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Factors influencing the knowledge level of PMKSY Beneficiaries on Drip irrigation Technology in Tamil Nadu

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Abstract

The investigation was carried out in three districts of Tamilnadu state with 300 PMKSY beneficiaries practicing drip irrigation system. The three districts were selected purposively as they had highest area comes under drip irrigation system of PMKSY scheme. Majority of the PMKSY beneficiaries had medium level of knowledge (58.00 per cent) on drip irrigation technology. The practices viz, subsidy and cost (87.67 per cent), water use efficiency (83.67 per cent) and features of drip irrigation system (74.83 per cent) were found with more mean percentage scores. Whereas, the mean scores for components of drip irrigation system (45.23 per cent) and operation and maintenance (43.55 per cent) were formed to be below fifty per cent. The characteristics viz, age (X_1), educational status (X_2), farm size (X_4), farming experience (X_5), annual income (X_6), extension agency contact (X_7), risk orientation (X_{12}), scientific orientation (X_{13}), innovativeness (X_{15}) and subsidy orientation (X_{16}) were found to have positive and significant relationship with knowledge level of PMKSY beneficiaries.

Key words : Knowledge, Drip irrigation technology, PMKSY scheme, Water use efficiency.

Knowledge was generally understood as an intimate acquaintance of an individual with facts[8]. Knowledge as a body of understood information possessed by an individual. India has 18 per cent of world population, having 4 per cent of world's fresh water, out of which 85 per cent is used in agriculture. India receives an average of 4,000 billion cubic meters of precipitation every year (3000 BCM from monsoon *i.e.*, June to September). National annual rainfall is around 1183 mm, out of which 75 per cent is received in four months during monsoon (July to September). The heavy rainfall in short period leads to run

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off capita water availability was 1544 cubic meter. The anticipated per capita water availability in 2025 will be 1401 cubic meter (167 liter/day) and 1191 cubic meter in 2050,[4]. The demand for water increases while the supply of water was constant. Water stressed condition was observed in states like Rajasthan and Gujarat because of arid climate in that region and water scarcity in Tamil Nadu, Karnataka and Andhra Pradesh was a consequence of poor aquifer properties in this state. The population of India in 2050 was predicted to be 1.6 billion, subsequently there will be increase in demand for water, food and energy. As per OECD (Organization for Economic Co-operation and Development) environmental outlook 2050, India would face severe water constraints by 2050. Indian farming accounts for 90 per cent water use due to fast-track ground water depletion and poor irrigation system. Irrigation has played a significant role in the food security enhancement and overall economic development of the nation[5].

Drip irrigation is one of the most recent advancements in irrigation technology, (also known as trickling irrigation or micro irrigation) was created in 1959 by irrigation technology expert Simcha Blass. Drip irrigation is defined as the practices, slow application of water in the form of discrete or continuous or tiny streams or drop by drop emitting through mechanical devices called drip irrigation. When using micro irrigation, water is sprayed into the root zone of the plant repeatedly at low pressure over an extended period of time. The water is needed for multi purposes viz., agriculture, industry, domestic use, energy sector etc. In India, only Agriculture sector accounts for over 85 per cent of total water use[6]. Through a system of lateral lines, sub-mains, and main line with emission station distributed throughout their lengths. Drip irrigation is the most effective form of watering plants. The emitter, dripper, orifice evenly distributes water, nutrients, and other growth-promoting compounds. Maintaining soil moisture just slightly below field capacity. This prevents the plant from experiencing water stress or water overload by utilising the combined forces of capillarity and gravity to replace moisture and nutrients instantly. Micro irrigation assures water savings of 30% to 70%, yield increases of 25% to 100%, and operation cost reduction of 15% to 30% for crop production. Fertilizer usage can also be optimized in this way. By minimising frictional losses and pumping hours, it cuts energy consumption by about 50%. Drip irrigation technology is more profitable as it saves 60-70% water as compared to surface irrigation method and reduces labour cost, protects the plants from diseases by minimizing humidity in atmosphere. Soluble fertilizers can also be applied with drip irrigation water by the drip system of irrigation, 95 per cent of the irrigation water can be used efficiently. Thus, drip irrigation has become a means of hi-tech agriculture / Horticulture and precision farming. This technology is especially suitable for saline and alkaline soil and for better water use efficiency.

In 2006, Micro irrigation started from centrally sponsored scheme (CSS) by Government of India (GoI). In 2010, CSS was amplified in scope and renamed as National Mission on Micro Irrigation (NMMI), which was subsequently brought under the ambit of the National Mission on Sustainable Agriculture.

In 2015, NMMI was brought as a scheme under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). PMKSY was approved by the Cabinet Committee on Economic Affairs (CCEA), chaired by Prime Minister Narendra Modi, on 15 July 2015, with the motto of "Per drop -More crop". It is being implemented to expand cultivated area with assured irrigation, reduce wastage of water and improve water use efficiency (Press Information Bureau - 2021). The study not only explored the knowledge level of PMKSY beneficiaries and also brings out the personal characteristics which influence the knowledge level of the PMKSY beneficiaries.

The present investigation was carried out in three districts of Tamil Nadu. Among the 38 districts, three districts viz. Dharmapuri, Erode and Salem were selected purposively as they had maximum number of PMKSY beneficiaries' who installed drip irrigation system during 2019-2020. From each selected districts, two blocks were selected purposively again considering the maximum number of PMKSY beneficiaries who had installation of drip irrigation system. Two villages were selected from each of the selected block based on the presence of higher number of PMKSY beneficiaries. Thus, twelve villages were totally selected. A sample size of 300 PMKSY beneficiaries were selected from those twelve selected villages by using proportionate random sampling method. The data were collected by personal interview method. The collected data were analysed and the results are interpreted in tables. Cumulative frequency method, percentage analysis and zero order correlation were the statical tools used for the study. The items in the knowledge test were read out to each PMKSY beneficiaries was asked to indicate the correct answer from among the choices provided. A score of 'two' was given for correct answer and 'one' for incorrect answer. The total knowledge score for each respondent was computed by adding the respondent's score for each item. The maximum possible score that could be secured by a respondent in this test was 68 and the minimum score one could obtain in the test was 34. The knowledge index was worked out for individual respondent using the formula :

$$KI = \frac{TSi}{MSi} X\ 100$$

Were,

KI = Knowledge index

TSi = Total score secured by i^{th} respondents.

MSi = Maximum possible score for i^{th} respondents.

Based on the knowledge index, the respondents were categorised into three groups, viz., low, medium and high based on cumulative frequency method. A percentage analysis was also done on the item-wise knowledge on recommended drip irrigation system for PMKSY beneficiaries.

Knowledge level of PMKSY beneficiaries on Drip irrigation technology :

Overall knowledge level of the respondents about drip irrigation technology :

The results on distribution of respondents according to their overall knowledge level on drip irrigation technology are presented in Table-1.

Table-1. Distribution of the respondents according to their overall knowledge level about drip irrigation technology

(n=300)

S.No.	Category	Frequency	Per cent
1.	Low	11	03.67
2.	Medium	174	58.00
3.	High	115	38.33
	Total	300	100.00

Table-1 shows that more than half the proportion of the respondents (58.00 per cent) had medium level of knowledge on drip irrigation system followed by more than one-third of the PMKSY beneficiaries (38.33 per cent) who had high level of knowledge on drip system. Only a negligible proportion of the PMKSY beneficiaries had low level of knowledge on drip irrigation system. This may be due to their medium level of educational status, frequent contact with extension agencies and the officials of the State Agriculture and Horticulture Department. The medium to high level of knowledge of drip irrigation system was due to their necessity to ensure water use efficiency and high level of dependency on agriculture. The finding of this study is in line with the findings of Sneha[9] who also found that majority of the respondents had medium level of knowledge about drip irrigation system.

Knowledge level of the respondents on various aspects of drip irrigation technology:

In order to obtain detailed in-depth idea and facts about knowledge level of the respondents, a technology wise knowledge level of the respondents was worked out and presented in Table-2.

Table-2. Knowledge level of respondents on various aspects of drip irrigation technology

(n=300)

S.No	Knowledge Aspects	Frequency	Percentage
I	**Subsidy and cost**		
i.	Scheme provide subsidy for installing drip system.	280	93.33
ii.	Rate of subsidy for drip irrigation system.	260	86.67
iii.	Installation cost of drip system/ac	272	90.67
iv.	Cost effectiveness of drip system compared to other methods of irrigation.	240	80.00
	Mean percentage		**87.67**
II.	**Water use efficiency**		
i.	Drip irrigation technology saves water as compared to other methods of irrigation.	262	87.33
ii.	An additional area can be irrigated by drip irrigation technology.	270	90.00
iii.	Water requirement for tapioca plant / day.	230	76.67
iv.	Equal distribution of water possible on high wind velocity in drip irrigation.	220	73.33

v.	Surface run-off can be eliminated by using drip irrigation technology.	230	76.67
vi.	Drip system saves 50 to 70 per cent of water.	280	93.33
vii.	Drip system keep soil moisture within the desired range for optimum plant growth.	265	88.33
	Mean percentage		**83.67**
III.	**Components of irrigation system**		
i.	Types of filters used in drip irrigation system.	120	40.00
ii.	Types of drippers used in drip irrigation system.	135	45.00
iii.	Pressure gauges.	110	36.67
iv.	Types of valves used in drip irrigation system.	130	43.33
v.	Spacing of laterals.	140	46.67
vi.	Using emitters.	105	35.00
vii.	Fertigation.	210	70.00
	Mean percentage		**45.23**
IV.	**Operation and Maintenance**		
i.	Frequent check-up of filters, main, sub-main, laterals and drippers.	169	56.33
ii.	Installing sub main and laterals in line with the slop of the field.	170	56.67
iii.	Require cleaning of clogs in drip system	130	43.33
iv.	Automated operation of drip system	10	3.33
v.	Chemicals used for cleaning the laterals.	165	55.00
vi.	Adjusting pressure in the pressure gauges to 10 -30 psi.	140	46.67
	Mean percentage		**43.55**
V.	**Features of drip irrigation system.**		
i.	Suitable for fruit plants.	240	80.00
ii.	Protecting crops from diseases.	220	73.33
iii.	Liquid fertilizer, insecticides, fungicide and herbicide applied through drip irrigation system.	180	60.00
iv.	The average life span of drip sets.	210	70.00
v.	Save electric energy	190	63.33
vi.	Used water scarce area.	270	90.00
vii.	Maintaining physical condition and structure of soil.	170	56.67
viii.	Minimizing surface run- off.	270	90.00
ix.	Controlling weeds in field.	260	86.67
x.	Used saline water.	235	78.33
	Mean percentage		**74.83**
	Overall mean percentage		**67.00**

Subsidy and cost :

Table-2, reveals that the mean percentage score for subsidy and cost is 87.67 per cent. Majority of the respontents had knowledge on the practices viz, name of the scheme (93.33 per cent), rate of subsidy for drip irrigation system (80.67 per cent), installation cost of drip system / ac 90.67 per cent and cost effectiveness of drip system compared to other method of irrigation (80.00 per cent). The Government take more efforts to create awareness among people about PMKSY scheme. Thus, majority of the respondents had more knowledge on subsidy and cost related items.

Water use efficiency :

The mean per cent score for water use efficiency was 83.67 per cent. Majority of the respontents had knowledge on the practices viz., Drip system saves 50 to 70 per cent of water (93.33 per cent), an additional area can be irrigated by drip irrigation technology (90.00 per cent). Followed by Drip system keep soil moisture within the desired range for optimum plant growth (88.33 per cent), Drip irrigation technology saves water as compared to other methods of irrigation (87.33 per cent), Whereas, the aspects viz., Water requirement for tapioca plant / day (76.67 per cent) Surface run-off can be eliminated by using drip irrigation technology (76.67 per cent) and equal distribution of water possible on high wind velocity in drip irrigation (73.33 per cent), were found with means score of below eighty.

Components of irrigation system :

The mean percentage score for components of drip irrigation system was found to be 45.23 per cent. The fertigation practice was known to three-fourth of the respondents (70.00 per cent), The remaining practices viz., spacing of laterals (46.67 per cent), types of drippers used in drip irrigation system (45.00 per cent), types of valves used in drip irrigation system (43.33 per cent), types of filters used in drip irrigation system (40.00 per cent), Pressure gauges (36.67 per cent) and Using emitters (35.00 per cent) were found to be aware by less than fifty per cent of the respondents.

Operation and maintenance :

The mean percentage score for operation and maintenance was found to be 43.55 per cent. The practices with mean scores of about forty were Installing sub main and laterals in line with the slop of the field (56.67 per cent), followed by frequent check-up of filters, main, sub-main, laterals and drippers (56.33 per cent), chemicals used for cleaning the laterals (55.00 per cent), adjusting pressure in the pressure gauges to 10 -30 psi (46.67 per cent), and require cleaning of clogs in drip system (43.33 per cent). Automated operation of drip system (3.33 per cent) was found to be aware by negative proportion of the respondents.

Features of drip irrigation system :

The mean percentage score for feature of drip irrigation system operation and maintenance was found to be 74.83 per cent. Highest mean scores were observed with the practices viz., suitable for water scarce area and minimizing surface run- off (90.00 per cent), controlling weeds in field (86.67),

suitable for fruit plants (80.00 per cent), used for saline water (78.33 per cent), protecting crops from diseases (73.33 per cent), and average life span of drip sets (70.00 per cent). The remaining practices namely save electric energy (63.33 per cent), Liquid fertilizer, insecticides, fungicide and herbicide can be applied through drip irrigation system (60.00 per cent) and maintaining physical condition and structure of soil (56.67 per cent) were found to be aware by less than mean percentage of the respondents.

Relationship between the profile characteristics of respondents with their knowledge level of respondents on drip irrigation technology:

An attempt was made to find out the relationship between the selected personal characteristics of users with their knowledge of recommended management practices of drip irrigation technologies. The correlation co-efficient (r) was worked out for each of dependent variable.

Table-3. Relationship between the profile characteristics of the respondents with their knowledge level on drip irrigation technology. (n=300)

S.No	Variables	Correlation Co-efficient 'r' value	Standardized Regression co-efficient	Standard error of 'b'	't' value
X1	Age	0.467**	0.750	0.612	1.225NS
X2	Educational status	0.198**	2.015	0.816	2.469**
X3	Occupational status	0.095NS	-0.052	1.249	-0.576
X4	Farm size	-0.115*	-0.418	0.235	-1.778*
X5	Farming experience	0.176**	1.458	0.512	2.847**
X6	Annual Income	0.117*	0.700	0.400	1.750*
X7	Extension agency contact	0.125*	0.285	0.141	2.021*
X8	Social participation	0.105NS	0.007	0.158	0.133NS
X9	Mass media exposure	-0.088	0.550	0.475	1.157NS
X10	Attitude towards PMKSY	-0.110NS	-0.062	0.046	-1.300
X11	Decision making pattern	0.045NS	-0.073	1.134	-0.826
X12	Risk orientation	0.135*	2.045	1.145	1.786*
X13	Scientific orientation	0.131*	0.146	0.047	2.826**
X14	Economic motivation	0.011NS	-0.016	0.071	-0.349
X15	Innovativeness	0.119*	0.116	0.416	2.026*
X16	Subsidy orientation	0.118*	0.314	0.165	1.915*

A= 8.601 R^2= 0.546 F= 7.165**

** - Significant at 0.01% per cent level of probability

* - Significant at 0.05% per cent level of probability NS – Non significant,

Relationship between the profile characteristics of the respondents with their knowledge level on drip irrigation technology:

Correlation analysis was performed to find out the association of independent variable with the dependent variable knowledge level of PMKSY beneficiaries in drip irrigation technology and results are presented in Table-3.

Table-3 exhibited that out of sixteen variables considered for the study, three variables viz., age (X_1), educational status (X_2), and farming experience (X_5) had shown positive significant association with knowledge level PMKSY beneficiaries at one per cent level of probability. whereas the variables farm size (X_4), annual income (X_6), extension agency contact (X_7), risk orientation (X_{12}), scientific orientation (X_{13}), innovativeness (X_{15}) and Subsidy orientation (X_{16}) had significant association at five per cent level of probability.

The correlation values for the rest of the six variables showed non- significant association with knowledge level of PMKSY beneficiaries.

Educational status had shown positive and significant association at 0.01 per cent level of probability. Majority of respondents had formal education. The PMKSY beneficiaries with higher level of education might be more receptive for new knowledge, have more grasping power and thus would have understood the significance of drip irrigation for tapioca cultivation. It may be stated that more educational status would have motivated the PMKSY beneficiaries to gain knowledge on drip irrigation technology. This finding is supported by the findings of Biradar *et al*.,[3] and Bhavik Patel *et al*.,[2].

Farm size had shown negative and significant association at 0.05 per cent level of probability. This otherwise mean that the farmers with less farm size had more knowledge. Under PMKSY scheme, 100 % of subsidy is given to small and marginal farmers. Hence, the farmers with small holding would have curious to know about the drip irrigation technology.

Farming experience had shown positive and significant at 0.01 per cent level of probability. As majority of PMKSY beneficiaries were having high level of farming experiences, this might have influenced them to realise the importance of drip irrigation technology.

Annual income had shown positive and significant relationship at 0.05 per cent level of probability. Most of them had small and marginal level of farm size and medium level of economic motivation. This situation might have motivated the PMKSY beneficiaries to know about drip irrigation technology.

The variable extension agency contact had showed positive association with knowledge level of drip irrigation technologies at 0.05 per cent level of probability. The respontents who had more contact with extension agencies can gain more knowledge about drip irrigation system. The extension agency may provide information on drip irrigation technology through various extension

methods. This finding derives support from the findings of Balamurugan[1].

Risk orientation showed a positive and significant association with knowledge level of drip irrigation technology at 0.05 per cent level of probability. The people high risk orientation would always be receptive to accept any innovation. Hence, the PMKSY beneficiaries with more risk orientation would have the tendency to seek knowledge on drip irrigation system. This may be the reason for the reported relationship between risk orientation and knowledge level. This finding derives support from the findings of Balamurugan[1].

Scientific orientation had exhibited a positive and significant association at 0.05 per cent level of probability. This might be due to the fact that most of the PMKSY beneficiaries had high to medium level of scientific orientation, innovativeness and economic motivation. This would also tend to favour their attitude towards scientific innovations and enabled them to aware about drip irrigation technology in PMKSY scheme. Subsequently, the farmers who have higher aspiration and direction towards scientific techniques for drip irrigation system would have acquired higher knowledge level. This finding of the study was in agreement with the findings of Mahammad *et al.*,[7].

Innovativeness showed a positive and significant association with knowledge level of drip irrigation technology at 0.05 per cent level of probability. The formal education of the PMKSY beneficiaries coupled with their medium to high level of innovativeness would have facilitated them to seek more knowledge on drip irrigation technology.

Subsidy orientation was found to have positive and significant association with knowledge level of farmers on drip irrigation technologies at 0.05 per cent level of probability. The orientation towards avialian subsidy would have naturally prompted them to know more about the schemes and their benefits. This finding derives support from the findings of Sneha[9].

Contribution of profile characteristics of the respondents with the knowledge level of respontents on drip irrigation technology of the respondents:

In order to find out which of the independent variables explained the variation in the knowledge level and also to know the extent of contribution, linear multiple regression analysis was worked out and the results are presented in Table-3.

It could be observed from the Table-3 that all the sixteen variables together explained (R^2=.546) 54.60 per cent of the variation in the knowledge level drip irrigation technologies. The 'F' value was found to be significant at 0.01 per cent level of probability. Hence, it could be concluded that a linear functional relationship between the independent and dependent variables could be established.

It can also be inferred that the strength of these variable can be explained as a unit increase ceteris paribus in age (X_1), educational status (X_2), farm size (X_4), farming experience (X_5), annual income(X_6), extension agency contact(X_7), risk orientation (X_{12}), scientific orientation (X_{13}), innovativeness (X_{15}) and subsidy orientation (X_{16}) would increase the

knowledge level of PMKSY scheme beneficiaries by 0.750, 2.015, 0.418, 1.458, 0.700, 0.285, 2.045, 0.146, 0.116 and 0.314 unit respectively.

The other variables did not show significant effect on the knowledge level of PMKSY beneficiaries in drip irrigation technology.

The prediction equation is as follows.
$Y= 8.601+[0.750X_1+2.015 X_2 -0.052 X_3+0.418 X_4 + 1.458X_5+ 0.700 X_6 +0.285 X_7 +0.007 X_8+0.550 X_9-0.062 X_{10} -0.073 X_{11}+2.045 X_{12}+0.146 X_{13}-0.016 X_{14}+0.116 X_{15}+0.314 X_{16}]$.

Hence, it may be concluded that age (X_1), educational status (X_2), farm size(X_4), farming experience (X_5), annual income (X_6), extension agency contact(X_7), risk orientation (X_{12}), scientific orientation (X_{13}), innovativeness (X_{15}) and subsidy orientation (X_{16}) were the crucial variables influencing the knowledge level of PMKSY beneficiaries in drip irrigation system. This finding is in line with the findings of Balamurugan[1].

Knowledge forms the base for adoption of any agricultural technology. Majority of the respontents had medium to high level of knowledge on drip irrigation technology. The beneficiaries had more knowledge on the aspects viz., scheme provide subsidy for installing drip system (93.33 per cent), installation cost of drip system (90.67 per cent), an additional area can be irrigated by drip technology (90.00 per cent), drip system saves 50 to 70 per cent of water (93.33 per cent), suitable for fruit plants (80.00 per cent), used for wate scarce area (90.00 per cent), and minimizing surface run-off (90.00 per cent). The variable viz., age, educational status, farming experience, annual income, extension agency contact, risk orientation, scientific orientation, innovativeness, subsidy orientations were found to have positive and significant relationship knowledge level of beneficiaries. Hence, these factors may be taken into consideration while formality strategies for PMKSY beneficiaries. It is suggested that the extension agency may conduct mass awareness campaigns and make publicise the drip irrigation technology through social media tools. So as to reach mass of farmers and create awareness among them about PMKSY scheme and drip irrigation technology.

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