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KNOWLEDGE LEVEL OF KINNOW GROWERS ABOUT DRIP IRRIGATION SYSTEM IN PUNJAB INDIA

Shachi Singh[1], Rupinder Kaur[2*] and Vipan Rampal[3]

[1]Sant Baba Bhag Singh University, UIA, Jalandhar-144030, Punjab, India
[2]Directorate of Extension Education, Punjab, Agricultural University, Ludhiana, Punjab, India
[3]Department of Extension Education, Punjab Agricultural University, Ludhiana-141004, Punjab, India
*Corresponding author E-mail: adskilldevelopment@pau.edu

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ABSTRACT

The Present study was undertaken to determine the knowledge level of kinnow growers about drip irrigation system. The study was conducted in four districts of Punjab i.e. Bathinda, Fazilka, Hoshiarpur and Sri Muktsar Sahib/ Faridkot which were selected purposively. From each district 25 farmers were selected randomly who had adopted drip irrigation system while 25 non-adopters were selected from the same area or the adjoining area of adopter farmers which constituted a sample of 200 farmers for the study. Findings of the study revealed that majority of the respondents had medium level of knowledge regarding drip irrigation system. A positive and significant relationship was found between age, education, mass media exposure and extension contacts with the knowledge level of respondents.

***Key words*:** Knowledge level, Drip irrigation, Conventional irrigation, Kinnow cultivation

Introduction

India is a vast country where the agriculture sector accounts for more than 85 percent of the total water usage for various purposes, particularly for crop irrigation. Irrigation can be defined as the application of water to soil in addition to natural rainfall in order to support plant growth, improve crop yield, and in some cases enhance the quality of plant parts that are harvested. It plays a significant role in improving the efficient use of agricultural inputs, increasing cropping intensity and boosting crop productivity. Furthermore, the development of irrigation systems contributes to generating employment opportunities and improving wage rates for agricultural labourers. Proper irrigation scheduling is also crucial for achieving optimal plant growth and higher crop yields (Kalyankar *et al*., 2011).

However, in recent times, water scarcity has become a major global concern due to a multitude of factors. The problem is particularly severe and is expected to worsen because of the rapid decline in irrigation water potential, rapid population growth, and increasing economic activities in many countries (Rosegrant *et al*., 2002). Several studies indicate that the problem of groundwater scarcity and the continuous degradation of groundwater resources across many regions can be addressed through two main approaches. The first is supply-side management, which includes watershed development and the expansion of water resources through major and minor irrigation projects. The second is demand-side management, which focuses on the efficient and planned use of available water in both the short and long term, including practices such as drip irrigation and improved water management techniques.

With the rapid decline in irrigation water potential, increasing water demand from multiple sectors, and the growing need for sustainable water-use efficiency in agriculture, various demand management strategies have been introduced since the late 1970s. These include measures such as water pricing and the formation of water users' associations to enhance water-use efficiency, particularly in surface irrigation. Among these strategies, the adoption of micro-irrigation technologies, such as drip and sprinkler irrigation, has gained significant importance (Kumar and Palanisami, 2010). Therefore, it is essential

to assess the knowledge level of farmers regarding various aspects of the drip irrigation system in order to understand their level of awareness and understanding of this technology.

Materials and Methods

The study was confined to four districts of Punjab i.e. Bathinda, Fazilka, Hoshiarpur and Sri Muktsar Sahib/ Faridkot which were selected purposively. From each district 25 farmers were selected randomly who had adopted drip irrigation system while 25 non-adopters were selected from the same area or the adjoining area of adopter farmers which constituted a sample of 200 farmers for the study.

Construction of knowledge test

In order to measure the level of knowledge of the respondents, a number of items were prepared in the knowledge test covering all the aspects of drip irrigation system under kinnow cultivation. The following procedures were adopted for developing knowledge test:

Collection of Items

Items related to drip irrigation system under kinnow cultivation were prepared in consultancy with the scientists/professors and reviewing the relevant literature. Overall all there were 32 items covering all the knowledge aspects of drip irrigation system. The items were edited and drafted in such a way that each item depicted only single idea and did not have any obscurity.

Jury opinion

These 33 items were sent to the 5 experts. The experts were expected to check each items carefully, whether the items really measured the knowledge of the respondents about different aspects of drip irrigation system in kinnow cultivation. They had liberty to add/ omit or modify any of the items. After considering the opinion of the experts, these items were discussed in the advisory committee meeting and at last, 32 items were retained in the knowledge test.

Item analysis

The 32 items were administrated to 30 farmers from a non-sampled area. They were not included in the sample but they were included in pre-testing. Each statement was having two response categories either correct or wrong. Each correct answer was allotted 1 score while wrong/ no response was awarded 0 mark. Thus, total score secured by all the individual respondents on 32 items for correct answers was knowledge score.

The scores obtained by 30 non-sampled farmers were arranged in descending order and divided into two groups. The respondents who scored highest scores were included in the upper group and lowest score achievers were involved in the lower group i.e. upper 25 per cent or top half and lower 25 per cent or bottom half. The data pertaining to the correct response for all the items in respect of these two groups were tabulated for calculating the difficulty and discrimination indices (Jha and Singh 1970).

i. Item difficulty index:

The index of item difficulty was worked out as the proportion of the respondents answering on items correctly. This was based on the assumption that the difficulty is linearly related to the level of respondents' knowledge about different aspects of drip irrigation system under kinnow cultivation.

$$\text{Difficult Index (P)} = \frac{R}{N} \times 100$$

Where

R = No. of respondents who answered the item correctly

N= Total number of respondents who take the test

ii. Discrimination index:

The second criterion for item selection was the discrimination index. If the test and an item measure the same ability or competence, we would expect that those having a high overall test score would have a high probability of being able to answer the item and vice-versa for those having a low overall test score. Thus, a good test item should discriminate between those who score high on the test and those who score low. It is denoted by letter D_i and is calculated by following formula:

$$D_i = \frac{R_u - R_L}{Ni/2}$$

Where

D_i = Discrimination index of a item i

R_u = Number of correct answer to item i among the 25% of the highest test score

R_L = Number of correct answer to item i among the 25% of the lowest test scores

N_i = No. of person in both the group

Final selection of knowledge items

Though, aforementioned criteria were the main considerations for final selection of knowledge items, yet due care was taken not to eliminate the important aspects if any. For this purpose, 20 items were considered for final selection. Because these items were formed after

Table 1: Distribution of respondents according to their item wise knowledge about drip irrigation system in kinnow cultivation. (n = 200)

S. No.	Aspects	Drip (n_1=100)		Conventional (n_2=100)	
		f (%)	Overall Rank	f (%)	Overall Rank
I. General aspects about irrigation/DIS					
1.	Maximum area under drip irrigation system in India	56 (56.00)	XV	17(17.00)	XII
2.	Irrigation method in which the chances of occurrence of disease is very less	89 (89.00)	I	33(33.00)	V
3.	Relevance of the tagline 'Per drop more crop' under Pradhan Mantri Krishi Sinchayi Yojana	52 (52.00)	XVII	14(14.00)	XIV
4.	Irrigation method in which the amount of water can easily be measured	76 (76.00)	VI	32(32.00)	VI
5.	Irrigation method highly suitable along with fertilizer application	70 (70.00)	XII	35(35.00)	IV
6.	Irrigation method in which water efficiency is high if managed correctly	72 (72.00)	X	38(38.00)	III
II. Yield and quality					
1.	Effect of drip Irrigation System on the quality of kinnow plant	77 (77.00)	V	16(16.00)	XIII
2.	Effect of drip irrigation system on the root growth of kinnow plant	53(53.00)	XVI	9(9.00)	XVI
III. Technical aspects					
1.	Appropriate source of irrigation under drip irrigation system	74 (74.00)	VIII	44(44.00)	I
2.	Extent of water saving in kinnow orchards under drip irrigation system	48 (48.00)	XIX	21(21.00)	XI
3.	Depth of mains and sub-mains below the soil surface to avoid damage during inter-culture and deterioration due to ultraviolet radiation	67 (67.00)	XIII	5(5.00)	XVII
4.	Suitable time to operate drip irrigation system	75 (72.00)	VII	30(30.00)	VII
5.	Appropriate duration of installing drip irrigation system for kinnow orchards	81 (81.00)	II	39(39.00)	II
IV. Precautionary measures for DIS					
1.	Quality component mark used under drip irrigation system	45 (45.00)	XX	4(4.00)	XVIII
2.	Acid used to protect the drip pipes from algae and bacteria formation	50 (50.00)	XVIII	2(2.00)	XX
3.	Filter used for separation of algal/living impurities in water	73 (73.00)	IX	3(3.00)	XIX
V. Natural resource management					
1.	Effect of drip irrigation system on the fertilizer requirement of the kinnow crop	79 (79.00)	III	24(24.00)	IX
2.	Effect of drip irrigation system on soil nutrients	78 (78.00)	IV	22(22.00)	X
VI. Economical aspects					
1.	Average cost of installation of Drip Irrigation System per acre (If water tank is available)	62 (62.00)	XIV	12(12.00)	XV
2.	Subsidy provided by the Punjab government on Drip Irrigation System under Soil Conservation Department	71 (71.00)	XI	25(25.00)	VIII

taking experts' opinion and thoroughly discussing in the advisory committee. Items having difficulty index i.e. 0.25 to 0.75 and discrimination index (D_i) above 0.20 were selected for knowledge test. Difficulty index and discrimination index of all the items pertaining to knowledge test have been mentioned in Appendices.

Reliability of the knowledge test

The reliability of test was assessed by using the method of split half technique. The test items consisting of 32 items were administered to 30 non-sampled respondents. The scores to all 32 items were allotted as 1 for correct and 0 for wrong response. The scores obtained by each of the respondent on odd and even numbered items in respect of two halves of the test were calculated separately. The Pearson product moment correlation coefficient (r) between the two sets of scores was calculated but this correlation would be the reliability for the half of the test rather than of the whole test.

Therefore, a statistical correction must be made to estimate reliability of the whole test. This statistical correction is known "Spearman Brown Proficiency" formula i.e.

$$r' = \frac{2r}{1+r}$$

The r value thus calculated was 0.663 and r' value was calculated was 0.797 which was found significant at 1 per cent level of probability. Therefore, indicating that this test had high internal consistently.

Validity of the knowledge test

The validity of the test was established through content validity. The validity was taken while collecting and selecting the statements covering different aspects pertaining to drip irrigation system under kinnow cultivation by consulting relevant literature and with consultation of specialists. The same were subjected to item difficulty and discrimination index to select the final statements. Hence, it was logical to assume that test satisfies representation as well as sensible method of test construction, this fulfills the criteria for content validity. The empirical type of validity determination was used to calculate what Guilford (1954) called the intrinsic validity. According to him, it is the degree to which whether the test measures the true score components. The intrinsic validity of these instruments was also calculated by using the following formula:

Validity = $\sqrt{r'} = \sqrt{0.797} = 0.893$

Results and Discussion

Knowledge is the extent of information possessed by the respondents pertaining to the different aspects of drip irrigation system under kinnow cultivation. It has been discussed under following subheads:

Item wise knowledge of the respondents

A knowledge test was prepared to check the knowledge of respondents about various aspects of drip irrigation system in kinnow cultivation. All the knowledge items were divided into six major aspects viz: General aspects about irrigation/DIS, Yield and quality, Technical aspects, Precautionary measures for drip irrigation system, Natural Resource Management, and Economical aspects. A perusal of Table 1 show that for general aspects about irrigation/DIS, more than half of the respondents i.e.56 per cent (using drip irrigation system) had knowledge about maximum area under drip irrigation system in India while only 17 per cent respondents (using conventional irrigation system) had knowledge about the same. Large majority of the respondents i.e. 89 per cent (using drip irrigation system) had knowledge about irrigation method which reduces the chances of occurrence of disease in kinnow crop while 33 per cent respondents (using conventional irrigation system) had knowledge about the same. These findings were in conformity with the findings of Jitarwal (2007). More than half of the respondents i.e.52 per cent (using drip irrigation system) and 14 per cent respondents (using conventional irrigation system) had knowledge about the relevance of the tagline 'Per drop more crop' under Pradhan Mantri Krishi Sinchayi Yojana. Majority of the respondents i.e. 76 per cent drip irrigation users and 32 per cent conventional irrigation users had knowledge about irrigation method which measures the amount of water easily. Seventy per cent drip irrigation users and 35 per cent conventional irrigation users had knowledge about irrigation method highly suitable along with fertilizer application. Majority of the drip irrigation users (72%) and 38 per cent conventional irrigation users had knowledge about irrigation method having high water efficiency if managed correctly.

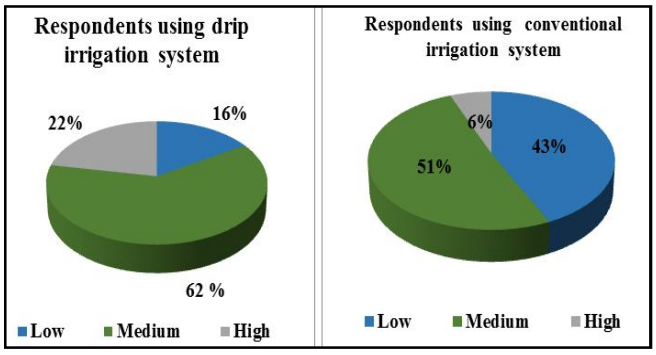

Fig. 1: Graphical presentation of respondents according to their knowledge level about drip irrigation system in kinnow cultivation.

In case of yield and quality aspects, 77 per cent drip irrigation users and 16 per cent conventional irrigation users had knowledge regarding effect of drip irrigation system on the quality of kinnow plant.

More than half (53%) of the drip irrigation users and only 9 per cent conventional irrigation users had knowledge about effect of drip irrigation system on the root growth of kinnow plant.

As far as technical aspects are concerned, 74 per cent drip irrigation users had knowledge regarding appropriate source of irrigation under drip irrigation system while 44 per cent conventional irrigation users had knowledge about the same. Forty-eight per cent drip irrigation users had knowledge regarding extent of water saving in kinnow orchards under drip irrigation system and 21 per cent conventional irrigation users had knowledge about the same. Majority of the drip irrigation users (67%) and only 5 per cent conventional irrigation

Table 2: Distribution of respondents according to their knowledge level about drip irrigation system in kinnow cultivation. (n = 200)

Drip (n_1=100)		Conventional (n_2=100)	
Knowledge level	**Frequency (%)**	**Knowledge level**	**Frequency (%)**
Low (4-9)	16 (16.00)	Low (0-4)	43 (43.00)
Medium (9-14)	62 (62.00)	Medium (4-8)	51 (51.00)
High (14-19)	22 (22.00)	High (8-12)	6 (6.00)

users had knowledge about the depth of mains and sub-mains below the soil surface to avoid damage during inter-culture and deterioration due to ultraviolet radiation while 75 per cent drip irrigation users and 30 per cent conventional irrigation users had knowledge about suitable time of operating drip irrigation system. It was observed that knowledge regarding appropriate duration of installing drip irrigation system for kinnow orchards was possessed by 81 per cent and 39 per cent drip irrigation users and conventional irrigation users respectively.

In case of precautionary measures for drip irrigation system, 45 per cent drip irrigation users and only 4 per cent conventional irrigation users had knowledge about the quality component mark used under drip irrigation system. It was further revealed that knowledge regarding acid used to protect the drip pipes from algae and bacteria formation and filter used for separation of algal/living impurities in water was possessed by 50 per cent (drip irrigation users) and 2 per cent (conventional irrigation users) followed by 73 per cent (drip irrigation users) and 3 per cent (conventional irrigation users), respectively.

Under natural resource management aspects, knowledge regarding effect of drip irrigation system on the fertilizer requirement of the kinnow crop was possessed by 79 per cent drip irrigation users and 24 per cent conventional irrigation users while little less than 80 percent drip irrigation users had knowledge about effect of drip irrigation system on soil nutrients as compared to conventional users (22 %).

Under economical aspects, 62 per cent drip irrigation users possessed knowledge about average cost of installation of drip irrigation system per acre (if water tank is available) as compared to conventional irrigation users (12%) while 71 per cent and 25 per cent (drip and conventional users, respectively) had knowledge regarding subsidy provided by the Punjab government on drip irrigation system under Soil Conservation Department.

Based on the overall ranking, it was concluded that majority of the drip irrigation users had knowledge about irrigation method which reduces the chances of occurrence of disease in kinnow crop:

Table 3: Relationship of socio-personal characteristics of respondents with knowledge level regarding drip irrigation system in kinnow cultivation. (n=100)

S. No.	Characteristic	'r' value
1.	Age	0.612*
2.	Educational Qualification	0.413*
3.	Mass Media Exposure	0.286*
4.	Extension contacts	0.274*
5.	Participation in Extension Activities	-0.0777
6.	Economic motivation	-0.041
7.	Risk orientation	0.026
8.	Innovativeness	-0.129
*Significant at 0.05 level and 0.01 level		

(i) followed by appropriate duration of installing drip irrigation system for kinnow orchards

(ii) effect of drip irrigation system on the fertilizer requirement of the kinnow crop

(iii) effect of drip irrigation system on soil nutrients

(iv) effect of drip irrigation system on the quality of kinnow plant

(v) with 89 per cent, 81 per cent, 79 per cent, 78 per cent and 77 per cent respectively.

Most of the conventional irrigation users had knowledge about appropriate source of irrigation under drip irrigation system:

(i) followed by appropriate duration of installing drip irrigation system for kinnow orchards

(i) irrigation method having high water efficiency if managed correctly

(iii) irrigation method highly suitable along with fertilizer application

(iv) and irrigation method which reduces the chances of occurrence of disease in kinnow crop

(v) with 44 per cent, 39 per cent, 38 per cent, 35 per cent and 33 per cent respectively.

Overall knowledge level of the respondents

The data in the Table 2 illustrate that in case of respondents using drip irrigation system, majority of them (62%) had medium level of knowledge followed by 22 per cent and 16 per cent having high and low level of knowledge. respectively. These results were in agreement with the findings of Jitarwal (2007). The medium knowledge of respondents using drip irrigation system might be ascribed because of their moderate exposure to mass media, extension contacts or lack of adequate technical guidance provided by the agencies working for transfer of technology in the study area.

In case of respondents using conventional irrigation

system, more than half of them (51%) had medium level of knowledge followed by 43 per cent and 6 per cent having low and high level of knowledge, respectively. Although medium level of knowledge was found among both types of respondents but there was a massive variation in knowledge scores of the respondents it was because of the fact that respondents using drip irrigation system would possess more knowledge about the various aspects of drip irrigation system as they were actually using this technology on their field conditions.

Relationship between socio-personal characteristics and knowledge level of kinnow growers using drip irrigation system

Data presented in Table 3 indicate that socio-personal characteristics of respondents such as: age, education, mass media exposure and extension contacts were positively and significantly correlated with knowledge level of respondents at 0.05 and 0.01 level of significance. The findings were supported by the findings of Patel and Patel (2016) who reported that education, mass media exposure and extension contacts were positively and significantly correlated with the knowledge of banana growers about drip irrigation system. Thus, it can be concluded that education and extension contact played a significant role in increasing the knowledge of kinnow growers about drip irrigation system. The kinnow growers using drip irrigation system with better education might be more receptive for new knowledge and thus, would have understood the importance of drip irrigation system in kinnow cultivation. Similarly, higher level of mass media exposure would have helped them in updating with the latest information and increased extension contacts would have helped them in acquiring more and more information, exchanging ideas and thoughts thereby increasing their knowledge about drip irrigation system.

Other variables such as: participation in extension activities, economic motivation, risk orientation and innovativeness were non-significantly associated with knowledge level of respondents at 0.05 and 0.01 levels of significance.

Conclusion

Majority of the respondents had medium level of knowledge in case of drip irrigation system while little more than half of the respondents had medium level of knowledge in case of respondents using conventional irrigation system. A positive and significant relationship was found between age, education, mass media exposure and extension contacts with knowledge level of respondents. So there is considerable scope for enhancing the knowledge level farmers using drip irrigation system and conventional irrigation system. There should be organized training programmes, awareness campaigns and demonstration regarding operation and maintenance of the drip system. More focus should be given on mass media exposure and extension contacts of farmers as they exert highly significant influence on knowledge and adoption of drip irrigation.

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