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Assessing the impact of knowledge and adoption of soil health cards on soil health management in Agra district, Uttar Pradesh

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ABSTRACT

A Soil Health Card is a printed report that displays soil health indicators and associated descriptive terms and it is provided to the farmers for each of his holdings. It will contain the status of his soil with respect to 12 parameters, namely N, P, and K (macronutrients); S (secondary nutrient); Zn, Fe, Cu, Mn, and B (micronutrients); and pH, EC, and OC (physical parameters). Based on this, the SHC also indicates fertilizer recommendations and soil amendments required for better soil management practices to increase agricultural production in their farms. The study revealed that the increasing pattern regarding the number of awareness programs and training programs towards soil health management and the number of soil samples analyzed by KVK (242 to 3863) during the last five years, i.e., 2019–2024. Results indicated that the majority of the respondents belonged to the middle-age group of 35-55 years (49.33%), followed by the old-age group (30.00%); the high school education group (37.33%), followed by middle school group (24.67%); and the medium landholding group having 2-5 ha (36.00%), followed by the small landholding group (28.00%). It was observed that the majority of the respondents fell into the medium level of knowledge (62.00%), followed by high knowledge (23.33%) and medium adoption of soil health cards. The reason behind the partial adoption and no adoption of soil health cards might be due to their unawareness about the benefits of balanced fertilizer application and soil health management strategies in farming.

Keywords: Soil health management, Soil health card, Soil fertility, Knowledge, Adoption

INTRODUCTION

Soil health and fertility are crucial components for sustainable agriculture, ensuring both productivity and profitability for farmers. Implementing scientifically recommended fertilizer usage and crop planning is a crucial step toward sustainable agriculture. Embracing sustainable soil fertility management (SFM) practices is essential for ensuring long-term agricultural productivity (Chowdary *et al.,* 2018; Kapoor *et al.,* 2021). Soil testing is indeed a scientifically sound diagnostic tool for evaluating soil health, identifying nutrient deficiencies or excesses, and recommending appropriate soil amendments, including fertilizer recommendations. It helps farmers make informed decisions about soil fertility status for sustainable and profitable agricultural practices. Soil testing as a tool for judicious fertilizer use hinges on the principle of profitability, meaning that when all other production factors are optimized, there's a high probability of a profitable response to nutrient application based on soil test results. The more accurate soil test results indicate the accurate nutrient needs of a specific crop and field, the more likely a farmer is to maximize profits by using fertilizers effectively. Therefore, the present study was conducted by Krishi Vigyan Kendra, Bichpuri, R.B.S. College, Agra, to evaluate the farmers' awareness regarding soil health cards as well as agriculture soil health management.

MATERIALS AND METHODS

Present study was conducted in Agra district in Uttar Pradesh, particularly examining knowledge and adoption of soil testing and soil health cards for soil health management among farmers. It selected five blocks (Achenera, Akola, Bah, Bichpuri and Kheragarh) among 15 blocks and 2 villages within each, drawing a sample of a total of 150 respondents (15 farmers per village) using a simple random sampling method (Table 1). The study aims to assess the impact of Krishi Vigyan Kendra, Bichpuri, conducting awareness programs, method demonstrations, and training programs on soil testing since its inception in these adopted villages. To assess the knowledge level towards soil testing and soil

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health cards and the extent of adoption of recommendations of soil health cards, the questionnaire was prepared in the local language with a view to studying and collecting data through personal interviews of the selected respondents. Age, education, and landholding were taken as independent variables, and level of knowledge and extent of adoption were taken as dependent variables for the study. The data were tabulated and analyzed with the objective to draw a meaningful conclusion.

Table 1: Details of the blocks and villages selected for assessment

S. No.	Name of Selected Blocks	Name of Selected Villages	No of respondents
1.	Achenera	Ardaya	15
		Gadima	15
2.	Aokla	Aokla	15
		Garou	15
3.	Bah	Madhepura	15
		Chaurangahar	15
4.	Bichpuri	Laramda	15
		Bichpuri	15
5.	Kheragarh	Bah Soniga	15
		Baruer	15
	Total		150

RESULTS AND DISCUSSION

This study investigates the impact of extension programs on soil health management conducted by Krishi Vigyan Kendra, Bichpuri, examining independent and dependent variables to assess their impact on farmer knowledge level and extent of adoption of Soil Health Card (SHC) recommendations. It analyzes how awareness programs and other extension activities influence farmers' understanding of soil health and their willingness to use SHC-based fertilizer recommendations. The results indicated that the number of soil sample analysed increased with the year, from 242 numbers during 2019-20 to 3863 numbers during 2023-24 (Table 2). This may be attributed to the organization of 118 awareness initiatives, including training sessions, Kisan Gosthis, dissemination of information via the 'Kisan Sarthi' app, and a free-soil testing campaign led by KVK, Bichpuri. These efforts significantly contributed to the widespread adoption of soil testing practices among farmers. The results of this study align with those of Singh and Singh (2014), who found that most trainees believed their knowledge and skills had improved as a result of the training programs.

Table 2: Details of various extension programmes on soil health management and soil analysis at KVK Agra

S. No.	Year	No of Programmes	No of soil samples analysed	No of Villages covered
1.	2019-20	21	242	11
2.	2020-21	20	873	12
3.	2021-22	23	1305	27
4.	2022-23	27	1548	32
5.	2023-24	29	3863	41
	Total	118	7831	123

Independent Variables

The data (Table 3) indicated that maximum of the respondents (49.33%) were middle-aged. i.e., the 36-55 age groups, followed by 30.00% and 20.67% from the old and high age group, respectively. This could be attributed to the migration of younger individuals to cities in search of better-paying jobs compared to those in agriculture. Regarding education, the majority of respondents (37.33%) had completed high school, followed by 24.67% with middle school education, 15.33% with primary education, 12.00% with graduates, and 10.67% with

Table: 3. SHC beneficiaries based on their age (N-150)

Age Group	Frequency	%
Young age (below 35 years)	31	20.67
Middle age (36-55 years)	74	49.33
Old age (above 55 years)	45	30.00
Total	150	100.00

illiterate (Table 4).

Table: 4. SHC beneficiaries based on their education (N-150) (Scale by Supe, 2007)

Age Group	Frequency	%
Illiterate	16	10.67
Primary Education	23	15.33
Middle school	37	24.67
High school	56	37.33
Graduate	18	12.00
Total	150	100.00

Similar findings were reported by Chowdary *et al.* (2018). Most of the respondents were practicing agriculture in medium landholdings, *i.e.,* 2–5 ha (36.00%), followed by small farmers (28.00%), large farmers (22.00%), and marginal farmers (14.00%), respectively (Table 5).Similar conclusionswere reported by Kumar *et al.* (2022).

Table: 5. SHC beneficiaries according to their landholding (N-150)

Age Group	Frequency	%
Marginal (up to 1.0 ha)	21	14.00
Small farmers (1-2 ha)	42	28.00
Medium farmers (2-5 ha)	54	36.00
Large farmers (More than 5 ha)	33	22.00
Total	150	100.00

Knowledge Level

Results revealed that among the 20 statements about soil testing and soil health cards, (97.33%) of the SHC beneficiaries have knowledge of the statement (Table 6) 'What are the major nutrients covered in SHC?' and were accorded the first rank. (93.33%) of the SHC beneficiaries had knowledge of the statement 'Does SHC provide information about pH and EC?' and it was ranked second. The statement, 'How will soil fertility be maintained?' ranked third by the SHC beneficiaries with (84.67%) knowledge. The statements 'Can we alter the crop planning and scientific farming through SHC information?' and 'Can we improve the fertility status and productivity of soil through SHC information?' ranked fourth and fifth with (84.00%) and (81.33%) knowledge, respectively. The reason for more knowledge obtained by SHC beneficiaries might be due to their regular and periodical contact with the KVK, Bichpuri officials, and Soil and Water testing laboratories, UP State Department of Agriculture.

Table 6: Respondent knowledge on issues related to soil health card and its usage

Statement on knowledge on Soil testing and Soil Health Card	Frequency	Knowledge	Rank
What is soil humus?	55	36.67	XVIII
Do you know about soil Health Card Scheme?	71	47.33	XVI
What are the micro nutrients mentioned in SHC	50	33.33	XIX
What are secondary nutrients present in SHC	34	22.67	XX
What are major nutrients covered in SHC	146	97.33	I
From where soil samples should be collected?	105	70.00	X
In how many places soil should be collected per acre for soil testing?	84	56.00	XV
What is the depth that soil sample has to be collected in cultivated land for food crops?	119	79.33	VI
What is the depth that soil sample has to be collected in land for horticultural crops?	100	66.67	XII
What is the validity period of SHC recommendations?	69	46.00	XVIII
Is it SHC provides information about pH and EC?	140	93.33	II
Can we improve the fertility status and productivity of soil through SHC information?	122	81.33	V
Can we alter the crop planning and scientific farming through SHC information?	126	84.00	IV
The pH value for acidic soil ranges between 4 to 6	89	59.33	XIV
What is used as an amendment for acidic soil?	96	64.00	XIII
What is used as an amendment for alkaline soil?	104	69.33	XI
How soil fertility will be maintained?	127	84.67	III
How crop yield can be enhanced?	108	72.00	IX
Do you know the application of fertilizers to the field based on the results of SHC?	109	72.67	VIII
Details present in SHC- dosage of fertilizer application to crops	115	76.67	VII

Knowledge Index (KI)= Total Knowledge score obtained/Total attainable score X 100

The lower percentage of SHC beneficiaries can be attributed to their limited awareness regarding specific features of the Soil Health Card, particularly concerning the micronutrients and secondary nutrients listed in it. However, it has been observed that more than 50% of the beneficiaries possess knowledge related to soil testing and the usage of soil health cards, with a reported knowledge index of 65.63.Similar observations were reported by Kumar *et al.* (2022).

Knowledge Index (KI) = 1312.67/2000X100=65.63

From Table 7, the observations are showing that half of the respondents (62.00%) had medium knowledge about soil health, with high and low knowledge levels at 23.33% and 14.67%, respectively, suggests that while a significant portion of the population has some understanding, there's a lack of widespread, in-depth knowledge about the importance of soil health.The likely reason for the overall level of knowledge may be attributed to limited awareness about soil health. This finding is consistent with the study conducted by Madhu *et al.* (2020).

Table 7: Distribution of respondents according to their overall knowledge levelon SHC(N=150)

Knowledge Level	Frequency	%
Low (up to 33.33%)	22	14.67
Medium (33.3 to 64.66%)	93	62.00
High (above 64.66%)	35	23.33
Total	150	100.00

From the (Table 8), it is observed that the majority of the respondents belong to the medium adoption level (56.00%), followed by the higher adoption level (24.67) and the lower adoption level (19.33) with regard to the adoption of soil health management practices by health card results. The reason for medium adoption might be that the majority of the respondents have medium knowledge about soil health management and belong to a medium education level. The findings were in line with the findings of Manimekalai *et al.* (2021).

Table 8: Distribution of respondents according to their overall adoption level onSHC (N=150)

Adoption Level	Frequency	%
Low (up to 33.33%)	29	19.33
Medium (33.3 to 64.66%)	84	56.00
High (above 64.66%)	37	24.67
Total	150	100.00

Constraints of the Farmers towards Adoption Recommendations

The data illustrated in Table 9 revealed that the majority of the respondents (88.67%) expressed that they are facing difficulty having knowledge about the importance of the micronutrients, and (80.67%) of the respondents expressed their constraint as fertilizer prices being too high to purchase. About (73.33%) of the respondents expressed that calculating the fertilizer dose on the basis of the nutrient status of the soil is very difficult. Later, non-availability of organic manure and lack of proper knowledge about scientific methods of soil sampling were in IV^{th} and V^{th} rank with (66.00%) and (60.67%). These findings are in coincidence with the findings of Naruka *et al.* (2018).

Table 9: Constraints faced by the farmers in adoption of SHC (N=150)

Constraints	Frequency	Percentage	Rank
Challenges in determining fertilizer dosage based on soil nutrient levels	110	73.33	III
Insufficient awareness of scientific soil sampling techniques	91	60.67	V
Difficulty in interpreting the information provided in the soil health card	66	44.00	X
Limited understanding of the significance of micronutrients	133	88.67	I
Use Of More Fertilizers Leads To More Yields	90	60.00	VI
No awareness about importance of soil testing	68	45.33	IX
Non -availability of organic manures	99	66.00	IV
Prices of fertilizers are high	121	80.67	II
Sometimeadequate quantity of fertilizers not available	81	54.00	VIII
Issue of soil health card was too late	62	41.33	XI
Soil testing not done in their fields	51	34.00	XII
Non-availability of micronutrients in the market	88	58.67	VII

CONCLUSION

Based on present study, it may be concluded that there is a need to encourage thefarmers to use soil test-based fertilizer application; a multi-pronged approach is recommended, including large-scale demonstrations, training programs, and awareness campaigns to be organized on a large scale. These initiatives should also be focus on practical aspects like interpreting soil health cards and proper sampling techniques in the presence of farmers.

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