples deficient (%)	Soil samples analysed	Samples deficient (%)
		Zn	**Fe**	**Cu**	**Mn**	**B**		**S**	
Anantapur	1329	45.67	30.85	1.20	2.33	600	1.83	600	49.67
Chittoor	571	33.10	31.00	5.25	2.63	571	12.78	571	18.21
East Godavari	692	3.90	4.05	0.00	0.00	0	-	-	-
Guntur	402	17.66	11.69	2.74	0.75	402	0.00	402	23.63
Kadapa	582	19.59	13.92	0.17	0.00	582	1.37	582	25.60
Krishna Nagar	594	19.53	6.40	0.34	1.85	594	4.88	594	14.48
Kurnool	552	36.59	31.16	0.91	5.43	552	7.43	552	41.85
Prakasham	699	20.03	22.32	0.29	0.57	0	-	-	-
Srikakulam	459	20.70	4.58	0.22	0.00	0	-	-	-
Vijayanagaram	428	6.07	3.74	0.47	0.00	0	-	-	-
Vishakhapatnam	500	13.00	18.40	0.00	1.20	0	-	-	-
West Godavari	486	12.76	14.61	7.00	5.56	486	0.41	486	11.73
Andhra Pradesh	**7294**	**23.50**	**17.9**	**1.43**	**1.7**	**3787.00**	**4.3**	**3787**	**35.5**

Table 4. Micronutrients and secondary nutrients in different district of Telangana

District	Samples analysed	Soil samples deficient (%)				Samples analysed	Samples deficient (%)	Samples analysed	Samples deficient (%)
		Zn	**Fe**	**Cu**	**Mn**	**Boron**		**Sulphur**	
Adilabad	499	52.51	15.83	0.60	0.60	-	-	-	-
Karimnagar	630	21.27	14.92	0.95	0.00	630	14.60	630	51.27
Khammam	460	15.65	8.70	0.43	0.00	-	-	-	-
Medak	428	17.76	9.11	0.47	0.00	-	-	-	-
Mahbubnagar	899	27.92	12.35	4.00	2.56	899	9.23	899	21.25
Nalgonda	256	7.42	17.19	0.39	2.34	256	43.75	256	54.69
Nizamabad	520	14.23	41.92	0.00	5.19	520	4.42	520	28.08
Rangareddy	468	14.32	7.91	3.63	24.79	468	4.27	468	14.32
Warangal	779	47.50	20.80	0.13	0.13	-	-	-	-
Telangana	4939	26.83	16.68	1.38	3.56	2773	11.90	2773	31.8

Item-9 Query **Shri Raju Shetti, Member of Parliament expressed his concerns about use of organic manure (Khad) in our soils. He desired that the composition of organic manure requires standardization and methods for certification need to be worked upon.**

Reply:

The potential availability of all animal excreta in the country is about 369 million tonnes of which 119 million tonnes is actually available that potentially can supply 1.7 million tonnes (Mt) of plantnutrients (NPK). Country also generates about 679 million tonnes of crop residues, in which 226 million tonnes is actually available that has a nutrient potential of about 5.6 million tonnes of NPK. It is estimated that about 64.8 million tonnes city wastes is generated annually which have potential to supply 0.285 million tonnes NPK. **(Reference: Manna et al (2015) ICAR-IISS Technology Folder, Page 1-8).**

The composition of manure has already been standardized and method of certification have been also worked out for organic manure, city compost amd vermicompost (Reference**: Fertilizer Control Order (1985, amended November, 2013, page 220-238).**

L. Soil Health Management

I. What will be the impact of global warming on soil health?

- The important soil properties such as organic C and N mineralisation, soil respiration, microbial biodiversity and biomass are sensitive to global warming.
- Atmospheric warming may reduce the stock of soil organic carbon due to increase in the rate of its decomposition and loss of carbon to atmosphere.
- This gradual reduction in soil organic carbon may eventually reduce the nutrient and moisture holding capacity of soil, degrade physical and structural stability, hamper the movement of water and air in soil and thus affect the suitability of soil for plant growth.

II. Whether ICAR has conducted any study to assess the impact of increasing temperature on soil health in the country?

- A study was carried out at ICAR-IISS, Bhopal to investigate the impact of environmental parameters (temperature and moisture content) on CH_4 oxidation of farm yard manure (FYM). FYM exhibited maximum CH_4 oxidation at 35 °C.
- The CO_2 emission was observed to be greater in macro-aggregates followed by micro-aggregates and mineral associates at 25, 35 and 45 °C. Temperature affected C mineralisation rate and it depended upon source and amount of substrate applied.
- Modelling study conducted at IISS Bhopal revealed that soil carbon sequestration rate is the function of soil carbon content, net primary productivity, soil texture, rainfall, temperature and C: N ratio of residue.

III. Whether ICAR has conducted any studies to assess soil organic carbon content and water holding capacity of soils in different parts of the country? If so, provide details thereof.

- Soil organic C content was assessed at ICAR-IISS, Bhopal under different long-term fertiliser experiments. Samples were collected from LTFE of Jabalpur, Palampur, Ranchi, Barrackpore, Bhopal, Akola, and Pantnagar were assessed for TOC and Walkley Black C and also allocation of C in different C pools (active, slow and resistant). In another study samples from different land use systems of Vertisols of central India were collected for computation of SOC stocks. Samples were also analysed for SOC content by MIR spectroscopy and routine laboratory procedures for soils of central India.
- In a modelling study the impact of climate change on SOC status of Vertisols of central India has been assessed and it was observed that balanced fertilisation and integrated approach (NPK+FYM) are the keys to maintain SOC under future climate change scenarios.
- Moisture stress is also feared to be intensifying, particularly in Rabi season when precipitation is projected to decline and temperature rise is predicted to be more severe. Less precipitation coupled with high evapo-transpirational loss of soil water caused by higher temperature may induce severe moisture stress to crops (Kalra et al., 2007).

IV. What are the reasons for deterioration of soil quality in the country and ways for its improvement?

Reasons for deterioration of Soil Quality:

- Imbalance use of fertlisers to different crops and cropping system under different soil orders as evidenced from the long-term fertilizer experiments (LTFE) under AICRP (LTFE).
- Soil degradation and soil erosion, salinity, water logging, faulty agricultural practices and nutrient mining.

Ways to improve soil quality:

- Soil conservation to reduce erosion, maintaining soil organic matter, and enhance water and nutrient bioavailability.
- Cultivation of crop species, genotypes and cropping systems that make optimal use of soil resources for food production while conserving soil fertility.
- Employing conservation agricultural practices i.e. no-tillage, reduced or minimum tillage with residues retained at the surface as surface cover.
- Employing various morphological (e.g. altered root: shoot ratio), physiological (e.g. improved nutrient uptake efficiency of root) and biochemical (e.g. secretion of nutrient solubilizing and mobilizing rhizo-chemicals) adjustments in crop rhizosphere.
- Integrated application of fertilisers, organic manures and bio-fertilisers to different crops and cropping systems in agriculture.
- Besides being a measure of climate change mitigation, carbon sequestration is also important for improving organic carbon status and hence quality of soil in a long term. Thus it improves soil health.

2017

Sub.: Reply to Lok Sabha Question Dy. No. 3687 for 25.07.2017 regarding "Absence of proper use of fertilizers"-reg.

(a) Whether it is a fact that the farmers of the country are not aware of the of the proper use of fertilizers due to which they have to suffer financial losses;

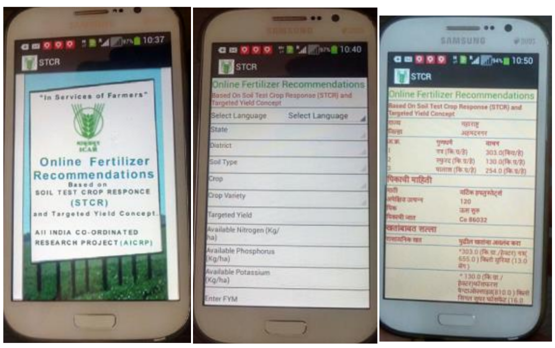
Majority of the farmers of the country are aware about the benefits of fertilizer use. However, farmers generally used higher dose of N fertilizer and therefore, the use is imbalanced. This is evident from the fact that the present NPK ratio 6.7:2.4:1 is skewed towards N as compared to the ideal ratio of 4:2:1.

(b) If so, whether the Government has taken any measure to create awareness among the famers in this regard, if so, the details thereof;

The Soil Health Card Scheme launched by GOI in February 2015, which provides manure and fertilizer recommendations to 14 crores farmers for six crops based on analysis of 12 soil parameters. More than 7000 FLDs have been conducted by ICAR-IISS and its AICRP on STCR, LTFE and MSN for creating awareness among the farmers about uses of balanced fertilizations in crops and cropping systems. Apart from these, the ICAR institutes, SAUs, KVKs, State Departments and other extension agencies have taken several measures for creating awareness among farmers like campaign through mass media (television, radio, bulletins, extension materials and newspaper) and conducting trainings on fertilizer use and soil health.

(c) Whether the government has provided information regarding proper use of fertilizers through mobile app; and

Mobile App for delivering fertilizer recommendations directly to farmers' mobile: Recently a mobile based bilingual (Marathi and English) STCR App for fertilizer recommendations of Maharashtra based on yield target was prepared in collaboration with National Informatics Centre (Govt. of India), Pune.



(d) if so, whether the farmers have taken interest therein and got benefit of the same?

Since the mobile App provides balanced fertilizer information in Marathi language, the farmers of Maharashtra are showing interest in the App.

Sub: Reply to Rajya Sabha question Dy. No. S2286, S345 due for answer on 10/03/2017 regarding adverse effect of chemical fertilizers on climate -reg.

Question- Whether government proposes to study the extent of damage being caused and implement schemes discouraging use of chemical fertilizers as they are found to contain substances like methane, carbon dioxide, ammonia, and nitrogen and emission of which contributes to a great extent in the emergence of greenhouse effect threatening the environment with global warming and climate change.

Response -

Forty years of long term fertilizer experiment (LTFE) results revealed that application of chemical fertilizer in right amount and right time in balanced way did not have any adverse effect on soil health rather have beneficial effect on soil health. Rather it encourages soil carbon sequestration and reduction in CO_2 emission.

The information regarding extent of greenhouse gases emissions due to application of chemical fertilizers may be obtained from Division of CESCRA, ICAR-IARI, New Delhi.

In this context, Institute has been attempting to generate information on GHG emission under different management practices such as conventional tillage with residue burning and conservation agriculture namely (no tillage and reduced tillage) with residue retention with recommended dose of fertilizer application. GHG emission under conservation agriculture (CA) is also being carried out to validate the efficiency of CA practice to mitigate GHG emission.

Sub.: Reply to Lok Sabha admitted unstarred Question Dy. No. 802 for 20.07.2017 regarding "Contamination of Ground Water”-reg.

Sub.: Material for Lok Sabha admitted unstarred Question Dy. No. 802 for 20.07.2017 regarding "Contamination of Ground Water” -reg.

The ICAR-IISS Bhopal has not carried out any specific study to ascertain the widespread use of fertilizers and pesticides causing contamination in groundwater in the country. However, there is a possibility of nitrate contamination in ground water above the permissible limit of 10 mg NO_3-N/L due to excessive use of nitrogenous fertilizers particularly in light textured soils.

ICAR-IISS is recommending soil test based balanced and integrated nutrient management through conjunctive use of organic and inorganic sources of plant nutrients to ensure judicious use of chemical fertilizers preventing deterioration in soil health and contamination of ground water.

D No. 10959 Lok Sabha Question: Use of Cow urine for organic farming:

Will the Minister of AGRICULTURE AND FARMERS WELFARE -

(a) Whether the Indian Council for Agriculture Research (ICAR) has conducted any study regarding use of cow urine for organic farming;

Ans. (a) Yes, ICAR-Indian institute of Soil Science (IISS), Bhopal has conducted experiment under organic farming project. ICAR-IISS, Bhopal is one of the centre of Network Project on Organic farming and IIFSR, Modipurum (Meerut), is the Lead Centre.

(b) if so, the details thereof: and

Ans. (b) Experiment has been conducted at ICAR-IISS, Bhopal to compare the impact of 100% organic nutrient sources and 75% organic + innovative practice (Application of 10% vermiwash and 10% cow urine was sprayed at 30 and 45 days after sowing of crop) on wheat crop productivity and soil health. In wheat, grain yield was recorded highest in 100% organic, but 75% organic + innovative practice (application of 10% vermiwash and 10% cow urine) was at par with 100% organic (Table 1). Soil biological properties was recorded highest under 100% organic and 75% organic + innovative practices (Table 2).

Table1: Impact of organic practices on wheat grain yield (kg/ha)

Treatment	2013-14	2014-15	2015-16	2016-17	Mean
100 % Organic	2722	3004	3181	3189	3024
75 % Organic +Innovative (10% vermiwash and 10 % cow urine)	2689	2881	2978	2892	2860
50 % Organic + 50 % Inorganic	2511	2758	2870	2816	2739
75 % Organic + 25 % Inorganic	2656	2803	3022	3133	2903
100 % Inorganic	2344	2546	2644	2797	2583
State Recommendation	2422	2580	2696	2785	2621

Table 2: Impact of organic practices on Soil Biological Health

Treatment	ß glucosidase (mg p-nitrophenol [PNP] released kg^{-1} soil h^{-1})	Alkaline Phosphatase (µg PNP g^{-1} soil hrs^{-1})	FDA(µ g fluorescein g^{-1} soil hrs^{-1}))	DHA (µgTPF g^{-1} soil d^{-1})
100 % Organic	191	360	275	118
75 % Organic +Innovative (10% vermiwash and 10 % cow urine)	143	346	244	108
50 % Organic + 50 % Inorganic	194	295	245	99
75 % Organic + 25 % Inorganic	160	313	236	110
100 % Inorganic	181	338	260	75
State Recommendation	154	356	255	91

(c) the fresh steps taken by the Government to boost organic farming using natural resources in the country

Anc. (c) Details can be obtained from IIFSR, Modipurum (Meerut), Uttar Pradesh.

Sub.: Reply to Rajya Sabha Question Dy. No. S-2624, S-4891 due for reply on 11.08.2017 regarding Decrease in nutrient value of Indian Soil.

(a) Whether it is a fact that India's Agricultural soil is losing its nutritional value very sharply. Which is effecting per acre production of crops and their nutritional value as well;

No Please. In Long Term Fertilizer Experiment (LTFE), a treatment is receiving 150% dose of nutrient (660 kg fertilizer nutrient every year; 180+90+60= 330X2 = 660) in terms of NPK since last 45 years. A very good productivity in both the season crops is obtained and soil health also improved significantly with referee to initial soil condition. But we did not have any study on effect on human and animal's health. AICRPs on LTFE, STCR and Micro and Secondary Nutrients works with macro, micro and secondary nutrients containing fertilizers. There is no evidence of their adverse impact on the fertility of soil, water, human and environment in the country when applied at optimum rate. Forty years long term fertilizer experiment results revealed that application of chemical fertilizer in right amount and right time in balanced way did not have any adverse effect on soil health rather have beneficial effect on soil health. However, imbalance use of fertilizer or use of urea alone in acid soils (Alfisols) without organic manure or lime as soil amendments declined the soil pH only in upland situation.

(b) If so, the average nutritional value of soil recorded, State-Wise, nutritional-wise for last five years, the details thereof.

ICAR-Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status (Table 1) and micro and secondary nutrient status (Table 2) from different soil testing laboratories located in various states.

Table 1. Summary of soil fertility (N, P and K) status of soils of different States of India

State	% Area deficient		
	Available Nitrogen	Available Phosphorus	Available Potassium
Uttar Pradesh	100	100	61
Uttarakhand	80	100	67
Punjab	100	47	11
Haryana	100	100	39
Himachal Pradesh	24	88	100
Madhya Pradesh	90	87	46
Maharashtra	100	100	21
Rajasthan	100	100	24
Gujarat	89	100	37
Chhattisgarh	100	100	59
Bihar	94	97	96
W.B.	100	90	19
Orissa	100	100	69
Assam	100	100	82
Jharkhand	100	98	79
Andhra Pradesh	100	100	58
Tamil Nadu	98	62	32
Karnataka	81	96	22
Kerala	94	76	82

Source: AICRP STCR

Table 2 Secondary and Micro nutrient status

State	Nutrient deficiency (%)					
	S	Zn	Fe	Cu	Mn	B

Andhra Pradesh	22.4	22.9	17.2	1.3	1.6	4.1
Arunachal Pradesh	3.1	4.6	1.4	1.4	3.0	39.1
Assam	21.6	28.1	0.0	2.8	0.0	32.7
Bihar	30.1	45.3	12.0	3.2	8.8	39.4
Chhattisgarh	23.3	25.6	7.1	3.2	14.8	20.6
Goa	35.3	55.3	12.2	3.1	16.9	12.9
Gujarat	42.5	36.6	25.9	0.4	0.5	18.7
Haryana	36.0	15.4	21.7	5.1	6.2	3.3
Himachal Pradesh	2.2	8.6	0.5	1.4	6.7	27.0
Jammu & Kashmir	6.2	10.9	0.4	0.3	4.6	43.0
Jharkhand	55.0	17.5	0.1	0.8	0.3	60.0
Karnataka	38.9	30.7	7.7	2.3	0.1	36.8
Kerala	41.1	8.4	2.9	1.2	2.4	54.5
Madhya Pradesh	32.7	57.0	8.3	0.5	2.3	4.3
Maharashtra	22.1	38.6	23.1	0.1	3.0	20.7
Manipur	7.2	11.5	2.1	2.5	2.1	37.2
Meghalaya	3.5	3.8	1.3	1.0	3.0	47.9
Odisha	39.7	32.1	6.4	7.1	2.1	51.9
Punjab	31.4	19.2	13.0	4.7	26.2	19.0
Rajasthan	50.3	56.5	34.4	9.1	28.3	3.0
Tamil Nadu	12.5	63.3	12.6	12.0	7.4	20.7
Telangana	27.6	26.8	16.6	1.4	3.5	16.5
Uttar Pradesh	31.7	27.3	15.6	2.8	15.8	20.6
Uttrakhand	13.5	9.6	1.4	1.5	4.8	13.4
West Bengal	55.2	14.4	0.0	1.8	1.0	37.1
India (average)	**26.3**	**36.3**	**12.1**	**4.1**	**7.1**	**23.6**

Source: AICRP on MSPE

ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) Sponsored Project on “GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country” prepared GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts from geo-referenced soil samples collected and the digital maps have been uploaded in the Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders.

Recently, Govt. of India initiated the Soil Health Card Scheme on 17 February, 2015 which intends to record soil fertility status and provides manure and fertilizer recommendations to 14 crores farmers for six crops based on analysis of 12 soil parameters.

Sub: Reply to Lok Sabha question Dy. No. 2216 due for answer on 07/02/2017 regarding excessive usage of fertilizers -reg.

(i) Whether the government has assigned any research institute to conduct research on measures to facilitate improvement of soil fertility in order to check excessive usage of fertilizers and

Yes, there are several institute and universities in the country working on improvement of soil fertility and ICAR-IISS is one among them.

(j) if so, the details thereof:

ICAR-Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status**.** There is not much change in the soil fertility status as compared to earlier reports of 1976 and 2002 (Table 1). These results showed that the status of P was increased in some areas due to continuous application of phosphatic fertilizers. Similarly, per cent soils high in available K increased from 27% in 1976 to 49% in 2011. The per cent soils low in available N increased from 52% in 1976 to 57% in 2011. Analysis of more than 2.5 lakhs soil samples revealed the deficiencies of Zn in 39.9% soils followed by S in 32.9% soils, Fe in 12.6% soils, Cu & Mn in 4% - 6% soils (table2).

Table 1. Change in available N, P and K status of Indian soils with time.

Year	**% Soils in different categories**		
	Low	**Medium**	**High**
Available N Status			
1976	52	43	4
2002	63	26	11
2011	57	36	7
Available P Status			
1969	47	49	4
1979	46	50	5
1996	49	49	2
2002	42	38	20
2011	51	40	9
Available K Status			
1976	20	53	27
1980	22	44	34
2002	21	51	28
2002	13	37	50
2011	9	42	49
Sources: Motsara (2002); Muralidharudu et al. (2011); Hasan (2002)			

Hence, there is no report suggesting the decline in soil fertility and productivity, due to excessive use of chemical fertilizers. The experience from long term fertilizer experiment trials (LTFE) also revealed that balanced use of fertilizers doesn't affect soil fertility. In LTFE, recommended dose of fertilizers are used since inception of the experiment and till date no adverse effect on soil heath was recorded even after 40 years. On the contrary continuous use of balanced application of fertilizers resulted in improvement of soil quality compared to no use of fertilizer or suboptimal or imbalance use of fertilizer

Table 2. Micronutrients and secondary nutrients status in different states of India

State	Samples analysed	Samples deficient (%)	Samples deficient (%)	Samples deficient (%)	Samples deficient (%)	Samples analysed	Samples deficient (%)	Samples analysed	Samples deficient (%)
		Zn	**Fe**	**Cu**	**Mn**		**B**		**S**
Andhra Pradesh	7292	23.5	17.9	1.4	1.7	3787	4.3	5200	35.5
Assam	7208	28.1	0.0	2.8	0.1	7208	10.5	5798	18.4
Bihar	14487	45.4	12.4	3.2	9.1	14219	38.9	18250	37.7
Chhattisgarh	4731	20.2	6.8	3.2	14.1			751	30.5
Goa	680	55.3	3.5	3.1	9.1			-	-
Gujarat	7587	36.6	25.9	0.4	0.5	7587	18.7	6234	42.1
Haryana	5637	15.4	21.7	5.2	6.2	5637	3.2	5673	35.8
Himachal Pradesh	10586	8.0	0.5	1.2	7.3			3437	24.2
Jammu & Kashmir	597	7.4	0.2	0.0	2.0			-	-
Jharkhand	995	11.3	0.0	0.2	0.3	995	61.4	1593	49.3
Karnataka	7987	43.1	10.9	3.6	0.2	520	28.5	8996	36.5
Kerala	894	18.3	1.2	0.4	3.6	894	31.2	1144	31.8
Madhya Pradesh	14236	65.9	8.8	0.5	2.4	5643	1.8	14019	36.7
Maharashtra	13663	39.3	23.7	0.1	3.1	6968	44.6	10825	36.0
Manipur	1860	18.3	0.0	0.0	0.0	60	9.9	-	-
Odisha	4591	29.2	8.0	8.3	2.6	4565	45.7	7358	39.5
Punjab	6166	21.2	11.06	4.8	25.2	5068	20.1	4500	38.0
Rajasthan	6320	56.5	34.4	9.2	28.3	1094	22.0	8172	54.0
Tamil Nadu	34315	63.2	12.6	12.1	7.5	34315	20.61	29753	15.3
Telangana	4939	26.8	16.7	1.38	3.6	2773	11.9	4032	31.8
Uttar Pradesh	8072	32.4	10.2	5.0	8.7	6088	21.73	15365	37.0
Uttarakhand	2575	9.6	1.4	1.5	4.8	2575	7.5	2669	12.7
West Bengal	3872	13.8	0.1	1.76	1.0	3358	40.2	2903	53.0
India (Average)	**169290**	**39.9**	**12.6**	**4.6**	**6.0**	**113354**	**22.9**	**156672**	**32.9**

Note: Critical Level used (mgkg^{-1}): Zn 0.6 (0.5 -1.2); Cu 0.2 (().2-0.6); Fe 4.5 (3,5-7.0); Mn 3.5 (2.0 -5.0); B 0.45/5.0 (0.2 – 0.5). Values in the parenthesis are the range and the values outside the parenthesis are largely used for categorizing soil as deficient
Source: AICRP (MSPE) as on 2015

To improve soil fertility and to check excessive usage of fertilizers, organic fertilizer has been recommended. However, the extent of usage of organic fertilizer as a replacement to chemical fertilizer depends on several factors including crop type, soil and environmental parameters. Some of the research findings carried out under the All India Network Project on Soil Biodiversity and Biofertilizer are given below.

- Application of biofertilizer consortia (*Azospirillum, Azotobacter* and *PSB*) as seed treatment in jute decreased the nitrogenous and phosphatic fertilizer requirement by 50% in Assam.
- Potassium solubilizing bacteria improved sorghum yields in Andhra Pradesh and also saved 25% K fertilizer.

- Liquid biofertilizers have become popular and farmers in Andhra Pradesh are saving 20-25% of chemical fertilizers and reporting 10-155 additional yields in their crops. The demand for liquid biofertilizer by the farmers with drip irrigation facility for the crops like cotton, turmeric, sugarcane, sweet orange and pomegranate has increased in Maharashtra.
- Use of bio-enriched compost @ 1 t/ha could minimize the recommended nitrogenous and phosphatic fertilizer to 50% without any yield loss of crops grown in rice- toria and rice- wheat sequence. Incorporation of either enriched compost or Biofertilizers with subsequent reduction of fertilizers (N & P) showed improved soil health.

Sub.: Reply to Rajya Sabha Question Dy. No. S-2897 for 11.08.2017 regarding "Fertility of Soil"

(a) Wheather Government has evaluated the fertility of soil/arable land across the country?

Yes, micro and secondary nutrients status of soils across the country has been assessed by AICRP on secondary and micronutrients and pollutant elements in soils and plants.

(b) If so, the norms adopted for the purpose and the extent of micronutrients deficiency noticed, States/UT-wise.

Soil samples were collected from the farmer's field through stratified random sampling technique. The number of samples varied from 300 to 1500 per district depending upon the size of the district. The samples were processed and analysed for estimation of different secondary and micronutrients by standard procedures. The current status (2011-2016) of secondary and micronutrient in different states of India is given below.

S.No.	State	Nutrient deficiency (%)					
		S	Zn	Fe	Cu	Mn	B
1.	Andhra Pradesh	22.4	22.9	17.2	1.3	1.6	4.1
2.	Arunachal Pradesh	3.1	4.6	1.4	1.4	3.0	39.1
3.	Assam	21.6	28.1	0.0	2.8	0.0	32.7
4.	Bihar	30.1	45.3	12.0	3.2	8.8	39.4
5.	Chhattisgarh	23.3	25.6	7.1	3.2	14.8	20.6
6.	Goa	35.3	55.3	12.2	3.1	16.9	12.9
7.	Gujarat	42.5	36.6	25.9	0.4	0.5	18.7
8.	Haryana	36.0	15.4	21.7	5.1	6.2	3.3
9.	Himachal Pradesh	2.2	8.6	0.5	1.4	6.7	27.0
10.	Jammu & Kashmir	6.2	10.9	0.4	0.3	4.6	43.0
11.	Jharkhand	55.0	17.5	0.1	0.8	0.3	60.0
12.	Karnataka	38.9	30.7	7.7	2.3	0.1	36.8
13.	Kerala	41.1	8.4	2.9	1.2	2.4	54.5
14.	Madhya Pradesh	32.7	57.0	8.3	0.5	2.3	4.3
15.	Maharashtra	22.1	38.6	23.1	0.1	3.0	20.7
16.	Manipur	7.2	11.5	2.1	2.5	2.1	37.2
17.	Meghalaya	3.5	3.8	1.3	1.0	3.0	47.9
18.	Odisha	39.7	32.1	6.4	7.1	2.1	51.9
19.	Punjab	31.4	19.2	13.0	4.7	26.2	19.0
20.	Rajasthan	50.3	56.5	34.4	9.1	28.3	3.0
21.	Tamil Nadu	12.5	63.3	12.6	12.0	7.4	20.7
22.	Telangana	27.6	26.8	16.6	1.4	3.5	16.5
23.	Uttar Pradesh	31.7	27.3	15.6	2.8	15.8	20.6
24.	Uttrakhand	13.5	9.6	1.4	1.5	4.8	13.4
25.	West Bengal	55.2	14.4	0.0	1.8	1.0	37.1
India (average)		**26.3**	**36.3**	**12.1**	**4.1**	**7.1**	**23.6**

Sub.: Reply to Lok Sabha Question Dy. No. 2942 due for reply on 20.12.2017 regarding Panchgavya- reg.

(a) wheather any research has been conducted on the benefit of panchagavya in the country, if so, the details thereof.

Beneficial effect of application of panchagavya alone or in combination with other organics/microbial preparation on crop performance has been documented by many authors in India (Natrajan, 2008; Bindumathi Mohan, 2008; Sangeetha and Thevanathan, 2010; Gore and Sreennivasaa, 2011; Vijayakumari, et al., 2012; Shubha, et al., 2014). In a study conducted at ICAR-IISS, Bhopal, the Panchagaya was evaluated for its microbial content. The count of culturable heterotrophic bacteria (25×10^8 cfu/ml) and N- fixers (22×10^6 cfu/ml) were significantly higher compared to cattle dung manure. Since, panchagavya contain highly rich media for supporting microbial growth and also has good sources of microbial inoculums like cow dung, curd etc. this enriches the total count of microbes. In a pot culture study conducted with wheat as test crop, higher total chlorophyll content and nitrate reductase activity in flag leaf of wheat was recorded with application of panchagavya compared to unfertilized control but the value was significantly lower than chemically fertilized crops. Improvement in yield to the extent of 10% was recorded with application of panchagavya alone compared to unfertilized control. In a field study at ICAR-IISS on organic nutrient management practices, application of panchagavya along with recommended dose of organic manure improved the yield of the wheat crop.

(b) wheather the Government has set up any central committee to validate the usefulness of panchagavya in medicinal and agricultural terms: Information not available.

(c) if so, the term of the reference of the said committee: Not available.

(d) the Time by which the said committee is likely to submit its report?Not available.

Sub.: Reply to Rajya Sabha Unstarred Question Dy. No. 3423 due for reply on 29.12.2017 regarding Websites/Portals - reg.

Website /Portals in the Ministry

Table:-I

Name of Websites or portals	URL details of Websites or portals	No. of visitors since 2014	Complaints received since 2014 till 31st November 2017	Responses since 2014 till 31st November 2017
IISS Website	www.iiss.nic.in	41000	NA	NA
IISS Webmail	www.iiss.res.in	90 (IISS Users)	NA	NA

Table-II

No. of Twitter handles maintained since 2014	No. of users since 2014	Performance mechanism	No. of face book pages maintained since 2014	No. of users since 2014	Performance mechanism of
NA	NA	NA	1	User: 4162 Followers: 4150	NA

Sub.: Reply to Lok Sabha question Dy. No 5868 due for 25.07.2017 regarding Use of chemical Fertilizers in Agriculture

(a) Whether excessive use of chemical fertilizers has caused many problems including loss of land fertility and diseases amongst the farmers and animals and if so, the details thereof and the corrective measure taken by the Government in this regard.

Reply: No

(b) Whether the Government has conducted any research to ascertain to extent to which the states including Punjab has been adversely affected due to excess use of chemicals fertilizers, and

In Long Term Fertilizer Experiment (LTFE), a treatment is receiving 150% dose of nutrient (660 kg fertilizer nutrient every year; 180+90+60= 330X2 = 660) in terms of NPK since last 45 years. A very good productivity in both the season crops is obtained and soil health also improved significantly with referee to initial soil condition. But we did not have any study on effect human and animal's health.

ICAR- Indian Institute of Soil Science located at Bhopal under DAC (Division of INM) Sponsored Project on "GPS and GIS Based Soil Fertility Maps for Precise Fertilizer Recommendations for the Farmers of the Country", prepared GPS and GIS based soil fertility maps of primary, secondary and micronutrients of 173 districts from geo-referenced soil samples completed and the digital maps have been uploaded in the Indian Institute of Soil Science website (http://www.iiss.nic.in/districtmap.html) for the benefit of different stakeholders. AICRPs on LTFE, STCR and Micro and Secondary Nutrients works with macro, micro and secondary nutrients containing fertilizers. There is no evidence of their adverse impact on the fertility of soil, water, human and environment in the country when applied at optimum rate. Forty years long term fertilizer experiment results revealed that application of chemical fertilizer in right amount and right time in balanced way did not have any adverse effect on soil health rather have beneficial effect on soil health. However, imbalance use of fertilizer or use of urea alone in acid soils (Alfisols) without organic manure or lime as soil amendments declined the soil pH only in upland situation. The long term experiments have indicated no adverse effect of fertilizer or pesticides on soil health. Punjab with 243 kg per hectare fertilizer consumption is one of the largest consumers of fertilizers in India. Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab in contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause monetary loss.

There are 100 institutions of ICAR apart from 70 State Agricultural Universities, 2 Central Agricultural Universities and 641 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

1.ICAR-Indian Institute of Soil and Water Conservation, Dehradun

2ICAR-Central Soil Salinity Research Institute, Karnal

3ICAR-Indian Institute of Soil Science, Bhopal

4ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soil, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations. Also, a long term experiment is in progress at 17 locations across the country to study the impact of chemical fertilizer on soil health and crop productivity. Soil health is continuously monitored across the country at 17 locations covering all types of soils (Alluvial, Vertisols and Alfisols). ICAR-Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status (Table 1) and micro and secondary nutrient status (Table 2) from different soil testing laboratories located in various states.

Table 1. Summary of soil fertility (N, P and K) status of soils of different States of India

State	% Area deficient		
	Available Nitrogen	**Available Phosphorus**	**Available Potassium**
Uttar Pradesh	100	100	61
Uttarakhand	80	100	67
Punjab	**100**	**47**	**11**
Haryana	100	100	39
Himachal Pradesh	24	88	100
Madhya Pradesh	90	87	46
Maharashtra	100	100	21
Rajasthan	100	100	24
Gujarat	89	100	37
Chhattisgarh	100	100	59
Bihar	94	97	96
W.B.	100	90	19
Orissa	100	100	69
Assam	100	100	82
Jharkhand	100	98	79
Andhra Pradesh	100	100	58
Tamil Nadu	98	62	32
Karnataka	81	96	22
Kerala	94	76	82

Source: AICRP STCR

Hence, there is no report suggesting the decline in soil fertility and productivity, due to excessive use of chemical fertilizers. The experience from long term fertilizer experiment trials (LTFE) also revealed that balanced use of fertilizers doesn't affect soil fertility. In LTFE, recommended dose of fertilizers are used since inception of the experiment and till date no adverse effect on soil heath was recorded even after 40 years. On the contrary continuous use of balanced application of fertilizers resulted in improvement of soil quality compared to no use of fertilizer or suboptimal or imbalance use of fertilizer

Table 2. Micronutrients and secondary nutrients status in different states of India

State	**Samples analysed**	**Samples deficient (%)**	**Samples deficient (%)**	**Samples deficient (%)**	**Samples deficient (%)**	**Samples analysed**	**Samples deficient (%)**	**Samples analysed**	**Samples deficient (%)**
		Zn	**Fe**	**Cu**	**Mn**		**B**		**S**
Andhra Pradesh	7292	23.5	17.9	1.4	1.7	3787	4.3	5200	35.5
Assam	7208	28.1	0.0	2.8	0.1	7208	10.5	5798	18.4
Bihar	14487	45.4	12.4	3.2	9.1	14219	38.9	18250	37.7
Chhattisgarh	4731	20.2	6.8	3.2	14.1			751	30.5
Goa	680	55.3	3.5	3.1	9.1			-	-
Gujarat	7587	36.6	25.9	0.4	0.5	7587	18.7	6234	42.1
Haryana	5637	15.4	21.7	5.2	6.2	5637	3.2	5673	35.8
Himachal Pradesh	10586	8.0	0.5	1.2	7.3			3437	24.2
Jammu & Kashmir	597	7.4	0.2	0.0	2.0			-	-
Jharkhand	995	11.3	0.0	0.2	0.3	995	61.4	1593	49.3
Karnataka	7987	43.1	10.9	3.6	0.2	520	28.5	8996	36.5
Kerala	894	18.3	1.2	0.4	3.6	894	31.2	1144	31.8
Madhya Pradesh	14236	65.9	8.8	0.5	2.4	5643	1.8	14019	36.7
Maharashtra	13663	39.3	23.7	0.1	3.1	6968	44.6	10825	36.0
Manipur	1860	18.3	0.0	0.0	0.0	60	9.9	-	-
Odisha	4591	29.2	8.0	8.3	2.6	4565	45.7	7358	39.5
Punjab	**6166**	**21.2**	**11.06**	**4.8**	**25.2**	**5068**	**20.1**	**4500**	**38.0**
Rajasthan	6320	56.5	34.4	9.2	28.3	1094	22.0	8172	54.0
Tamil Nadu	34315	63.2	12.6	12.1	7.5	34315	20.61	29753	15.3
Telangana	4939	26.8	16.7	1.38	3.6	2773	11.9	4032	31.8
Uttar Pradesh	8072	32.4	10.2	5.0	8.7	6088	21.73	15365	37.0
Uttarakhand	2575	9.6	1.4	1.5	4.8	2575	7.5	2669	12.7
West Bengal	3872	13.8	0.1	1.76	1.0	3358	40.2	2903	53.0
India (Average)	**169290**	**39.9**	**12.6**	**4.6**	**6.0**	**113354**	**22.9**	**156672**	**32.9**

Note: Critical Level used (mgkg^{-1}): Zn 0.6 (0.5 -1.2); Cu 0.2 (().2-0.6); Fe 4.5 (3,5-7.0); Mn 3.5 (2.0 -5.0); B 0.45/5.0 (0.2 – 0.5). Values in the parenthesis are the range and the values outside the parenthesis are largely used for categorizing soil as deficient
Source: AICRP (MSPE) as on 2015

(c) The details of steps taken by the government to ensure availability and promote the use of bio-fertilizers in the country?

To improve soil fertility and to check excessive usage of fertilizers, organic fertilizer has been recommended. However, the extent of usage of organic fertilizer as a replacement to chemical fertilizer depends on several factors including crop type, soil and environmental parameters. Some of the research findings carried out under the All India Network Project on Soil Biodiversity and Biofertilizer are given below.

- Application of biofertilizer consortia (*Azospirillum, Azotobacter* and *PSB*) as seed treatment in jute decreased the nitrogenous and phosphatic fertilizer requirement by 50% in Assam.
- Potassium solubilizing bacteria improved sorghum yields in Andhra Pradesh and also saved 25% K fertilizer.
- Liquid biofertilizers have become popular and farmers in Andhra Pradesh are saving 20-25% of chemical fertilizers and reporting 10-155 additional yields in their crops. The demand for liquid biofertilizer by the farmers with drip irrigation facility for the crops like cotton, turmeric, sugarcane, sweet orange and pomegranate has increased in Maharashtra.
- Use of bio-enriched compost @ 1 t/ha could minimize the recommended nitrogenous and phosphatic fertilizer to 50% without any yield loss of crops grown in rice- toria and rice- wheat sequence. Incorporation of either enriched compost or Biofertilizers with subsequent reduction of fertilizers (N & P) showed improved soil health.

2018

ICAR-IISS, Bhopal

Achievements of Extension Activities of ICAR Institutes (other than KVKs) of Madhya Pradesh

S.No.	Activities	2017-18		2018-19 Upto November	
		No of Activities	No. of participants	No of Activities	No. of participants
1	Exhibition	6	206	4	200
2	Kisan Melas	1	118	Nil	Nil
3	Technology Week	2	100	1	80
4	Field Days	17	995	4	250
5	Farmers – Scientist Interface	8	135	5	
6	Group Meetings	3	179	3	104
7	Ex-trainees Sammelans	Nil	Nil	Nil	Nil
8	Farm Advisory Services	2	14	1	9
9	Exposure visits	9	272		
10	Celebration of important days	6	194	1	200
11	Farmers visit to KVKs	Nil	Nil	Nil	Nil
12	Diagnostic visits	1	5	Nil	Nil
13	Kisan Ghosthi	7	676	3	180
14	Soil Health camps	Nil	Nil	Nil	Nil
15	Animal Health Camp	4	246	Nil	Nil
16	Training/Workshop	14	390	Nil	Nil
17	Awareness progrmme	1	20	Nil	Nil
18	Any other (specify) Winter school/MTC/Trainig	6	123	3	70

Performance of Frontline demonstrations of different crops during 2017-18

S.No.	Crop	No. of demonstrations	Average yield of demonstrations	Average yield of local check	% increase in yield
1.	Soybean-rice-wheat	85	3.7 t/ha (rice) 0.70 t/ha (soybean)	2.5 0.5	48 40
2.	Wheat-chickpea	99	4.8 t/ha (wheat) 1.4 t/ha (chickpea)	3.0 1.0	60 40
3.	Okra. Bittergaurd, pumpkin	25	-	-	-
4.	Tomato, brinjal	25	-	-	-
5.	Rice	3	3.50	2.50	40
6.	Wheat	5	3.00	2.25	33.3
7.	Raya	10	8665.00 kg/ha	5428.00 kg/ha	59.64

8.	Toria	20	14.90 q/ha	7.70 q/ha	93.51
9.	Paddy	11	15956.50 kg/ha	8729.50 kg/ha	82.79
10.	Okra	6	12.16 t/ha	9.39 t/ha	29.50
11.	Rice	7	5338	4820	10.74
12.	Soybean	6	975	790	23.41
13.	Wheat	12	5563	4717	17.93

Performance of Frontline demonstrations of different crops during 2018-19

S.No.	Crop	No. of demonstrations	Average yield of demonstrations	Average yield of local check	% increase in yield
1.	Rice (DSR)	50	36.5 q/ha	40 q/ha under transplanting	10 Yield penalty but resource conserved in the farm of soil, water & energy
2.	Soybean	42	16.01 q/ha	14 q/ha	12.5
3.	Rice	9	5500	4520	21.68
4.	Soybean	7	760	580	31.03
5.	Wheat	14	4375	3488	25.43

Sub.: Reply to Rajya Sabha admitted Question Dy. No. 3038 for 28/12/2018 regarding "Harmful effects of fertilizers"-reg.

(d) How many hectares of land have become saline in nature/barren due to excessive use of fertilizers?

Response: The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2000 kg/ha) during 2016-17 from 710 kg/ha during 1960-61. The present total food grain production of 275.68 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

For the last 45 years, fertilizers in quantities larger than the recommended dose have been used in various experiments but have not caused any salinity developed in the soils.

(b) Are any steps taken towards preventing excessive use of fertilizers?

Response: Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. "Soil Health Card" Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

As per our observations, application of fertilizer at the rate of 150% of recommended dose, no adverse effect on soil health was observed till date, So no action is required. It is always recommended to farmers to apply balanced and recommended quantities of fertilizers prescribed for different crops in various areas of the country.

(c) What effect do this fertilizer have on human body if they are transferred in human diet through food?

Response : Irrespective of sources of plant nutrients, organic or inorganic, plants take nutrients only in inorganic form; Organic sources also need to be mineralized in inorganic form before being taken up by roots. Roots do not have sensors to distinguish between organic or inorganic sources. As long as our fertilizer application is balanced coupled with organic sources, neither it will not cause any decline in productivity, nor decline in soil health. No study has been done in this issue. Application of required amount of fertilizers help in proper plant nutrition, growth and yield as fertilizer application enhances phyto-avilable nutrients in soil. Plants absorb nutrients in ionic form from soil. There will be no adverse effect on human body if the nutrients are transferred to human body through food.

(d) What measures are taken to improve the quality of fertilizers to increase the productivity with very little use; and

Response : Ministry of Agriculture and Farmers Welfare has introduced mandatory neem coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being Neem Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea.

(e) Have we found any alternative to fertilizer with same productivity?

Response : Organic manures especially vermicompost have potential; however, the yield is usually not on par with what we get from use of fertilisers. DAC&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients. Judicious and integrated approach of nutrient has been found to be the best practice to achieve the optimum productivity and improvement in soil health.

Sub.: Reply to Lok Sabha admitted Question Dy. No. 8040 for 01/01/2019 regarding "Soil pollution in India"

a) Whether wide spread pollution increased all over the country in the last two decades?

Ans. This impressive growth of Indian economy during last two decades has, however, accompanied by an increasing threat to our soils and environment from emission, discharge and disposal of pollutants from industries. According to numerous studies, pollution in agricultural soils has become a growing concern due to enhanced industrialization and urbanization. Several toxic metals and compounds generating out of several anthropogenic activities are contaminating our precious natural resources(Soil and Water) and also threatening the very existence of different forms of life including human beings.

The study conducted by AICRP MSPE by collecting and analysing soil and plant samples from nearby areas of rivulets and rivers in some peri-urban areas of major cities revealed that accumulation of heavy metals like cobalt, cadmium, nickel, chromium and lead in soils and plants grown in the soils irrigated with water from rivulets and rivers carrying industrial and ternary effluents and sewage water.

However, there is no evidence of accumulation of heavy metals in the soils of agricultural land.

b) If so, the extent of problem of the soil pollution, State and Union Territory wise?

Ans. Although sporadic information generated from some parts of the country indicated the build-up of pollutants in agriculture land, a systemic and comprehensive report on anthropogenic activities and the status of soil pollution is not available. To combat it and develop an effective action plan for remediation of such area, we need to have first-hand information on the status and extent of soil pollution in the country.

c) Whether the Indian Council of Agricultural Research (ICAR) and National Academy of Agricultural Sciences has estimated that 71% of the countries cultivated fields are moving towards conditions that would no longer support farming, if so, the details thereof and the extent of problem, State and Union territory wise?

Ans. In India, information on extent of soil pollution, its impact on other functional area, plant and human health is not complete. About 60% of the geographical area of the country is occupied by the agricultural land, most of which is facing one or more kind degradation stresses. The data given by different agencies on soil degradation mainly focus on physical aspects of soil deterioration like erosion, water logging etc. and in case of chemical degradation (particularly soil pollution) not much attention was given except on soil salinity problems.

d) The steps taken by the Government to overcome them and the progress made so far, State and Union Territory wise?

Ans. In India, agricultural soils may indeed be managed to enhance the productive capacity and to reduce the vulnerability to pollution at farm level but are often traded off against higher priority for short term food and water security under the pressure of increasing production goal. The farm system is a complex social-ecological system wherein biophysical and socioeconomic concerns interact and sometimes counteract in complex ways. Finding solution to check soil pollution requires integrated approaches, and it has to be at the national scale where regulations are to be designed and implemented at the farm level. Some of the ICAR Institutes and State Agriculture Universities are currently engaged in evaluating the extent of heavy metal pollution in some target areas and developing technologies for their remediation. Also ICAR has sponsored the conduct of several training programmes on management of polluted soils through different ICAR Institutes and SAU’s to create awareness.

Sub: Reply to Rajya Sabha starred question No. 189 for 03.08.2018 - Soil Testing Labs -reg.

Annexure-I

Number of soil testing labs set-up in ICAR Institutes (excluding Krishi Vigyan Kendras) during 2014-15 to 2017-18.

S. No.	Name of ICAR Institute	Number of mini soil testing labs	No. of Large/ Static Soil Water Testing labs	Number of Soil Health cards distributed	Number of farmers benefitted
1.	ICAR-IISS, Bhopal	Nil	One*	790**	790

*This lab is part of the institute.

** In addition to above Soil Health Card distribution, institute has provided more than 1500 soil testing services to Department. of Agriculture and Farmers Welfare, (M.P.), KVKs of ATARI, (Zone IX), Jabalpur and other SAUs/Organizations.

2019

Sub.: **Reply to Lok Sabha Starred Question No. 4916 on Agricultural Universities and Institution**

(a) **The details of agricultural universities/institution in India under the union government along with their functioning and allocation of funds during the last 5 years;**

Reply: **Functioning of the institute**

ICAR-IISS was established on 16 April, 1988 with the mission of "Providing scientific basis for enhancing and sustaining productivity of soil resources with minimal environmental degradation". Since its inception, the institute has made earnest effort to attain its mission and received national and international recognitions. The institute activity has been strengthened further by the scientific and managerial activities of three All India Coordinated Research Projects and one All India Network Project. These four institute based projects act as a part of the "Network-Support Programmes" of the Institute with their centers located in various State Agricultural Universities and ICAR institutes, providing access to the diverse soils, agro-ecosystems across the agro-ecological zones of the country for effective implementation of the various programs of the Institute at national level. The institute has made significant scientific contributions in the frontier areas of soil science such as input use efficiency including nanotechnology, carbon sequestration and climate change, integrated nutrient supply system, biofortification, nutrient transformation and dynamics in soil-plant systems, organic matter recycling and management, soil biodiversity and genomics, environmental impact on agricultural production, utilization of solid wastes and waste water, bio and phyto-remediation, etc.

The Institute has the mission of "Providing scientific basis for enhancing and sustaining productivity of soil resources with minimal environmental degradation" with following mandates:

i. Basic and strategic research on physical, chemical and biological processes in soils related to management of nutrients, water and energy
ii. Advanced technologies for sustainable soil health and quality
iii. Coordinate the network research with State Agricultural Universities, National, International and other Research Organizations.

The priorities of the institute are to carry out soil science research in challenging areas, which are normally not undertaken elsewhere in the country through multidisciplinary approaches and thereby, to carry out comprehensive investigations in the following critical areas:

Programme 1: Soil Health and Input Use Efficiency

- Integrated nutrient management: Indigenous mineral and by-product sources
- Nanotechnology
- Precision agriculture
- Organic farming and produce quality
- Crop simulation modeling and remote sensing
- Fertilizer fortification
- Resilience of degraded soils.
- Developing a workable index of soil quality assessment imbibing influence of different physical, chemical and biological soil attributes

Programme 2: Conservation Agriculture and Carbon Sequestration vis-à-vis Climate Change

- The carbon sequestration research in the context of sustainable management of land and soil resources and conserving deteriorating environment.

- Conservation agriculture and carbon sequestration
- Tillage and nutrient interactions
- Crop adaptation to climate change and rhizospheric study

Programme 3: Microbial Diversity and Genomics

- Characterization and prospecting of large soil bio-diversity
- Characterization of functional communities of soil organisms
- Testing of mixed bio-fertilizer formulations
- Efficient and improved composting techniques

Programme 4: Soil Pollution, Remediation and Environmental Security

- Soil pollution impact assessment and toxicity amelioration
- Phytoremediation and bioremediation of contaminated soils
- Developing technology for efficient reuse/disposal of city and industrial wastes
- Developing soil management practices for minimizing emission of greenhouse gases
- Environmental impact and risk assessment of nanoparticles on soil health and plant nutrition.

Allocation of funds

FINAL RE ALLOCATED BY ICAR						
CONSOLIDATED IISS PLAN PLUS AICRPS INCLUDING CRP ON CA						(RS IN LAKHS)
FINANCIAL YEAR	HEAD	OTHER THAN NEH, TSP	NEH	TSP	SCSP	TOTAL
2014-15 FINAL RE	GRANT CAPITAL	74	0	15		89
	GRANT SALARIES	1261.8	7	0		1268.8
	GRANT GENERAL	479.2	13	195		687.2
	TOTAL RE	1815	20	210		2045
2014-15 ACTUAL EXPENDITURE	GRANT CAPITAL	73.98	0	15		88.98
	GRANT SALARIES	1261.76	7	0		1268.76
	GRANT GENERAL	479.17	13	194.86		687.03
	TOTAL RE	1814.91	20	209.86		2044.77
2015-16 FINAL RE	GRANT CAPITAL	335.2	3.7	30.9		369.8
	GRANT SALARIES	1483	27.3	0		1510.3
	GRANT GENERAL	705.5	24.2	239.8		969.5
	TOTAL RE	2523.7	55.2	270.7		2849.6
2015-16 ACTUAL EXPENDITURE	GRANT CAPITAL	333.39	3.7	25.9		362.99
	GRANT SALARIES	1483	27.3	2		1512.3
	GRANT GENERAL	698.86	24.2	233.22		956.28
	TOTAL RE	2515.25	55.2	261.12		2831.57
2016-17 FINAL RE	GRANT CAPITAL	260	24.03	19.13		303.16
	GRANT SALARIES	1550	0	0		1550
	GRANT GENERAL	741.17	55	120.3		916.47
	TOTAL RE	2551.17	79.03	139.43		2769.63
2016-17 ACTUAL EXPENDITURE	GRANT CAPITAL	183.72	0	0		183.72
	GRANT SALARIES	1213.9	15	0		1228.9
	GRANT GENERAL	658.59	3	75.6		737.19

	TOTAL RE	2056.21	18	75.6		2149.81
2017-18 FINAL RE	GRANT CAPITAL	0.00	0.00	0.00	0.00	0.00
	GRANT SALARIES	0.00	0.00	0.00	0.00	0.00
	GRANT GENERAL	0.00	0.00	0.00	0.00	0.00
	TOTAL RE	0.00	0.00	0.00	0.00	0.00
2017-18 ACTUAL EXPENDITURE	GRANT CAPITAL	181.22	25.00	0.00	0.00	206.22
	GRANT SALARIES	2870.98	0.00	0.00	0.00	2870.98
	GRANT GENERAL	812.43	75.00	55.69	0.00	943.12
	TOTAL EXP	3864.63	100.00	55.69	0.00	4020.32
2018-19 FINAL RE	GRANT CAPITAL	110.74	25.00	0.00	13.71	149.45
	GRANT SALARIES	3496.81	0.00	0.00	0.00	3496.81
	GRANT PENSION	166.00	0.00	0.00	0.00	166.00
	GRANT GENERAL	656.00	44.00	54.00	74.04	828.04
	TOTAL RE	4429.55	69.00	54.00	87.75	4640.30
2018-19 ACTUAL EXPENDITURE	GRANT CAPITAL	105.60	25.00	0.00	13.45	144.05
	GRANT SALARIES	3496.77	0.00	0.00	0.00	3496.77
	GRANT PENSION	249.89	0.00	0.00	0.00	249.89
	GRANT GENERAL	569.49	44.00	53.03	73.06	739.58
	TOTAL EXP	4421.75	69.00	53.03	86.51	4630.29

(b) **Whether the agricultural universities/institutes could fruitfully use of allocated funds, if so the details of thereof and if not the action taken by the government in this regard;**

Reply: Yes, please see the table given above.

(c) **The details of the total number of private agricultural universities in the country along with their locations;**

Reply: NA

(d) **The admission process of these universities;**

Reply: NA

(e) **Whether there is any control of the government in the functioning of such universities; and**

Reply: NA

(f) **If so, the details thereof and if not, whether the government would consider setting up any council /committee for monitoring of the functioning of these universities?**

Reply: NA

Sub.: Reply to Lok Sabha D.No. No 409 - reg.

(a) **Whether keeping in view of enchroachment the Government has demarketd the boundaries of properties including lands of institutes under ICAR across the country;**

Reply: Demarketed by boundary wall

(b) if so, the details thereof and the action taken or to be taken by the Government in this regard;

Reply: Secured by boundary wall.

(c) Whether the Government has prepared any roadmap to stop vacate and ensure zero tolerance towards enchroachments on properties including lands of institutes under ICAR;

Reply: Already secured by boundary wall and there is no enchroachment with round the clock visit by Security Section.

(d) Whether the Government ins planning to digitalize the details of properties including lands of institutes under ICAR throughout the Country;

Reply: Digitized at Director (Works) office.

(e) if so, the action plan chalked out in this regard;

Reply: NA

(f) if not, the reasons thereof?

Reply: NA

Sub.: Reply to Lok Sabha D.No. No 2232 sitting on 12/02/2019

(e) Whether the Government has carried out any research to ascertain the extent to which the excessive use of chemical fertilizers destroys soil fertility and causes various types of diseases and other problems;

Response: Under AICRP-LTFE 150% more amount than recommended dose of fertilizers is being used since last 46 years but so far no adverse effect on soil health has been observed.

(b) If so, the details thereof including the level to which the quality of soil has reduced due to imbalanced use of fertilizer every year, state-wise;

Response: Due to imbalanced use of nutrient, reduction in soil productivity was noticed specially in acid soils.

The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, Thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also promoted higher fertilizer use. However, there exist cases, where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2000 kg/ha) during 2016-17 from 710 kg/ha during 1960-61. The present total food grain production of 284.83 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

(c) The follow-up action by the government on the findings of the said research

Response :Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. “Soil Health Card” Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil

Health Cards. To educate the farmers are called to the site and shown the effect and farmers are educated through literature training.

(d) Whether the government has launched any programme/campaign to create awareness amongst the farmers regarding the effects of imbalanced use of fertilizers and the need to use conventional and harmless fertilizers of the benefits of organic farming and;

Response : In AICRP-LTFE large number of field demonstrations are being conducted every year across the different state to educate farmer on balanced use of fertilizer. In the training programme farmers are given knowledge on effect of imbalanced use of fertilizer.

It is always recommended to farmers to apply balanced and recommended quantities of fertilizers prescribed for different crops in various areas.

(e) The steps taken to check the imbalanced use of fertilizers along with the outcome thereof

Response : On farm training are arranged to educate the farmer on balanced use of fertilizer. Radio/TV/ and print media is also used to educate farmer's and the society on balanced use of fertilizer.

It is always recommended to farmers to apply balanced and recommended quantities of fertilizers prescribed for different crops in various areas.

(f) The details of the progress report after taking the above steps?

Response : The Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers’ practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Ministry of Agriculture and Farmers Welfare has introduced mandatory neem coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being Neem Coated. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea.

DAC&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

Sub.: Reply to Lok Sabha Admitted Stared Question No. 324 regarding Fertility of Soil

(a) Whether it is a fact that fertility of soil is being lost due to over use of chemical fertilizers and if so, the details thereof?

Reply: . Under ICAR-All India Coordinated Research Project on Long Term Fertilizer Experiment. 150% more amount than recommended of fertilizers is being used since last 46 years but so far no adverse effect on soil health has been observed.

(b) Whether the Government has conducted any research in this regard;

Reply: It is always recommended to farmers to apply balanced and recommended quantities of fertilizers prescribed for different crops in various areas. Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency and maintenance of soil fertility through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers.

On farm training are arranged to educate the farmer on balanced use of fertilizer. Radio/TV/ and print media is also used to educate farmer's and the society on balanced use of fertilizer. It is always recommended to farmers to apply balanced and recommended quantities of fertilizers prescribed for different crops in various areas.

(c) if so, the outcome of the said research; and

Reply: ICAR- All India Coordinated Research Project. on Soil Test Crop Response has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Progressive Farmers' practice (kg grain/kg NPK)**	**STCR- IPNS practice (kg grain/kg NPK)**
Rice	120	11.4	16.8

Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

(d) The corrective steps taken by the government in this regard?

Reply: "Soil Health Card" Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

Ministry of Agriculture and Farmers Welfare has introduced mandatory neem coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being Neem Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea.

Rajya Sabha Provisional Starred Qn S3272 for 02/12/2019 regarding "Emission of greenhouse gases" –reg.

a) Whether government is aware that the decreasing presence of carbon in soil on account of the land turning into barren and desert land due to soil erosion is becoming a leading cause of emission of greenhouse gas (GHG) and also climate change

Reply: Our institute is not working on the mandate of soil erosion and greenhouse gas emission. However, ICAR-IISS Bhopal is working on greenhouse gas emission under different tillage and cropping systems. Based on the preliminary data generated, we observed that no significant changes occurred under different tillage systems.

b) Whether the experts, while having deliberations on the report of Intergovernmental Panel on Climate Change (IPCC) have opined that the agriculture, forests and land use accounts for one third of total global emissions and deforestation leads to a greater emissions of greenhouse gases; and

Reply: Agreed

c) if So, the steps taken by Government to nullify the ill-effects of land erosion of by the year 2030

Reply: This institute is working on improving soil carbon and health through conservation agriculture practices, crop residue recycling (in-situ decomposition & retention) coupled with best management practices (BMPs) and balanced fertilizer application. In fact, based on the data generated during last 7-8 years clearly indicated that CA practices improve soil organic carbon (SOC) significantly compared to conventional farming practices. In additions, CA practices coupled with residue retention also help in reducing soil erosion. Steps taken to nullify the ill effects of land erosion are: 1. Conservation agriculture 2. Integrated nutrient management 3. Balanced fertilization 4. Soil and water conservation measures 5. In-situ residue decomposition and composting as alternate to crop residue burning 6. Reclamation and Rehabilitation of polluted lands

Sub.: Reply to Rajya Sabha starred/unstarred D.No. No S-407 sitting on 08/02/2019

(f) How many hectares of land has become saline in nature/barren due to excessive use of fertilizers?

Reply: The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also promoted higher fertilizer use. However, there exist cases, where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2000 kg/ha) during 2016-17 from 710 kg/ha during 1960-61. The present total food grain production of 284.83 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

(g) Are any steps taken towards preventing excessive use of fertilizers?

Reply: It is always recommended to farmers to apply balanced and recommended quantities of fertilizers prescribed for different crops in various areas.

Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. “Soil Health Card” Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	**No. of trials**	**Progressive Farmers' practice**	**STCR- IPNS practice**
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

(C) What measures are taken to improve the quality of fertilizers to increase the productivity with very little use;

Reply: Ministry of Agriculture and Farmers Welfare has introduced mandatory neem coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being Neem Coated. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea.

(e) Wheather the Government has undertaken to research to find alternatives to fertilizer, if so, the details thereof?

Reply: Organic manures especially vermicompost have potential; however, the yield is usually not on par with what we get from use of fertilisers. DAC&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

Sub.: Reply to Rajya Sabha admitted starred/unstarred question S5370 for 26.07.2019 - reg.

a. Whether Govt proposes to encourage biofertilizers instead of chemical fertilizers and pesticides in view of their adverse effect on human health

Biofertilizers are being promoted by Government as a part of integrated nutrient management package consisting of chemical fertilizers, organic manures and biofertilizers. But not exclusively on their own for sole application or as some kind of substitute for chemical fertilizers.

b. If so, whether Govt has conducted any study that on the impact of using biofertilizer production?

Several researches have been conducted on the impact of biofertilizer on crop production. ICAR IISS has conducted several studies under All India Network Project on Soil Biodiversity Biofertilizers (AINP SBB). For sustainable crop production, application of biofertilizer along with chemical fertilizer is recommended. Appropriate biofertilizer can save about 25% of chemical fertilizer. In eastern region and high rainfall regions biofertilizer can save even more chemical fertilizer. Reduction in chemical fertilizer with biofertilizer improves soil health, and also have positive impact on soil productivity and environment.

c. Whether Govt would promote production/research of such biofertilizer so that production is not be affected and it remain cost effective at the same time?

Yes. Biofertilizers are being promoted by government through various schemes, like National Mission for Sustainable Agriculture (NMSA)/ Paramparagat Krishi Vikas Yojana (PKVY), Rashtriya Krishi Vikas Yojana (RKVY) and National Mission on Oilseeds and Oil Palm (NMOOP), National Food Security Mission (NFSM) and Indian Council of Agricultural Sciences (ICAR). The Indian Council of Agriculture Research is promoting biofertilizer under ICAR-All India Network Project on Soil Biodiversity-Biofertilisers (AINP SBB) and Network project on Organic Farming. The NPOF is developing location specific organic farming package of practices for crops and cropping systems. The project of ICAR's Network project on Soil Biodiversity-Biofertilisers (AINP SBB) has developed improved and efficient biofertilisers for different crops, soil and agro-climatic regions. ICAR in XI plan includes 17 centres across the country to give R & D base to biofertilizers. The major facets of work are on: Diversity of Rhizobium, Plant Growth Promoting Rhizobacteria, Formulation and Testing of Mixed Biofertilizers, Biofertilizer Technology, Diversification of Biofertilizer usage into disadvantaged areas-tribal, drylands, hill and NEH region and finally frontline demonstrations in farmer fields. Several liquid biofertiliser technology with higher shelf life has also been developed. In addition, biopesticides, consortia for enhanced composting has been developed and promoted. The scheme promotes biofertilizer extensively at tribal and SC farmers. Research is being intensified to develop biofertilizers with novel strains for different crops.

Reply to Lok Sabha unstarred Q.No. 1462 due for answer on 12/02/2019 regarding Krishi Vigyan Kendras

(C) Whether any techniques/methods have been implemented beyond the pilot/test in respect of the research conducted at ICAR in the last five years;

Reply: The technology of Mridaparikshak mini lab has been implemented beyond pilot test. It is commercialized and about 11000 units are already in use in soil health assessment.

During last five years following techniques were implemented by the farmers.

1. Reutilization of accumulated P in soil by which resulted saving of 1 m tons of P worth 5000 crore without compromising the productivity.

2. Green manuring in Western Ghat has infiltrated into the farmers field. This has resulted in net additional profit of five thousand/ha in addition to improvement in soil health.

3. In different regions of country integrated nutrient management modules (IPNS) were developed to optimize the productivity and to reduce the cost of cultivation, are being adopted by the farmer of the region.

(d) if so, details thereof; and

Reply: Success story on Mridaparikshak (enclosed).

Minimal capital requirement

The biggest advantage is in the reduction of capital required for the establishment of laboratory. Traditional laboratories require huge equipment such as Atomic Absorption Spectrophotometer, Visible Spectrophotometer, Flame Photometer, Water Distillation Unit, Large Weighing Balances, Voluminous Shaker, air-conditioners etc. The total cost of these equipment is ₹ 3000000/. In addition, they require a large area (around 400 sq metre) to accommodate this equipment. The total cost of establishing a new laboratory comes out to be rupeesone crore which is the biggest deterrent in expanding the network of soil testing laboratories in the country. In contrast, Mridaparikshak costs only ₹ 86000/ for estimation of 100 soil samples, and subsequently ₹ 17000/ as refilling cost to analyze another 100 soil samples.

Economization in nutrient application, reducing fertilizer subsidy and increasing farmers' income

Mridaparikshak is expected to optimize and economize the application of major and micronutrients. It is expected to reduce the fertilizer nutrient applications considerably in the regions where the soil test levels (soil available nutrients) have become quite high as a result of heavy and indiscriminate use of fertilizers. Muralidharudu et al (2011) while analyzing the data of 430 districts found that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51%districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status. There is considerable scope to reduce the fertilizer nutrient applications in the areas where soil test values have become high.

The balanced fertilizer application is especially important for India because a huge amount of foreign exchange is spent every year on import of fertilizers. Potassic fertilizers are entirely imported and almost 90% of the phosphatic fertilizers are also imported either as finished product or in the form of raw materials like rock phosphate, phosphoric acid, and sulphur (Subba Rao et al., 2015). Though urea is manufactured in India, still a large part of it is imported. Fertilizers, on account of high import cost, have to be subsidized. The total fertilizer subsidy in India in 2015-16 was around Rs. 73 thousand crores. Hence, soil fertility management and soil test based balanced fertilizer applications are most important aspects for sustainable farming. Mridaparikshak can reduce the farmers' expense on fertilizers by optimizing the nutrient applications, thereby reducing the burden on imports and subsidy.

There is huge mining of micronutrients form soil without proper replenishment. As a result, about half of the Indian Soils are suffering from Zn deficiency, 33% soils are deficient in B, Mn deficiency are coming up in rice-wheat growing areas of sandy loam soils in Northern India. The Fe deficiency has been a problem in upland soils. Hence, greater use of micronutrients with proper management strategies is essential for enhancing food production in future. Mridaparikshak prescribes balanced micronutrient recommendations such as Zn, Fe, Mn, B, and Cu.

Impact

Mridaparikshak mini lab is a technology of recent origin. The first version of Mridaparikshak was launched in Indian market in August, 2015. Subsequently, the technology has been upgraded to include all the essential parameters required for making the soil health card as per the Govt. Soil Health Card Scheme (SHC).

In a short span of two years, 8785 Mridaparikshak units have been sold in Indian market and 3.34 million soil samples have been analysed and millions of soil health cards have been prepared(on all India basis, around 14% of the total SHC are prepared by Mridaparikshak during 2016-17). In years to come this technology is expected to increase its share significantly in the area of soil health assessment and preparation of soil health cards.

Mridaparikshak mini lab has been procured by almost the all the Krishi Vigyan Kendras, several state department of agricultural laboratories, NGOs, Public Sector Organizations and others.

Contact:
Head
Division of Soil Chemistry and Fertility
ICAR-Indian Institute of Soil Science, Nabibagh, Bhopal (M.P.) – 462 038
Or
Director
ICAR-Indian Institute of Soil Science, Nabibagh, Bhopal (M.P.) – 462 038
Phone: +91-755-2730946, +91-755-2730970
Fax: +917552733310
www.iiss.nic.in

SUCCESS STORY

Mridaparikshak

A Mini Lab for Soil Health Assessment

Soil Health Assessment and Soil Test Based Balanced Fertilizer Application for 140 Million Farmers in India

A Dream Made Possible

ICAR-Indian Institute of Soil Science
Nabibagh, Berasia Road, Bhopal-462 038 (M.P.)

Preamble

Good soil health is the key to the sustainable agriculture and farmers' income. Good soil health can only be maintained with the periodic assessment of soil health parameters. There are 140 million farmers' holdings in India which would require testing of 47 million soil samples in one year, if samples are tested periodically at an interval of 3 years. This is not possible with 1600 traditional soil testing laboratories, with only 600 laboratories with micronutrient testing facility in India. The existing infrastructure of traditional laboratories could estimate only 6 million soil samples for all the essential soil health parameters in one year. Creation of new laboratories would require investment of thousands of crores.

Mridaparikshak mini lab has made this possible. Mridaparikshak costing only Rs. 86000/ is far cheaper and economical when compared to traditional laboratory which costs around one crore for its creation.

Features

- Mridaparikshak is a digital, mobile, quantitative, rapid, affordable and easy to operate mini laboratory, for the estimation of soil health parameters, fertilizer recommendations, and generation of soil health cards.
- It gives quantitative results of the soil health parameters that can be disseminated on real time basis to the farmers' mobile through Short Message Service (SMS).
- The results include, in addition to soil test parameters, the advisory on nutrient recommendations, specific to crop and soil.
- The results can also be stored in memory and the output can be saved in external storage devise.
- Subsequently, a soil health card can be generated which can be sent to farmers either electronically or by post in the form of hard print.
- Mridaparikshak is protected vide patent application No. 2522/DEL/2015.

Components

Mridaparikshak equipment comprises of smart soil pro, shaker, weighing balance, heater, reagent bottles filled with chemicals, glass-wares and plastic-wares, filter papers, sieves, other accessories that include poly-bags for soil sample storage, tissue papers, rods for stirring, gloves, goggles, notebook for recording the soil data, and distilled water (single and double separately). It also comes with a manual giving details on how to use mridaparikshak.

Launching of Mridaparikshak Mini Lab (February 18, 2015)

Working

Mridaparikshak can determine available form of nutrients such as nitrogen (N), phosphorus (P), potassium (K), sulphur (S), iron (Fe), manganese (Mn), zinc (Zn), copper (Cu) and boron (B). It can additionally provide status of soil pH, soil electrical conductivity (EC) and organic carbon. In addition, it can also assess special soil conditions such as alkalinity, acidity and calcareousness and prescribe the rates of amendments. Mridaparikshak can also prescribe fertilizer doses for primary nutrient namely N, P, and K for targeted yields of different crops grown in different soils. It can also prescribe doses of secondary and micronutrient fertilizers namely S, Zn, B, Fe, Mn and B.

Sequence of operations in Mridaparikshak

Mridaparikshak being distributed to rural youth

Benefits of Mridaparikshak

Ease of operations and low running cost

Mridaparikshak is easy to operate, rapid, quantitative, and digital mini lab. It is a low cost laboratory (Costing ₹ 86000/ + taxes). This laboratory can analyze 100 soil samples, each for fifteen parameters. Once the chemicals are exhausted, they can be refilled for ₹ 17000. It can be easily transported to village and the soil analysis can be performed right at the farmers' doorstep. Because of these features, the mini laboratory could be a boon in the Central Governments' Soil Health Card (SCH) programme. According to SHC programme, more than 14 crore soil health cards are to be distributed to farmers at an interval of two-three years. This min laboratory can make this programme realizable and achievable. It also reduces cost on power requirement since the equipment are customized to analyse only the required parameters and the equipment are also light weight. It ensures uninterrupted working since the power back up is provided (incorporated in shaker which can be connected to Smart Soil Pro) with the mini lab.

Rapid and user friendly

Mridaparikshak reduces the time required in analysis of soil health parameters. The major advantage is that all the laboratory requirements are met at one place. The soil analysts need not run from one room to another for the analysis of soil samples, as in the traditional laboratory.

Another advantage is the quick dissemination of soil test results. One of the main drawbacks in the traditional soil testing laboratories is the late delivery of soil test results. Mridaparikshak is provided with memory card on which the results can be stored and quickly transmitted to farmers' mobile.

Mridaparikshak is easy to operate. It can be operated by young educated farmers/rural youths(11-12 Pass) with short training.

(e) if not, the reasons thereof?

Reply: Nil

Lok Sabha

Admitted version of un-starred question Dy. No. 1256 for 28/06/20199

	Question	Answer
a)	Whether all the Central government Department and PSUs have constituted Internal Complaints Committee (ICCs) to prevent sexual harassment at workplace, if so, the details thereof and if not the reasons thereof.	Yes, the committee details are enclosed.
b)	The total number of sexual complaints filed by employees of Departments of Central Governments before the respective ICCs since 2013.	0
c)	Whether it is true that ICCs have not completed the investigation into such complaints within the statutorily mandated period and if so, the details thereof along with the number of such pending cases.	Not Applicable
d)	The action taken or being taken against such ICCs of Central Government/Department that have failed to submit their investigation reports within statutorily mandate period.	Not Applicable
e)	The number of employees of Central Government/Department Officials that have been suspended or dismissed on charges of sexual harassment since 2013.	Not Applicable
f)	Whether the judiciary falls under the purview of women at workplace (Prevention, Prohibition and redressal) Act, 2013 and so, the details of ICCs in Higher Court and if not the reasons thereof?	Not Applicable

भा.कृ.अ.प.– भारतीय मृदा विज्ञान संस्थान
नबीबाग, बैरसिया रोड़, भोपाल

ICAR-INDIAN INSTITUTE OF SOIL SCIENCE
Nabibagh, Berasia Road, Bhopal 462038 (MP)

F.No.PS/8-15/98/ Dated: 05.02.2019

OFFICE ORDER

In partial modification to this office order F.No.PS/8-15/98/ dated 23/02/2016, the Women Cell Committee and Prevention of Sexual Harassment of Women Employees committee is reconstituted as given below. All the earlier orders in this effect stand withdrawn with immediate effect.

Women Cell		
1	Dr. (Mrs.) Kollah Bharti, Pr. Scientist	Chairperson
2	Dr. Asha Sahu, Sci.	Member
3	Dr. Sudeshna Bhattacharjya, Sci.	Member
4	Dr. Gurav Priya Pandurang, Sci.	Member
5	Dr. Madhumonti Saha, Sci.	Member
6	Mrs. Seema Sahu, ACTO	Member
7	Mrs. Geeta Yadav, Private Secretary	Member
8	Mrs. Kavita Bai, SSS	Member

Committee for Prevention of Sexual Harassment of Women Employees		
1	Dr. Sangeeta Lenka, Sr. Scientist (SS)	Chairperson
2	Dr. Shalini Chakraborty, Sci. Fruit Research Station, Itkhedi	Member External
3	Dr. K.C. Shinogi, Sci.	Member
4	Dr. Seema Bharadwaj, Sci.	Member
4	Mrs. Nirmala Mahajan, ACTO	Member
5	Mrs. Yojana Meshram, Personal Assistant	Member
6	Mrs. Babita Tiwari, Assistant	Member
7	SAO /AAO	Member- Secretary

(Ashok K. Patra)
Director

Distribution:

1. All the Members of the Committees.
2. All Head of Divisions/PCs/I/c Sections/Units.
3. SAO/FAO/AF&AO/AAO, IISS, Bhopal

ICAR-Indian Institute of Soil Science, Bhopal

Lok Sabha

Admitted version of unstarred question no. 6 for 02.02.2018

Question	Answer to be provided
a) The number of complaints of sexual harassment filed by female employees in all the Ministries /Departments of the Government during each of the last three years and the current year, Ministry/Institute -Wise.	0
b) The details of such complaints and status of their disposal.	Not Applicable
c) Whether a large number of fake complaints are being filed by female employees to get under benefit; and	No
d) If so, the details thereof?	Not Applicable

Lok Sabha provisionally admitted Starred Dy. No. 581 due for answer on 19.11.2019 regarding "Promotion of bio-fertilizers" –reg.

a) **Whether a recent study has revealed that most of the serious ailments are occurring due to excessive use of chemical fertilizers and insecticides, if so, whether the government has formulated any concrete programme conducting its study;**

b) Whether the government proposes to promote the use of bio-fertilizer in view of the adverse effect of chemical fertilizer and pesticides on human health in the country including in the Gopalganj district of Bihar and if so, the details of;

Reply: Based on research, it is recommended that integrated nutrient management strategy improves soil biology and crop performance. This strategy includes use of both inorganic and organic fertilizers. Organic sources improve soil C and microbial diversity enabling better soil function.

Biofertilizer has been developed for most Indian crops. State agricultural universities (SAUs) are mostly involved in biofertilizer research and production for local crops. In Bihar SAUs like RAU Pusa, and BAU Ranchi, and other ICAR regional centers participate in the research and development on biofertilizer.

c) Whether the government proposes to promote production of research work on such bio-fertilizers in the country including in Gopalganj district of Bihar to insure there is no shortage of bio-fertilizers and there production remains unaffected and the production is cost effective as well;

Reply: Research on biofertilizers is being carried out at various SAUs and ICAR institutes. Under ICAR's AINP SBB project, biofertilizer has been developed for most Indian crops. In Bihar, RAU Pusa has developed promising biofertilizer for rice and other crops using multi trait microbial strains.

d) If so, whether the government has conducted any study on the effect of bio-fertilizers on the agricultural output;

Reply: Research has been carried out to study the effect of biofertilizers on agricultural output. Performance of biofertilizer depends on soil quality and environmental factors. Symbiotic N fixing Rhizobia sp efficiently contributes to increased crop yield along with lessening chemical fertilizer input. Efficient biofertilizers can contribute up to 25% of crop yield.

e) The details of the scheme of the government to promote organic/bio-fertilizers of better quality in place of chemical fertilizers so as to avoid adverse impact on agricultural production; and

Reply: Biofertilizer use is promoted by through trainings and field demonstrations. Such activities are extensively undertaken in the regions dominated by tribals and other socially backward classes. During 2017 to 20, AINP SBB conducted 27 trainings, where 1416 number of farmers were benefitted.

f) Whether the government proposes to setup outlets for organic/bio-fertilizers on the lines of outlets setup for many available chemical fertilizers.

Reply: There are biofertilizer production units functional under SAUs produce similar to the lines of chemical fertilizers. Although the quantum of production is comparatively less but is growing over the years. The biofertilizer production by SAUs associated with AINP SBB marketed biofertilizer of Rs 879 lakhs during 2017-20.

2020

Sub.: Lok Sabha provisional starred/unstarred question Diary No. 4946 due for answer on 03/03/2020 regarding "organic manure and bio-fertilizer" –reg.

d) Whether the Government plans to promote production and Utilization of Organic manures and bio-fertilizers;

The Government of India has launched the National Programme for Organic Production (NPOP) in the year 2001. During 2004, Government of India has initiated a National Net Work Project on Organic Farming through ICAR with Project Directorate of Farming System Research, Modipuram (UP) with the objective of encouraging the use of organic manures for boosting agricultural production in the country.

b) if so, the names of non-chemical biofertilizers produced and marketed in various parts of the country including the state of Maharashtra along with the details of support systems existing in this regards

Farmers having animal component in their farming system produce different types of organic manures at their farm. Also, there are certain firms, such as Agro Phos India Ltd (Indore), Divya Pruthvi Agronomics P Ltd (Pune), Gujarat Fertiliser trading co. (Vadodara), Bagia nursery (Chandigarh), Global enterprise (Ahmedabad), Humiphos – Vasumitra life energy Pvt Ltd (Pune) and Jay enterprise (Mumbai), etc., which are marketing different organic fertilizers.

c) **whether the Government proposes to bring these bio-fertilizers under the proposed Nutrient Based Subsidy (NBS) system, if so the details thereof.**

NA

d) the type of assistance likely to be provided by the Government to the farmers for the bio-fertilizers produced in their farms, details thereof , State -wise

NA

Sub.: Lok Sabha provisional admitted unstarred Q. Dy. No. 4174 due for answer on 03/03/2020 regarding "Production of organic manures" -reg.

a) the details of the different types of organic manure produced in the Country;

Different types of composts such as vermicomost, phosphocompost, NADEP compost, Mineral Enriched Compost , Poultry manure , **Sheep and Goat Manure , Green manures etc produced in the Country.**

b) the amount of money the Government has been spending on purchasing organic manures during the last three years;

Not Applicable

c) the details of the number of approved firms for supplying organic manure in the country, state/UT-wise;

Not Applicable

d) the problem faces by Government in the production of organic manure in the country;

Not Applicable

e) whether the Government is conducting any research for developing manure for crops from organic waste, if so, the details thereof;

Research for developing compost for crops from organic waste is being done at ICAR-Indian Institute of Soil Science, Bhopal. Team of Scientists of ICAR-IISS, has developed several technologies like phospho-sulpho-nitro compost, vermicompost, microbial enriched compost, rapo-compost and family net vessel compost. Effort are being made to lessen the composting time with the novel consortia of microbes.

f) the details of research bodies involved in such research: and

The Government of India has launched the National Programme for Organic Production (NPOP) in the year 2001. During 2004, Government of India has initiated a National Net Work Project on Organic Farming through ICAR (Indian Council of Agricultural Research) with Project Directorate of Farming System Research, Modipuram (UP) with the objective of encouraging the use of organic manures for boosting agricultural production and sustaining soil health in the country. The project is working with 20 centres across the country.

g) the correspondence cost of producing such manure against the chemical fertilizers?

The comparative cost of producing such manure against the chemical fertilizers: For producing one tone of enriched phospho-compost, the total cost of raw materials is Rs. 976. In addition aonetime cost has to be incurred for the preparation of Kaccha heap (12’x7.5’x3.5’) which is equal to Rs. 1250. It is estimated that 100 kg phospho-compost is equivalent to 3.3 to 5.1 kg urea and 20.2-26.2 kg SSP.

g) the correspondence cost of producing such manure against the chemical fertilizers?

The comparative cost of producing such manure against the chemical fertilizers: For producing one tone of enriched phosphocompost, the total cost of raw materials is Rs. 976. In addition a onetime cost has to be incurred for the preparation of Kacha heap (12’x7.5’x3.5’) which is equal to Rs. 1250. It is estimated that 100 kg phosphocompost is equivalent to 3.3 to 5.1 kg urea and 20.2-26.2 kg SSP.

Sub.: Rajya Sabha provisionally starred/unstarred question Diary No. S4034 due for answer on 13/03/2020 regarding “coverage of cultivated areas under micro irrigation” –reg.

Questions	**Replies**
e) the total area covered under micro-irrigation (MI) during the year 2019-20;	Information is not available at the institute level. However, institute is working on micro-irrigation in research project
b) the total enhancement in yield (kg/ha) of produce from area cultivated through MI during the years 2018-19 and 2019-20;	Information is not available at the institute
c) the total number of farmers who has adopted MI during the year 2019-20;	Information is not available at the institute
d) the total number of micro-water harvesting structures created during the year 2018-19 and 2019-20, State-Wise; and	N.A.
e) the total number of scientific knowledge awareness camps conducted during the same period, state-wise?	Institute regularly conducts farmers training programmes for dissemination of scientific knowledge

Sub.: Lok Sabha starred/unstarred parliament question Diary No. 10463 due for answer on 17/03/2020 regarding “Using crop residue” –reg.

(a) Whether the Government is likely to consider any effective measures to use crop residue after harvest;

Reply: ICAR-IISS had carried out research work on recycling of crop residues after harvest under Conservation Agriculture (CA) and in-situ decomposition of residue using microbial consortia. There has been improvement in adoption of CA practices in Punjab, Haryana and Western UP. In-situ decomposition technique was carried out in farmersfields of Haryana, Madhya Pradesh and Maharashtra. It was observed that 30 days is required to decompose rice-wheat residue and 45 days is sufficient to decompose sugarcane residue.This can be adopted as potential technology where there is availability of sufficient time.

(b) Whether the fertility of the land is being reduced as the crop residue is burned on the fields which destroys the microbes and insects beneficial for agriculture; and

Reply:The burning of crop residue reduce the soil microbial activity as compared to in-situ decomposition of residue.

(c) If so, whether the Government is likely to promote the use of low cost technique to produce compost manure from crop residue?

Reply: Yes, Government should promote the use of low cost technique to produce compost manure from crop residue.

Sub.: Lok Sabha starred question Diary No. 10447 due for answer on 17/03/2020 regarding "Subsidy for buying fertilizers" –reg.

Q. a: Whether there is a direct connection between cases of cancer and farming using fertilizers, if so, the steps taken to balance the use of fertilizers in farming

Reply: Studies conducted under AICRP (LTFE) revealed that there was no reduction in productivity and deterioration of soil health with application of either recommended dose of fertilizer or higher dose (150% of RDF). Application of recommended dose of fertilizer resulted in increase in population of soil microorganisms as well. Studies further indicated that application of fertilizer at higher doses than the recommended amount also did not have any adverse effect on quality of produce. However, there in is no such study conducted connecting cancer with fertilizer usage.

Q. b: Whether the government is considering to promote organic farming, if so the fund allocated for the purpose and the details of action mooted for the same?

Reply: Yes, the ICAR-IIFSR, Modipuram is conducting network project on organic farming.

Sub.: Lok Sabha Provisional Admitted Starred/Unstarred Parliament Question Dy. No. 11592 on 'Women farmers' due for answer on 24.3.2020–reg.

Statewise Number of Women staff positioned in SMD/ICAR Institutes for the year 2019-20

1	2	3	4	5	6
S. No.	State/UT	SMD/ICAR Institutes	Total No. of Women Scientists,Technician, Administrative and Supporting staff and other staff in position as on 2019-20	Total No. of Scientists, Technician,Administrative and Supporting staff and other staff in position as on 2019-20	SMD/Institute-wise percentage of woman employees (Col 4/Col 5)*100
1	**Madhya Pradesh**	**ICAR-IISS, Bhopal**	**18**	**101**	**17.82%**

Sub.: Lok Sabha provisionally admitted Unstarred Q. Dy. No 5158 answer regarding- Excessive use of Chemical Fertilizers

a. **Whether the government has conducted any research that excessive use of chemical fertilizers is reducing soil fertility thereby creating major problems for the poor farmers**

Yes.,Under ICAR-All India Coordinated Research Project on Long Term Fertilizer Experiment. 150% more amount than the recommended dose of fertilizers is being used since last 46 years but so far no adverse effect on soil health has been observed.

b. **If so, the details of the above research**

The long-term experiments since 1972 have indicated no adverse effect of fertilizer on soil health. For instance, the soil of Himachal Pradesh though they are medium to high in available N, low to medium in available P & K yet there is no decline in soil fertility and crop productivity with the use of balanced fertilization. The soil biological health in terms of microbial count and enzymatic activities are also comparable with INM (NPK + FYM) across the major cropping systems.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

c. **Whether the government is considering any proposal to increase subsidies for organic farming or diverting subsidies from chemical to organic farming.**

Not applicable to this institute.

d. **If so, the details thereof; and**

Not Applicable

e. **The steps taken by the government as per the said research**

Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers. Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertilizer. Further, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, bio-fertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the Kisan Mela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Besides, AICRP on LTFE has conducted seventeen field experiments on major crops like rice, wheat, maize, G. nut, soyabean, sorghum, ragi and safflower in different agro-ecological zones with graded doses of major nutrients and observed that there is no decline in soil fertility with 150% NPK dose and balanced nutrient application.

Further, AICRP (STCR) and AICRP (LTFE) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

2021

Sub.: Reply to Lok Sabha Provisional Admitted Starred Parliament Question Dy. No.13408 on 'Vocational Education in Farming' due for answer on 30.03.2021-reg.

(a) the details of measures taken by the Government to promote entrepreneurship among young people associated with agriculture during the last five years;

Reply: The details are as follows:

Name of the programme/Training	Number of participants	Duration	Sponsors
Skill Development Training Programme on "Vermicompost Production"	23 students	22 February to 2 March, 2017	ICAR-IISS, Bhopal
Organic Farming System Approach	35 candidates of Agri-Clinic and Agri- Business	August 1, 2018	Centre for Advanced Research & Development, Bhopal, Madhya Pradesh
Organic Farming & Soil health management	Diploma in Agricultural Extension Services for Input Dealers (DAESI) programme	October 16, 2018	Indo-Europen Chamber of Commerce & Industry, Bhopal (Madhya Pradesh)
Vermicomposting technique	Green House Operator under Prime Minister Skill Development Programme	November 20, 2018	KVK, ICAR-CIAE, Bhopal
Organic Farming System Approach	62 students of Agri-Clinic and Agri- Business Centre Scheme	December 6, 2018	Indo-Europen Chamber of Commerce & Industry, Bhopal, Madhya Pradesh
Organic Farming	20 candidates of Agri-Clinic and Agri- Business	December 18, 2018	Centre for Entrepreneurship Development, Madhya Pradesh (CEDMAP)
Organic Farming	35 candidates of Agri-Clinic and Agri-Business	December 20, 2018	Centre for Advanced Research & Development, Bhopal, Madhya Pradesh
Organic Farming, demonstration along with techniques of soil testing	20 candidates of Agri-Clinic and Agri- Business	December 22, 2018	Centre for Entrepreneurship Development, Madhya Pradesh (CEDMAP)
Organic Farming	25 candidates of Agri-Clinic and Agri- Business	January 10, 2019	Centre for Entrepreneurship Development, Madhya Pradesh (CEDMAP).
Special training on Soil and Water Clinic	37 Students and 03 staffs	March 12, 2019	Sadguru College of Agriculture Mirajgaon, Ahmednagar Affiliated to Mahatma Phule Krishi Vidypeeth, Rahuri
Organic Farming System Approach	33 candidates of Agri-Clinic and	May 4, 2019	Centre for Advanced Research & Development,

	Agri- Business		Bhopal (MP)
Organic Farming & Soil health management	20 Diploma in Agricultural Extension Services for Input Dealers (DAESI) programme	July 3, 2019	Krishi Vigyan Kendra Raisen (MP)
Organic Farming & Soil health management	Diploma in Agricultural Extension Services for Input Dealers (DAESI) programme	September 29, 2019	Krishi Vigyan Kendra Raisen (MP)
Organic Farming & Soil health management	35 Dealers Diploma in Agricultural Extension Services for Input Dealers (DAESI)	November 20, 2019	Krishi Vigyan Kendra Dhar
A skill training programme on Soil and Water Testing Lab Analyst (NSQF level-5)	20 students	February 15 to March 16, 2021	Agriculture Extension Division, ICAR, New Delhi
A skill training programme on Vermicompost Producer (NSQF level-4)	20 students	February 17 to March 18, 2021	Agriculture Extension Division, ICAR, New Delhi

(b) the details of measures taken to retain youth in agriculture during the said period;

Reply:

Name of the programme/Training	**Number of participants**	**Duration**	**Sponsors**
Importance of soil health/ Role of soils in landscape planning	40 Post graduate students	November 16, 2018	School of Planning and Architecture (SPA)
Special training on Soil Testing: Entrepreneurship Development	31 Students	March 6, 2019	Mahatma Phule Krishi Vidypeeth College of Agriculture, Pune, Biocare India Pvt. Ltd. Nagpur and Pelican Equipments Chennai.

(c) whether the Government is planning to implement vocational education in farming and agriculture to all school students; and

Reply: NA

(d) if so, the details thereof and if not, the reason thereof?

Reply : NA

Sub.: Rajya Sabha unstarred question No. 1253 regarding ‘Tribal hamlets” due for answer on 29/07/2021.

(a) The strategies or action-plans by Government for the infrastructure development of tribal hamlets across the country;

Reply: This institute has not developed any infrastructure at the tribal hamlets. However, through TSP budget of the Institute,agricultural inputswere distributed to the tribal farmers in the tribal areas including aspirational districts. Also, conducted capacity building programmesof the tribal farmers for improving soil health,enhancing crop productivity and income.
The agri-inputs were distributed to the beneficiaries under the following projects:

1. Enhancing the productivity of major crops through improving the natural resource base of tribal inhabited areas of central India.
2. Enhancement of soil health and livelihood of tribals in Central India.

(b) whether tribal hamlets are provided health related infrastructural development to fight against COVID pandemic, if so, the detailed data in this regard;

Reply : NA

(c) the utilization of the funds allotted to the NGOs working for the welfare of Scheduled Tribes, strengthening education among Scheduled Tribe girls in Low Literacy Districts and
other schemes and programmes being implemented for the welfare of the tribal people;and

Reply: NA

(d) the data for the year 2019, 2020 and 2021

Reply: The number and beneficiaries under various activities are as follows:

Particulars	**2019-20**		**2020-21**		**2021-22**	
	No.	Beneficiaries	No.	Beneficiaries	No.	Beneficiaries
Training	54	1853	22	742	9	478
Demonstration (FLDs)	347	347	31	87	228	228
Field day/visit	5	300	79	179	0	0
KisanSangoshthi	1	200	0	0	3	125
Farmer field School	1	100	1	100	0	0
Input distribution	1757	1757	1497	1497	100	100
Micronutrient kit	103	103	128	128	0	0
SHC (Soil health card)	0	0	50	50	0	0
Total	**2268**	**4660**	**1808**	**2783**	**340**	**931**

Sub.: The point-wise reply on Lok Sabha Starred/Unstarred Question Diary No 3803 regarding 'Testing of soils" due for answer on 7.12. 2021.

d) Whether the government has considered the adoption of various sensor technologies such as temperature, pH, soil moisture and humidity in collaboration with the Internet of Things (IoT) to give remote access to the farmers so they could monitor, control and manage the quality of the soil themselves and if so, details thereof;

Reply: STCR prescription equations have been integrated in the Soil Health Card Portal developed by Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India in collaboration with NIC, New Delhi (http://soilhealth.dac.gov.in/).

e) if not the alternative measures which the Government is considering for the empowerment of farmers in testing soil quality and

Reply: Apart from STLs, soil test kits (Mridaparikshak and Pusa STFR Meter) were also employed for soil testing.

Sub.: The point-wise reply on PQ Starred/Unstarred Question Diary No 2649 regarding 'Testing of soil quality" raised by Shri Parvesh Sahib Singh Verma and Shri T.R.V.S. Ramesh.

(a) the details of the current method of testing soil quality as employed by the Government;

Reply: Soil health is assessed by estimating 12 parameters. They are soil pH, Electrical conductivity (EC), Organic carbon, available nitrogen, phosphorus, potassium, sulphure, iron, copper, zinc, manganese, and boron. These are analyzed by using standard lab procedures. Soil quality is often computed by estimating Soil Quality Index (SQI). The parameters used for calculating SQI differ from soil to soil. There may be physical and biological parameters in addition to shown above.

(b) whether the Government has considered the adoption of various sensor technologies such as temperature, pH, soil moisture and humidity in collaboration with the Internet of Things (IoT) to give remote access to the farmers so they could monitor, control and manage the quality of the soil themselves and if so, the details thereof; and

Reply: STCR prescription equations have been integrated in the Soil Health Card Portaldeveloped by Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India in collaboration with NIC, New Delhi (http://soilhealth.dac.gov.in/).

Division of soil chemistry and fertility has successfully employed Ion Selective Field Effect Transistors (ISFET) for the estimation of soil pH. However, it is so far tested as standalone technique without IOT."

(c) if not, the alternative measures which the Government is considering for the empowerment of farmers in testing soil quality?

Reply: Apart from STLs, soil test kits (Mridaparikshak and Pusa STFR Meter) were also employed for soil testing.

Technologies developed during COVID-19 with targets and achievements

[1] Technology

a) The details of new technologies which are being developed during the agricultural advancement and doubling the income of farmers during the last three years, particularly during COVID-19 period

Reply: Balance and Integrated Nutrient Management Boosted Crop Yield in Vertisols in Tribal Areas: It has been proved through on-farm experiments and long term fertilizer trials that balanced and integrated use of nutrients are essential to sustain productivity.

b) the targets set/achieved so far; and

Reply:

About 70 field demonstrations were conducted at different locations in tribal area of Maharashtra. The results indicated that balanced application of nutrient resulted in better productivity compared to farmers' practice (Table 1). However, integrated use of nutrients has further improved the productivity of soybean, sorghum, chickpea and wheat. The results also indicated that sorghum, and wheat responded to applied K which is generally not applied by the farmers assuming that soil are rich in K. Thus, the results from field demonstrations indicated that balanced use of nutrients is essential to sustain the productivity and incorporation of FYM has further increased the sustainability level. With the aim of awareness programme through TSP, Scientists imparted several trainings on balanced and integrated use of nutrients to the tribal farmers before taking up the demonstrations in the villages. Literature in regional language was also provided to update the knowledge of tribal farmers. Field demonstrations were conducted with farmers' participation as per training content and the scientist's guidance. Extension activities like Field Day-cum-Training programme were organized successfully.

Table 1. Effect of various treatments on grain yield (q/ha) of different crops (Akola, Maharashtra) (2018-2020)

Treatments	Soybean	Sorghum	Chickpea	Wheat
100% NPK	9.94 (22.4%)	28.31 (29.3%)	13.19 (35.6%)	27.22 (33.4%)
100% NPK + FYM @ 5 t ha-1	11.45 (41.0%)	32.21 (47.1%)	14.38 (47.8%)	29.91 (46.5%)
100% NP (-K)	9.22 (13.5%)	25.95 (18.5%)	11.63 (19.5%)	25.35 (24.2%)
Farmers' practice (N & P are used in less quantity and K=0)	8.12	21.89	9.73	20.41
CD at 5%	0.65	1.72	0.55	1.40

The values in bracket indicate % increase in yield over the farmers' practice for respective crops.

c) whether the government has any plans/schemes to support the farming community, if so, the details thereof?

Reply:

There is a plan to distribute agricultural inputs such as fertilizers, seed, biofertilizers, agrochemicals to the farmers in tribal areas under the STC (TSP) scheme. In this regard, front line demonstrations (FLDs) will be planned for the benefit of the farmers. Similarly, different extension activities like Kisan Goshti, Farmers' Day, Field Day, Training Programmes will be organized at the University Level or in the villages as per suitability. Literature in regional language will be provided to create awareness amongst the tribal farmers.

[2] Technology

a) The details of new technologies which are being developed during the agricultural advancement and doubling the income of farmers during the last three years, particularly during COVID-19 period

Biofertilizer for spices of Kerala - Biofertilizers were developed which improved the yield of ginger and pepper by 14-30% in Wayanad district of Kerala.

b) the targets set/achieved so far; and

Reply:

Biofertilizer worth Rs 97810/- were distributed to the farmers during 2017-20. About 2989 farmers in Kerala were benefitted by training on uses of the biofertilizer.

c) whether the government has any plans/schemes to support the farming community, if so, the details thereof?

Reply:

Proposed to intensify biofertilizer use in the areas dominated by tribal and SC farmers of Kerala.

[3] Technology

a) The details of new technologies which are being developed during the agricultural advancement and doubling the income of farmers during the last three years, particularly during COVID-19 period

Seed coat formulation of biofertilizer - In this technology thin film of biofertilizers is coated on the surface of the seeds. The approach provides customized biofertilizer coating, uniform biofertilizer application, and easier application compared to traditional techniques of biofertilizer application.

b) the targets set/achieved so far; and

Reply:

During last three years about 410 farmers were trained and benefitted using this technology.

c) whether the government has any plans/schemes to support the farming community, if so, the details thereof?

Reply:

Planned to popularize the technology for adaptation and use by farmers of Tamil Nadu.

[4] Technology

a) The details of new technologies which are being developed during the agricultural advancement and doubling the income of farmers during the last three years, particularly during COVID-19 period

Ekcel ShrdR and CompostR machine was developed for rapo compsting of biowaste .

b) the targets set/achieved so far; and

Reply:

The formulated microbial consortia comprised of Fungi, bacteria and actinomycetes are also being evaluated for in situ decomposition of crop residue in farmer's field through demonstration mode.

c) whether the government has any plans/schemes to support the farming community, if so, the details thereof?

Reply:

A demonstration has been done in farmers field for in-situ decomposition for rice & wheat residue.

[5] Technology

a) The details of new technologies which are being developed during the agricultural advancement and doubling the income of farmers during the last three years, particularly during COVID-19 period

Conservation agriculture

b) the targets set/achieved so far; and

Reply:

To standardize the technology for different cropping system.

c) whether the government has any plans/schemes to support the farming community, if so, the details thereof?

Reply:

Technology for two cropping systems has been standardized with significant advantage in terms of reduction in cost of cultivation, resource saving, improvement in soil health and crop productivity.

The technology has been demonstrated to farmers through participatory research module in 10 villages.

Soybean- Wheat cropping system

Maize- Chickpea cropping system

[6] Technology

a) The details of new technologies which are being developed during the agricultural advancement and doubling the income of farmers during the last three years, particularly during COVID-19 period

Development of fertilizer prescription equations and online fertilizer recommendations.

b) the targets set/achieved so far; and

Reply:

Target-1: Development of fertilizer prescription equations for important crops to recommend plant nutrients through locally available organic sources and inorganic sources based on soil test values and yield targets under STCR-IPNS system:

Achievement: Developed prediction equations under Integrated Plant Nutrient Supply System for Hybrid Rice (Ranjit), Maize (Hybrid (BT. cotton Hybrid), Soybean (Basara), Kharif rice (IET 4786), Boro rice (IET 4786), Sweet potato (Kisan), Linseed (Neelam B-67), Fenugreek (Pusa Early Bunching),Onion (Sukhsagar),Turmeric (Palam Lalima), Hybrid Maize (P3377), Oats (Pant Forage Oats-3), Wheat (WH-1105), Mustard (Pusa Bold), Rice (IRH-103),Wheat, Brinjal, Chickpea, Bottle gourd (Madhuri), Knolkhol (White Vienna), Cucumber, Radish, Pea, Bhendi Hybrid (Green gold plus), Chrysanthemum (hybrid Poornima) Irrigated beans, Dry chilli under dryland, Seasame (TKG-21), Ash gourd (KAU local), Taramira (RTM-314), Sesamum Kharif, Clusterbean, Barley, Brinjal, Maize, Soybean, Sugarcane (Co 0238), Wheat (DBW 16) and Maize (HQPM-5).

Target-2: Development of prediction equations for cropping sequences.

Achievement: Developed prediction equations for Linseed (Neelam B-67) and Maize (Amar).

Target-3: Development of soil testing protocol for the estimation of N and P in organic farming system.

Achievement: For N, 1/15 M neutral Phosphate buffer is the suitable extractant for the estimation of potentially mineralizable N; for P, 0.1 M NaOH + 0.05 M EDTA for potentially mineralizable P and 2% citric acid for solubilization of insoluble phosphate are the suitable extractant for the estimation of potentially available P was found useful.

Target-4: Development of online fertilizer recommendation system.

Achievement: Web-based fertilizer recommendation system through STCR approach coupling with geo-referenced soil fertility maps of Tumkur district

Target 5: Patenting and commercialization of technology.

Achievement: Patent #347189 for Portable Soil Testing Kit for Agricultural and Horticultural Crops granted.

c) whether the government has any plans/schemes to support the farming community, if so, the details thereof?

Reply:

AICRP (STCR) is implementing STC (erstwhile TSP) funded by Government of India to uplift the economic condition of tribal farmers with main emphasis of FLDs and capacity building w.r.t. soil test based STCR recommendation for achieving targeted yield of crops and cropping systems. With the fast developing world, tribals required specific attention not only with monetary allocation but along with special interventions for their rapid socio-economic development. It required an integrated approach of all departments in a united manner and not works in isolation. The STC envisages reducing gaps between the tribal and non-tribal in health, education, communication and other areas of basic amenities of life by providing legal and administrative support. The Sub-Plan also implements income-generating schemes to boost the income of the tribals on a sustainable basis by taking into account their aptitude and skill. Similarly, AICRP (STCR) is implementing NEH and SCSP programmes also.

Reply of Lok Sabha Q No 8792 sitting on the 16/03/2021 regarding soil health fertility-reg.

(a) whetherthe Government has conducted any study to estimate the loss of fertility and nutrients in soil in places affected by cyclones,floods and landslides;

Reply: Not done under STCR.

(b) if so, the details thereof specific to Odisha.

Reply: Not done under STCR.

(c) the detailsof districtsin Odisha found to be facing challenges in terms of soilfertility;

Reply: GPS/GIS-based soil fertility mapping of 8 districts of Odisha, viz., Puri, Cuttack, Baleshwar, Bhadrak, Khordha, Dhenkanal, Nayagarh and Anugul were conducted. More than 80% soils of Odisha are acidic. Because of high acidity phosphorous gets fixed and more than 60% soils are deficient in phosphorous. Only 25% soils are deficient in available potassium. In secondary nutrient sulphur is deficient in 45 – 50% soils. In micronutrients, Zinc deficiency occurs in 30 – 35% soil and Boron deficiency occurs in more than 50% soils because of the upland light textured soils. Molybdenum deficiency occurs in >60% soil. There is no deficiency of iron, manganese and copper. Organic carbon status is medium.

(d) whether the Governmentproposes to introduce measures to increase soil health and fertility;

Reply: Kindly refer below.

(e) if so, the details thereof; and

Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. “Soil Health Card” Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the KisanMela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

(f) the details of any assistance extended to farmers who suffer loss due to infertile soil in their field?

Reply: DAC&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients. Further, Ministry of Agriculture and Farmers Welfare has introduced mandatory *neem* coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being *Neem* Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea. Through STC and SCSP programmes also, ICAR Institutes are organizing awareness programmes in villages.

Sub.: The point-wise information on Rajya Sabha Provisionally Admitted Starred/Unstarred Question Diary No.-- U1299, U1304 regarding 'Production of organic manure through agricultural wastes and animal dung' by Shri Sanjay Seth and Shri K.C. Venugopal due for answer on 30.07. 2021.

(a) Whether Indian Council of Agricultural Research (ICAR) has developed improved technology for preparation of quality composts from animal excreta etc, if so, the details thereof;

Reply: Yes, ICAR-IISS, Bhopal has developed several technologies for the preparation of quality composts from animal excreta (i.e cow dung) namely Vermicompost, Mineral-enriched compost (such as Phospho-Sulpho-Nitro (P-S-N) compost, Phospho compost), Microbially enriched compost, and Rapo-compost. Also, a lignocellulolytic microbial consortium has been identified by the Institute scientists which can reduce the conventional period of composting (9-12 months) to 30-45 days depending upon the substrate used.

(b) The details of funds released as subsidy to various States for setting up of fruit/vegetable market waste compost production unit;

Reply: Not Known

(**c) The other steps taken by Government to promote the production of organic manure through the utilization of agricultural wastes and animal dung**

Reply: Several Projects are being undertaken in the Institute under various Government initiatives like MeraGaonMera Gaurav (MGMG), Swachchata Action Plan (SAP), Tribal Sub Plan (TSP), Scheduled Caste Sub Plan (SCSP) to promote the production of organic manure through the utilization of agricultural wastes and animal dung. Activities under these projects include on-farm demonstration for preparation of improved compost using microbial inoculums and natural rock minerals. Portable vermibed is also being distributed to the farmers for the preparation of vermicompost from animal excreta and farm wastes. Training to the interested farmers was also conducted for farmers on "vermicompost preparation" for a period of one month.

Sub.: Point-wise reply on Lok Sabha unstarred question diary No. 6361 regarding "Presence of microplastics" for reply on 03.08.2021- reg.

1. Whether the Government is aware of the fact that fertilizers and pesticides being a leading cause for presence of microplastics in agriculture and Horticulture.

Reply: Not much studies have been made at this institute. However, in the literature it has been reported that fertilizer materials coated with polymers such as polysulfone, polyacrynonitrile, or cellulose acetate may be a source of micro-plastics in the soils (Trenkel 2010, GESAMP 2015, Ekebafe et al. 2011).

(b) Whether any action has been taken to revoke license provided to companies producing said fertilizers and pesticides?

Reply: Not known.

(c) **If so, the details thereof and if not, reasons therefore;**

Reply: Not applicable

(d) Whether the Government proposes to formulate any alternative to fertilizers containing microplastics; and

(e) if so, the details thereof and the time by when the same is estimated to be implemented?

Reply: Considering the concerns of microplastics use in agriculture, there is a need for alternative materials i.e. biodegradable plastics.

Sub.: The point-wise reply on Lok Sabha Diary No 11075 regarding 'Management of soil health" to be answered on 21.12.2021.

(a) The details of various programs under implementation, for management of soil health in the country and report there under during each of the last three years and the current year, State-wise;

Reply: The AICRP on "Long-term fertilizers experiments to study changes in soil quality, crop productivity and sustainability". Now, the AICRP-LTFE is operating at 17 cooperating centres of the country under the broad mandate of

The details of the impact of imbalance and balance fertilizer application on soil available nutrients and SYI during last three years is as follows:

Data revealed that there is improvement in soil fertility due to balanced and Integrated Nutrient Management (INM) practices at different locations than imbalance fertiliser application. However, 100% N adversely affected the crop productivity across all the LTFEs with more pronounced effect in Alfisols. The soil quality parameters namely Soil Quality Index (SQI), Sustainable Yield Index (SYI) and microbial count improved with integration of organic and inorganic i.e. 100% NPK+FYM (Table 1-5 and Fig 1).

Table 1: Average available soil N (kg ha^{-1}) under different nutrient management options during last three years at experimental sites of AICRP-Long-Term Fertilizer Experiments (LTFEs)

Location	**State**	**Initial**	**Control**	**N**	**NP**	**NPK**	**150% NPK**	**NPK+ Zn**	**NPK+ Lime**	**NPK+ FYM**
Akola	Maharashtra	120	115	219	240	248	309	262	-	318
Bangalore	Karnataka	257	167	155	175	179	200	-	174	214
Barrackpore	West Bengal	223	211	230	232	245	265	245	-	263
Bhubaneshwar	Odisha	187	184	198	207	232	234	222	240	271
Coimbatore	Tamil Nadu	178	151	185	198	193	231	213	-	244
Jabalpur	Madhya Pradesh	193	178	210	250	288	328	288	-	340
Jagtial	Telangana	108	129	134	139	139	140	128	-	142
Junagadh	Gujarat	161	143	176	191	203	240	207	-	260
Ludhiana	Punjab	87	85	115	117	118	128	120	-	130
New Delhi	Delhi	-	191	229	234	234	285	234	-	274
Palampur	Himachal Pradesh	736	267	330	355	365	370	366	361	397
Pantnagar	Uttarakhand	392	173	226	233	232	302	232	-	313
Parbhani	Maharashtra	216	191	213	242	260	282	245	-	286
Pattambi	Kerala	-	182	201	210	216	204	-	236	230
Raipur	Chhattishgarh	236	177	206	213	220	250	217	-	252
Ranchi	Jharkhand	295	159	167	171	192	180	-	148	183
Udaipur	Rajasthan	360	251	292	311	351	399	345	-	386

Table 2: Average available soil P (kg ha^{-1}) under different nutrient management options during last three years at experimental sites of AICRP-Long-Term Fertilizer Experiments (LTFEs)

Location	State	Initial	Control	N	NP	NPK	150% NPK	NPK+ Zn	NPK+ Lime	NPK+ FYM
Akola	Maharashtra	8.40	4.82	7.98	16.86	17.68	21.92	17.96	-	22.9
Bangalore	Karnataka	34.3	17.66	17.76	70.85	42.03	84.78		41.58	78.48
Barrackpore	West Bengal	41.5	5.70	7.30	41.60	46.80	58.80	41.10	-	61.00
Bhubaneshwar	Odisha	19.4	6.00	8.60	10.20	12.00	11.90	9.90	11.10	41.30
Coimbatore	Tamil Nadu	11.00	7.80	11.92	20.11	22.91	26.09	22.12	-	27.18
Jabalpur	Madhya Pradesh	7.60	8.50	9.80	27.80	33.70	37.20	31.9	-	36.90
Jagtial	Telangana	19.30	9.65	7.92	26.08	22.68	31.45	23.92	-	33.50
Junagadh	Gujarat	9.48	13.70	13.60	24.50	25.70	31.30	24.90	-	37.90
Ludhiana	Punjab	9.00	13.80	15.80	52.40	49.60	82.30	53.10	-	88.50
New Delhi	Delhi	16.00	18.90	17.50	34.50	35.70	43.40	34.60	-	41.20
Palampur	Himachal Pradesh	12.10	16.00	16.00	110.00	64.00	148.00	75.00	78.00	135.00
Pantnagar	Uttarakhand	18.00	7.83	9.93	18.60	18.80	32.53	18.93	-	29.00
Parbhani	Maharashtra	16.00	13.34	13.58	16.74	15.38	18.45	15.65	-	19.10
Pattambi	Kerala	15.57	12.78	9.84	18.73	18.22	19.06	-	18.11	19.13
Raipur	Chhattishgarh	16.00	10.00	14.00	25.60	26.00	27.30	26.30	-	29.00
Ranchi	Jharkhand	12.6	14.4	19.5	82.5	72.6	167.7	-	77.7	152
Udaipur	Rajasthan	22.4	15.83	16.21	24.25	25.37	33.49	27.59	-	31.24

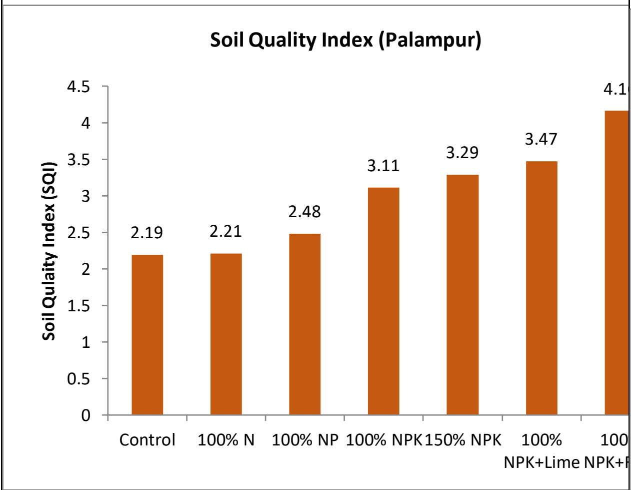
Table 3: Average available soil K (kg ha^{-1}) under different nutrient management options during last three years at experimental sites of AICRP-Long-Term Fertilizer Experiments (LTFEs)

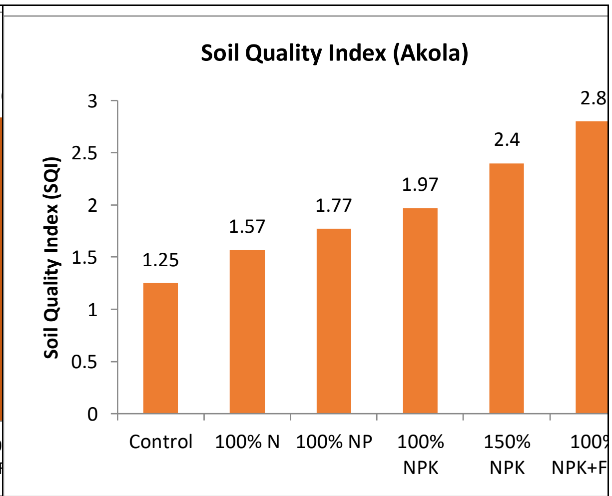
Location	State	Initial	Control	N	NP	NPK	150% NPK	NPK + Zn	NP K+ Li me	NPK+ FYM
Akola	Maharashtra	358	157	198	225	389	481	384	-	492
Bangalore	Karnataka	123	78.38	64.31	63.88	144.6	184	-	164	177
Barrackpore	West Bengal	143	138	126	130	174	201	173	-	200
Bhubaneswar	Odisha	43	93	91	97	103	115	102	114	153
Coimbatore	Tamil Nadu	810	536	567	572	668	701	654	-	759
Jabalpur	Madhya Pradesh	370	244	247	250	298	320	289	-	336
Jagtial	Telangana	364	373	375	393	475	481	430	-	466
Junagadh	Gujarat	184	159.4	146.3	145.3	214.9	260.8	249.5	-	258
Ludhiana	Punjab	88	77.7	83.3	108.6	126.6	145.6	117.6	-	143
New Delhi	Delhi	155	209	193	182	268	332	289	-	314
Palampur	Himachal Pradesh	194	109	130	127	156	184	164	162	203
Pantnagar	Uttarakhand	125	93	89	91	129	142	123	-	145
Parbhani	Maharashtra	766	621	645	693	697	771	651	-	783
Pattambi	Kerala	173	46	50	51	72	81	-	71	79
Raipur	Chhattishgarh	474	361	361	376	391	414	385	-	425
Ranchi	Jharkhand	157	119	126	83	118	136	-	101	126
Udaipur	Rajasthan	671	471	477	487	556	598	558	-	584

Table 4: Sustainable yield index (SYI) of long term fertility trials at different location of India under AICRP-Long-Term Fertilizer Experiments (LTFEs).

Centre	State	Crop	Con trol	N	NP	100% NPK	150% NPK	NPK+ FYM	NPK + Lime

Barrackpore	West Bengal	Rice	0.15	0.29	0.34	0.35	0.41	0.40	-
		Wheat	0.11	0.30	0.36	0.38	0.47	0.41	-
Pantnagar	Uttarakhand	Rice	0.13	0.39	0.43	0.41	0.38	0.50	-
		Wheat	0.15	0.46	0.51	0.51	0.50	0.62	-
Ludhiana	Punjab	Maize	0.03	0.18	0.24	0.29	0.32	0.44	-
		Wheat	0.14	0.43	0.63	0.70	0.76	0.78	-
Palampur	Himachal Pradesh	Maize	0.01	0.07	0.15	0.35	0.36	0.53	0.47
		Wheat	0.04	0.05	0.15	0.28	0.28	0.42	0.40
Ranchi	Jharkhand	Soybean	0.10	0.01	0.21	0.49	0.47	0.62	0.60
		Wheat	0.03	0.02	0.29	0.35	0.36	0.43	0.41
Coimbatore	Tamil Nadu	Finger Millet	0.08	0.12	0.36	0.37	0.41	0.46	-
		Maize	0.06	0.09	0.36	0.39	0.43	0.47	-
Raipur	Chhattishgarh	Rice	0.60	0.43	0.61	0.61	0.68	0.66	-
		Wheat	0.26	0.38	0.68	0.67	0.81	0.75	-
Jagtial	Telangana	Kharif Rice	0.32	0.46	0.52	0.55	0.57	0.58	-
		Rabi Rice	0.24	0.31	0.45	0.46	0.50	0.48	-
Jabalpur	Madhya Pradesh	Soybean	0.13	0.14	0.26	0.32	0.30	0.35	-
		Wheat	0.14	0.15	0.49	0.54	0.56	0.59	-
Akola	Maharashtra	Sorghum	0.01	0.15	0.21	0.29	0.40	0.40	-
		Wheat	0.00	0.13	0.18	0.31	0.41	0.00	-
Pattambi	Kerala	Kharif/Rice	0.33	0.44	0.46	0.48	0.50	0.61	0.49
		Rabi/Rice	0.47	0.58	0.62	0.68	0.69	0.82	0.67





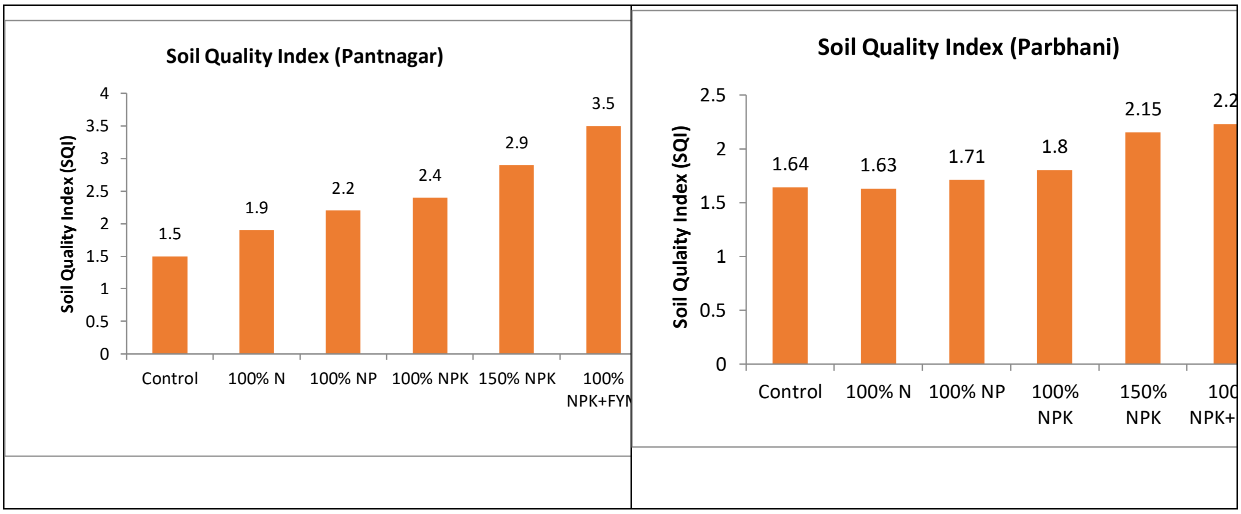


Figure 1: Soil Quality Index of long term fertilizer experiments at Palampur (Himachal Pradesh), Akola (Maharashtra), Pantnagar (Uttarakhand) and Parbhani (Maharashtra).

Table 5: Studies on soil microbial population at under different centres of AICRP-LTFE centres at Coimbatore (Tamil Nadu), Jagtial (Telangana) and Pantnagar (Uttarakhand).

Coimbatore (Finger millet-Maize)			
Treatments	**Bacteria ($x10^6$)per g soil**	**Fungi ($x10^4$)per g soil**	**Actinomycetes ($x10^3$)per g soil**
Control	47	12	8
100% N	74	13	9
100% NPK	85	14	10
150% NPK	92	15	11
100% NPK + FYM	133	17	13
Jagtial (Rice-Rice)			
Treatments	**Bacteria ($x10^6$)per g soil**	**Fungi ($x10^3$)per g soil**	**Actinomycetes($x10^4$)per g soil**
Control	8.86	3.21	2.67
100% N	10.23	2.68	2.92
100% NP	15.49	4.51	4.63
100% NPK	20.46	6.34	4.26
150% NPK	19.82	7.15	6.27
100% NPK + FYM	25.67	10.98	8.64
Pantnagar (Rice-Wheat)			
Treatments	**Bacteria ($x10^6$)per g soil**	**Fungi ($x10^4$)per g soil**	**Actinomycetes ($x10^5$)per g soil**
Control	0.55	0.60	0.78
100% N	1.46	1.27	1.89
100% NP	1.68	1.66	1.00
100% NPK	1.80	1.48	1.71
150% NPK	1.87	1.48	1.76
100% NPK+FYM	2.32	1.99	2.16

(b)Whether the Government has commissioned any study to identity the main reasons for loss of fertility of the soil, land degradation and conversion of fertile land into barren land in various parts of the country especially Punjab;

Reply:

No, AICRP-LTFE does not have the study on loss of fertility of the soil, land degradation and conversion of fertile land into barren land. However, AICRP-LTFE has a centre at Punjab Agricultural University (PAU), Ludhiana, Punjab (Table 6 & 7). It studies the impact of integrated nutrient management such as imbalance, balanced and integrated nutrient management (INM) on soil and crop productivity.

(c) If so, the thereof;

Reply:
The findings of the long term fertility trial at PAU, Ludhiana depicts the importance of balanced and integrated nutrient management (INM) on crop yield (Table 6) and microbial biomass carbon (MBC) (Table 7) that imbalance nutrient application leads to loss of productivity and microbial biomass carbon (MBC) while, balanced and INM improved it.

Table 6. Effect of long-term fertilizer application on average maize and wheat grain yield (q ha^{-1}) under maize-wheat cropping sequence during last three years at PAU, Ludhiana.

Treatments	**Mean maize yield (q ha^{-1})**	**Mean wheat yield(q ha^{-1})**
Control	14.4a	19.2 a
100%N	35.3 b	35.7 b
100%NP	46.0 c	45.5 c
50%NPK	36.4 b	36.8 b
100%NPK	52.9 d	50.3 d
150%NPK	55.3 e	54.7 e
100%NPK+Zn	53.7 de	53.6 e
100%NPK+FYM	62.2 f	57.5 f

Values within a column, followed by different letters are significantly different at $p \leq 0.05$ by Duncan's Multiple Range Test

Table 7. Effect of long-term application of inorganic fertilizer and farmyard manure on microbial biomass carbon (MBC) of surface and sub-surface soil under Maize-Wheat cropping system at PAU, Ludhiana.

Treatment	**MBC (mg kg^{-1})**	
	0-15 cm	**15-30 cm**
Control	137a	87a
100% N	207b	114b
100% NP	241c	126b
100% NPK	290d	157c
100% NPK+FYM	386f	229e
150% NPK	307e	175d

Values within a column, followed by different letters are significantly different at $p \leq 0.05$ by Duncan's Multiple Range Test

(d) Whether the Government has received proposals from the State of Punjab for financial assistance for the improvement of soil health; and

Reply: Not Applicable

(e) If so, the details thereof including the funds allocated, released and utilized for the purpose during the said period, district-wise?

Reply: Not Applicable

Sub.: Lok Sabha Provisionally Admitted Starred Questionregarding'Promotion of Modern Farming' due for answer on 20/07/2021

(a) whether the Government is promoting modern farming along with traditional farming in the country;

Reply: Yes, Government is promoting modern farming along with traditional farming.

(b) if so, the details thereof;
Reply:
India embarked on the path of modern agriculture using HYV, chemical fertilizers especially urea, and irrigation water leading to Green Revolution. This Green Revolution made India self – sufficient in food grains through using high yielding and fertilizer responsive crop varieties. However, post-green revolution input-intensive conventional agriculture production system have led to second generation problems such as deteriorating soil health, declining soil organic matter and increasing multiple deficiencies of major nutrients (N, P, K, and S) and micronutrients (Zn, Fe, and Mn) due to their over mining from soils, decline in the groundwater table, increased energy cost of pumping water, deterioration of groundwater quality, development of sodicity & salinization problems, development of biotic & abiotic stress, development of herbicide resistance and a shift in weed flora and pest populations, decline in partial factor productivity and decreasing farm productivity & profitability.

Presently, the Government is promoting modern farming through following approaches:
(i) Integrated nutrient management (INM): This strategy is the most logical concept for managing and sustaining long term soil health and crop productivity. It encompasses conjunctive use of chemical fertilizers including secondary and micronutrients, organic manures, composts/vermicomposts, biofertilizers and green manures etc. Thus, supply of complete and balanced fertilization through INM practices enhances nutrient-use efficiency, maintains soil health and thereby enhances crop yields and leads to farmers' profitability. Besides, Site-specific nutrient management (SSNM) and application of resource conserving techniques (RCTs) are also used to conserve resources, ensure their optimal utilization and enhance resource or input use-efficiency.
(ii) Organic farming and Natural farming practices: ICAR- IISS has been evaluating different management practices including nutrient managements through organics/compost, balanced use of nutrients, waste management through off-situ and in-situ composting, innovative and natural farming inputs to improve crop productivity and sustainable soil health. Further to improve farmers' income and reduce the uncertainty in farming, these information are being frequently advocated and educated to the farmers in various on field programs. Besides, under NICRA project, ICAR-IISS have organized KisanPathsala to educate the farmers on "climate smart agriculture" with contingency plan under climatic vagaries to minimize the loss and ensure round the year income.
(iii) Precision farming using hyper-spectral remote sensing for assessing soil health, drip and sprinkler irrigation for higher water use efficiency and crop productivity is being developed at the institute.

(c) whether the Government is providing facilities to promote modern farming in the country and if so, the details thereof;
Reply: Yes, Government is providing facilities to promote modern farming through various national schemes and funding research projects. The government is promoting soil test based fertilizer nutrient applications for maintaining a good soil health. Recently, GOI has initiated a mammoth programme of preparing and distributing soil health cards to about 14 crore

farmers in the country. These soil health cards will contain the information about soil fertility and soil test based fertilizer nutrient recommendation. Besides, the government provides assistance for promoting organic farming across the country though different schemes for maintaining the soil health and crop quality.

ICAR-IISS, Bhopal has started working on projects involving integrated nutrient management (2002 onwards), organic farming (2004 onwards). Last year a new experiment on natural farming was initiated in the institute. The lead centre for both projects is ICAR-IIFSR, Modipuram. Out of 21 centres under AI-NOPF, ICAR-IISS, Bhopal is one among them taking up research project on evaluation of Organic farming and Natural farming practices for improving soil health under soybean based cropping system. ICAR-IISS has also initiated two projects on hyper spectral remote sensing/spectroscopy based assessment of soil health using mid-infrared/near infrared region (MIR/NIR) spectroscopy.

(d)whether the Government has also fixed any target to promote modern farming; and
(e) if so, the details thereof including the present achievements in this regard?

Reply: Targets are being set in EFC document for each year and for a period over five years. The achievements are being monitored and sent to council in cabinet report. Besides, the progress is also being monitored in RAC and IRC conducted at institute. Low cost integrated nutrient modules have been developed for soybean - wheat and maize-chickpea cropping systems suitable for central India. The institute has developed organic package of practices of wheat, soybean, mustard, chickpea isabgol and linseed crops for Central India. Also methods for recycling of organic wastes have been developed at the Institute which is being demonstrated in farmers' field.

Sub.: Lok Sabha unstarred diary No. 3532 regarding 'Increasing of carbon dioxide in the atmosphere" due for answer on 27/07/2021

(b) whether any survey has been conducted with regard to the fact that new striking revelations in the agriculture science confirms that due to increase in the amount of carbon dioxide in the atmosphere, resulting in enhanced photosynthesis resulting increase in production but with the such as protein, minerals and other micronutrients has decreased, if so, the details thereof;

Reply: Elevated atmospheric CO_2 (eCO_2) can enhance the yield of many crops but affects their nutritional quality. Several studies across the globe have been carried out, which suggest that mineral nutrient quality in the edible part of the crops declines under elevated CO_2. The major mechanisms proposed are: (1) carbohydrate dilution effect – where the carbon assimilation is more under elevated CO_2 leads to dilution of mineral concentration in plant tissues, (2) decrease in transpiration rates –which reduces the flow of nutrients from soil and imbalances the nutrient allocation in different parts of the plant. (3) down-regulation of photosynthesis and increased photorespiration causes variations in mineral concentrations in plant parts. In a meta analysis of 1,015 observations, it was noted that elevated CO_2 increased the concentrations of carbohydrates or sugars in edible parts of crops but decreased the concentrations of protein, nitrate, magnesium, iron, and zinc up to 18% (Dong et al., 2018). In wheat, many studies suggest that grain yield increases but both nitrogen and protein content declines under elevated CO_2(Loladze, 2014). Similar observations has been noted in soybean but the effect found to vary with cultivars (Zheng et al., 2020).

(b) whether any research being conducted to compensate the reduction of nutrients taking place in the production of crops; and

Reply: Yes

(c) if so, the details thereof?

Reply:
A field study carried out for three consecutive seasons of wheat crop during 2016-17 to 2018-19 in Open Top Field chambers (OTCs) in Black clay soils at Bhopal, with CO_2 elevation to about 550 parts per million (which is equivalent to the predicted CO_2 concentration after 75 years from today) clearly revealed no significant reduction in grain protein content as long as N is available in optimum quantity in soil.
However, significant reduction in dry gluten content in wheat grain was observed under elevated CO_2 as well as with co-elevation of temperature. In soybean, our study showed carbon dioxide (CO_2) enrichment produced 30–65% higher biomass and 26–59% higher grain yield under various N doses. As compared to ambient CO_2concentration, elevated CO_2 resulted in significant reduction of seed P concentration at most of the N application levels. In this study seed N and K concentrations were not affected either by CO_2 or N application. Elevated CO_2 resulted higher uptake of N by 18–61%, P by 23–62%, and K by 22–62% under various N treatments. Significantly higher nutrient uptake under elevated CO_2 despite reduction or no change in the concentration of the three major nutrients in plant tissues bears significance for devising nutrient management plans to maintain optimum productivity in the future. Similarly, the field experiments have also shown no significant trend of reduction in micronutrient concentration in grains.

However, long term studies are needed to conclusively prove whether there is significant reduction in concentration of protein or other mineral elements in wheat or soybean grain.

Sub.: The point-wise reply on Lok Sabha Starred Question Diary No 203 regarding 'implementing skilling programme" to be answered on 13.12.2021

Reply

Please find herewith the details of input on implementing skilling programme for ST Community and /or the ST beneficiaries w.r.t. ICAR-Indian Institute of Soil Science, Bhopal including AICRPs for the year 2018-19, 2019-20, 2020-21 and 2021 till date.

S. No/ Year	Name of Scheme/ programme	Total Number of Persons trained- in Maharashtra and NE States	Total Tribal people trained- in Maharashtra and NE States	Total Funds allocated	Total Funds allocated for Maharashtra and NE States	Total Funds allocated for Maharashtra and NE States- under ST Component
01	ICAR-IISS	-	-	9130.04	0.00	0.00
02	AICRP on LTFE (Maharashtra)	578	578	2082.07	88.60	12.50
03	AICRP-MSPE((Maharashtra & NE)	330	215	3555.29	438.62	6.00
04	AINP on Soil Biodiversity-Biofertilizers (Maharashtra & NE)	308	0.00	789.7	117.45	0.00
05	AICRP on STCR (Maharashtra & NE)	1007	402	2943.08	199.83	0.00

Sub.: Reply to Lok Sabha Starred Question Dy. No. 563 due for answer on 20.07.2021 regarding "Exhibition for farmers at gram panchayat level" - reg.

a) whether the Government is considering to organise exhibitions at gram panchayat level to apprise farmers regarding high quality seeds, equipments and latest methods of irrigation so that the knowledge gained in the laboratories of agricultural institutes and universities of the country is used on and farmers get proper benefit;

Reply: ICAR-IISS, Bhopal Adopted more than 90 villages under MGMG, SAP, CRP on CA, FARMERS FIRST, SCSP, TSP and NICRA schemes in which different activities like farmers-scientist interaction /kisan sangosthi/farmers training / field day were organised at gram panchayat level to apprise farmers regarding good quality seeds, equipments and latest methods of irrigation. In addition certain technologies developed by the institute like crop residue management, composting, balanced fertilizer application, integrated farming system and organic farming etc were also demonstrated on farmers field through these schemes.

b) if so, the details thereof including the details of the requests received from various States/Union Territories in this regard so far along with the details of the action taken thereon during the last three years and till date

Reply: Institute is working under various projects on farmers' field and different activities as given in point (a) were conducted during last three years and till date in various adopted villages under different programme. In brief, different activities included were farmers trainings (50 nos.), field days (20 nos), demonstrations (500 nos). Besides this different inputs distributed to farmers include seed of wheat (80q), chickpea (25q), soybean (100q) and 6000 bags of fertilizers including urea (2800 bags), DAP (1500 bags), MOP (200 bags) and 12:32:16 NPK (1500 bags) in different adopted villages.

c) whether there is any proposal to organize training camps/loan fairs regularly for farmers at block/district level in this regard;

Reply: Different activities will be conducted as per the project/scheme commitments.

d) if so, the details thereof; and the details of the requests received from various States/Union Territories including Rajgarh, Gorakhpur, Karnal, Alipurduar, Chittorgarh and Rajasthan and action taken thereon during the last three years and till date?

Reply: Activities are taken up in the project implementation sites only as per action plan of the project/scheme.

Excessive use chemical fertilizer

a) **whether the Government has conducted any research to ascertain the extent to which the land fertility is being affected by the excessive use of chemical fertilizers and various diseases and other problems that are being caused because of it;**

Reply: The AICRP on Long-Term Fertilizer Experiments (AICRP LTFE) has been conducting trials to study the impact of manures and fertilizers on crop productivity and soil quality at different locations in the country since 1971. These experiments have not indicated any adverse effect of fertilizer or pesticide on soil health.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss. Also imbalanced use of fertilizers, especially high dose of nitrogen make crops more succulent and pest pressures increased. Even under the soils of Himachal Pradesh,which are medium to high in available N, low to medium in available P and K, there is no decline in fertility with the use of balanced fertilization.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased tremendously. The present total food grain production of 296 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

There are about 97 institutions of ICAR apart from 47 State Agricultural Universities and about 600 KVKs in the country. All these institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xxxvi) ICAR-Indian Institute of Soil & Water Conservation, Dehradun
xxxvii) ICAR-Central Soil Salinity Research Institute, Karnal
xxxviii) ICAR-Indian Institute of Soil Science, Bhopal
xxxix) ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soils, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, ICAR-IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Long-term studies have indicated that raising of crops with the use of balanced fertilization have not affected soil fertility. Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status.

Summary of soil fertility (N, P and K) status of soils of different states of India

State	**% Area**								
	Available Nitrogen			**Available Phosphorus**			**Available Potassium**		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
U.P.	98	2	0	97	3	0	0	61	39
Uttarakhand	43	37	20	68	32	0	0	67	33
Punjab	73	27	0	0	47	53	0	11	89
Haryana	96	4	0	92	8	0	0	39	61
H.P.	0	24	76	33	55	12	65	35	0
M.P.	27	63	10	31	56	13	17	29	54
Maharashtra	88	12	0	93	7	0	4	17	79
Rajasthan	88	12	0	55	45	0	0	24	76
Gujarat	68	21	11	34	66	0	0	37	63
Chhattisgarh	59	41	0	50	50	0	29	30	41
Bihar	36	58	6	29	68	3	23	73	4
W.B.	40	60	0	30	60	10	10	09	0
Orissa	57	43	0	44	56	0	11	58	31
Assam	27	73	0	17	83	0	38	44	18
Jharkhand	7	93	0	75	23	2	3	76	21
Andhra Pradesh	44	56	0	55	45	0	0	58	42
Tamil Nadu	94	4	2	15	47	38	1	31	68
Karnataka	20	61	19	27	69	4	8	14	78
Kerala	17	77	6	0	76	24	0	82	18

b) if so, the details thereof along with the follow up action taken by the government on the conclusion of the said research;

Reply: Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. “Soil Health Card” Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertilizer. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the KisanMela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum–capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

The results emanated from AICRP on Long Term Fertilizer Experiments (AICRP LTFE) on long-term effect of nutrient application through fertilizers and manures on crop productivity, soil fertility and soil health based onstudies oflong term fertilizer experiments (LTFE)conducted at Pantnagar (Uttarakhand), New Delhi, Ranchi (Jharkhand), Jabalpur (Madhya Pradesh), Bangalore (Karnataka), Coimbatore (Tamil Nadu) are briefly mentioned hereunder:

Impact of long –term manure and fertilizer application on crop productivity: Long term manure and fertilizer application in balanced form has resulted in an increase in the crop productivity compared to imbalanced nutrient management. The nutrient application with 150% NPK (super optimal dose) has either maintained crop yield or surpass the yield to that of 100% NPK across almost all the LTFE locations.However, no nutrient application (control) over the years has drastically reduced the grain yield of major crops at all locations. Integrated nutrient management (INM) through 100% NPK+FYM further enhanced the yield with a maximum yield over all other treatments at LTFEs. However, a slight decline in crop productivity was observed at some LTFEs such as Pantnagar (Mollisols). This may be due to gradual decline of micronutrients and Zn in particular at Pantnagar. The Zn deficiency had been reported to result in nutrient deficiency such as "Khaira Disease' in rice in Tarai belt of Uttarakhand. However, Zn-deficiency got corrected with the addition of Zn as it has been demonstrated by GBPUATPantnagar through superimposition of Zn under LTFE at Pantnagar. However, Zn deficiency was not observed in INM i.e. 100% NPK+ FYM treatment.

Effect of long-term application of fertilisers and manures on average crop productivity(kg/ha) during 2016-19.

Treatments	GBPUA & TPantnagar		ICAR-IARI New Delhi		BAU, Ranchi	
	Rice	Wheat	Maize	Wheat	Soybean	Wheat
Control	1274	1184	1707	1972	552	715
100% NPK	3674	3363	5415	5372	1426	3259
150% NPK	3520	3306	6402	6205	1653	3403
100%NPK +FYM	5131	4748	6260	6045	2053	4302

Effect of long-term application of fertilisers and manures on average crop productivity(kg/ha) during 2016-19.

Treatments	JNKVV, Jabalpur		GKVK, Bangalore		TNAU, Coimbatore	
	Soybean	Wheat	Fingermillet	Maize	Fingermillet	Maize
Control	698	1334	780	910	1305	2850
100%NPK	1452	5463	2750	5420	2276	5440
150%NPK	1713	6108	3370	5930	2454	5525
100%NPK +FYM	1821	6279	3260	6150	2703	6302

Impact of long–term manure and fertilizer application on soil environment: The biological activity is one of the indicators for assessing soil environment and soil health in particular. The continuous use of chemical fertilizer may alter the biological activities of organisms in soil. Therefore, it is necessary to monitor the soil biological condition on regular basis to have mid-term correction in the nutrient management practices. It is documented that organic carbon favours the physical, chemical and biological processes in soil. There is a sharp decline in soil organic carbon (SOC) due to imbalance nutrient management i.e. control. On the contrary, balanced and INM have improved the SOC across all the LTFEs.

Data on microbial counts indicates that application of nutrient resulted increase in population of bacteria, fungi andactinomycetescompared to control. The 150% NPK (super optimal dose) has either maintained or surpass soil microbial count to that of 100% NPK across almost all the LTFE locations. Relatively larger increase in population of all the micro-organisms in NPK+FYM indicated that addition of FYM favoured proliferation of these organisms which is obvious because FYM acts as carbon source. Thus, balanced and integrated nutrient management improves below ground soil microflora therby overall soil biodiversity.

Soil organic carbon (g/kg) under long-term application of fertilisers and manures

Treatments	GBPUA& T, Pantnagar	IARI, New Delhi	BAU, Ranchi	JNKVV, Jabalpur	GKVK, Bangalore	TNAU, Coimbatore
Cropping system	**Rice-Wheat**	**Maize-Wheat**	**Soybean-Wheat**	**Soybean-Wheat**	**Fingermillet-Maize**	**Fingermillet-Wheat**
Control	6.12	3.01	4.10	4.22	4.20	4.60
100%NPK	9.82	4.42	4.70	7.60	4.80	6.20
150%NPK	8.80	5.22	4.60	8.72	5.10	6.40
100%NPK+FYM	15.64	5.32	5.50	8.95	5.60	7.10

Microbial count under long-term application of fertilisers and manures

Treatments	GBPUA & T, Pantnagar (Rice-Wheat)			TNAU, Coimbatore (Fingermillet-Wheat)		
	Bacteria(x 10^6cfu g^{-1} soil)	Fungi (x 10^4cfu g^{-1} soil)	Actinomycetes (x10^5cfu g^{-1} soil)	Bacteria (x 10^6cfu / g of dry soil)	Fungi (x10^3cfu / g of dry soil)	Actinomycetes (x10^4cfu / g of dry soil)
Control	0.55	0.60	0.78	45	11	7
100%NPK	1.80	1.48	1.71	90	14	10
150%NPK	1.87	1.48	1.76	83	13	9
100 NPK +FYM	2.32	1.99	2.16	131	16	12

Microbial count under long-term application of fertilisers and manures.

Treatments	JNKVV, Jabalpur (Soybean-Wheat)		
	Bacteria (cfu x 10^7 g^{-1} soil)	Fungi (cfu x 10^7 g^{-1} soil)	Actinomycetes (cfu x 10^7 g^{-1} soil)
Control	11.67	18.46	13.64
100%NPK	23.85	33.22	26.18
150%NPK	25.09	37.86	29.03
100% NPK +FYM	39.06	42.74	39.60

cfu= colony forming unit

c) the details of the quantum of chemical fertilizers being used in the country during the each year of the last three years and in the current year;

Reply: On per hectare basis, NPK use for 2017-18, 2018-19 and 2019-20 (Provisional) was found to be 133.9, 135.9 and 144.9 kg/ha, respectively. The NPK ratios for the years were 6.1:2.5:1, 6.6:2.6:1, 7.0:2.8:1, respectively.

The quantum of chemical fertilizers used in the country (mt)

Consumption	2017-18	2018-19	2019-20	Current year (2020-21)
NPK	25.94	26.59	27.37	not available

d) whether the government has run any programme/campaign to aware/train farmers regarding the use of harmless fertilizers/organic farming; and

Reply: Yes, Under AICRP LTFE and AICRP on STCR at various locations organics such as FYM, green manure, Biofertilizers alone and also in combination were included and studied under LTFEs.

e) if so, the details thereof.

Reply: Organic manures especially vermicompost have potential; however, the yield is usually not on par with what we get from use of fertilisers. DAC&FW is implementing ParamparagatKrishiVikasYojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation.Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients. Further, Ministry of Agriculture and Farmers Welfare has introduced mandatory *neem* coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being *Neem* Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea. Through STC and SCSP programmes also, ICAR Institutes are organizing awareness programmes in villages.

At Pattambi (Kerala), 50% NPK + green manure gave comparable yield of rice with INM i.e. 100% NPK+FYMand thus helps in saving of 50% NPK each season during Kharif and rabi. At Akola (Maharashtra), application of FYM @ 10 t/ha per season in sorghum and wheat has gradually helped in maintaining soil organic C and nutrient status but could not sustain the crop yield.

Sub.: The point-wise information onLok Sabha Starred Question Diary No 3283 regarding 'Excess use of chemical fertilizer' due for answer on 27.07. 2021.

e) whether the Government has conducted any research to find out fertility of land being affected due to the excess use of chemical fertilizer and various diseases and other problems caused by it:

Reply: Yes.

f) if so, the details thereof;

Reply: The AICRP on Long-Term Fertilizer Experiments (AICRP LTFE) has been conducting trials to study the impact of manures and fertilizers on crop productivity and soil quality at different locations in the country since 1971. These experiments have not indicated any adverse effect of fertilizer or pesticide on soil health.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss. Also imbalanced use of fertilizers, especially high dose of nitrogen make crops more succulent and pest pressures increased. Even under the soils of Himachal Pradesh,which are medium to high in available N, low to medium in available P and K, there is no decline in fertility with the use of balanced fertilization.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased tremendously. The present total food grain production of 296 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

Many ICAR institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xl) ICAR-Indian Institute of Soil & Water Conservation, Dehradun
xli) ICAR-Central Soil Salinity Research Institute, Karnal
xlii) ICAR-Indian Institute of Soil Science, Bhopal
xliii) ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soils, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, ICAR-IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Long-term studies have indicated that raising of crops with the use of balanced fertilization have not affected soil fertility. Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status.

Summary of soil fertility (N, P and K) status of soils of different states of India

State	**% Area**								
	Available Nitrogen			**Available Phosphorus**			**Available Potassium**		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
U.P.	98	2	0	97	3	0	0	61	39
Uttarakhand	43	37	20	68	32	0	0	67	33
Punjab	73	27	0	0	47	53	0	11	89
Haryana	96	4	0	92	8	0	0	39	61
H.P.	0	24	76	33	55	12	65	35	0
M.P.	27	63	10	31	56	13	17	29	54
Maharashtra	88	12	0	93	7	0	4	17	79
Rajasthan	88	12	0	55	45	0	0	24	76
Gujarat	68	21	11	34	66	0	0	37	63
Chhattisgarh	59	41	0	50	50	0	29	30	41
Bihar	36	58	6	29	68	3	23	73	4
W.B.	40	60	0	30	60	10	10	09	0
Orissa	57	43	0	44	56	0	11	58	31
Assam	27	73	0	17	83	0	38	44	18
Jharkhand	7	93	0	75	23	2	3	76	21
Andhra Pradesh	44	56	0	55	45	0	0	58	42
Tamil Nadu	94	4	2	15	47	38	1	31	68
Karnataka	20	61	19	27	69	4	8	14	78
Kerala	17	77	6	0	76	24	0	82	18

g) the action taken /being taken by the Government on the outcome of said research;

Reply: Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. “Soil Health Card” Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

Also the Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertilizer. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the KisanMela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers’ practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

The results emanated from AICRP on Long Term Fertilizer Experiments (AICRP LTFE) on long-term effect of nutrient application through fertilizers and manures on crop productivity, soil fertility and soil health based onstudies oflong term fertilizer experiments (LTFE)conducted at Pantnagar (Uttarakhand), New Delhi, Ranchi (Jharkhand), Jabalpur (Madhya Pradesh), Bangalore (Karnataka), Coimbatore (Tamil Nadu) are briefly mentioned hereunder:

Impact of long –term manure and fertilizer application on crop productivity: Long term manure and fertilizer application in balanced form has resulted in an increase in the crop productivity compared to imbalanced nutrient management. The nutrient application with 150% NPK (super optimal dose) has either maintained crop yield or surpass the yield to that of 100% NPK across almost all the LTFE locations.However, no nutrient application (control) over the years has drastically reduced the grain yield of major crops at all locations. Integrated nutrient management (INM) through 100% NPK+FYM further enhanced the yield with a maximum yield over all other treatments at LTFEs. However, a slight decline in crop productivity was observed at some LTFEs such as Pantnagar (Mollisols). This may be due to gradual decline of micronutrients and Zn in particular at Pantnagar. The Zn deficiency had been reported to result in nutrient deficiency such as "Khaira Disease' in rice in Tarai belt of Uttarakhand. However, Zn-deficiency got corrected with the addition of Zn as it has been demonstrated by GBPUATPantnagar through superimposition of Zn under LTFE at Pantnagar. However, Zn deficiency was not observed in INM i.e. 100% NPK+ FYM treatment.

Effect of long-term application of fertilisers and manures on average crop productivity(kg/ha) during 2016-19.

Treatments	**GBPUA & TPantnagar**		**ICAR-IARI New Delhi**		**BAU, Ranchi**	
	Rice	**Wheat**	**Maize**	**Wheat**	**Soybean**	**Wheat**
Control	1274	1184	1707	1972	552	715
100% NPK	3674	3363	5415	5372	1426	3259
150% NPK	3520	3306	6402	6205	1653	3403
100%NPK +FYM	5131	4748	6260	6045	2053	4302

Effect of long-term application of fertilisers and manures on average crop productivity(kg/ha) during 2016-19.

Treatments	**JNKVV, Jabalpur**		**GKVK, Bangalore**		**TNAU, Coimbatore**	
	Soybean	**Wheat**	**Fingermillet**	**Maize**	**Fingermillet**	**Maize**
Control	698	1334	780	910	1305	2850
100%NPK	1452	5463	2750	5420	2276	5440
150%NPK	1713	6108	3370	5930	2454	5525
100%NPK +FYM	1821	6279	3260	6150	2703	6302

Impact of long–term manure and fertilizer application on soil environment: The biological activity is one of the indicators for assessing soil environment and soil health in particular. The continuous use of chemical fertilizer may alter the biological activities of organisms in soil. Therefore, it is necessary to monitor the soil biological condition on regular basis to have mid-term correction in the nutrient management practices. It is documented that organic carbon favours the physical, chemical and biological processes in soil. There is a sharp decline in soil organic carbon (SOC) due to imbalance nutrient management i.e. control. On the contrary, balanced and INM have improved the SOC across all the LTFEs.

Data on microbial counts indicates that application of nutrient resulted increase in population of bacteria, fungi andactinomycetescompared to control. The 150% NPK (super optimal dose) has either maintained or surpass soil microbial count to that of 100% NPK across almost all the LTFE locations. Relatively larger increase in population of all the micro-organisms in NPK+FYM indicated that addition of FYM favoured proliferation of these organisms which is obvious because FYM acts as carbon source. Thus, balanced and integrated nutrient management improves below ground soil microflora thereby overall soil biodiversity.

Soil organic carbon (g/kg) under long-term application of fertilisers and manures

Treatments	**GBPUA& T, Pantnagar**	**IARI, New Delhi**	**BAU, Ranchi**	**JNKVV, Jabalpur**	**GKVK, Bangalore**	**TNAU, Coimbatore**
Cropping system	**Rice-Wheat**	**Maize-Wheat**	**Soybean-Wheat**	**Soybean-Wheat**	**Fingermillet-Maize**	**Fingermillet-Wheat**
Control	6.12	3.01	4.10	4.22	4.20	4.60
100%NPK	9.82	4.42	4.70	7.60	4.80	6.20
150%NPK	8.80	5.22	4.60	8.72	5.10	6.40
100%NPK+FYM	15.64	5.32	5.50	8.95	5.60	7.10

Microbial count under long-term application of fertilisers and manures

Treatments	**GBPUA & T, Pantnagar (Rice-Wheat)**			**TNAU, Coimbatore (Fingermillet-Wheat)**		
	Bacteria(x 10^6cfu g^{-1} soil)	**Fungi (x 10^4cfu g^{-1} soil)**	**Actinomycete (x10^5cfu g^{-1} soil)**	**Bacteria (x 10^6cfu / g of dry soil)**	**Fungi (x10^3cfu / g of dry soil)**	**Actinomycetes (x10^4cfu / g of dry soil)**
Control	0.55	0.60	0.78	45	11	7
100%NPK	1.80	1.48	1.71	90	14	10
150%NPK	1.87	1.48	1.76	83	13	9
100 NPK +FYM	2.32	1.99	2.16	131	16	12

Microbial count under long-term application of fertilisers and manures.

Treatments	**JNKVV, Jabalpur (Soybean-Wheat)**		
	Bacteria (cfu x 10^7 g^{-1} soil)	**Fungi (cfu x 10^7 g^{-1} soil)**	**Actinomycetes (cfu x 10^7 g^{-1} soil)**
Control	11.67	18.46	13.64
100%NPK	23.85	33.22	26.18
150%NPK	25.09	37.86	29.03
100% NPK +FYM	39.06	42.74	39.60

cfu= colony forming unit

h) whether the government has lunchedany programme to create awareness/provide training to farmers with regard to the harmful effects of fertilizers and the need for organic farming; and

Reply: Yes, Under AICRP LTFE and AICRP on STCR at various locations organics such as FYM, green manure, Biofertilizers alone and also in combination were included and studied under LTFEs.

e) if so, the details thereof.

Reply: Organic manures especially vermicompost have potential; however, the yield is usually not on par with what we get from use of fertilisers. DAC&FW is implementing ParamparagatKrishiVikasYojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation.Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients. Further, Ministry of Agriculture and Farmers Welfare has introduced mandatory *neem* coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being *Neem* Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea. Through STC and SCSP programmes also, ICAR Institutes are organizing awareness programmes in villages.

At Pattambi (Kerala), 50% NPK + green manure gave comparable yield of rice with INM i.e. 100% NPK+FYMand thus helps in saving of 50% NPK each season during Kharif and rabi. At Akola (Maharashtra), application of FYM @ 10 t/ha per season in sorghum and wheat has gradually helped in maintaining soil organic C and nutrient status but could not sustain the crop yield.

Sub.: Reply to Parliament Question 153 on "Effect on contaminated ground water on irrigation" - reg.

1. Is the contaminated groundwater is affecting irrigation?

Response: Few studies indicate that groundwater has been contaminated due to industrial activities and major concern related to crop production in rise in salinity. Industries, particularly those associated with molasses based distilleries, textiles, leather tanning release salts into the environment through industrial effluents, and these may percolate through the soil profile and contaminate the groundwater due to their high mobility in the soil. It may happen when effluent treatment plants don't remove salts from the effluent water. As a result of this, salinity of groundwater has been found elevated in and around certain industrial clusters of India; deteriorating irrigation water quality *[Ref. Saha JK, Rao AS, Mandal B (2013b) Integrated management of polluted soils for enhancing productivity and quality of crops. In: Gaur RK, Sharma P (eds) Approaches to plant stress and their management. Springer, India. pp 1-21]*.

A case study in and around Ratlam city indicated that groundwater turned red and saline due to contamination from industrial activity. Irrigation with such contaminated groundwater had adverse effect on productivity of different crops *[Ref.: (1) Saha JK, Sharma AK (2006) Impact of the use of polluted irrigation water on soil quality and crop productivity near Ratlam and Nagda industrial area. Agricultural Bulletin IISS-1. Indian Institute of Soil Science, Bhopal, India; (2) Saha JK (2005) Changes in Salinity and Sodicity of Soils with continuous application of contaminated water near Industrial area. Journal of Indian Society of Soil Science 53:612-617]*.Similar adverse effect has also been observed Pali, Rajasthan.

In West Bengal, arsenic (As) contamination in groundwater has been reported from nine districts, particularly in high cropping intensities areas within the upper delta plain along the Bhagirathi and other rivers. *[Ref.: Saha, J., Selladurai, R., Coumar, M., Dotaniya, M., Kundu, S., &Patra, A. (2017). Soil Pollution - An Emerging Threat to Agriculture. https://doi.org/10.1007/978-981-10-4274-4]*.

2. If so, quantification of the effect of contaminant on irrigation?

Response: The effect of contaminants on irrigation water quality and impact on crop productivity depends on type and concentration of contaminants in groundwater, soil type and type crops grown. In India, sodium, chloride and sulphate are the major and ubiquitous contaminants in groundwater and adversely impact soil and crop quality. *[Saha JK, Sharma AK (2006) Impact of the use of polluted irrigation water on soil quality and crop productivity near Ratlam and Nagda industrial area. Agricultural Bulletin IISS-1. Indian Institute of Soil Science, Bhopal, India]*. Degradation in groundwater quality due to industrial activities has been reported in other areas; however comprehensive study on their effect on soil and crop is lacking *[Ref.: Saha, J., Selladurai, R., Coumar, M., Dotaniya, M., Kundu, S., &Patra, A. (2017). Soil Pollution - An Emerging Threat to Agriculture. https://doi.org/10.1007/978-981-10-4274-4]*.

3. Is the effect is substantial? so that remedial measure is required for contaminated groundwater which is being used for irrigation?

Response: The effect contaminated groundwater (used as irrigation) may be severe on crop yields when salinity and Na levels are beyond the permissible levels. However, when groundwater is contaminated with toxic elements (like As, Cd, Cr, Pb, Hg etc.), its use as irrigation may contaminate food chain affecting human and animal health

Sub.: The point-wise information on Rajya Sabha Starred/Unstarred Question Diary No U477 regarding 'Decline in fertility of soil due to over use of chemical fertilizer" due for answer on 3.12. 2021.

i) Whether fertility of soil is also lost due to over use of chemical fertilizer, if so whether government has conducted any research in this regard and if so, the outcome of the said research;

Reply: The AICRP on Long-Term Fertilizer Experiments (AICRP LTFE) has been conducting trials to study the impact of manures and fertilizers on crop productivity and soil quality at different locations in the country since 1971. These experiments have not indicated any adverse effect of fertilizer or pesticide on soil health.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss. Also imbalanced use of fertilizers, especially high dose of nitrogen make crops more succulent and pest pressures increased. Even under the soils of Himachal Pradesh,which are medium to high in available N, low to medium in available P and K, there is no decline in fertility with the use of balanced fertilization.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased tremendously. The present total food grain production of 296 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

Many ICAR institutions are having the soil fertility assessment and management as one of the objectives directly or indirectly. There are four institutes listed below that are solely working on various issues related to soil management.

xliv) ICAR-Indian Institute of Soil & Water Conservation, Dehradun
xlv) ICAR-Central Soil Salinity Research Institute, Karnal
xlvi) ICAR-Indian Institute of Soil Science, Bhopal
xlvii) ICAR-National Bureau of Soil Survey and Land Use Planning, Nagpur

The Departments of Soil Science in different State Agricultural Universities are engaged in monitoring the soil fertility status of respective states, providing best nutrient management practices for different soils, crops, climatic situations and also developing technologies/ management practices for all the predominant crops / cropping sequences of the respective states. The ICAR institutes, especially the above mentioned four institutes through All India Co-ordinated research projects and in-house projects are providing solutions to national issues, which may not be tackled by individual department of the State Agricultural University. For instance, ICAR-IISS Bhopal through the AICRP located at the institute is presently engaged in mapping district wise soil fertility with respect to major and micro nutrients and to give suitable nutrient recommendation through soil test crop response prescription equations.

Long-term studies have indicated that raising of crops with the use of balanced fertilization have not affected soil fertility. Recently, Indian Institute of Soil Science, Bhopal has compiled soil test data of last five years on available N, P and K status from different soil testing laboratories located in various states. The compilation showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P. Available K status showed that the soils of about 9% districts were low, 42% were medium and 49% were high in available K status.

Summary of soil fertility (N, P and K) status of soils of different states of India

State	% Area								
	Available Nitrogen			Available Phosphorus			Available Potassium		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
U.P.	98	2	0	97	3	0	0	61	39
Uttarakhand	43	37	20	68	32	0	0	67	33
Punjab	73	27	0	0	47	53	0	11	89
Haryana	96	4	0	92	8	0	0	39	61
H.P.	0	24	76	33	55	12	65	35	0
M.P.	27	63	10	31	56	13	17	29	54
Maharashtra	88	12	0	93	7	0	4	17	79
Rajasthan	88	12	0	55	45	0	0	24	76
Gujarat	68	21	11	34	66	0	0	37	63
Chhattisgarh	59	41	0	50	50	0	29	30	41
Bihar	36	58	6	29	68	3	23	73	4
W.B.	40	60	0	30	60	10	10	09	0
Orissa	57	43	0	44	56	0	11	58	31
Assam	27	73	0	17	83	0	38	44	18
Jharkhand	7	93	0	75	23	2	3	76	21
Andhra Pradesh	44	56	0	55	45	0	0	58	42
Tamil Nadu	94	4	2	15	47	38	1	31	68
Karnataka	20	61	19	27	69	4	8	14	78
Kerala	17	77	6	0	76	24	0	82	18

The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2000 kg/ha) during 2016-17 from 710 kg/ha during 1960-61. The present total food grain production of 275.68 million tonnes has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

j) The details of the schemes and projects under implementation to check the declining fertility

Reply: Indian Council of Agricultural Research (ICAR) focuses at improving fertilizer use efficiency through establishment of STCR-IPNS based fertilizer prescription equations based on resource endowment capacities of the farmers.

Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. “Soil Health Card” Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

The Government of India through its research, education and extension institutes has been giving training to farmers to maintain the fertility of soil through judicious use of fertiliser. Also, it is mandatory for all the ICAR institutes to provide training to the farmers. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, biofertilizer use as well as soil management for efficient crop production. Also the farmers are educated during the KisanMela. The institute has conducted about 30 training programmes for farmers (20-25 no. in each programme) under various themes such as soil testing, organic farming and technology exposure to farmers. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to validate STCR recommendations on different crops including cereals, oilseed, pulses and horticultural crops which have shown advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers’ practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6

Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Ministry of Agriculture and Farmers Welfare has introduced mandatory *neem* coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being *Neem* Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea.

DAC&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

The results emanated from AICRP on Long Term Fertilizer Experiments (AICRP LTFE) on long-term effect of nutrient application through fertilizers and manures on crop productivity, soil fertility and soil health based on studies of long term fertilizer experiments (LTFE)conducted at Pantnagar (Uttarakhand), New Delhi, Ranchi (Jharkhand), Jabalpur (Madhya Pradesh), Bangalore (Karnataka), Coimbatore (Tamil Nadu) are briefly mentioned hereunder:

Impact of long –term manure and fertilizer application on crop productivity: Long term manure and fertilizer application in balanced form has resulted in an increase in the crop productivity compared to imbalanced nutrient management. The nutrient application with 150% NPK (super optimal dose) has either maintained crop yield or surpass the yield to that of 100% NPK across almost all the LTFE locations (Table 1 & 2).However, no nutrient application (control) over the years has drastically reduced the grain yield of major crops at all locations. Integrated nutrient management (INM) through 100% NPK+FYM further enhanced the yield with a maximum yield over all other treatments at LTFEs. However, a slight decline in crop productivity was observed at some LTFEs such as Pantnagar (Mollisols). This may be due to gradual decline of micronutrients and Zn in particular at Pantnagar. The Zn deficiency had been reported to result in nutrient deficiency such as “Khaira Disease’ in rice in Tarai belt of Uttarakhand. However, Zn-deficiency got corrected with the addition of Zn as it has been demonstrated by GBPUAT Pantnagar through superimposition of Zn under LTFE at Pantnagar. However, Zn deficiency was not observed in INM i.e. 100% NPK+ FYM treatment.

Table 1. Effect of long-term application of fertilisers and manures on average crop productivity (kg/ha) during 2016-19.

Treatments	GBPUA & TPantnagar		ICAR-IARI New Delhi		BAU, Ranchi	
	Rice	Wheat	Maize	Wheat	Soybean	Wheat
Control	1274	1184	1707	1972	552	715
100% NPK	3674	3363	5415	5372	1426	3259
150% NPK	3520	3306	6402	6205	1653	3403
100% NPK	5131	4748	6260	6045	2053	4302

+FYM						

Table 2. Effect of long-term application of fertilisers and manures on average crop productivity (kg/ha) during 2016-19.

Treatments	JNKVV, Jabalpur		GKVK, Bangalore		TNAU, Coimbatore	
	Soybean	Wheat	Fingermillet	Maize	Fingermillet	Maize
Control	698	1334	780	910	1305	2850
100% NPK	1452	5463	2750	5420	2276	5440
150% NPK	1713	6108	3370	5930	2454	5525
100% NPK +FYM	1821	6279	3260	6150	2703	6302

Impact of long–term manure and fertilizer application on soil environment: The biological activity is one of the indicators for assessing soil environment and soil health in particular. The continuous use of chemical fertilizer may alter the biological activities of organisms in soil. Therefore, it is necessary to monitor the soil biological condition on regular basis to have mid-term correction in the nutrient management practices. It is documented that organic carbon favours the physical, chemical and biological processes in soil. There is a sharp decline in soil organic carbon (SOC) due to imbalance nutrient management i.e. control (Table 3). On the contrary, balanced and INM have improved the SOC across all the LTFEs.

Data on microbial counts indicates that application of nutrient resulted increase in population of bacteria, fungi and actinomycetescompared to control. The 150% NPK (super optimal dose) has either maintained or surpass soil microbial count to that of 100% NPK across almost all the LTFE locations (Table 4 & 5). Relatively larger increase in population of all the micro-organisms in NPK+FYM indicated that addition of FYM favoured proliferation of these organisms which is obvious because FYM acts as carbon source. Thus, balanced and integrated nutrient management improves below ground soil microflora therby overall soil biodiversity.

Table 3. Soil organic carbon (g/kg) under long-term application of fertilisers and manures

Treatments	GBPUA& T, Pantnagar	IARI, New Delhi	BAU, Ranchi	JNKVV, Jabalpur	GKVK, Bangalore	TNAU, Coimbatore
Cropping system	**Rice-Wheat**	**Maize-Wheat**	**Soybean-Wheat**	**Soybean-Wheat**	**Fingermillet-Maize**	**Fingermillet-Wheat**
Control	6.12	3.01	4.10	4.22	4.20	4.60
100% NPK	9.82	4.42	4.70	7.60	4.80	6.20
150% NPK	8.80	5.22	4.60	8.72	5.10	6.40
100% NPK+FYM	15.64	5.32	5.50	8.95	5.60	7.10

Table 4. Microbial count under long-term application of fertilisers and manures

Treatments	GBPUA & T, Pantnagar (Rice-Wheat)			TNAU, Coimbatore (Fingermillet-Wheat)		
	Bacteria(x 10^6cfu g^{-1} soil)	Fungi (x 10^4cfu g^{-1} soil)	Actinomycetes (x10^5cfu g^{-1} soil)	Bacteria (x 10^6cfu / g of dry soil)	Fungi (x10^3cfu / g of dry soil)	Actinomycetes (x10^4cfu / g of dry soil)
Control	0.55	0.60	0.78	45	11	7
100%NPK	1.80	1.48	1.71	90	14	10
150%NPK	1.87	1.48	1.76	83	13	9
100 NPK	2.32	1.99	2.16	131	16	12

+FYM						

Table 5. Microbial count under long-term application of fertilisers and manures.

Treatments	JNKVV, Jabalpur (Soybean-Wheat)		
	Bacteria (cfu x 10^7 g^{-1} soil)	**Fungi (cfu x 10^7 g^{-1} soil)**	**Actinomycetes (cfu x 10^7 g^{-1} soil)**
Control	11.67	18.46	13.64
100%NPK	23.85	33.22	26.18
150%NPK	25.09	37.86	29.03
100% NPK +FYM	39.06	42.74	39.60

cfu= colony forming unit

k) The success achieved there under during the last three years and the current year, year-wise?

Reply: Organic manures especially vermicompost have potential; however, the yield is usually not on par with what we get from use of fertilisers. DAC&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients. Further, Ministry of Agriculture and Farmers Welfare has introduced mandatory *neem* coated urea with improved use efficiency. Entire quantity of indigenously produced urea and imported urea is being *Neem* Coated w.e.f 1st September, 2015 and 1st December, 2015 respectively. Research on NCU by Indian Agricultural Research Institute, New Delhi indicated increase in the rice grain yield by 6.3% to 11.9% over normal urea. Through STC and SCSP programmes also, ICAR Institutes are organizing awareness programmes in villages.

At Pattambi (Kerala), 50% NPK + green manure gave comparable yield of rice with INM i.e. 100% NPK+FYM and thus helps in saving of 50% NPK each season during Kharif and rabi. At Akola (Maharashtra), application of FYM @ 10 t/ha per season in sorghum and wheat has gradually helped in maintaining soil organic C and nutrient status but could not sustain the crop yield.

2022

Sub.: The point-wise reply on Rajya Sabha Provisionally Admitted Question Diary No U747 regarding 'Effect of zinc deficiency in agricultural land" to be answered on 11.02.2022-reg.

(b) Whether it is fact that about 40% of the agricultural soil or about 60 million hectares of agricultural land is zinc deficient in the country;

Reply: The survey work carried out by ICAR, All India Coordinated Research Project on Micro and Secondary Nutrients and Pollutant Elements in Soils and Plants, IISS, Bhopal revealed that about 36.5% sampled sites (out of 2,42, 827 surface soil samples collected from more than 600 districts of the country during 2014-2020) were deficient in plant-available Zn (having available Zn concentration of $\leq$0.60 mg kg^{-1}).

(c) if so the details thereof;

Reply: Out of 36.5%, about 7.90% and 28.6% of the sampled sites were acute deficient $\leq$0.30 mg kg^{-1}) and deficient (<0.30 to $\leq$0.60 mg kg^{-1}) in available Zn, respectively. Recommendations have been developed and provided to the farmers for management of Zn deficiency in different soil-crop contexts for enhancing crop yield and crop quality.

(d) whether it is also a fact that about 8,00,000 people die annually due to zinc deficiency of which 4,50,000 are children under the age of five; and

Reply: No such information is available with us.

(e) if so, the steps Government is taking in this regard?

Reply: No such information is available with us.

Sub.: The point-wise reply on Rajya Sabha Question Diary No U3531 regarding "Developing of agriculture sector in Maharashtra" to be answered on 23.03.2022 - reg.

a) Whether Agriculture Research Centres and Development Institutes are working for the development of agriculture sector in Maharashtra;

Reply: Yes, AICRPs located at ICAR-IISS Bhopal (MSPE, STCR and LTFE) are working for the development of agricu
lture sector in Maharashtra.

b) if so, the details thereof, location-wise;

Reply: The AICRP-MSPE is having one cooperating centre at Dr. P.D.K.V., Akola, Maharashtra involved in research pertaining to secondary and micronutrients and heavy metal management in soil-plant systems.
The AICRP-STCR has one cooperating centre at MPKV, Rahuri, Maharashtra which is involved in research for development of fertilizers prescription equations based on resource endowment capacities of farmers.
The AICRP-LTFE unit is having 2 of its centre in Maharashtra at Dr PDKV, University of Akola (Maharashtra) and MPKV, Parbhani (Maharashtra)

c) whether the said agriculture research centres and development institutions have undertaken agriculture developmental works during the last three years along with the details thereof, and

Reply: During the last three years, the centre has imparted training to famers of the state for adopting efficient secondary and micronutrients management strategies for higher crop yield, better crop quality and maintaining/improving soil health.
During the last three years, the STCR centre developed fertilizer prescription equations for Bitter gourd (cv. Phule green gold and Samrat), Maize, Onion (cv. Baswant 780) and Turmeric (cv. Salem) developed under integrated plant nutrient supply system (IPNS) to recommend nutrients based on soil test values, yield targets and through locally available organic sources. Also imparted training/demonstrations to famers and other stakeholders of the state for achieving higher crop productivity, profitability and soil sustainability/improving soil health through STCR approach of plant nutrient management.
The Long Term Fertilizer Experiments (LTFE) centres at Akola and Parbhani had undertaken research work in the long term fertility trials during past few decades under imbalance dose (i.e., unfertilised control, 100% N, 100% NP) and balance dose of nutrients (100% recommended dose of NPK) and emerged with the findings that balance (100% recommended dose of NPK) and integrated nutrient management (100% recommended dose of NPK+FYM @ 5 t ha-1) had sustained crop productivity, soil health and sustainability under sorghum-wheat cropping system in Akola and soybean-safflower at Parbhani.

d) The extent to which growth in agricultural sector was achieved by the said developmental works?

Reply: No such information is available with us.
On an average, yield enhancement of 15-20% was achieved in farmers filed through STCR approach.
The technologies emerged from AICRP on Long Term Fertilizer Experiments (LTFE) such as balanced (100% recommended dose of NPK) and integrated nutrient management (100% recommended dose of NPK+FYM@ 5 t ha-1) options for improving the soil health and crop productivity are being adopted by the farmers. In this direction, awareness camps, trainings,

farmers day, field visits were provided for better knowledge updates of the nutrient management technology for sustaining the crop production.

Sub.: The point-wise reply on Rajya Sabha Question Diary No S4205 regarding "Loss in topsoil and soil health in the country" to be answered on 01.04.2022 - reg.

(a) whether any comprehensive satellite/on-ground assessment of soil-health has been undertaken in the last five years, and if so, State/Union Territory/soil-type- wise details thereof;

Reply: Nil.

(b) whether Government is aware of losses in soil fertility, organic carbon, humus, nutrients, soil biodiversity in various types of soils in the country and if so, the details of steps taken to prevent soil health decline, including amount allocated and utilized for this purpose;

Reply:

The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2325 kg/ha) during 2019-20 (4th advance estimates) from 710 kg/ha during 1960-61. The total food grain production of 310.74 million tonnes recorded in 2020-21 has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

AICRP on Long Term Fertilizer Experiments (LTFE) indicated that balance as well as integrated nutrient management either stabilized or enhanced the soil fertility, organic carbon, nutrient status, soil biodiversity and overall crop productivity at almost all the experimental sites. Continuous use of chemical fertilizers in imbalanced manner has deteriorated soil fertility, organic carbon, nutrient status, soil biodiversity and crop productivity. Combined use of chemical fertilizer and FYM (NPK+FYM) found highly beneficial with maximum attainable crop productivity. Hence, integrated nutrient management is the viable option to sustain soil fertility, organic carbon, soil biodiversity in major soils in the country. (Please refer Annexure-I for details).

Under ICAR-AICRP-MSPE, on-ground assessment of soil health parameters namely available secondary and micronutrients status in more than 600 districts of the country have been carried out during 2014-2020. There were variable and widespread deficiencies of available sulphur and micronutrients in different states. The deficiencies of S (40.8% of soils), Zn (36.5% of soils) and B (23.2% of soils) were higher compared to the deficiencies of Fe (12.8% of soils), Cu (4.2% of soils) and Mn (7.1% of soils). The state-wise deficiency status of available S and micronutrients are given in Table 9 (Annexure I).

Soil biodiversity loss is generally linked to the reduction of different forms of life living in soils, both in terms of quantity and variety. Decline in soil biodiversity significantly affect the soils' ability to function, respond to perturbations and recover from a disturbance. Several factors have been identified to have negative effects on soil biodiversity, including land use change, soil sealing, intensive exploitation, soil organic matter decline, pollution and climate change etc. The extent of the impact of these factors on biodiversity loss depends on soil type, vegetation and nutrient status, which makes difficult to generalize the biodiversity loss due to certain factors. In a study, bacterial diversity in soil under long term fertilizer application was evaluated, which highlighted that application of both inorganic and organic fertilizers improved soil biodiversity indices than continuous application of inorganic fertilizer. To check biodiversity loss, programs are in place to popularize conservation agriculture, organic farming and natural farming.

(c) whether Government is aware of annual topsoil depth lost since the last five years and if so, details of soil lost in tonnes thereof; and

Reply: Soil loss is being addressed mainly by ICAR-IISWC, Dehradun.

(d) steps taken to prevent and reverse the loss of soil and soil-productivity?

Reply: Steps taken to prevent and reverse the soil loss: This is being addressed mainly by ICAR-IISWC, Dehradun.

Steps taken to prevent and reverse the soil-productivity:
The Government of India through its research, education and extension institutes of Indian Council of Agricultural Research (ICAR) has been giving training to farmers And other stakeholders to maintain the soil productivity through judicious use of fertiliser. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, integrated nutrient management, organic farming as well as soil management for efficient crop production and sustaining soil health. Also the farmers are educated during the Kisan Mela. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to demonstrate the efficacy of fertilizer prescription equations of cereals, oilseed, pulses and horticultural crops based on resource endowment capacities of the farmers. The advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum–capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Also the Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. "Soil Health Card" Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

DA&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

Sub.: The point-wise reply on Rajya Sabha Question Diary No 3372 regarding "Depletion of organic carbon in soil" to be answered on 01.04.2022 - reg.

(a) whether it is a fact that fertilizer application rate has risen from 12.4 kgm per hectare in 1969 to 175 kgm per hectare and depletion of organic carbon in soil has been massive;

Reply: As per the FAO, Rome estimate the fertilizer consumption rate per hectare of arable land of India increased from 12.4 kg in 1969 to 175 kg in 2018 growing at an average annual rate of 5.96%.

(b) if so, the details thereof; and

Reply: The results under AICRP LTFE indicated that balance as well as integrated nutrient management either stabilized or enhanced the organic carbonat almost all the experimental sites. Continuous use of chemical fertilizers in imbalanced manner has deteriorated soil organic carbon. Combined use of chemical fertilizer and FYM (NPK+FYM) found highly beneficial with maximum attainable soil organic carbon. Hence, integrated nutrient management is the viable option to sustain soil organic carbon in major soils in the country.

Soil organic carbon (SOC) is crucial constituent of soil which governs the soil condition and to a large extent nutrient status also as most of soil processes such as chemical, physical and biological are dependent on soil organic carbon. It is well documented that if there is more carbon in soil better will be the soil condition. Data revealed that imbalanced or no use of fertilizer nutrients resulted in decline of soil organic carbon at almost all the LTFE sites (Table 1). On the contrary, balanced use of fertilizer resulted in increase in carbon status of soil. Decline in soil organic carbon was due to addition of carbon less than the quantity lost from the system on annual basis. Imbalanced use of nutrients (N, NP) led to poor crop productivity which in turn added less amount of carbon through residual biomass (stubble and roots), whereas balanced use of nutrient resulted in increase in crop productivity which in turn add more carbon through residual biomass. However, Pantnagar is an exception where except NPK + FYM none of the treatments could maintain initial carbon. Decline in carbon at Pantnagar is due to change in land use pattern from forest to agriculture which accelerated oxidization of native carbon from soil. Only NPK+ FYM could maintain the C status because of additional supply of carbon through FYM annually.

Table 1. Effect of nutrient management on SOC (g kg-1) at long term fertilizer experimental sites of AICRP LTFE (2019)

Location	Initial	Control	N	NP	NPK	150% NPK	NPK + Zn	NPK+ Lime	NPK+ FYM
Akola	4.6	3.1	4.0	4.8	5.4	6.9	6.5	-	7.8
Bangalore	4.6	4.2	3.7	4.3	4.8	5.1	-	4.6	5.6
Barrackpore	7.1	5.6	6.6	7.1	7.2	7.3	7.0	-	8.9
Coimbatore	3.0	4.6	5.1	6.0	6.2	6.4	6.2	-	7.1
Jabalpur	5.7	4.2	5.2	6.7	7.6	8.7	7.6	-	8.9
Jagtial	7.9	6.1	5.4	6.6	7.5	6.7	7.2	-	8.2
Junagadh	8.9	6.1	5.9	7.2	7.4	8.1	7.6	-	9.1
Ludhiana	2.2	2.9	3.8	3.8	4.2	4.1	4.1	-	5.3
New Delhi	4.4	3.0	4.4	4.3	4.4	5.2	4.7	-	5.3
Palampur	7.9	8.0	8.1	9.7	10.1	9.7	9.2	11.1	13.3
Pantnagar	14.8	6.1	9.0	9.9	9.8	8.8	10.0	-	15.6
Parbhani	5.5	5.5	5.5	5.5	6.3	6.6	5.6	-	6.7

Raipur	6.2	4.3	4.4	5.4	6.5	6.9	6.3	-	7.0
Ranchi	4.5	4.1	4.7	4.6	4.7	4.6	-	3.8	5.5
Udaipur	6.8	5.2	6.5	6.9	7.5	7.9	7.6	-	9.1

(c) the steps Government is taking to improve the quality of soil?

Reply: Steps Government is taking to improve the soil quality.

The Government of India through its research, education and extension institutes of Indian Council of Agricultural Research (ICAR) has been giving training to farmers and other stakeholders to maintain the soil quality through balanced and judicious use of fertilisers and manures. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, integrated nutrient management, organic farming as well as soil management for efficient crop production and sustaining soil health. Also the farmers are educated during the Kisan Mela. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to demonstrate the efficacy of STCR-IPNS prescription equations of cereals, oilseed, pulses and horticultural crops based on resource endowment capacities of the farmers. The advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken a large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balanced use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Also the Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. "Soil Health Card" Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

DA&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

Sub.: The point-wise reply on Lok Sabha Question Diary No 474 regarding "Use of bio-fertilizers and pesticides" to be answered on 19.07.2022 - reg.

(d) whether the government proposes to promote the use of bio-fertilizers and pesticides in the agriculture;

Reply: Yes

(e) if so, details thereof;

Reply: Research on biofertilizers is being carried out at various SAUs and ICAR institutes. Under ICAR's AINP SBB project, biofertilizer has been developed for most Indian crops.

(f) the volume of increase in crop yield achieved by the use of bio-fertilizers and pesticides during the last three years;

Reply: Research has been carried out to study the effect of biofertilizers on agricultural output. Performance of biofertilizer depends on soil quality and environmental factors. Symbiotic N fixing Rhizobia sp efficiently contributes to increased crop yield along with lessening chemical fertilizer input. Efficient biofertilizers can contribute up to 25% of crop yield.

(g) the course of action chalked out by the Government to augment the use of bio-fertilizers and pesticides in the country; and

Reply: Biofertilizer use is promoted by through trainings and field demonstrations. Such activities are extensively undertaken in the regions dominated by tribals and other socially backward classes. During 2017 to 21, AINP SBB conducted 30 trainings, where 1866 number of farmers/ Agricultural Officers were benefitted.

There are biofertilizer production units functional under SAUs produce similar to the lines of chemical fertilizers. Although the quantum of production is comparatively less but is growing over the years. The biofertilizer production by SAUs associated with AINP SBB marketed biofertilizer of Rs1229 lakhs during 2017-21.

(h) the steps taken of curtail the use of chemicals and promote the use of bio-fertilizers?

Reply: Based on research, it is recommended that integrated nutrient management strategy improves soil biology and crop performance. This strategy includes use of both inorganic (75%) and organic (25%) fertilizers. With this approach there will be saving of 25% Inorganic chemical fertilizers besides 5% crop yield improvement. Additionally, organic sources improve soil C and microbial diversity enabling better soil function.

Sub.: The point-wise reply on Rajya Sabha Question Diary No S334 regarding "Usage of fertilizers" to be answered on 19.07.2022 by Shri Iranna Kadadi - reg.

(a) the details of total usage of fertilizers per tonne of grains statewise;

Reply: NA

(b) the manner in which government plans to monitor and limit the use of chemical fertilizers in Indian agriculture industry;

Reply: NA

(c) the details of fertilizers banned by government and their quantity used in the agricultural industry in the past five years before they were banned;

Reply: NA

(d) the reason for banning the above mentioned chemical fertilizers; and

Reply: NA

(e) The details of fertilizers according to Government have contributed maximum to global warming and soil degradation and erosion in the past five years?

Reply: The long term experiments since 1973 have indicated no adverse effect of fertilizer on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2386 kg/ha) during 2020-21 (fourth advance estimates) from 710 kg/ha during 1960-61. The total food grain production of 314.51 million tonnes (third advance estimate) recorded in 2021-22 has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major components for determining the genetic potential of crops.

Among the chemical fertilizers, application of urea at a higher dose than the recommendation and in an imbalanced way under anaerobic condition causes release of N2O (a GWG) to the atmosphere. But the release of the GHG is negligible when the fertilizer is applied following proper management techniques, like application in split doses and aerobic condition. Besides this balanced application of fertilizer increases the crop biomass production, and helps in sequestration of carbon in the soil and thus it acts as a sink of GHGs and thus helps in mitigation of climate change.

When chemical fertilizers are applied in a balanced amount and as per the recommended dose for a crop, it doesn't degrade the soil and also doesn't cause erosion. Integrated application of chemical fertilizer along with organic manure improves soil health and reduces degradation.

The imbalance use of fertilizer in the form of 100% Nitrogen (urea) alone, 100% NP (DAP) alone or 50% NPK degrades soil. However, balanced and integrated nutrient management (100% NPK+FYM/Lime) improves the crop productivity and soil quality. Soil quality refers to a state of soil or its capacity to function and sustain plant productivity while reducing soil degradation. It is estimated by considering a range of 25-30 soil parameters (chemical, physical and biological).Under AICRP-LTFE, few centres computed Soil Quality Index (SQI) in different soils and cropping systems. The results of the long term experiments revealed that long term usage of imbalance fertiliser use (Control,100% N and 100% NP) led to poor soil quality (Figure 1) while balanced use of fertilizers (100% NPK) as well as integrated nutrient management (INM)through 100% NPK+FYM/Lime led to better soil quality. The Nitrogen (N) through Urea, Phosphorus (P) through DAP and Potassium through MOP fertilizer were applied as per the recommended dose of fertilizers (RDF) in major crops in different LTFE sites.

In Alfisols of Palampur, the SQI was in the order of 100% NPK+FYM>100%NPK+Lime>150% NPK>100% NPK>100% NP>100% N>Control. Further, the application of lime along with 100% NPK significantly improved SQI over 150% NPK, 100% NPK and imbalance dose of nutrients. Thus, it was evident from the findings that imbalance use of fertilizers degrades soil quality across almost all the LTFE sites, however, the adverse effect was more pronounced in Alfisols group of soils. Balanced and INM (100% NPK+FYM/Lime) improved and sustained the crop yield and soil quality to the large extent.

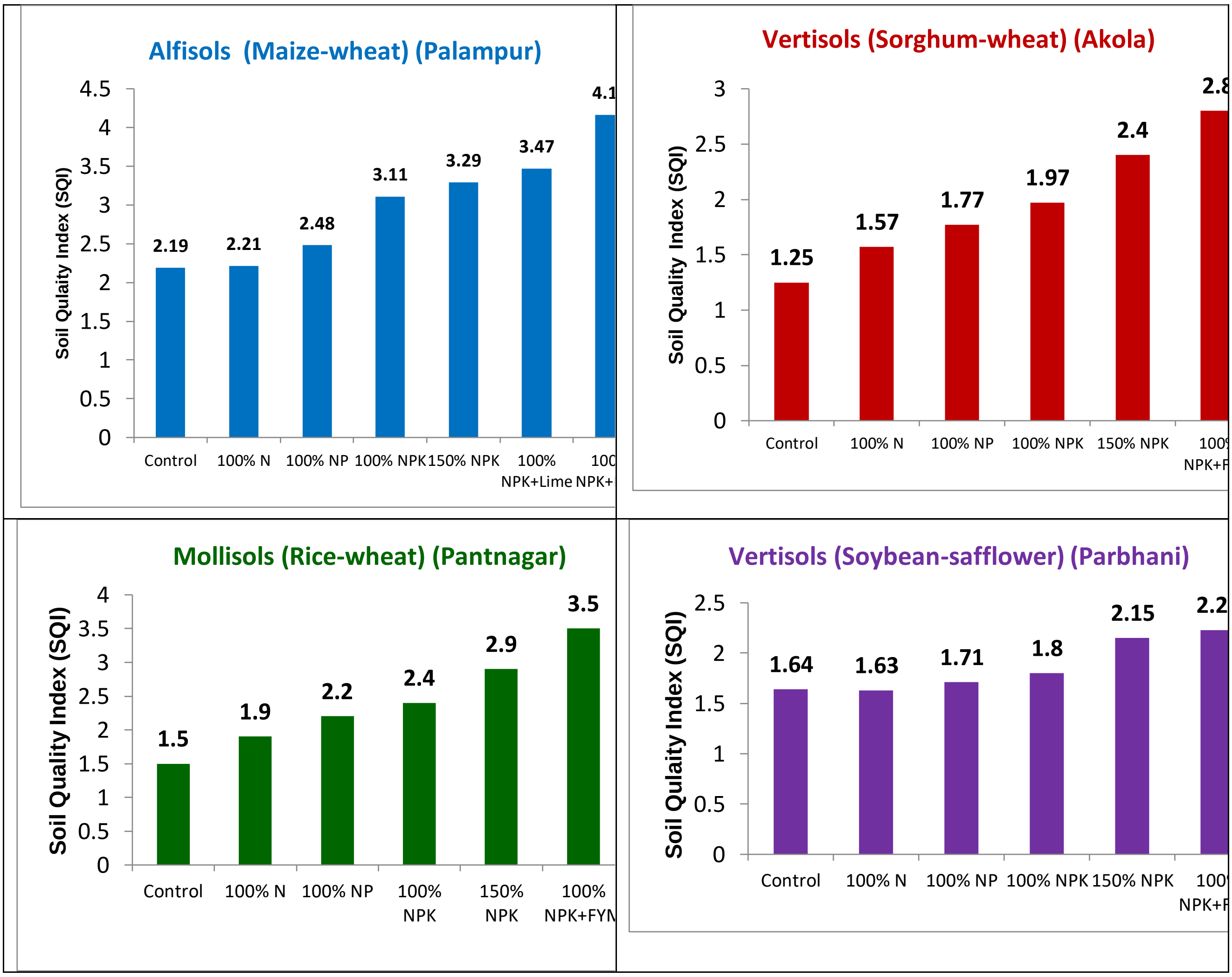


Figure 1: Long term impact of imbalance, balance and INM (100% NPK+FYM/Lime) on soil quality index (SQI) at LTFEsites.

Sub.: The point-wise reply on Rajya Sabha Starred/ Unstarred Question Dy. No. S3043, S3335 & U2023 regarding Depletion in fertility of Soil –reg.

(a) Whether government is aware that fertility of soil in the country is depleting rapidly and that soil in many states including Bihar and Uttar Pradesh has been found to be very deficient in Nitrous and Phosphorus, if so the details thereof;

Reply: The long term experiments since 1973 have indicated no adverse effect of fertilizer or pesticide on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2386 kg/ha) during 2020-21 (fourth advance estimates) from 710 kg/ha during 1960-61. The total food grain production of 314.51 million tonnes (third advance estimate) recorded in 2021-22 has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

Soil test data compiled by ICAR-Indian Institute of Soil Science, Bhopal on available nitrogen and phosphorus status from different soil testing laboratories located in various states including Bihar and Uttar Pradesh showed that the soils of about 57% districts were low in available N, 36% medium and 7% were high. Similarly, soils of about 51% districts were low, 40% were medium and 9% were high in available P.

Summary of soil fertility (nitrogen and phosphorus) status of soils of different States of India

State	**% Area**					
	Available Nitrogen			**Available Phosphorus**		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**
Bihar	36	58	6	29	68	3
Uttar Pradesh	98	2	0	97	3	0
Uttarakhand	43	37	20	68	32	0
Punjab	73	27	0	0	47	53
Haryana	96	4	0	92	8	0
H.P.	0	24	76	33	55	12
M.P.	27	63	10	31	56	13
Maharashtra	88	12	0	93	7	0
Rajasthan	88	12	0	55	45	0

Gujarat	68	21	11	34	66	0
Chhattisgarh	59	41	0	50	50	0
W.B.	40	60	0	30	60	10
Orissa	57	43	0	44	56	0
Assam	27	73	0	17	83	0
Jharkhand	7	93	0	75	23	2
Andhra Pradesh	44	56	0	55	45	0
Tamil Nadu	94	4	2	15	47	38
Karnataka	20	61	19	27	69	4
Kerala	17	77	6	0	76	24

a) **the efforts made by Government to find the reasons for the depleting fertility of soil and the remedial steps taken in this regard.**

Reply: The Government of India through its research, education and extension institutes of Indian Council of Agricultural Research (ICAR) has been giving training to farmers And other stakeholders to maintain the soil productivity through judicious use of fertiliser. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, integrated nutrient management, organic farming as well as soil management for efficient crop production and sustaining soil health. Also the farmers are educated during the Kisan Mela. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to demonstrate the efficacy of fertilizer prescription equations of cereals, oilseed, pulses and horticultural crops based on resource endowment capacities of the farmers. The advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice
Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum– capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Also the Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. "Soil Health Card" Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

DA&FW is implementing Paramparagat Krishi Vikas Yojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

b) the number of farmers have been provided Soil Health Card (SHC) in the country to increase agricultural production and the total number of soil health laboratories along with number of farmers getting soil health test done during last five years state-wise and district-wise.

Reply: This is related to DA&FW.

c) the budget allocation and utilization of funds under SHC scheme since last five years, State –wise and year-wise and

Reply: This is related to DA&FW.

d) whether the centre for science and advancement has analyzed the soil test report of the Ministry of Agriculture and Farmers Welfare and if so, the conclusions drawn therefrom?

Reply: This is related to DA&FW.

Sub.: The point-wise reply on Lok Sabha Admitted Starred Question No 467 regarding 'Marketing of Subsidized Fertilizers" to be answered on 09/12/2022-reg.

(f) The other steps taken/proposed to be taken by the Government to create awareness among farmers for the balanced use of fertilizers?

Reply: The Government of India through its research, education and extension institutes of Indian Council of Agricultural Research (ICAR) has been giving training to farmers and other stakeholders to maintain the soil productivity through judicious and integrated use of manures and fertiliser.

Awareness meeting/seminar/camps/campaigns are regularly conducted by ICAR -IISS Bhopal frequently in each and every rural area of the country across states to sensitize farmers. National level campaign on efficient and balanced use of fertilizers (including nano-fertilizers) was conducted on 21st June 2022 by the institute to sensitized all the stakeholders. Besides, the institute conducts awareness program meetings/seminars/camps/training on several occasion including World Soil Day (5 December), Soil Health Awareness Week (1-7 December), Environmental Day (5 June), Agricultural Education Day (3 December) and International Women Day (8 December) every year at its institute premises, project area and different AICRP/AINP centres across country. These awareness program were conducted at farmers' fields through FLDs/OFTs to improve soil health through balanced use of fertilizers, STCR based recommendation, micronutrient applications and solid as well as liquid biofertilizers use.

A National Campaign on Efficient and Balanced Use of Fertilizer (including nano-fertilizers) was organized by ICAR-Indian Institute of Soil Science on **21** June 2022. The program was attended by about 4229 farmers from Khajuri, Shahpura, Begonia, Jhapdiya, Bharopura, Charpahadi, Pipliya, Kanera, Raipur, Kuthar and Karond Khurd **v**illages from nearby villages around Bhopal.

Participation summary of various stakeholders in the campaign

No. of Staff members participated	No. of Dignitaries	Farmers	Members of civil society	School / college children	Total
823	215	4229	123	744	6134

The AICRP on STCR conducted frontline demonstrations (FLDs) and on-farm trialsat farmers' field in different states to demonstrate and popularized the efficacy of fertilizer prescription equations of cereals, oilseed, pulses and horticultural crops based on resource endowment capacities of the farmers. Also training on soil sampling and testing, integrated nutrient management as well as soil management for efficient crop production and sustaining soil health were conducted for the benefit of farmers and Soil Testing Laboratory personnel. The state-wise FLDs and trainings conducted and impact thereof for the last five years (2018-22) are presented below:

A. Frontline demonstrations (FLD) at farmers' field

State	No of FLD	Crops and varieties covered	Increased yield of the technology over farmers' practice (%)
Odisha	159	Tomato (Red Ruby), Tomato (NS 585), Tomato (Super tomato), Lady's finger (SVOK-0001), Lady's finger (Shakti), Brinjal (Fitto crown), Lady's finger (Shakti), Cowpea (YB-	36.8

		07), Tomato (Utkal Raja), Brinjal (VNR-B5),	
Madhya Pradesh	145	Paddy (Kranti, MTU 1010, IR-64), Lentil (JL 3), Chick pea (JG-14, JG-63, JG-16, TJT-501), Wheat (JW 3211, HI 1500, JW-3211, MP-3020, GW-273, GW-322)	27.8
Chhattisgarh	460	Rice (Mahamaya,Sampada , Swarna, MTU-1010, Balmleshwari, Chnadrahasini, MTU 1001, MC-13), Tomato (Vaishnavi 2082), Brinjal (VNR-125),Potato (KufriBahar), Wheat (CG-04, JW-3382, HI-8777, HI- 1544, Kanchan ,GW 266, HD 2932, GW-322, LOK-1), Mustard (Bharat Sarson-2),Chickpea (RVG- 202, JG-11), Maize (DKC9165, 900 M Gold, Pioneer 3501, PAC-3396, Hycell, DKC9114), Soybean (JS-97-52)	24.8
Telangana	168	Castor (PCH 111), Soybean (JS 335), Bengal gram (NBEG-3), Maize (DHM121, Sugar-75), Groundnut (K-6), Rice (MTU1010, KNM 118, RNR 15048, RNR 15048, NithyaHaritha, Dharani), Maize (DHM 121, DHM 117),Chickpea (NBEG -3)	12.5
Uttar Pradesh	163	Rice (Aman, Sudha, InduriSambha, HUR 3022),Maize (GS-802, Jaunpury), Barley (RD2050), Wheat (Malviya-234), Mustard (Ashirwad)	62.5
West Bengal	30	Cabbage (Green Express), Cauliflower (Snow ball), Broccoli (CSH-1), Onion(Sukhsagar), Pointed gourd (Haibathkali), Tomato (Amlik), Mustard (B9), Kharif Rice (Satabdi)	9.8
Karnataka	173	Maize (Hema), Ragi (Indaff-9, GPU-28), Groundnut (TMV-2), Foxtail millet (SIA-3156)	23.9
Tamil Nadu	269	Groundnut (VRI 2, TMV 7), Sorghum (Co 30), Maize (Swaraj, TNAU CO 6, CO 6), Okra (Avantika, NS -7772 & TNAU Hybrid CO 4, Hybrid Co Bh H1), Rice (Bhavani), Turmeric (BSR2), Cotton (Anjali, Jai 2, Suraj),Black Gram (Co 6, MDU 1), Groundnut (Co 7), Radish (Ural), Maize (TNAU CO6, Kanagagold,Pioneer 804), Aggregatum onion (Nandhini), Tomato(Vijay), Sugarcane (CO 86032), Rainfed Tapioca (Mulluvadi), Tomato (PKM1), Carrot (Tokito), Cabbage hybrid (Harirani),Tomato (Sivam), Brinjal (Duruva), Turmeric (BSR &Local), Chilli (Priyanka), Ragi (CO 15), Sorghum (Local	58.7
Bihar	189	Wheat (HD 2733, HD 2824), Rice (6444, Rajshree and Saryug-52), Onion, Rajmash, Sugarcane, Cauliflower	51.8
Himachal Pradesh	124	Maize (K-121), Wheat(HPW 155), Pea (Azad Pea-1), Soybean (Palam Soya, PK-472, Harit soya), Toria (Bhiwani)	86.5
Maharashtra	135	Paddy(Indrayani), Fingermillet (PhuleNachani)	36.5
Kerala	7	Tomato(Anagha), Cowpea(Anaswara), Groundnut(K-6)	17.3
West Bengal	57	Jute (JRO 204, Co-58), Rice (NDR 97), Lentil (B 256)	44.9
Assam	74	Rapeseed (TS-38), Hybrid Rice (US-382), Scented Rice (Joha Rice and KetekiJoha)	92.4
Haryana	12	Raya (RH 0749 and RH 406)	42.0
Uttarakhand	2	Rice, Brinjal (VNR B-5)	42.5

Manipur	4	Rice (RC- Maniphou 10)	30-38%

B. Trainings and seminars conducted by different centers to popularized target yield based nutrient recommendations

State	No. of trainings	No. of participants	No. of women
Odisha	10	284	121
Madhya Pradesh	21	505	108
Chhattisgarh	14	675	175
Telangana	15	722	167
Uttar Pradesh	8	445	236
West Bengal	4	522	203
Karnataka	1	100	40
Tamil Nadu	12	512	192
Bihar	1	84	20
Maharashtra	11	524	164
Kerala	14	771	438
Manipur	16	667	430
Assam	2	125	60
Puducherry	14	245	--

The All India Coordinated Research Project (AICRP) on Long term Fertilizer Experiments (LTFEs) was established in 17 different centres of the country to assess the impact of long term fertiliser use and manuring (balanced and integrated nutrient management) on soil quality, crop productivity and sustainability. The results emanated from long term fertiliser experiments revealed that, the balanced (100% NPK) and integrated nutrient management (100% NPK+FYM) found to be superior for crop production, soil health and sustainability.

The technologies related to secondary and micronutrients management in soil-plant systems for higher crop production and crop quality are being disseminated to the farmers of different states by the respective AICRP-MSPE centers, time to time by conducting FLDs, and farmers training.

Sub.: The point-wise reply on Rajya Sabha regarding 'Utilization of Drone in Agricultural Sector" - reg.

Agri-Drone Project

Table 1

Name of ATARI	No. of drones allotted	No. of drones purchased so far	No. of drones for which Purchase Process started	Utilization of Drone in Crop Disease Detection		Utilization of Drone in Crop Damage Assessment		Utilization of Drone in Accurate Prediction of Crop Yield	
				Name of Crop	Name of Crop Disease	Name of Crop	Assessed Level of Damage	Name of Crop	Level of Accuracy in Prediction of Crop Yield
ICAR-IISS	-	-	-	-	--	-	-	--	-

Agri-Drone Project

Table 2

Name of ATARI	No. of drones allotted	No. of drones purchased so far	No. of drones for which Purchase Process started	Utilization of Drone in Optimizing the Use of Seeds				Utilization of Drone in Optimizing the Use of Fertilizers				Utilization of Drone in Optimizing the Use of Water			
				Name of Crop	Extent of Optimizing the Use of Seeds	Extent of Improvement in Crop Productivity	Time Saved	Name of Crop	Extent of Optimizing the Use of Fertilizers	Extent of Improvement in Crop Productivity	Time Saved	Name of Crop	Extent of Optimizing the Use of Water	Extent of Improvement in Crop Productivity	Time Saved
ICAR-IISS	02	Nil	02	-	-	-	-	-	-	--	-	-	-	-	-

02 Farmers' days were organized to sensitize the farmer to use Drone in various activities of agriculture.

NOTE: In addition, please also enlist the initiatives/steps taken regarding :

1. Educating the Farmers about the benefits of **Drone's Utilization in the Agricultural Sector;** and
2. **Promotion of Usage of Drones in Agricultural Sector**

Sub.: The point-wise reply on Rajya Sabha unstarred dairy no. S2642 on ‘Zero tillage processing farming” - reg.

a) the details of the zero tillage process and its benefits for yield and agricultural land;

Reply : Zero tillage farming is an agricultural technique for growing crops without disturbing the soil through primary tillage operation. Here previous crop residues were kept on the surface and crops were sown directly using zero-till seeding machinery like, happy seeder. However, the concept of conservation agriculture which includes zero tillage farming is being adopted by a large swath of the country particularly in the irrigated Indo-gangetic plains for rice-wheat system. Conservation agriculture is an umbrella term which includes three principles, zero or reduced tillage operation, recycling of crop residue, crop rotation and cover cropping. Crop rotation and cover cropping helps in control of weed population and also reduces the incidences of pest and diseases.

Conservation agriculture (CA) provides an alternative to residue burning as it recycles the crop residues in-situ. Residue addition in the field recycles costly nutrient input in the soil. The CA system increases water productivity and also the nutrient use efficiency. Conservation agriculture system provides sustainable higher crop productivity while it reduces the cost of labour and fossil fuel use through reduced primary tillage operation. Long-term adoption of conservation agriculture improves soil health, sequesters carbon in the soil system, improves soil bio-diversity and reduces the runoff and sediment/erosion losses of the fertile top soil from the arable land and checks land degradation particularly in sloppy landscape. The CA system is pivotal for soil health restoration and improvement. To ensure the full potential benefit of CA, the three principles of CA need to be implemented carefully.

b) The areas in India where in cultivation is being done through zero tillage process, crop-wise and state-wise details thereof;

In general, in the Indo-Gangetic Plains across India, Pakistan, Nepal and Bangladesh, largeadoption of no-till wheat with some 5M ha is reported, but only modest adoption ofpermanent no-till systems and full CA (Farooq and Siddique, 2014; Hobbs et al., 2008). Theexception appears to be India and Pakistan, where significant adoption (1.5 and0.6 M ha,respectively) of no-till practices by farmers has occurred in recent years in the rice-wheatdouble cropping system (Farooq and Siddique, 2014; Kassam et. al., 2018), and also in therainfed uplands areas in India for crops such as maize, sorghum, millets, cotton, pigeon peaand chickpea. Recent reports suggest that in the Indo-Gangetic Plains in India, there may be up to 3.5 M ha of CA-based rice-wheat system (Paroda, 2018).

c) Whether any scheme is being run by the Government for the practice of zero tillage, if so, the details thereof?

ICAR started a central sector scheme, consortia research platform on conservation agriculture (CRP on CA), since 2015. The details of the scheme is given hereunder.

Consortia Research Platform on Conservation Agriculture

Mission:

Mainstreaming conservation agriculture for sustainable use and management of natural resources to improve productivity and ensuring food security.

Objectives:

- Develop and validate location specific CA technologies for sustainable intensification of cropping systems across agro-ecologies.
- Quantify impact of CA on soil health, pest dynamics, input use efficiency, carbon sequestration and greenhouse gas emissions.
- Capacity building, knowledge management, institutional arrangement and enabling policies for accelerated adoption of Conservation Agriculture.
- Adapt and mainstream available best bet location specific CA practices for enhanced productivity and profitability in rainfed and irrigated eco-systems.

Multi-Pronged Approach:

1. **Basic & Strategic Research:** To carry out long-term research on evolving CA packages and development of suitable machinery for irrigated and rainfed cropping systems by understanding and overcoming operational constraints at farm level

- Generate need-based component technologies for different production systems.
- Validation and refinement of component technologies.
- Fine-tuning the existing and new CA machinery.
- Screen and identify suitable varieties.
- Quantify tangible and non-tangible benefits.

2. **Adaptive Research:** To organize on-station and on-farm adaptive trials on CA and front-line demonstrations in irrigated and rainfed cropping systems.

- Synthesis and documentation of the CA based best management practises (BMPs).
- Participatory adaptation and out-scaling of CA based BMPs.

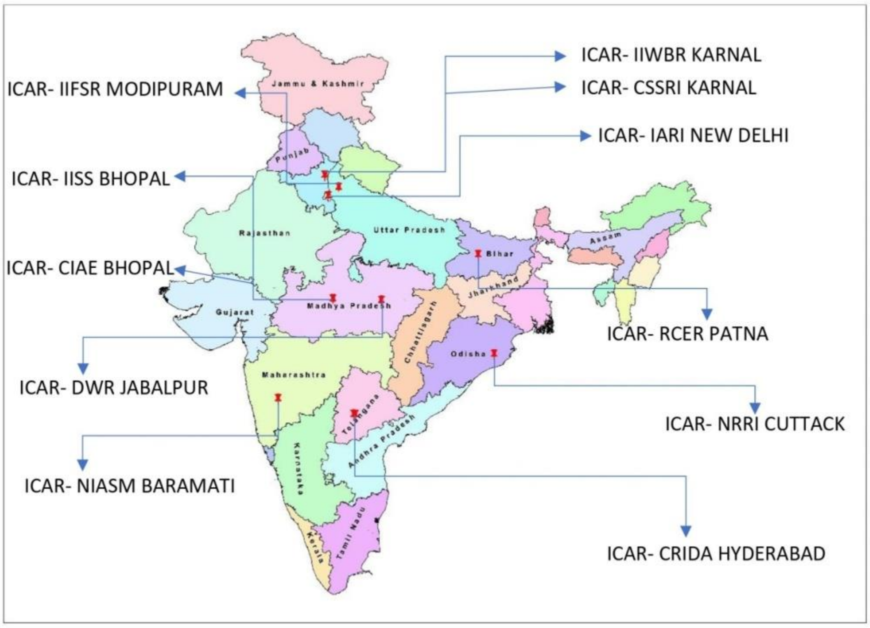
3. **Capacity Building:** Capacity building, knowledge management and enabling policies for accelerated adoption of Conservation Agriculture.

Major Cropping Systems:

Rainfed: Rice-fallow(12mha), Soybean Wheat* /Soybean-Chickpea(2.23mha), Pearlmillet/ Sorghum/clusterbean-wheat/mustard/chickpea(5.7mha), etc.

Irrigated: Rice-Wheat (10 mha), Rice-Rice/Greengram (5.9 mha), Maize-wheat/ chickpea (2 mha), Wheat-Sugarcane (0.97mha).

CRP ON CA CENTRES LOCATION IN INDIA



Sub.: The point-wise reply on Rajya Sabha Question Dy. No. S453 regarding Degradation of soil due to usage of chemical fertilizers –reg.

(a) whether Government has conducted any research to find out the extent to which soil fertility is destroyed due to excessive use of chemical fertilizers and is causing various types of problems;

Reply: Yes please.The All India Coordinated Research Project (AICRP) on Long term Fertilizer Experiments (LTFEs) was established in 17 different centres of the country to assess the impact of long term fertiliser use and manuring (imbalance, balance and integrated nutrient management) on soil quality, crop productivity and sustainability. The results emanated from long term fertiliser experiments revealed that imbalance dose of nutrients (control, 100% N, 100% NP, 50% NPK) found to be not sustainable for crop production and soil health while, the balanced (100% NPK) and integrated nutrient management (100% NPK+FYM) found to be superior for crop production, soil health and sustainability.

(b) If so, the details thereof and the extent to which the quality of soil has degraded every year in the country including Jharkhand due to the imbalanced use of fertilizers; and

Reply: The long term experiments since 1973 have indicated no adverse effect of fertilizer on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2386 kg/ha) during 2020-21 (fourth advance estimates) from 710 kg/ha during 1960-61. The total food grain production of 314.51 million tonnes (third advance estimate) recorded in 2021-22 has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

The soil quality index was worked out for few of the LTFE centres given below:

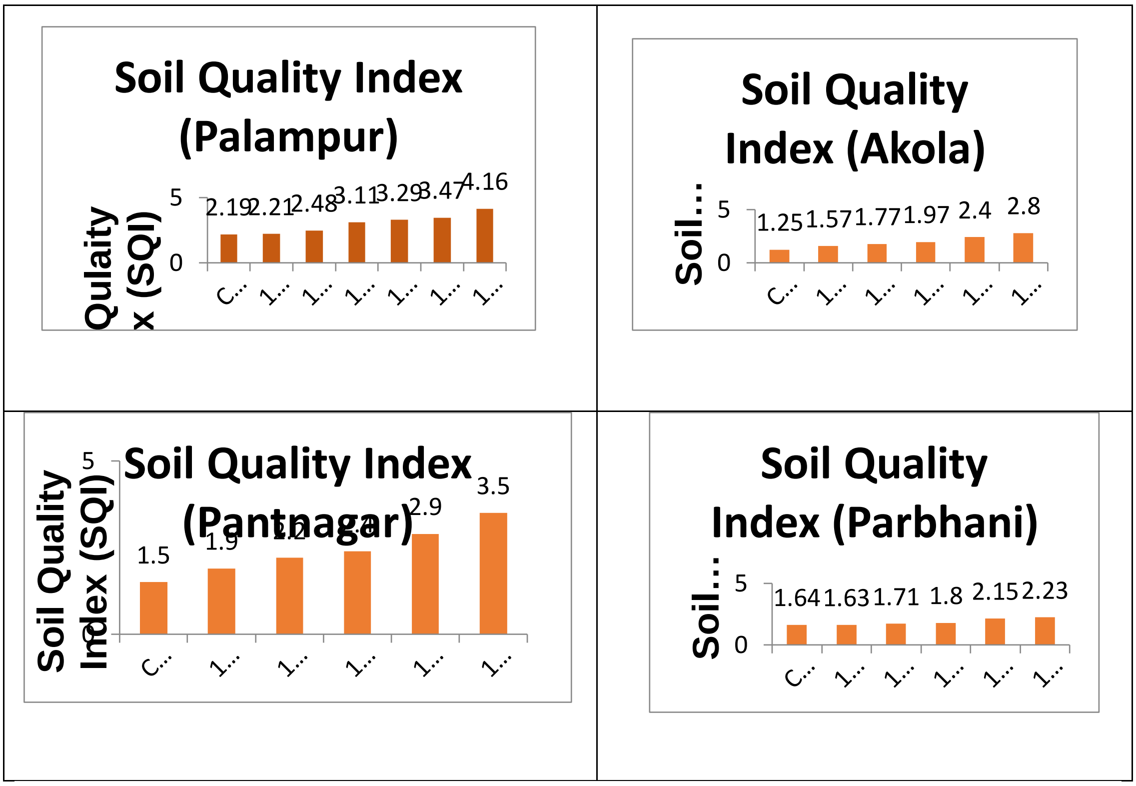


Figure 1: Soil Quality Index under LTFE centres.

The results of soil quality index (SQI) suggest that the control, imbalance (100% N, 100% NP) had lower SQI values than balance (100% NPK), super optimal dose (150% NPK) and integrated nutrient management (INM) (100% NPK+FYM) (Figure 1).

Overall across different centres of LTFE, it is very evident that balanced (100% NPK) and INM (100% NPK+FYM) performs better for improving the soil health in terms of physical, chemical and biological properties, crop productivity and sustainability over imbalance use of fertilizers.

1. Soil pH

Soil pH is one of the most widely accepted dominant factor that regulates availability of soil nutrients, structure of vegetation and of microbial community, primary productivity of soil and range of soil processes. Perusal of data (**Table 1)** revealed that continuous use of fertilizer did not have any effect on soil pH except in Alfisols at Bangalore, Bhubaneswar, Palampur, Pattambi and Ranchi. Application of fertilizer in Alfisols (Red soil) resulted in decline in soil pH and the effect is more pronounced with application of urea alone (100% N). Data further indicated that application of organic manure (FYM) maintained soil pH. The decline in soil pH of acid soil is due to production of H^+ on mineralization of urea and hydrolysis of Al^{+3} and Fe^+ but incorporation of FYM chelated Al^{+3} in acid soils, which reduces the release of H^+ ions.

Table 1 Effect of long term nutrient management on soil pH at long term fertilizer experimental sites of AICRP LTFE (2019)

Location	Initial	Control	N	NP	NPK	150% NPK	NPK+Zn	NPK+ Lime	NPK+ FYM

Akola	8.1	8.1	7.9	8.0	8.0	8.0	8.0	-	8.1
Bangalore	6.2	5.6	4.5	5.1	5.3	4.8	-	5.5	5.3
Barrackpore	7.1	7.3	7.3	7.4	7.3	7.4	7.4	-	7.6
Bhubaneswar	5.8	4.3	4.7	5.0	4.8	4.9	5.0	5.8	5.6
Coimbatore	8.2	8.5	8.5	8.6	8.7	8.8	8.7	-	8.7
Jabalpur	7.6	7.5	7.5	7.5	7.6	7.6	7.6	-	7.5
Jagtial	8.2	8.3	8.4	8.3	8.1	8.2	8.3	-	8.2
Junagadh	8.2	8.0	7.9	8.0	8.0	7.9	8.0	-	8.1
Ludhiana	8.2	7.7	7.2	7.1	7.2	7.0	7.1	-	7.1
Palampur	5.8	5.5	4.4	5.1	5.2	4.9	5.4	6.3	5.5
Pantnagar	7.3	8.2	8.2	8.2	8.3	8.3	8.2	-	8.3
Parbhani	8.1	8.3	8.2	8.2	8.2	8.1	8.2	-	7.4
Pattambi	5.5	5.0	4.9	5.0	5.0	4.9		5.4	5.2
Raipur	7.7	7.4	7.6	7.5	7.5	7.6	7.4	-	7.7
Ranchi	5.3	5.6	4.4	5.4	5.5	5.0	-	5.8	5.5
Udaipur	8.2	8.3	8.3	8.3	8.3	8.3	8.2	-	8.2

2. Electrical conductivity

Electrical conductivity (EC) indicates soluble salt present in the soil solution. Data revealed that there is little increase in electrical conductivity may be due to application of phosphatic and potassic fertilizer over the years (**Table 2**). However, the change noted is very meagre and far less than the maximum critical value.

Table 2Effect of nutrient management on EC (dS m^{-1}) (2019)

Location	**Initial**	**Control**	**N**	**NP**	**NPK**	**150% NPK**	**NPK + Zn**	**NPK + Lime**	**NPK+ FYM**
Akola	0.30	0.24	0.30	0.32	0.35	0.36	0.34	-	0.36
Bangalore	0.06	0.15	0.11	0.13	0.13	0.09	-	0.12	0.17
Coimbatore	0.20	0.52	0.56	0.56	0.61	0.64	0.61	-	0.63
Jabalpur	0.18	0.16	0.17	0.16	0.18	0.17	0.18	-	0.18
Jagtial	0.47	0.54	0.62	0.59	0.61	0.59	0.64	-	0.49
Junagadh	0.37	0.39	0.43	0.43	0.42	0.49	0.43	-	0.31
Ludhiana	0.20	0.27	0.25	0.22	0.29	0.23	0.25	-	0.26
Palampur	-	0.44	0.46	0.50	0.62	0.68	0.56	0.68	0.69
Pantnagar	0.35	0.80	0.84	0.85	0.82	0.86	0.84	-	0.87
Parbhani	0.22	0.25	0.25	0.24	0.25	0.26	0.25	-	0.22
Pattambi	-	0.04	0.03	0.04	0.03	0.04	-	0.03	0.04
Raipur	0.20	0.21	0.21	0.24	0.24	0.25	0.22	-	0.24
Ranchi	-	0.09	0.12	0.10	0.10	0.13	-	0.10	0.13
Udaipur	0.49	0.86	0.85	0.89	0.86	0.92	0.88	-	0.86

3. Soil organic carbon

Soil organic carbon (SOC) is crucial constituent of soil which governs the soil condition and to a large extent nutrient status also as most of soil processes such as chemical, physical and biological are dependent on soil organic carbon. It is well documented that if there is more carbon in soil better will be the soil condition. Data revealed that imbalanced or no use of fertilizer nutrients resulted in decline of soil organic carbon at almost all the LTFE sites (**Table 3).**

Table 3Effect of nutrient management on SOC (g kg^{-1}) at AICRP-LTFEs (2019)

Location	Initial	Control	N	NP	NPK	150% NPK	NPK + Zn	NPK + Lime	NPK+ FYM
Akola	4.6	3.1	4.0	4.8	5.4	6.9	6.5	-	7.8
Bangalore	4.6	4.2	3.7	4.3	4.8	5.1	-	4.6	5.6
Barrackpore	7.1	5.6	6.6	7.1	7.2	7.3	7.0	-	8.9
Bhubaneswar	4.3	3.6	3.6	4.1	5.3	5.5	5.0	5.6	5.9
Coimbatore	3.0	4.6	5.1	6.0	6.2	6.4	6.2	-	7.1
Jabalpur	5.7	4.2	5.2	6.7	7.6	8.7	7.6	-	8.9
Jagtial	7.9	6.1	5.4	6.6	7.5	6.7	7.2	-	8.2
Junagadh	8.9	6.1	5.9	7.2	7.4	8.1	7.6	-	9.1
Ludhiana	2.2	2.9	3.8	3.8	4.2	4.1	4.1	-	5.3
New Delhi	4.4	3.0	4.4	4.3	4.4	5.2	4.7	-	5.3
Palampur	7.9	8.0	8.1	9.7	10.1	9.7	9.2	11.1	13.3
Pantnagar	14.8	6.1	9.0	9.9	9.8	8.8	10.0	-	15.6
Parbhani	5.5	5.5	5.5	5.5	6.3	6.6	5.6	-	6.7
Raipur	6.2	4.3	4.4	5.4	6.5	6.9	6.3	-	7.0
Ranchi	4.5	4.1	4.7	4.6	4.7	4.6	-	3.8	5.5
Udaipur	6.8	5.2	6.5	6.9	7.5	7.9	7.6	-	9.1

On the contrary, balanced use of fertilizer resulted in increase in carbon status of soil. Decline in soil organic carbon was due to addition of carbon less than the quantity lost from the system on annual basis. Imbalanced use of nutrients (N, NP) led to poor crop productivity which in turn added less amount of carbon through residual biomass (stubble and roots), whereas balanced use of nutrient resulted in increase in crop productivity which in turn add more carbon through residual biomass. However, Pantnagar is an exception where except NPK + FYM none of the treatments could maintain initial carbon. Decline in carbon at Pantnagar is due to change in land use pattern from forest to agriculture which accelerated oxidization of native carbon from soil. Only NPK+ FYM could maintain the C status because of additional supply of carbon through FYM annually.

4 Nutrient Status

4.1 Available N

Available nitrogen (N) represents that form which is easily absorbed by plant roots and is quite dependent on soil organic carbon content. Data indicated increase in available N status with balanced use of nutrients and followed the pattern similar to soil carbon (**Table 4**). Most of the places there was increase in soil N compared to initial status. This is due to addition of carbon through residual biomass, which also contain N. Thus, from the results it is concluded that balanced use of nutrient irrespective of soil not only increased the crop productivity but also carbon and available N status. This could be one of the reasons for continuous increase in soil productivity at most of the sites of LTFE.

Table 4 Available N (kg ha^{-1}) in soil under different nutrient management options at AICRP LTFE (2019)

Location	Initial	Control	N	NP	NPK	150% NPK	NPK+ Zn	NPK+ Lime	NPK+ FYM
Akola	120	115	219	240	248	309	262	-	318
Bangalore	257	167	155	175	179	200	-	174	214
Barrackpore	223	211	230	232	245	265	245	-	263

Bhubaneswar	187	184	198	207	232	234	222	240	271
Coimbatore	178	151	185	198	193	231	213	-	244
Jabalpur	193	178	210	250	288	328	288	-	340
Jagtial	108	129	134	139	139	140	128	-	142
Junagadh	161	143	177	192	203	241	207	-	260
Ludhiana	87	85	115	118	119	128	121	-	130
New Delhi	-	191	229	234	234	285	234	-	274
Palampur	736	267	330	355	365	370	366	361	397
Pantnagar	392	173	226	233	232	302	232	-	313
Parbhani	216	191	213	242	260	282	245	-	286
Pattambi	-	182	201	210	216	204	-	236	230
Raipur	236	177	206	213	220	250	217	-	252
Ranchi	295	159	167	171	192	180	-	148	183
Udaipur	360	251	292	311	351	399	345	-	386

4.2 Available P

Phosphorus (P) is an essential macronutrient and required for plant nutrition and contributes significantly to crop productivity. Perusal of data on crop productivity indicated that crop responded to applied P at majority of sites (**Table 5**). Continuous absence of P in nutrient schedule resulted in decline of available P status in soil, whereas inclusion of P in fertilizer schedule increased P status in soil. Increase in available P status was more in alluvial and acid soil compared to Vertisols. This is due to very high P fixation capacity of Vertisols. Increase in soil P status is quite obvious, because of uptake of P by crop is less than the applied. The unused P is reflected in different forms of P in soil.

Table 5Available soil P (kg ha^{-1}) under different nutrient management options at AICPR-LTFE (2019)

Location	Initial	Control	N	NP	NPK	150% NPK	NPK+ Zn	NPK+ Lime	NPK+ FYM
Akola	8.4	4.8	8.0	16.9	17.7	21.9	18.0	-	22.9
Bangalore	34.3	17.7	17.8	70.8	42.0	84.8	-	41.6	78.5
Barrackpore	41.5	5.7	7.3	41.6	46.8	58.8	41.1	-	61.0
Bhubaneswar	19.4	6.0	8.6	10.2	12.0	11.9	9.9	11.1	41.3
Coimbatore	11.0	7.8	11.9	20.1	22.9	26.1	22.1	-	27.2
Jabalpur	7.6	8.5	9.8	27.8	33.7	37.2	31.9	-	36.9
Jagtial	19.3	9.6	7.9	26.1	22.7	31.4	23.9	-	33.5
Junagadh	9.5	13.7	13.6	24.5	25.7	31.3	24.9	-	37.9
Ludhiana	9.0	13.8	15.8	52.4	49.6	82.3	53.1	-	88.5
New Delhi	16.0	18.9	17.5	34.5	35.7	43.4	34.6	-	41.2
Palampur	12.1	16.0	16.0	110.0	64.0	148.0	75.0	78.0	135.0
Pantnagar	18.0	7.8	9.9	18.6	18.8	32.5	18.9	-	29.0
Parbhani	16.0	13.3	13.6	16.7	15.4	18.4	15.6	-	19.1
Pattambi	15.6	12.8	9.8	18.7	18.2	19.1	-	18.1	19.1
Raipur	16.0	10.0	14.0	25.6	26.0	27.3	26.3	-	29.0
Ranchi	12.6	14.4	19.5	82.5	73.0	167.7	-	77.7	152.0
Udaipur	22.4	15.8	16.2	24.2	25.4	33.5	27.6	-	31.2

4.3 Available K

Potassium (K) is an essential element for crop growth and is required in large quantity. Available status of K (**Table 6)** showed variation in different soils. In Alfisols, there has been decline in available K status in most of the treatments except 150% NPK and NPK+ FYM. But at Bhubaneswar and Jagtial increase in available K status was recorded in the plots which were deprived off supply of K. This is due to supply of K through irrigation water. In Vertisols there was decline in available K in most of the treatments except in NPK + FYM. In this particular treatment supply of K through organic manure is more than the crop removal. On the contrary to Vertisols, increase in available K status was recorded in alluvial soils of Punjab, Delhi and Pantnagar with the presence of K in fertilizer schedule. Such increase in available K status is due to addition of K through irrigation water, flood water and upward movement of soluble K and addition of root biomass.

Table 6Effect of nutrient management options on available soil K status (kg ha^{-1}) at AICRP-LTFE locations (2019)

Location	Initial	Control	N	NP	NPK	150% NPK	NPK+ Zn	NPK+ Lime	NPK+ FYM
Akola	358	157	198	225	389	481	384	-	492
Bangalore	123	78	64	64	145	185	-	164	177
Barrackpore	143	138	126	130	174	201	173	-	200
Bhubaneswar	43	93	91	97	103	115	102	114	153
Coimbatore	810	536	567	572	668	701	654	-	759
Jabalpur	370	244	247	250	298	320	289	-	336
Jagtial	364	373	375	393	475	481	430	-	466
Junagadh	184	159	146	145	215	261	250	-	258
Ludhiana	88	78	83	109	127	146	118	-	144
New Delhi	155	209	193	182	268	332	289	-	314
Palampur	194	109	130	127	156	184	164	162	203
Pantnagar	125	93	89	91	129	142	123	-	145
Parbhani	766	621	645	693	697	771	651	-	783
Pattambi	173	46	50	51	72	81	-	71	79
Raipur	474	361	361	376	391	414	385	-	425
Ranchi	157	119	126	83	118	136	-	101	126
Udaipur	671	471	477	487	556	598	558	-	584

(c) the follow-up action taken by Government on the findings of the soil research.

Reply: The Government of India through its research, education and extension institutes of Indian Council of Agricultural Research (ICAR) has been giving training to farmers And other stakeholders to maintain the soil productivity through judicious use of fertiliser. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, integrated nutrient management, organic farming as well as soil management for efficient crop production and sustaining soil health. Also the farmers are educated during the KisanMela. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to demonstrate the efficacy of fertilizer prescription equations of cereals, oilseed, pulses and horticultural crops based on resource endowment capacities of the farmers. The advantages of STCR technology over general fertilizer recommendations as given below:

Crop	No. of trials	Progressive Farmers' practice	STCR- IPNS practice

Rice	120	11.4	16.8
Wheat	150	10.3	14.2
Maize	35	12.7	17.7
Raya	25	4.8	7.6
Groundnut	50	5.1	6.8
Soybean	17	9.6	12.2
Chickpea	35	6.1	9.4

Further, AICRP (STCR) has undertaken large number of demonstrations and field day –cum–capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Also the Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. "Soil Health Card" Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) in February, 2017 indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

DA&FW is implementing ParamparagatKrishiVikasYojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

Sub.: Lok Sabha Un-starred Question No. 1738 for answer on 16.12.2022 by Shri B.B. Patil and Shri Shanmuga Sundaram K, MPs on "Acute Shortage of Essential Fertilizers" - regarding

b) The step taken/proposed to be taken to reduce dependency on chemical fertilizers and to promote the usage of natural fertilizers in the country;

Reply: To reduce dependency on chemical fertilizer, ICAR- All India Network Project on soil biodiversity and biofertilizers (AINP SBB) at ICAR-IISS Bhopal is working on the development of different biofertilizers. The biofertilizers are either carrier based solid formulation or liquid biofertilizers. The biofertilizers are specifically prepared using microbial inoculants which can fix atmospheric N2, solubilize nutrients like P, K, Zn etc or plant growth promoters. Integrated nutrient management strategy gives the best result compared to chemical fertilizer application alone. Based on research, it is recommended that integrated nutrient management strategy improves soil biology and crop performance. This strategy includes use of both inorganic (75%) and organic (25%) fertilizers. With this approach there will be saving of 25% Inorganic chemical fertilizers besides 5% crop yield improvement. Additionally, organic sources improve soil C and microbial diversity enabling better soil function.

ICAR –IISS has developed various composting techniques for recycling of organic wastes, crop residue farm wastes etc. which can not only supplement plant nutrient but also enrich the soil with organic carbons.To improve nutrient content in the compost technology, enrichment with indigenous rock minerals such as rock phosphate, mica, pyrite and microbial enriched compost have been developed by the institute. Besides, package of practices for organic cultivation of wheat, chickpea, mustard, soybean, linseed maize etc has been developed by the Institute for Central India which is adopted by the farmers. Aproject on natural farming has been submitted by the institute to the state government which is under consideration

c) the measures implemented to create awareness amongst farmers across country;

Reply : Institute is regularly conducting workshop, training, awareness campaign, demonstration, lectures, exhibitions etc. in the institute premises, in villages or as invited experts in different forums.

- To promote organic and natural farming in MP state, a National campaign on Cow-Compost-Carbon-Climate under Theme: Organic/Natural Farming was organized on 22.08.2022. In this, efficient management of crop residue and composting using cattle dung for sustainable food production, soil carbon storage and mitigate climate change effect was covered by different experts.
- A six days training for entrepreneurship development for students of Madhya Pradesh was organized during 11-16 July, 2022 on topic 'Soil Testing and Organic Farming.'
- A farmers' training for the farmers under KVK Kaimur, Bihar was conducted during 29-31 Aug. 2022.
- Besides this, the scientists of the institute are frequently giving advisory/training to the officials of state department of agriculture, and farmers of the state through trainings and farm pathsalas.
- Institute is maintaining a long term organic and natural farming experiments. Farmers from different parts of the state and all over countries are being given training and exposure visit to this site for giving onsite practical experience of organic and natural farming including composting technology for nutrient management.
- Dr. A. B. Singh, Director (In charge) addressed more than 8000 farmers and officials in a three days national farmers fair at Morena, Madhya Pradesh on 11th Nov. 2022.

- A workshop cum training on ‘Composting for soil and human health’ was organized in the Institute on 2nd Dec. 2022 in which more than 100 farmers participated and learnt about various composting techniques and importance of organic farming in human health.
- Dr. A. B. Singh, Director (In charge) delivered lecture on natural farming in Workshop on Natural farming at RVSKV, Gwalior in which 402 KVK, ICAR Scientists, farmers and staffs of state Agril. Department participated.

Besides, the institute conducts awareness meetings/seminars/camps on the occasion of World Soil Day (5 December), Soil Health Awareness Week (1-7 December), Environmental Day (5 June), Agricultural Education Day (3 December) and International Women Day (8 December) every year at its institute premises and project area.

Various awareness programmes on INM and biofertilizer use were also conducted at different AICRP LTFE centres and AINP SBB centres, respectively, across the country:

Name of the state	**Awareness programs on INM/ Biofertilizer use at AICRP/AINP centres**
Madhya Pradesh	AICRP LTFE (ICAR-IISS, Bhopal –PC Unit, Centre: JNKVV Jabalpur)
	AINP SBB (ICAR-IISS, Bhopal PC Unit, Centre: JNKVV Jabalpur)
Karnataka	LTFE (Centre: UAS GKVK Bangalore)
	SBB (Centre: UAS, Dharwad)
Odisha	LTFE (Centre: OUAT Bhubaneswar)
	SBB (Centre: OUAT, Bhubaneswar)
Tamil Nadu	LTFE (Centre: TNAU Coimbatore)
	SBB (Centre: TNAU Coimbatore)
Telangana	LTFE (Centre: PJTSAU Jagtial)
Punjab	LTFE (Centre: PAU Ludhiana)
Himachal Pradesh	LTFE (Centre: CSK HPKV Palampur)
	SBB (Centre: DYSUHF, Solan)
Jharkhand	LTFE (Centre: BAU Ranchi)
	SBB (Centre: BAU, Ranchi and CRRI, Hazaribagh)
Uttarakhand	LTFE (Centre: GBPUA&T Pantnagar)
	SBB (Centre: GBPUAT, Pantnagar)
Kerala	LTFE (Centre: KAU Pattambi (Vellanikara)
	SBB (Centre: KAU, Thrissur)
Gujarat	LTFE (Centre: JAU Junagadh)
	SBB (Centre: ICAR-DGR, Junajadh)
Rajasthan	LTFE (Centre: MPUA&T Udaipur))
	SBB (Centre: MPUAT, Udaipur)
Maharashtra	LTFE (Centre: VNMKU Parbhani and Dr. PDKV Akola)
	SBB (Centre: MAU, Parbhani)
Chhattisgarh	LTFE (IGKV Raipur)
New Delhi	LTFE (Centre:ICAR-IARI, New Delhi and ICAR-IASRI, New Delhi)
	SBB (Centre: ICAR-IARI, New Delhi)
West Bengal	LTFE (Centre: ICAR-CRIJAF, Barrackpore)
Haryana	SBB (Centre : HAU, Hisar)
	SBB (Centre : AAU Jorhat)
Andhra Pradesh	SBB (Centre : ANGRAU, Amaravati)
Bihar	SBB (Centre: RAU, Pusa)

The AINP SBB project also extends trainings and demonstration to farmers to popularize biofertilizer use in the country. During last 10 years, about 45546 farmers and 811 agricultural officers were trained under the AINP SBB. In addition 246 front line demonstrations and 193 on farm trails were conducted to exhibit efficiency of biofertilizer technologies to farmers.

Sub.: Lok Sabha Q. Dy. No. 2284 for 20/12/2022 on "Innovation and New Technologies in Farm Sector" – reg.

a) the details of the initiatives taken by the government for innovation/development of new technologies in the farm sector across the country during each of the last three years and the current year;

Reply: Package of practices for organic cultivation of wheat, chickpea, mustard, soybean, linseed maize etc has been developed by the Institute for Central India which is adopted by the farmers

1. Farming systems, Organic farming packages,

- Under NPOF project, Package of practices for organic cultivation of wheat, chickpea, mustard, soybean, linseed maize etc has been developed by the Institute for Central India
- A varietal screening experiment was initiated during past three years to select the best cultivars of Wheat, Chickpea, Soybean and Maize, Mustard and Groundnut to perform under organic nutrient management.

2. Climate resilient technologies

- Optimization of Nitrogenous (N) fertilization to maximize the soil carbon (SOC) sequestration rate in the Soybean-wheat system of India.
- Increasing soil carbon is the core of climate-resilient agriculture. Enhanced SOC minimizes the adverse effects of climate variability and climatic extremes. Therefore, we optimized the N fertilization rate to maximize the soil carbon sequestration rate. Under a soybean-wheat system, the optimum N application rate for maximum soil C sequestration in Vertisol was estimated to be 155 kg N ha^{-1} for wheat and 20 kg N ha^{-1} for soybean.
- Further, it was found that the carbon sequestration rate is maximum in integrated treatments i.e 100% NPK + 5 T farmyard manure application. The SOC sequestration rate is 300 kg/ha in 100% NPK + FYM (INM); 120 kg/ha in 150% NPK, and 84 kg/ha in 100% NPK.

3. Mridaparikshak

The technology of Mridaparikshak mini lab for the estimation of soil health parameters was developed in the year 2015 and further refined and commercialized in 2016.

4. Salt tolerant varieties

Nil

5. Sub surface drainage

Nil

c) if so, the details thereof along with the number of farmers who availed benefits from such innovation/technologies during the said periods;

Reply: The year-wise details of dissemination/sale of Mridaparikshak mini-lab is given below:

Year	Mridaparikshak units sold (No.)	Estimated No. of Soil Health Cards prepared (Million)
2015-16	471	0.83
2016-17	3922	13.59
2017-18	5714	7.03
2018-19	1192	6.19
2019-20	44	1.16
2020-21	56	0.05

Total	**11399**	**28.87**

Mridaparikshak mini-labs were procured by KVKs, State Department of Agriculture laboratories and others. An estimated 28.87 million soil health cards were prepared by this technology. The soil health cards were distributed to farmers by various agencies

Sub.: The point-wise information onLok Sabha Unstarred Question Diary No 9306 regarding 'Research on fertility of soil' due for answer on 27.12.2022 - reg.

l) whether the Government has conducted any research regarding the fact that the fertility of soil is being destroyed by the excessive use of chemical fertilizers;

Reply: Yes. Under AICRPs of ICAR IISS Bhopal including AICRP on LTFE, STCR and MSPE, research has been carried out on the effect of balanced fertilizer application including secondary and micronutrients on crop yield and crop quality. It has been found that imbalanced application of fertilizer nutrients resulted in reduced crop yield and low soil fertility levels.

m) if so, the report of the said research;

Reply:The long term experiments since 1973, have indicated no adverse effect of fertilizers on soil health. The soils of Himachal Pradesh are medium to high in available N, mostly low to medium in available P and K. In these soils also no decline in fertility has been reported with the use of balanced fertilization.

A case may be cited with respect to Punjab with high fertilizer consumption (one of the largest consumers of fertilizers in India). Fertilizer input has considerable contribution in enhancing crop yields in the region. Along with other inputs, the fertilizers have helped Punjab contributing 30-40% of rice and 40-50% of wheat in the central pool, thus, ensuring food security of the country. At the country level, Punjab produces 22% wheat, 11% rice, and 10% cotton from 1.5% geographical area. Assured irrigation conditions also engender higher fertilizer use. However, there exist cases where more susceptibility to certain plant diseases, pests and lodging and hence the yield loss is ascribed to the use of more than recommended dose of nitrogenous fertilizers. Excessive use of fertilizers on soils where soil test does not recommend otherwise has been observed to cause significant monetary loss.

Also India as a whole has made a commendable progress in genetic enhancement of different crops and the productivity levels have increased to three times (2325 kg/ha) during 2019-20 (4th advance estimates) from 710 kg/ha during 1960-61. The total food grain production of 310.74 million tonnes recorded in 2020-21 has been achieved mainly due to enhancement in productivity. In addition to productivity per se per day productivity is also one of the major component for determining the genetic potential of crops.

The research results have been published in biennial reports of AICRP-MSPE.

n) the steps taken by the Government on the basis of the said research

Reply:The Government of India through its research, education and extension institutes of Indian Council of Agricultural Research (ICAR) has been giving training to farmers and other stakeholders to maintain the soil fertility and productivity through judicious use of fertilizer. The farmers are trained to make them aware of the soil health through frontline demonstrations, training on soil sampling and testing, integrated nutrient management, organic farming as well as soil management for efficient crop production and sustaining soil health. Also the farmers are educated during the KisanMelas. These training programmes are being conducted every year for the benefit of farmers. AICRP (STCR) has conducted on-farm trials/ field demonstrations to demonstrate the efficacy of fertilizer prescription equations of cereals, oilseed, pulses and horticultural crops based on resource endowment capacities of the farmers.

Further, AICRP (STCR) has undertaken large number of demonstrations and field day cum capacity building programmes under Schedule Tribe Component (erstwhile Tribal Sub Plan, TSP) to promote balance use of fertilizer and soil test based fertilizer recommendations amongst tribal farmers.

Also the Soil Health Management (SHM) Scheme under National Mission of Sustainable Agriculture (NMSA) aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soul health and its productivity; up-gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations. Soil Health Card Scheme is under implementation in the country since February, 2015 to provide Soil Health Card to all farmers in the country. Soil Health Card will provide information to farmers on soil nutrient status of their soil and recommendations on appropriate dosage of nutrient to be applied for improving soil health and its fertility thus increase agricultural productivity. Soil Health Card will be issued every 2 years for all land holdings in the country. A study was conducted by National Productivity Council (NPC) indicates that there has been a decrease in use of chemical fertilizer application in the range of 8-10% as a result of application fertilizer and micro nutrients as per the recommendation on Soil Health Cards.

DA&FW is implementing Paramparagat Krishi VikasY ojana (PKVY) with an aim to develop sustainable models of organic farming through a mix of traditional wisdom and modern science to ensure, inter alia, long term soil fertility buildup and resource conservation. Integrated nutrient management is better option where conjoint use of manures and fertilizer is used for meeting the crop demand of plant nutrients.

The benefit of balanced fertilizer application including secondary and micronutrients has been demonstrated by conducting frontline demonstrations (FLDs) and imparting trainings to the farmers of different states by the various centers of AICRP-MSPE.

Sub.: The point-wise information on Lok Sabha Unstarred Question Diary No 10318 regarding 'Space technology in Agriculture' due for answer on 27.12.2022 - reg.

o) whether the Government is using space technology in agriculture sector in the country;

Reply: Information not available

p) if so, the details thereof and the areas identified by the government for this purpose;

Reply: Information not available

q) the details of the achievements made by the government by using space technology in agriculture and allied sector during each of the last three years and the current year;

Reply: Information not available

r) the challenges faced by the goverment while using space technology in agricultural sector;

Reply: Information not available

s) whether the goverment has also launched a pilot project using space technology for better yield estimated and if so, the details thereof and the outcome of the project; and

Reply: Information not available

t) the further steps being taken by the government for use of space technology in agriculture and allied sectors for the betterment of farmers?

Reply: Information not available