A STUDY ON THE EXTENT OF ADOPTION OF SPRINKLER IRRIGATION SYSTEM BY THE FARMERS IN JHUNJHUNU DISTRICT OF RAJASTHAN

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ABSTRACT
Adoption of any technology is finally putting the new practice or idea into use which is the last stage of the adoption process. Present study was conducted on keeping in view the adoption of sprinkler system of irrigation by the farmers in the Jhunjhunu district of Rajasthan. A total of 160 farmers were selected out of them 80 adopters and 80 non-adopters were constituted the sample size. The respondents were interviewed with the help of structured interview schedule. Medium level of adoption was found among majority of the respondents. The reason behind this was low knowledge level of the respondents, some climatic economic and technical constraints were also identified. Among different practices, adoption of distance between nozzles was ranked first while the adoption of the area under sprinkler system was found at the bottom. Adoption index was used with modification for measuring extent of adoption.

Key words: Recommended irrigation practices, Adoption level, Sprinkler irrigation.

INTRODUCTION
Through sprinkler irrigation technique light application of water can be made efficiently on the seedlings and young plants, soluble fertilizers, herbicides and fungicides can be applied through irrigation water economically and with little extra equipment. Sprinkler method ensures and high degree of water control and enables judicious use of even small water flow on undulated and shallow soils. It saves land from channels and ridges and overall irrigation efficiency is 80-82% as compared to 30-50% in surface irrigation. Sprinkler irrigation can also be used to protect the crops against frost and high temperature, which reduces the quality and quantity of harvest, labour costs also reduce from 1/3 to 1/4ths as compared to surface method of irrigation. Several available studies on adoption of sprinkler system of irrigation separately addressed this issue. The studies by Sharma (1989), Yadav (1997) Puranik (1992) revealed that knowledge, caste, education, size of land holding, soil at participation, source of information and farm power are instrumental in the adoption of sprinkler irrigation system.

MATERIALS AND METHODS
The present study was conducted in the Jhunjhunu district of Rajasthan, which is situated in the 23.8N latitude in northern part of Rajasthan. This district is divided into six tehsils constituting eight panchayat samshtis, 288 gram panchayats, and 865 villages the total geographical area of the district is 591681 hectares, out of which about 436901 hectares is cultivated. The net irrigated area is around 155476 hectare and it is mainly plain. The district was selected purposely for the study because of the following reasons: (i) It has highest irrigated area under sprinkler irrigation system i.e. 82 per cent of its net irrigated area. (ii) the district is ranked third in Rajasthan state as per the total number of sprinkler sets installed (iii) the investigator belongs to the selected area and is well acquainted with the area, people and their dialect, which will facilitate him in

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rapport building with the farmers resulting in making the study more credible and trustworthy. Out of the eight panchayat samities two with maximum number of sprinkler sets installed during last four years (2005-2008) were selected. Two gram panchayats Narar (405) and Devram (317) of Chirawa panchayat samiti and two gram panchayats Bakara (185) and Bharu (105) of Jhunjhunu panchayat samiti having maximum sprinkler sets were retained for present study. For the purpose of selection of respondents, a list of farmers (adopters and non adopters of sprinkler system) was prepared with the help of village patwari, local leaders and agriculture supervisor of respective villages a sample size of 160 of which 80 adopter and 80 non adopter were selected randomly.

**Statistical tools and analysis**

The data so collected were transferred on the worktable and tally sheets. They were processed tabulated, classified and analyzed for statistical tests treatments in the light of objectives of the study. The following statistical tests were applied for interpretation of data.

(i) **Percentage**: simple comparison was made on the basis of percentage.

(ii) **Mean score**: Mean score was obtained by total scores of each statement divided by total number of respondents.

\[
\text{Mean score} = \frac{\text{Total score of a practice}}{\text{Total no. of respondents}} \times 100
\]

(iii) **Mean per cent score**: Mean percentage score was obtained as total score obtained by the respondents for that item, divided by the maximum obtainable score for the item multiplied.

\[
\text{Mean per cent score} = \frac{\text{Total score obtained}}{\text{Maximum obtainable score}} \times 100
\]

(iv) **Standard deviation**: Mean and standard deviation were used for categorizing the respondents into different categories and to find out the variability of the dependent and independent variables included in the study.

\[
\text{Formula} = \frac{\sum \sigma^2 - (\sum \sigma)^2}{N (n)^2}
\]

Where,

- S.D. = Standard deviation
- \( \sigma^2 \) = Sum of squares of the variables \( x \)
- \( \sigma \) = Sum of the values of the variables \( x \)
- \( N \) = Number of respondents.

(v) **Rank**: Ranks were awarded in the descending order according to the frequencies/M.P.S. This was used to find out the constraints faced by the respondents in adoption of sprinkler irrigation technology on the descending order to assess the priority of degree of variables.

(vi) **Correlation**: The Correlation Coefficient (r) is a measure of the degree of association to study the relationship between any two variables. Correlation technique was frequently used in this study. Correlation Coefficient between dependent variable \( Y \) and selected independent variable \( X_1, X_2, X_3, X_4, X_5, X_6 \) and \( X_7 \) were calculated by using the following formula:

\[
r = \frac{\sum xiyi - (\sum xi)(\sum yi)/N}{\sqrt{\sum xi^2 - (\sum xi)^2/N} \sqrt{\sum yi^2 - (\sum yi)^2/N}}
\]

Where,

- \( r \) = Correlation Coefficient
- \( N \) = Number of paired observation
- \( xi \) = Value of \( x \) variable for ith pair
- \( yi \) = Value of \( y \) variable for ith pair

The significance of correlation coefficient was tested by using the following formula:

\[
t = \frac{r \sqrt{N-2}}{1-r^2}
\]

d.f. = \( N-2 \)

(vi) **Analysis of variance**: Analysis of variance was applied to find out significant difference, if any, among the farmers of selected villages with adoption expressed by them. The following formula was used for calculating the 'F' value.

\[
\text{Mean sum of squares "between villages" } F = \frac{\text{Mean sum of squares "between villages"}}{\text{Mean sum of squares "within villages"}}
\]

It can be calculated as under:

(a) **Correction factor (C.F.)** = \( \frac{E (G)^2}{N} \)

Where

- \( G \) = is grand total of observations
- \( N \) = is total number of respondents

(b) **Total sum of squares (T.S.S.)**

\[
\sum xi^2 - \text{C.F.}
\]

(c) **Sum of squares within villages**

\[
\text{Error} = \text{TSS} - \text{S.S. between villages}
\]

(d) **Degree of freedom**

\[
\text{Error} = \text{TSS} - \text{S.S. between villages}
\]

- between villages = \( K-1 \)
- Total = \( N-1 \)
- with villages = \( N - K \)
(e) Mean sum of squares

\[
\text{M.S.} = \frac{\text{Sum of squares}}{\text{Degree of freedom}}
\]

The level of significance at 5 and 1 percent were used.

(vii) Critical difference: When the result was significant, it was further tested with critical difference (minimum for significant difference) to see the difference between the farmers of selected villages.

\[
\text{C.D.} = \text{SEm} \times \sqrt{2} \times t \text{ (error d.f.)}
\]

Measurement of extent of adoption

The extent of adoption of sprinkler system of irrigation was measured by means of adoption index, developed by Jat (1991) with slight modification. As the purpose was to find out the adoption level of the farmers, their procedure with modification was followed. Nine practices were selected for the study of extent of adoption.

As per Table 1 the proportion of each of the nine parameters (actual/recommended) were calculated and multiplied by the corresponding weight. Then their values of all nine items were summed and divided by 31 the total number of weights. The resulting value was multiplied by 100 indicates the percentage of the extent of adoption of the parameter for sprinkler system of irrigation.

\[
\text{Adoption index of sprinkler system of irrigation} = \frac{\text{Total score}}{\text{Total weight}} \times 100
\]

A well structured and pretested personal interview schedule was used to collect the data. Data were collected by the investigator through personal interview technique. Therefore, data were analyzed by using appropriate statistical tools.

**RESULTS AND DISCUSSION**

In the present study different categories of farmers were identified according to their level of adoption and in this way respondents were categorized into these groups. A close look of Table 3 explains that as a whole about 62.00% of the farmers were found to be medium adopters. While 23.00% were low adopters and only 15.00% of the respondents were high adopters. Further, the extent of adoption of sprinkler irrigation system was analysed separately. The collective importance of all the nine practices was highlighted by ranking them in increasing order on the basis of their percentage of adoption. It was apparent from the data presented in Table 2 that overall intent of adoption of sprinkler irrigation system of the respondents was 81.90%.

**TABLE 1. Weightage procedure for each selected practice of adoption.**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Weight</th>
<th>Weighage procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area under sprinkler system of irrigation</td>
<td>5</td>
<td>Actual area ____________ x 100</td>
</tr>
<tr>
<td>Water pressure used</td>
<td>6</td>
<td>Actual water pressure used ____________ x 100</td>
</tr>
<tr>
<td>Distance between two nozzles</td>
<td>3</td>
<td>Actual distance between two nozzles ____________ x 100</td>
</tr>
<tr>
<td>Depth of water applied for each irrigation.</td>
<td>3</td>
<td>Actual depth of water applied for each Irrigation. ____________ x100</td>
</tr>
<tr>
<td>Irrigation intervals</td>
<td>2</td>
<td>Actual irrigation interval ____________ x100</td>
</tr>
<tr>
<td>Height of the riser.</td>
<td>3</td>
<td>Actual height of the riser ____________ x100</td>
</tr>
<tr>
<td>No of sprinkler/ha.</td>
<td>3</td>
<td>Actual number of sprinkler/ha. ____________ x100</td>
</tr>
<tr>
<td>Distance between two nozzles.</td>
<td>4</td>
<td>Actual diameter of coverage by each Nozzle. ____________ x100</td>
</tr>
<tr>
<td>Time of irrigation in one setting.</td>
<td>2</td>
<td>Actual time of irrigation in one setting. ____________ x 100</td>
</tr>
</tbody>
</table>
The adoption level of each of the nine parameters of sprinkler irrigation system was also measured. Adoption of distance between nozzles was 96.30% and ranked first, second rank was accorded to height of the riser as it was adopted to the extent of 95.05% followed by water pressure (90.20%) number of sprinkler (85.00%) diameter of coverage by each nozzle (76.0%) irrigation intervals (74.0%) depth of water applied for each irrigation (70.0%) area under sprinkler system of irrigation (62.10%) are ranked III, IV, V, VI, VII, VIII & IXth respectively.

Hence it may be inferred from the above results that the farmers were found very conscious about distance between nozzles they rated it as the most important parameter among all the nine important parameters of sprinkler irrigation. While the area under sprinkler system of irrigation was regarded as the least important component of sprinkler irrigation system. Above results shows that still there was gap between what was recommended and adopted by the farmers. The probable reasons of this might be that while interviewing with the respondents it was reported that about half of them were facing the problem of non-availability of technical guidance.

Similarly about 40% of the respondents have also reported that proper adoption of the sprinkler irrigation system require high technological competence which is very difficult for an average farmer. These might have been the reasons about such findings. The findings of the study were in line with the findings of Sharma (1989) and Singh (1995) who reported that the majority of the respondents were medium adopters.

About the extent of adoption of individual parameters of sprinkler irrigation system, it was noted that distance between nozzles, height of raiser, water pressure, diameter of coverage by each nozzle, irrigation intervals, depth of water applied for each irrigation. Area under sprinkler system of irrigation was adoption to the extent of 96.30, 95.50, 90.20, 85.00, 76.00, 74.00, 70.00, and 62.20 percent, respectively. For less extent of adoption of different new technological factors like higher cost, lack of money, lack of knowledge, high initial investment were responsible.

Table 3 revealed that adoption of sprinkler system of irrigation technology is medium level means majority of respondents (62.0%) were medium adopters of sprinkler irrigation system and adoption level of the farmers was found to be positively and significantly associated with the knowledge, caste, education, size of land holding, source of information and farm power while negatively and non significantly associated with the social participation of the respondents. Various measures like training of the farmers, strong contact with subsidy procedure, regular electricity supply. Necessary training may prove significant for improving adoption. Emphasis should be given on water conservation through sprinkler system of

### TABLE 2. Extent of adoption of sprinkler system of irrigation by the farmers.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Extent of adoption</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area under sprinkler system of irrigation</td>
<td>62.10</td>
<td>IX</td>
</tr>
<tr>
<td>Water pressure used(type of sprinkler / water pressure)</td>
<td>90.20</td>
<td>III</td>
</tr>
<tr>
<td>Distance between two nozzles(range of sprinkler / distance in meters)</td>
<td>96.30</td>
<td>I</td>
</tr>
<tr>
<td>Depth of water applied for each irrigation (soil / depth in mm)</td>
<td>70.00</td>
<td>VIII</td>
</tr>
<tr>
<td>Irrigation intervals(type of sprinkler / days)</td>
<td>74.00</td>
<td>VII</td>
</tr>
<tr>
<td>Height of the riser (type of crop / height meter)</td>
<td>95.05</td>
<td>II</td>
</tr>
<tr>
<td>Number of sprinkler / hectare</td>
<td>85.00</td>
<td>V</td>
</tr>
<tr>
<td>Diameter of coverage by each nozzle</td>
<td>76.00</td>
<td>VI</td>
</tr>
<tr>
<td>Time of irrigation in one setting</td>
<td>88.00</td>
<td>IV</td>
</tr>
</tbody>
</table>

### TABLE 3. Distribution of the farmers under different adoption categories of sprinkler system of irrigation.

<table>
<thead>
<tr>
<th>Adoption Categories</th>
<th>Percentage</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low adopters (Score below 151.42)</td>
<td>23.00</td>
<td>II</td>
</tr>
<tr>
<td>Medium adopters (Score from 151.42 to 229.16)</td>
<td>62.00</td>
<td>I</td>
</tr>
<tr>
<td>High adopters (Score above 229.16)</td>
<td>15.00</td>
<td>III</td>
</tr>
</tbody>
</table>
irrigation. All the essential supplies and services regarding sprinkler irrigation system should be made available in easy reach of the farmers. The farmers must be convinced through various sources of information about the use of water economically by sprinkler irrigation system.

REFERENCES