

## **An Empirical Investigation of Farmer's Perception and Attitude Towards Soil Health Testing in Punjab**

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### **Abstract**

*The study aims to understand the perception and attitude of farmers towards Soil Health Testing (SHT) in Punjab. The primary data were collected from 240 farmers, 80 from each of the three cropping belts of Punjab viz. cotton belt, paddy belt and vegetable belt selected on proportionate sampling basis through a structured non disguised questionnaire. Sixty farmers who did not get SHT done were also surveyed to understand the reasons for their non adoption of SHT. The study revealed that the majority of the farmers got soil health testing done randomly from state agricultural university. ie, PAU or KVK's. The major source of information about SHT was neighbours, progressive farmers, television, kisangoshthis and melas. Famers had a positive perception of the SHT and were aware of the benefits of it. They felt that crop yield increased by monitoring soil nutrient status by testing. Overall they were satisfied with soil health testing. The major constraints faced were the inadequate follow up by the extension agency and unscientific methods of collecting soil samples. The farmers who were not getting soil heath testing done said that even without it they were getting the full yield of crops and even other farmers who got SHT were not benefitted much, hence testing was not required.*

**Keywords:** *Soil health testing, Attitude, Perception, Adoption, Satisfaction, Benefits*

**JEL Classification:** *Q16, Q24, C10*

### **Introduction**

The soil health testing refers to the analysis of a soil sample to determine nutrient content, composition and other characteristics such as the acidity or pH level. Soil testing is a broad soil fertility evaluation programme which helps the farmer's in judicious application of chemical fertilizers for healthy growth of crop as it gives reliable information about the deficiency of major nutrient in the soil as well

as hazards such as soil acidity, alkalinity and salinity etc. So it is essential to create maximum awareness among farmers about careful use of chemical fertilizers and regular testing of soil.

The previous studies found that there was within-field variability of plant-available nutrients which often results in different fertilizer requirements across a field. The Grid and ZS approach were the most effective across all nutrients and fields (Mallarino and

Wittry 2004). Gruver and Weil (2006) discovered SQ (Soil Quality) benchmarks. Farmer judgments of SQ were based on their past experience and many factors like crop performance, soil water availability and erosion history, soil quality, soil type, soil nutrients, fertilizer applications, natural flora and fauna available in the soil (Berazneva *et al.*, 2016). The strong relationships were observed between soil C parameters, soil structural parameters and farmer SQ ratings. Similar patterns of difference in farmer and scientist understanding of soil were revealed in England, Switzerland and France (Yeshaneh, 2015). Weil *et al.* (2015) gave a simple method of estimating changes in biologically active soil carbon that helps in evaluating the soil quality impacts of alternative management practices. Mairura *et al.* in 2007 indicated that farmer's understood and consequently utilized spatial heterogeneity and temporal variability in soil quality status within their farms as a resource to maintain or enhance agricultural productivity. The use of geo referenced Precision Soil Testing (PST) helps in understanding how producers perceive the useful life of soil-test information which may be important for monitoring the effectiveness of best nutrient management practice adoption (Lambert *et al.*, 2009)

The Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers' Welfare initiated a scheme to issue Soil Health Cards (SHC) to all the farmers through the Department of Agriculture in all States and Union Territories. SHC is a printed report containing the status of his soil with respect to 12 physical parameters N, P, K, S, Zn, Fe, Cu, Mn, Bo and pH, EC, OC that a farmer will be handed over for each of his holdings. Based on this, the SHC also indicates fertilizer recommendations (dosage of different nutrients needed), soil amendment required and an advisory based on the soil

nutrient status of a farmer's holding for the farmer so as to realize optimal yields. The Government planned to distribute 14 crore soil health cards by 2017 (Patel and Chauhan, 2012). But the scheme could not be implemented with vigour. Some states did not issue a single card by 2015-16.

Despite knowing its importance, the attitude of farmers towards soil testing practices was unfavourable (Yadav *et al.*, 2006, Patel and Chauhan, 2012). In Gujarat state 52 percent of respondent had knowledge of soil testing and used soil health cards for advance farming, balance the dose of fertilizers for sustaining soil health, lowering the input cost and improving the farm product (Patel *et al.*, 2017). Encouragement and attentiveness is still needed to change the attitude of farmers towards soil health testing especially of those who never get SHT done. Most important need is to organize training programs on importance of soil testing, set up mobile soil testing laboratories to increase reliability of results, soil health campaigns etc. In Punjab, the state department of agriculture has recently announced that every farmer must maintain soil test cards and go for regular soil testing. The experts from Punjab Agricultural University (PAU) said this effort was need of the hour as agricultural soil in the state was being over exploited due to very high crop intensification which, according to them, is about 190 percent. The Union Government is providing financial assistance/grant to States under the scheme "Macro Management of Agriculture" for establishing and strengthening Soil testing labs throughout the country, organizing farmers' trainings and field demonstrations involving balanced use of fertilizers and micro-nutrients

Some entrepreneurs and companies are devising low cost technologies, so that the farmers can do the testing on their own, get results and do a regular monitoring of soil health. For example device named Prizm, a

low cost spectrophotometer for soil and field diagnostic testing by “Test right Nanosystems” has been developed. Prizm is a pocket molecular sensor called spectrophotometer, which finds out the molecular composition of any material. Its applications include water and soil testing to diagnostics. This solution is currently being used by laboratories at schools and colleges. Prizm which is available for Rs35,999 replaces traditional system that costs Rs six to seven lakh. The study envisaged to understand the awareness level, perception and attitude of farmers of Punjab towards soil health testing.

### **Data Sources and Methodology**

Research design for the study was exploratory. Population for the study consisted of all the farmers of Punjab who were getting SHT done for their farms. A total of 240 farmers, 80 from each of the three cropping belts viz. paddy, cotton and vegetable belt were selected and surveyed on proportionate sampling basis (Marginal, small, medium and large farmers) in the ratio of 4:1. Out of 240 farmers surveyed 193 (80%) farmers were marginal, small and medium farmers while 47 (20%) were large farmers. The primary data was collected from the farmers in the year 2018 through a well-designed and structured questionnaire based on close ended, multiple choice and five point Likert scale questions which were specifically designed to get in depth information about the profile of the respondent farmers, frequency of soil health testing, source of information about SHT, perception about SHT, benefits of soil health testing and constraints farmers faced in soil health testing. Sixty (60) farmers who were not getting SHT done were also interviewed to understand the reasons for not getting SHT done. The data was checked for normality and it was found to be normally distributed. Statistical significance of the parameters was

checked through t-test ANOVA was used to study the difference between perception, attitude, benefits and satisfaction w.r.t various demographics. Further multiple range Tukey test was applied where the results of ANOVA were found to be significant to group the similar responses together.

## **Results and Discussion**

### **Socio economic profile of respondents**

The socio economic profile of respondent farmers w.r.t. age, education, land holding, source of land, farming experience, occupation along with farming, annual income of farmers, purpose of farming, and source of information of agricultural practices is given in Table 1.

A perusal of Table 1 showed that 83.34 per cent farmers were above 35 years of age; 57.5 per cent of farmers had studied between 8<sup>th</sup> and 12<sup>th</sup>, 32.5 per cent farmers were marginal and small, 47.92 per cent farmers were semi medium and medium and 35.83 percent farmers leased land along with their own land. Majority i.e. 124 farmers (51.67%) had more than 21 years of farming experience. Almost 64 per cent farmers had income between Rs 2-8 lakh and only few farmers (2.92%) had income less than 2 lakh per annum. Farmers (78.75%) had adopted livestock farming and were doing some business or service along with agriculture. All the farmers said that they were following conventional methods of agriculture and were doing farming mainly for marketing purposes. Most of the farmers (86.66%) followed agricultural practices based on their own experience, 44.10 per cent followed recommendations of the university also and 40.41 percent simply followed other farmers while 22.08 percent farmers also followed the recommendations and advise of suppliers of inputs. Since farmers were leasing

**Table 1. Socio economic profile of respondents (N=240)**

Particulars	No. of Respondents	Percent -age
<b>Age (years)</b>		
18-35	40	16.66
35-50	144	60.00
Above 50	56	23.34
Total	<b>240</b>	<b>100.00</b>
<b>Education</b>		
Illiterate	17	7.08
Primary	30	12.50
Secondary	67	27.92
Higher secondary	71	29.58
Graduate	45	18.76
Post graduate and above	10	4.16
Total	<b>240</b>	<b>100.00</b>
<b>Land holding(ha)</b>		
Marginal (<1 )	19	7.9 2
Small ( 1 to 2 )	59	24.58
Semi medium farmers (2 to 4)	56	23.34
Medium farmers (4 to 10 )	59	24.58
Large (Above 10 )	47	19.58
Total	<b>240</b>	<b>100.00</b>
<b>Source of land</b>		
Owned/inherited	154	64.17
Both(leased and inherited)	86	35.83
Total	<b>240</b>	<b>100.00</b>
<b>Farming experience</b>		
1 to 10 years	27	11.25
11 to 20 years	89	37.08
> 21 years	124	51.67
Total	<b>240</b>	<b>100.00</b>
<b>Occupation along with farming</b>		
Only agriculture	51	21.25
Agriculture with livestock farming	125	52.08
Agriculture with livestock farming and business/service	64	26.67
Total	<b>240</b>	<b>100.00</b>
<b>Annual income(Rs)</b>		
<2 lakhs	7	2.92
2-4 lakhs	75	31.25
4-8 lakhs	78	32.50
>8 lakhs	80	33.33
Total	<b>240</b>	<b>100.00</b>
<b>Source of information of agricultural practices</b>		
According to recommendation of university	106	44.10
Based on your own experiences	208	86.66
What other farmers apply	97	40.41
Based on dealers advice	53	22.08

land, had adopted subsidiary occupations and were doing business or service along with agriculture, their income was observed to be higher.

### Centres of soil health testing and frequency of soil health testing

Farmers were asked regarding the centres from where they got SHT done and the frequency with which they get SHT done for their farms. Analysis of Table 2 shows that 43.75 percent farmers got SHT done from state agricultural university i.e, PAU and 42.91percent farmers got SHT done from KVKs of PAU. Only 18.33 percent farmers got SHT from private laboratories. Majority of farmers 103 (42.92 %) had done their soil testing on random basis i.e. they do not have particular time period for soil testing. Farmers who had done SHT done only once were 85 (35.41%), followed by 36 (15 %) farmers who had got SHT done after a year. Very less number of farmers get SHT done 12 (5%) after every season and only 4 (1.67%) farmers had got soil testing after every crop. No difference in soil health testing pattern was found among the farmers wrt land holding, occupation and income.

### Sources of information regarding soil health testing

Respondents were asked about the source of information about the soil health testing on a three point Likert scale from 1(Never) to 3(Often). Single mean t test was applied to study the statistical significance of the results. Majority of respondents got information about SHT from neighbours, some get information from progressive farmers and television Kissan gosthis/kissanmela and agricultural magazine (Table 3). Some get information from agri input supply source.(Mean score 2.15) Many get information from KVK subject

**Table 2. Centres of Soil health testing and frequency of soil health testing in Punjab**

Parameters	No. of Respondents	Percentage
<b>Soil testing centres</b>		
Krishi Vigyan Kendras	103	42.91
State agricultural university	105	43.75
Private laboratory	44	18.33
<b>Frequency of soil testing (N=240)</b>		
Once only	85	35.41
After every crop	4	1.67
After every season	12	5.00
After a year	36	15.00
Any other(randomly)	103	42.92
Total	240	100

**Table 3. Sources of information regarding soil health testing in Punjab****(N=240)**

Source of information	Mean	SD	t value
Neighbour/Relatives	2.53	0.63	12.92*
Progressive farmers	2.46	0.61	11.66*
Television	2.46	0.52	13.67*
Kissan Gosthis / KissanMela	2.24	0.83	4.56*
Agricultural magazines and Extension literature	2.17	0.87	3.16*
Agricultural input supply sectors	2.15	0.75	3.25*
KVK Subject Matter Specialists/ Scientists	2.10	0.89	1.80
Extension functionaries of agriculture department	2.10	0.84	1.99*
Radio	2.09	0.67	2.20*

\*Significant at 5% level of significance, \*\* Significant at 10% level of significance

matter specialist/scientists and some from radio. Further the respondents said that both macro and micro nutrients were checked in the test report.

### Attitude and perception of farmers towards soil health testing

Attitude and perception of farmers towards soil health testing was studied with the help of various parameters which were rated on a 5 point likert from Strongly Agree (5) to Strongly Disagree(1). ANOVA was applied to understand the differences in perception of respondents towards soil health testing w.r.t. age, education, land holding, income, and occupation.

The study revealed that respondents were of the view that SHT was required as too much

fertilizers harmed the soil (Mean score 4.76), unfertile land was a problem and without the chemicals agriculture is not possible (Mean Score 4.22) (Table 4). Farmers also responded that soil testing information is useful for some particular time period and observed that soil health testing after each crop is not required (Mean score=4.19). Farmers also felt that water quality harms the soil and hence SHT is beneficial. The respondent farmers were getting SHT done mostly irregularly, but they encouraged other farmers to go for testing of soil. Farmers felt that taking soil sample was easy and not complex.

There is no significant difference in the perception and attitude of respondents wrt age, land holding and occupation. Significant

**Table 4. Attitude and Perception towards soil health testing in Punjab**

(N=240)

Particulars	Mean	SD	t-value
I feel too much use of fertilizers harms the soil, hence soil health testing is required	4.76	0.44	61.76*
For me unfertile land is important problem, hence soil health testing is required	4.44	0.52	42.76*
I have observed that without the use of chemicals agriculture is not possible, hence timely Soil Health Testing is required	4.22	0.63	29.98*
Soil testing information is useful for some particular time period after which it loses relevance	4.21	0.67	27.66*
I observed that testing after each crop is not required	4.19	0.65	28.37*
According to me water quality harms the soil, hence soil health testing is required	4.15	0.70	25.30*
I also encourage other farmers to use soil testing	4.02	0.86	18.17*
I use the soil test results of other farmers in my village	3.35	1.21	4.50*
I observed that method of taking soil sample is complex process	2.61	1.25	4.74*

\*Significant at 1% level of significance.

difference in the perception and attitude of respondent's w.r.t. income and education was observed (Table 5). Multiple range Tukey test was applied on education and it was found that Illiterate, Primary, Secondary, Higher Secondary, Graduate were placed in one group (Group A significant value 0.98) and Post Graduate and above in second group (Group B

**Table 5. Difference in attitude and perception of respondents towards soil health testing w.r.t age, education, land holding, income and occupation**

Particulars	N	Mean	SD	t-value/ p-value	Groups on the basis of Tukey	Significant values of group
<b>Age (years)</b>						
18-35	40	4.01	0.34	1.28 (0.28)	-	
35-50		3.92	0.31			
Above 50	56	3.91	0.32			
<b>Education</b>						
Illiterate	17	3.95	0.32	4.43 (0.001)	Group A	Significant value (Group A 0.98) (Group B 1.0)
Primary	30	3.94	0.26		Group A	
Secondary	67	3.90	0.36		Group A	
Higher Secondary	71	3.90	0.34		Group A	
Graduate	45	3.89	0.32		Group A	
Post Graduate and above	10	4.38	0.24		Group B	
<b>Land holding (ha)</b>						
Marginal (<1 )	19	3.88	0.34	3.33 (0.11)	-	
Small ( 1 to 2 )	59	3.91	0.30			
Semi medium farmers(2 to 4)	56	3.82	0.33			
Medium farmers (4 to 10)	59	4.00	0.31			
Large (Above 10 )	47	4.02	0.41			
<b>Income (Rs)</b>						
<2 lakhs	7	3.78	.41	7.04 (0.00)	Group A	Significant value (Group A 0.92)
2-4 lakhs	75	3.98	.27		Group A	
4-8 lakhs	78	3.78	.35		Group A	
>8 lakhs	80	4.01	.35		Group A	
<b>Occupation</b>						
Only agriculture	51	3.96	.37	0.98 (0.37)	-	
Agriculture with livestock farming	125	3.90	.32			
Agriculture with livestock farming and business/service	64	3.96	.35			

Figures in parentheses indicates p values

1.0), as the perceptions of below graduate respondents were significantly different from that of Postgraduates. With respect to income all the respondents were placed in one group (Group A significant value 0.92) indicating that the perceptions regarding soil health testing were similar in all income groups.

### Benefits of soil health testing

Benefits of soil health testing were asked from respondents on a Likert scale ranging 1 (Strongly Agree) to 5 (Strongly Disagree). Single mean t test was applied to study the statistical significance of the results. Further, ANOVA was applied to understand difference in benefits of Soil Health Testing to respondents w r t age, education, land holding, income and occupation.

The respondents reported that SHT is necessary and crop yield improves by monitoring the soil nutrients status (Mean

score 4.34,) and observed that soil testing also help in conservation, appropriate soil and water management and soil testing is basic step for quality crop production (Table 6). Farmers also responded that timely delivery of results of soil health testing helps in improving productivity. They also prefer soil testing for fertilizer application. The respondents felt that soil testing has improved profitability of crops their productivity and in sowing appropriate crops. Some farmers observed more yield in one year after soil testing. Some farmers also believed that soil testing reduced the cost of cultivation. The respondents reported that SHT is necessary and crop yield improves by monitoring the soil nutrients and soil testing also helps in conservation, appropriate soil and water management and is the basic step for quality management, but very few farmers believe that soil health testing reduces the cost of cultivation.

**Table 6. Benefits of soil health testing in Punjab**

Particulars	Mean	SD	(N=240)
			t-value
Based on my experience, Soil testing is necessary and crop yields	4.34	0.58	35.53*
Soil testing helps in soil conservation, appropriate soil and water management	4.31	0.62	32.53*
Soil testing is basic step for quality crop production	4.20	0.69	26.66*
Timely delivery of results of Soil Health testing helps in improving productivity	4.17	0.77	23.53*
I prefer soil testing for fertilizer application	4.14	0.71	24.65*
Soil testing has improved profitability of crops	4.09	0.73	22.94*
Soil testing has improved my productivity	4.05	0.79	20.43*
Soil testing helps in sowing appropriate crops	4.04	0.79	20.39*
More yield in one year after soil testing	4.02	0.71	22.23*
Soil testing reduces the cost of cultivation after soil testing	4.02	0.76	20.77*

\*Significant at 1% level of significance.

### Satisfaction with soil health testing

Satisfaction of farmers towards soil health testing was studied on a Likert scale ranging 1 (Highly satisfied) to 5 (Highly Dissatisfied) and single mean t test was applied to find the statistical significance of results. ANOVA was applied to understand the differences in satisfaction towards Soil Health Testing of respondents w.r.t. age, education, land holding, income, and occupation.

The farmers reported that soil health testing results were reliable (Mean score 4.43) and farmers get results within a particular time limit (Mean score 4.36) (Table 7). They were satisfied with the extension services and advice provided by university, department of

agriculture on the basis of SHT. The farmers were also satisfied with the results of yield of crop after soil health testing. All the parameters were found to be significant at 5% level of significance. No significant difference in the satisfaction towards soil health testing wrt age education, land holding, income and occupation was observed.

### Constraints faced by farmers in soil health testing

Out of 240 farmers 120 farmers responded to this question. Farmers were asked to rank the constraints faced by them according to their importance and rank scores have been calculated. The major constraints faced by farmers (Table 8) were inadequate follow-up

**Table 7. Satisfaction with soil health testing in Punjab**

(N=240)			
Particulars	Mean	SD	t-value
Reliable soil testing results	4.43	0.63	35.31*
Timely delivery of Results of soil health testing	4.36	0.65	32.39*
Satisfaction with the extension services and advise provided by university, department of agriculture	4.10	0.70	24.09*
Satisfied with the Results of yield of crops after soil health testing	4.08	0.68	24.48*

\*Significant at 1% level of significance.

**Table 8. Constraints faced by farmers in soil health testing in Punjab**

(N=120)		
Constraints	Rank score	Rank
Inadequate follow-up by extension agency	322	1
Unscientific methods of collecting soil samples	260	2
Results are not communicated properly	254	3
Guidance after the test will not be provided	250	4
Complex to adopt the recommendations	228	5
Results are too technical to understand	206	6
Less benefits	156	7

by extension agency unscientific methods of collecting soil samples results were not communicated properly guidance after the test was not provided The minor constraints faced by farmers were that it was complex to adopt the recommendations, results are too technical to understand and some felt that the SHT had very less benefits (Rank score=156).

### **Reasons for not adopting soil health testing**

To understand the reasons for non adoption of soil health testing by the farmers, 60 farmers from different cropping belts were surveyed. The Persual of table 9 reveals that 50 percent farmers did not get SHT done because they did not have soil health test labs in their locality and 41.67 percent farmers felt that it is difficult to go to state agriculture university and no proper facilities are available at private labs or KVKs and 26.67 percent of farmers have no idea about soil health testing i.e, lack awareness. Moreover, 16.67 percent of farmers believed they have good productivity without SHT and 10 percent farmers said that other farmers opined that there was no improvement in crop productivity with SHT and 6.67 percent

farmers felt that only fertilizers matter for crop improvement.

### **Conclusion and Policy Implications**

Farmers despite knowing the benefits of SHT and having a positive perception do not go for regular SHT. Those who go for regular soil health testing are large farmers but most of the farmers are getting it done on random basis. Mostly no significant differences were found in the perceptions of farmers regarding SHT wrt demographics. Some of the farmers who had not got soil health testing done are unaware and said that there is lack of facilities of soil health testing in their areas and in the opinion of farmers who get SHT done there was no improvement in crop yield and productivity even after SHT . The need is to implement the Soil health Card scheme emphatically which will help in improving the awareness among farmers regarding SHT. Simultaneously there is need to set up laboratories in large numbers so that Soil testing becomes easy for the farmers. Development and popularisation of low cost technologies for SHT so that farmers use it in their fields and on their own is the need of the hour.

**Table 9. Reasons for not adopting soil health testing in Punjab**

**Multiple response (N=60)**

<b>Reasons for adopting Soil Health Testing</b>	<b>Number of respondents</b>	<b>Percentage</b>
No Soil health Test labs in their locality	30	50.00
Difficult to go to state agriculture university and no proper facilities are available at private labs or KVKs	25	41.67
No idea about it	16	26.67
Good productivity and yield up to full potential without SHT	10	16.67
We heard from others that there is no improvement in crop productivity and the yield remains the same	6	10.00
Fertilizers are important, other things really do not matter	4	6.67

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