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SOIL HEALTH CARD SCHEME EVALUATION IN CHANDRAPUR DISTRICT, CENTRAL INDIA

GHATE, D.N. AND *KAMBLE, R.K.
Centre for Higher Learning and Research in Environmental Science Sardar Patel College, Ganj Ward, Chandrapur 442 402, India
*Corresponding author: rahulkk41279@yahoo.com

Abstract
Soil health card scheme (SHCS) is implemented in India in 2015 with objectives to study soil quality, to enhance crop production and recommended dose of fertilizer (RDF). An evaluation of the scheme was carried out in Chandrapur district of Central India. For carrying out this study, 50 farmers were identified (39 male and 11 female) with and inclusion criteria of those farmers using soil health card. A special design quantitative-based questionnaire tool was developed for this study. To evaluate the scheme emphasis was laid upon knowledge, information, implementation, satisfaction rate, farmer's attitude, constraint and suggestions given by the farmers. From the results, it can be seen that farmers knowledge for soil sample sending to the laboratory is minimum (38%) and elements present is maximum (88%). Macronutrients addition to the soil as stated in SHC is carried out by 42% farmers; whereas, (38%) for micronutrients. To understand the recommended dose of fertilizer farmers need expert advice (76%). Receipt of SHC before sowing is reported by (44%) farmers. About 90% farmers feel that SHCS is useful to them and 82% are recommending it to other farmers. The satisfaction level is in the order of income increased > soil nutrient balance > yield increase > production increase. Farmer's attitude towards the scheme being a blessing is 68%; whereas, 52% with saving input cost. Constraint reported by farmers is micronutrients unavailability (66%) followed by the problem in sending a soil sample to the laboratory (38%). Maximum (84%) farmer's suggestion is to have the crop-wise recommended dose of fertilizer. This scheme being recently introduced in India is yet to reach to all farmers and further reviews need to be carried out periodically for its effective implementation by removing bottlenecks in it.

Key Words: *Agriculture, Chandrapur, Soil health, Soil health card scheme*

Introduction

Agriculture has a significant history in India and plays a crucial role in its economy. The initial stage of a developing country largely depends upon agricultural production with a share in national income, export and employment (Makadia, 2012). In 2018 agriculture contributed 17.30% to India's Gross Domestic Product (GDP). Agriculture is the main source of economic and livelihood for more than 54.6% the population (Charel, 2016). Increase in

demand for food supply is mounting pressure on the soil to meet the same.

Soil being the most important element for farming provides essential nutrients to the crop which determines crop yield. Soil health refers to sufficient and proportional amount of macro and micronutrients in it (Patel, 2013). Soil quality is degrading due to physical, chemical and biological factors in addition anthropogenic pressure is also responsible for it. Soil testing for different parameters has serves as a sound scientific tool to assess its potential to supply plant nutrients.

Soil health card scheme (SHCS) is a Government of India's initiative started in 2015 with objectives to study and review soil quality from its functional characteristics to water holding capacity, nutrient content and other biological properties. By June 2015, 3.4 million SHC were issued to Indian farmers. In this scheme, a soil sample is collected from the farm and it is tested for various physicochemical parameters in government laboratories with special emphasis on micronutrients availability and its status. To make this scheme successful a soil health card agricultural portal is also launched by the government.

Efforts to define soil health in the context of multiple soil functions being in 1977 (Warkentin and Fletcher, 1977) and were followed by more formalized definitions (Larsons and Pierce, 1991; Karlen *et al*., 1997) and specific strategy to enhance soil health (Doran *et al*., 1996). According to Islam *et al*., (2017) farmers can perform full grade of necessary field management with the assistance of soil health card. Long term use of this health card will provide a fruitful soil quality changing trends. Jenkins (2002) stated soil health card raises awareness of soil health. Reasons for developing soil scorecards were to promote and increased awareness regarding soil sources and to encourage landowners and operators to "look below ground" (Karlen *et al*., 2001). Pandiraj *et al*., (2017), reported soil fertility status as acidic to neutral and available nitrogen and phosphorus in most of the soil falls under the low category. According to Patel *et al*., (2017) 52% respondent use soil health card for advanced farming which lowers the input cost and improves farm production. Major constraint faced by the soil health cardholder was difficult to calculate fertilizer dose (Charel, 2016). Lungmuana *et al*., (2016) found that many farmers will be benefited by understanding the soil condition after implementation of SHCS and the quantity of nutrients to be applied which will increase food production. Constraint faced by soil health cardholders include problems while making soil health card, difficulty in calculating fertilizer dose, the time gap between soil sample taken and issuing of the card, received soil health card after harvest etc. (Mukati,2016). Goyal (2014) reported limited resources such as shortage of trained manpower, obsolete equipment's in the soil test laboratories, the time lag in transporting samples from farm to laboratory and illiteracy rate among farmers are bottlenecks in the scheme. Suggestions given by farmers to improve SHCS include the crop-wise recommended dose of fertilizer and micronutrients status should be displayed in soil health card. It is observed that farmers utilize the fertilizers judiciously as per the recommendations in SHC as compared to others. Furthermore, profit obtained from sugarcane and Kharif paddy crop was relatively higher for farmers with soil health card (Makadia, 2012). No significant change in the fertilizer

consumption level of farmers in receipt of soil health card was noticed. Farmers belong to Scheduled Caste (SC) category was less aware of SHCS.

This study was conducted to evaluate the soil health card scheme in Chandrapur district of Central India with an objective to assess awareness level of farmers towards this scheme, constraint reported by farmers and suitable measures to strengthen the scheme in future. Review of literature revealed that no study pertaining to SHCS in Chandrapur district was carried out previously. This may be perhaps the first study in its kind.

Study Area

Chandrapur district is located between 19'25º N to 20'45º N and 78'50º E to 80'10ºE in Maharashtra state of Central India (Figure 1) and covers an area of 11364 sq km. The district comprises of 15 administrative blocks. The district can be sub-divided into two physiographic regions i.e., a plain region in valleys of Wardha, Penganga and Wainganga Rivers and upland hilly region. The major soils found are the black soil (56.6%), shallow black soil (25.5%) and medium-deep black (10.5%). The soils of Wainganga and Wardha valleys are most fertile. The best soil from the district is black soil confined to the rivers in tracks. It is trap soil of great depth and fertility. Other common soil observed in the district is Morand due to its loamy texture it is suitable for irrigation (CGWB, 2013).

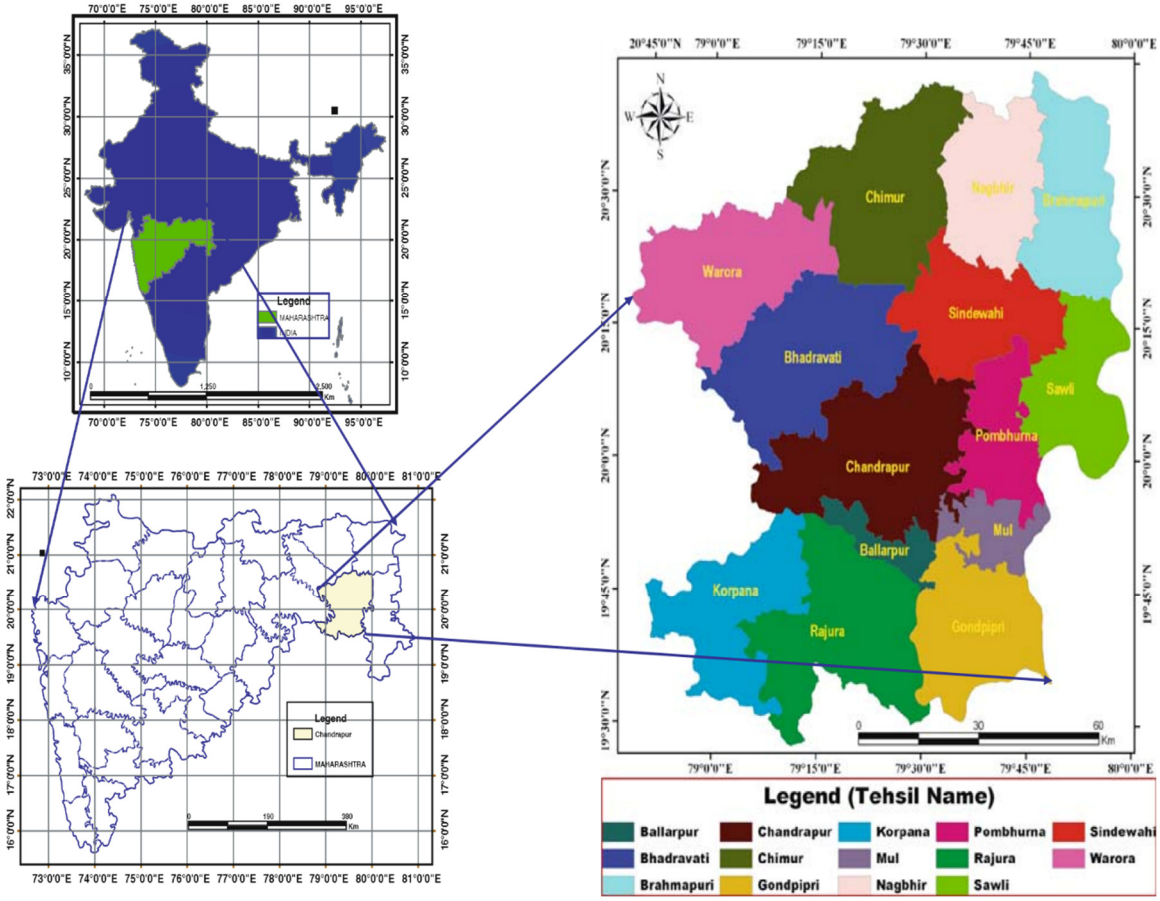

Fig. 1: Chandrapur district with different administrative blocks (Satapathy *et al*., 2009)

Land Use Pattern

The major crops in the district are rice, soybean, cotton, sorghum and pigeon pea. The maximum area under cultivation is 5050 sq km with a cropping intensity of 117.8%. Non agriculture use of land is 91.7 thousand hectares; whereas, permanent pasture and cultivable wasteland ranked 56 hectares (ha) and 36.6 ha respectively. Barren uncultivable land covers 26.3 thousand ha area and area under irrigation is 118,000 ha (Agriculture Contingency Plan Chandrapur district, CRIDA, CGWB, 2013).

Climate

The district falls under the category of Agro Climatic Zone with hot sub-humid eco-region. Winter is mild and cool; whereas, summer is very hot. Maximum ambient temperature during summer reaches to 48 ^{o}C (May); whereas, in winter minimum temperature recorded as 7 ^{o}C (December). South-west monsoon contributes maximum rainfall in the district. Average rainfall in the district is 1200-1450 mm with an average number of rainy days as 66 (CGWB, 2013).

Methodology

Study Design

To evaluate the soil health card scheme from the district sample size was drawn from the identified population of the farmers those using soil health card. For carrying out this study, 50 farmers were identified from nine administrative blocks of the district.

Interview Schedule

An interview schedule was served as a tool for extracting information from farmers regarding SHCS. A specially designed interview schedule keeping in view the objective of this study was prepared. The interview schedule comprises of knowledge and information of SHCS, implementation and satisfaction rate, farmer's attitude and constraints faced by them furthermore suggestions for improvement of the scheme. A pilot study was carried out on a few selected farmers. Feedback from them was incorporated in the interview schedule for its improvement. The information collected through this interview schedule was of quantitative in nature.

Data Collection

Primary data for the study was collected through interview schedule. Individual farmers interview conducted at their residence or in agricultural exhibition conducted at various places in the district. In addition, personal, socio-economic and knowledge level of the farmers were also collected. Secondary data with respect to land use, soil type, agriculture was also collected from various government agencies.

Data Analysis

The data collected through interview schedule was extracted and analyzed with the help of SPSS (version 16), Microsoft Excel® and presented in the form of graph and tables.

Results and Discussion

Results pertaining to farmer's information level regarding SHCS are presented in Table 1 and satisfaction level in Table 2. Figures 2 and 3 depict nutrient implementation level and information of identified nutrients respectively. Receipt of soil health card by farmers is depicted in Figure 4; whereas, attitude towards this scheme in Figure 5. Figures 6 and 7 depict constraints faced by farmers while adopting SHCS and suggestions made by farmers to improve the scheme respectively.

Socio-economic Profile of Respondent

Of the identified farmers, 39 (78%) were male and 11 (22%) female. Of these farmers, 8 (16%) were illiterate, 7 (14%) with primary education; whereas, 29 (58%) and 6 (12%) with education level up to secondary and graduation respectively. Landholding of the farmers as 14% (n=7) marginal (<1.00 acre) 38% (n=19) small (1.01 to 2.00 acre), 22% (n=11) medium (2.01 to 3.00 acre) and 26% (n=13) large (>3.00 acre). The major occupation of the farmers was farming (n=21, 42%), farming and animal husbandry (n=19, 38%) and farming and business (n=10, 20%). Farmers have varied farming experience ranging from <9 years (n=9, 18%) to a high level (n=9, 18%). Farming experience of 10-30 years was reported by 32 (64%) farmers. An equal percentage of farmers (50%, n=25) have irrigation facility and un-irrigated type of irrigation. Farming type was in odder of chemical (70%, n=35) > mix (organic and chemical) (18%, n=9) > organic (12%, n=6).

Farmer's Information Level Regarding SHC

Responses gathered from the farmers pertaining to information regarding SHC is presented in Table 1. From the table, it can be seen that only 38% farmers have reported convenience in sending a soil sample to the laboratory for testing. Maximum farmers (82%, n=41) are referring SHC to other farmers. Level of SHC understanding as easy is reported by 80% farmers. Farmers' following the recommendation as stated in SHC is 64%. Maximum (76%, n=38) farmers reported the need for expert advice sometimes to understand fertilizers doses to be applied in the farm.

Table 1: Farmers information level regarding SHC

Response	Yes (%)	No (%)	Sometimes (%)
Convenience in sending soil samples to laboratory	38	62	0
SHC referring to other farmers	82	18	0
SHC is easy to understand	80	10	10
Difficulties about card information	18	72	10
Elements quantity known	88	12	0
Used for reclamation activity	78	20	2
Nutrients addition	86	14	0
Follows recommendations	64	4	32
Understanding doses own basis	50	4	46
Need expert advice	10	14	76

Satisfaction Level of SHC

Satisfaction level of SHC pertaining to five categories is presented in Table 2. Increased in farm income is reported by 86% farmers in the range of 0-20%. Nutrient expenses reduction in the range of 0-20% is reported by 50% farmers, on the other hand, 24% farmers reported an increase in nutrient expenses in the range of 0-20%. Increase in crop production and soil fertility is in the range of 0-20% is reported by 60% farmers.

Table 2: Satisfaction level of SHC scheme

Particular	0-20%	21-40%	41-60%	61-80%	81-100%
Income increased	86	6	6	2	0
Nutrient expenses reduced	50	6	2	0	0
Yield increased	82	16	0	2	0
Nutrient expense increased	24	12	6	0	0
Productivity increased	60	8	24	6	2
Soil fertility increased	60	6	24	8	2
Nutrient status known	4	16	26	14	40
Unstable nutrient balance	82	12	2	0	4

Nutrient Implementation Level

Nutrient implementation level pertaining to micronutrients, macronutrients and biological elements is depicted in Figure 2. From the figure, it can be seen that 42% and 46% farmers sometimes and always apply macronutrients (N, P and K) in the field respectively. This indicates ~88% soil requires macronutrients. In case of micronutrients (S, Zn, Bo, Mn, Fe and Cu), 56% farmers never applied in their field; whereas, 26% and 38% applied it always and sometimes respectively. On comparison of macro and micronutrients application to the field, it can be observed that macronutrients requirement is more. In the case of biological elements, 66% farmers never applied bio fertilizer or organic manure in the field.

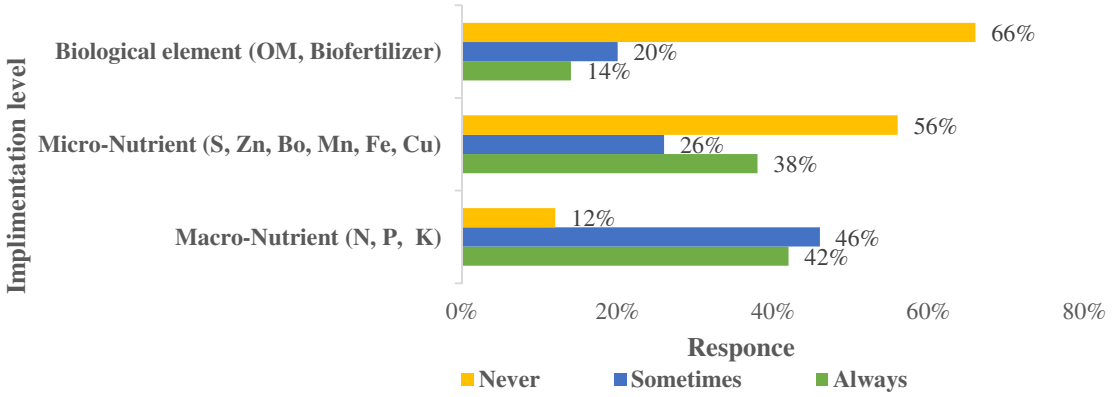

Fig. 2: Nutrient implementation level

Nutrient Status

SHCS is specially designed for the reduction of unmanageable nutrients in the soil which can help farmers for management of nutrients added to the farm. Figure 3 depicts excess and deficient nutrient status in soil. From the figure it can be seen that deficient nutrients are in the order of Zn > N > K > Bo > Mn > S > P; whereas, excess nutrients as N > K > P. Furthermore, it can be seen that farmers are applying in excess quantity the major macronutrients (N, P and K) in soil which may deteriorate soil quality. From the figure, it is concluded that micronutrients deficit soil is more as compared with macronutrients. Pandiaraj et al., (2017) reported available nitrogen and

phosphorus in most soils falls under low category whereas medium to the high content of potassium existed in the soil. Sulphur content in the soil varied from low to medium.

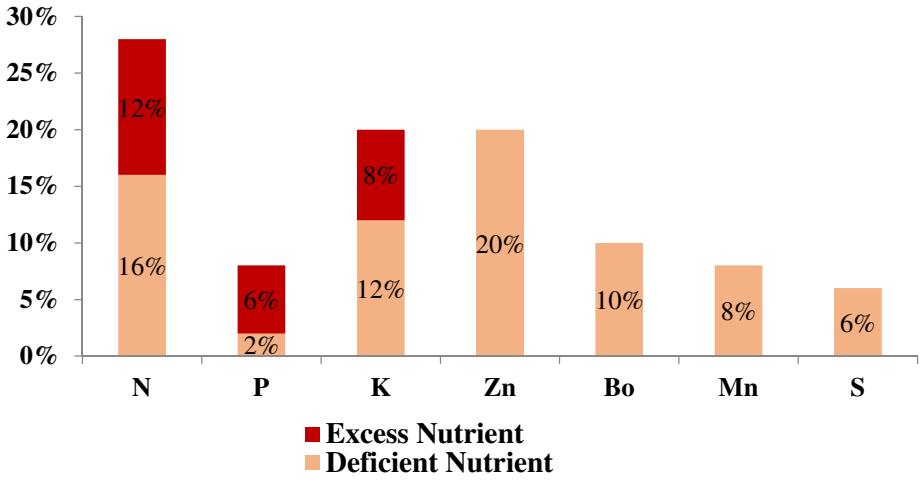

Fig. 3: Information of identified nutrients

SHCS Received By Farmers

Soil health card provides details pertaining to soil quality and nutrient status and thus it becomes very essential for farmers to receive the same well in time. Figure 4 depicts a soil health card received by the farmers. From the figure it can be seen that 44% farmers receive it before sowing; whereas, 22% after sowing. On the other hand, SHC received by farmers in the middle of crop production, at harvesting time and after harvesting is 8%, 18% and 8% respectively. About 56% farmers received SHC after sowing. The late receipt of SHC does not allow the farmers to follow the recommendations stated in it for the addition of macro and micronutrients. Thus, it becomes crucial to receive SHC well in time.

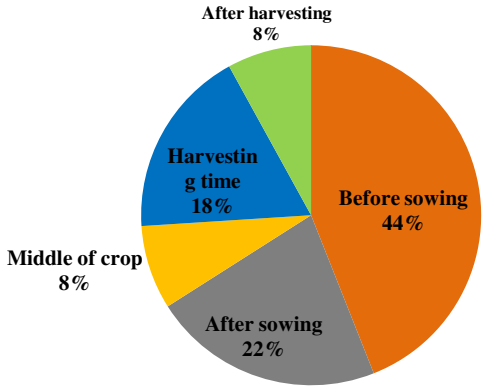

Fig. 4: Soil health card received by the farmers

Farmer's Attitude towards SHC

The attitude of farmers towards SHCS with respect to different aspects in three levels is depicted in Figure 5. From the figure it can be observed that 68% (n=34) farmers feel SHC is a blessing, 52% said it saves input cost with respect to fertilizers and other nutrients. About 64% farmers agree that the scheme is useful; whereas, 86% reported un-useful to illiterate. Fertility status of the field is known is responded by 90% farmers. Overall the attitude of farmers towards this scheme is positive and optimistic. Illiterate farmer's attitude towards the scheme is negative. According to Patel *et al*. (2017) 52% farmers used soil health card for advanced farming and to balance the dose of fertilizer. About one-third respondent reported very low to low adoption of the recommended technology. Some farmers have neutral deposition towards soil health card whereas some have a positive relationship.

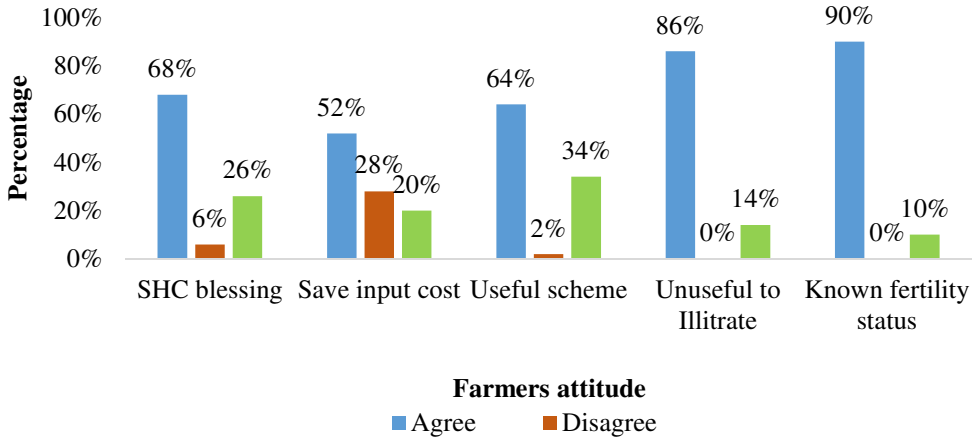

Fig. 5: Farmer's attitude towards SHCS

Constraints Faced by Farmers in Adopting SHC

While adopting SHCS farmers faced some constraints which is depicted in Figure 6 in three categories of high, medium and low. Highest constraint (66%) faced is for unavailability of micronutrients followed by the problem in sending a soil sample to the laboratory (38%) and least difficult (12%) in the calculation of fertilizer dose. In medium category, maximum constraint (68%) is reported as time gap to receive SHC followed by difficulties in calculation of doses (66%) and least (16%) unable to operate internet. In case of low category constraint, unable to operate internet contribute maximum (54%) and least in time gap to receive SHC (14%). The results reported in this study corroborates with Charel (2016) and Mukati (2016). Goyal (2014) pointed out the shortage of trained manpower, obsolete equipment's in laboratories, delay in transportation of samples, illiterate are an additional constraint to achieve the objective of the scheme. Patel (2013) found unavailability of micronutrient status of soil and difficulty in calculating fertilizer dose is a major constraint.

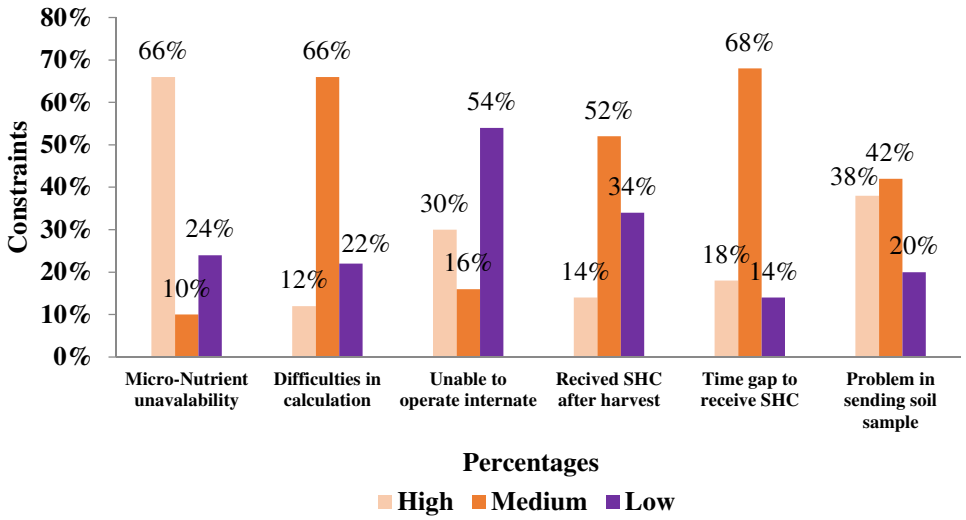

Fig. 6: Constraints faced by farmers in adopting SHCS

Suggestions from Farmers

Farmers after utilizing SHC have made some suggestions for its improvement which is depicted in Figure 7. From the figure, it can be seen that 84% suggestions are for the crop-wise recommended dose of fertilizer (RDF) followed by SHC should be issued prior to crop season (78%) is highly suggested recommendation category. In the case of medium suggestions category, 40% suggestions were made for soil testing laboratory at the administrative block-level followed by SHC to be made easy to understand (26%). Among the least suggested suggestions, 56% recommendations are made for farmers to be trained for soil sampling followed by 22% each in SHC to be made easy to understand and soil testing laboratory at the administrative block-level. Patel (2013) reported crop-wise recommended dose of fertilizer should be given and availability of micronutrients status should be displayed in the soil health card as major suggestions.

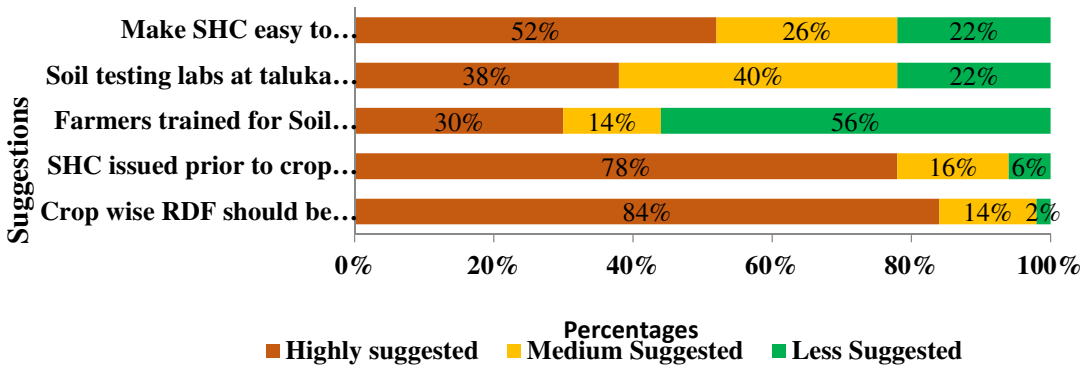

Fig. 7: Suggestions made by farmers for SHCS

About 52% farmers fully agree with an overall reduction in input cost of farming and 20% to some extent. Adopting recommendations as suggested in SHC has resulted in crop productivity increased in the range of 0-20% is reported by 88% farmers. About 86% farmers have reported increase in farm income in the range of 0-20%. In case of nutrients expenses reduction, 50% farmers reported it in the range of 0-20%, while 24% reported increase in nutrient expense. This increase in nutrient expenses can be attributed to absence or low level of micro and macronutrients in the soil. Overall, it can be observed that SHCS has positive impact on the farmers who are availing this scheme.

Conclusion

The study is carried out to evaluate SHCS in Chandrapur district of Central India. From the results obtained in this study, it can be concluded that farmers are aware of the scheme to a lesser extent and the card is not reached to the farmers before sowing activity. The attitude of farmers towards this scheme is positive for some variables. Farmers face numbers of constraints while adopting the scheme. For the overall improvement of the scheme, the numbers of suggestions are suggested by farmers. Contribution of the scheme has resulted in farm production increase and nutrient expense reduction.

The study has a limitation of being conducted in the selected administrative blocks of the district. Inclusion of sample population from other parts of the country with the addition of other evaluation aspects can be helpful to improve in future. The outcome of the study can be used by stakeholders to make necessary improvements in the scheme for its overall effectiveness and empowerment of farmers.

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