Journal of Agricultural Development and Policy, 2022
Volume 32, No. 2, 260-269

Adoption of Soil Nutrient Testing for Resource Management: A Study of Farmers' Perception

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Abstract

The study attempted to understand the farmers' perception regarding the adoption of soil nutrient testing for resource management in agriculture and how the adoption level varies with age groups, landholding sizes, and income groups. An exploratory research study was undertaken and farmers' responses were recorded using a well-structured, disguised questionnaire. From eight villages in two major districts of Punjab, a total of 150 farmers were selected as respondents. These respondents belonged to different age groups, landholding sizes, and income groups to represent the whole population effectively. It was found that most of the respondents were aware of the ill effects of excessive usage of fertilizers, but still practiced fertilizer inputs based on their personal experiences instead of using any technical advice established. Young and middle-aged farmers, farmers belonging to semi-medium and medium landholding sizes and medium income groups had higher adoption levels as compared to others. Approximately 50 per cent of the respondents were not using soil nutrient testing while 35 per cent of the total respondents used the technology more than once. Age, landholding sizes, and income groups had a significant effect on the perception of respondents towards the adoption of soil nutrient testing for resource management.

Keywords: Adoption, perception, resource management.

JEL Codes: M31, M37, Q01, Q24.

Introduction

With the commencement of the Green Revolution in the developing world, India was not far behind. During the period 1960s, most of the agriculture in India got transformed into an industrial set-up with the adoption of modern technology and methods such as the use of machinery for cultivation, high-yielding variety seeds, irrigation facilities, and the use of chemicals to enhance productivity. This revolutionized Indian agriculture massively, especially in Punjab, Haryana, and western Uttar Pradesh, making India self-sufficient in terms of food grains. However, it caused greater long-term financial, sociological, and environmental problems for the people of Punjab (Shiva, 2007). The Punjab experience showed that the Green Revolution was neither green in terms of environmental sustainability and conservation of natural resources nor revolutionary in the context of justice for small and marginal farmers.

The time now demands shifting toward ecological conservation, financial encouragement, and social justice for the small and marginal farmers by increasing productivity in a sustainable manner. Abrol and Sangar (2006) concluded that the strategy to promote conservative agriculture calls for moving away from conventional compartmentalization and hierarchical arrangements of research that generates and perfects technologies, the extension that delivers it, and farmers who passively adopt it (Cook and Bramley, 1998). There is a need to bring all the involved stakeholders on a common platform to conceive end-to-end strategies. There are several resource conservation technologies available that are affordable and efficient in working. One such technique is soil nutrient testing (SNT). The history of soil testing is linked with the growth and development of soil science. Soil testing was recognized as a sub-unit of soil science that emerged in the early 1940s with agriculture's transition from subsistence to production farming systems.

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Most farmers are still using large quantities of chemical fertilizers to increase production without knowing the fertility status of the soils of their fields (Sheriff, 2005). Soil nutrient testing is a broad soil fertility evaluation program that helped farmers in the sensible application of chemical fertilizers to the crops. The soil testing of a particular field gave reliable information about the deficiency of major nutrients in the soil as well as hazards such as soil acidity, alkalinity, salinity, etc. The main objective of soil health testing is to know the content or amount of nutrients available in the soil (Peck, 2011). A balanced amount of these nutrients is very important for the healthy growth of the crop. The soil nutrient testing helped identify the major nutrient composition of soil along with nitrogen composition. It gave the composition of the macronutrients: nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), sulfur (S), magnesium (Mg), iron (Fe), carbon (C), oxygen(O), hydrogen (H) and the micronutrients (or trace minerals): boron (B), chlorine (Cl), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo) in soil. Soil testing was an accepted agricultural management practice for decades. Interpretations and fertility recommendations based on soil analyses and the information obtained with soil samples on cropping systems, tillage practices, soil types, manure use, and other parameters contributed to the increased efficiency of agricultural production (Sims *et al*, 2000). Soil testing can be highly advantageous to farmers in achieving maximum production and earning maximum profit. Therefore, it is essential to create maximum awareness among farmers about the careful use of chemical fertilizer and regular testing of soil.

Looking upon the importance of soil testing and its contribution towards optimum production of crops and maximum net profit of farmers, it becomes all the more important to study the awareness and perception of farmers towards soil health testing. Even with the development of numerous conservation technologies, there were challenges in acceptance of these technologies. This study attempted to understand consumers' perception regarding adoption of soil nutrient testing for resource management.

Data Sources and Methodology

Exploratory research was carried out for meeting the objectives of the study. The study explored farmers' awareness and adoption of conservation agriculture technologies in Punjab. Primary data were collected through a structured, non-disguised questionnaire. Extensive literature review was done to establish the items/ statements in the questionnaire. Two districts, Ludhiana and Patiala, were randomly selected for the study.

Table 1. Profile of the respondents

Particulars	No. of Respondents	Percentage
Age (years)		
18-35	46	30.7
36-50	70	46.7
Above 50	34	22.7
Total	150	100
Education Level		
Illiterate	5	3.3
Primary schooling	13	8.7
Secondary	32	21.3
Higher Secondary	66	44.0
Graduate	22	14.7
Post Graduate and above	12	8.0
Total	150	100
Land holding (ha)		
Marginal (<1)	18	12.0
Small (1 to 2)	28	18.7
Semi medium farmers (2 to 4)	54	36.0
Medium farmers (4 to 10)	36	24.0
Large (>10)	14	9.3
Total	150	100

Table 2. Profile of farmers regarding farming

Particulars	No. of respondents	Percentage
Farming experience (years)		
Low (1 to 10)	53	35.3
Medium (11 to 20)	24	16.0
High (> 20)	73	48.7
Total	150	100
Occupation		
Only agriculture	28	18.7
Agriculture along with livestock farming	93	62.0
Agriculture along with livestock farming and business/service	29	19.3
Total	150	100
Annual income (Rs)		
<2 lakhs	35	23.3
2-4 lakhs	53	35.3
4-6 lakhs	50	33.3
6-8 lakhs	1	0.7
>8 lakhs	11	7.3
Total	150	100
Purpose of farming		
Commercial	47	31.3
Subsistence	103	68.7
Total	150	100
Cultivation practices		
Conventional	150	100.0
Organic	0	0
Total	150	100
Crop management fertility practices		
Crop rotation	37	24.7
Intercropping	1	0.7
Any other	13	8.7
None	99	66.0
Total	150	100

From eight villages of Ludhiana and Patiala districts of Punjab, 150 farmers were selected on stratified sampling basis. The sample consisted of 46, 54 and 50 were marginal-small, semi-medium, and medium-large farmers.

A well-structured questionnaire was prepared for the collection of primary data. The questionnaire was pre-tested and suitable modifications were made before the selection of the statements for the questionnaire. The data were collected from the farmers through personal interview method. The questions were specifically designed to get in depth information about the profile of the respondents, frequency of soil nutrient testing, source of information, perception about soil nutrient testing, benefits and constraints faced. The farmers who were not using soil nutrient testing technology were interviewed to understand the reasons for them not using this technology. The respondents were asked close-ended as well as open-ended questions, multiple choice and scale-based questions. They were asked to provide response on five-point Likert scale.

Results and Discussion

A perusal of Table 1 revealed that 30.7 per cent farmers aged between 18-35 years, 46.7 per cent farmers aged between 36-50 years and 22.7 per cent farmers aged above 50 years. It was noticed that 3.3, 8.7, 21.3, 44.00, 14.7, and eight per cent were illiterate, primary education, secondary education, till higher secondary, graduates, and postgraduates, respectively. Based upon the size of the landholding of the it was found that 12, 18.7, 36, and 24, and 9.3 per cent were marginal farmers (with landholding size less than 1 hectare), small farmers (with landholding size 1-2 hectare), semi medium farmers (with landholding size 2-4 ha), medium farmers (with landholding size 4-10 ha) and large farmers (with landholding size more than 10 ha).

It was noticed that 35.3, 16.0, and 48.7 per cent of the farmers had 1-10, 11-20, and more than 20 years of farming experience. The results revealed that 18.7 per cent farmers had only agriculture as their occupation, whereas 62 and 19.3 per cent undertook agriculture along with livestock farming and a business/service in addition to agriculture and livestock farming (Table 2). The annual income from agriculture was observed to be `2 lakhs, `2-4 lakhs, `4-6 lakhs, `6-8 lakhs and above `8 lakhs for 23.3, 35.3, 33.3, 0.7, and 7.3 per cent of the sample farmers, respectively.

A perusal of Table 2 revealed that 31.3 per cent farmers undertook commercial agriculture (cultivate for commercial purposes) whereas the remaining 68.7 per cent farmers had subsistence agriculture. All the sample farmers observed during this study carried out conventional cultivation practices and none practiced organic agriculture. For crop fertility management, 24.7, 0.7, 8.7, and 66 per cent of the sample farmers practiced crop rotation, practiced intercropping, manure addition to the soil, and did not practice any method for crop fertility management.

Perception and Awareness of Farmers towards Soil Nutrient Testing

The basis on which the farmers put fertilizers into their crops is presented in Table 3. The results showed that highest per cent of the sample farmers (46.00) applied fertilizers based on their own experiences and 28.7 per cent farmers applied fertilizers according to the blanket recommendations by the state university. Only 16 per cent farmers applied fertilizers according to actual requirements of the soil. The over-usage and/or under-usage of fertilizers were justified, since only a few farmers actually got their soils and crop checked for actual fertilizer requirements. These actual requirements can be checked using various tools, among which soil nutrient testing and leaf color chart were covered under this study.

The perception of farmers towards excessive usage of fertilizers is presented in Table 4. The results revealed that the farmers tend to disagree with the statement that application of

Table 3. Source of recommendation regarding chemical and fertilizer application

Source of recommendation	No. of respondents	Percentage
According to blanket recommendations by the state university	43	28.7
On dealers' advice	7	4.7
Based on your own experiences	69	46.0
Based on other farmers' experience	7	4.7
According to actual requirements of the soil	24	16.0
Total	150	100

Table 4. Perception towards excessive usage of fertilizers

Statements	Mean	SD	t-value	p- value
Application of more fertilizers leads to increased yield	3.63	1.046	42.455***	.000
Excessive use of fertilizers harm soil fertility in long term	1.45	0.756	23.542***	.000
Excess fertilizers may be absorbed by the soil and may damage the quality of underground water	1.32	0.509	31.746***	.000
Excess fertilizers may impact my health by direct contamination through hands	1.07	0.321	40.724***	.000
Excessive use of fertilizers may have severe effect on the crop produce to be consumed	1.42	0.627	27.746***	.000
Excess fertilizers invite insects, pests and diseases	1.51	0.766	24.081***	.000

*** *Significant at one per cent level.*

Table 5. Centers of soil nutrient testing and frequency of testing

Particulars	No. of Respondents	Percentage
Soil Nutrient Testing centres		
Krishi Vigyan Kendras	2	1.4
Punjab Agricultural University	54	36.0
Private laboratory	18	12.0
Frequency of soil nutrient testing		
Once only	22	14.7
After every cropping cycle	20	13.3
Yearly	32	21.3
Never	76	50.7
Total	150	100

more fertilizers led to increased yield. Farmers agreed with the statements that excessive fertilizers may impact farmers' health by direct contamination that excessive fertilizers may damage the quality of underground water that excessive use of fertilizers may had severe effect on the crop produce to be consumed that excessive fertilizers harm soil fertility in long term and slightly agree with the statement that excessive fertilizers invite insects pests and diseases.

The respondents' preferred centres of soil nutrient testing, and frequency of soil nutrient testing is presented in Table 5. The results showed that only 2.7 per cent respondents had no information regarding soil nutrient testing while the other 97.3 per cent respondents were aware of soil nutrient testing. The results further revealed that 97.3 per cent respondents had knowledge about soil nutrient testing; only 49.3 per cent respondents got their soil tested. Out of these 74 respondents, 34.7 per cent got their soil tested regularly while 14.7 per cent respondents stopped getting their soil tested after one time. The most preferred center for getting soil tested was state university, which is preferred by 36 per cent respondents. This may be due to the proximity of the state university to the respondents. It was further noticed that 12 per cent farmers preferred private laboratory, while only 1.4 per cent farmers preferred Krishi Vigyan Kendra.

A perusal of Table 6 showed that Department of Agriculture and Farmers' Welfare and Kisan Melas were the sources in getting information about soil nutrient testing. KVK subject matter specialists/scientists were the next effective source of information followed by relatives/ fellow farmers, agricultural magazines and extension literature and agricultural input supply sector. This gives us an insight as to which channel is effective in raising more awareness and how the technologies can me made to reach more farmers.

A perusal of Table 7 showed that the respondents tend to agree slightly with the statement that soil nutrient test results for adjoining fields gave them the correct result. The respondents tend to disagree more or less with all other listed statements. The sample farmer also agreed that the testing of soil nutrients is not required after every year taking soil sample for testing is complex. Soil nutrient test results are useful for some period and they become irrelevant thereafter, soil nutrient testing is not easily available in your proximity, and soil nutrient test results were not completely dependable.

Table 6. Source of information regarding soil nutrient testing

Sources of information	Mean	SD	t-value	p-value
Agricultural magazines and extension literature	0.06	0.238	3.084***	.002
KVK subject matter specialists/ scientists	0.15	0.362	5.195***	0.000
Department of Agriculture and Farmers' Welfare	0.42	0.495	10.387***	0.000
Agricultural input supply dealers	0.01	0.082	1.000NS	.319
Kisan Melas	0.42	0.495	10.387***	0.000
Relatives/ fellow farmers	0.07	0.250	3.262***	0.001
No information	0.03	0.162	2.020**	0.045

**** and ** Significant at one and five per cent level.*
NS: Non-significant.

Table 7. Perception of respondents towards soil nutrient testing

Particulars	Mean	SD	t-value	p-value
Use of soil nutrient test results of adjoining fields gives me correct results	1.98	1.182	19.727***	0.000
Testing of soil nutrients is not required after every year	2.92	1.325	25.998***	0.000
Taking soil sample for soil nutrient testing is complex	3.55	1.270	32.936***	0.000
Soil nutrient test results are useful for some period and they become irrelevant thereafter	3.84	1.137	39.823***	0.000
Soil nutrient testing is not easily available in your proximity	2.45	1.400	20.604***	0.000
Testing of soil nutrients takes too much time	2.29	1.332	20.311***	0.000
	2.31	1.285	21.196***	0.000

*** *Significant at one per cent level.*

The perception of respondents towards soil nutrient testing with respect to age is presented in Table 8. The perusal of results presented in Table 8 showed that there was a significant difference between the mean perceptions of different age groups for statement No. 1, 3, 4, 5 and 6, while all three age groups tend to had similar perception regarding statement No. 2 and 7.

The results in the above tables signify the study conducted by Shashank and his colleagues in 2016, in which they found that high cost of fertilizers; lack of fertilizer subsidies; lack of knowledge on nutrient management packages; lack of proper fertilizer management skills; lack of awareness on use of bio fertilizers; lack of awareness regarding green manure crops; non availability of farm yard manure; non availability of fertilizers at proper time; irregular release of canal water; lack of technical guidance; lack of training programs and non-availability of labour; lack of soil testing labs; off time arrival of soil test results; improper soil sampling; and improper soil test results were the most serious constraints in adoption of soil nutrient testing by the farmers.

The results presented in Table 9 revealed that out of the 46 young aged respondents, 34.8 per cent respondents got their soil tested for nutrients just once, while 34.8, 22.86, 24.3 per cent got soils tested every year, 50 per cent of the middle-aged respondents get their soil tested for nutrients every year, and 85 per cent respondents after every cropping

Table 8. Perception of respondents towards soil nutrient testing with respect to age

Statement No.	Particulars	Mean perception of age groups			F-value	P-value
		18-35	36-50	Above 50		
I	Use of soil nutrient test results of adjoining fields gives me correct results	2.37	1.62	2.15	6.061***	0.003
II	Testing of soil nutrients is not required every year	2.95	2.95	2.82	0.128NS	0.880
III	Taking soil sample for nutrient testing is complex	2.98	3.92	3.58	7.768***	0.001
IV	Soil nutrient test results are useful for some period and they become irrelevant thereafter	4.19	3.81	3.45	4.082***	0.019
V	Soil nutrient testing is not easily available in your proximity	3.00	2.13	2.33	5.441***	0.005
VI	Testing of soil nutrients takes too much time	2.79	2.19	1.85	5.340***	0.006
VII	Soil nutrient test results are not completely dependable	2.05	2.44	2.39	1.326NS	0.269

*** *Significant at one per cent level.*
NS: Non-significant.

Table 9. Age and frequency of soil nutrient testing

(Per cent, n=150)

Age groups	Never used	Once only	After every cropping cycle	Yearly	Total
18-35 (young)	28.26 [17.02]	34.78 [72.73]	2.17 [5.00]	34.78 [50.00]	100.00 (46)
36-50 (middle aged)	45.71 [42.11]	7.14 [22.73]	24.29 [85.00]	22.86 [50.00]	10.00 (70)
Above 50 (mature aged)	91.18 [40.78]	2.94 [4.54]	2.85 [10.00]	-	100.00 (34)
Total	50.67 (76)	14.67 (22)	13.33 (20)	21.33 (30)	100.00 (150)

Figures in parentheses ( ) are number of sample farmers.
Figures in parentheses [ ] are per centage with respect to columns.

cycle. Out of the 34 mature aged respondents, only 2.85 per cent respondents get their soil tested after every cropping cycle. Also, out of the 76 respondents who have never got their soil tested, 45.71 per cent were young, 42.11 per cent are middle aged and 40.78 per cent are old aged. It could be concluded that old aged farmers were not aware about newer technologies, while equal number of young aged farmers were aware of the soil nutrient testing and using it regularly, and aware of soil nutrient testing but were not interested.

The perception of respondents towards soil nutrient testing with respect to landholding is presented in Table 10. There was a significant difference between the means scores of statements 1 to 6 with respect to landholding, while the perception of various groups remained similar in context of dependability on soil nutrient test results.

The results presented in Table 11 showed that out of the 18 respondents belonging to marginal landholding category, 100 per cent respondents never got their soil tested for

Table 10. Perception of respondents towards soil nutrient testing with respect to landholding

Statement No.	Particulars	Mean perception					F-value	p-value
		Marginal	Small	Semi medium	Medium	Large		
I	Use of soil nutrient test results of adjoining fields gives me correct results	1.82	1.35	2.26	1.50	3.54	12.82***	.008
II	Testing of soil nutrients is not required after every year	2.53	2.30	2.84	3.00	4.62	8.549***	.000
III	Taking soil sample for soil nutrient testing is complex	3.65	2.83	3.58	4.28	2.54	8.407***	.000
IV	Soil nutrient test results are useful for some period and they become irrelevant thereafter	3.82	3.65	3.82	3.64	4.85	3.174***	.016
V	Soil nutrient testing is not easily available in your proximity	1.29	2.35	3.14	2.47	1.38	9.871***	.000
VI	Testing of soil nutrients takes too much time	1.82	2.13	2.78	2.33	1.23	4.844***	.001
VII	Soil nutrient test results are not completely dependable	2.82	2.48	2.08	2.19	2.54	1.369NS	.248

**** Significant at one per cent level.*
NS: Non-significant.

Table 11. Land holding and frequency of soil nutrient testing

(Per cent)

Particulars	Never used	Once only	After every cropping cycle	Yearly	Total
Marginal	100.00 [23.68]	-	-	-	100.00 (18)
Small	96.43 [35.52]	-	3.57 [5.00]	-	100.00 (28)
Semi medium	22.22 [15.79]	18.52 [45.45]	18.52 [50.00]	40.74 [68.75]	100.00 (54)
Medium	36.11 [17.11]	13.89 [22.73]	25.00 [45.00]	25.00 [22.12]	100.00 (36)
Large	42.86 [7.90]	50.00 [31.82]	-	7.14 [13.13]	100.00 (14)
Total	50.67 (76)	14.67 (22)	13.33 (20)	21.33 (32)	100.00 (150)

Figures in parentheses ( ) are number of sample farmers.
Figures in parentheses [ ] are per centage with respect to columns.

nutrients. Small landholding category respondents get their soil tested for nutrients every year, and after every cropping cycle. Out of the 54 respondents having semi-medium landholding size, 22.22 per cent respondents never get their soil tested, while 40.74 per cent get their soil tested every year. Out of the 36 respondents having medium landholding size, 25 per cent get soil tests done every year and 25 per cent get the tests done after every crop cycle, while 36.11 per cent respondents never get their soil tested for nutrients. Of the farmers with large landholding size, only 7.14 per cent farmers get their soil tests done every year. Also, out of the 76 respondents who have never got their soil tested, 23.68 per cent belonged to marginal landholding category, 35.52 per cent belonged to small landholding category, 15.79 per cent belonged to semi-medium, 17.11 belonged to medium landholding category and 7.90 per cent were large farmers.

Table 12. Perception of respondents towards soil nutrient testing with respect to income

Particulars	Mean perception of income groups (Rs)					F-value	p-value
	<2 lakhs	2-4 lakhs	4-6 lakhs	6-8 lakhs	>8 lakhs		
Use of soil nutrient test results of adjoining fields gives me correct results	1.47	1.98	2.42	2.00	1.50	4.050***	.004
Testing of soil nutrients is not required after every year	1.88	2.89	3.36	2.00	4.50	14.22***	.000
Taking soil sample for soil nutrient testing is complex	3.29	3.61	3.56	2.00	4.20	1.418 NS	.231
Soil nutrient test results are useful for some period and they become irrelevant thereafter	4.24	3.39	4.14	2.00	3.20	5.801***	.000
Soil nutrient testing is not easily available in your proximity	1.26	3.09	2.88	2.00	1.50	15.18***	.000
Testing of soil nutrients takes too much time	1.47	2.45	2.62	1.00	2.90	5.557***	.000
Soil nutrient test results are not completely dependable	2.03	2.39	2.30	2.00	3.00	1.188NS	.319

**** Significant at one per cent level.*
NS: Non-significant.

Table 13. Income and frequency of soil nutrient testing

(Per cent)

Income (Rs)	Never used	Once only	After every cropping cycle	Yearly	Total
<2 lakhs	77.14 [35.53]	-	22.86 [40.00]	-	100.00 (35)
2-4 lakhs	50.94 [35.53]	1.89 [4.54]	16.98 [45.00]	30.19 [50.00]	100.00 (53)
4-6 lakhs	32.00 [21.05]	32.00 [72.73]	6.00 [15.00]	30.00 [46.87]	100.00 (50)
6-8 lakhs	-	100.00 [4.54]	-	-	100.00 (1)
>8 lakhs	54.54 [7.89]	36.37 [18.19]	-	9.09 [3.13]	100.00 (11)
Total	50.67 (76)	14.67 (22)	13.33 (20)	21.33 (32)	100.00 (150)

Figures in parentheses ( ) are number of sample farmers.
Figures in parentheses [ ] are percentage with respect to columns.

It could be concluded that the farmers with semi medium and medium size landholding are more aware about the technology and they have the interest to use these. These categories can be focused more on to make the rest aware and use of technologies be promoted. In addition, the large farmers seem to be aware of the technology and still are not using it, shows their lack of interest. Interest needs to be generated in this category with proper extension system.

A perusal of Table 12 revealed that there was a significant difference between mean perceptions regarding soil nutrient testing of various income groups as regard to statements 1 to 6, while the mean perceptions regarding to complexity of taking soil samples and dependability on soil nutrient test results were similar.

The results presented in Table 13 revealed that out of the 35 respondents belonging to less than Rs two lakh income group, 77.14 per cent respondents never got their soil tested for nutrients and the rest 22.86 get their soil tested after every cropping cycle. Out of 53 respondents belonging to Rs 2-4 lakh income group, 50.94 per cent never got their soil tested, 16.98 per cent got the soil test done after every cropping cycle, while 30.19 per cent respondents get their soil tested for nutrients every year. Out of the 50 respondents having Rs 4-6 lakh annual income, 32 per cent respondents never get their soil tested, 32 per cent got their soil tested for nutrients just once, while 30 per cent get their soil tested every year. Of the 11 respondents having annual income more than Rs 8 lakhs, 54.54 per cent never got their soil tested, 36.37 per cent got the soil tested for nutrients just one and only 9.09 per cent respondents belonging to this group get soil tests done every year. Out of the 76 respondents who have never got their soil tested, 35.53 had income less than Rs 2 lakhs, 35.53 per cent had annual income between Rs 2 and 4 lakhs, 21.05 per cent had annual income between Rs 4 and 6 lakhs and the rest 7.89 per cent had an annual income more than 8 lakhs. It can be drawn out from the observation that the lower income groups (income < 4 lakhs) and the higher income groups (income > Rs 6 lakhs) need to be made more aware about the benefits of using soil nutrient testing for resource management and their interest needs to be generated. The lower income groups should also be made aware about various subsidies being provided on soil nutrient testing, so they can come forward and plan their resources accordingly.

Conclusion and Policy Implications

The awareness among respondents regarding soil nutrient testing was the result of extension activities performed by the Department of Agriculture and Farmers' Welfare, Kisan Melas, KVK scientists, fellow farmers, Agricultural magazines and extension literature. Efforts are needed to reach the segment of farmers that are still unaware of the technology. The respondents were found to be familiar with the ill-effects of excessive usage of fertilizers, but majority of them were not using any resource management technology in agriculture. There was enough awareness, moderate level of interest of the farmers as well, but the desire to use soil nutrient testing for resource management still needs to be created. Among those who adopted soil nutrient testing for resource management, young and middle-aged farmers, farmers with semi-medium and medium landholdings and belonging to medium income groups adopted soil nutrient testing most actively. When asked about the reason for not adopting this technology in an open-ended question, most common answer was the unreliability of the soil test results as the farmers assumed that the tests were not being conducted

accurately. Thus, the extension system for this technology needs to be improved in order to build the trust of farmers.

References

Abrol I P and Sangar S 2006. Sustaining conservation agriculture: Conservation agriculture the way forward. *Current Science* **91:**1020-1025.

Cook S E and Bramley R G V 1998. Precision agriculture: Opportunities, benefits and pitfalls of site-specific crop management in Australia. *Australian Journal of Experimental Agriculture* **38**:753-763.

Peck T R 2011. Soil testing: Past, present and future. *Communications in Soil Science and Plant Analysis* **21**:1165-1186.

Shashank D, Rao I S, Sailaja A and Madhavi M 2016. Constraints perceived by the paddy farmers in adoption of nutrient management practices in Nalgonda district of Telangana state. *International Journal of Humanities and Social Sciences* **5**:107-112.

Sheriff G 2005. Efficient waste? Why farmers over-apply nutrients and the implications for policy design. *Applied Economic Perspectives and Policy* **27**:542-557.

Shiva V 2007. The not so green revolution: Lessons from India. In Aksel Naerstad (Ed.) *Africa can feed itself* (Pp. 142-150). Grensen, Oslo, Norway: The Development Fund. Retrieved from https://www.utviklingsfondet.no/files/uf/documents/Africa_Can_Feed_Itself.pdf.

Sims J T, Edwards A C, Schoumans O F and Simard R R 2000. Integrating soil phosphorus testing into environmentally based agricultural management practices. *Journal of Environmental Quality* **29**:60-71.

Received: June 23, 2022 Accepted: September 15, 2022