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RESEARCH ARTICLE :

Constraints faced by the farmers in adoption of drip irrigation system in Bikaner district of Rajasthan

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SUMMARY : Recognized the fast decline of irrigation water potential and increasing demand for water from different sectors a number of demand management strategies and programme to save water and increase the existing water use efficiency in Indian Agriculture. In this changing agricultural scenario and a shift towards precision farming, drip irrigation happens to be the technology capable of providing more efficient utilization of water. The present investigation was conducted in four Panchayat samities of Bikaner district of Rajasthan. A total sample of 234 respondents was selected for the study purpose. The data were collected, classified, tabulated and statistically analyzed. The study revealed that most constraints like 'clogging of drippers by suspended materials' was (Technical constraint) perceived by 88.46 per cent farmers, 'insufficient supply of electricity for irrigating fields' was (Infrastructural constraint) expressed by 81.20 per cent farmers, 'Initial installation cost is very high' was (Financial constraint) perceived by 96.58 per cent farmers, 'Inadequate awareness about the advantage of drip irrigation system' was (Educational constraint) perceived by 81.62 per cent farmers and 'unsuitable in the area where water is highly saline' was (Climatic and geographical constraint) perceived by 68.80 per cent farmers in adoption of drip irrigation system.

KEY WORDS :
Drip irrigation system, Farmers, Constraints

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BACKGROUND AND OBJECTIVES

Agricultural production plays a very crucial role in the national economy. The increase in human population together with rapid industrial and urban development resulted in a sharp rise in the demand for agricultural products. Water is a well known basic and the most important input for agricultural production. Increasing competition of water with the other water users in the future would limit the water availability for expanding irrigated area. In traditional surface irrigation method the losses in water conveyance and application are large. These losses can be considerably reduced by farmers by adopting drip irrigation technology.

Drip irrigation, also known as trickle irrigation or micro irrigation is an irrigation method which minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants, either on to the soil surface or directly on to the root zone, through a network of valves, pipes, tubing and emitters. Drip irrigation is most suitable for row crops

(vegetables, soft fruit), tree and vine crops where one or more emitters can be provided for each plant. Drip irrigation is adaptable to any farmable slope and most soils (FAO, 1988).

The area under drip irrigation in India is around 33.87 lakh ha has been reached with the efforts of the Government of India, while it was only 1500 ha in 1985. The leading states of the country in respect of drip irrigation area are Maharashtra, Andhra Pradesh and Karnataka. The Rajasthan state ranks 6th in terms of area covered under drip irrigation system with an area about 170098 hectares after the area of Maharashtra (896343 ha), Andhra Pradesh (834865 ha), Karnataka (429903 ha), Gujarat (411208 ha) and Tamil Nadu (290009 ha). (Anonymous, 2015).

Drip irrigation system has more than 80-90 per cent irrigation efficiency and capable of increasing yield by 20-40 per cent with 40-70 per cent water saving and making 30 per cent reduction in fertilizer as well as electricity demand because water is directly applied to effective root zone of plants through network of plastic pipe. Acknowledging its benefits, researchers from across the country have reported that drip irrigation is the better alternative for irrigating the row crops, mulched crops, orchards, gardens, greenhouses, nurseries and ornamental plantations as against the conventional surface irrigation systems (Anonymous, 2014). Rajasthan is such a state where water scarcity is a limiting resource, rains are uneven, drought is a reoccurring factor, sandy soils cover a major part of the state and topography is undulating type. Under such situation, it is the need of the hour to adopt drip irrigation system. But still a big section of the farmers are clinged to age-old pattern of irrigation, which causes huge loss of water. Hence this study aims to identify the constraints faced by the farmers in adoption of drip irrigation system was undertaken.

RESOURCES AND METHODS

The present study was conducted in Bikaner district of Rajasthan. Out of six, four Panchayat samities were selected purposely on the basis of highest area and large number of beneficiary farmers of drip irrigation system. From the selected four Panchayat samities 25 per cent farmers having drip irrigation system were selected randomly. Hence, total sample of 234 respondents was selected for the study purpose. The data were collected by personal interview method with the help of interview schedule. The collected data were classified, tabulated and statistically analyzed.

OBSERVATIONS AND ANALYSIS

Constraints faced by the farmers in adoption of drip irrigation system were classified into five categories namely: technical, infrastructural, financial, educational and climatic and geographical constraints. The data regarding these constraints have been presented under following heads:

Technical constraints :

A critical analysis of data in Table 1 reveals that the constraints like 'clogging of drippers by suspended materials' was most perceived technical constraint by 88.46 per cent farmers and had occupied rank first. 'Lack of awareness about crop water requirement and fertigation schedule' was second most important technical constraint, which was perceived by 85.04 per cent respondents. Likewise, 'lack of technical know-how' (82.48 %) and 'un usefulness for field crops' (81.62 %) were perceived next important constraints by the farmers and occupied ranked third and fourth, respectively among the technical constraints. 'Requirement of clean water' (76.07 %), 'need pressure to discharge water' (73.93

Table 1: Technical constraints faced by the farmers in adoption of drip irrigation system (n= 234 Multiple response)

Sr. No.	Constraints	Frequency	Percentage	Rank
1.	Clogging of drippers by suspended materials	207	88.46	I
2.	Lack of awareness about crop water requirement and fertigation schedule	199	85.04	II
3.	Lack of technical know-how	193	82.48	III
4.	Un usefulness for field crops	191	81.62	IV
5.	Requirement of clean water	178	76.07	V
6.	Need pressure to discharge water	173	73.93	VI
7.	Require frequent maintenance	165	70.51	VII
8.	Damage of micro-tube /laterals by squirrel and rats	148	63.25	VIII
9.	Blockage of water pipe line	136	58.12	IX

%) 'require frequent maintenance' (70.51 %) and 'damage of micro-tube/laterals by squirrel and rats'(63.25 %) were found to be comparatively less important constraints and were ranked fifth, sixth, seventh and eighth, respectively. Whereas, 'blockage of water pipe line' was perceived by only 58.12 per cent respondents and was ranked at last position.

From the Table 1 it can be concluded that 'clogging of drippers by suspended materials' was one of the important technical constraint in adoption of drip irrigation system. The probable reason was in the study area mostly irrigation source is canal. Hence, the slime, algae, sand and other organic or inorganic materials comes with the water and the dripper line may also be blocked by deposition of salts which reduced the speed of water discharge by the sets and unequal distribution of water.

The problem like 'lack of awareness about crop water requirement and fertigation schedule' was second position in the technical constraints. This might be due to the fact that the farmers were taking multi crops (mostly vegetables and fruit plants), scientifically each crop water requirement and fertigation schedule is different. The farmers were unknown about the particular crop water requirement and fertigation schedule due to lack of technical knowledge about each crop. Hence, they did not decide the crop water requirement and fertigation schedule.

'Lack of technical know-how' has been regarded as the third important technical constraint in adoption of drip irrigation system. This might be due to the reason that the technical advice regarding adoption of drip irrigation system was not being provided sufficiently by extension personnels like VEWs, AAOs etc. as expressed by the farmers. Mostly dealers provided this kind of advice at the time of installation of drip irrigation system. The findings are in accordance with the findings of Sasane *et al.* (2011) and Chandran and Surendran (2016) who reported that clogging of drippers and lack of technical awareness were the major constraints in adoption of drip irrigation system.

Infrastructural constraints :

The findings presented in Table 2 revealed that the constraint like 'insufficient supply of electricity for irrigating fields' was the most perceived infrastructural constraint expressed by 81.20 per cent farmers and had occupied rank first. 'Technical staff, working in the fields is not available' was second most important infrastructural constraint and perceived by 77.35 per cent farmers. Similarly, 'services by the companies are poor after sales' was perceived 71.37 per cent respondents and was ranked third. Whereas 'lower quality of pipe and micro-tubes' was perceived as constraint by only 57.69 per cent farmers and was ranked at last.

The above results show that 'insufficient supply of electricity for irrigating fields' was major infrastructural constraint. This might be due to the fact that supply of electricity was very poor and irregular in the study areas due to which the farmers may not be able to apply proper irrigation water to the fields.

Next important constraint like 'technical staff, working in the fields is not available' has also hindered the adoption of drip irrigation system. The probable reason of the fact that ratio between extension worker and farm families was not in workable position and inadequate to cater the need of farming community in context to transfer of drip irrigation technology.

Similarly, the constraint like 'services by the companies are poor after sales' might be due to the reason that the dealers might not employ the qualified engineers or experts of irrigation system because of their costly services. The findings were supported by the findings of Shashidhara *et al.* (2007), Barse *et al.* (2010) and Meti (2013) who reported that irregular supply of electricity and inadequate follow up services by drip irrigation agencies about operating system.

Table 2 : Infrastructural constraints faced by the farmers in adoption of drip irrigation system (n = 234 Multiple response)

Sr. No.	Constraints	Frequency	Percentage	Rank
1.	Insufficient supply of electricity for irrigating fields	190	81.20	I
2.	Technical staff, working in the field is not available	181	77.35	II
3.	Services by the companies are poor after sales	167	71.37	III
4.	Generally, timely spare parts are not available	162	69.23	IV
5.	Inadequate distribution net work in rural areas	143	61.11	V
6.	Lower quality of pipe and micro-tubes	135	57.69	VI

Financial constraints :

The data presented in Table 3 concluded that 'initial installation cost is very high' was most perceived under financial constraint by the 96.58 per cent farmers and had occupied first rank. However, 'high cost of maintenance' was felt by 87.61 per cent farmers and was ranked second. 'Subsidy provision is less' was perceived by 84.19 per cent farmers which was ranked third, followed by 'loaning procedure is complex' (70.09 %) and 'higher cost of liquid fertilizers' (68.38 %) which were ranked fourth and fifth, respectively. The constraint like 'Inadequate credit facilities for the farmers' was perceived by only 53.85 per cent farmers and ranked as last.

From the above results it may be observed that majority of the farmers reported that 'initial installation cost is very high' that's why an average farmers could not afford to adopt it. The probable reason was the farmers were not very much aware about the cost benefit ratio of installation of drip irrigation system. The problem of 'high cost of maintenance' might be due to the reason that mostly the spare parts required for maintenance of drip sets were not available in the local market due to their high cost. So, the farmers had to purchase it from city market, which also added to the cost. Also after installation of drip sets the farmers have to devote most of their time and money for maintenance and repair of drip sets leading to frustration only.

The problem of 'subsidy provision is less' might be due to the reason that subsidy provision is decided by the Government and it is totally depends on their availability of budgets and other economic issues. Hence, the subsidy provision may be increased or decreased by the government in respect of drip irrigation system. The findings are in accordance with the findings of Sasane *et al.* (2011); Bhingardeve *et al.* (2012) and Bhuriya *et al.* (2016) who reported that high initial cost and inadequate credit facilities for the farmers were the major constraints in adoption of drip irrigation system.

Educational constraints :

Table 4 revealed that 'inadequate awareness about the advantage of drip irrigation system' was most important educational constraint as it was perceived by 81.62 per cent farmers and ranked first. 'Lack of individual's contact with experts related to drip irrigation system for effective adoption' was perceived by 79.49 per cent farmers and ranked second. Likewise constraint 'lack of knowledge about operating of drip irrigation system' was perceived by 76.07 per cent farmers and ranked third. Whereas, 'adequate number of demonstrations were not arranged to motivate and develop skills for its adoption' was perceived by only 64.96 per cent farmers and was ranked last constraint in adoption of drip irrigation system.

From the above findings it can be concluded that most of the farmers under study area were lack of understanding about operating, maintenance and

Table 3 : Financial constraints faced by the farmers in adoption of drip irrigation system (n = 234 Multiple response)

Sr. No.	Constraints	Frequency	Percentage	Rank
1.	Initial installation cost is very high	226	96.58	I
2.	High cost of maintenance	205	87.61	II
3.	Subsidy provision is less	197	84.19	III
4.	Loaning procedure is complex	164	70.09	IV
5.	Higher cost of liquid fertilizers	160	68.38	V
6.	Inadequate credit facilities for the farmers	126	53.85	VI

Table 4: Educational constraints faced by the farmers in adoption of drip irrigation system (n = 234 Multiple response)

Sr. No.	Constraints	Frequency	Percentage	Rank
1.	Inadequate awareness about the advantage of drip irrigation system	191	81.62	I
2.	Lack of individual's contact with experts related to drip irrigation system for effective adoption	186	79.49	II
3.	Lack of knowledge about operating of drip irrigation system	178	76.07	III
4.	Uneducated farmers feel difficulty in using drip irrigation system	170	72.65	IV
5.	Lack of systematic campaign for popularizing the drip irrigation system	168	71.79	V
6.	Farmers training are not arranged for its installation	162	69.23	VI
7.	Adequate number of demonstrations were not arranged to motivate and develop skills for its adoption	152	64.96	VII

advantage of drip irrigation system. Also there were no special campaigns, trainings or demonstrations for making the people aware about drip irrigation technology.

The constraint like 'lack of individual's contact with experts related to drip irrigation system for effective adoption' was ranked second, which could be attributed to fact that no specific government personnel were there to provide technical guidance to the farmers regularly. Hence, these problems were faced by the respondents.

The constraint like 'lack of knowledge about operating of drip irrigation system' might have been faced due to the reason that education plays an important role in eradicating the social prejudices and beliefs hampering the acceptability of the technology. The farmers were not in possession of correct scientific knowledge due to less contact with extension workers, lack of training and less exposure to farm information. The findings was supported by the findings of Patel *et al.* (2012) and Bhuriya *et al.* (2016) who reported that lack of technical knowledge and training facilities were the major constraints in adoption of drip irrigation system.

Climatic and geographical constraints :

Table 5 explains that the constraint like 'unsuitable in the area where water is highly saline' was ranked first in climatic and geographical constraints in priority of constraints in adoption of drip irrigation by the farmers as it was perceived by 68.80 per cent farmers. About 62.82 per cent farmers felt the problem of 'less suitable to clay soil' which was ranked second and the constraint 'inability to minimize temperature of atmosphere' was perceived by 56.84 per cent farmers and ranked third. Whereas, 'high temperature reduces the durability of drip irrigation system' was perceived by only 51.71 per cent farmers and was ranked last.

The above results revealed that the constraint like 'unsuitable in the area where water is highly saline' might be due to the reason that in some areas where irrigating water is highly saline, due to deposition of salt in to the spores of drippers might blocked the drippers and affect the water distribution, which require frequently maintenance and cleaning of the drip system. Therefore, the farmers less prefer where the water is highly saline. Similarly, the problem like 'less suitable to clay soil' might be due to the reason that the small particles of clay soil reach to the drippers through irrigation water due to which the drippers were clogged and the water supply to the root zone was disturbed. Further the constraint like 'inability to minimize temperature of atmosphere' because of through drip irrigation system the supply of irrigation water can ground surface and near to the root zone of the plant so due to the reason through drip irrigation the temperature of atmosphere could not be reduced. The findings were supported with the findings Jitarwal (2007).

Category wise overall position of constraints :

The overall position of constraints as perceived by the farmers in adoption of drip irrigation system as presented in Table 6.

A critical examination of data in Table 6 reveals that majority of the farmers faced the 'financial constraints' (76.78 MPS) in adoption of drip irrigation system and under this head the constraints were initial installation cost is very high, high cost of maintenance, subsidy provision is less, loaning procedure is complex,

Table 5: Climatic and geographical constraints faced by the farmers in adoption of drip irrigation system (n = 234 Multiple response)

Sr. No.	Constraints	Frequency	Percentage	Rank
1.	Unsuitable in the area where water is highly saline	161	68.80	I
2.	Less suitable to clay soil	147	62.82	II
3.	Inability to minimize temperature of atmosphere	133	56.84	III
4.	High temperature reduces the durability of drip irrigation system	121	51.71	IV

Table 6 : Category wise overall position of constraints as perceived by the farmers in adoption of drip irrigation system (n = 234)

Sr. No.	Constraints	No. of statements	M PS	Rank
1.	Financial constraints	6	76.78	I
2.	Technical constraints	9	75.50	II
3.	Educational constraints	7	73.69	III
4.	Infrastructural constraints	6	69.66	IV
5.	Climatic and geographical constraints	4	60.04	V

higher cost of liquid fertilizers and inadequate credit facilities for the farmers. Due to high cost and complexity of procedures, the respondents might have perceived this category as the most dominant category of constraints in adoption of drip irrigation system. Therefore, it was ranked first. Similarly the 'technical constraints' were the second important categories of constraints (75.50 MPS).

The constraints under the categories like 'educational constraints' and 'infrastructural constraints' were the accorded third and fourth ranks (73.69 and 69.66 MPS), respectively, whereas 'climatic and geographical constraints' were recorded as last rank (60.04 MPS). The present findings are in agreement with the findings of Jitarwal (2007) and Bunker (2011).

Conclusion:

From the above findings it can be concluded that 'clogging of drippers by suspended materials' was most perceived under technical constraint. Similarly the 'insufficient supply of electricity for irrigating fields' was perceived under infrastructural constraint and 'Initial installation cost is very high' was perceived under financial constraint. Likewise 'inadequate awareness about the advantage of drip irrigation system' was under educational constraint and 'unsuitable in the area where water is highly saline' was perceived under climatic and geographical constraints. Further it can be concluded that among all the constraints, financial constraints were the most important constraints and climatic and geographical constraints were observed as least important constraints in adoption of drip irrigation system by the farmers.

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