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INVESTING IN THE HEALTH OF SOIL : PARAMOUNT TO FUTURE OF FARMING

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Abstract

In the Union budget 2015-16, priority has been assigned to agriculture sector with the aim to cater to two major factors of agriculture production i.e. soil and water. After the realization of the fact about markdown in the production of the land due to the deteriorating condition of soil, Government of India is implementing soil schemes for the benefit of the farmer and the nation. Imbalanced use of fertilizers, low addition of organic matter and non-replacement of depleted micro and secondary nutrients over the years are some of the other problems that are of major concern. The Union Minister of Agriculture recently launched two web portals – Soil Health Card (SHC) and Fertilizer Quality Control System (FQCS). The Soil Health Card is a printed report that will be given to farmers once in three years for each of his/her land holding. It will include all the essential information on macro nutrients in the soil, secondary nutrients, micro nutrients, and physical parameters. Finally, the card will also contain an advisory on the corrective measures that a farmer should follow up to improve soil health and crop yield. For the current year (2015-16) an allocation of Rs. 96.46 crore (GOI share) has been made. A 50:50 sharing pattern between GOI and State Governments will be implemented. The Fertilizer Quality Control System provides information on the quality of imported fertilizers at ports while States check the quality of indigenously manufactured fertilizers. Maintaining the soil health is a worrying issue that is needed to be worked upon in our country to improve food security, enhance agricultural productivity and create rural job opportunities. Thus, raising awareness among society and decision makers, supporting effective policies, promotion of investment in sustainable soil management schemes and soil information collection as well as monitoring at all levels are some of the ways for overall Soil Health.

'Healthy Soils are ground for healthy food production.'

Key words : Agriculture policies, Soil Health Card, fertilizers, fertilizer quality control system.

Introduction

Soil is often referred as "skin *or crust of the earth*". It is a mixture of rocks, debris, organic matter, inorganic minerals, gases, liquids, humus that develops on the earth's surface and supports the growth and existence of a number of plants and living organisms. The major source of nutrients for plants is Soil. The trio of Nitrogen, Phosphorus and Potassium (NPK) are the main nutrients required by plants. Other important nutrients include Calcium, Magnesium and Sulphur. Some of the micronutrients include iron, manganese, zinc, copper and molybdenum, zinc which are known as trace elements and are important but required in small amounts by the plant.

Soil health is defined as the "the continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, promote the quality of air and water environments, and maintain plant, animal, and human health" (Pankhurst *et al*., 1997). Or simply, it can be defined as the sufficiency of the soil to sustain life. In fact, the major functions of soil include storage, recycling and filtering of nutrients essential for plant growth and serves as habitat for various microorganisms. Healthy agricultural soil is one that is capable of supporting the production of food and fiber to a level and with a quality, sufficient to meet human requirements and to continue to sustain those functions that are essential to maintain the quality of life for humans and the conservation of biodiversity (Kibblewhite *et al*., 2008).

Soil Quality Assessment

Testing the soil is necessary to assess inherent power of soil to supply nutrients for plants. Soil testing can be carried out through scientific research, demonstrations

on fields and recommended fertilizer use by the farmers. Soil testing was first setup in India during 1955 with 16 soil testing Labs. Since then, Government of India has been supporting various programs to increase the soil analyzing capacity in the country. Agriculture Scientists and planners have recognized the use of the service but, it is laid low due to inadequate scientific extension and support. Doran and Parkin (1994) suggested that soil quality assessments could be used as a management tool or aid to help farmers select specific management practices and as a measure of sustainability. Acton and Padbury (1993) proposed that the definition of soil quality should be based on three critical soil functions, each representing major expectations placed on soils by farmers and agriculture or other resource managers. The major section of government, policy makers, agricultural scientists and agricultural extension departments still think that chemical fertilizer application is the primary way of improving our crop and food production. Majority of these sections seldom think of what is happening to long term health of soil and its capacity to produce sustainably (Reddy Suresh, 2013).

In the Union budget 2015-16, priority has been assigned to agriculture sector with the aim to cater two major factors of agriculture production *i.e.* soil and water. The markdown in production of land due to depleting soil health and imbalanced use of fertilizers and minerals is a reason for concern. Thus for the benefit of the farmers and Nation, Government of India is introducing and implementing a number of Soil schemes and Policies. The two major web portals launched by the Union Minister of Agriculture are -

1. Soil Health Card (SHC)
2. Fertilizer Quality Control System (FQCS)

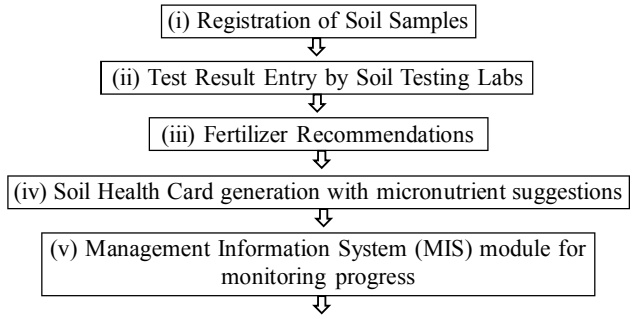
Soil Health Card

In order to develop and strengthen infrastructure, the state governments are issuing Soil Health Cards with an aim to help the producers get better agricultural yield. The card advises and enlightens the farmers of the various properties of the soil. It includes crop wise recommendations of nutrients and fertilizers needed for farms for improving productivity with optimum uses of agriculture inputs. The Soil Health Card is a printed report that will be given to farmers once in three years for each of his/her land holding. It will include all the essential information on macro nutrients in the soil, secondary nutrients, micro nutrients, and physical parameters. Finally, the card will also contain an advisory on the corrective measures that a farmer should follow to improve soil health and crop yield.

Funding : For the current year (2015-16) an allocation of Rs. 96.46 crore (GOI share) has been made. A 50:50 sharing pattern between GOI and State Governments will be implemented.

Registration of the soil samples, recording of test results and finally the generation of the Soil Health Card (SHC) with Fertilizer Recommendations is performed using the Online Web Portal.

The systematic workflow SHC portal is as follows:



Soil Sampling and Testing

It is a method by which elements like nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, manganese, copper, iron, zinc, boron, and molybdenum are chemically removed from the soil and measured for their "plant available" content within the sample. Recommended dosage of fertilizer is determined by quantity of available nutrients in the sample. The test measures organic carbon content, pH, electrical conductivity (EC), alkalinity and acidity of soil. The most vital step in testing is the collection of representative soil sample.

Sampling frequency and timing : Soil testing should be carried out once in every three to five years. The soil sample should be taken well before sowing/planting, so there is time to treat the soil. Sampling should be done at the same time each year. It is better to take the samples in the same month of the year in which the previous samples were taken. In India, samples can be taken during April to June but prior to the application of manures/ fertilizers.

Depth : A sampling depth of 15-20 cm is required for most of the field crops. For a pasture crop, a 10 cm depth is normally sufficient. However, for deep rooted crops like sugarcane, cotton, and horticultural crops, sampling from different depths may be needed. Khurpi, tube auger or spade may be used for sampling of soft or moist soils. A screw auger can be used on hard or dry soils (Srivastava, Jha, Tripathi, Pradip and Patra, 2015).

Soil sample collection will be applied on nationally agreed norms / standards of 10 ha for rainfed areas and

2.5 ha for irrigated areas. By implication, a total of 2.53 crore samples will be collected and tested to generate 14 crore soil health cards to individual farmers, once in 3 years. The target for the year 2015-16 is 84 lakh of samples, against which 34 lakh samples have already been collected (Source: http://pib.nic.in/newsite/PrintRelease.aspx?relid=123288). The Government of India has undertaken a massive effort to provide soil health cards to all farmers. How best the soil health information could be used to provide rational fertilizer recommendation on both spatial and temporal scales to the farmers ensuring sustained soil health while we try to feed the burgeoning population would be the key discussion point in this group (Rao, 2015).

Effectiveness of issuing SHCs to farmers of India

The scheme was launched in February 2015 with an aim to cover 84 lakh cards in the Phase I. Only 34 lakhs SHCs were issued till July 2015. Andhra Pradesh has taken the lead in distribution of the Soil Health Cards to farmers. Tamil Nadu and Punjab collected the maximum amount of soil samples for testing during the kharif season. Tamil Nadu has not distributed the cards yet. Other states taking the lead include Uttar Pradesh, Punjab, Chhattisgarh, Telangana and Odisha. Farmers in states like Haryana, Kerala, Mizoram, Arunachal Pradesh, Sikkim, Tamil Nadu, Goa, Gujarat, Uttarakhand and West Bengal have not been issued a single card as against the targets set for them for 2015-16 (Source: http://www.mapsofindia.com/my-india/government/soil-health-card-shc-for-indian-farmers).

In the first phase of the scheme till March 2016, 2.5 lakh samples of agricultural land of 2,200 villages in 40 blocks of Haryana would be collected with a target of making Soil Health Cards of 5.25 lakh farmers. (Source:http://indiatoday.intoday.in/story/soil-health-cards-to-be-made-for-farmers/1/473754.html). The Table 1 shows the Status of Soil Health Card scheme of different states with the target no.of samples, no. of samples collected, no. of samples tested, no. of SHC's issued .

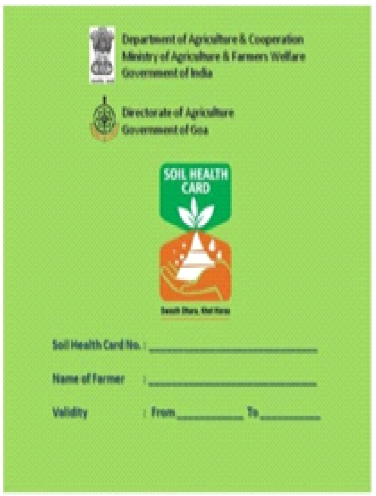
Fertilizer quality control system

The major point of concern is the quality of the fertilizers provided to the farmers, and therefore, the quality control system that ensures delivery of good quality fertilizers must be effective and efficient. It is clear that productivity is affected by poor quality fertilizers to a large extent. Yet, in spite of the presence of an elaborate mechanism for quality control in India, the problem of spurious fertilizers is rampant (Kale and Laveesh, 2011). Farmers usually face obstacles pertaining to procurement of the right quality of fertilizers, faulty supply of fertilizer and high cost of supply. Thus, quality of fertilizer plays a key role in improving crop yield and farm livelihood. High upfront input cost raises expectations of higher return at the time of harvest. Moreover, farmers are not in a position to examine the quality of fertilizers at the dealers point. Adulterated fertilizers can cause serious damage to the soil and crops and to the livelihood of the farm family. The quality of fertilizers cannot be evaluated after application in farm fields and should therefore be determined prior to its application to ensure that farmers are protected from fertilizer adulteration and malpractices (Perumal *et al*., 2014).

Fertilizer Quality Control System (FQCS) is a web based application developed by NIC for processing of sample collection, testing and analysis reports generation. The application can be accessed at the URL http://www.fqcs.dac.gov.in. It has been developed for Fertilizer Quality Control Laboratories in consultation with Central Fertilizer Quality Control and Training Institute (CFQC&TI). Labs are involved in drawing, inspection and analysis of both indigenous and imported fertilizers. There are 74 notified fertilizer quality control labs in the country for analysis of samples – one Central Laboratory at Faridabad, three Regional Laboratories at Mumbai, Kalyani and Chennai and 70 State Laboratories. The Fertilizer Quality Control System provides information on the quality of imported fertilizers at ports while States check the quality of indigenously manufactured fertilizers.

Methods for efficient nutrient and soil health management

1. Adopting 4R's, an innovative approach that takes into account the economic, social and Environmental dimensions of fertilizer management and is important for sustainable agriculture System. The 4Rs includes-
   - right source of nutrient
   - at the right rate
   - at the right time
   - at the right place.
2. Following Site-specific nutrient management (SSNM) *i.e.*, a set of nutrient management principles that aims to supply a crop's nutrient requirements through Residue recycling and legumes integration.
3. Judicious or optimal use of NPK
4. Adoption of integrated nutrient management (INM)
5. Water is an important factor influencing the transport and absorption of nutrients in soil plant system. Water and nutrients have been reported to display a strong interaction for their effect in crop growth and yield.



SOIL HEALTH CARD

Farmer's Details

Name	
Address	
Village	
Sub-District	
District	
PIN	
Aadhaar Number	
Mobile Number	

Soil Sample Details

Soil Sample Number		
Sample Collected on		
Survey No.		
Khasra No. / Dag No.		
Farm Size		
Geo Position (GPS)	Latitude:	Longitude:
Irrigated / Rainfed		

Name of Laboratory

SOIL TEST RESULTS

S. No.	Parameter	Test Value	Unit	Rating
1	pH			
2	EC			
3	Organic Carbon (OC)			
4	Available Nitrogen (N)			
5	Available Phosphorus (P)			
6	Available Potassium (K)			
7	Available Sulphur (S)			
8	Available Zinc (Zn)			
9	Available Boron (B)			
10	Available Iron (Fe)			
11	Available Manganese (Mn)			
12	Available Copper (Cu)			

Secondary & Micro Nutrients Recommendations

Sl. No.	Parameter	Recommendations for Soil Applications
1	Sulphur (S)	
2	Zinc (Zn)	
3	Boron (B)	
4	Iron (Fe)	
5	Manganese (Mn)	
6	Copper (Cu)	

General Recommendations

1	Organic Manure	
2	Biofertiliser	
3	Lime / Gypsum	

International Year of Soils 2015

Healthy Soils for a Healthy Life

Fertilizer Recommendations for Reference Yield (with Organic Manure)

Sl. No.	Crop & Variety	Reference Yield	Fertilizer Combination-1 for N P K		Fertilizer Combination-2 for N P K	
1	Paddy (Dhaan)					
2						
3						
4						
5						
6						

(Source: http://www.soilhealth.dac.gov.in/Content/FAQ/SOILHEALTHCARD-English.pdf)

Fig. 1 : Specimen of Soil Health Card.

Soil and crop management practices that add or maintain soil carbon appear to be among the most important for restoring, maintaining, or improving soil quality. The soil quality assessment method that has been developed does not provide a definitive answer with regard to the measurements or specific functions which should be included in a soil quality index, but it uses specific measurements that describe soil functions and it is dynamic (Kheyrodin, 2014).

Conclusion

There are many constraints in the implementation of SHC Scheme. These include shortage of skilled manpower, delayed supply chain management, cases where soil is not worth agriculture productivity, transfer of officers, old and non-functional lab equipments, disturbed power supply (Goyal Govind, 2014).

The SHC System has information of all districts of each state which is used for the benefit of farmers as well as agricultural scientists and decision makers. The Soil Health Card System is an important project by the Government for the benefit of the farmers at the grass-root level. Farmer details from the district/taluka/village levels are contained in a huge database. Thus, it is able to provide specific type of result to the farmer for easy and precise information when required.

Developing a national portal containing data of soil supports the current initiative of generating the "Soil Health Card" for millions of geo-referenced farm field soils. This is thus a logical initiation point for a "national

Table 1 : Status of Soil Health Card Scheme as on 09.12.2015.

S. no.	State	Target no. of samples 2015-16	No. of samples collected	No. of samples tested	No. of SHCs issued till 09.12.2015
I.	**South Zone**				
1	Andhra Pr	400000	401782	401610	1274518
2	Karnataka	533000	0	0	3700
3	Kerala	63800	20000	9000	12064
4	Tamil Nadu	426000	364576	239366	980892
5	Telangana	584000	324561	238245	242000
II.	**West Zone**				
6	Gujarat	1366000	1208000	1091000	800000
7	Madhya Pr	805000	421000	275000	275000
8	Maharashtra	911000	800000	370000	1522000
9	Rajasthan	904000	530000	190000	225000
10	Chhattisgarh	292588	92000	62000	59248
11	Goa	25000	13993	210	0
III.	**North zone**				
12	Haryana	400000	223509	19064	20000
13	Punjab	176000	152345	66574	64897
14	Uttarakhand	67607	28562	21433	72322
15	Uttar Pr	1800000	468327	22894	66736
16	Himachal Pr	69635	50522	26377	18994
17	J & K	55106	16431	8995	8586
IV.	**East Zone**				
18	Bihar	448000	234931	95709	660000
19	Jharkhand	47850	22730	5747	9844
20	Odisha	310000	97122	75814	222436
21	West Bengal	310000	96240	32000	10500
V.	**NE Zone**				
22	Arunachal Pr	9000	0	0	0
23	Assam	180000	16847	3756	413
24	Manipur	11000	3000	0	0
25	Meghalaya	22000	19432	10589	15668
26	Mizoram	9671	2000	2000	
27	Nagaland	11141	9400	8400	5470
28	Sikkim	13000	65000	65000	0
29	Tripura	10912	8388	6391	6950
	Total	**1,02,61,310**	**56,90,698**	**33,47,174**	**65,77,238**

(Source: http://www.radhamohansingh.com/pdf/Report_on_World_Soil_Day.pdf)

soil data repository" for the future generations, and will be an exceptionally valuable resource to expedite research, organizing, planning and implementation of the upgraded agricultural practices at the local (Village/ District), regional (State) and country scale. This kind of repository will also aid fixing Fertilizer Quality Control management practices, based on climate, soil type and management practices to lessen soil nutrient unearthing while preserving the soil fertility levels.

The Government of India has been consistently pursuing policies conducive to increased availability and consumption of fertilizers in the country. Over the last four and half decades, production and consumption of fertilizers has increased significantly. The country had achieved near self-sufficiency in N and P, with the result that India could manage its requirement of these fertilizers from indigenous industry and imports of all fertilizers except K were nominal. By 2020, fertilizer demand in

the country is projected to increase to about 41.6 million tons– 23 million tons of N, 11.5 million tons of P and 7.1 million tons of K. Overall, a conducive and stable policy environment, availability of raw materials, capital resources, and price incentives will play a critical role in meeting the fertilizer requirements of the country (Sharma and Hrima, 2011).

The soil health is an alarming issue that is needed to be worked upon in our country to improve food security, enhance agricultural productivity and create rural job opportunities. Thus raising awareness among society and decision makers, supporting effective policies, promotion of investment in sustainable soil management schemes and soil information collection and monitoring at all levels are some of the ways for overall soil health.

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