

Use of Soil Health Cards by the farmers of Khordha district

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**Nayak AA., M.Sc. (Ag.) (Extension Education) Thesis, 2023.
Use of Soil Health Cards by the farmers of Khordha district**



**DEPARTMENT OF AGRICULTURAL EXTENSION EDUCATION
COLLEGE OF AGRICULTURE
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BHUBANESWAR-751003, ODISHA
2023**

Use of Soil Health Cards by the farmers of Khordha district

*A Thesis submitted to the
Odisha University of Agriculture and Technology
in Partial fulfilment of the Requirement for the degree of
Master of Science in Agriculture
(Extension Education)*

By

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CERTIFICATE-I

This is to certify that the thesis entitled “**Use of Soil Health Cards by the farmers of Khordha district**” submitted in partial fulfilment of the requirements for the award of the degree of **Master of Science in Agriculture (Extension Education)** to the **Odisha University of Agriculture and Technology, Bhubaneswar** is a faithful record of bonafide and original research work carried out by **Atya Aneesha Nayak, Adm. No. 211221706** under my guidance and supervision. No part of this thesis has been submitted for any other degree or diploma.

It is further certified that the assistance and help received by her from various sources during the course of investigation has been duly acknowledged.

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CERTIFICATE-II

This is to certify that the thesis entitled “Use of Soil Health Cards by the farmers of Khordha district” submitted by Atya Aneesha Nayak, Adm. No. 211221706 to the Odisha University of Agriculture and Technology, Bhubaneswar in partial fulfilment of the requirements for the degree of **Master of Science in Agriculture (Extension Education)** has been ~~disapproved~~ ^{approved} by the students’ advisory committee and the external examiner.

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ABBREVIATIONS USED

%	:	Percentage
&	:	And
⁰ C	:	Degree Celsius
AAO	:	Assistant Agriculture Officer
BAO	:	Block Agriculture Officer
EC	:	Electrical Conductivity
<i>et al.</i>	:	and other people
etc.	:	Et-cetra
f	:	Frequency
Fig.	:	Figure
FYM	:	Farm Yard Manure
ha	:	Hectare
i.e.	:	That is
MPS	:	Mean Percent Score
NAC	:	Notified Area Council
NGO	:	Non-Governmental Organisation
NPK	:	Nitrogen, Phosphorus, Potassium
S.D.	:	Standard Deviation
SHC	:	Soil Health Card
Sl. No.:	:	Serial number
STLs	:	Soil Testing Laboratories
VAW	:	Village Agricultural Workers

ABSTRACT

The present study entitled “Use of Soil Health Cards by the farmers of Khordha district” was undertaken with a view to assess the level of awareness of the farmers, to measure the nature of use of Soil Health Card, to study the perception of official stakeholders on the utility of Soil Health Cards and to identify the constraints faced by farmers with suggestions to overcome them. The study was conducted in Baliana and Balipatna block of Khordha district. The blocks and villages were selected purposively and a total of 93 respondents were selected through fixed proportionate random sampling by lottery method and 20 officials were selected randomly from the blocks. The responses from each respondent was collected with the help of a structured interview schedule. The findings of the study revealed that majority (62.37%) of farmers have medium level of awareness about SHC. Majority 52.69 per cent of farmers have medium level of use efficiency of major nutrients, 66.67 per cent of the farmers have medium level of use efficiency of minor nutrients, 82.80 per cent of the farmers have medium level of use efficiency of bio-fertilisers and 60.22 per cent farmers have medium level of use efficiency of the soil chemical parameters. Majority (80%) of the officials have moderate level of perception on utility of SHC while (59.14%) farmers have moderate level of perception. The study further revealed that improper information about soil micro nutrient status, difficulty in calculating fertiliser doses by the farmers, higher time gap between soil sample collection and SHC distribution, lack of Soil Testing Laboratories are major constraints faced by the farmers. Majority of the respondents suggested that SHC should be given before the cropping season when there is no standing crop. They also suggested that soil samples should be collected in the presence of farmers, SHC should include crop specific recommendations of fertiliser usage and it should be given every year to the farmers.

INTRODUCTION

1.1 Soil of India

Soil is considered one of the five important elements of earth, representing the physical and material aspect of the natural world. On the other hand, is a complex mixture of organic matter, minerals, water, air and microorganisms that covers the earth's surface and provides a habitat for plants and animals. Thus, soil is an essential component for agriculture and ecosystems, that provides nutrients to the plant. Soil is the source of all major nutrients, on which our body is solely dependent on and so, soil supports lives on earth. Any damage or degradation of soil quality can affect the quality of plants, food and lives on earth.

India, being one of the top exporters of agricultural products, extensive agricultural practices have led to a remarkable increase in food grain production, which is driven by the adoption of improved seed varieties, the widespread use of fertilizers and reliable irrigation. However, the current usage ratio of nitrogen, phosphorus and potassium (NPK) in the country, as of 2021-22, is imbalanced, standing at 7.7:3.1:1, deviating from the recommended ratio of 4:2:1 (Fertiliser Association of India, 2021-2022). This discrepancy is even more pronounced in key agricultural states like Punjab and Haryana, where NPK usage ratios are alarmingly high, at 31.4:8.0:1 and 27.7:6.1:1, respectively (union budget 2020-2021). Regrettably, this imbalanced application of fertilizers has resulted in deficiencies of essential nutrients, including primary nutrients (NPK), secondary nutrients (sulphur), and various micronutrients (such as boron, iron, manganese, zinc and copper) in many regions across the country. This inappropriate application of fertilizers in these imbalanced ratios have caused deficiency of primary nutrients (i.e. NPK), secondary nutrients (like sulphur) and the micronutrients (boron, copper, zinc, etc.) in the soils of the major agriculturally active states of India. Therefore, it became essential to promote the awareness for appropriate use of required sources of nutrients associated with use of soil, to enhance soil nutrient availability. Especially in case of small and marginal farmers, the use of blanket fertilizer are followed for N, P & K which considerably deviates from the actually formulated soil fertility need and often found without any of the secondary and micro nutrients, in various cropping systems.

A large portion of farmers lack formal education and believe that increasing the application of various inputs, including fertilizers, will directly lead to improved soil fertility and better crop yields. Unfortunately, this misconception often results in overuse of fertilizers, which can have detrimental effects on crops by causing root damage due to excessive heating and complexation. Thus, government of India came up with several schemes for the proper utilization of the available resources to improve agricultural productivity. One such scheme is Soil Health Card scheme.

1.2 Soil Health Card (SHC) Scheme

Based on the use of fertilizers in various regions of our country, fertility maps have been prepared using the soil test results, but this information could not provide the exact picture for the farm of each farmer. Due to sub-optimal use of farming resources, low addition of organic matter without considering any replacement for the depleted micro and macro nutrients over the years, deterioration of soil health has become an important cause of concern. The Indian government has initiated the “Soil Health Card” program as part of the National Mission for Sustainable Agriculture (NMSA) with the goal of distributing Soil Health Cards (SHCs) to every farmer in the nation. This scheme has been launched by Prime Minister Narendra Modi on 19th February 2015, at Suratgarh town of Sri Ganganagar district in Rajasthan. This initiative has been established for addressing deficiencies in the used fertilizers by assessing soil nutrient levels, in every three years. Furthermore, the Soil Health Card program offers guidance to farmers on the types and quantities of fertilizers they should use. It facilitates the collection of soil samples, which are then tested in approved laboratories. This card provides necessary insights by assessing the use of major fertilizers, identifying the nutrient deficiency and providing solutions and recommendations for required additives to achieve a balanced soil composition.

Every year, during April/May, soil testing campaigns are getting organized by Department of Agriculture across the country, aiming wider implementation of the SHC scheme. The departmental staff will create awareness about the soil health and start collecting the soil samples according to the prescribed procedure. The generated information during the campaign will be sent to the concerned soil testing labs in that region. The process begins with the essential recording of GPS coordinates during soil sampling and this data is subsequently downloaded into the STL computer system.

Soil samples are generally taken after the harvesting of rabi and kharif crop completes, ensuring there is no standing crop in the targeted field. The collected soil samples are then registered under the names of both the main grid and individual grid farmers on an online Soil Health Card Portal, developed by NIC (National Informatics Centre). Soil samples will be drawn in a grid of 2.5 ha in irrigated area and 10 ha in rainfed area with the help of revenue maps and GPS tools. The soil samples will undergo a comprehensive analysis of 12 parameters including organic carbon (OC), pH, electrical conductivity (EC), as well as essential nutrients like nitrogen (N), phosphorus (P), potassium (K), sulfur (S) and micronutrients such as zinc, copper, iron, boron and manganese. Following the analysis of these soil samples, Soil Health Cards will be distributed to the farmers in their regional languages, along with strong encouragement to adopt fertilizer recommendations based on the soil test results. Over the time, the extensive use of SHC would also be helpful in determining the changes in soil health due to poor land management.

Following are the objectives of the Soil Health Card scheme

- To investigate the functioning status of the soil testing laboratories in country and provide the required support through capacity building.
- To issue Soil Health Card for the regional farmers in each two to three years, which can provide a basis for addressing the nutrient deficiency in fertilization practices.
- To diagnosis the soil fertility constraints by following standard procedure for uniform sampling across the targeted regions through soil test based nutrient management.
- To build state as well as district level staff and farmers for implementing and promoting the nutrient management practices.
- To adopt balanced and integrated use of fertilizers, which will result in reducing cost of cultivation in the benefit of the farmers.

The Soil Health Card system is considered environmentally safe and is a valuable tool for optimizing fertilizer usage within the Integrated Nutrient Management (INM) framework. Furthermore, the scheme aims to provide capacity-building training sessions for district and state-level staff, enhancing their expertise in soil analysis and fertilizer recommendation. Additionally, the scheme offers financial

assistance to farmers to address nutrient deficiencies and promotes the adoption of balanced and integrated nutrient management practices within their crop systems.

Keeping this in mind, the current study, titled **“Use of Soil Health Cards by the farmers of Khordha district”**, was conducted with following objectives in mind:

1. To assess the level of awareness of the farmers on Soil Health Card
2. To measure the nature of use of Soil Health Card by the farmers
3. To study the perception of official stakeholders on the utility of Soil Health Cards
4. To identify the constraints faced by the farmers by using Soil Health Cards and their suggestions

1.3 Scope and significance of this study

The Soil Health Card (SHC) scheme is one of the important initiatives taken by the central government of India, aiming for proportionate use of chemical fertilizers following the recommended standards by the regional laboratory facilities. The successful implementation of this scheme requires huge expenditures as it involves advanced technologies and special man power for governing the activities at ground level. Thus, it became important to monitor its outcome and prepare the corresponding recommendations to the government for better implementation and further improvements. The results of this study will be very much helpful in the following areas

- In monitoring the current progress in implementation or execution of the SHC scheme.
- Gathering information regarding the awareness of the farmers about the scheme will provide the useful guidelines to the governing agencies to increase their efforts for the wide spreading of the scheme.
- This study will also provide information regarding the constraints faced by the local farmers in using the Soil Health Card.
- The outcome will help the Govt. authorities to consider required modifications in the further implementation of the scheme.

Hence, the planned study in thesis would also be greatly helpful to the scientists, extension workers, and NGO's to identify the feasibility of Soil Health Card information. This study aims for developing suitable extension strategies for effective utilization of Soil Health Card information. Further research and developmental work can be planned by extending its adoption by the farmers.

1.4 Limitations of this study

While every effort was made to ensure the study's precision and relevance in line with the study design, several limitations should be noted:

- Constraints related to time, financial resources, transportation and other physical facilities during the investigation may have impacted the study's scope.
- Many of the farmers whose soil was tested were unaware of the results of their soil tests.
- The study was conducted exclusively in two blocks of a district, potentially limiting the generalizability of its findings to other regions.
- The investigation relied primarily on individuals' perceptions and expressed opinions gathered through recall methods.

1.5 Organization of the chapters

The study has been organised into 5 chapters:

Chapter I : Introduction

Chapter II : Review of literature pertaining to present study

Chapter III : Materials and methods used for the study

Chapter IV : A critical analysis of the result and presentation of the discussion

Chapter V : Summary and conclusion of the study

REVIEW OF LITERATURE

This chapter presents a brief review of literature pertaining to the present problem of the study. Review of literature helps the researchers in getting better ideas regarding appropriate sampling design and preparation of the structured interview schedule to obtain better solution to the research problem. Hence, an attempt is made to review various methods used in earlier studies to specify the concepts used and adopted in the present study. The literature available on the present study was furnished under the following headings:

2.1 Awareness of the farmers on Soil Health Card

2.2 Use of Soil Health Card by the farmers

2.3 Perception on the utility of Soil Health Cards

2.4 Constraints faced by the farmers by using Soil Health Cards and their suggestions

2.1 Awareness of the farmers on Soil Health Card

Bhatt *et al.* (2009) revealed that all the recipients were informed about several facets of Soil Health Cards, such as primary nutrients (N, P, & K), soil pH and soil EC. However, 74.00 per cent had knowledge of irrigation water analysis and only 20.00 per cent were informed about sulphur analysis. A mere 2.50 per cent of farmers were aware of the analysis of a micro-nutrient, specifically manganese. Moreover, when it comes to farmers without Soil Health Cards, the proportion of individuals aware of these aspects was notably lower.

Mukati (2016) revealed that among the Soil Health Card holders only 81.19 per cent, were aware about SHC and the rest 18.81 per cent were unaware about SHC.

Saha *et al.* (2016) revealed that the Soil Health Card serves as a tool to inform farmers about their soil's nutritional condition. Twelve farmers who utilize Soil Health Cards can now make more informed decisions when planning their future crop patterns, resulting in improved productivity. These Soil Health Cards are distributed to farmers based on a comprehensive soil test database, with corresponding recommendations meticulously documented within the cards.

Patel *et al.* (2017) in their study concluded that 37 per cent of SHC beneficiaries had sufficient knowledge and understanding regarding benefits of soil testing, then the others have comparatively low, medium, very high and very low level of knowledge are by 18 percent, 16 per cent, 15 per cent and 14 per cent, respectively.

Reddy (2017) found that at the national level 82.2 per cent of the sample farmers were aware of SHC. Awareness levels were quite good in south, west, central and eastern zones, with about 80 per cent to 90 per cent awareness. A lowest awareness of 31.8 per cent was found in the north east region, followed by 78.4 per cent in the north.

Bunkar (2018) in his study revealed that a majority of 66.66 per cent of SHC holders had medium level of awareness, where people with low and high level of awareness about the scheme are 15.00 per cent and 18.34 per cent, respectively.

Chakrawarty *et al.* (2018) reported that when it comes to the awareness of different types of fertilizers (FYM, organic and inorganic), the majority of beneficiaries, totaling 37.50 per cent, demonstrated a high level of awareness. This was followed by 37.49 per cent of beneficiaries with partial awareness and 25.01 per cent with the lowest level of awareness. Similarly, in terms of awareness regarding fertilizer dose application (N:P:K; 20:40:20), the data revealed that the majority of beneficiaries, accounting for 35.83 per cent, had partial awareness. This was followed by 35.00 per cent with high awareness and 29.16 per cent with the lowest level of awareness.

Charel *et al.* (2018) found that the difficulties to calculate fertilizer dose on the basis of nutrient status of soil was 70.00 per cent. A high time gap of 62.50 per cent was observed between soil samples taken and issuing cards. Absence of micronutrient status of soil in the SHC was reported as 60.00 per cent. A 57.50 per cent of notable understanding on the content of the SHC was reported. After crop harvest, a 50.00 per cent of Soil Health Cards have been received. Uncertainty about the quality and reliability of the information presented in the Soil Health Card (SHC) was 47.50 per cent and the sample collection took place in the presence of farmers was only 37.50 per cent.

Jaiswal and Singh (2018) reported that the awareness levels among farmers were as follows: 57.50 per cent had a moderate level of awareness, 25.00 per cent had a high level of awareness and 17.50 per cent had a low level of awareness. When assessing farmers' responses regarding the usefulness of the Soil Health Card (SHC), a predominantly positive response of 79.17 per cent was resulted, with the rest 20.83 per cent expressing a negative viewpoint.

Shehrawat *et al.* (2018) reported that awareness of farmers regarding checking soil health using SHC studies (56.34%), Govt. of India's validation for the scheme (57.34%), the scheme also contributes in reducing the input cost (53.67%), it gives the nutrient status of soil (57.34%) and it also informs about the type of soil (56.34%). Awareness of the farmers about the role of SHC in the cropping pattern and crop sequence information was (47.00%) and (47.34%), respectively. The results emphasize that, (56.67%) of farmers were aware that SHC informs about the correct dosages of fertilizers and (56.00%) people know that it helps the farmers in using chemical fertilizers, whereas the farmers awareness on the role of SHC in maintaining the soil fertility is (53.66%) and (53.00%) know that it increases productivity of crops as well. Most farmers, specifically 53.67 per cent, indicated their awareness that Soil Health Cards (SHC) promote the prudent use of fertilizers and similarly the number of farmers acknowledged that SHC aids in diagnosing soil related issues and determining the specific nutrient requirements was 54.34 per cent.

Archana and Balasubramanian (2019) revealed that 74.17 per cent of farmers belongs to Tamil Nadu, were aware about the scheme, whereas the scheme was not known to only 25.83 percent of the farmers.

Bhayal *et al.* (2019) observed that farmers having a medium awareness about the Soil Health Card was 42.14 per cent and farmers with low awareness counts 32.15 per cent had low awareness, whereas people with high awareness about the Soil Health Card was only 25.71 per cent.

Singh *et al.* (2020) reported that the majority of farmers (93%), were well-informed about the Soil Health Card, which furnishes data about the soil's nutrient content. They also recognized that the Soil Health Card assesses the overall health of the farm and highlights its strengths and weaknesses concerning various nutrients and

organic carbon levels. However, only some (42%) of the farmers were aware that the effectiveness of the Soil Health Card relies on farmers adhering to the recommendations consistently.

Lokesh *et al.* (2021) reported that farmers with a medium level of awareness of SHC scheme forms the majority (67.91%) farmers, followed by farmers with high (17.92%) awareness and low (14.17%) awareness level about SHC scheme.

2.2 Use of Soil Health Card by the farmers

Bireescu *et al.* (2014) conducted a study with the objective of evaluating key physical, chemical and biological indicators of soil health, along with indicators of soil residual pollution, in the context of transitioning from intensive olericulture systems to organic systems. This transition aimed to establish a sustainable management approach. The shift to organic systems resulted in a reduction in the adverse impacts of intensive practices, paving the way for enhanced biological activity and the cultivation of healthier vegetables.

Chowdary (2015) in his study on the factors influencing the utilization of recommendations from Soil Health Cards, identified various determinants, including factors such as annual income, a scientific mindset, one's perception of soil health, a willingness to learn about the Soil Health Mission, a satisfaction index and the extent to which farmers followed the recommendations outlined in the Soil Health Card.

Dilip and Lakdawala (2016) found that across all villages in the three talukas, the phosphorus content was predominantly at medium levels, with very few areas having high phosphorus content. The fertility index for phosphorus across these talukas averaged at 2.00. This valuable information equips farmers with insights into their farm's condition and nutrient needs for the upcoming crop season, helping them make informed decisions about the appropriate fertilizers to apply.

Parewa *et al.* (2016) reported that the scheme aims to promote integrated nutrient management by carefully using inorganic fertilizers including the micronutrients and secondary nutrients in conjunction with organic manures and biofertilizer to enhance soil health and its productivity.

Chouhan *et al.* (2017) uncovered a noteworthy difference in the yields of specific kharif crops, such as paddy, soybean and maize, when comparing data before and after soil testing in the studied region. After applying the recommended doses of fertilizer (RDF), the yield of paddy, soybean and maize experienced significant increases of 19.42 per cent, 13.79 per cent and 9.3 per cent, respectively.

Makadia *et al.* (2017) determined that farmers with Soil Health Cards exhibited a reduced tendency to overuse nitrogenous fertilizer compared to those without Soil Health Cards, particularly in the context of sugarcane and kharif paddy crops. Additionally, the underutilization of phosphatic and potassic fertilizers was less prevalent among farmers who possessed Soil Health Cards, as opposed to those who did not, particularly in the case of sugarcane and kharif paddy crops.

Patel *et al.* (2017) identified a significant portion, accounting for 52 per cent of the respondents fell into the high to very high category regarding their knowledge of soil testing and the utilization of Soil Health Cards for advanced farming practices. These farmers embraced the technology to effectively regulate fertilizer doses, ensuring the health of their soil. This substantial majority recognized the technology's value in preserving soil health, reducing input costs and enhancing farm production.

Chowdary *et al.* (2018) reported that the Soil Health Card (SHC) serves as a valuable tool for assessing alterations in soil health influenced by land management practices. The SHC presents comprehensive information regarding soil health indicators using descriptive terms. Moreover, it offers crop-specific recommendations for the necessary nutrients and fertilizers, empowering farmers to enhance their productivity by employing the right inputs.

Yogesh (2018) highlighted that, an approximately 73.34 per cent of respondents believed that the Soil Health Card should include information about the micronutrient status and a 71.66 per cent of respondents suggested that crop-specific recommended fertilizer doses should be included in the card. A substantial 68.34 per cent of respondents recommended issuing the Soil Health Card before the beginning of the crop season. About 66.67 per cent of respondents advocated for training farmers in the process of collecting soil samples from their own land. A noteworthy 63.34 per cent of respondents suggested ensuring village-level internet access. Around 60.00 per cent of respondents favoured conducting soil sample collection in the

presence of the farmer. A smaller percentage, 16.67 per cent, proposed establishing soil testing laboratories at the taluka level, staffed by highly qualified experts.

Purakayastha *et al.* (2019) conducted a study that revealed significant correlations between native soil texture and the Soil Health Index (SHI). Specifically, they found that sandy clay loam soil exhibited the highest SHI at 0.67, followed by sandy loam at 0.57, loamy fine sand at 0.44 and fine sand at 0.35. The study also evaluated different manuring and tillage practices and their impact on SHI. It was observed that Green Manuring (GM) practices had the highest SHI at 0.56, followed by Farm Yard Manure (FYM) at 0.49 and No Manure (NM) at 0.47. In terms of tillage practices, Direct Seeded Rice with Zero Tillage (DSR-ZT) ranked the highest with an SHI of 0.76, followed by Conventional Tillage with Zero Tillage (CTZT) at 0.59, System of Rice Intensification with Zero Tillage (SRI-ZT) at 0.55 and Conventional Tillage with Conventional Tillage (CT-CT) at 0.49. The developed Soil Health Card (SHC) was found to contain essential information about farmers, field location, soil type, and cropping practices. Additionally, the SHC provided information on eleven chemical indicators, four physical indicators, three biological indicators, and the SHI. The SHC offers advantages over routine soil testing by presenting information about the soil's health status as influenced by various management practices, offering amelioration recommendations, and providing crop-specific fertilizer and manure recommendations.

Singh *et al.* (2019) found that important source of nutrients for plant growth are chemical fertilizers. But it has been defined by the agricultural scientists to have about 13 balanced and suggestion use of the fertilizers. Optimum use of fertilizers results in decreasing the cost and increasing the yield of their crops as well. The prerequisite is conducting soil testing and getting Soil Health Card (SHC) by the peasants.

2.3 Perception on the utility of Soil Health Cards

Bagri and Kinjulck (2012) reported an empirical observation on the view of the farmers in Madhya Pradesh about Seed Village Programme and it was evident that, a majority of about 51.66 per cent of the farmers had moderately favourable perception, while farmers having highly favourable perception were 26.66 per cent

with and only 21.66 per cent had unfavourable perception about the utility of seed village programme conducted in Rewa block.

Kadam *et al.* (2012) reported about (53.85 %) of the farmers had moderate level of perception about their role and the respondents with good perception was 39.42 per cent and followed by 6.73 per cent with poor perception about their role, respectively.

Prakash Tamagond (2013) reported that medium role of perception category constitutes 39.00 per cent of farm facilities, where families with high and low role perception were 34.00 per cent and 27.00 per cent, respectively, in his study on importance of perception and performance of farm families under the Bhoochetana programme.

Sonawane *et al.* (2015) in their study on perception of farmers towards crop insurance scheme noticed that, a majority 59.16 per cent of the crop insurance beneficiaries were with a low level of perception towards Crop Insurance Scheme and 30.84 per cent were having medium perception, where only 10.00 per cent has high level of perception towards the scheme.

Dariush *et al.* (2016) reported positive attitudes of the rice growers towards water and soil conservation, whereas farmers of rice category grower with a good and moderate level of positive attitude were 44.8 per cent and 41.2 per cent, respectively.

Laxman (2016) indicated that more than half part of about 58.75 per cent respondents had moderate level of perception, whereas 20.63 per cent and 20.62 per cent had poor and good level of perception, respectively.

Kavyashree (2016) in her study on comparative analysis of public, private and corporate extension system reported that, equal number of farmers had least favorable (36.66%) and favorable (36.66%) perception towards public extension system, while, more than one fourth of the farmers had most favorable (26.66%) perception towards public extension system. Whereas, in case of private extension system nearly (43.33%) of the farmers had favourable perception with (30.00%) of them having most favourable and (26.66%) with least favourable perception towards private extension system. A majority of (40.00%) of the farmers belonged to least favourable

perception with the rest of (33.33%) and (26.66%) of the farmers with most favourable and favourable perception towards corporate extension system, respectively.

Kumari (2016) revealed that that (54.17%) of the respondents had medium level of perception, which is a major percentage and this was followed by low and high level of perception on climate variability constitute of (25.00%) and (20.83%), respectively.

Mukati *et al.* (2018) reported on Farmer's perception regarding Soil Health Card from his study that, a maximum number of Soil Health Card holders (83.76%) were having favourable attitude regarding Soil Health Card, whereas a farmers with less favourable were (11.97%) and only (4.27%) were identified with most favourable attitude towards Soil Health Card.

Charel (2018) conducted a study on perception and use efficiency of Soil Health Card by the farmers and found that majority of the Soil Health Card beneficiaries had a moderate level of perception about the programme constituted of (70.83%), followed by the card holders with good and poor level of perception about Soil Health Card scheme as (15.00%) and (14.17%), respectively.

Jaiswal and Singh (2018) in their study identified that about (82.50%) of SHC holders had moderate level of perception, which is a majority portion and a poor and good level of perception was found in (12.50%) and (5.00%) of the card holders.

Rathor (2018) indicated from his study that maximum per cent had favourable attitude regarding Soil Health Card of Soil Health Card holders constituted about (83.66%), followed by farmers with less favourable and most favourable attitude towards Soil Health Card was (11.97%) and (4.27%), respectively.

2.4 Constraints faced by the farmers by using Soil Health Cards and their suggestions

2.4.1 Constraints faced by the farmers

Chowdary *et al.* (2016) observed that the primary challenge highlighted by the participants was the lack of effective follow-up by extension agencies, which was cited by (63.0%) of the respondents. This was followed by concerns regarding the

absence of tangible outcomes (43.0%), the complexity of implementing the recommendations (26.0%), insufficient knowledge (23.0%), limited benefits (14.0%), time constraints (11.0%), non-compliance by peers and unscientific soil sample collection methods (9.0%) and lastly, the issue of higher costs (3.0%).

Charel *et al.* (2018) mentioned that the level of difficulty to calculate fertilizer dose based on the nutrient status of soil was 70.00 per cent, whereas the time gap between soil samples taken and issuing cards was too high of around 62.50 per cent. In the Soli Health Card, the unavailability of micronutrient status of soil was 60.00 per cent. The content of SHC was not understandable by 57.50 per cent. People who received Soil Health Cards after crop harvest constitutes 50.00 per cent. There were concerns raised about the accuracy and dependability of the information presented in SHC, accounting for 47.50 percent of the respondents. Additionally, it was noted that in 37.50 per cent of cases, soil sample collection did not take place in the presence of farmers.

Chaudhary (2018) reported one of the majorly important constraints faced by beneficiary farmers was inadequate facilities in soil testing labs, which are testing sample for keeping the sample safely and unavailability of proper facilities, along with improper care of the samples in the labs. Additionally, the complex steps of the procedure were the constraints faced by beneficiary farmers after adopting Soil Health Card Scheme. The farmers also complained about demand of extra charges by the concern officials.

Jaiswal and Singh (2018) revealed that maximum 75.83 per cent having problem in making SHC, followed by 64.17 per cent faced difficulty in calculating fertilizer dose on the basis of nutrient status of soil, about 55.83 per cent collection of soil sample was not performed in presence of farmer, a high time gap between soil samples taken & issuing cards, which was 52.50 per cent, 37.50 per cent received SHC after crop harvest, 32.50 per cent inability to understand all the information given in the card, 24.17 per cent no subsidy on inputs required by the government for improving the soil quality and 22.50 per cent irregularity of extension services.

Lamkane (2018) reported that unavailability of micronutrients status of soil on SHC was ranked first among the problems faced by most respondents (76.67%).

About 75 per cent respondents found difficulties in calculating the dose of fertilizers as per the recommendation and 73 per cent were not able to operate internet. Non availability of internet hindered the successful application of SHC. Soil sample collection in absence of farmers was reported as constraints by half of respondents.

Mukati *et al.* (2018) found that a significant majority of Soil Health Card holders encountered various challenges. These challenges included difficulties in calculating fertilizer doses based on soil nutrient status (64.10%), absence of farmers during soil sample collection (55.56%), extended time intervals between soil sampling and card issuance (51.28%), receiving Soil Health Cards after crop harvest (40.17%), difficulty in comprehending all the information provided on the card (25.64%), a lack of government subsidies for soil quality improvement inputs (20.51%) and inconsistent availability of extension services (17.09%). These challenges hindered their ability to address their concerns promptly.

Naruka *et al.* (2018) reported that a majority of the farmers (70.00%) expressed their lack of knowledge about the importance of micronutrients and 68 per cent of them expressed challenges faced with high prices of fertilizers and 58 per cent farmers expressed their view on non-availability of organic manure.

Niranjan *et al.* (2018) revealed that most farmers who had their soil tested faced several challenges. The foremost issue was the difficulty in calculating the appropriate number of fertilizers based on their Soil Health Cards (87.00%). This was followed by concerns about the high cost of fertilizers (79.00%), a lack of proper training (74.00%), inadequate availability of the 35 recommended fertilizers in the local market (63.00%), insufficient knowledge about the ideal soil sample collection method (56.00%), a dearth of technical guidance on when and how to apply fertilizers (53.00%), limited capital for fertilizer purchases (34.00%), doubts about the credibility of SHC recommendations (47.00%), the inconvenience of distant soil testing laboratories (45.00%), insufficient awareness regarding the benefits of Soil Health Cards (35.00%), delayed availability of SHCs (23.00%) and the belief that soil testing was unnecessary due to satisfactory crop yields (19.00%).

Singh *et al.* (2018) reported that most of the card holders found it difficult to understand the technical terms used in the card, like 'pH', 'EC', 'OC'. These are some

of the most crucial elements for soil health and respondents did not even understand the difference between the translated Hindi words for ‘organic manure’ and ‘biofertilizer.’ However, when researchers explained it to them using specific examples and biofertilizer, they understood organic manure.

Archana and Balasubhramanian (2019) reported that the first constraint was all the information given in the card was not understandable, with the mean score of 96 per cent followed by very high score of (82.8%) for the time gap between soil samples taken and issuing cards, (72.00%) for lack of proper scientific guidance, (63.60%) for showing high prices of fertilizers, organic manure and bio-fertilizers are not available for (56.40%) and non-availability of micronutrient fertilizers in market was (49.20%).

Babu *et al.* (2019) studied the participants faced several challenges, including: Difficulty in calculating fertilizer doses based on soil nutrient status (85.84%), receiving Soil Health Cards after the crop harvest (82.51%), lengthy time gaps between soil sample collection and card issuance (79.17%), Soil sample collection not being done in the presence of farmers (72.92%), lack of technical guidance regarding fertilizer application methods and timing (69.59%), inadequate availability of recommended fertilizers in the local market (63.34%), distant location of soil testing laboratories (54.59%), high fertilizer prices (52.92%), doubts about the quality and reliability of information provided in the Soil Health Cards (46.67%), lack of training (37.50%), difficulty in operating the internet for access to the Soil Health Card portal (34.59%), inconsistent availability of extension services (30.84%). These challenges collectively hindered the effective use of Soil Health Cards and soil testing practices among the respondents.

Ghaswa *et al.* (2019) reported that most farmers expressed difficulty in application of fertilizers as per recommendations was (72.22%), due to too high the prices of fertilizers. (69.44%) of them expressed difficulty due to their lack of knowledge about the importance of micronutrients, whereas (65.27%) farmers expressed their view on non-availability of organic manure.

Veeraiiah *et al.* (2019) reported that the respondents expressed the issue of lack of rains lead to improper sown of crops (14.81%), unable to understand the results given in Soil Health Cards (7.40%), lack of believe in the results presented in Soil

Health Cards (7.40%), lack of facilities for irrigation (5.50%), more fertilizers usage leads to more yields (3.70%), expected yield not obtained (3.70%), soil test was not done in their fields (3.70%) and new Soil Health Cards not issued (3.70%) were the constraints in adoption of Soil Health Card recommendations.

Ghate and Kamble (2020) revealed three categories of high, medium and low. Highest of (66%) are due to constraints faced is for unavailability of micronutrients, followed by (38%) due to the problem in sending a soil sample to the laboratory and (12%) least difficulty occurred during the fertilizer dose calculation. In medium category, maximum constraint (68%) is reported as time gap to receive SHC followed by difficulties in calculation of doses (66%) and least (16%) unable to operate internet. The low category consists of constraints due to inability to operate internet, which contribute maximum (54%) and least in time gap to receive SHC (14%).

Kaur *et al.* (2020) reported that 93 per cent of the card holders faced difficulty in operating internet to access the SHC portal. 90 per cent of the beneficiaries reported delay in receiving SHC and lack of mobile soil testing vans along with lack of demonstration and training to use SHC as major constraints. Insufficient follow up by the extension agency and non-availability of internet cafe in the area were some other constraints reported by about three-fourth of the beneficiaries. Difficulty in using soil test-based fertilizer recommendations paved a hindrance for 75 per cent of the respondents in using SHC. Additionally, farmers did internalize the recommendation and the information on SHC also altered their preferred fertilizer mix, but other factors such as cost, liquidity or timely availability of fertilizers prevented them from acting on these preferences by shifting their actual application.

Kumar (2020) revealed that a major difficulties faced by paddy growers in terms of acceptance of Soil Health Card program were: unavailability of status of micronutrient (75.83%), difficulty fertilizer dose calculation based on nutrient status of soil and longer time gap between soil samples taken and issuing cards (72.50%), whereas (70.0%) received Soil Health Cards after crop harvest. The others are due to unavailability of internet facility (59.10%), unable of operate internet (68.33%) and collection of soil sample was not done in presence of farmers (61.66%).

Kumar *et al.* (2020) identified significant challenges in the context of Soil Health Cards. Among the constraints related to the average rank value, they found

that the following issues were particularly prominent: a substantial time gap between soil sample collection and card issuance, with a mean rank of 5.38; farmers having trouble in comprehending all the information presented in the Soil Health Card, with a mean rank of 4.75 and farmers encountering challenges in determining fertilizer dosages based on the soil's nutrient status, with a mean rank of 4.70.

Madhu *et al.* (2020) found that a significant number of farmers expressed concerns about the delayed distribution of Soil Health Cards, which, in turn, hindered their ability to implement recommended fertilizer practices. To maximize the benefits for farmers, the study suggests that Soil Health Card results should be provided before the start of the kharif season. Additionally, the study highlighted that illiterate farmer encountered difficulties in referring to and comprehending the content of the Soil Health Card, often requiring assistance from literate peers. As a result, the researchers identified farmer illiteracy as a notable constraint in this context.

Sheetal *et al.* (2020) revealed a major technical constraints due to improper information about micronutrient status in soil, which was ranked first (50.00 MPS) by beneficiary respondents followed by lack of knowledge about the micronutrients and their importance ranking second (45.44 MPS) and least knowledge about scientific method of collection of soil sample had ranked third (36.11 MPS), very long time gap between soil sample taken and issuing card was reported which ranked fourth (30.50 MPS), respectively.

2.4.2 Suggestions given by farmers

Bhunwal (2011) unveiled key recommendations provided by farmers to address the challenges they encountered when employing bio-control measures for plant protection. These recommendations included: standardizing the quality of bio-control agents, providing training to farmers on the production and application of bio-control agents, conducting result and method demonstrations with the active involvement of the farming community to underscore the significance of these agents and motivate farmers, organizing awareness campaigns within the farming community to highlight the benefits of bio-control measures, ensuring that bio-control agents are readily accessible to all farmers in need, making publications on proven bio-control agents readily available to farmers. These suggestions aimed to enhance the adoption and effectiveness of bio-control measures in plant protection.

Patel and Chauhan (2011) mentioned some of the major suggestions given by the farmers to accelerate the application of Soil Health Card were: crop wise recommended dose of fertilizer should be given, a must display of availability of micronutrient, issue of SHC prior to crop season, training of farmer to take soil sample of its own soil, soil testing laboratory should be established with highly qualified supporting staff maintaining taluka level, internet facility should be provided at village level and soil sampling procedure should be done in presence of farmer.

Patel (2013) reported majority of the farmers had suggestions regarding availing provision of crop wise recommended dose of fertilizer in Soil Health Card.

Chowdhary *et al.* (2016) identified various recommendations put forth by the respondents. The primary suggestion, expressed by a substantial (96.00%) of the respondents, was the prompt distribution of Soil Health Cards. Following this, (84.00%) of the respondents advocated for extended follow-up by the extension agency, while (71.00%) emphasized the importance of including all farmers in the Bhoochetana project. Additionally (28.00%) of respondents highlighted the need for an increased number of demonstrations (13.00%) called for training in soil sampling and Soil Health Card utilization and 6.00% suggested weekly visits by Agricultural Extension Officers (AEO) to the farmers' fields. These recommendations collectively aimed to enhance the effectiveness of Soil Health Card initiatives.

Charan (2019) evident that among the perceived operational suggestions, followed by the suggestions given in the SHC must be according to the land area of the farmers by which they can easily calculate the fertilizer doses (58.33%), biofertilizer doses and reference yield should be given (23.33%) in the order of priority.

MATERIALS AND METHODS

A research methodology design, which outlines, justifies, and describes a variety of research procedures, is necessary for every systematic research effort. This chapter includes a detailed description of the materials and research techniques used. The study area, the sampling procedure, the variables and their empirical measurements, the methods for gathering data, the analytical stages, and the statistical tools used to analyse the findings are all covered in this section. The methodology used for this study was based on the collection of primary data through household surveys and in-person interviews with the farmers and Assistant Agriculture Officers, as well as secondary data using existing sources. The following sub-headings cover the topics covered in this chapter.

3.1 Location of the study

3.1.1 Odisha at a glance

3.1.2 Cropping pattern of the state of Odisha

3.1.3 Location and geographical area of Khordha district

3.1.4 Cropping pattern of the district

3.2 Research design

3.3 Sampling procedure

3.3.1 Selection of district

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3.3.3 Selection of villages

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3.3.5 Selection of officials

3.4 Tools and techniques used for the data collection

3.4.1 Pilot study

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3.4.3 Pre-testing of interview schedule

3.4.4 Rapport building with farmers

3.4.5 Collection of information

3.5 Selection of variables

3.6 Operationalisation of variables

3.7 Statistical tools used for analysis

3.1 Location of study

The present research was carried out in the Khordha district of Odisha in the year 2022–2023. Odisha was chosen since it is the researcher's home state and because of the sheer number of SHC beneficiaries. There are 30 districts in Odisha. Out of that Khordha district was purposefully chosen for the study because it had the maximum number of Soil Health Card beneficiaries (State Quality Control Laboratory, Bhubaneswar, 2022-2023).

The district is divided into two sub-divisions: Bhubaneswar and Khordha. Khordha district has 10 tehsils, 10 blocks, 3 municipalities, 2 NAC, 34 police stations, 1534 villages and 190 gram panchayats. Also, the researcher is a native of this district and the location was chosen for the convenience in data gathering.

3.1.1 Odisha at a glance

Odisha has total districts of 30 number that is located between latitude of 17⁰51'N to 20⁰51'N and longitude of 81⁰50'E to 87⁰50'E. The land area is approximately 1,55,707 square kilometers and there are ten agroclimatic zones with varying soil, terrain, rainfall and cropping patterns.

The two regions of Odisha are the coastline region and the plateau region. The plateau region makes up 77 percent of all geographic area, and the coastal region makes up about 23 percent. Odisha's total cultivated area is 61.60 lakh hectares, or about 47% of its high land, 28% of its middle land and around 25% of its low land. cultivated area under irrigated water is around 54% and rest is rainfed.



Fig. 3.1.1. Map of Odisha



Fig. 3.1.2. Map of Khordha district



Fig. 3.1.3. Map of Balianta



Fig. 3.1.4. Map of Balipatna

3.1.2 Cropping pattern of the state of Odisha

Odisha produces a wide range of crops, the bulk of which being rice. However, farmers also grow a variety of horticultural products, including fruits, vegetables, spices and others. Depending on the rainfall, certain areas cannot cultivate. One of the main factors affecting the growth of any crop in a particular place is rainfall. Crop production varies from region to region and varies by area in terms of production.

3.1.3 Location and geographical area of Khordha district

Khordha district is situated between latitudes 19⁰40'N and 20⁰25'N and longitudes 84⁰55'E and 86⁰5'E. It is 75 meters high. The existence of large water bodies like the Chilika lake and its proximity to the Bay of Bengal both have a substantial impact on the bioclimatic conditions there. In general, the region experiences hot, humid weather from April through May and frigid weather from December through January. It has maximum and minimum temperatures of 42.2⁰C and 11.1⁰C, respectively and average annual precipitation of 1408 mm. Typically, the average relative humidity ranges from 46% to 89%.

The Khordha district is located in the coastal plain of the east and southeast regions and is part of an agro-climatic zone with a variety of agro-ecosystems and sandy-loam, loam, clay-loam and clayey soil types. The district is further divided into two subregions: the lateritic subregion, which includes Bhubaneswar, Begunia, Bolagarh, Banpur, Jatni, Khordha and Tangi and the deltaic alluvium subregion, which includes the Balipatna, Baliana and Chilika blocks.

Table 3.1.3.1. Administrative details of Khordha district

Administrative details of the district			
Number of Sub-Divisions	2	Number of Tehsils	10
Number of Municipalities/Corporations	3	Number of N.A.Cs	2
Number of Blocks	10	Number of Police Stations	34
Number of Gram Panchayats	190	Number of inhabited villages	1356
Number of Uninhabited Villages	178	Number of villages	1534

(Source: District Statistical Handbook, Khordha 2020, Directorate of Economics and Statistics, Odisha)

Table 3.1.3.2. Sub-divisions, blocks and tehsils under Khordha district

Sub-division		Block		Tehsil	
List of Subdivisions of the district		List of Blocks of the district		List of Tehsils of the district	
Sl. No.	Name	Sl. No.	Name	Sl.No.	Name
A.	Bhubaneswar	a.	Balianta	a.	Bhubaneswar
B.	Khordha	b.	Balipatna	b.	Balianta
		c.	Banpur	c.	Balipatna
		d.	Begunia	d.	Jatni
		e.	Bhubaneswar	e.	Khordha
		f.	Bolagarh	f.	Begunia
		g.	Chilika	g.	Bolagarh
		h.	Jatani	h.	Banapur
		i.	Khordha	i.	Tangi
		j.	Tangi	j.	Chilika

(Source: www.khordha.nic.in)

Table 3.1.3.3. Geographical and demographic details of Khordha district

Geographical and demographic details of the district		
Geographical area	2813 sq. km.	
Area under forest:	669.74 sq.km	
Population	Numbers	
Male	1167137	
Female	1084536	
SC Male	151528	
SC Female	145984	
ST Male	115051	
ST Female	59094	
Male (Others)	491445	
Female (Others)	465640	
Total	2251673	
Population density	800 per sq. km	
Sex ratio (females per 1000 males)	929	
Literacy	Percentage	
Literacy rate	86.9%	
Literacy rate (Rural)	83%	
Literacy rate (Urban)	91%	
Decadal growth rate	19.9%	
Households	Numbers	
Total Households	494212	
Rural Households	247304	54.04%
Urban Households	246908	49.96%

(Source: District Statistical Handbook, Khordha 2020, Directorate of Economics and Statistics, Odisha)

3.1.4 Cropping pattern of the district

The backbone of Khordha's economy is agriculture. The local climate is ideal for growing crops including rice, arhar, green gram, peanut and mustard, among others. Numerous horticultural crops are also grown, including brinjal, cauliflower, cabbage, etc.

Table 3.1.4. Land utilisation pattern of different blocks in Khordha district (in ha)

Sl. No.	Block	Forest	Land under non-agricultural use	Permanent pastures and other grazing land	Cultivable waste	Current fallows	Net area sown
1.	Balianta	16	4188	635	1169	1103	5321
2.	Balipatna	86	2659	921	384	389	7796
3.	Banapur	10824	2786	1033	523	583	13424
4.	Begunia	2325	2569	1825	2708	1464	13503
5.	Bhubaneswar	8893	4343	4509	3459	353	2468
6.	Bolagarh	1267	2684	1157	502	859	15257
7.	Chilika	3168	6256	815	190	204	4427
8.	Jatani	1647	4256	2649	3968	472	4562
9.	Khordha	825	2232	2038	2786	4662	8986
10.	Tangi	1748	10750	848	4374	1088	10639
	District total	30799	54623	16468	20331	11796	88368

(Source: District Statistical Handbook, Khordha 2020, Directorate of Economics and Statistics, Odisha)

3.2 Research design

Ex-post-facto methodology was chosen as the research approach for the current study because the phenomena has already begun and is still occurring.

It is also known as “after-the-fact design,” and social scientists employ it the most frequently. It concentrates on what has already happened. As a result, a researcher cannot change what has already happened. Therefore, taking it into account in this situation was ideal.

3.3 Sampling procedure

In this study for selecting the district, block and village purposive sampling was used and for selecting the farmers fixed proportionate random sampling by lottery method was used.

3.3.1 Selection of district

Among all the districts of Odisha, Khordha was purposively selected for the study as it is one of the highest Soil Health Card receiving district in the state. Another reason for selecting the district was that the researcher is native to the district.

3.3.2 Selection of block

Balianta and Balipatna block were selected purposively out of 10 blocks of Khordha district. These blocks were selected through purposive sampling method because these were the blocks with the highest number of Soil Health Card beneficiaries.

3.3.3 Selection of villages

A total of six villages has been selected from the two blocks. From the Balipatna block three villages namely Nariso, Biswanathpur and Amankud, and from Balianta block Dhabalahar, Bentapur and Nagapurusa were selected purposively as these villages were having maximum number of SHC beneficiaries.

3.3.4 Selection of respondents

A total of 93 respondents from the six villages were selected. They were selected based on fixed proportionate random sampling by lottery method. The researcher had taken 25% of the farmers having Soil Health Cards from each sample village.

Table 3.3.4. Selection of sample respondents

Block	Villages	No. of SHC beneficiaries	No. of respondents taken
Balipatna	Nariso	50	13
	Biswanathpur	50	12
	Amankud	43	11
	Total	143	36
Balianta	Dhabalahar	90	22
	Bentapur	55	14
	Nagapurusa	85	21
	Total	230	57

3.3.5 Selection of officials

A total of 20 officials i.e. Block Agriculture Officers and Assistant Agriculture Officers were selected randomly from the blocks of the district.

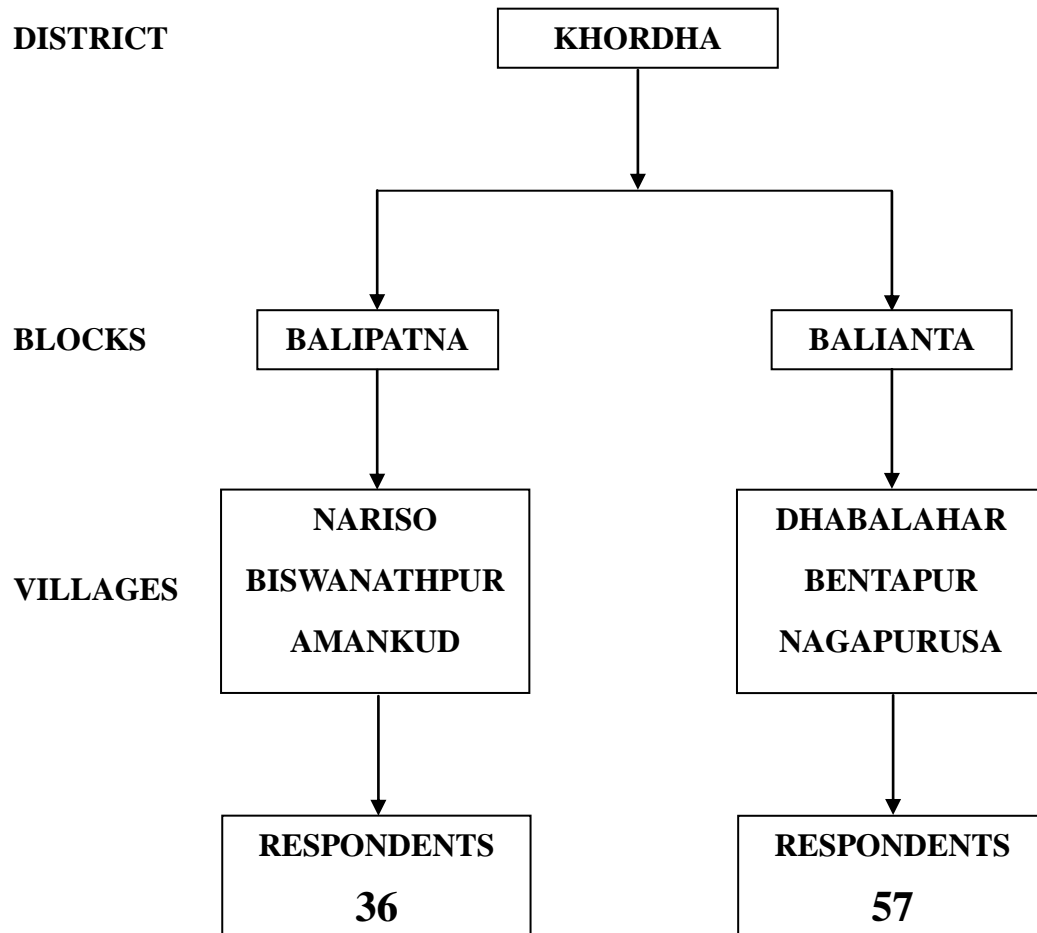


Fig. 3.3. Sampling plan of the study area

3.4 Tools and techniques used for the data collection

3.4.1 Pilot study

Before creating an interview schedule, the researcher conducted a trial study in the study region in February 2023. This pilot study's objective was to learn first hand facts regarding Soil Health Card in the Khordha district.

3.4.2 Development of interview schedule

Numerous proposals were added to and deleted from the interview schedule depending on the data gathered during the pilot research. Due to time and resource constraints, a careful review of each objective-specific question was conducted and questions with lower validity and reliability were left out. In May 2023, the interview schedule was prepared.

3.4.3 Pre-testing of interview schedule

A pretesting was conducted by the researcher in June 2023, using 10% of the SHC beneficiaries, prior to the interview schedule's final implementation. Based on the outcomes and input obtained during this pretesting, many adjustments and corrections were done.

3.4.4 Rapport building with farmers

The researcher must establish rapport in order to acquire accurate and reliable data. By making frequent trips to the research area, interacting amicably with the farmers' members, and receiving assistance from the block members like Agriculture Officers and VAWS. This technique was carried out in June 2023, which facilitates the development of cordial relationships with respondents and, in turn, facilitates the easier collection of responses.

3.4.5 Collection of information

The data was collected with the help of a structured interview schedule developed based on the objectives of the study. With the help of this schedule information regarding the awareness level of farmers, nature of use of SHC and perception of the officials and farmers were recorded. The data were given codes, analysed and it was represented in the form of tables to draw valid conclusions.

3.5 Selection of variables

The variables for the study were chosen through a thorough examination of existing literature and consulting various experts from soil science department and the initial research conducted in the study area. Variables that directly align with the study's objectives were carefully chosen for comprehensive investigation. So the variables for the present study are:

Table 3.5. Variables of the study

Sl. No.	Variables	Measurement
1.	Awareness	Scale followed by Kumar, 2021
2.	Use of SHC	Scale followed by Mahendrasinh, 2016
3.	Perception	Scale followed by Mukati, 2016

3.6 Operationalization and measurement of variables

The study assessed variables by putting numerical values on them depending on how significant they were in determining the measurement. Here, we give a brief description of the scoring methods that were used to measure these variables.

3.6.1 Level of awareness of farmers on SHC

Awareness of a person can be defined as the ability of that person to perceive, feel and to be conscious of the events, objects or sensory pattern. It is the state of being conscious of something.

With the aid of existing literature and consultation with experts, an interview schedule with 18 statements regarding the scheme has been prepared following Kumar 2021, in order to assess the farmers' level of awareness of the initiative.

Table 3.6.1.1. Scores assigned to awareness level of farmers

Sl. No.	Category	Score
1.	Fully aware	3
2.	Partially aware	2
3.	Unaware	1

All the scores were summed up to get the overall awareness score of the respondents. Then, the respondents were categorised into three groups based on mean and standard deviation.

Table 3.6.1.2. Distribution of farmers based on overall awareness level of farmers

Sl. No.	Category	Score
1.	Low	Below Mean-S.D.
2.	Medium	Between mean \pm S.D.
3.	High	Above Mean+ S.D

3.6.2 Nature of use of Soil Health Card

It refers to the frequency and manner with which the recommendations of SHC has been utilised by the farmers. For this study a total of 16 statements has been prepared in consultation with experts from the field of soil science, agronomy and

extension for deriving meaningful conclusions. The responses from the respondents were obtained on a three point continuum.

Table 3.6.2.1. Scores assigned based on nature of use of SHC

Sl. No.	Category	Score
1.	Always using information given on SHC	3
2.	To some extent using the information	2
3.	Never using the information	1

All the scores were summed up to get the overall values of the respondent. Again these were categorised into three categories on the basis of use efficiency as low, medium and high.

Table 3.6.2.2. Distribution of farmers based on their use efficiency of the information in SHC

Sl. No.	Use efficiency	Score
1.	Low	Below Mean-S.D.
2.	Medium	Between mean \pm S.D.
3.	High	Above Mean + S.D

3.6.3 Perception about SHC

The definition of perception, according to the New Webster's dictionary, it is the apprehension with mind or senses an immediate or initiative recognition as of moral or aesthetic quality. It can also be defined as an active process of becoming aware or getting meaningful understanding about situation. It is the process whereby sensory stimulation is translated into organised experience.

For this study a total of 25 statements has been prepared followed by Mukati 2016, by consulting experts from the fields of agronomy, soil science and extension.

Table 3.6.3.1. Scores assigned based on degree of perception

Sl. No.	Category	Score
1.	Agree	3
2.	Undecided	2
3.	Disagree	1

For this study, the perception of

- 20 official stakeholders (Block Agriculture officers and Assistant Agriculture officers) from the blocks.
- 93 farmers of the two blocks has been taken into consideration.

All the scores were summed up to obtain the overall score of the respondents. The respondents were categorised into three categories.

Table 3.6.3.2. Distribution of officials and farmers based on their level of perception about SHC

Sl. No.	Level of perception	Score
1.	Poor	Below Mean-S.D.
2.	Moderate	Between mean \pm S.D.
3.	Good	Above Mean+ S.D

3.6.4 Constraints faced by farmers while using SHC

Constraints are the factors or hinderances that restrict an object from achieving its probable outcome with reference to the objectives. So its important to identify and prioritize those factors to find probable solutions.

For this present study the constraints are categorised into four categories namely operational, technical, financial and social constraints. The responses were recorded on a three point continuum based on the severity of the constraint.

Table 3.6.4. Scores assigned to constraints based on the severity of the problem

Sl. No.	Level of severity of the constraint	Score
1.	Severe	3
2.	Moderate	2
3.	Low	1

3.7 Statistical tools used for analysis of the data

3.7.1 Frequency

Frequencies were applied to the data in order to determine how the respondents were distributed in relation to the chosen variable. The number of times an observation is repeated is known as its frequency.

3.7.2 Percentage

A data presentation that shows the percentage of observations for each data point is known as a percentage frequency distribution. It is a widely used approach for expressing various data, including relative frequency responses.

The percentage frequency distributions are frequently shown as tables, bar graphs, or pie charts. Frequency percentage formula:

$$\frac{f}{X} \times 100$$

Where, f = Frequency

X = Sum of all items

3.7.3 Arithmetic mean

Arithmetic mean represents a number that is obtained by dividing the sum of the elements of a set by the number of values in the set.

$$\text{Arithmetic mean } (\bar{X}) = \frac{\sum x_i}{n} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

Where, \bar{X} = Arithmetic mean

$\sum x_i$ = Sum of total observations,

x_i = value of i^{th} item of x, where $i = 1, 2, \dots, n$

n = Total number of respondents

3.7.4 Standard deviation

Standard deviation (S.D.) of a set of observation is the square root of the arithmetic mean of the squares of the deviations. The deviations being measured from the arithmetic mean of the distributions. It is commonly denoted by the symbol σ . It is a measure of variability around mean.

$$\text{S.D. } (\sigma) = \sqrt{\frac{1}{n-1} \left[\sum x_i^2 - \frac{(\sum x_i)^2}{n} \right]}$$

Where $\sum x_i^2$ = Sum of squares of observations

$(\sum x_i)^2$ = Square of sum of 'x' values

n = Number of respondent

RESULTS AND DISCUSSION

The data collected from the respondents were analysed in accordance with the methodology outlined in chapter III and the result of the analysis are prepared, presented and discussed in this chapter under following headings:

4.1 Awareness of farmers about Soil Health Card

4.2 Nature of use of Soil Health Card

4.3 Perception on utility of Soil Health Card

4.4 Constraints faced by farmers and their suggestions

4.1 Awareness of farmers about Soil Health Card

Awareness is the ability to perceive, feel or to be conscious of the events. For quantifying this variable farmers were queried whether they are aware about the several parameters, usefulness or benefits of SHC. This depends on their age, education level, exposure social contact etc.

From the Table 4.1.1, it was observed that majority (73.12%) of farmers are fully aware about 'from where they can collect the SHC' followed by 12.90 and 13.98 per cent farmers partially aware and unaware of it, respectively.

It was also observed that majority (55.91%) fully aware of the method of taking soil sample followed by (44.01%) partially aware of soil sampling because even before the introduction of SHC scheme the farmers here used to send their soil sample for soil testing. Moreover, progressive farmers having some scientific knowledge in these areas assist other farmers in sampling.

Also, (54.84%) of farmers are aware of the ideal time of soil sampling followed by (30.11%) partially aware and (15.05%) are unaware of it. About the distribution of SHC (52.69%) are fully aware, (26.88%) are partially aware and 20.43 per cent farmers are unaware of it. The cards are usually distributed by the officials via their subordinates like VAWs or sometimes through the Krushak saathis at their doorstep.

It was seen that majority (44.09%) of farmers are partially aware of the benefits followed by 32.26 per cent farmers fully aware and 23.65 per cent unaware of the benefits accruing to the use of SHC. This could be due to lack of understanding of the contents or recommendations given in SHC by the farmers.

Majority (60.22%) are partially aware about the purpose of SHC followed by (24.73%) fully aware and (15.05%) totally unaware of it.

Majority (44.09%) are partially aware of the precautions that should be taken while soil sampling followed by (30.11%) fully aware and (25.80%) totally unaware of it. This could be due to lack of scientific knowledge or approach of doing things among the farmer. Also this could be due to lack of guidance or expert advices from the agricultural experts, lack of contact between farmers and officials.

Majority (44.09%) of farmers are partially aware about all parameters (OC, EC, pH, major nutrients and minor nutrients) followed by 38.71 per cent totally unaware and 17.20 per cent fully aware of the parameters. This is due to medium level of education, scientific orientation, mass media exposure and extension contact.

From the above table it is interpreted that, majority (80.65%) of farmers are totally unaware of the SHC web portal followed by 15.05 per cent farmers partially aware means they know the existence of the portal but they rarely visit the website and only 4.30 per cent farmers can access the portal. This may be attributed to their low to medium level of education and mass media exposure.

Majority (73.12%) farmers were unaware of the fact that 'who initiated the scheme' followed by (26.88%) partially aware that it was initiated by Department of Agriculture and Farmers' welfare.

Table 4.1.1. Statement wise awareness of farmers on SHC**n=93**

Sl. No.	Statements	Fully aware		Partially aware		Unaware		Mean score
		f	%	f	%	f	%	
1	Are you aware about the SHC Scheme?	40	43.01	51	54.84	2	2.15	2.41
2	Are you aware of the date of starting SHC in you locality?	30	32.26	17	18.28	46	49.46	1.83
3	Who Initiated SHC scheme?	0	0.00	25	26.88	68	73.12	1.27
4	What is Slogan of this scheme?	0	0.00	1	1.08	92	98.92	1.01
5	What is main purpose of the SHC Scheme?	23	24.73	56	60.22	14	15.05	2.10
6	Have you ever visited the SHC web portal i.e. www.soilhealth.dac.gov.in	4	4.30	14	15.05	75	80.65	1.24
7	Are you aware of the parameters displayed in SHC?	16	17.20	41	44.09	36	38.71	1.78
8	Are you aware of the method of taking soil sample?	52	55.91	40	43.01	1	1.08	2.55
9	What is ideal time for soil sampling?	51	54.84	28	30.11	14	15.05	2.40
10	Precautions to be taken while taking soil Sample?	28	30.11	41	44.09	24	25.80	2.04
11	Number of the cards, farmer gets every year.	28	30.11	50	53.76	15	16.13	2.14
12	Who tests the soil sample and where?	26	27.96	40	43.01	27	29.03	1.99
13	From where SHC can be collected?	68	73.12	12	12.90	13	13.98	2.59
14	How much farmer must pay for each sample test?	40	43.01	39	41.94	14	15.05	2.28
15	Who distributes SHC?	49	52.69	25	26.88	19	20.43	2.32
16	Are you aware about the information provided in SHC?	21	22.58	48	51.61	24	25.81	1.97
17	Are you aware about the benefits of SHC?	30	32.26	41	44.09	22	23.65	2.09
18	Are you aware about the effect of SHC on soil?	15	16.13	38	40.86	40	43.01	1.73

Table 4.1.2. Distribution of respondents according to their overall level of awareness on SHC

n=93

Sl. No.	Level of awareness	f	%
1.	Low (<26.84)	17	18.28
2.	Medium (26.84-44.62)	58	62.37
3.	High (> 44.6)	18	19.35
Total		93	100
Mean-35.73		S.D. - 8.89	

It is depicted from Table 4.1.2 that out of the total 93 SHC beneficiaries majority (62.37%) of farmers have medium level of awareness followed by 19.35 per cent of farmers having high level of awareness and 18.28 per cent of farmers have low level of awareness.

The probable reason for this higher percentage of medium level of awareness (62.37%) might be due to medium level of education of the most of the farmers because of medium level of education, they have access to mass media and understanding of scientific aspects of farming. As a result, they are able to interact with agricultural experts and other government officials on various issues and problems in farming practices.

The probable reason for higher level of awareness (19.35%) among certain farmers may be attributed to their higher level of education, resulting in better interaction with the agriculture experts, more scientific orientation, higher motivation to try new ideas (innovative farmers).

The low level of awareness among some of the farmers is due to low level of education, lack of interest, less interaction with the experts and low media exposure due to which farmers were unable to understand the information in SHC.

4.2 Nature of use of Soil Health Card

Nature of use depicts how efficiently and frequently the farmers are utilising the recommendations given in the SHC. This depends on their education and level of

understanding. For this study the respondents are divided into three categories viz. always using the information given in SHC, to some extent using and never using the information.

Table 4.2.1. Distribution of farmers according to their use of major nutrients

n= 93

Sl. No.	Statements	Always using		Some extent using		Never using		Mean score	Rank
		f	%	f	%	f	%		
1	Application of organic matter in the soil as per information given in the SHC.	65	69.89	16	17.21	12	12.90	2.57	I
2	Application of nitrogenous fertilizer in the soil as per the information given in SHC.	58	62.37	24	25.80	11	11.83	2.51	II
3	Application of phosphorus in the soil as per information given in the SHC.	55	59.14	27	29.03	11	11.83	2.47	III
4	Application of potash in the soil as per information given in the SHC.	49	52.69	28	30.11	16	17.20	2.35	IV

Table 4.2.1 indicates the rank order of application of major nutrients by farmers on the basis of information given in SHC. The application of organic matter in the soil ranked 1st with mean score 2.57 followed by the application of nitrogenous fertiliser which ranked 2nd with a mean score of 2.51. Application of phosphorus in the soil as per SHC ranked 3rd and potash ranked 4th with mean score 2.47 and 2.35, respectively.

Table 4.2.2. Distribution of farmers according to their overall use efficiency of major nutrients

n=93

Sl. No.	Use efficiency of major nutrients	f	%
1.	Low (<7.82)	12	12.90
2.	Medium (7.82-11.98)	49	52.69
3.	High (>11.98)	32	34.41
Total		93	100
Mean- 9.90		S.D.- 2.08	

From Table 4.2.2, it was found that majority 52.69 per cent of farmers have medium level of use efficiency of major nutrients in the soil followed by 34.41 per cent of farmers with high and 12.90 per cent of farmers with low level of use efficiency.

The probable reason for such medium level of use efficiency is the availability of the fertilisers containing major nutrients in the market. Also the visibility of the effect of application of such fertilisers are evident in the form of higher growth and productivity compared to other nutrients. So, the farmers prefer such fertilisers more.

Table 4.2.3. Distribution of farmers according to their use of minor nutrients

n= 93

Sl. No.	Statements	Always using		Some extent using		Never using		Mean score	Rank
		f	%	f	%	f	%		
1	Application of sulphur in the soil as per information given in the SHC.	32	34.41	40	43.01	21	22.58	2.12	I
2	Application of zinc fertilizer in the soil as per the information given in SHC.	31	33.34	40	43.01	22	23.65	2.10	II
3	Application of copper in the soil as per information given in the SHC.	24	25.81	40	43.01	29	31.18	1.95	IV
4	Application of iron in the soil as per information given in the SHC.	20	21.51	26	27.96	47	50.53	1.71	V
5	Application of manganese in the soil as per information given in the SHC.	20	21.51	24	25.81	49	52.68	1.69	VI
6	Application of boron in the soil as per information given in the SHC.	26	27.96	45	48.39	22	23.65	2.04	III

Table 4.2.3 indicates the rank order of application of minor nutrients by farmers in the soil as per the recommendations of SHC. The application of sulphur in the soil ranked 1st with mean score 2.12 followed by application of zinc which ranked 2nd with mean score 2.10. The application of boron in the soil ranked 3rd with mean score 2.04, copper ranked 4th with mean score 1.95, iron ranked 5th with mean score 1.71 and manganese ranked 6th with mean score 1.69.

Table 4.2.4. Distribution of farmers according to their overall use efficiency of minor nutrients

n=93

Sl. No.	Use efficiency of minor nutrients	f	%
1.	Low (<7.82)	18	19.35
2.	Medium (7.82-15.38)	62	66.67
3.	High (>15.38)	13	13.98
Total		93	100
Mean- 11.60		S.D. – 3.78	

From Table 4.2.4 it was found that majority (66.67%) of the farmers have medium level of use efficiency of minor nutrients as per SHC followed by 19.35 per cent with low and 13.98 per cent with high level of use efficiency.

It can be said that majority of farmers have medium to low level of use efficiency of SHC information. The probable reason for such medium to low micronutrient uptake is lack of awareness and knowledge among farmers about the nutritional status and benefits of such micro nutrients and also their belief that major nutrients are sufficient for crop growth.

Table 4.2.5. Distribution of farmers according to their use of bio-fertilisers

n=93

Sl. No.	Statements	Always using		Some extent using		Never using		Mean score	Rank
		f	%	f	%	f	%		
1	Application of azotobacter culture in the soil as per information given in the SHC.	4	4.30	18	19.35	71	76.35	1.28	II
2	Application of phosphorus solubilising bacterial culture in the soil as per the information given in SHC.	0	0.00	13	13.98	80	86.02	1.14	III
3	Application of rhizobium culture in the soil and seeds as per information given in the SHC.	20	21.51	40	43.01	33	35.48	1.86	I

Table 4.2.5 indicates the rank order of application of bio-fertilisers by farmers as per the information given in SHC. It was found that application of rhizobium culture in the soil and seeds as per information in SHC ranked 1st with mean score 1.86 followed by application of azotobacter which ranked 2nd and phosphorus solubilising bacteria ranked 3rd with mean score 1.28 and 1.14, respectively.

Table 4.2.6. Distribution of farmers according to their overall use efficiency of bio-fertilisers

n=93

Sl. No.	Use efficiency of bio fertilisers	f	%
1.	Low (<2.97)	0	0.00
2.	Medium (2.97-5.59)	77	82.80
3.	High (>5.59)	16	17.20
Total		93	100
Mean- 4.28		S.D. – 1.31	

Table 4.2.6 depicts that majority (82.80%) of the farmers have medium level of use efficiency of bio-fertilisers followed by only 17.20 per cent of farmers with high level of use efficiency of bio fertilisers.

The reason for medium use efficiency of bio fertilisers among farmers are the high cost, unavailability of such bio fertilisers in the near by markets, lack of knowledge about its benefits and less visible effects of its impact compared to other major nutrients. Only few progressive farmers who have attended the training programmes are using such bio-fertilisers to some extent.

Table 4.2.7. Distribution of farmers according to their use of soil chemical parameters

n=93

Sl. No.	Statements	Always using		Some extent using		Never using		Mean score	Rank
		f	%	f	%	f	%		
1	Application of lime in the soil as per information related to soil pH is given in SHC to overcome the problem.	22	23.66	38	40.86	33	35.48	1.88	II
2	Application of gypsum in the soil as per information given in the SHC to overcome the problem	24	25.81	34	36.56	35	37.63	1.86	III
3	Use of good quality water as per information given in SHC to overcome the problem related to E.C of soil.	49	52.69	28	30.11	16	17.20	2.35	I

Table 4.2.7 indicates the rank order of farmers according to the use of soil chemical parameters as per the information given in SHC. Use of good quality water as per information in SHC to overcome E.C of soil ranked 1st with mean score 2.35. Application of lime as per information in SHC ranked 2nd followed by application of gypsum ranked 3rd with mean score 1.88 and 1.86, respectively.

Table 4.2.8. Distribution of farmers according to their overall use efficiency of soil chemical parameters

n=93

Sl. No.	Use efficiency of chemical parameters	f	%
1.	Low (< 4.43)	16	17.20
2.	Medium (4.43-7.81)	56	60.22
3.	High (> 7.81)	21	22.58
Total		93	100
Mean- 6.12		S.D. – 1.69	

From Table 4.2.8 it was found that majority 60.22 per cent farmers have medium level of use efficiency of the soil chemical parameters followed by 22.58 per cent of farmers with high and 17.20 per cent of farmers with low use efficiency.

It is evident that a slightly more than three-fifth (60.22%) of the farmers have medium level of use efficiency because of availability of canal water for irrigation in these areas. Lime is applied by farmers based on the acidity of the soil. Also the high cost of gypsum may be attributed to the medium use efficiency of the chemical parameters.

4.3 Perception on utility of Soil Health Card

The active process of becoming aware of something or gaining a meaningful hold of a situation or element is called perception. This study shows how people perceived the Soil Health Card. The respondents both officials and farmers were given a series of statements pertaining to perception, and asked to answer whether they agreed or disagreed with each statement.

Table 4.3.1. Distribution of officials based on their perception of the utility of SHC**n=20**

Sl. No.	Statements	Agree		Undecided		Disagree	
		f	%	f	%	f	%
1	SHC can be obtained after soil testing.	20	100.00	0	0.00	0	0.00
2	Soil testing helps in obtaining the soil health information.	20	100	0	0.00	0	0.00
3	Scientific farming can be adopted through SHC recommendation.	18	90.00	2	10.00	0	0
4	Soil health and soil fertility is the basis for sustainable production and productivity.	20	100.00	0	0.00	0	0.00
5	SHC is easy to understand by farmers to calculate exact quantity of fertilizer.	15	75.00	2	10.00	3	15
6	Excess cost on fertilizers and nutrients can be reduced by following SHC information	20	100.00	0	0.00	0	0.00
7	Fallow land cannot be converted into cultivable land by using the soil test results	13	65.00	3	15.00	4	20.00
8	Based on SHC information farmers can apply required quantity of macro and micro nutrients into the soil.	20	100.00	0	0.00	0	0.00
9	The information about secondary nutrient given in the SHC is not much useful to farmers.	14	70.00	4	20.00	2	10.00
10	Deficient soil can be reclaimed by using suitable reclamation measures.	19	95.00	0	0.00	1	5.00
11	SHC helps us to establish coordination among farmers, extension workers and scientists.	17	85.00	3	15.00	0	0.00
12	SHC gives crop wise recommendation of fertilizers & nutrients	11	55.00	3	15.00	6	30.00
13	Soil degradation cannot be reduced from soil test results.	17	85.00	2	10.00	1	5.00
14	Soil testing should be done every year.	15	75.00	1	5.00	4	20.00
15	Suitable crop planning can be adopted through SHC information.	20	100.00	0	0.00	0	0.00
16	Soil pH value given in SHC helps in knowing acidity & alkalinity of soil.	20	100.00	0	0.00	0	0.00
17	From the soil test results farmers cannot decide the type of crops to be cultivated for more income.	4	20.00	2	10.00	14	70.00
18	EC (Electrical Conductivity) value given in SHC helps in knowing salinity level of the soil.	18	90.00	1	5.00	1	5.00
19	SHC is not useful for maintaining economic stability of farmers.	2	10.00	3	15.00	15	75.00
20	Based on soil test results farmers can plan the future of their crops as well as land.	20	100.00	0	0.00	0	0.00
21	SHC does not gives a clear idea of which nutrients the soil is lacking.	1	5.00	0	0.00	19	95.00
22	Soil Health Card scheme provides awareness about judicious use of chemical fertilizers.	18	90.00	2	10.00	0	0.00
23	The required quantity of bio fertilizer to be applied is not given in the Soil Health Card.	9	45.00	3	15.00	8	40.00
24	It is not possible to follow all the recommendation given in SHC.	4	20.00	7	35.00	9	45.00
25	There is no need of SHC as farmers are practicing agriculture in a better way.	0	00.00	1	5.00	19	95.00

Table 4.3.1 depicts that majority (100%) of officials agreed that SHC can be obtained after soil testing, soil testing helps in obtaining the soil health information, soil health and soil fertility is the basis for sustainable production and productivity, excess cost on fertilizers and nutrients can be reduced by following SHC information, based on SHC information farmers can apply required quantity of macro and micro nutrients into the soil, suitable crop planning can be adopted through SHC information, soil pH value given in SHC helps in knowing acidity & alkalinity of soil and based on soil test results farmers can plan the future of their crops as well as land.

95 per cent of officials disagreed on the statement that there is no need of SHC as farmers are practicing agriculture in a better way, 90 per cent officials disagreed SHC does not give a clear idea of which nutrients the soil is lacking and 75 per cent disagreed SHC is not useful for maintaining economic stability of farmers.

Table 4.3.2. Overall perception of officials about SHC

n=20

Sl. No.	Level of perception	f	%
1	Poor (< 64.48)	2	10
2	Moderate (64.48- 73.22)	16	80
3	Good (>73.22)	2	10
Total		20	100
Mean – 68.85		S.D. – 4.37	

From Table 4.3.2 it can be interpreted that the majority (80%) of the officials have moderate level of perception, 10 per cent have good perception and 10 per cent have poor perception about SHC.

The official stake holders are the implementing agencies of the Soil Health Card scheme. Hence majority of them have moderate to good perception about the scheme. They believe that SHC is helpful in increasing and improving the productivity and fertility of the soil by reducing the over utilisation of fertilisers. According to them the SHC can bring positive changes in the farming practices and inculcate in the minds of farmers about the judicious use of fertilisers.

Table 4.3.3. Distribution of farmers based on their perception of the utility of SHC**n=93**

Sl. No.	Statements	Agree		Undecided		Disagree	
		f	%	f	%	f	%
1	SHC can be obtained after soil testing.	46	49.46	24	25.81	23	24.73
2	Soil testing helps in obtaining the soil health information.	40	43.01	31	33.33	22	23.66
3	Scientific farming can be adopted through SHC recommendation.	37	39.78	32	34.41	24	25.81
4	Soil health and soil fertility is the basis for sustainable production and productivity.	41	44.09	33	35.48	19	20.43
5	SHC is easy to understand by farmers to calculate exact quantity of fertilizer.	17	18.28	39	41.94	37	39.78
6	Excess cost on fertilizers and nutrients can be reduced by following SHC information	39	41.93	28	30.11	26	27.96
7	Fallow land cannot be converted into cultivable land by using the soil test results	42	45.16	28	30.11	23	24.73
8	Based on SHC information farmers can apply required quantity of macro and micro nutrients into the soil.	38	40.86	28	30.11	27	29.03
9	The information about secondary nutrient given in the SHC is not much useful to farmers.	38	40.86	26	27.96	29	31.18
10	Deficient soil can be reclaimed by using suitable reclamation measures.	32	34.41	33	35.48	28	30.11
11	SHC helps us to establish coordination among farmers, extension workers and scientists.	45	48.39	25	26.88	23	24.73
12	SHC gives crop wise recommendation of fertilizers & nutrients	49	52.69	27	29.03	17	18.28
13	Soil degradation cannot be reduced from soil test results.	44	47.31	24	25.81	25	26.88
14	Soil testing should be done every year.	62	66.67	21	22.58	10	10.75
15	Suitable crop planning can be adopted through SHC information.	39	41.94	37	39.78	17	18.28
16	Soil pH value given in SHC helps in knowing acidity & alkalinity of soil.	37	39.78	34	36.56	22	23.66
17	From the soil test results farmers cannot decide the type of crops to be cultivated for more income.	39	41.93	28	30.11	26	27.96
18	EC (Electrical Conductivity) value given in SHC helps in knowing salinity level of the soil.	26	27.96	45	48.39	22	23.65
19	SHC is not useful for maintaining economic stability of farmers.	40	43.01	22	23.66	31	33.33
20	Based on soil test results farmers can plan the future of their crops as well as land.	21	22.58	37	39.78	35	37.64
21	SHC does not gives a clear idea of which nutrients the soil is lacking.	36	38.71	26	27.96	31	33.33
22	Soil Health Card scheme provides awareness about judicious use of chemical fertilizers.	47	50.54	29	31.18	17	18.28
23	The required quantity of bio fertilizer to be applied is not given in the Soil Health Card.	43	46.24	23	24.73	27	29.03
24	It is not possible to follow all the recommendation given in SHC.	41	44.09	23	24.73	29	31.18
25	There is no need of SHC as farmers are practicing agriculture in a better way.	38	40.86	22	23.66	33	35.48

From Table 4.3.3 it is depicted that majority 66.67 per cent farmers perceived that soil testing should be done every year. 52.69 per cent farmers agreed that SHC gives crop wise recommendations of nutrients and fertilisers. 50.54 percent of farmers agreed that SHC scheme provides awareness about judicious use of chemical fertiliser.

It was also found that 39.78 per cent disagreed SHC is easy to understand by farmers to calculate exact quantity of fertilizer. 37.64 per cent farmers disagreed that based on soil test results farmers can plan the future of their crops as well as land and 35.48 percent disagreed that there is no need of SHC as farmers are practicing agriculture in a better way.

Table 4.3.4. Overall perception of farmers about SHC

n=93

Sl. No.	Level of perception	f	%
1	poor (<44.44)	18	19.35
2	Moderate (44.45-58.57)	55	59.14
3	Good (> 58.58)	20	21.51
Total		93	100
Mean - 51.51		S.D. – 7.07	

Table 4.3.4 interprets the overall perception of farmers on SHC. It was found that majority of the farmers (59.14%) have moderate level of perception followed by 21.51 per cent of farmers with good perception and 19.35 per cent of farmers with poor level of perception.

This moderate level of perception is due to their medium level of education resulting in medium level of mass media exposure, moderate level of understanding of the scientific aspects of the information given in SHC and medium to low interaction of farmers with government officials.

4.4 Constraints faced by the farmers and their suggestions

4.4.1 Constraints faced by the farmers

Constraints are the hinderances faced by individuals in getting desired outcomes. In this study the constraints are divided into 4 groups as operational, technical, financial and social constraints. The responses from the farmers were recorded on a three point continuum according to the severity of the problem as severe (3), moderate (2) and low (1).

4.4.1.1. Distribution of respondents according to the operational constraints

n=93

Sl. No.	Constraints	Severe		Moderate		Low		Mean score	Rank
		f	%	f	%	f	%		
1	Non availability of SHC at the required time.	51	54.84	22	23.65	20	21.51	2.33	III
2	Difficulty in calculating the fertilizer doses.	54	58.06	26	27.96	13	13.98	2.44	I
3	Lack of soil testing laboratories nearby.	46	49.46	30	32.26	17	18.28	2.31	IV
4	Unavailability of agriculture supervisor.	39	41.94	35	37.63	19	20.43	2.22	V
5	Variation in fertilizer application.	49	52.69	29	31.18	15	16.13	2.37	II

Table 4.4.1.1 indicates the rank order of operational constraints faced by farmers while using SHC, majority of SHC users found difficulty in calculating fertiliser doses as their major problem and ranked 1st with mean score 2.44, followed by variation in fertiliser application ranked 2nd with mean score 2.37, non availability of SHC at the required time, lack of STLs, unavailability of agriculture supervisor rank 3rd, 4th, 5th, respectively with mean score 2.33, 2.31, 2.22, respectively.

Difficulty in calculating the fertiliser doses was the major constraint expressed by majority of users as majority of them had medium level of education and were unable to comprehend the doses given in SHC. So, there is variation between recommended doses of application and the actual amount doses applied. Mostly farmers receives SHC at the end of crop season or after harvesting. This is a major setback in its implementation.

Table 4.4.1.2. Distribution of respondents according to the technical constraints

n= 93

Sl. No.	Constraints	Severe		Moderate		Low		Mean score	Rank
		f	%	f	%	f	%		
1	Soil samples were collected in the absence of farmers.	43	46.23	30	32.26	20	21.51	2.25	V
2	Soil Health Cards were distributed at end of the crop season.	52	55.91	21	22.58	20	21.51	2.34	IV
3	Time gap between the soil sample collection and Soil Health Card distribution was very high.	54	58.06	23	24.74	16	17.20	2.41	II
4	Lack of knowledge about scientific method of collection of soil sample.	39	41.94	33	35.48	21	22.58	2.19	VI
5	Improper information about micro nutrient status in soil.	56	60.22	23	24.73	14	15.05	2.45	I
6	Difficulty in understanding all the information given in SHC.	50	53.76	27	29.04	16	17.20	2.37	III

Table 4.4.1.2 shows that the technical constraint ‘improper information about micro nutrient status in the soil ranked 1st with mean score 2.45 followed by time gap between soil sample collection and SHC distribution ranked 2nd with mean score 2.41. Difficulty in understanding all the information given in SHC, SHCs distributed at the end of crop season, soil samples were collected in the absence of farmers, lack of knowledge about scientific method of soil collection ranked 3rd, 4th, 5th, 6th with mean score 2.37, 2.34, 2.25, 2.19, respectively.

Majority of the farmers feel that SHC lacks adequate information about micro nutrient status of the soil which is crucial for the fertility and productivity of plants. Lack of faculty or soil sample analysts may be the reason for long gap between sample collection and distribution. Lack of knowledge due to medium to low level of education is the reason for difficulty in understanding all the information given in SHC.

Table 4.4.1.3. Distribution of respondents according to the financial constraints

n=93

Sl. No.	Constraints	Severe		Moderate		Low		Mean score	Rank
		f	%	f	%	f	%		
1	Unavailability and high cost of FYM as per soil health cards.	34	36.56	24	25.81	35	37.63	1.99	IV
2	No subsidy on inputs required for improving soil quality by the govt.	41	44.09	29	31.18	23	24.73	2.19	III
3	High cost of the micro nutrients.	64	68.82	18	19.35	11	11.83	2.57	II
4	High cost of soil ameliorants.	69	74.19	13	13.98	11	11.83	2.62	I

From the Table 4.4.1.3, it is depicted that the ‘high cost of soil ameliorants ranked 1st with mean score 2.62 followed by high cost of micro nutrients which ranked 2nd with mean score 2.57. No subsidy on inputs by the govt ranked 3rd and unavailability and high cost of FYM ranked 4th with mean score 2.19 and 1.99, respectively.

Soil ameliorant like gypsum and other micro nutrients are costly and farmers find difficult to afford it as most of them are marginalised or small farmers. Most of the farmers expressed that, they are facing problems in getting subsidies on fertiliser and seeds. This may be due to lack of coordination between farmers and officials. Farmers are facing difficulty in getting the required quantity of organic manure (FYM).

Table 4.4.1.4. Distribution of respondents according to the social constraints**n= 93**

Sl. No.	Constraints	Severe		Moderate		Low		Mean score	Rank
		f	%	f	%	f	%		
1	Lack of awareness.	24	25.81	46	49.46	23	24.73	2.01	V
2	Lack of motivation for using SHC.	48	51.61	29	31.18	16	17.21	2.34	I
3	Lack of education among the farmers using soil health card.	42	45.16	29	31.18	22	23.66	2.22	IV
4	Non availability of extension workers to advise.	41	44.09	33	35.48	19	20.43	2.24	III
5	Innovative farmers are not following the SHC recommendation which is inhibiting other farmers to follow Soil Health Card.	45	48.39	29	31.18	19	20.43	2.28	II

Table 4.4.1.4 depicts that the social constraint ‘lack of motivation for using SHC’ ranked 1st with mean score 2.34 followed by innovative farmers not following SHC recommendation inhibiting other farmers to follow SHC ranked 2nd with mean score 2.28. Non availability of extension workers to advise ranked 3rd, lack of education among farmers using SHC ranked 4th and lack of awareness ranked 5th with mean score 2.24, 2.22, 2.01, respectively.

Most of the farmers lacked the interest and motivation for using SHC recommendations as most of them rely on application of excessive fertilisers to get maximum output in less time thereby degrading soil fertility. Non availability of extension advisors and lack of coordination between innovative farmers and govt officials may be the reason for non adoption of SHC recommendations by the innovative farmers. Most of the farmers were of medium level of education.

4.4.2 Distribution of respondents according to the suggestions elicited by them

The farmers were requested to provide their valuable recommendations on how to resolve the problems they were facing while using SHC. Each suggestion's frequency, percentage and ranking was determined.

Table 4.4.2. Distribution of respondents according to the suggestions elicited by them

n=93

Sl. No.	Suggestions	Frequency	Percentage	Rank
1	The Soil Health Card should include crop-specific recommendations for fertilizer usage (complex fertilizers).	79	84.95	III
2	Soil sample should be collected in presence of farmer.	82	88.17	II
3	SHC should be given to farmers before the cropping season.	86	92.47	I
4	SHC should be given to farmers every year.	75	80.65	IV
5	Training should be given for better understanding about the content of Soil Health Cards.	73	78.49	V
6	Farmers should be given training on how to take their own soil samples without others help.	70	75.27	VI
7	STLs should be established at block and village level with highly qualified staff.	64	68.81	VIII
8	Farmers should receive subsidies for inputs from government.	67	72.04	VII
9	Recommended fertilisers should be available in the market.	60	64.51	IX
10	Proper and timely agriculture extension services.	57	61.29	X

From the Table 4.4.2 it was seen that majority of the farmers (92.47%) recommended that SHC should be given before cropping season and ranked 1st. 88.17 per cent farmers recommended soil sample should be collected in presence of farmer and ranked 2nd followed by crop specific recommendation for fertiliser usage (84.95%) ranked 3rd. 80.65 per cent farmers suggested that SHC should be distributed every year and ranked 4th followed by (78.49%) of them suggested that there should be training for better understanding about the content of SHCs and ranked 5th.

Likewise, 75.27 per cent of farmers recommended that there should be training on how to take their own soil samples without others help and ranked 6th. They (72.04% of farmers) suggested that they should receive subsidies for inputs from government and ranked 7th. 68.81 per cent of farmers told that Soil Testing Laboratories should be established at the block and village levels with highly qualified staff for timely testing of soil samples which is ranked 8th. 64.51 per cent of farmers requested that the recommended fertilisers should be made available in the market and ranked 9th. Lastly, they (61.29% of farmers) requested for proper and timely agriculture extension services.

SUMMARY AND CONCLUSION

This chapter is the final stage of the research study as it contains the summary, conclusion and suggestions for future study. This chapter's primary goal is to provide an overview of the findings, draw a conclusion based on the current research and highlight some of the implications for future work.

The Indian government has initiated the "Soil Health Card" program as part of the National Mission for Sustainable Agriculture (NMSA) with the goal of distributing Soil Health Cards (SHCs) to every farmer in the nation. This initiative has been established for addressing deficiencies in the used fertilizers by assessing soil nutrient levels, in every three years. Furthermore, the Soil Health Card program offers guidance to farmers on the types and quantities of fertilizers they should use. It facilitates the collection of soil samples, which are then tested in approved laboratories. This card provides necessary insights by assessing the use of major fertilizers, identifying the nutrient deficiency, and providing solutions and recommendations for required additives to achieve a balanced soil composition. Soil samples are drawn in a grid of 2.5 ha in irrigated area and 10 ha in rainfed area with the help of revenue maps and GPS tools. The soil samples will undergo a comprehensive analysis of 12 parameters including organic carbon (OC), pH, electrical conductivity (EC), as well as essential nutrients like nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and micronutrients such as zinc, copper, iron, boron and manganese. Following the analysis of these soil samples, Soil Health Cards will be distributed to the farmers in their regional languages.

Keeping this in mind, the current study, titled "**Use of Soil Health Cards by the farmers of Khordha district**", was conducted with following objectives in mind:

1. To assess the level of awareness of the farmers on Soil Health Card
2. To measure the nature of use of Soil Health Card by the farmers
3. To study the perception of official stakeholders on the utility of Soil Health Cards
4. To identify the constraints faced by the farmers by using Soil Health Cards and their suggestions

Ex-post-facto methodology was chosen as the research approach for the current study because the phenomena has already begun and is still occurring.

District, blocks and villages were selected purposively while respondents were selected based on fixed proportionate random sampling by lottery method. The two blocks are Baliana and Balipatna. The six villages having maximum number of SHC beneficiaries are Nariso, Biswanathpur and Amankud and from Balipatna block and Dhabalahar, Bentapur and Nagapurusa from Baliana block. Data was collected with the help of an interview schedule from 93 respondents. Statistical tools like frequency, percentage, mean, standard deviation were used to derive conclusions.

5.1 Key findings of the study

5.1.1 Awareness of farmers about Soil Health Card

- Majority (73.12%) of farmers were fully aware about ‘from where they can collect the SHC’ followed by 12.90 and 13.98 per cent farmers partially and unaware of it, respectively.
- Majority (55.91%) fully aware of the method of taking soil sample followed by (44.01%) partially aware of soil sampling method.
- Majority (54.84%) of farmers were aware of the ideal time of soil sampling followed by (30.11%) partially aware and (15.05%) are unaware of it.
- Majority (44.09%) of farmers were partially aware of the benefits followed by 32.26 per cent farmers fully aware and 23.65 per cent unaware of the benefits accruing to the use of SHC.
- Majority (60.22%) were partially aware about the purpose of SHC followed by (24.73%) fully aware and (15.05%) totally unaware of it.
- Majority (44.09%) were partially aware of the precautions that should be taken while soil sampling followed by (30.11%) fully aware and (25.80%) totally unaware of it.
- Majority (44.09%) of farmers were partially aware about all parameters (OC, EC, pH, major nutrients and minor nutrients) followed by 38.71 per cent totally unaware and 17.20 per cent fully aware of the parameters.
- Majority (80.65%) of farmers are totally unaware of the SHC web portal followed by 15.05 per cent farmers partially aware of the portal.

- Overall, majority (62.37%) of farmers have medium level of awareness followed by 19.35 per cent of farmers having high level of awareness and 18.28 per cent of farmers have low level of awareness.

5.1.2 Nature of use of Soil Health Card

- On the basis of application of major nutrients as per the recommendations of SHC, the application of organic matter in the soil ranked 1st with mean score 2.57 followed by nitrogenous fertilizer (2.51), phosphorus (2.47), potash (2.35) and ranked 2nd, 3rd, 4th, respectively.
- Majority 52.69 per cent of farmers have medium level of use efficiency of major nutrients in the soil followed by 34.41 per cent of farmers with high and 12.90 per cent of farmers with low level of use efficiency.
- On the basis of application of minor nutrients as per the recommendations of SHC, the application of sulphur in the soil ranked 1st with mean score 2.12 followed by zinc (2.10), boron (2.04), copper (1.95), iron (1.71) and manganese (1.69) and ranked 2nd, 3rd, 4th, 5th, 6th, respectively.
- Majority (66.67%) of the farmers had medium level of use efficiency of minor nutrients as per SHC followed by 19.35 per cent with low and 13.98 per cent with high level of use efficiency.
- On the basis of application of bio-fertilisers as per the recommendations of SHC, the application of rhizobium culture in the soil and seeds as per information in SHC ranked 1st with mean score 1.86 followed by azotobacter (1.28) and Phosphorus solubilising bacteria (1.14) and ranked 2nd and 3rd, respectively.
- Majority (82.80%) of the farmers had medium level of use efficiency of bio-fertilisers followed by only 17.20 per cent of farmers with high level of use efficiency of bio-fertilisers.
- On the basis of use of soil chemical parameters as per the information given in SHC, use of good quality water as per information in SHC to overcome E.C of soil ranked 1st with mean score 2.35. Application of lime as per information in SHC ranked 2nd followed by application of gypsum ranked 3rd with mean score 1.88 and 1.86, respectively.
- Majority 60.22 per cent farmers had medium level of use efficiency of the soil chemical parameters followed by 22.58 per cent of farmers with high and 17.20 per cent of farmers with low use efficiency.

5.1.3 Perception on utility of Soil Health Card

- Majority (80%) of the officials had moderate level of perception, 10 per cent had good perception and 10 per cent have poor perception about SHC.
- Majority of the farmers (59.14%) had moderate level of perception followed by 21.51 per cent of farmers with good perception and 19.35 per cent of farmers with poor level of perception.

5.1.4 Constraints faced by farmers and their suggestions

- Majority of SHC users found difficulty in calculating fertiliser doses and ranked 1st with mean score 2.44, followed by variation in fertiliser application ranked 2nd with mean score 2.37, non availability of SHC at the required time, lack of STLs, unavailability of agriculture supervisor rank 3rd, 4th, 5th, respectively with mean score 2.33, 2.31, 2.22, respectively.
- The technical constraint ‘improper information about micro nutrient status in the soil ranked 1st with mean score 2.45 followed by time gap between soil sample collection and SHC distribution ranked 2nd with mean score 2.41. Difficulty in understanding all the information given in SHC, SHCs distributed at the end of crop season, soil samples were collected in the absence of farmers, lack of knowledge about scientific method of soil collection ranked 3rd, 4th, 5th, 6th with mean score 2.37, 2.34, 2.25, 2.19, respectively.
- For financial constraints ‘high cost of soil ameliorants ranked 1st with mean score 2.62 followed by high cost of micro nutrients which ranked 2nd with mean score 2.57. No subsidy on inputs by the govt ranked 3rd and unavailability and high cost of FYM ranked 4th with mean score 2.19 and 1.99, respectively.
- The social constraint ‘lack of motivation for using SHC’ ranked 1st with mean score 2.34 followed by innovative farmers not following SHC recommendation inhibiting other farmers to follow SHC ranked 2nd with mean score 2.28. Non availability of extension workers to advise ranked 3rd, lack of education among farmers using SHC ranked 4th and lack of awareness ranked 5th with mean score 2.24, 2.22, 2.01, respectively.
- Majority of the farmers (92.47%) recommended that SHC should be given before cropping season.

- 88.17 per cent farmers recommended soil sample should be collected in presence of farmer.
- 84.95 per cent of farmers suggested for crop specific recommendation for fertiliser usage.
- 80.65 per cent farmers suggested that Soil Health Card should be distributed every year.
- 78.49 per cent farmers recommended that training should be given for better understanding about the content of Soil Health Cards.
- 75.27 per cent of farmers recommended that there should be training on how to take their own soil samples without others help.
- 72.04 per cent of farmers suggested that they should receive subsidies for inputs from government.
- 68.81 per cent of farmers told that Soil Testing Laboratories should be established at the block and village levels with highly qualified staff for timely testing of soil samples.
- 64.51 per cent of farmers requested that the recommended fertilisers should be made available in the market.

5.2 Conclusion

The study indicated that majority of the farmers have medium level of awareness about the parameters mentioned in the SHC, the purpose of SHC scheme, benefits of SHC and the information given in SHC. Also, majority of farmers have medium level of awareness about method of soil sampling, ideal time of soil sampling and the precautions to be taken while doing so. Majority of farmers have medium level of use efficiency of the information given in SHC i.e. medium level of use efficiency of major nutrients, minor nutrients, bio-fertilisers and soil chemical parameters as majority of the farmers have medium level of education.

Majority of the officials have moderate to high level of perception about SHC whereas majority of the farmers have moderate level of perception about SHC. As the officials are the ones who bear the responsibility of implementing the scheme, they have a positive attitude towards it. They believe that SHC scheme can bring a positive change in the farming practices and it has the potential to improve the farming condition of the area thereby enhancing the standard of living of the farmers in that area.

Major constraints faced by the farmers are difficulty in calculating the fertilizer doses, improper information about micro nutrient status in soil, time gap between the soil sample collection and Soil Health Card distribution was very high, high cost of soil ameliorants and micro nutrients, non availability of extension workers to advise. The important suggestions given by farmers are SHC should be given to farmers before the cropping season, soil sample should be collected in presence of farmer and the Soil Health Card should include crop-specific recommendations for fertilizer usage (complex fertilizers).

5.3 Implications

- Majority of the farmers are unable to calculate the fertiliser doses, so simple method for calculating fertilizer dose for specific crop should be given SHC and examples related to calculation of fertilizer doses should be given in SHC.
- Proper training on soil sampling procedure should be organised for farmers.
- Regular contact should be maintained by the soil sampling staff for developing confidence in farmer.
- The process of soil testing should be completed as early as possible by organizing special campaign for soil testing to avoid delay in getting results from SHC.
- Early action, decision, completion and implementation process should be there for timely provision of SHC.
- More expert and technical staff should be engaged for timely completion of work.
- More Soil Testing Laboratories should be established at the village and block levels.

5.4 Suggestions for future work

- The current study was confined to Balianata and Balipatna blocks of Khordha district of Odisha with a sample size of 93 and the findings are relevant to that region only. As a result, further research in this field could be conducted in other areas allowing for the generalization of findings.
- This research contained only a few variables. Other related variables can be added for further study.
- The contribution of different variables could be increased by using more advanced statistical approaches, which could increase the study's power.

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APPENDICES

**DEPARTMENT OF AGRICULTURAL EXTENSION EDUCATION
ODISHA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

Title of thesis: Use of Soil Health Cards by the farmers of Khordha district

Respondent No : _____

Respondent Name : _____

Block : _____

Village : _____

Age : _____

Education : _____

PART -A

1. Awareness about Soil Health Card

Sl. No.	Parameters of Awareness	Fully aware (3)	Partially aware (2)	Unaware (1)
1.	Are you aware about the SHC Scheme?			
2.	Are you aware of the date of starting SHC in you locality?			
3.	Who Initiated SHC scheme?			
4.	What is Slogan of this scheme?			
5.	What is main purpose of the SHC Scheme?			
6.	Have you ever visited the SHC web portal i.e. www.soilhealth.dac.gov.in			
7.	Are you aware of the parameters displayed in SHC?			
8.	Are you aware of the method of taking soil sample?			
9.	What is ideal time for soil sampling?			
10.	Precautions to be taken while taking soil sample.			
11.	Number of the cards, farmer will get every year?			
12.	Who tests the soil sample and where?			
13.	How much farmer must pay for each sample test?			
14.	From where SHC can be collected?			
15.	Who distributes SHC?			
16.	Are you aware about the information provided in SHC?			
17.	Are you aware about the benefits of SHC?			
18.	Are you aware about the effect of SHC on soil.?			

2. Nature of Use of Soil Health Card

Sl. No.	Statements	Always using information given in SHC	To Some extent using information given in SHC	Never using information given in SHC
Major nutrients				
1	Application of organic matter in the soil as per information given in the SHC.			
2	Application of nitrogenous fertilizer in the soil as per the information given in SHC.			
3	Application of phosphorus in the soil as per information given in the SHC.			
4	Application of potash in the soil as per information given in SHC.			
Minor nutrient				
5	Application of sulphur in the soil as per information given in the SHC.			
6	Application of zinc in the soil as per information given in the SHC.			
7	Application of boron in the soil as per information given in the SHC.			
8	Application of iron in the soil as per information given in the SHC.			
9	Application of manganese in the soil as per information given in the SHC.			
10	Application of copper as per the information given in the SHC.			
Biological elements				
11	Application of azotobacter culture in the soil as per information given in the SHC.			
12	Application of phosphate solubilizing bacterial culture in the soil as per information given in the SHC.			
13	Application of rhizobium culture in the soil as per information given in the SHC.			
Other soil chemical parameters				
14	Application of lime in the soil as per information related to soil pH in he given SHC to overcome the problem			
15.	Application of gypsum in the soil as per information given in the SHC to overcome the problem.			
16.	Use of good quality water as per information given in SHC to overcome the problem related to E.C of soil			

3. Constraints faced by farmers

SI No.	Constraints	Response		
		Severe	Moderate	Low
1.	OPERATIONAL ASPECT			
	A. Non availability of SHC at the required time.			
	B. Difficulty in calculating the fertilizer doses.			
	C. Lack of soil testing laboratories nearby.			
	D. Unavailability of agriculture supervisor.			
	E. Variation in fertilizer application.			
2.	TECHNICAL ASPECT			
	A. Soil samples were collected in the absence of farmers.			
	B. Soil health cards were distributed at end of the crop season			
	C. Time gap between the soil sample collection and soil health card distribution was very high.			
	D. Lack of knowledge about scientific method of collection of soil Sample.			
	E. Improper information about micro nutrient status in soil.			
	F. Difficulty in understanding all the information given in SHC.			
3.	FINANCIAL ASPECT			
	A. Unavailability and high cost of FYM as per soil health cards.			
	B. No subsidy on inputs required for improving soil quality by the govt.			
	C. High cost of the micronutrients.			
	D. High cost of soil ameliorants.			
4.	SOCIAL ASPECT			
	A. Lack of awareness			
	B. Lack of motivation for using SHC			
	C. Lack of education among the farmers using soil health card.			
	D. Non availability of extension workers to advise.			
	E. Innovative faemers are not following the soil health card recommendation which is inhibiting other farmers to follow Soil Health Card.			

Suggestions by farmers

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

PART -B

Perception of line staffs :

Respondent No :

Respondent Name :

Designation :

Sl. No.	Items	Agree	Undecided	Disagree
1	SHC can be obtained after soil testing.			
2	Soil testing helps in obtaining the soil health information.			
3	Scientific farming can be adopted through SHC recommendation.			
4	Soil health and soil fertility is the basis for sustainable production and productivity.			
5	SHC is easy to understand by farmers to calculate exact quantity of fertilizer			
6	Excess cost on fertilizers and nutrients can be reduced by following SHC information			
7	Fallow land cannot be converted into cultivable land by using the soil test results			
8	Based on SHC information farmers can apply required quantity of macro and micro nutrients into the soil.			
9	The information about secondary nutrient given in the SHC is not much useful to farmers.			
10	Deficient soil can be reclaimed by using suitable reclamation measures.			
11	SHC helps us to establish coordination Among farmers, extension workers and scientists.			
12	SHC gives crop wise recommendation of fertilizers & nutrients			
13	Soil degradation cannot be reduced from soil test results.			

14	Soil testing should be done every year.			
15	Suitable crop planning can be adopted through SHC information.			
16	Soil pH value given in SHC helps in knowing acidity & alkalinity of soil.			
17	From the soil test results farmers cannot decide the type of crops to be cultivated for more income.			
18	EC (Electrical Conductivity) value given in SHC helps in knowing salinity level of the soil.			
19	SHC is not useful for maintaining economic stability of farmers.			
20	Based on soil test results farmers can plan the future of their crops as well as land.			
21	SHC does not gives a clear idea of which nutrients the soil is lacking.			
22	Soil health card scheme provides awareness about judicious use of chemical fertilizers.			
23	The required quantity of bio fertilizer to be applied is not given in the soil health card.			
24	It is not possible to follow all the recommendation given in SHC.			
25	There is no need of SHC as farmers are practicing agriculture in a better way.			

Use of Soil Health Cards by the farmers of Khordha district

by Atya Aneesha Nayak, Adm. No. 211221706

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