Design of Sprinkler Irrigation System

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Abstract- This study was conducted at a CTAE agriculture farm presently whole farm is irrigated through flood irrigation. Sprinkler Irrigation system was designed to increase water use efficiency and productivity of farm and also to converted whole farm from flood irrigation system to Sprinkler Irrigation system. Sprinkler irrigation method distributes water to crops by spraying it over the crop Area like a natural rainfall. The water under pressure flows through perforations or nozzles and sprays over the area. The pressure is provided by a pump of suitable capacity and horsepower.

I. INTRODUCTION
Sprinkler irrigation method distributes water to crops by spraying it over the crop Area like a natural rainfall. The water under pressure flows through perforations or nozzles and sprays over the area. The pressure is provided by a pump of suitable capacity and horsepower.

Sprinkler Irrigation is a method of applying irrigation water which is similar to rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air and irrigated entire soil surface through spray heads so that it breaks up into small water drops which fall to the ground.

Sprinklers provide efficient coverage for small to large areas and are suitable for use on all types of properties. It is also adaptable to nearly all irrigable soils since sprinklers are available in a wide range of discharge capacity.

Jain Sprinkler system is an unique irrigation system. It is designed to ensure maximum water saving, combining high quality, affordability and ease of installation. All the products are made out of high strength & chemical resistance engineering plastics to achieve functional satisfaction and to maintain cost economics.

All sprinklers undergo extensive quality testing in our well-equipped state of the art lab. Moreover, performance of the products is also tested in the field to ensure uniform water distribution and higher efficiency.

II. MATERIAL AND METHOD
In this material and methods chapter study of area, soil type, irrigation source, soil, types of crops, component used, advantage and disadvantage system and cost estimation of system is included.

1. Location of the study area: The area is located at horticulture farm, when is attached to CTAE, Udaipur. Its latitude and longitude coordinates are 24° 35’ and 73° 42’ respectively and Its latitude 582.17, above MSL and having an area of 11.81 ha.
2. Soil type: types of soil available sandy loam soil.
3. Irrigation sources: well no. 1, farm pond well, bawdy and open well.
4. Water table: average water level is 35 feet.
5. Types of crops: - wheat
6. Climate: - the area falls in semi-arid to sub humid agro climate zone 4-A. of Rajasthan average annual rainfall in the region is 660 mm. which varies from year to year.

III. COMPONENTS OF SPRINKLER IRRIGATION SYSTEM
(i) A pump unit (ii) main and sub main line (iii) Couplers (iv) Sprinkler head (v) nozzles(vi) risers pipe(vii) tee and elbow
Other accessories such as valves, bends, plugs.
IV. DESIGN OF SPRINKLER IRRIGATION SYSTEM

Basic Data

Based on the field observations and also data from instructional farm CTAE, Udaipur.

<table>
<thead>
<tr>
<th>S.no</th>
<th>Group</th>
<th>Source of irrigation</th>
<th>Field no.</th>
<th>Area in hct.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>G-1</td>
<td>Well no 1</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2A</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2B</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4A</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4B</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>3.81</strong></td>
</tr>
</tbody>
</table>

Design of sprinkler Irrigation system

Water Requirement

The total area of the group G-1 is 3.81 hct. The total water requirement for this group is determined as follows:

No. of nozzles required = total area / area covered by one sprinkler in given interval

=38100/2592

=14.6 (say 15 nozzles)

Total water requirement = discharge of one nozzles x No. of nozzles

= 0.69x15 =10.35 L/sec

The layout length of lateral = 385m

Total Head

In selecting a suitable pump, it is necessary to determine the max. total head against which the pump is working.

\[
\text{Total head} = (\text{suction head} + \text{delivery head} + \text{filter losses} + \text{main line loss} + \text{operating pressure} + \text{fitting loss} + \text{ventur head loss} + \text{elevation difference})
\]

Suction and Delivery head is 10m, Filter losses is 5m, operating pressure is 25m, Fitting losses is 5m, and Ventur head loss is 2m

Total head \( (H) = 10 + 0.45 + 25 + 2 + 2 + 2 \)

\( = 41.45 \) m

Net depth of Irrigation

<table>
<thead>
<tr>
<th>Available moisture in Sandy loams soil</th>
<th>92 mm/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Root depth of wheat crop</td>
<td>0.56 m</td>
</tr>
</tbody>
</table>
The allowable soil moisture depletion & 50% 
Net depth of Irrigation & 2.57cm 

| Capacity of sprinkler system |  
| Q = (2780 x A x d.net)(F x H x E) |

Where

A = 3.81 hct  
d.net = 14.42 cm  
F = 8 days  
H = 6 hrs/day  
E = 75%  

= (2780 x 3.81 x 2.57)(8 x 6 x 75)  
= 7.58 lps = 8 lps  

**Power Requirement**

H.P = (Discharge x total head)/(75 x efficiency of motor x efficiency of pump)  

= (Q x H)/(75 x Motor x Pump)  

= (8 x 41.45)/(75 x 0.8 x 0.75)  

= 7.37 h.p (As per Available pumps select the pump size of 7.5 h.p)

Where

Q = Discharge of main line, lps  
H = Total head, m  
Nmotor = efficiency of motor (assumed 80%)  
Npump = efficiency of pump (assumed 75%)  

IV. CONCLUSIONS

This study was conducted at a CTAE agriculture farm presently whole farm is irrigated through flood irrigation. Sprinkler Irrigation system was designed to increase water use efficiency and productivity of farm and also to converted whole farm from flood irrigation system to Sprinkler Irrigation system.

To convert whole CTAE farm from flood irrigation to Sprinkler Irrigation system was estimated, the total discharge (8 lps), power requirement (7.5 H.P).

REFERENCES

[2] https://www.india.gov.in/topics/agriculture  