Journal of Agricultural Development and Policy, 2019
Volume 29, No. 2, 145-154

Consumers' Perception Regarding Adoption of PAU Tensiometer for Irrigation Scheduling in Agriculture

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Abstract

The Indian state of Punjab pioneered Green Revolution along with some other states, transforming India into a food-surplus country. The state, later, witnessed serious consequences of intensive farming using chemicals and pesticides and taking two resource-intensive crops per year from the same soil. This involved increased groundwater irrigation and cultivation of water-intensive crop, rice, in Punjab which never was its native place. This study attempts to understand the consumers' perception regarding adoption of PAU Tensiometer for resource management and irrigation scheduling in agriculture and how the adoption level varies among various age groups, landholding sizes and income groups. An exploratory research study was undertaken and farmers' responses were recorded using a well-structured, disguised questionnaire. The farmers selected for the study belonged to different age groups, landholding sizes and income groups in order to represent the whole population effectively. The study found out that most of the respondents had the thought that standing water was better for the crop. A majority of the respondents practiced irrigation scheduling through traditional methods instead of any scientific aid. The old farmers, farmers belonging to marginal and small landholding sizes and medium income groups were observed to have higher willingness to adopt the technology as compared to others. Age, landholding sizes and income groups had significant effect on the awareness and perception of respondents towards adoption of PAU Tensiometer for resource management in agriculture.

Keywords: Perception, Tensiometer, Resource management, Irrigation, Adoption

JEL Classification: M00, M31, M37, Q01, Q24

In India, the Green Revolution was initiated with the motive of making India self-sufficient in terms of food production. This included new high-yielding varieties (HYVs) of cereals, especially dwarf wheat and paddy, in association with chemical fertilizers and agro-chemicals, and with controlled water-supply (usually involving irrigation) and new methods of cultivation, including mechanization; the creation of large dams and irrigation projects. All of these together were seen as a 'package of practices' to supersede 'traditional' technology and to be adopted as a whole.

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Green Revolution along with the other states, transforming India into a food-surplus country. The state then witnessed serious consequences of intensive farming using chemicals and pesticides and taking two intensive crops per year from the same soil. This involved intensive irrigation and cultivation of water-intensive crop, rice, in Punjab which never was its native place. Economically efficient irrigation management, immediately, requires the coordination of a number of irrigation and production practices which may affect water use (Bernardo *et al* 1987). The strategies to promote these practices as a part of Conservation Agriculture call for moving away from conventional compartmentalization and hierarchical arrangements of research that generates and perfects technologies, extension that delivers it and farmers who passively adopt it (Abrol and Sangar 2006). There is a need to bring all the involved stakeholders on a common platform to conceive end-to-end strategies. The off-site benefits accounted for a majority of the net social benefits that included more regular surface hydrology, reduced sediment loads and increased carbon sequestration. This could be used as grounds for the development of regional, national or even global incentive programmes supporting the adoption of conservation agriculture (Stonehouse, 1997).

The knowledge of the renewability potential of natural resources is a critical determinant of the attitude and management of conservation measures adopted to achieve sustainability(Fakoya *et al,* 2007). Thus there is a need to make farmers aware of the renewability potential of groundwater and how it is depleting rapidly. One of the possible approaches for proper irrigation scheduling is measuring the soil water potential (Buttaro *et al* 2015).

Agriculturalists are the principal managers of global useable lands and will shape, perhaps irreversibly, the surface of the Earth in the coming decades. Zerssa *et al* (2017) determined the factors affecting farmer's perception to make decision on soil and water conservation practices on their farm land. Majority of the farmers were found to be aware about the introduced soil and water conservation (SWC) but few of them implemented it. The study concluded that many of the problems related to non-implementation were related to lack of real participation of farmers in planning of conservation effort. New incentives and policies for ensuring the sustainability of agriculture and ecosystem services are crucial if we are to meet the demands of improving yields without compromising environmental integrity or public health (Tilman *et al* 2002). In the absence of additional incentives, farmers' adoption of conservation agriculture only remains a function of its perceived profitability at the individual farm scale alone (Stonehouse 1997).

The need for irrigation scheduling is the current demand of the state and several techniques have already been designed by scientists to check irrigation requirements. Tensiometer is one such device that helps in irrigation scheduling, thus preventing over-irrigation and wastage of water.

In spite of availability of such cost-effective and easy-to-use device, the use has been observed as limited. This study attempts to understand consumers' preferences regarding adoption of PAU tensiometer for resource management. The study also makes an attempt to understand the effects of age of the respondents, landholding size and income of the respondents on their level of adoption and their perception towards the use of PAU tensiometer for irrigation scheduling.

Data Sources and Methodology

Exploratory research was carried out for meeting the objective of the study. The study explored farmers' awareness and adoption of PAU tensiometer for irrigation scheduling in Punjab. Secondary data was collected to develop the items in the questionnaire. Primary data was collected through a structured, non-disguised questionnaire.

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

Data collection

The data were collected from the farmers by personally interviewing them. Questions were specifically designed to get in depth information about the profile of the respondents, frequency of usage of PAU tensiometer, source of information, perception about PAU tensiometer, benefits and constraints they face in using this technology. The farmers who were not using the conservation agriculture technologies were interviewed to understand the reasons for them not using these technologies. This was done specifically using open ended question.

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. The questionnaire was pre-tested and suitable modifications were made before the selection of the text of the questionnaire. Before administrating the questionnaire, main objectives of the study were explained to respondents.

Results and Discussions

Profile of respondents

From Table 1, it can be seen than out of 150 farmers, 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. Amongst these 150 farmers, 3.3 per cent were illiterate, 8.7 per cent have studied primary education, 21.3 per cent have studied secondary education, 44.0 per cent have studied till higher secondary, 14.7 per cent were graduates and 8.0 per cent were postgraduates.

Based upon the size of the landholding of these 150 farmers, 12.0 per cent were marginal farmers, 18.7 per cent were small farmers, 36.0 per cent were semi medium farmers, 24.0 per cent were medium farmers and 9.3 per cent were large scale farmers. Also, out of these 150 farmers, 131 (87.3%) farmers owned their lands, 10 (6.7%) farmers rented and 9 (6.0%) leased the lands for cultivation.

From Table 2, it can be observed that 35.3 per cent of the farmers had low farming experience (1-10 years), 16.0 per cent farmers had medium farming experience (11-20 years) and 48.7 per cent farmers had high farming experience (more than 20 years). About 18 per cent farmers had only agriculture as their occupation, 62.0 per cent undertook agriculture along with livestock farming and 19.3 per cent had a business/ service in addition to agriculture and livestock farming. The annual income from agriculture was observed to be

Table 1: Profile of the respondents

Particulars	No. of Respondents	Percentage
Age		
18-35(Young)	46	30.7
36-50(Middle aged)	70	46.7
Above 50(Old)	34	22.7
Total	**150**	**100**
Education		
Illiterate	5	3.3
Primary (1st to 7th)	13	8.7
Secondary (8th to 10th)	32	21.3
Higher Secondary (11th to 12th)	66	44.0
Graduate	22	14.7
Post Graduate	12	8.0
Total	**150**	**100**
Land Holding		
Marginal (<1 hectare)	18	12.0
Small (1 to 2 hectare)	28	18.7
Semi medium farmers(2 to 4 hectares)	54	36.0
Medium farmers (4 to 10 hectares)	36	24.0
Large (Above 10 hectare)	14	9.3
Total	**150**	**100**
Source of land		
Owned/inherited	131	87.3
Rented	10	6.7
Leased in	9	6.0
Total	150	100

less than 2 lacs for 23.3 per cent farmers, and above 8 lacs for 7.3 per cent of the farmers. Out of these 150 farmers, 47 (31.3%) farmers undertook commercial agriculture, i.e. they cultivate for commercial purposes whereas the rest farmers did subsistence agriculture. All the farmers observed during this study carried out conventional cultivation practices and none practiced organic agriculture. For crop fertility management, 0.7 per cent farmer practiced intercropping and 9 per cent practiced manure addition to the soil, while 66.0 per cent farmers do not practice any method for crop fertility management.

Perception and awareness of farmers towards selected conservation technologies

This section describes the perception of the farmers towards irrigation scheduling and awareness regarding PAU tensiometer. Various observations under this section are discussed further.

Table 2: Farming profile of the respondents

Particulars	No. of Respondents	Percentage
Farming Experience		
Low (1 to 10 years)	53	35.3
Medium (11 to 20 years)	24	16.0
High (> 20 years)	73	48.7
Total	**150**	**100**
Occupation		
Only Agriculture	28	18.7
Agriculture with Livestock Farming	93	62.0
Agriculture with Livestock farming and Business/Service	29	19.3
Total	**150**	**100**
Annual income (in lakhs)		
<2	35	23.3
2-4	53	35.3
4-6	50	33.3
6-8	1	0.7
>8	11	7.3
Total	**150**	**100**
Farming purpose		
Commercial	47	31.3
Subsistence	103	68.7
Total	**150**	**100**
Cultivation practices		
Organic	0	0
Conventional	150	100.0
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**

It can be observed from table 3 that 141 (94.0%) respondents use surface irrigation as their primary irrigation method, while the rest 9 (6.0%) use localized irrigation for meeting the crop water requirements. None of the respondents used drip, sprinkler, manual or any other method of irrigation.

Table 3: Methods of irrigation and irrigation scheduling

Particulars	No. of Respondents	Percentage
Method of irrigation		
Surface irrigation	141	94.0
Localized irrigation	9	6.0
Drip irrigation	0	0
Sprinkler irrigation	0	0
Manual irrigation	0	0
Any other	0	0
Total	150	100
Method of irrigation scheduling		
Traditional	140	93.3
Scientific determination	10	6.7
Total	**150**	**100**

Table 4: Perception of respondents towards irrigation

Statements	Mean	SD	t-value	p- value
More irrigation prevents weeds from growing in the soil	2.69	1.380	23.897*	.001
More the amount of standing water, better it is for the crop	3.89	0.980	48.578*	.002
Use of fertilizer by plants is more when accompanied by irrigation, thus irrigation is a must with every fertilizer application	2.73	1.349	24.807*	.002
Newer methods of irrigation require more time and efforts than traditional methods	2.07	1.097	23.072*	.001
Too much irrigation harm soil fertility, hence proper irrigation scheduling is required	1.60	0.777	25.214*	.002

**Significant at 1% level of significance*

Also, 140 (93.3%) out of 150 respondents used traditional methods to schedule their irrigation, while only 10 (6.7%) respondents used scientific methods to schedule their irrigation.

A perused of Table 4 shows that most of the respondents agreed that the standing water was better for the crop, while they tend to disagree with all other statements that were actually not true for irrigation. It is evident from table 5 that the mean perceptions of the respondents belonging to different age groups tend to vary significantly with regard to statement 1, 3 and 5. This means that various age groups show different behavior with regard to these statements while the mean perceptions for the statements 2 and 4 are more or less same.

The data presented in Table 6 shows the mean perceptions of the respondents

Table 5: Perception of respondents towards irrigation application with respect to age

Statements	Age groups			F	Significance p-value
	18-35 (Young)	36-50 (Middle aged)	Above 50 (Old)		
More irrigation prevents weeds from growing in the soil	3.04	2.14	3.35	12.635*	.001
More the amount of standing water, better it is for the crop	3.89	3.96	3.74	0.584	.559
Use of fertilizer by plants is more when accompanied by irrigation, thus irrigation is a must with every fertilizer application	3.20	2.51	2.56	4.067*	.019
Newer methods of irrigation require more time and efforts than traditional methods	2.35	1.94	1.94	2.214	.113
Too much irrigation harm soil fertility, hence proper irrigation scheduling is required	2.04	1.34	1.53	13.362*	.001

**Significant at 1% level of significance*

Table 6: Perception of respondents towards irrigation application with respect to landholding

Statements	Mean perception with respect to landholding					F	Significance p-value
	Marginal	Small	Semi medium	Medium	Large		
More irrigation prevents weeds from growing in the soil	3.44	3.29	2.69	2.42	1.29	7.840*	.001
More the amount of standing water, better it is for the crop	3.44	4.21	3.91	4.06	3.29	3.510*	.009
Use of fertilizer by plants is more when accompanied by irrigation, thus irrigation is a must with every fertilizer application	3.78	1.57	3.07	2.33	3.43	14.164*	.001
Newer methods of irrigation require more time and efforts than traditional methods	2.39	1.54	2.26	2.31	1.39	4.774*	.001
Too much irrigation harm soil fertility, hence proper irrigation scheduling is required	1.50	1.21	2.00	1.39	1.50	7.094*	.002

**Significant at 1% level of significance*

Table 7: Perception of respondents towards irrigation with respect to income

Statements	Mean perception of income groups					F	Significance p-value
	<2 lakhs	2-4 lakhs	4-6 lakhs	6-8 lakhs	>8 lakhs		
More irrigation prevents weeds from growing in the soil	3.17	1.96	3.14	1.00	2.82	7.626*	.001
More the amount of standing water, better it is for the crop	4.11	4.13	3.72	3.00	2.82	5.801*	.001
Use of fertilizer by plants is more when accompanied by irrigation, thus irrigation is a must with every fertilizer application	2.51	2.87	3.04	1.00	1.55	3.820*	.006
Newer methods of irrigation require more time and efforts than traditional methods	1.71	2.47	2.04	1.00	1.45	4.128*	.003
Too much irrigation harm soil fertility, hence proper irrigation scheduling is required	1.37	1.58	1.78	1.00	1.64	1.613	.174

**Significant at 1% level of significance*

Table 8: Frequency of determination of soil moisture and knowledge about moisture measuring tools

Particulars	No. of Respondents	Percentage
Frequency of determination of soil moisture		
Weekly	13	8.7
Fortnight	9	6.0
Every month	15	10.0
Before sowing the crop	17	11.3
Never	96	64.0
Total	150	100
Knowledge about moisture measuring tools		
Electrical resistance block	0	0
Tensiometer	42	28.0
Time Domain Reflectometry (TDR)	0	0
Water potential probes	0	0
No knowledge	108	72.0
Total	**150**	**100**

Table 9: Sources of information about soil moisture measuring tools

Source of information	Mean	SD	t value	p-value
Agricultural magazines and extension literature	0.00	.000	-	-
Progressive Farmers	0.00	.000	-	-
KVK subject matter specialists/ scientists	0.07	.262	3.434*	.001
Department of Agriculture and Farmers' Welfare	0.27	.601	5.571*	.001
Agricultural input supply sector	0.00	.000	-	-
Television	0.00	.000	-	-
Radio	0.00	.000	-	-
Kisanmelas	0.15	.351	5.195*	.002
Relatives/ fellow farmers	0.00	.000	-	-
No information	0.00	.000	-	-

**Significant at 1% level of significance*

belonging to various groups of different landholding sizes tend to vary significantly towards all the statements regarding irrigation asked in the study.

The mean perceptions of the respondents belonging to different income groups tend to vary significantly with regards to statements 1, 2, 3 and 4, while the respondents of different income groups tend to have similar perception towards the statement 5 (Table 7).

The date presented in Table 8 shows the frequency of soil moisture determination by the respondents and the knowledge of respondents about the moisture measuring tools. It can be seen from the table that out of the 150 respondents, 8.7 per cent check soil moisture every week, 6 per cent respondents check their soil moisture fortnightly, 10 per cent check soil moisture every month, and 11.3 per cent respondents check soil moisture only before sowing the crop. Out of the 44 respondents who check their soil moisture, 28 per cent respondents have knowledge about PAU tensiometer, while the rest have no knowledge about any soil moisture measuring tool.

It is evident from table 9 that Department of agriculture and Farmers' Welfare is the best source of information about soil moisture measuring tools, followed by Kisanmelas and KVK subject matter specialists/ scientists.

Conclusions and Policy Implications

It was found that most of the respondents were of the thought that standing water was better for the crop. Out of the 150 farmer respondents, only 42 were aware of PAU tensiometer, 32 were interested in using the technology, all 32 had the desire to use this but only 7 respondents actually used PAU tensiometer for irrigation scheduling. Majority of the respondents practiced irrigation scheduling through traditional methods instead of any scientific aid. Old farmers, farmers belonging to marginal and small landholding sizes and medium income groups were observed to have higher willingness to adopt the technology as compared to others. Age, landholding sizes and income groups had significant effect on the awareness and perception of respondents towards adoption of PAU tensiometer for resource management in agriculture. For not using the technology, major factors were non awareness and non-availability. Most of the respondent farmers do not schedule their irrigation. This lack of awareness can be drawn out as the major factor. The Department of agriculture and Farmers' Welfare and Kisanmelas are the most effective sources of information to the farmers about the conservation technologies, thus the information can be further dispensed through these channels. Since there is a huge gap between awareness and action of respondents towards this technology, there is a definite potential for marketing of the technology to the farmers on the whole.

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Received: October 10, 2019, Accepted: November 2, 2019