Gokhale Institute of Politics and Economics
(Deemed to be University)
Pune – 411 004

AERC Report

Agro-Economic Research Centre (AERC)

Impact of Soil Health Card Scheme on Production, Productivity and Soil Health in Maharashtra

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महाराष्ट्र राज्य कृषि विभाग
कृषि, सहकार व शेतकरी कल्याण विभाग
भारत सरकार
जमीन आरोग्य पत्रिका अभियान

मृद आरोग्य अभियान - जमीन आरोग्य पत्रिका 9/8/2016

प्रयोगशाळा नमुना क्रमांक :-	2729A201600001036	जमीन आरोग्य पत्रिका क्र.	273506434620321
शेतकऱ्यांचे नाव :-		भ्रमणध्वनी :-	
राज्य : महाराष्ट्र, जिल्हा : सांगली, तालुका :	तासगांव	गांव : जुळेवाडी	सर्वे क्रमांक : 21
आधार क्रमांक :		रेखांश :	अक्षांश :

अ.क्र.	गुणधर्म	वाचन	सर्वसाधारण मर्यादा	शेरा	विशेष सल्ला
1	सामु	8.00	6.5 - 7.5	मध्यम अल्कली	जमिनीत सेंद्रिय खते व ताग, धैंचा उडीद, मुग, शेवरी, गिरीसीडीया या हिरवळीच्या खतांचा वापर कराव.
2	क्षारता (मिसा/सेमी)	0.34	0 - 1	साधारण	शिफारस नाही
3	सेंद्रिय कार्बन (टक्के)	0.22	0.40 - 0.60	कमी	
4	स्फुरद (किलो/हे)	6.16	14 - 21	अत्यंत कमी	
5	पालाश (किलो/हे)	85.12	150 - 200	अत्यंत कमी	
6	तांबे (पीपीएम)	13.76	0.20 - 99.99	पुरेसे	
7	लोह (पीपीएम)	29.68	4.5 - 99.99	पुरेसे	
8	जस्त (पीपीएम)	5.26	0.6 - 99.99	पुरेसे	
9	मंगल (पीपीएम)	13.34	2.0 - 99.99	पुरेसे	

पिक निहाय खताची शिफारस

पुढील पिक :	ऊस (आडसाल)	शेणखत :	25.00 टन / हेक्टर	
खताची आवश्यक मात्रा :		नत्र	स्फुरद	पालाश
पीकाची जात :	कोणतीही	500.00	255.00	255.00

रासायनिक खते देण्याच्या वेळा	खताची आवश्यक मात्रा (कि .ग्रॉ./हे.)			
	युरिया	सिंगल सुपर फॉस्फेट	म्युरेट ऑफ पोटॅश	
लागवडीवेळी	108.70	796.88	212.50	100 किलो युरियात 46 किलो नत्र असते. तेव्हा 1 किलो नत्र देण्यासाठी 2 किलो 220 ग्रॅम युरिया द्यावा
लागवडीनंतर 6 - 8	434.78	0.00	0.00	उसेच 100 किलो सिंगल सुपर फॉस्फेटमध्ये 16 किलो स्फुरद असते. तेव्हा 1 किलो स्फुरद देण्यासाठी अंदाजे 6 किलो 250 ग्रॅम सिंगल सुपर फॉस्फेट द्यावे.
लागवडीनंतर 12 - 16	108.70	0.00	0.00	
बांधणीवेळी	434.78	796.88	212.50	100 किलो म्युरेट ऑफ पोटॅशमध्ये 60 किलो पालाश असते. तेव्हा 1 किलो पालाश देण्यासाठी 1 किलो 670 ग्रॅम म्युरेट ऑफ पोटॅश वापरावे.
				करुनी माती परीक्षण ... करुया जमिनीच्या आरोग्याचे रक्षण।

सुपिकता पातळीनुसार वापरावयाची रासायनिक खताची मात्रा

अ.क्र.	सुपिकता पातळी	सेंद्रीय कर्ब	स्फुरद कि/हे	पालाश कि/हे	वापरावयाची खत मात्रा
1	अत्यंत कमी	0.20 पेक्षा कमी	7 पेक्षा कमी	100 पेक्षा कमी	शिफारशीपेक्षा 50 टक्के जास्त
2	कमी	0.21 ते0.40	8 ते 14	101 ते 150	शिफारशीपेक्षा 25 टक्के जास्त
3	मध्यम	0.41 ते 0.60	15 ते 21	151 ते 200	शिफारशीप्रमाणे
4	साधारण भरपूर	0.61 ते 0.80	21 ते 28	201 ते 250	शिफारशीपेक्षा 10 टक्के कमी
5	भरपूर	0.81 ते 1.00	29 ते 35	251 ते 300	शिफारशीपेक्षा 25 टक्के कमी
6	अत्यंत भरपूर	1.00 पेक्षा जास्त	35 पेक्षा जास्त	301 पेक्षा जास्त	शिफारशीपेक्षा 50 टक्के कमी

नोट : हा अहवाल कोर्टाच्या कामासाठी चालणार नाही
जिल्हा मृद सर्वेक्षण व मृद चाचणी अधिकारी, सांगली

July 2017

Submitted to
Department of Agriculture, Cooperation and Farmers Welfare
Ministry of Agriculture and Farmers Welfare
Government of India

AERC/2017

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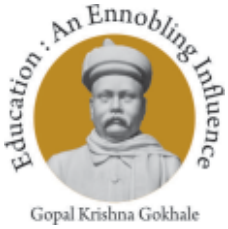

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Submitted to

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Government of India

July 2017

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Foreword

The centrally sponsored Soil Health Card Scheme was launched in February 2015 with a view to increase efficiency of fertiliser usage and for increasing the crop yield. The scheme aims at periodic distribution of soil health cards to all the farmers and provision of information on soil fertility along with recommendations relating to application of nutrients. In view of this, the present study was undertaken to examine the implementation status of the scheme in Maharashtra, awareness about the scheme and impact of the scheme on and yield and net income of the crops.

The analysis of the secondary as well as primary data collected from the field revealed that lot of importance has been given to completion of targets relating to sample collection, testing, printing and distributing cards. However, this has not led to creation of awareness about importance of the scheme and application of recommendations on the soil health card. As a result, this probably led to mere distribution of cards. Though the yield and incomes of soil tested farmers were higher than those of control farmers, the differences were not very high. Perhaps, the differences could have been more if the soil tested farmers were able to follow the application norms printed on the Soil Health Cards.

Therefore the policy implications include creating awareness among the farmers about of Soil Health Card Scheme and Soil Health Cards with focus on interpretation of the card and on conversion of recommended doses of nutrients into doses of fertilisers to be applied. It is felt that there should be more interaction among the farmers and the officials at regular intervals for dissemination of information about recommended doses of fertilisers and their importance in increasing yields of the crops. Soil Health Cards should be distributed in time before the beginning of the season so that the farmers have recommendations about all doses of fertilisers including the basal doses.

The study would be very useful for the researchers as well as the policy makers. I thank Jayanti Kajale and Sangeeta Shroff for undertaking this study.

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Rajas Parchure, Professor and
Officiating Director,
July 2017.

Acknowledgements

This report titled 'Impact of Soil Health Card Scheme on Production, Productivity and Soil Health in Maharashtra' was conducted by the Agro-Economic Research Centre of Gokhale Institute of Politics and Economics, Pune, at the initiative of the Ministry of Agriculture, Government of India, New Delhi. The report was coordinated by ADRTC, Institute for Social and Economic Change, Bangalore. We sincerely thank Dr. Ramappa, who coordinated the study and Dr. Maruthi, Head of ADRTC, for their cooperation and efforts taken in coordinating the study. Our sincere thanks to Shri.P.C.Bodh from the Ministry of Agriculture and Farmers Welfare for his support and guidance throughout the completion of the study.

The study could be completed due to the co-operation and support received by us from many in the Institute. We would like to thank Prof. Rajas Parchure, Officiating Director, Gokhale Institute of Politics and Economics for giving us an opportunity to undertake this project and the motivation provided for completing the work. We also thank Mr. Rajesh Bhatikar, Registrar, for providing us the necessary infrastructure and support.

For writing the report, information had to be collected from various officials. Our thanks to Mr. Sambhaji Kadupatil, Commissioner of Agriculture (Officiating), Government of Maharashtra for the support extended during the study. Special thanks to Mr. Chandrakant Gorad, Deputy Director of Agriculture, Soil Survey and Soil Testing, Government of Maharashtra for providing the necessary secondary data for the study. We are also grateful to the District Superintending Agriculture Officers of the sample districts viz. Sangli and Osmanabad for their cooperation during the survey. We also thank the District Soil Survey Officers and Taluka Agricultural Officers of the sample districts.

We thank all the respondent households for patiently responding to our questionnaire. The field investigators Mr. S. S. Dete and Mr. Ravi Gayakwad collected the primary data. Our sincere thanks to them for their hard work. We thank Mr. Ms. Rukaiya Khan, Mr. Anil Memane and Mr. Mankar for providing statistical assistance. Finally, we thank all our colleagues and staff of the office, computer centre and library for their co-operation.

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July, 2017

Executive Summary

Impact of Soil Health Card Scheme on Production, Productivity and Soil Health in Maharashtra

Soil test based application of fertilisers is extremely important for increasing efficiency of fertiliser usage and increasing the crop yield. The centrally sponsored Soil Health Card Scheme (SHCS) was launched in February 2015 with a view to provide soil health cards (SHCs) periodically to the farmers. A SHC reports test values of various parameters such as micro and macro nutrients, organic carbon and soil pH. Depending upon these values, soil is rated and recommendations relating to application of nitrogen (N), Phosphorous (P) and Potash (K) are given for various crops. The application of recommended doses of fertilisers (RDF) therefore is expected to improve health and productivity of the soil.

Maharashtra is one of the economically leading states of India. However as per 2011 census, still about 52.71 percent of workforce is engaged in this sector which contributes merely around 8 percent to the state domestic product indicating lower productivity of the state soil. In addition to this, various factors such as increasing input costs, poor irrigation facilities, marginalization of landholdings, weak supply chains have been constraining the performance of the agricultural sector of the state and the farmers are unable to obtain satisfactory income.

In view of this, implementation of the SHCS is expected to reveal soil deficiencies in the state and improve nutrient application thereby increasing the capacity of the soil to increase crop yield. This study therefore focusses on implementation as well as adoption of SHCS in Maharashtra.

Major Objectives and Scope of the Study

1. To document the status and implementation of Soil Health Card Scheme in Maharashtra
2. To analyze the impact of adoption of soil testing technology and recommended doses of fertilizers on the basis of Soil Health Cards on crop production, productivity and soil health in Maharashtra.

Data and Methodology

The study is based on secondary as well as primary data collected from the field. Secondary data relating to the status and implementation of the scheme was collected from the office of Commissioner Agriculture, Government of Maharashtra, Pune. Two

districts based on the implementation status of the scheme were to be selected. Based on the discussions with the state level officials districts Sangli from western Maharashtra region and district Osmanabad form central Maharashtra (Marathwada region) were selected. From each of the districts, two taluks/tehsils were selected. From each of the selected talukas, two villages were selected. In one of these two, testing of soil had been over and cards were distributed in the beginning of rabi season of 2015-16. Therefore, soil tested farmers were selected randomly from this village. The other village was a village where soil testing was yet to be conducted**.** Therefore control farmers were selected randomly from this village**.**

From each of the talukas a sample of 15 soils tested farmers (STFs) and 15 control farmers (CFs) were selected. Thus, in all, 60 farmers per district and a total of 120 farmers for the state as a whole were selected. Since the scheme is not specific to any crops, data was collected for three major crops of each of the sample farmers for analysing implementation status of SHCS. While selecting the households care was taken to have representation of the farmers belonging to different farm size groups based on operational land holdings. The reference period for the study was Rabi 2015-16 as soil health cards were distributed in the state during the rabi season.

Major Findings of the Study

Major Findings arising from the Analysis of the Secondary Data are as Follows:

- The official data on distribution of SHCs shows that more than 39 lakh and more than 81 lakh SHCs were issued to the farmers at the state level in 2015-16 and 2016-17 respectively. This constitutes 85 percent and 89 percent of the target set for distribution.
- The classification of districts according to the combined (for the two years) percentage of SHCs issued shows that in Raigad, the progress was less than 50 percent. In all, in 10 districts, the progress was below 80 percent. In majority i.e. 24 districts, the progress was more than 80 percent and in 9 districts, the targets were overachieved (more than 100 percent).
- The districts wherein targets have been overachieved were from Nasik and Kolhapur divisions.
- The data shows that in a number of districts, the targets have not been met and this suggests need for strengthening of the distribution machinery.

Major Findings arising from the Analysis of the Primary Data are as Follows:

- **Socio-economic Characteristics of Sample Households**

- Both the categories of farmers had similar demographic characteristics. Average years of age were 47.3 and of education were 9 years. Overall, around 98 percent of the respondents were male respondents. The social composition of the households showed that most of the households (86 percent) belonged to the 'general' category of farmers.
- Agriculture was the main occupation for all the sample households. The average area of land owned was 6.2 acres and the net operated area was 5.8 acres. The size of land owned was larger (7.1 as compared to 5.4 acres) in case of STFs. The net operated area was also larger (6.2 acres as compared to 5.2 acres) in case of STFs.
- The proportion of land irrigated was around 53 percent for both the categories of farmers indicating that 46 percent of the total land is unirrigated. Overall, major sources of irrigation were dug well (47.5 percent) as well as bore well (55 percent).
- The cropping pattern of both the categories of farmers was broadly similar. The major kharif crops were jowar and soybean that occupied almost 75 percent of the total kharif area of total sample households. Gram, rabi jowar and wheat were the major rabi crops occupying around 90 percent of the rabi area of the sample farmers. Sugarcane and horticultural crops were important perennial crops of the sample households. However, for CFs, sugarcane was the most important crop and for STFs, along with sugarcane, horticultural crops were also important.

- **Gross Income by Agricultural Production**

- Though yield and income of STFs were higher than the of CGFs, the differences were not very high. Similarly, these differences could also be explained in terms of differences in the prices of inputs and products.

- **Awareness on SHC Scheme**

- In relative terms, the STFs were more aware than the CFs about Integrated Nutrient Management, Soil Health Mission and Soil Health Card Scheme.
- 98 percent of the STFs were aware about SHCs as they were the beneficiaries of SHCs.
- However, only around 55 percent of the STFs were aware about Integrated Nutrient Management and imbalanced application of fertilisers.

- Only 4 (6.7 percent of the) STFs had attended fertiliser training programmes of any type.

➢ **Adoption of Recommended Doses of Fertilizers on Soil Test Basis**

- Analysis of the data revealed gaps between the actual applied quantity of various fertilisers and the recommended doses of fertilisers (RDF) which were based on the soil test results for the sample crops.
- For gram in case of majority of the fertilisers, applied doses were greater than the RDF.
- For the other two crops- wheat and gram, however, applied doses were less than the RDFs.
- Among various organic fertilisers, the farmers applied only farm yard manure (FYM) for all the three major crops.
- The per acre expenditure of the farmers on FYM ranged between Rs.5800 and Rs. 6888.

➢ **Problems Encountered during Implementation of the Scheme**.

- Out of a total of 60 STFs, only 39 farmers responded to the question relating to problems encountered during implementation.
- 35 percent of the farmers reported that they did not face any problem. It appeared that they were unable to report any problem probably because their awareness about the scheme was very low.
- 17 percent of those who replied felt that they did not have proper information about SHCS.
- 18 percent of the farmers felt that they had problem in understanding/ reading information given on the SHCs. This indicated that farmers could not understand and accordingly apply the RDF. It was revealed that the farmers had difficulty in converting the recommended doses of NPK into application in terms of quantities of simple and complex fertilisers available in the market.
- 13 percent of the farmers said that soil sample was not collected from each farmers' land which indicated that the farmers did not have any idea about the scheme and the grid method of soil sample collection. As a result of this method of soil sample selection, in case of many farmers, soil sample was not taken and SHCs were directly distributed. This method could not ensure dissemination of information about the scheme as well as the cards as this did not lead to

interaction of the farmers with the government officials about the scheme as well as the SHC.

- 5 percent of the farmers reported that the farmers did not use RDF not only because of low level of awareness about the scheme/ card but also because it was also dependent on various factors such as availability of water, economic status of the farmers etc.
- 12 percent of the farmers reported that they did not get SHC reports in time i.e. before the sowing season and as a result, basal dose could not be given as per the RDF.
- Overall, the analysis of the secondary as well as primary data collected from the field revealed that lot of importance was given to completion of targets relating to sample collection, testing, printing and distributing cards. However, this did not lead to creation of awareness about SHCS and SHCs. As a result, this probably led to mere distribution of cards.

➢ **Suggestions Given by the Farmers regarding Implementation of SHCS**.

- As 35 percent of the farmers did not report any problem, they did not have any suggestion to offer.
- Out of the remaining farmers, 32 percent suggested that there was a need for creating awareness about the scheme and usage of SHCs.
- 8 percent of the farmers had a suggestion for the other farmers. According to them, all farmers should apply the RDF which would have positive impact on crop production.
- As farmers were not aware of the grid system, 13 percent of the farmers felt that soil sample should be collected from each farmer's land.
- 12 percent of the farmers suggested that the SHCs should be distributed on time.

➢ **Impact of Application of RDF**

- Majority of those who responded felt that increase in crop yield (more than 90 percent of the farmers) and improvement in crop growth (more than 70 percent of the farmers) were the most important and important visible changes after application of RDF.
- Majority of the farmers probably did not feel that there was any visible change in incidence of pests and diseases and costs of other inputs and therefore did not respond.

- Again, as was observed from the data, for all the crops, the applied quantity of fertilisers was either less or more than the RDF.
- Perhaps the visible changes in the yield and other parameters could have been important for more number of farmers if the farmers had followed the application norms (RDF).

➢ **Impact on Cost of Cultivation after Soil Testing**

- The before and after figures of the quantities applied of the inputs show that in case of some inputs there was a decline and in case of some inputs there was an increase after soil testing. However, the changes were marginal in case of all the three crops.
- It was observed that the increase in net income for all the crops was mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.
- For comparing the extent of increase in gross income as well as total cost for each crop, Benefit Cost Ratio (BCR) was calculated for both the time periods- before and after soil testing. It was observed that for all the three crops, the BC ratio was higher after soil testing was done as compared to the earlier period.
- BC was also found for the difference in values of gross income and total cost in the two time periods. This shows the extent to which the incremental income is higher than the incremental costs. The BC ratio of the difference was 4.86, 3.68 and 1.92 for jowar, gram and wheat respectively. As is mentioned above, the increase in income is mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.
- The difference in terms of percentage change was found. It is observed that the net income increased by more than 50 percent for jowar and wheat and by around 22 percent in case of gram. However, as was already observed, the increase was mainly on account of increase in product prices and cannot perhaps be attributed to increase in the yield of the crop. Thus, there may not be direct relationship between improvement in soil health due to soil testing and yield level of the concerned crop after soil testing.

Policy Suggestions

Based on the analysis of the data, following policy implications emerge

- Efforts should be made to create awareness about of Soil Health Card Scheme, the grid system of soil sample collection, Soil Health Cards and Integrated Nutrient Management and their importance among all farmers. The focus should be on interpretation of soil health card and on conversion of recommended doses of nutrients into doses of fertilisers to be applied.
- Farmers should be compulsorily given training about application of various fertilisers before the beginning of the season and during the season so that the recommendations about fertiliser doses based on changing climatic conditions and availability of water can be given.
- The analysis of the data revealed that the actual applied doses of fertilisers were not equal to recommended doses. Similarly, the difference in yield and income before and after soil testing was not very large. Therefore, it is felt that there should be interaction among the farmers and the officials at regular intervals for dissemination of information about recommended doses of nutrients and their importance in increasing yields of the crops.
- Soil Health Cards should be distributed in time before the season starts so that the farmers have recommendations about basal doses also.

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Chapter 1

Introduction

1.1 Background

Testing of soil is an integral part of fertiliser management policy. It is well known that Indian soils have become deficient not only in major nutrients such as N (nitrogen), Phosphorous (P) and Potassium (K) but also in secondary as well as micro nutrients. Deficiency of micronutrients during the last three decades has grown in both, magnitude and extent because of increased use of high analysis fertilizers, use of high yielding crop varieties and increase in cropping intensity and has adversely affected production and productivity of crops (http://www.nfsm.gov.in/Micronutrient.pdf). Therefore, it is extremely essential to arrest the declining soil health by judicious application of various nutrients.

Testing of soil reveals its characteristics and nutrient deficiencies. Depending upon the extent of deficiencies revealed through testing, if soil is supplemented with nutrients required for a particular cropping pattern, the productivity of the soil would be enhanced. Therefore, soil test based application of fertilisers is extremely important for increasing efficiency of fertiliser usage and increasing the crop yield. The Soil Testing Programme was started for the first time in India in 1955-56 and 16 soil testing laboratories were set up under 'Determination of Soil Fertility and Fertility Use' programme.

Before the implementation of centrally sponsored Soil Health Card Scheme (SHCS) in February 2015, some of the states were issuing Soil Health Cards (SHCs) to the farmers. However, there were no uniform norms / guidelines for soil sampling, testing and distribution of SHCs. Therefore, the scheme was launched with a view to promote soil test based nutrient management for increasing nutrient use efficiency. The scheme aims at periodic distribution of SHCs to all the farmers to provide information on soil fertility along with recommendations relating to application of nutrients. A Soil Health Card (SHC) reports the test values of various parameters such as micro and macro nutrients, organic carbon and soil pH. Depending upon these values, soil is rated and recommendations relating to application of N, P K are given for various crops. The application of recommended doses of fertilisers (RDF) therefore is expected to improve health and productivity of the soil.

State wise targets and achievement of the SHCS implemented in 2015-16 are presented in table 1.1.

Table 1.1: Status of Soil Health Card Scheme for Distribution of Soil Health Cards (SHCs) as on 02.05.2017 (In lakhs)

Sl.No	State	Total Target for Printing & Distribution of SHCs for Cycle-I (2015-16 & 2016-17)	Cumulative No. of SHCs Distributed up to 02.05.2017	Percent Progress of SHCs Distributed
I.	**South Zone**			
1	Tamil Nadu	70.47	64.64	91.73
2	Andhra Pradesh	74.55	53.15	71.29
3	Telangana	57.21	32.83	57.38
4	Kerala	7.05	3.88	54.96
5	Karnataka	92.10	50.56	54.90
II.	**West Zone**			
6	Chhattisgarh	38.91	40.29	>100.00
7	**Maharashtra**	**129.77**	**119.09**	**91.77**
8	Goa	0.25	0.20	81.49
9	Madhya Pradesh	127.94	54.64	**42.71**
10	Rajasthan	127.61	40.05	**31.38**
11	Gujarat	87.87	24.74	28.16
III.	**North Zone**			
12	Himachal Pradesh	3.85	5.34	>100.00
13	Uttarakhand	7.50	7.02	93.58
14	Uttar Pradesh	263.91	80.13	**30.36**
15	J & K	9.14	2.50	27.35
16	Haryana	43.61	10.81	24.78
17	Punjab	46.20	6.83	14.79
IV.	**East Zone**			
18	Bihar	72.36	38.59	53.33
19	Odisha	36.97	19.26	52.09
20	West Bengal	71.90	27.38	38.08
21	Jharkhand	6.38	2.17	34.00
V.	**NE Zone**			
22	Nagaland	1.85	1.85	100.00
23	Sikkim	0.46	0.46	100.00
24	Mizoram	0.12	0.08	68.55
25	Tripura	1.81	1.06	58.46
26	Meghalaya	2.10	0.90	43.01
27	Assam	15.41	1.46	9.46
28	Arunachal Pradesh	1.14	0.10	8.52
29	Manipur	1.15	0.05	4.67
VI.	**Union Territories**			
30	Puducherry	0.20	0.20	100.00
31	Andaman & Nicobar	0.08	0.02	24.59
32	Chandigarh	0.003	0.00	0.00
33	Dadara Nagar & Haveli	0.12	0.00	0.00
	Total	1399.96	690.27	49.31

Source: http://www.soilhealth.dac.gov.in/

The table shows zone wise and state wise target for printing and distribution of SHCs and the SHCs distributed up to May 2017. It is observed that 100 percent SHCs are distributed in states of Chhattisgarh, Himachal Pradesh, Nagaland and Sikkim.

These states are followed by Tamil Nadu, Maharashtra and Uttarakhand. It is observed that the target set for printing and distribution of SHCs is highest for Uttar Pradesh which ranks highest in terms of population. It is followed by states such as Maharashtra, Madhya Pradesh and Rajasthan. Among these 4 states, the share of Uttar Pradesh in total target set at all India level is around 19 percent. It is followed by Maharashtra with a share of 9.27 percent. It is observed that the percentage of progress of SHCs distributed is around 92 percent in this state. Thus from the secondary data, among the bigger and developed states, Maharashtra emerges as the state with better progress in terms of SHC distribution.

Maharashtra is one of the economically leading states of India. However, the agricultural sector of Maharashtra presents a dismal picture. As per 2011 census, about 52.71 percent of workforce is engaged in this sector while contribution of this sector to state domestic product is fast declining and is now only a single digit figure of 7.7 percent indicating lower productivity of the state soil. In addition to this, various factors such as increasing input costs, poor irrigation facilities, marginalization of landholdings, weak supply chains, have been constraining the performance of the agricultural sector of the state and the farmers are unable to obtain satisfactory income.

In view of this, implementation of the SHCS is expected to reveal soil deficiencies in the state and improve nutrient application thereby increasing the capacity of the soil to increase crop yield. This study focusses on the implementation as well as adoption of SHCS in Maharashtra.

Table 1.2 presents the district wise soil health card progress report for the years 2015-16 and 2016-17 for Maharashtra. It is observed that for Maharashtra as a whole, the share of soil sample tested to that collected was 105 percent and 107 percent in 2015-16 and 2016-17 respectively. For majority of the districts, this percentage was more than 90 percent in both the years. It was also observed that the percentage share of SHC issued was higher for the agriculturally developed divisions of western Maharashtra viz. Pune and Kolhapur (around 35 percent in both the years). This could be because of the smaller size of landholdings prevalent in this region.

Table 1.2: District wise Soil Health Card Progress Report for Maharashtra

		2015-16			2016-17			2015-16 and 2016-17
Sr. No.	Name of District/ Division	Share of sample tested to that collected in districts (%)	% share of districts in distribution of total SHC	% of SHCs issued to the target	Share of sample tested to that collected in districts (%)	% share of districts in distribution of total SHC	% of SHCs issued to the target	SHCs issued %
1	Thane	72	1	68	82	1	100	84
2	Palghar	204	1	102	413	1	50	60
3	Raigad	87	1	44	90	1	42	43
4	Ratnagiri	91	3	73	97	2	58	63
5	Sindhudurga	184	2	94	275	2	85	88
KOKAN		102	3,16,723*	72	92	547819	62	65
6	Nasik	100	6	101	127	5	101	101
7	Dhule	111	3	160	97	1	73	102
8	Nandurbar	122	2	149	96	1	63	92
9	Jalgaon	100	3	86	104	4	111	103
NASIK		104	5,41,149*	111	111	936033	96	101
10	Ahemadnagar	128	5	59	121	7	86	77
11	Pune	112	4	71	100	5	132	105
12	Solapur	109	7	125	109	5	100	108
Pune		117	6,42,341*	81	113	1419803	101	94
13	Satara	95	8	108	123	7	101	103
14	Sangli	105	6	137	107	5	105	116
15	Kolhapur	90	5	90	114	5	97	94
KOLHAPUR		99	7,46,832*	110	105		101	104
16	Aurangabad	108	3	70	143	3	71	70
17	Jalna	104	4	110	106	3	84	93
18	Beed	91	2	37	92	4	74	62
AURANGABAD		101	3,54,312*	67	113	803283	76	73
19	Latur	127	3	104	124	3	96	99
20	Osmanabad	116	3	107	179	4	141	130
21	Nanded	98	3	61	114	3	66	65
22	Parbhani	138	2	82	83	2	80	81
23	Hingoli	100	1	61	84	2	102	88
LATUR		116	5,18,576*	82	120	1171645	93	89
24	Buldhana	100	4	101	107	5	142	128
25	Akola	99	1	68	99	2	97	87
26	Washim	103	2	101	101	1	76	84
27	Amravati	93	2	68	103	3	99	88
28	Yeotmal	100	2	69	86	3	113	98
AMRAVATI		99	4,46,894*	81	97	1219784	110	100
29	Wardha	100	1	56	119	1	68	64
30	Nagpur	98	1	51	104	2	82	71
31	Bhandara	100	2	104	98	1	73	84
32	Gondia	100	2	87	102	1	44	58
33	Chandrpur	68	2	74	89	2	100	91
34	Gadchiroli	100	1	104	106	1	88	93
NAGPUR		92	3,48,574*	77	101	694212	77	77
MAHARASHTRA		105	39,15,401	86	107	81,61,726	91	89

Note : * =Absolute number of SHCs distributed

Source: Office of the Commissioner Agriculture, GoM, Pune

The data on distribution of SHCs shows that more than 39 lakh and more than 81 lakh SHCs were issued to the farmers at the state level in 2015-16 and 2016-17 respectively. This constitutes 85 percent and 89 percent of the target set for

distribution. Nasik and Kolhapur are the divisions in which the performance of districts shows that the targets have been more than achieved.

However, in a number of other districts, the targets have not been met and this suggests need for strengthening of the distribution machinery. The classification of districts according to the combined (for the two years) percentage of SHCs issued is shown in table 1.3. It is seen that in Raigad, the progress is less than 50 percent. In all, in 10 districts, the progress is below 80 percent. In majority i.e. 24 districts, the progress is more than 80 percent and in 9 districts, the targets are overachieved (more than 100 percent).

Table 1.3: Classification of Districts as per the percentage of SHCs issued to the Targets Set.

% of SHCs issued to the targets set	Below 50 %	50 to 60 %	60 to 70 %	70 to 80 %	80 to 90%	90 to 100 %	Above 100%
No. of Districts	1	2	5	2	8	7	9
Districts	Raigad	Palghar Gondia	Ratnagiri , Beed, Nanded, Aurangabad Wardha	Ahmednagar, Nagpur	Thane, Sindhudurg, Parbhani, Hingoli Akola, Washim, Amravati, Bhandara	Nandurbar, Kolhapur, Jalna, Latur, Yeotmal, Chandrapur, Gadchiroli	Nasik, Dhule, Jalgaon, Pune, Solapur, Satara, Sangli, Osmanabad, Buldhana,

1.2 Review of literature

The recent studies focusing on impact of soil testing and distribution of SHCs in various regions across the country point out usefulness and need for such a scheme. However, the studies reveal major constraints in adoption of soil management practices. Inability of the farmers to interpret recommendations on SHCs is considered to be one of the major constraints (Mohapatra and Kameswari, 2014;Goyal). Thus, this indicates importance of not only physical infrastructure for implementation of the scheme to be implemented but also of creating awareness about the scheme and usage of SHCs among the farmers.

1.3 Major Objectives and Scope of the Study

1. To document the status and implementation of soil health card scheme.
2. To analyze the impact of adoption of soil testing technology and recommended doses of fertilizers on the basis of SHCs, on crop production, productivity and soil health.

1.4 Data and Methodology

The present study is based on secondary as well as primary data collected from the field. Secondary data relating to the status and implementation of the scheme was collected from the office of Commissioner Agriculture, Government of Maharashtra, Pune. Two districts based on the implementation status of the scheme were to be selected. Based on the discussions with the state level officials districts Sangli from western Maharashtra region and district Osmanabad form central Maharashtra (Marathwada region) were selected. From each of the districts, two taluks/tehsils were selected. From each of the selected talukas, two villages were selected. In one of these two, testing of soil had been over and cards were distributed in the beginning of rabi season of 2015-16.Therefore soil tested farmers were selected randomly from this village. The other village was a village where soil testing was yet to be conducted**.** Therefore control farmers were selected randomly from this village**.**

From each of the districts a sample of 15 soil tested farmers and 15 control farmers were selected. Thus, in all, 60 farmers per district and a total of 120 farmers for the state as a whole were selected. Since, the scheme is not specific to any crops, data was collected for three major crops of each of the sample farmers for analysing implementation status of SHCS. While selecting the households care was taken to have representation of the farmers belonging to different farm size groups based on operational land holdings. The reference period for the study was Rabi 2015-16 as soil health cards were distributed in the state during the rabi season.

Table 1.4: Sampling Design

District 1	Sangli				Total
Taluka	Miraj	Miraj	Tasgaon	Tasgaon	
	Control group	Soil tested group	Control group	Soil tested group	
Villages	Dhavli	Mhaisal	Poonadi	Arawade	4
Sample size	15	15	15	15	60
District 2	Osmanabad				
	Osmanabad	Osmanabad	Tuljapur	Tuljapur	
Villages	Ambehol	Khanapur	Barul	Teerth budruk	4
Sample	15	15	15	15	60
Grand total					120

1.5 Limitations of the Study

The study is mainly discusses awareness of the farmers about soil health card scheme and the soil health cards and their perceptions about change in output, yield, costs etc. after they received soil health cards. It can be noted that changes in theses variables after receiving SHCs as compared to the earlier period (before distribution) could have taken place due other factors also. Also, the study does not refer to the scientific evidence relating to fertiliser usage and RDF. Hence, care should be taken while interpreting these results as outcome of application of SHCs.

1.6 Chapter Stream

Chapter 1 on introduction is followed by chapter two in which socio economic characteristics of the sample households are discussed. Chapter three studies the awareness of the households about soil health card scheme. Chapter four focusses on responses of the farmers relating to the application of recommended doses of fertilisers as mentioned on the soil health cards. Chapter five studies changes in the cost of cultivation, yield , income, crop growth etc. after distribution of soil health cards. Chapter 6 presents conclusions and policy implications.

Chapter 2

Socio-Economic Characteristics of the Sample Households

2.1 General Characteristics

It can be seen form table 2.1 that both the categories of farmers have similar demographic characteristics. Average years of age are 47.3 years and of education is 9 years. This means that most of the respondents have taken education up to 8th or 9th standard. Overall, around 98 percent of the respondents were male respondents.

Table 2.1: General Characteristics of sample households

	Particulars	Control Farmers	Soil tested farmers	Total
1	Average age of respondents	46	48	47.3
2	Average years of education of respondents	8	10	9
3	Agriculture as main occupation	100	100	100
4	Gender (% of respondents)			
	Male	100	95	97.5
	Female	0	5	2.5
5	Average family size	7	6	7
6	Average number of people engaged in farming	3.1	2.7	3
7	Average years of experience in farming	24.6	24.8	24.7
8	Caste (% of respondents)			
	SC	5	13.3	9.2
	ST	0	0	0
	OBC	5	3.3	4.2
	NT	0	1.7	0.8
	General	90	81.7	85.8

Another major feature is that agriculture is the main occupation for all the sample households. The social composition of the households shows that most of the households belong to the 'general' category of farmers. Overall, around 86 percent of the farmers belong to the general category. The share of reserved category farmers was very low i.e. only 5 percent and 13 percent in case of CFs and STs respectively.

2.2 Landholdings

Table 2.2: Average Operational Landholdings of Sample Households (acres)

	Particulars	Control Farmers	Soil tested farmers	Overall
1	Owned land	5.4	7.1	6.2
2	Leased in	0.2	0	0.1
3	Leased out	0	0	0
4	Uncultivated land	0.4	0.8	0.6
5	Rental value of leased in land (Rs/acre)			
	Irrigated Land	233.3	0	116.7
	Unirrigated Land	0	0	0
6	Rental value of leased out land (Rs/acre)			
	Irrigated Land	0	0	0
	Unirrigated Land	0	0	0
7	Total average irrigated land	2.8 (53.85 %)	3.3 (53.23%)	3.1 (53.45)
8	Total average un-irrigated land	2.4 (46.15%)	2.9 (46.77%)	2.7 (46.55)
9	Net operated land (acre)	5.2 (100)	6.2 (100)	5.8 (100)

It can be seen from table 2.2 that the average area of land owned is 6.2 acres and the net operated area is 5.8 acres. The size of land owned and of net operated area is larger in case of STFs. The proportion of land irrigated is around 53 percent for both the categories of farmers indicating that 46 percent of the total land is unirrigated.

2.3 Sources of Irrigation

Table 2.3 shows data on sources of irrigation. It is seen that overall, major sources of irrigation are dug well (47.5 percent) as well as bore well (55 percent). It is also seen that the percentage of STFs with these sources is higher than in case of CFs. The households have not reported canal as a source of irrigation. The table indicates that farmers mainly have to rely on private sources for irrigation.

Table 2.3: Sources of Irrigation of Sample Households (Percentage of farmers)

	Particulars	Control Farmers	Soil tested farmers	Overall
1	Dug well	35	60	47.5
2	Bore well	43.3	66.7	55
3	Canal	0	0	0
4	Tank	13.3	3.3	8.3
5	Others *River (Lift Irrigation)	20	8.3	14.2

Note: *Multiple answer/responses received

2.4 Cropping Pattern

Table 2.4 shows that the cropping pattern of both the categories of farmers is broadly similar. The major kharif crops were soybean and jowar that occupied almost 75 percent of the total kharif area of total sample households. Tur was the third most important kharif crop.

In case of rabi crops, for both the category farmers, gram, rabi jowar and wheat were the major crops occupying around 90 percent of the rabi area of the sample farmers. In case of perennial crops, sugarcane and horticultural crops were important crops of the sample households. However, for CFs, sugarcane was the most important crop and for STFs, along with sugarcane, horticultural crops were also important.

Table 2 .4 : Cropping Pattern of the Sample Households (Area in acres)

Season	Area	Control Farmers	Soil Tested Farmers	Total
Kharif	Jowar	28.5 (19.55)	32.75 (16.48)	61.25 (17.78)
	Moong	4 (2.74)	8 (4.03)	12 (3.48)
	Soyabean	79.25 (54.37)	117.75 (59.25)	197 (57.18)
	Tur	18.75 (12.86)	15.75 (7.92)	34.5 (10.01)
	Groundnut	0 (0)	4.5 (2.26)	4.5 (1.31)
	Udid	15.25 (10.46)	20 (10.06)	35.25 (10.23)
	Total	145.75 (100)	198.75 (100)	344.5 (100)
Rabi	Gram	43.8 (31.91)	49.25 (26.96)	93.05 (29.08)
	Groundnut	4 (2.91)	9 (4.93)	13 (4.06)
	Jowar	58.58 (42.68)	93.25 (51.04)	151.83 (47.46)
	Maize	5.12 (3.73)	5.58 (3.05)	10.7 (3.34)
	Wheat	25.75 (18.76)	25.62 (14.02)	51.37 (16.06)
	Total	137.25 (100)	182.7 (100)	319.95 (100)
Perineal	Sugarcane	35 (70.86)	23.75 (50.53)	58.75 (60.95)
	Fruits and Vegetables	14.39 (29.14)	23.25 (49.47)	37.64 (39.05)
	Total	49.39 (100)	47 (100)	96.39 (100)

Note: Figures in parenthesis are percentages to season category total)

2.5 Gross Income by Agricultural Production

Data relating to crop wise production, productivity and income obtained was collected from both the categories of farmers for kharif, rabi and perennial crops. It is observed from table 2.5 that though there are differences in yield and income of CGFs, and STFs, the differences are not very high. Similarly differences in gross income can also be explained in terms of differences in the price received for the product. Among the kharif crops, income obtained was higher for the STFs in case of moong, soybean and tur. For rabi crops, income was higher for STFs in case of gram, groundnut, jowar and wheat. Highest income was obtained by commercial perennial crops such as sugarcane and horticultural crops.

Table 2.5: Gross Income Realized by the Sample Households by Agricultural Production

Season	Crops	Control farmers						Soil tested farmers					
		% of farmers cultivat--ing the crop	Yield Per acre	Total Avg. production per household (Qtls)	Total Avg. qty sold (Qtls)	Avg. price (Rs/ Qtl)	Avg. income obtained (Rs per acre)	% of farmers cultivating the crop	Yield Per acre	Total Avg. production per household (Qtls)	Total Avg. qty sold (Qtls)	Avg. price (Rs/ Qtl)	Avg. income obtained (Rs per acre))
Kharif	Jowar	7	3.4	6.7	5.5	1602	10036	5.1	3.2	10	5.9	2030	9338
	Moong	2.5	1.4	1.1	1.1	3655	**5025**	2.5	1.9	2.5	1.8	5553	**10813**
	Soyabean	12.9	4.4	13.3	13.2	3302	14984	11.9	4.6	19.2	18.2	3325	15630
	Tur	5.5	1.7	2.9	2	7953	**14016**	3.8	2.5	4.4	3.4	7641	**19632**
	Groundnut	0	0	0	0	0	0	0.8	3	6	3	5167	17300
	Udid	4	4.3	8.3	6.9	5761	**25184**	5.5	2.9	4.4	3.8	5520	**16115**
Rabi	Gram	18.4	3.4	3.4	2.5	5005	17079	21.2	3.4	3.2	2.2	5171	18044
	Groundnut	1.5	2.9	3.9	2.9	5207	17100	3.4	4.3	4.1	1.8	4897	22087
	Jowar	19.4	3.1	4.3	4.3	1740	9924	22.0	3.4	6.2	1.8	1874	11176
	Maize	2	10.9	14	11.5	1321	20098	2.5	12.1	12.7	10	1332	18508
	Wheat	11.9	7.5	7.1	2.8	2016	15462	9.3	7.9	7.7	3.3	2009	16323
Perinnial	Sugarcane	6.5	43.7	117.7	116.5	2292	**100711**	5.1	42.8	77.6	77.6	2462	**105740**
	Fruits and Vegetables	8.5	8	6.7	6.3	7064	**57525**	6.8	25.6	43.6	43.3	4744	**121523**

Concluding Remarks

The analysis showed that both the categories of farmers had overall similar demographic and socio economic characteristics. The cropping pattern of both the categories of farmers was broadly similar. Though there were differences in yield and income of CGFs and STFs, the differences were not very high. Similarly differences in gross income could also be explained in terms of differences in the price received for the product.

Chapter 3

Status on Awareness on SHC Scheme

3.1 Awareness on Soil Testing

Table 3.1 shows responses of the households to questions on awareness on soil testing. It is found that overall, only about 36 percent of the households were aware of integrated nutrient management (INM). Out of the STFs, only about 55 percent were aware. This percentage is low considering the fact that their soil had been tested. Out of the CFs, only around 17 percent were aware of the INM. Majority of the STFs were aware of soil health mission (SHM) and SHC but not about the grid system under SHCS. Only 20 percent of the STFs were aware about the grid system. No farmer from the CF category was aware about the grid system. It can be noted that though majority of the STF households were aware about the schemes, only 33 percent of these households experienced reduction in chemical fertilisers. As for the CFs, the percentage of households that aware about the SHM and SHCS was less than 50 percent and no household from this category experienced reduction in consumption of chemical fertilisers due to INM.

Table 3.1: Awareness on Soil Testing among Sampling Households (% of farmers)

	Particulars	Control farmers	Soil tested farmers	Total
1	Households know about INM	16.7	55	35.8
2	Households experienced the reduction in consumption of chemical fertilizers due to INM	0	33.3	16.7
3	Households awareness on imbalanced application of fertilizers and its effects	15	55	35
4	Households knowledge about ongoing programmes on Soil Health Mission	36.7	95	65.8
5	Households aware of Soil Health Cards	41.7	98.3	70
6	Households awareness on grid system under SHC scheme	0	20	11.7

It was thus observed that the overall, the extent of awareness regarding INM, SHM, SHCS and SHCs was more in case of the STFs.

3.2 Sources of Information about Soil Testing

As far as sources of information on soil testing are concerned, responses show that the major source of information has been the agricultural department. In case of CFs, Gram panchayat and neighbours also have been the minor sources of information.

Table 3.2: Sources of Information about Soil Testing (% of farmers)

	Sources	Soil tested farmers	Control farmers
1	SAUs	0	0
2	KVKs	5	0
3	Private companies	0	0
4	Agriculture department	96.7	88.46
5	Friends	3.3	0
6	Gram-panchayat	5	11.54
7	Neighbors	5	7.69

Note: *Multiple responses received

3.3 Training Programs Attended on Application of Chemical Fertilizers

The percentage of training programmes attended by the households was very low. The details are presented in table 3.3.

Table 3.3: Training Programs Attended on Application of Chemical Fertilizers

	No. of farmers attended	Organised by	Name of the programme	Year when attended	Duration (Hrs)
1	STF 1	Dept. of Agriculture	Fertiliser Managemet	June 2016	3
	STF 2	Grape Association	Grape Managemet	2015	1
	STF 3	Vasantdada Sugar Institute	Sugarcane Managemet	2009	11
	STF 4	KVK	-	2015-16	3
2	% of Farmers attended	6.67			
3	Average number of Hours	4.5			

Only 4 or 6.7 percent of the STFs attended the training programmes and the average number of hours per household was 4.5.Only one farmer had attended

training programme organized by the state department of agriculture. This underlines need for creating awareness among the farmers about fertiliser training programmes.

3.4 Method of Application of Fertilizers

All the farmers were asked questions regarding the method of application of various fertilisers. Tables 3.4a and 3.4b show the method of application of fertilisers in case of STFs and CFs respectively. It was observed that for different fertilisers, different methods of application were used by the households. For urea and SSP, majority of the households adopted broadcasting method. In case of DAP and complex fertilisers, application was mainly through drilling as well as broadcasting. Potash was applied by fertigation method by all the households which used it. In case of micro nutrients, 100 percent of the households used spraying method. For other fertilisers, the application was through drilling.

Table 3.4a: Method of Application of Fertilizers in case of STFs (% of STF farmers).

	Method of fertilizer application	Urea	DAP	SSP	Potash	Micro nutrients	Complex fertilizers	Other fertilizers
1	Broadcasting	93.5	37	100	0	0	37	0
2	Spraying	1.6	3.7	0	0	100	13	0
3	Fertigation	1.6	0	0	100	0	4.3	0
4	Drilling	3.2	59.3	0	0	0	46	100
5	Total	100	100	100	100	100	100	100

Table 3.4b: Method of Application of Fertilizers in case of CFs (% CF of farmers).

		Urea	DAP	SSP	Potash	Micro Nutrients	Complex	Other Fertiliser
1	Broadcasting	87	29.5	100	0	0	45.8	0
2	Spraying	0	2.3	0	0	0	4.2	0
3	Fertigation	2.2	0.0	0	0	0	4.2	0
4	Drilling	10.9	68.2	0	0	0	45.8	0
5	Total	100	100	100	0	0	100.0	0

However, for both the categories of farmers, fertiliser wise and method wise extent of application is similar.

3.5 Details of Soil Sampling

The details of soil sampling show that the STF households did not have to bear the cost of soil sampling. The responses showed that the average distance from the field to the testing lab was 25.5 kms. It was also observed the average number of soil samples taken per household was 2.6 and the number of plots considered per household for soil testing was 2.7. The area covered was 6.7 acres per household.

Table 3.5: Details of Soil Sampling

Sl. No.	Particulars	Soil tested farmers
1	Average cost of soil testing (Rs/sample)	0
2	Average distance from filed to soil testing lab (kms)	25.5
3	Average samples taken for soil testing (no)	2.6
4	Average no. of plots considered for soil testing (no)	2.7
5	Average area covered under soil testing (acre)	6.7

3.6 Sources for Fertilizer Purchase

Table 3.6 shows sources of fertiliser purchase. For urea, DAP, SSP, more than 50 percent of the households had made purchases from private fertiliser shops or dealers and the rest from cooperative societies. This is observed for both the categories of farmers. For complex fertilisers, nearly 57 percent and 48 percent of the STF and CF households respectively had made purchases from cooperative societies and the rest from private fertiliser shops or dealers. For Potash, the proportion is equal for both the sources for both the categories of farmers.

Table 3.6: Sources for Fertilizers Purchase (% of farmers)

Sources	STF/ CF	Urea	DAP	SSP	Potash	Complex	Micro-nutrient	Bio-fertilizers	Organic Fertiliser
Private fert.shops dealers	STF	61.4	66.1	63.6	50	43.3	-	-	
	CF	56.9	66.7	50.0	50.0	51.9	33.3	0	100.0
Company authorized dealers	STF	-	-	-	-	-	-	-	-
	CF	-	-	-	-	-	-	-	-
Co-op societies	STF	38.6	33.9	36.4	50	56.7	-	-	-
	CF	43.1	33.3	50.0	50.0	48.1	66.7	-	-
Govt agency	STF	-	-	-	-	-	-	-	-
	CF	-	-	-	-	-	-	-	-
Others	STF	-	-	-	-	-	-	-	-
	CF	-	-	-	-	-	-	-	-
Total	STF	100	100	100	100	100	100	100	100
	CF	100	100	100	100	100	100	100	100

3.7 Soil Sampling

It is observed from table 3.7 that soil sample was mainly collected by the farmers themselves. Thus, 73 percent of the farmers collected their own sample.

Table 3.7: Sources of Soil Sample Collection (% of farmers)

Particulars	Soil tested farmers
Self	73.3
RSK officials	18.4
SAUs	0
KVKs	0
Farmer facilitator	8.3
	100

In case of 18.4 percent and 8.3 percent of the farmers, RSK officials and farmer facilitators respectively collected the soil sample.

Concluding Remarks

Analysis of the data shows that overall, the STFs was more aware than the CFs about INM, SHM, SHCS and SHCs. However, the data also shows that only around 55 percent of the STFs were aware about INM and imbalanced application of fertilisers.98 percent of the STFs were aware about SHCs as they were the beneficiaries of SHCs. However, only 6.7 percent of the STFs had attended training programmes. This clearly reveals that farmers need to attend fertiliser training programmes relating to soil health and get information about INM and SHM which would help them in using fertilisers efficiently on their own farms.

Chapter 4

Adoption of RDF as per SHC Scheme

4.1 Recommended Quantity of Fertilizers Based on Soil Test Results

Table 4.1 shows recommended as well as actual applied quantity of various fertilisers based on the soil test results for rabi sample crops of jowar, wheat and gram. It can be seen that in case of all the fertilisers including farm yard manure (FYM), there is a gap between the recommended doses of fertilisers (RDF) and the applied quantity. In case of jowar for all fertilisers (except MOP and 10.26.26), the applied quantity is less than the RDF. For gram however, in case of majority of the fertilisers, applied doses are greater than the RDF. In case of wheat, RDF are higher than the applied in case of all the fertilisers. It is also observed that the extent of the gap is uniformly higher in favour of RDF for all the crops in case of FYM and RDF is higher than the applied doses by around 45 percent to 50 percent.

Table 4.1: Average Recommended Quantity of Fertilizers based on Soil Test Results (as mentioned in the SHC) (Kgs/acre)

Crops		FYM	Urea	DAP	MOP	SSP	MgSo4	Potash	NPK (10.26.26)
Jowar	Recomd	4256	63.3	52.7	38.9	45	0	0	45.8
	Applied	2317 (-45.6)	52.2 (-17.5)	47.7 (-9.5)	41.7 (+7.2)	25 (-44.4)	0	0	47.5 (+3.7)
Gram	Recomd	3576	39.6	37.6	34.7	39.3	0	0	40
	Applied	1963 (-45.1)	45.3 (+14.4)	44.6 (+18.6)	50 (+44.1)	37.5 (-4.6)	0	0	46.4 (+16)
Wheat	Recomd	5579	67.3	47.3	47.2	55	0	0	65
	Applied	2647 (-52.6)	40.9 (-39.2)	41.8 (-11.6)	25 (-47)	0 (100)	0	0	55 (15.4)

Note: 1. Recomd = recommended. 2. Figures in the bracket indicate percentage of applied to RDF, +ve or -ve.

4.2 Organic Fertilizer for reference Crops

Responses relating to extent of application of organic fertilisers were elicited from the farmers. It was found that among various organic fertilisers, the farmers applied only the FYM for all the three major crops. Application of VC/ biogas, bio fertilisers, green manure etc. was not reported. It was observed that in case of jowar,

around 63 percent of those who cultivated the crop applied FYM. This percentage was even lower for gram (38 percent) as well as wheat (22 percent). In case of gram, the average area covered was least however, the quantity applied was highest as compared to other two crops. Considering the average price of FYM paid by these farmers and the average quantity applied, it is found that the per acre expenditure of the farmers ranged between Rs.5800 and Rs. 6888.

Table 4. 2: Applied Organic Fertilizers for Reference Crops

Particulars	FYM		
	Jowar	Gram	Wheat
Farmers applied organic fertilizers*(%)	63.3	38.3	22
Average area covered under organic fertilizers (Acres)	1.6	0.8	1.2
Average quantity applied (Kgs/acre)	2000	2348	2222
Price (Rs/kg)	2.9	2.6	3.1
Total expenditure (Rs. Per acre)	5800	6108	6888

Note: * percentage of farmers which applied FYM, out of total farmers who cultivated the concerned crop.

4.3 Problems Encountered While Implementation of the SHC Scheme

The respondents were asked to report problems if any, which they encountered during implementation of the scheme. The responses are presented in table 4.3

Out of a total of 60 STFs, only 39 farmers responded to the question relating to problems encountered during implementation. 17 percent of these farmers felt that they did not have proper information about SHCS. This was clear from the responses relating to problem 2 (table 4.3). 13 percent of the farmers said that soil sample was not collected from each farmers' land. Thus it was revealed that the farmers did not have any idea about the scheme and the grid method of soil sample collection wherein samples are drawn in a grid of 2.5 ha in irrigated areas and 10 ha. in rain fed areas. Therefore, the sample represents all the soils in that particular grid. As a result of this method of soil sample selection, it was found, that in case of many farmers, soil sample was not taken and SHCs were directly distributed. It was revealed from the discussions that collection of soil and distribution of SHC could not ensure dissemination of information about the scheme as well as the cards as this did not lead to interaction of the farmers with the government officials about the scheme as well as the card.

18 percent of the farmers felt that they had problem in understanding/ reading information given on the SHCs. This indicated that farmers could not understand and accordingly apply the RDF. It was revealed that the farmers had difficulty in converting the recommended doses of NPK into application in terms of simple and complex fertilisers available in the market. Five percent of the farmers reported that the farmers did not use RDF not only because of low level of awareness about the scheme/ card but also because it was also dependent on various factors such as availability of water, economic status of the farmers etc. Responses relating to first 3 questions (table 4.3) reveal that the level of awareness about the scheme was very low in case of a total of 48 percent of the farmers. Similarly, 35 percent of the farmers were unable to report any problem probably because their awareness about the scheme was very low.

12 percent of the farmers reported that they did not get SHC reports in time i.e. before the sowing season and as a result, basal dose could not be given as per the RDF.

Table 4.3: Problems Encountered while Implementation of the SHC Scheme

(% of STFs)

Sl. No.	Problems	% of STF farmers
1	Farmers do not have proper information about SHCS	17
2	Soil sample not taken from each farmer's land	13
3	Problem in understanding recommendations on the SHC	18
4	Farmers generally do use not RDF of SHC	5
5	Not getting SHC reports in time	12
6	Unable to report any problem	35
	Total	100

Overall, the analysis of the secondary as well as primary data collected from the field reveals that lot of importance was given to completion of targets relating to sample collection, testing, printing and distributing cards. However, this did not lead to creation of awareness about SHCS and SHCs. As a result, this probably led to mere distribution of cards.

4.4: Suggestions for Improvement of Soil Health Card Scheme

Based on the problems faced, farmers gave suggestions regarding implementation of SHCS. This is seen from table 4.4. As 35 percent of the farmers did not report any problem, they did not have any suggestion to offer. Out of the remaining farmers, 32 percent suggested that there was a need for creating

awareness about the scheme and usage of SHCs. 8 percent of the farmers had a suggestion for the other farmers. According to them, all farmers should apply the RDF which would have positive impact on crop production. As farmers were not aware of the grid system, 13 percent of the farmers felt that soil sample sould be collected from each farmer's land.12 percent of the farmers suggested that the SHCs should be distributed on time.

Table 4.4: Suggestions for Improvement of SHC Scheme (% of farmers)

Sl. No.	Suggestions	% of STF farmers
1	Awareness should be created about the SHCS and proper information should be given about importance / reading / and usage of SHC	32
2	Farmers should use RDF for betterment	8
3	Soil sample should be collected regularly and from every farmer's land for testing	13
4	Reports should be distributed in time	12
5	No suggestion	35
	Total	100

Concluding Remarks

Analysis of the data revealed gaps between the actual applied quantity of various fertilisers and RDF based on the soil test results for the sample crops. For gram in case of majority of the fertilisers, applied doses were greater than the RDF. For the other two crops however, applied doses were less than the RDFs. Among various organic fertilisers, the farmers applied only the FYM for all the three major crops. The per acre expenditure of the farmers on FYM ranged between Rs. 5800 and Rs. 6888.

Overall, analysis of the secondary as well as primary data collected from the field revealed that lot of importance was given to completion of targets relating to sample collection, testing, printing and distributing cards. However, this did not lead to creation of awareness about SHCS and SHCs. As a result, this probably led to mere distribution of cards. Therefore, the major suggestions of the farmers related to creation of awareness and about timely distribution of the cards.

Chapter 5

Impact of SHC Scheme

5.1 Impact of Application of Recommended Doses of Fertilizers on Yield

Table 5.1 shows yields of the reference crops before and after the distribution of SHCs. It is observed that the yield has increased in case of all the three sample crops viz. jowar, gram and wheat. The percentage change in yield before and after rabi season 2015-16 was comparatively higher i.e. 22 percent in case of gram. It was around 16 percent for wheat and 7 percent for jowar.

Table 5.1: Impact of Application of Recommended Doses of Fertilizers on Yield

Crop	Season	Average Yield (Quintal/acre)		% Change
		Before	After	
Jowar	Rabi-2015-16	4.44	4.76	7.1
Gram	Rabi-2015-16	2.84	3.48	22.3
Wheat	Rabi-2015-16	5.98	6.92	15.7

However, as was clear form table 4.1, the farmers had not applied fertiliser doses exactly as per the RDF. In some cases recommended doses were higher than the actual applied doses and in some cases lower. It was observed that for gram in case of majority of the fertilisers, applied doses were also greater than the recommended doses. Thus, it can be said that if the farmers had applied fertilisers in recommended quantities, yield could have been higher than the present levels.

5.2 Visible Changes Found after the Application of Recommended Doses of Fertilizers

With a view to understand the overall impact of application of RDF, farmers were asked about visible changes that were found after the application of RDF on different aspects of crop such as yield, crop growth, input usage etc. and were told to rank the responses. Table 5.2 shows percentage of farmers who responded and ranked the responses and also percentage of farmers who could not respond.

In case of first two questions relating to increase in crop yield and crop growth, majority of the farmers responded and ranked the responses in case of all the three crops. Majority of those who responded felt that increase in crop yield (more than 90 percent of the farmers) and improvement in crop growth (more than 70 percent of the farmers) were the most important and important visible changes after application of RDF. Majority of the farmers probably did not feel that there was any

visible change in incidence of pests and diseases and costs of other inputs and therefore did not respond. Again, as was observed from the data, for all the crops, the applied quantity of fertilisers was either less or more than the RDF. Perhaps the visible changes in the yield and other parameters could have been important for more number of farmers if the farmers had followed the application norms (RDF).

5.3 Cost of Cultivation and Income of Major Crops

The cost of cultivation data of the sample farmers was analysed to observe changes if any, in the quantity as well as costs after soil testing. It is observed from table 5.3a that the major items in the cost of cultivation were labour cost, manure/ FYM, seed cost (in case of gram and wheat) and irrigation charges. Among fertilisers and other chemicals, DAP, complex fertilisers and the PPC were the major items of the total cost.

The before and after figures of the quantities applied of the inputs show that in case of some inputs there was a decline and in case of some inputs there was an increase after soil testing. However, it was observed that the changes were marginal. This was observed in case of all the three crops. Before and after differences appear to be marginal in case of individual as well as total costs also. This indicates that the differences have emerged mainly due to higher prices of the cost items after soil testing period. The table shows that that total cost has increased for all the three crops. Income from main product as well as from by product has also increased. As a result, total gross income has also increased. Income net of cost of cultivation also shows increase in the 'after soil testing' period. However, it is observed that the increase in net income for all the crops was mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.

For comparing the extent of increase in gross income as well as total cost for each crop, Benefit Cost (BC) ratio was calculated for both the time periods- before and after soil testing. It is observed from table 5.3a that for all the three crops, the BC ratio was higher after soil testing was done as compared to the earlier period. BC was also found for the difference in values of gross income and total cost in the two time periods. This shows the extent to which the incremental income is higher than the incremental costs. The table shows that the BC ratio of the difference if 4.86, 3.68 and 1.92 for jowar, gram and wheat respectively. As is mentioned above, the increase in income is mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.

The difference in terms of percentage change was found and is presented in table 5.3b. It is observed that the net income increased by more than 50 percent for jowar and wheat and by around 22 percent in case of gram. However, as was already observed, the increase was mainly on account of increase in product prices and cannot perhaps be attributed to increase in the yield of the crop. Thus, there may not be direct relationship between improvement in soil health due to soil testing and yield level of the concerned crop after soil testing. .

Table 5.2: Visible Changes Found after the Application of Recommended Doses of Fertilizers (% of farmers)

	Reasons	JOWAR					GRAM					WHEAT				
		Most Imp	Imp	Least Imp	Overall		Most Imp	Imp	Least Imp	Overall		Most Imp	Imp	Least Imp	Overall	
					Respon--ded	No response				Respo-nded	No response				Respo-nded	No response
1	Increase in crop yield	74.4	20.5	5.1	75	25	78.9	18.4	2.6	75	25	82.4	11.8	5.9	77.3	22.7
2	Improvement in crop growth	23.5	50	26.5	62	39	25.7	48.6	25.7	69	31	7.1	64.3	28.6	63.6	36.4
3	Improvement in grain filling	28	32	40	44	56	8.3	37.5	54.2	47	53	18.2	36.4	45.5	50	50
4	Less incidence of pest and diseases	0	28.6	71.4	12	88	0	0	100	10	90	25	50	25	18.2	81.8
5	Changes in application of other inputs like seed, labor, pesticide etc. (increase/ decrease	0	76.9	23.1	23	77	0	30	70	20	80	0	71.4	28.6	31.8	68.2

Table 5.3a: Changes in Cost of Cultivation of Major Crops and Income (Rs per acre)

Variables	Unit	Jowar						Gram						Wheat					
		After ST		Before ST		Difference		After ST		Before ST		Difference		After ST		Before ST		Difference	
		Qty	Cost/ Incm (Rs)	Qty	Cost/ Incm (Rs)	Qty	Cost/ Incm (Rs)	Qty	Cost / Incm (Rs)	Qty	Cost/ Incm (Rs)	Qty	Cost / Incm (Rs)	Qty	Cost/ Incm (Rs)	Qty	Cost / Incm (Rs)	Qty	Cost / Incm (Rs)
Total labor cost		3	3540	3	3310	0	230	3	3264	3	3098	0	166	3	3492	3	3160	0	332
Manure/ FYM	Tones	1.9	3039	2.1	2980	-0.2	59	2.4	2681	2.6	2606	-0.2	75	2.3	2683	2.6	2433	-0.3	250
Seedlings	Kgs	4.8	245	4.9	221	-0.1	23	19.5	1160	19.7	1062	-0.2	97	29.4	1636	29.2	1379	0.2	257
Fertilizers- Urea	Kgs	46.6	348	46.1	285	0.5	63	46.4	295	47.1	287	-0.7	8	48.9	305	46.6	284	2.3	21
DAP	Kgs	39.3	999	41.4	1072	-2.1	-74	39.2	990	31.9	808	7.3	183	40.6	993	40.3	970	0.3	23
Potash	Kgs	25	430	37.5	535	-12.5	-105	25	420	25	420	0	0	25	435	0	0	25	435
SSP	Kgs	35	262	25	190	10	72	37.5	275	33.3	323	4.2	-48	41.7	703	43.8	518	-2.1	186
Complex (10.26.26)	Kgs	42.5	863	41.3	843	1.3	20	39.8	799	42.4	857	-2.6	-58	43.8	911	50.0	1067	-6.3	-156
Others	Kgs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PPC	Liters	1.3	875	1	500	0.3	375	1.3	775	1.2	841	0.1	-66	1	746	1.3	875	-0.3	-129
Irrigation	Acre inch	3.1	1273	3.4	1310	-0.3	-38	3.1	1146	3.2	1057	-0.1	89	7.2	1638	6.8	1529	0.4	108
Others		5	1915	3.0	1814	1.6	101	4.4	1591	3.1	1410	1.3	181	8.5	2219	6.5	1943	2	276
Rental value of land	Rs	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land revenue	Rs	7	1300	5	1200	2.0	100	0	0	0	0	0	0	0	0	0	0	0	0
Total Cost	Rs		15088		14260		828		13397		12770		627		15761		14158		1603
Main product yield	Rs	7.1	1870*	6.7	1746*	0.4	124	4.5	4881*	4	4961*	0.5	-80	8.5	2171	7.8	1997	0.7	174
By- product yield	Rs	12.8	836	11.1	744	1.7	92	2.4	390	2.3	325	0.1	65	4.0	360	3.9	317	0.1	43
Main Prd Gross Income	Rs		13277		11698		1579		21965		19844		2121		18454		15577		2877
By-Prd Gross Income	Rs		10701		8258		2442		936		748		189		1440		1236		204
Gross Income	Rs		23978		19957		4021		22901		20592		2309		19894		16813		3081
Net Income	Rs		8890		5697		3193		9504		7821		1682		4133		2655		1478
Benefit to Cost Ratio (Gross Income/ Total Cost)			1.59		1.40		4.86		1.71		1.61		3.68		1.26		1.19		1.92

Note: * indicates price per unit, Qty=Quantity, Incm=income

Table 5.3b: Percentage Change in the Cost of Cultivation of Major Crops and Income

(In percent)

	Variables	Jowar	Gram	Wheat
		%	%	%
1	Total labor cost	6.9	5.4	10.5
2	Manure/ FYM	2	3	10.3
3	Seedlings	10.6	9.2	18.6
4	Fertilizers- Urea	22.3	2.7	7.5
5	DAP	-6.9	22.6	2.3
6	POTASH	-19.6	0	0
7	SSP	37.9	-14.9	35.9
8	Complex(10.26.26)	2.3	-6.8	-14.6
9	Others	0	0	0
10	PPC	75	-8	-15
11	Irrigation	-2.9	8.4	7.1
12	Others	5.6	12.8	14.2
13	Rental value of land	0	0	0
14	Land revenue	8.3	0	0
15	Total	5.8	4.9	11.3
16	Main product yield	7.1	-1.6	8.7
17	By- product yield (RS/Qtl)	12.4	20	14
18	Main Prd Gross Income	13.5	10.7	18.5
19	By-Prd Gross Income	29.6	25.2	16.5
20	Gross Income	20	11	18
21	Net Income	56.0	21.5	55.7
22	Benefit –Cost Ratio			

Concluding Remarks:

Majority of those who responded felt that increase in crop yield and improvement in crop growth were the most important and important visible changes after application of RDF. Again, as was observed from the data, for all the crops, the applied quantity of fertilisers was either less or more than the RDF. Perhaps the visible changes in the yield and other parameters could have been important for more number of farmers if the farmers had followed the application norms (RDF). The before and after figures of the quantities applied of the inputs show that in case of some inputs there was a decline and in case of some inputs there was an increase after soil testing. However, the changes were marginal in case of all the three crops. It was observed that the increase in net income for all the crops was mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.

Chapter 6

Summary and Policy Suggestions

6.1 Background

Testing of soil is an integral part of fertiliser management policy. Fertilisers have to be applied according to the type of soil. Soil testing reveals various characteristics of soil. Depending upon the deficiencies revealed through testing, if soil is supplemented with nutrients required for a particular cropping pattern, the productivity of the soil would be enhanced. Therefore, soil test based application of fertilisers is extremely important for increasing efficiency of fertiliser usage and increasing the crop yield. The Soil Testing Programme was started in India in 1955-56 and 16 soil testing laboratories were set up under 'Determination of Soil Fertility and Fertility Use' programme. Before the implementation of centrally sponsored Soil Health Card Scheme (SHCS) in February 2015, some of the states were issuing SHCs. However, there were no uniform norms / guidelines for soil sampling, testing and distribution of SHCs. Therefore, the scheme was launched with a view to promote soil test based nutrient management for increasing nutrient use efficiency. The scheme aims at periodic distribution of SHCs to all the farmers to provide information on soil fertility along with recommendations relating to application of nutrients. A SHC reports the test values of various parameters such as micro and macro nutrients, organic carbon and soil pH. Depending upon these values, soil is rated and recommendations relating to application of nitrogen (N), Phosphorous (P) and Potash (K) are given for various crops. The application of recommended doses of fertilisers (RDF) therefore is expected to improve health and productivity of the soil.

Data on state wise targets and achievement of the SHCS implemented in 2015-16 shows that 100 percent SHCs are distributed in states of Chhattisgarh, Himachal Pradesh, Nagaland and Sikkim. These states are followed by Tamil Nadu, Maharashtra and Uttarakhand and Goa. It is observed that the target set for printing and distribution of SHCs is highest for Uttar Pradesh which ranks highest in terms of population as well as geographical area. It is followed by states such as Maharashtra, Madhya Pradesh and Rajasthan. Among these 4 states, the share of Uttar Pradesh is around 19 percent followed by Maharashtra with a share of 9.27 percent in the total target set. It is observed

that the percentage of progress of SHCs distributed is around 92 percent. Thus from the secondary data, among the bigger and developed states, Maharashtra emerges as the state with good progress in absolute as well as relative terms.

Maharashtra is one of the economically leading states of India. However, the agricultural sector of Maharashtra presents a dismal picture. As per 2011 census, about 52.71 percent of workforce is engaged in this sector while contribution of this sector to state domestic product is fast declining and is now only a single digit figure of 7.7 percent indicating lower productivity of the state soil. In addition to this, various factors such as increasing input costs, poor irrigation facilities, marginalization of landholdings, weak supply chains, have been constraining the performance of the agricultural sector of the state and the farmers are unable to obtain satisfactory income.

In view of this, implementation of the SHCS is expected to reveal soil deficiencies in the state and improve nutrient application thereby increasing the capacity of the soil to increase crop yield. This study focusses on the implementation as well as adoption of SHCS in Maharashtra.

The official data on distribution of SHCs shows that more than 39 lakh and more than 81 lakh SHCs were issued to the farmers at the state level in 2015-16 and 2016-17 respectively. This constitutes 85 percent and 89 percent of the target set for distribution. Nasik and Kolhapur are the divisions in which the performance of districts shows that the targets have been more than achieved. However, in a number of other districts, the targets have not been met and this suggests need for strengthening of the distribution machinery. The classification of districts according to the combined (for the two years) percentage of SHCs issued shows that in Raigad, the progress is less than 50 percent. In all, in 10 districts, the progress is below 80 percent. In majority i.e. 24 districts, the progress is more than 80 percent and in 9 districts, the targets are overachieved (more than 100 percent).

6.2 Review of literature

The recent studies focusing on impact of soil testing and distribution of SHCs in various regions across the country point out usefulness and need for such a scheme. However, the studies reveal major constraints in adoption of soil management practices. Inability of the farmers to interpret recommendations on SHCs is considered to be one

of the major constraints (Mohapatra and Kameswari, 2014;Goyal). Thus, this indicates importance of not only physical infrastructure for implementation of the scheme to be implemented but also of creating awareness about the scheme and usage of SHCs among the farmers.

6.3 Major Objectives and Scope of the Study

1. To document the status and implementation of soil health card scheme.
2. To analyze the impact of adoption of soil testing technology and recommended doses of fertilizers on the basis of SHCs, on crop production, productivity and soil health.

6.4 Data and Methodology

The present study is based on secondary as well as primary data collected from the field. Secondary data relating to the status and implementation of the scheme was collected from the office of Commissioner Agriculture, Government of Maharashtra, Pune. Two districts based on the implementation status of the scheme were to be selected. Based on the discussions with the state level officials districts Sangli from western Maharashtra region and district Osmanabad form central Maharashtra (Marathwada region) were selected. From each of the districts, two taluks/tehsils were selected. From each of the selected talukas, two villages were selected. In one of these two, testing of soil had been over and cards were distributed in the beginning of rabi season of 2015-16.Therefore soil tested farmers were selected randomly from this village. The other village was a village where soil testing was yet to be conducted**.** Therefore control farmers were selected randomly from this village**.**

From each of the districts a sample of 15 soil tested farmers and 15 control farmers were selected. Thus, in all, 60 farmers per district and a total of 120 farmers for the state as a whole were selected. Since, the scheme is not specific to any crops, data was collected for three major crops of each of the sample farmers for analysing implementation status of SHCS. While, selecting the households care was taken to have representation of the farmers belonging to different farm size groups based on operational land holdings. The reference period for the study was Rabi 2015-16 as soil health cards were distributed in the state during the rabi season.

6.5 Limitations of the Study

The study is mainly discusses awareness of the farmers about soil health card scheme and the soil health cards and their perceptions about change in output, yield, costs etc. etc. after they received soil health cards. It can be noted that changes in theses variables after receiving SHCs as compared to the earlier period (before distribution) could have taken place due other factors also. Also, the study does not refer to the scientific evidence relating to fertiliser usage and RDF. Hence, care should be taken while interpreting these results as outcome of application of SHCs.

6. 6 Chapter Stream

Chapter 1 on introduction is followed by chapter two in which socio economic characteristics of the sample households are discussed. Chapter three studies the awareness of the households about soil health card scheme. Chapter four focusses on responses of the farmers relating to the application of recommended doses of fertilisers as mentioned on the soil health cards. Chapter five studies changes in the cost of cultivation, yield , income, crop growth etc. after distribution of soil health cards. Chapter 6 presents conclusions and policy implications.

6.7 Major Findings of the Study

Major Findings Arising from the Analysis of the Secondary Data are as follows :

- The official data on distribution of SHCs shows that more than 39 lakh and more than 81 lakh SHCs were issued to the farmers at the state level in 2015-16 and 2016-17 respectively. This constitutes 85 percent and 89 percent of the target set for distribution.
- The classification of districts according to the combined (for the two years) percentage of SHCs issued shows that in Raigad, the progress was less than 50 percent. In all, in 10 districts, the progress was below 80 percent. In majority i.e. 24 districts, the progress was more than 80 percent and in 9 districts, the targets were overachieved (more than 100 percent).
- The districts wherein targets have been overachieved were from Nasik and Kolhapur divisions.
- The data shows that in a number of districts, the targets have not been met and this suggests need for strengthening of the distribution machinery.

Major Findings Arising from the Analysis of the Primary Data are as follows:

- **Socio-economic Characteristics of Sample Households**

- Both the categories of farmers had similar demographic characteristics. Average years of age were 47.3 and of education were 9 years. Overall, around 98 percent of the respondents were male respondents. The social composition of the households showed that most of the households (86 percent) belonged to the 'general' category of farmers.
- Agriculture was the main occupation for all the sample households. The average area of land owned was 6.2 acres and the net operated area was 5.8 acres. The size of land owned was larger (7.1 as compared to 5.4 acres) in case of STFs. The net operated area was also larger (6.2 acres as compared to 5.2 acres) in case of STFs.
- The proportion of land irrigated was around 53 percent for both the categories of farmers indicating that 46 percent of the total land is unirrigated. Overall, major sources of irrigation were dug well (47.5 percent) as well as bore well (55 percent).
- The cropping pattern of both the categories of farmers was broadly similar. The major kharif crops were jowar and soybean that occupied almost 75 percent of the total kharif area of total sample households. Gram, rabi jowar and wheat were the major rabi crops occupying around 90 percent of the rabi area of the sample farmers. Sugarcane and horticultural crops were important perennial crops of the sample households. However, for CFs, sugarcane was the most important crop and for STFs, along with sugarcane, horticultural crops were also important.

- **Gross Income by Agricultural Production**

- Though yield and income of STFs were higher than the of CGFs, the differences were not very high. Similarly, these differences could also be explained in terms of differences in the prices of inputs and products.

- **Awareness on SHC Scheme**

- In relative terms, the STFs were more aware than the CFs about Integrated Nutrient Management, Soil Health Mission and Soil Health Card Scheme.
- 98 percent of the STFs were aware about SHCs as they were the beneficiaries of SHCs.
- However, only around 55 percent of the STFs were aware about Integrated Nutrient Management and imbalanced application of fertilisers.

- Only 4 (6.7 percent of the) STFs had attended fertiliser training programmes of any type.

➢ **Adoption of Recommended Doses of Fertilizers on Soil Test Basis**

- Analysis of the data revealed gaps between the actual applied quantity of various fertilisers and the recommended doses of fertilisers (RDF) which were based on the soil test results for the sample crops.
- For gram in case of majority of the fertilisers, applied doses were greater than the RDF.
- For the other two crops- wheat and gram, however, applied doses were less than the RDFs.
- Among various organic fertilisers, the farmers applied only farm yard manure (FYM) for all the three major crops.
- The per acre expenditure of the farmers on FYM ranged between Rs.5800 and Rs. 6888.

➢ **Problems Encountered during Implementation of the Scheme**.

- Out of a total of 60 STFs, only 39 farmers responded to the question relating to problems encountered during implementation.
- 35 percent of the farmers reported that they did not face any problem. It appeared that they were unable to report any problem probably because their awareness about the scheme was very low.
- 17 percent of those who replied felt that they did not have proper information about SHCS.
- 18 percent of the farmers felt that they had problem in understanding/ reading information given on the SHCs. This indicated that farmers could not understand and accordingly apply the RDF. It was revealed that the farmers had difficulty in converting the recommended doses of NPK into application in terms of quantities of simple and complex fertilisers available in the market.
- 13 percent of the farmers said that soil sample was not collected from each farmers' land which indicated that the farmers did not have any idea about the scheme and the grid method of soil sample collection. As a result of this method of soil sample selection, in case of many farmers, soil sample was not taken and

SHCs were directly distributed. This method could not ensure dissemination of information about the scheme as well as the cards as this did not lead to interaction of the farmers with the government officials about the scheme as well as the SHC.

- 5 percent of the farmers reported that the farmers did not use RDF not only because of low level of awareness about the scheme/ card but also because it was also dependent on various factors such as availability of water, economic status of the farmers etc.
- 12 percent of the farmers reported that they did not get SHC reports in time i.e. before the sowing season and as a result, basal dose could not be given as per the RDF.
- Overall, the analysis of the secondary as well as primary data collected from the field revealed that lot of importance was given to completion of targets relating to sample collection, testing, printing and distributing cards. However, this did not lead to creation of awareness about SHCS and SHCs. As a result, this probably led to mere distribution of cards.

➢ **Suggestions Given by the Farmers Regarding Implementation of SHCS**.

- As 35 percent of the farmers did not report any problem, they did not have any suggestion to offer.
- Out of the remaining farmers, 32 percent suggested that there was a need for creating awareness about the scheme and usage of SHCs.
- 8 percent of the farmers had a suggestion for the other farmers. According to them, all farmers should apply the RDF which would have positive impact on crop production.
- As farmers were not aware of the grid system, 13 percent of the farmers felt that soil sample should be collected from each farmer's land.
- 12 percent of the farmers suggested that the SHCs should be distributed on time.

➢ **Impact of Application of RDF**

- Majority of those who responded felt that increase in crop yield (more than 90 percent of the farmers) and improvement in crop growth (more than 70 percent of the farmers) were the most important and important visible changes after application of RDF.

- Majority of the farmers probably did not feel that there was any visible change in incidence of pests and diseases and costs of other inputs and therefore did not respond.
- Again, as was observed from the data, for all the crops, the applied quantity of fertilisers was either less or more than the RDF.
- Perhaps the visible changes in the yield and other parameters could have been important for more number of farmers if the farmers had followed the application norms (RDF).

➢ **Impact on Cost of Cultivation after Soil Testing**

- The before and after figures of the quantities applied of the inputs show that in case of some inputs there was a decline and in case of some inputs there was an increase after soil testing. However, the changes were marginal in case of all the three crops.
- It was observed that the increase in net income for all the crops was mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.
- For comparing the extent of increase in gross income as well as total cost for each crop, Benefit Cost Ratio (BCR) was calculated for both the time periods- before and after soil testing. It was observed that for all the three crops, the BC ratio was higher after soil testing was done as compared to the earlier period.
- BC was also found for the difference in values of gross income and total cost in the two time periods. This shows the extent to which the incremental income is higher than the incremental costs. The BC ratio of the difference was 4.86, 3.68 and 1.92 for jowar, gram and wheat respectively. As is mentioned above, the increase in income is mainly explained by changes in the input and output prices as differences in yield appeared to be marginal.
- The difference in terms of percentage change was found. It is observed that the net income increased by more than 50 percent for jowar and wheat and by around 22 percent in case of gram. However, as was already observed, the increase was mainly on account of increase in product prices and cannot perhaps be attributed to increase in the yield of the crop. Thus, there may not be direct relationship

between improvement in soil health due to soil testing and yield level of the concerned crop after soil testing.

6.8 Policy Suggestions:

Based on the analysis of the data, following policy implications emerge

- Efforts should be made to create awareness about of Soil Health Card Scheme, the grid system of soil sample collection, Soil Health Cards and Integrated Nutrient Management and their importance among all farmers. The focus should be on interpretation of soil health card and on conversion of recommended doses of nutrients into doses of fertilisers to be applied.
- Farmers should be compulsorily given training about application of various fertilisers before the beginning of the season and during the season so that the recommendations about fertiliser doses based on changing climatic conditions and availability of water can be given.
- The analysis of the data revealed that the actual applied doses of fertilisers were not equal to recommended doses. Similarly, the difference in yield and income before and after soil testing was not very large. Therefore, it is felt that there should be interaction among the farmers and the officials at regular intervals for dissemination of information about recommended doses of nutrients and their importance in increasing yields of the crops.
- Soil Health Cards should be distributed in time before the season starts so that the farmers have recommendations about basal doses also.

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Mohapatra and Kameswar VLV(2014) 'Knowledge level of soil management practices and their adoption by farmers of Odisha', International Journal of Farm Sciences 4(4) : 240-246, 2014

Websites

http://soilhealth.dac.gov.in/

Annexure I

COMMENTS

on the report

"IMPACT OF SOIL HEALTH CARD SCHEME (SHCS) ON PRODUCTION, PRODUCTIVITY AND SOIL HEALTH IN MAHARASHTRA"

submitted by

AERC, Pune, Maharashtra

1. **Title of the draft report examined:**

   Impact of Soil Health Card Scheme on Production, Productivity and Soil Health in Maharashtra.

2. **Date of receipt of the Draft report:** 9th June, 2017

3. **Date of dispatch of the comments: 7**st July, 2017

4. **Comments on the Objectives of the study:**

   All the objectives of the study have been addressed

5. **Comments on the methodology**

   Common methodology proposed for the collection of field data and tabulation of results

   has been followed.

6. **Comments on analysis, organization, presentation etc.**

(i) In Table 2.2, the rental value of leased-in and leased-out for irrigated land and Un-irrigated land can be given separately, as there will be an huge difference between these two.

(ii) In Table 2.4 - Cropping pattern of sample households can be mentioned both in quantity as well as in % GCA.

(iii) Chapter -III can be given a title "Status of Awareness on SHC Scheme" instead of Awareness of SHC Scheme.

(iv) It is worth to mention the complete details of training programmes attended (Table 3.3) on application of chemical fertilizers.

(v) The information in Table 3.4 and 3.6 should be bifurcated for soil tested farmers and control farmers.

(vi) In Table 5.3a, B:C ratio need to be worked out for the selected crops to interpret the results better.

(vii) Throughout the report, the units mentioned in Tables should be in two digits for better clarity on the information provided.

(viii) *It is suggested to* ***copy edit the report*** *before finalizing.*

7. Overall view on acceptability of report

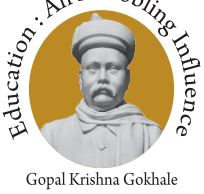
Authors are requested to incorporate all the comments and submit the final report along with soft copy of the data for consolidation.

Annexure II

Comments on Analysis, Organization, Presentation etc.

1. All the suggestions have been accommodated and tables have been revised accordingly.
2. Chapter III title has been changed.
3. Wherever possible, figures after decimal point are reported up to two digits
4. The report has been copy edited before finalizing.

Jayanti Kajale and Sangeeta Shroff.



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