

Research Article

Study on the impact on the farmers in the adoption of drip irrigation system

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SUMMARY : Drip irrigation is an effective method of providing irrigation water directly into soil at the root zone of plants. The present paper attempts to determine to what extent the farmers adopted drip irrigation system. Interviewing 120 farmers face-to-face, selected through proportionate sampling technique from eight Panchayat Samities of Chittorgarh and Udaipur in Rajasthan state of India, relevant data were gathered. Empirical data revealed that of total, 35 (58.33 %) and 31 (51.67%) of farmers from Chittorgarh and Udaipur districts, respectively fell under medium adoption level regarding DIS. Farmers of both the categories (Chittorgarh and Udaipur) are needed to be educated and persuaded regarding following techniques: Use of strainer filter to control physical impurities, use of fertigation with DIS, acid treatment for cleaning the system, use of emitters per plant, use of 5 ppm chlorine to avoid algae and bacteria and removal of emitters at the time of every ploughing.

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Drip irrigation system, Adoption, Farmers

BACKGROUND AND OBJECTIVES

Water is precious natural resource, which is limiting factor in agricultural production. It necessitates adoption of water management technologies for judicious use of scarce available water resource. Productivity and water management can be achieved by adopting drip irrigation system (DIS). This system has a tremendous scope in Rajasthan, which is already confronting the serious problems of water scarcity. Drip irrigation system (DIS) is relatively a new concept, which has been developed over the last decade throughout the world. In 1964, Symcha Blass, an Israeli Engineer developed the first potential drip irrigation system (DIS). Today, India ranks 7th in terms of coverage of area under drip irrigation with an irrigated area of 2, 87,500 hectares after USA, Spain, Australia, South Africa, Israel and Italy. In this method, water is supplied directly near to the roots of plants, drop by drop, with the help of drippers. Drippers are linked with

side pipelets, which are linked with main pipeline connected with water supplying source.

The Drip and sprinkler irrigation systems are the advanced methods of irrigation for overcoming various problems of water losses and other problems such as labour, money and water management. The drip or trickle irrigation method is rapidly gaining importance in areas where water is expensive or scarce and high value crops are produced. Drip irrigation is an effective technology and an efficient method of providing irrigation water directly into the soil at zone of plants, and it limits water requirement to the consumptive use of the plants. Thus, drip irrigation minimizes conventional losses such as deep percolation, run-off and soil evaporation. In India, this type of irrigation was practiced earlier through indigenous method such as perforated earthenwares, perforated bamboo pipes, pitchers and porous cups, etc.

Further, the dominant methods of irrigation

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in the state are surface, furrow and border. The overall efficiency in these types is quite low, rarely exceeding 25-40 per cent under field conditions. Such methods also cause soil erosion and salinization. Even after intensive efforts, only 68-lakh hectares of land has been brought under irrigation so far *i.e.* 32 per cent net cropped area of the state. In view of the importance of the drip irrigation with above background in the changed agriculture scenario, it was pertinent to investigate various facts of drip irrigation and therefore, the study entitled to what extent the farmers adopted drip irrigation system was undertaken.

RESOURCES AND METHODS

The study was conducted in Chittorgarh and Udaipur districts of southern Rajasthan which were selected purposely for the investigation. One hundred twenty farmers from eight Panchayat Samities of two districts were selected on the basis of proportionate random sampling technique. The data were collected by the researchers with the help of well constructed interview schedule by face-to-face method of interview technique. For analysis of data, various statistical measures were used, *viz.*, frequency, percentage mean, standard deviation, mean per cent score, rank correlation coefficient and 'z' test were used.

OBSERVATIONS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

Extent of adoption of drip irrigation system among the farmers :

To get an overview of the farmers regarding their extent of adoption of drip irrigation system, they were classified into three strata *i.e.*, high, medium and low levels of adoption. These categories were formed on the basis of calculated mean and standard deviation of the adoption scores obtained by the respondents.

The data given in Table 1 bring to focus that majority of the farmers 66 (55.00%) had medium level of adoption. Besides, 31 (25.86%) farmers were having high level of adoption. However only 23 (19.17%) of the total farmers possessed low level of adoption of drip irrigation system.

Critical analysis of data presented in Table 1 reveal that 35 (58.33%) Chittorgarh's and 31 (51.67%) Udaipur's farmers had medium level of adoption. Besides, 17 (28.34%) Chittorgarh's and 14 (23.33%) Udaipur's farmers reflected high level of adoption. Only, 8 (13.33%) Chittorgarh's and only 15 (25.00%) Udaipur's farmers reported low level of adoption.

Thus, it could be concluded that majority of farmers 66 (55.00%) had medium level of adoption of drip irrigation system. This might be due to the reason that the farmers had better contacts and followed to those farmers who had excellent knowledge regarding drip irrigation system. However, those having low level of adoption might have lesser access to the extension contacts and resources. The results of present investigation corroborate the findings of Jiterwal (2008) and Sharma (2002).

Aspectwise extent of adoption of drip irrigation system:

The adoption of drip irrigation system had been assessed under three major heads. The results have been presented in subsequent tables. It was attempted to determine the prioritization of adoption regarding aspects of DIS.

Extent of adoption consideration before using drip irrigation system among the farmers :

The data incorporated in Table 2 indicate that farmers of Chittorgarh had excellent level of adoption regarding the aspects namely, check carefully the starter switches, if electric motor is used/or the fuel tank or diesel set used with 70.00 MPS and ranked first by the farmers.

This was followed by the aspects like check carefully the workability of foot valve, use by-pass assembly to drain out excess water for maintaining the required pressure in DIS, check carefully the pipeline fitting of the pump set, use of the Ventury Model V-3 to give soluble fertilizers and plant protection chemicals, use of media filter to the biological impurities, use flow valve assembly and non-return valve to maintain the water flow in system at starting and stopping time, use of fertigation unit with drip irrigation system, use of liquid fertilizers through DIS and use of strainer filter to control physical impurities. The extent of adoption of Chittorgarh farmers about these practices was 69.17, 66.67, 65.00, 61.67, 58.33, 57.50, 56.67, 55.83 and 53.33 per cent,

Table 1: Categorization of farmers according to their extent of adoption about drip irrigation system (DIS) (n= 120)

| Sr. No. | Extent of adoption | District | | | | Total | |
|---------|-------------------------|-------------|-------|---------|-------|-------|-------|
| | | Chittorgarh | | Udaipur | | f | % |
| | | f | % | f | % | | |
| 1. | Low (< 19.30) | 8 | 13.33 | 15 | 25.00 | 23 | 19.17 |
| 2. | Medium (19.30 to 23.80) | 35 | 58.33 | 31 | 51.67 | 66 | 55.00 |
| 3. | High (> 23.80) | 17 | 28.34 | 14 | 23.33 | 31 | 25.83 |
| | Total | 60 | 100 | 60 | 100 | 120 | 100 |

f = Frequency, % = Per cent, Mean = 21.55 & S.D. = 2.25

respectively.

Further analysis of table reveals that of Udaipur's farmers extent of adoption about check carefully the pipeline fitting of the pump set was ranked first. The extent of adoption regarding aspects like check carefully the starter switches if electric motor is used/or the fuel tank or diesel sets used, checking carefully the workability of foot valve, use by-pass assembly to drain out excess water for maintaining the required pressure in DIS, use of the Ventury Model V-3 to give soluble fertilizers and plant protection chemicals, use of media filter to the biological impurities, use of fertigation unit with drip irrigation system, use of liquid fertilizers through DIS and use of strainer filter to control physical impurities was 66.67, 65.83, 65.00, 59.16, 57.50, 55.00, 54.16, 52.50 and 51.33 per cent, respectively.

From the above discussions, it could be inferred that the extent of adoption about considerations of various points before running the system among farmers of Chittorgarh ranged between 53.33 to 70.00 per cent, whereas, in case of farmers of Udaipur, the extent of adoption was observed between 51.33 to 66.67 per cent. Further, it can be concluded that farmers of Chittorgarh had comparatively more adoption than the farmers of Udaipur about all the practices of DIS in

the study area.

Further, data show that the rank order correlation value was 0.92, which shows a positive correlation between ranks assigned by the farmers of both the areas about consideration of various points before running the system. The significance of 'r' was also tested by 't' test and it was noted that calculated 't' value 2.83 was higher than its tabulated value at 1 per cent level of significance. This led to the conclusion that there was a significant correlation between the ranks assigned by the farmers of Chittorgarh and Udaipur about considerations of various points before running the system, though there was difference in magnitude of mean per cent score of both the categories of respondents.

Extent of adoption regarding operational techniques of drip irrigation system among the farmers :

The data given in Table 3 indicate that farmers of Chittorgarh and Udaipur possessed high level of adoption regarding selecting location of main line, sub-main and lateral and put the end plug at the end of the lateral with MPS 71.67 and 70.00, respectively.

These aspects were ranked first by the farmers of both the areas. It meant that most of the farmers of both the areas

Table 2 : Extent of adoption of considerations before running of drip irrigation system among the farmers (n= 120)

| Sr. No. | Consideration | District | | | | Total | |
|---------|---|-------------|------|---------|------|-------|------|
| | | Chittorgarh | | Udaipur | | MPS | Rank |
| | | MPS | Rank | MPS | Rank | | |
| 1. | Check carefully the workability of foot valve | 69.17 | 2 | 65.83 | 3 | 67.50 | 2 |
| 2. | Check carefully the pipeline fitting of the pump set | 65.00 | 4 | 60.00 | 1 | 62.50 | 4 |
| 3. | Check carefully the starter switches if electric motor is used of the fuel tank or diesel set used | 70.00 | 1 | 66.67 | 2 | 68.33 | 1 |
| 4. | Use by-pass assembly to drain out excess water for maintaining the required pressure in DIS | 66.67 | 3 | 65.00 | 4 | 65.83 | 3 |
| 5. | Use of media filter to the biological impurities | 58.33 | 6 | 57.50 | 6 | 57.91 | 6 |
| 6. | Use flow valve assembly and non-return valve to maintain the water flow in system at starting and stopping time | 57.50 | 7 | 54.16 | 8 | 55.83 | 7 |
| 7. | Use of the Ventury Model V-3 to give soluble fertilizers and plant protection chemicals | 61.67 | 5 | 59.16 | 5 | 60.42 | 5 |
| 8. | Use of liquid fertilizers through DIS | 55.83 | 9 | 52.50 | 9 | 54.16 | 9 |
| 9. | Use of fertigation unit with Drip irrigation system | 56.67 | 8 | 55.00 | 7 | 55.83 | 8 |
| 10. | Use of strainer filter to control physical impurities | 53.33 | 10 | 51.33 | 10 | 52.33 | 10 |

MPS= Mean per cent score, ** Indicate significance of value at P=0.1

$$r = 0.92^{**}$$

$$t = 2.83$$

Table 3 : Extent of adoption regarding operational techniques of drip irrigation system among the farmers (n=120)

| Sr. No. | Technique | District | | | | Total | |
|---------|--|-------------|------|---------|------|-------|------|
| | | Chittorgarh | | Udaipur | | MPS | Rank |
| | | MPS | Rank | MPS | Rank | | |
| 1. | Use pressure gauge to check the pressure in the system | 65.00 | 3 | 58.33 | 4 | 61.67 | 3 |
| 2. | Use of recommended emitters per plant | 60.00 | 4 | 61.67 | 3 | 60.83 | 4 |
| 3. | Use of acid treatment for cleaning the system | 48.33 | 5 | 43.33 | 5 | 45.83 | 5 |
| 4. | Selecting the location for main line, sub-main and lateral | 71.67 | 1 | 67.67 | 2 | 69.67 | 1 |
| 5. | Put the end plug at the end of the lateral | 68.33 | 2 | 70.00 | 1 | 69.16 | 2 |

MPS=Mean per cent score, ** Indicate significance of value at P=0.01

$$R = 0.80^{**}$$

knew the importance of selection of the location for main line, sub-main and lateral and putting the end plug at the end of the lateral.

In case of extent of adoption about put the end plug at the end of the lateral, use pressure gauge to check the pressure in the system, use of recommended emitters per plant and use of acid treatment for cleaning the system of Chittorgarh's farmers was 68.33, 65.00, 60.00 and 48.33 per cent, respectively.

Close analysis of Table 3 also shows the extent of adoption of Udaipur farmers about selecting the location for main line, sub-main and lateral, use of recommended emitters per plant use pressure gauge to check the pressure in the system and use of acid treatment for cleaning the system was 67.67, 61.67, 58.33 and 43.33 per cent, respectively.

Thus, from the above results and discussions, it could be inferred that the extent of adoption of drip farmers of Chittorgarh was 48.33 to 71.67 per cent, whereas in case of drip farmers of Udaipur the extent of adoption was observed to be in between 43.33 to 70.00 per cent in all of the operational techniques of drip irrigation system. Further, it can be concluded that farmers of Chittorgarh had high adoption than the farmers of Udaipur about all the operations of drip irrigation system.

Besides, table clearly shows that the calculated value of rank order correlation (r) was 0.80, found to be statistically significant at 1 per cent level of significance. This lead to the conclusion that there was highly significant correlation

between the ranks assigned by Chittorgarh's and Udaipur's farmers with respect to different aspects of drip irrigation systems operation in spite of difference in magnitude of mean per cent score. Meaning, the farmers of the both the districts visualized similar prioritization with regards to adoption of various operational techniques.

Figures presented in the Table 4 indicate that farmers of Chittorgarh and Udaipur had high level of adoption regarding cleaning of DIS regularly with MPS 66.67 and 58.33, respectively. This aspect was ranked first by the farmers of both the areas.

Further, drip farmers of Chittorgarh and Udaipur had moderate level of adoption about removal of emitters/laterals from the field at the time of every ploughing, with MPS 60.00 and 53.33, respectively and use of 5 ppm chlorine to avoid algae and bacteria with MPS 46.67 and 41.67 per cent, respectively. These aspects were ranked second and third, respectively by the farmers of both the locations.

In line with the findings, it could be inferred that the extent of adoption regarding maintenance of DIS among the farmers of Chittorgarh ranged from 46.67 to 67.67 per cent, whereas, in case of drip farmers of Udaipur the extent of adoption was observed to be between 41.67 to 58.33 per cent about all of the maintenance aspects of drip irrigation system.

Overall extent of adoption regarding drip irrigation system among the farmers :

Data presented in Table 5 vividly corroborate from the

Table 4 : Extent of adoption regarding maintenance of drip irrigation system among the farmers

(n= 120)

| Sr. No. | Aspect | District | | | | Total | |
|---------|--|-------------|------|---------|------|-------|------|
| | | Chittorgarh | | Udaipur | | MPS | Rank |
| | | MPS | Rank | MPS | Rank | | |
| 1. | Cleaning of DIS regularly | 66.67 | 1 | 58.33 | 1 | 59.16 | 1 |
| 2. | Removal of emitters/laterals from the field at the time of every ploughing | 60.00 | 2 | 53.33 | 2 | 60.00 | 2 |
| 3. | Use of 5 ppm chlorine to avoid algae and bacteria | 46.67 | 3 | 41.67 | 3 | 44.17 | 3 |

MPS= Mean per cent score

Table 5: Overall extent of adoption regarding drip irrigation system among the farmers

(n= 120)

| Sr. No. | Aspect | District | | | | Total | |
|---------|--|-------------|------|---------|------|-------|------|
| | | Chittorgarh | | Udaipur | | MPS | Rank |
| | | MPS | Rank | MPS | Rank | | |
| 1. | Considerations before using drip irrigation system | 61.51 | 2 | 58.71 | 2 | 60.11 | 2 |
| 2. | Operational procedures of drip irrigation system | 62.67 | 1 | 60.97 | 1 | 61.82 | 1 |
| 3. | Maintenance of drip irrigation system | 57.78 | 3 | 51.11 | 3 | 54.44 | 3 |
| | Overall | 60.68 | | 56.93 | | 58.64 | |

MPS = Mean per cent score

Table 6 : Comparison between Chittorgarh and Udaipur districts with regards to extent of adoption about drip irrigation system

(n= 120)

| Sr. No. | District | Mean | S.D. | 'Z' Value |
|---------|-------------|-------|------|-----------|
| 1. | Chittorgarh | 23.32 | 2.97 | 8.43** |
| 2. | Udaipur | 19.78 | 1.35 | |

** Indicate significance of value at P=0.01, S.D.= Standard deviation

major practices, that the farmers had high level of adoption about operation of drip irrigation system with MPS 61.82 which was placed at first position in the rank hierarchy by them. It was followed by consideration of various points before running the system and maintenance of drip irrigation system which were assigned II and III ranks with MPS 60.11 and 54.44, respectively. The results of the experiment are in agreement with the findings of Kumar (2003) and Ratan (1996).

Comparison between Chittorgarh and Udaipur districts with regards to extent of adoption about drip irrigation system:

H_{01} : There is no difference in extent of adoption between Chittorgarh's and Udaipur's farmers regarding drip irrigation system.

H_1 : There is difference in extent of adoption between Chittorgarh's and Udaipur's farmers regarding drip irrigation system.

To find out the significance of difference, if any in extent of adoption between Chittorgarh's and Udaipur's farmers regarding drip irrigation system, Z test was applied. Z value came to be 8.43, which was significant at 1.00 per cent level. It led to was acceptance of alternative hypothesis (H_1) and rejection of null hypothesis (H_{01}). Thus, there is highly significant difference in extent of adoption between Chittorgarh's and Udaipur's farmers regarding drip irrigation system.

From the above discussions, it is concluded that there was highly significant difference between the two districts. Thus, inferred that Chittorgarh's farmers had better adoption of drip irrigation system as compared to Udaipur's farmers. This might be due to the fact that Chittorgarh's farmers had relatively better economic conditions and they might have possessed comparatively more knowledge about drip irrigation system.

Therefore, it is recommended and suggested on the basis of above discussions, that both the categories of the farmers should be trained regarding drip irrigation system. But, more extensive training and persuasion is required for Udaipur farmers, more training is needed for maintenance of drip irrigation system.

Knowledge upgradation and persuasion is specifically imperative for following aspects about which the adoption was less.

Running of DIS :

- Use of strainer filter to control physical impurities.
- Use of fertigation unit with DIS.
- Use of liquid fertilizers through DIS.

Operational techniques:

- Use of acid treatment for cleaning the system.
- Use of recommended emitters per plant.

Maintenance of DIS :

- Use of 5 ppm chlorine to avoid algae and bacteria
- Removal of emitters/lateral from the field at the time of every ploughing.

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