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A Study on Farmer's Constraints in Utilizing Soil Health Card and Suggestions to Overcome in Rangareddy District of Telangana State

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Agriculture is the backbone of Indian economy and primary source of income of larger part of Indian population. In view of this, Global soil partnership was conducted by the United Nations Food and Agriculture Organization at its headquarters in Rome, Italy, from 7 to 9 September 2011. With this, Government of India had launched the Soil Health Card Scheme in 2015 to distribute soil health cards (SHCs) to each farmer with advanced technologies such as GPS-enabled tablets and mass testing, along with better fertilizer subsidy policies. The present study was conducted in two blocks namely Shabad and Kothur of Rangareddy district of Telangana State during the year 2019-2020 to analyse farmers constraints in utilizing soil health card and suggestions to overcome. Ex-post-facto-research design was used for the study. Data was collected using a standardised and

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pre-tested interview schedule. Unavailability of bio-fertilizers to follow recommended combinations (Rank I), labours were not capable to understand the balanced fertilizers application use (Rank II), cost of recommended inputs (Rank III) and delay in distribution of soil health cards (Rank IV) were being the major constraints experienced by farmers. Important suggestions offered by the farmers for the effective usage of soil health cards are: Government could organize awareness training programs to farmers about soil health cards (Rank I), to increase the credibility of the soil health card, soil sampling should be done in presence of farmers. (Rank II), the interpretation of the results on soil health cards need to be made simpler with visual charts (Rank III) and making the availability of recommended inputs in market (Rank IV). Need to be viewed seriously by making the availability of bio-fertilizers as per recommended combinations by the agricultural department and appropriate actions to be taken for timely distributing of cards and appropriate time to win the confidence of the farmers.

Keywords: Farmers; soil health card; soil health; constraints; suggestions to overcome; utility of soil health card.

1. INTRODUCTION

The global soil partnership was initiated by the United Nations Food and Agriculture Organization at its headquarters (Rome, Italy) in 2011. In response, the Government of India had launched the flagship Programme of Soil Health Card Scheme to cover the entire country with information communication and soil mapping events, aiming to maintain healthy soils to ensure the food and nutrient security, enhance the life expectancy of people, and maintain agricultural goods export at competitive prices. By 2050 the world population will increase to over nine billions, challenging the world food production and ecological services that rely on healthy soils. In today's world, climate change has been the major driver putting soil as a critical natural resource with the top priority in the global agenda. For the first time during the 11th plan, National Mission for Sustainable Agriculture (NMSA) was introduced as a part of the National Action Plan on Climate Change (NAPCC). The National Project on Management of Soil Health and Fertility and the Rain fed Areas Development Programme (RADP) was also introduced. It is recommended that conservation agriculture, integrated nutrient management, carbon sequestration, erosion control, saline and alkaline soils management, legislation for soil protection, development of remote sensing and GPS (Global Positioning System) - based Decision Support System (DSS) and amelioration of polluted soil to rejuvenate deteriorated soils. This was followed up in the 12th plan by introducing a new scheme: 'National Project on Management of Soil Health & Fertility' (NPMSH&F). Under this scheme, soil health cards were introduced along with strengthening of soil testing labs and expanding their testing capacity in the country. Further, Nutrient-Based Subsidy (NBS) system was introduced. During the recent years, some of the states like Karnataka, Gujarat, etc., have introduced soil management programmes like Bhoochetana and Krishi Mahotsav programmes. These programmes have provided insights and learnings for the central schemes. In India, intensive farming has led to impressive growth in food grain production by improved seeds varieties, assured irrigation & fertilizers application. States like Rajasthan, Maharashtra, Gujarat, Jammu and Kashmir, Karnataka, Jharkhand, Orissa, Madhya Pradesh, and Telangana account 24 % of the country's degraded area. As the extent of degradation increased over years, soil conservation has gained policy attention. Every year, India was spent nearly 70 billion rupees on fertilizer subsidy. As per estimates, subsidy amount was around Rs.5000/ha of net cropped area and around Rs.5100 per farmer, results in overuse of fertilizers, especially NPK at the cost of micro-nutrients and manures (Anonymous, 2017). India's arable land area is second largest with 159.7 million hectares (394.6 million acres) in the world, after the United States. India is largest fertilizer producer and consumer in the world after China and U.S. The main objectives of present and future agricultural development are food security, nutritional security, sustainability and profitability. In 2025, the demographic projections indicated that land availability per capita of 0.14 hectares will now be reduced to 0.10 hectares. As per World Watch Institute; India has to import 45 million tons of food grains by 2025, if the current growth rate of agricultural production continues. Therefore, focus on improving agricultural productiveness per unit area (159.7 million ha) per unit time. Its gross

irrigated area of (82.6 million ha) is the largest in the world. The present work will be a complementary contribution to the comprehensive study of the Farmers' perception about Soil Health Card in relation to maintaining healthy soils to ensure food and nutrition security which is required for feeding the growing population of the country and meeting their fast changing needs for biomass (energy), fibre, fodder, and other products can only be ensured with Nation's life expectancy of people with organic consumption of evergreen sustainable basis. By 2050 world population growth will increase over nine billions which will affect the world food production and ecological services again which will further pressure on soils. Today's world, soils recognition is still seen as a second priority but climate change is the major driver putting the soils in the first priority in global agenda. The conservation and, where possible, enhancement and restoration of world soil resources through sustainable and productive use should therefore be the ultimate twinned goal of the Global Soil Partnership. However, despite the essential role that soil plays in the life of people, there is increasing degradation of soil resources due to inappropriate practices, burgeoning population pressures and inadequate governance over this essential resource. The green revolution led to a quantum leap in food production and bolstered world food and nutrition security. In order to meet projected demands over the next 40 years, farmers in the developing world must double food production, a challenge made even more daunting by the combined effects of climate change and growing competition for land, water and energy. Soil is living medium as it provides nutrition to the plant growth and development. Healthy soil contains all 17 elements for crop growth and development. If soil lacks one or more elements, it either reduces yield production or degrades quality of crops. "Soil health" is an assessment of ability of a soil to meet the range of ecosystem functions. Soil health has been defined as "the ability of the soil to sustain the productivity, diversity, and environmental services of terrestrial ecosystems" (Intergovernmental Technical Panel on Soils 2020). In simple words, soil health defined as the "fitness of soil for use". Soil health is the integration of three forms such as physical, chemical and biological approaches with their functions; a healthy soil can balance all these three components. Soil health plays an imperative role in improving sustainable farming production and food and nutrition security in coming years. The unbalanced use of fertilizers, the shortage of organic matter and the insufficiency of micronutrients substitution and secondary nutrients leading to decrease in soil fertility in many parts of the country. Soil health assessment at regular intervals and a recommendation to ensure that the farmers follow required nutrients to harness the soil's native nutrients is needed. Healthy soils produce healthy crops that in turn nourish people and healthy ecosystem with healthy planetary process [1]. Shrivastava et al. [2] revealed that high price of chemical fertilizers, pesticides and insecticides, while incidents of pest and disease, adverse effect of climate, lack of technical guidance from village level workers, poor economic conditions of farmer, lack of knowledge on integrated pest management practices, non-availability plant protection appliances, fertilizers and pesticides locally and no proper market facilities were the major constraints faced by the farmers. Badole and Patio [3] indicated that major constraints faced by the staff working in soil testing labs were: lack of knowledge on recommended varieties in particular soil type. The other constraints were lack of knowledge, information on soil testing, insufficient information on new modern technology specially soil testing and fertilizer recommendation, how to take soil sample and preparation for analysis, lack of knowledge about recommended fertilizers dose and very little or not having knowledge on micro-nutrients. Patel and Chauhan [4] stated that over whelming majority of the respondents (91.00%) were having difficulty in identifying micro-nutrients deficiency due to non-availability of micro-nutrients status of soil. Further majority of the farmers (88.00%) were having difficulty in calculating fertilizer dose on the basis of nutrient status of soil. Majority of farmers (84.00%) had expressed that soil health card were issued after crop harvest, time taken between soil sampling and issuing cards to farmers was too high and collection of soil sample was done in absence of farmers as constraints. Patel [5] concluded that major constraints faced by the soil health card holders were non-availability of micro-nutrient of soil ranked first, whereas, were difficulty in calculating fertilizer dose on the basis of nutrient status of soil, after crop harvest, soil health card were received, time gap between soil samples taken and issuing soil health card is too high and soil sample collection was done in absence of farmer. Charel [6] reported that major constraints experienced were difficulty in calculating fertilizer dose on the basis of nutrient status of the soil, time gap between soil samples taken and issuing

cards is too high, unavailability of micronutrients status of soil in the soil health card, not able to understand the content of soil health card, after crop harvest soil health cards were received, doubt on the quality and reliability of the information provided in the soil health card and soil samples collection was not done in the presence of farmers. Borole [7] reported that 94.11 per cent of demonstrated paddy cultivators had given suggestions about use of paddy technologies that Cano weeder need to be made available at village level and at low charges, while 81.18 per cent suggested that healthy seedlings should be provided. Darandale [8] stated that major suggestions given by the tribal organic maize cultivators were: 52.50 per cent of them had extension workers need to be provided information on organic farming, timely supply of agricultural inputs need to be provided (50.83%), adequate agricultural inputs need to be provided (48.33%), marketing network on organic farm products need to be available (46.67%), special administrative set up should be promoted for organic farming (43.33%), publication on proven organic farming practices should be available (39.17%), market facility for organic products need to be available (38.33%), awareness about organic food products (27.50%) and special incentives or awards for adopters of organic farming need to be given (16.67%). Badole and Patio [7] stated that major suggestions given by the staff working in soil testing labs were: At least agriculture graduate (96.10%) and if possible post graduate in soil science agriculture chemistry need to be recruited in soil testing labs, while it is important to make available constant or technical guidance of service provider (90.20%). Soil sampling need to be done very carefully according to prescribe procedure if possible through expert (88.20%), training programmes for adoption of soil testing recommendations (70.60%), mobile soil testing laboratory for immediate identification of deficiency of nutrients and its correction (70.60%), to provide information in regional languages (62.70%) and to organize farmers visits to model farms (52.90%). Bhunwal [9] indicated that major suggestions given by the respondents to overcome the problems experienced by them in using bio-control agents in plant protection were: respondents need to be trained about production and usage of the bio-control agents, quality of bio-control agents need to be standardized, to create awareness among the farming community campaigns need to be organised, result and method demonstrations need to be conducted by involving farming community to show their importance, seeing is believing and to motivate them, publications on proven bio-control agents need to be made available and bio-control agents need to be made available for all the needy respondents. Patel and Chauhan [4] revealed that major suggestions given by the respondents to accelerate application of soil health card were: dose of fertilizer need to be given crop wise, availability of micro-nutrients should be displayed by agriculture department, before crop season. Soil health card need to be issued, soil testing labs need to be established at taluka level with highly qualified experts and supporting staff, soil sampling procedure should be done in presence of farmers and internet facility at village level need to be provided. Patel [5] indicated that major suggestions given by the soil health card holders to overcome the constraints associated with the acceptance of soil health card programme were: Dose of fertilizer need to be given crop wise recommendation (74.66%), availability of micro-nutrients status need to be presented (74.00%), before to crop season soil health card should be issued (73.33%), farmers should be trained in soil sample collection procedure (72.66%), soil testing labs need to be established at taluka level with the highly qualified experts and supporting staff (71.33%), soil sampling procedure need to be done in farmers presence (66.66%) and internet facility at village level need to be provided (70.00%). Charel [6] reported that major suggestions given by the soil health card holders were crop wise recommendation dose of fertilizer need to be given in the soil health card (76.66%), timely availability of soil health card to farmers (75.00%), availability of micronutrients status need to be displayed in soil health card (73.33%), soil health card need to be issued prior to crop season (68.33%), soil testing laboratory need to be established at taluka level with highly qualified staff (66.67%), provide training for better understanding about content of soil health cards (65.33%), farmer need to be trained to take soil sample of his own soil (60.83%), soil sampling procedure need to be done in presence of farmers (41.67%) and government need to be provide soil health card every year to each farmer (29.00%).

On the other hand, studies have shown that when awareness programmes are followed up by supporting programmes like inputs, etc., soil improvements and increased crop yields were conspicuous. For instance, the Bhoochetana programme in Karnataka has introduced direct

benefit transfer in fertilizer subsidy to increase efficiency and strengthening fertilizer supply chain along integrated nutrient management with emphasis on organic fertilizer. Under this programme, Karnataka government supplied micro-nutrients at 50% subsidy. The study estimated that total benefits with soil health mapping and soil test based fertilizer recommendations along with improved practices would be Rs.4.33 lakh crore, against the estimated cost of Rs 0.254 lakh crores (International Crops Research Institute for the Semi-Arid Tropics research report IDC-6). The benefit-cost ratio would be 17:1. Besides, economic benefits several environmental benefits, employment generation and several environmental benefits including enhancing the sustainability of Indian agriculture will be additional benefits. In a study of on-farm trails in 8 districts of Andhra Pradesh, it is shown that balanced nutrient treatment in the widespread multi-nutrient (including micronutrients) deficient soils has resulted in significantly higher yields. Balanced nutrition while increasing crop yields maintained plant nutrient composition. Post-harvest soil testing in Nalgonda district showed higher contents of soil organic carbon and available nutrients like P, S, B and Zn in plots with balanced nutrition treatment. In the absence of balanced nutrition, farmers were losing 8% to 102% of current yields in season 1 and 15% to 24% in each of the succeeding 3 to 4 seasons [10]. 2000- MDG's - Soil management and prevention of desertification. Implementation of soil erosion control (by wind and water) by planting windbreaks and cover crops; improvements in soil fertility with agroforestry systems, cover crops, and conservation of ground and surface water. 2008- This UNCCD policy brief "A Sustainable Development Goal for Rio+20: Zero Net Land Degradation" provides a snapshot of the world's land, explains causes and impacts of land degradation and suggests pathways to land-degradation neutrality. The brief reveals that sustainable land-use is a prerequisite for ensuring future water, food and energy security. Given the increasing pressure on land from agriculture, forestry, pasture, energy production and urbanization, urgent action is needed to halt land degradation. 2011- The Global Soil Partnership for Food Security and Climate Change Mitigation and Adaptation (GSP) brings together international, regional and national organizations that are working in the area of soil protection and sustainable management. The partnership aims to implement the provisions of the 1982 World Soil Charter, and to raise awareness and motivate action by decision-makers on the importance of soils for food security and climate change adaptation and mitigation. 2013- The Intergovernmental Technical Panel on Soils (ITPS) was established at the first Plenary Assembly of the Global Soil Partnership held at FAO Headquarters on 11th and 12th of June, 2013. The ITPS is composed of 27 top soil experts representing all the regions of the world. The main function of the ITPS is to provide scientific and technical advice and guidance on global soil issues to the Global Soil Partnership primarily and to specific requests submitted by global or regional institutions. The ITPS will advocate for addressing sustainable soil management in the different sustainable development agendas. 2015- The International Year of Soils, 2015 (IYS 2015) was declared by the Sixty-eighth session of the United Nations General Assembly on December 20th, 2013 after recognizing December 5th as World Soil Day. The purpose of the IYS is to raise awareness worldwide of the importance of soils for food security, agriculture, as well as in mitigation of climate change, poverty alleviation, and sustainable development. Soil health is proposed to focus on the maintenance of four key functions: carbon transformation; nutrient cycles; maintenance of the soil structure; and control of pests and diseases [11]. Naturally, soils contain many nutrients, among these the major elements of prime importance are nitrogen, phosphorus, calcium and potassium. Such nutrients are important for the growth and development of plants [12]. Over the years, the indiscriminate use of fertilizers, the less application of organic matter and the nonreplacement of reduced micro and secondary nutrients have contributed to soil nutrient deficiencies. The level of awareness and acceptance of soil fertility management strategies among the farming community is relatively limited and the acceptance of soil test-based fertilisers is also significantly affected by various factors [13]. That's why interpreting soil health management is vital to the sustainability and stability of the climate adaptive farming systems [14]. In order to achieve this, the application of soil testbased fertilisers as per the recommendations of the 'Soil Health Card' is a significant move by the Government of India towards sustainable agriculture, which was launched in 2015 (Mukati et al., 2018). The scheme is seen as a holistic measure to achieve sustainable soil health and farm economy with the full use of SHC recommendations, which is a tool to help farmers track and improve soil health and allows farmers to implement soil and crop-

specific fertilisers [15]. A SHC is intended to denote soil nutrient status to each farmer and recommend him on the right usage of fertilisers and micronutrients and also on the required soil amendments to be applied in the long term to maintain soil health [16]. Consequently, soil health needs to be assessed under various management schemes in order to recognise and enhance the functioning of soil ecosystems. Precise and comprehensive measurements of soil health will provide the basis for soil health management [17]. In view of the increasing importance of soil testing and management of soil health, investigation was carried out to examine the farmer's constraints in utilizing soil health card and suggestions to overcome.

Soil health is proposed to focus on the maintenance of four key functions: carbon transformation; nutrient cycles; maintenance of the soil structure; and control of pests and diseases [11]. Naturally, soils contain many nutrients, among these the major elements of prime importance are nitrogen, phosphorus, calcium and potassium. Such nutrients are important for the growth and development of plants [12]. Soil health is proposed to focus on the maintenance of four key functions: carbon transformation; nutrient cycles; maintenance of the soil structure; and control of pests and diseases [11]. Naturally, soils contain many nutrients, among these the major elements of prime importance are nitrogen, phosphorus, calcium and potassium. Such nutrients are important for the growth and development of plants [12]). Soil health is proposed to focus on the maintenance of four key functions: carbon transformation; nutrient cycles; maintenance of the soil structure; and control of pests and diseases [11]. Naturally, soils contain many nutrients, among these the major elements of prime importance are nitrogen, phosphorus, calcium and potassium. Such nutrients are important for the growth and development of plants [12]. The soil health card reduced the fertilizer use by 10 per cent (The Economic Times 2020). Major Constraints in utilising information were high time gap between soil samples taken and issuing cards, Difficulty in understanding all the information given in the soil health card and calculating fertilizer dose on the basis of nutrient status of soil. A proper training of farmers should be done for soil sample collection followed by analysing recommended dose of fertilizers [18]. Major Constraints in adopting the SHC recommendations were, difficulty in understanding the information given in the soil health card and calculating fertilizer dose on the basis of nutrient status of soil, unscientific method of collecting soil samples. Regular trainings to the farmers on soil sample collection procedure followed by interpreting recommended dose of fertilizers will create the positive intent among the farmers in adopting the SHC recommendation for sustainable soil health management [19]. The findings of the study revealed that the most important constraints being faced by the respondents in the adoption of Soil Health Card scheme were "lack of knowledge about the importance of micronutrients", "lack ofmobile soil testing vans", "unavailability of micronutrient in market" [20].

2. METHODOLOGY

The agencies that implemented the soil health card scheme programme were Department of Agriculture, State Agriculture Universities, Krishi Vignan Kendras and International Crops Research Institute for the Semi-Arid Tropics. For effective monitoring of schemes, output and outcome framework was finalized in consultation with National Institute for Transforming India. The scheme is managed by integrated management division in the ministry Agriculture Corporation and farmer's welfare, government of India. Based on objectives of the study, Ex-post-facto-research design is most often used with social and behavioural sciences because it is difficult to assign a respondent dynamic behavioural condition. Thus, Ex-post-facto-research design was used for the study. It was considered appropriate because the event has already happened. It was a systematic empirical study in which the researcher does not have direct control over independent variables because their manifestations have already occurred. The present study was conducted in Rangareddy district of Telangana State during the year 2019-2020. Rangareddy district was purposively chosen for the study. The rationale applied for selecting the district was large number of soil samples collected (93,912) and farmers covered (1, 67,041) were more compared to other districts in the state. The village-wise information relating to soil health card holders were obtained from Department of Agriculture, Indian Council of Agricultural Research, Krishi Vignan Kendras, Agricultural extension officers and Agricultural officers. Two blocks namely Shabad (60 respondents) and Kothur (60 respondents) were selected on the same criteria. Again from each block top three villages having more soil health card holders of small, medium and large farmers

were selected. In each of the identified villages 20 farmers were randomly selected for collecting the required data for the research. The total of 6 villages were selected and top three villages had maximum number of soil health cards had been issued were chosen in each block through simple random sampling 20 respondents per village were selected. Thus, 60 respondents were selected from each of the blocks namely Shabad and Kothur. One district X two blocks X three villages X 20 farmers. Totalling the sample constituted for the study to 120 farmers. The study aimed to assess farmer's constraints in utilizing soil health card and suggestions to overcome.

Name of the Villages	Name of the Block	No. of Farmers
Shabad	Shabad	20
Rudraram	Shabad	20
Hayathabad	Shabad	20
Anthireddyguda	Kothur	20
Chegur	Kothur	20
Thimmapur	Kothur	20
Total sample size		**120**

2.1 Status of Rangareddy District

The following table shows the distribution of number of soil samples collected, analysed, number of farmers covered, number of soil health cards printed and number of soil health cards issued to the farmers in district.

Sl. No.	Soil samples for 2015-16 & 2016-17 (cycle I)	Soil samples		No. of Farmers covered	No. of Soil health cards printed	No. of soil health card issued
		Collected	Tested			
1.		93,912	2,691	1,66,861	6,440	3,42,671

Source: Soilhealth.dac.gov.in

2.2 Distribution of Soils in Rangareddy District

Sl. No.	Soil types	Area in Hectares	Locations
1.	Red sandy loams (Red chalka)	125000	Medchal, Shameerpet, Hayathnagar, Saroornagar, Rajendranagar etc.
2.	Red loamy sands (Dubba soil)		Ibrahimpatnam, Yacharam, Maheshwaram, Kandukur, etc.
3.	Black cotton soils	98000	Chevella, Shabad, Kothur, Vikarabad, Tandoor etc.

Source: Rangareddy.telangana.gov.in

2.3 Distribution of Soil Testing Laboratories (STL) in Rangareddy District

Sl. No.	Particulars	No. s	Location
1.	Agriculture Market Committee (STLs)	4	Ibrahimpatnam, Medchal, Parigi and Vikarabad
2.	Main Lab and (Mobile soil testing lab at ARI)	1	Rajendranagar
3.	Total	5	

Source: Rangareddy.telangana.gov.in

2.4 Modalities Followed for Implementation of Soil Health Card

Telangana State Department of Agriculture was the nodal department for implementation of this scheme. It will provide necessary support to State Level Executive Committee (SLEC) and had the following functions:

a) Prepare annual state level action plan by compiling district-wise action plan and submit to the state level executive committee for approval and there after forward the same to executive committee.
b) Receive funds from Department of Agricultural Corporation for implementing / outsourcing organizations and oversee, monitor & review implementations of the programmes.
c) Organize workshops, seminars and training programmes for all interest groups/associations at state level.
d) Operationalize Information Communication Technology (ICT) enabled management system up to grass-root level.
e) Conduct independent evaluation to assess the performance of the scheme in state.
f) One per cent of total allocation to the state may be earmarked for administrative and other contingent expenses. Expenditure in excess of one per cent limit was met by the state from their own resources.

2.5 Statistical Tools and Tests Used

The data collected for the purpose of the study was objectively scored, categorized and tabulated. The following statistical tools were used in the study to analyse the data which was collected using personal interview method. To achieve the defined objectives, the filed survey method was adopted. Before the interview, the investigator had introduced her to the respondents and explained the purpose or objective of the study. Respondents were interviewed at their home or farms. To avoid misunderstanding, a friendly atmosphere was created among them. Statistical tools and tests used such as arithmetic mean, Frequency, percentage, standard deviation, rank, chi-square test and Yates' correction for continuity. Most popular Software like Spps was used to analyse the collected data.

3. RESULTS AND DISCUSSION

The data collected from our sampled respondents tabulated and analysed using suitable statistical tools and techniques. The results are explained along with the inferences drawn in relation to the objectives set forth for the study.

3.1 Constraints Faced by Farmers in Utilizing the Soil Health Card

Constraint analysis has become an important thrust area of extension research in recent days. The constraint analysis would help to lubricate the process of diffusion of new technologies among farmers. The constraints experienced by farmers in utilization of soil health card are discussed below.

The constraints experienced by the farmers in usage of soil health card are shown in Table 1. Unavailability of bio-fertilizers to adopt the recommended combinations (90.00%) with rank I, labours inability to understand the balanced application (88.33%) with rank II, cost of recommended inputs (86.66%) with III, delay in distribution of soil health cards (85.83%) with rank IV, farmers are not properly orientated and interpreted of the soil health card contents (81.66%) with rank V, the values mentioned in soil health cards are far from reality (78.33%) with rank VI, the follow-up activities by extension agency to make best use of soil health card recommendations is inadequate (77.50%) with rank VII, availability of organic manures (76.66%) with rank VIII, unavailability of recommended varieties (75.83 %)with rank IX, soil health cards were issued after basal / topdressing of nutrients (75.00 %) with rank X, sample fertilizer calculations are not given in soil health card (74.16%) with rank XI, illiteracy of farmers in reading the soil health card contents (68.33%) with rank XII were the major constraint experienced by farmers in usage of soil health card. Adoption of the soil health card recommendations is time consuming process for the farmers (61.66%) with rank XIII and Availability of bio-fertilizers (60.83%) with rank XIV were next major constraints.

Majority of the farmers complained about unavailability of bio-fertilizers to adopt recommended combinations which farmers were not able to practice recommended fertilizer application. So availability of fertilizers recommended combinations should be made available as per soil health cards recommendations. It was difficult for the illiterate farmers to refer and understand the content of soil health card therefore they need the

assistance of other literate farmers. Therefore, illiteracy of farmers was considered as one of the constraint.

Utility of soil health cards lies in the adoption of recommendations entailed therein by the farmers and Use of fertilizers in accordance with soil analysis of individual field is more beneficial. For this specific purpose, awareness programmes for farmers and soil sampling teams need to be organized by experts under State Agricultural Universities, Indian Council of Agricultural Research institutes and Central Agricultural University (CAUs) and other agricultural colleges. Even awareness creation to be carried out by soil testing labs through print and electronic media and awareness campaign about soil test based nutrient application and mission management by soil testing labs. To assist in the conduction of specific central and regional workshops to the farmers.

3.2 Suggestions Given by Farmers for better Implementing the Soil Health Card

Suggestion referred as an opinion about constraints which can be used as solution to overcome constraints or to minimize them. In order to develop the extension strategy, it is essential to seek the opinion of respondents who directly involved in utilization of soil health cards. The constraints experienced by them may sometimes be imaginary and sometimes due to lack of coordination of different levels. The respondents were requested to give their valuable suggestions against difficulties experienced by them with regard to use of soil health card. Based on the frequency and percentage of suggestions expressed by the respondents the statements were ranked and presented hereunder.

It is observed from the data shown in Table 2 that the major suggestions given by farmers to overcome constraints associated with the acceptance on soil health card were: Government could organize awareness training programs to farmers on soil health card (89.16 %) with rank I, to increase the credibility of soil health card, the soil sampling should be done in the presence of farmers (83.33%) with rank II, the interpretation of results of soil health card should make simpler with visual charts (77.50%) with rank III, making availability of recommended inputs in the market (75.83 %) with rank IV, mobile soil testing laboratory for on spot delivery of soil health cards (72.50 %) with rank V and soil health card should be made available in time (65.00%) with rank VI.

Since, majority of farmers had suggested that there should be timely availability of soil health card to farmers, efforts should be made from the soil health card scheme and departments of agriculture to ensure the farmers are getting their

Table 1. Constraints faced by farmers in utilizing the soil health card. (n=120)

Sl. No.	Constraints	f	%	Rank
1.	Delay in distribution on soil health card	103	85.83	IV
2.	Illiteracy of farmers to read the SHC contents	82	68.33	XII
3.	The values mentioned in the SHCs are far from the reality	94	78.33	VI
4.	Farmers are not properly orientated and interpreted of the soil health card contents	98	81.66	V
5.	The follow-up activities by extension agency to make best use of SHC recommendations is inadequate	93	77.50	VII
6.	Difficulty in following the soil test based recommendations	92	76.66	VIII
	Availability of organic Manures			
	Availability of Bio-fertilizers	73	60.83	XIV
	Unavailability of bio-fertilizers to adopt recommended combinations	108	90.00	I
	Cost of recommended inputs	104	86.66	III
	Labours inability to understand the balanced application	106	88.33	II
	Unavailability of recommended varieties	91	75.83	IX
7.	Sample fertilizer calculations are not given in soil health card	89	74.16	XI
8.	Soil health cards were issued after basal / topdressing of nutrients.	90	75.00	X
9.	Adoption of the SHC recommendations is time consuming process for the farmers	74	61.66	XIII

f=frequency of Farmers, %= Per cent

Table 2. Suggestions given by farmers for better implementing the soil health card (n=120)

Sl. No.	Suggestions	Farmers		
		f	%	Rank
1.	Government could organize awareness training programs to farmers on soil health card.	107	89.16	I
2.	Soil health card should be made available in time.	78	65.00	VI
3.	Making availability of recommended inputs in the market	91	75.83	IV
4.	To increase the credibility of soil health card, the soil sampling should be done in presence of farmers.	100	83.33	II
5.	The interpretation of results of Soil Health Card should make simpler with visual charts.	93	77.50	III
6.	Mobile soil testing laboratory for on spot delivery of soil health cards.	87	72.50	V

f=frequency of Farmers, %= Per cent

soil sampled, analysed and the soil health card are distributed to them well in time before the cropping season to meaningfully adopt and better use of soil health card. Training also need to be given on proper method of collecting soil sample and method of fertilizer application need to be displayed in soil health card.

Fig. 1. Glimpse of data collection with agricultural officer and agricultural extension officer regarding soil health card scheme programme

Fig. 2. Glimpse of data collection of soil health card holders constraints and Suggestions to overcome for Effective implementation of Soil Health Card Scheme in the Country

4. CONCLUSION

The farmers need to register at the web portal *www.soilhealth.dac.gov.in* along with the characteristics of collected soil samples and reports from soil test laboratory. Once registered, the farmer can track test results through soil testing labs, fertilizer and nutrient recommendations and soil health card generation. The majority of respondents possessed had medium perception about soil health card information. Extension personnel involved in conducting capacity building programmes need to be evolving an exercise that makes the farmers to comprehend soil health card values and right way of making inferences for cropping decisions. Field days need to be arranged at appropriate crop growth stage for farmers of the same and nearby villages. Subject matter specialists should explain the advantages of soil test based fertilization and need based use of soil amendments like for acidic soils (pH below normal) and alkaline or saline soils (pH above normal), Gypsum or liming materials are to be used. Also the Agriculture Officer of the area needs to be contacted for reclamation of soil. Intensive use and need of Information and Communication Technologies for database management for faster delivery of soil health cards in Public Private Panchayat Raj Partnership mode and popularizing soil test based Integrated Nutrient Management through field demonstrations or field days.

Soil and Water Conservation through Land Shaping Techniques in Coastal Regions should be strengthened for sustainable and conservative agriculture. The Panchayat Raj Institutes (PRIs) need to be involved in publicizing the demonstrations and training of farmers and in ensuring participation of farmers from nearby areas for widespread dissemination of technology. The follow-up activities by extension agency to make the best use on soil health card recommendations are inadequate was another constraint. Undertaking appropriate follow-up activities is a must for the success of any program or project. Timely reminding farmers through online platforms and giving holding hands in the procurement of fertilizers need to be carried out by extension agencies to win the confidence of the farmers.

Last but not least, in grid sampling soil mapping should be strengthened as it provides soil data of both farmers who practices chemical and natural farming side by side in farming locations irrespective of soil physical, chemical and biological properties and conditions along with specific site location on grid basis. In some cases soil health card may not be applicable to farmers who practice less application of fertilizers or opt for sustainable agriculture of natural farming. Knowledge management for farmers, policy makers and producers associations. To save healthy soils for sustainable agriculture to “Save and Grow” – farmers need to be facilitated to stop soil degradation and restore degraded soils through targeted soil research and development of robust soil information systems. The government need to promote inclusive policies in its governance with adequate investment for sustainable soil management and provide effective education / extension programmes at various levels.

CONSENT

As per international standard or university standard, Participants’ written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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