

# 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  $24^{\circ} 35'$  and  $73^{\circ} 42'$  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.

Table no. 1 : Details of field area and sources irrigation

S.no	Group	Source of irrigation	Field no.	Area in hct.
01	G-1	Well no 1	1	0.7
			2A	0.7
			2B	1.3
			3	0.47
			4A	0.47
			4B	0.17
			TOTAL	3.81

#### IV. DESIGN OF SPRINKLER IRRIGATION SYSTEM

##### Basic Data

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

TOPOGRAPHY	Area in gen. plane with 0.5-0.7 slope
CLIMATE	Sep-Feb. is considered
SOILS	Sandy loams
WIND VELOCITY	Within the Permissible limits
CROP	wheat
EFFECTIVE ROOT DEPTH OF CROP	560mm
GROWING SEASON	Rabi
MOISTURE HOLDING CAPACITY OF SOIL	92mm
AVAILABLE MOISTURE FOR 56CM ROOT	51mm

Considering Irrigation Efficiency at 80%, Gross Irrigation requirement works out to 32mm

Irrigation Interval	26/5.5mm/day=4.7 days (say 5 days)
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##### 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

$$=38100/2592$$

$$=14.6 \text{ (say 15 nozzles)}$$

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

$$= 0.69 \times 15 = 10.35 \text{ L/sec}$$

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.

Total head	(suction head + delivery head + filter losses + main line loss + operating pressure + fitting loss + venture head loss + elevation difference)
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Suction and Delivery head is 10m, Filter losses is 5m, operating pressure is 25m, Fitting losses is 5m, and Venture head loss is 2m

$$\text{Total head (H)} = 10 + 0.45 + 25 + 2 + 2 + 2$$

$$= 41.45\text{m}$$

##### Net depth of Irrigation

Available moisture in Sandy loams soil	92mm/m
Avg. Root depth of wheat crop	0.56m

The allowable soil moisture depletion	50%
Net depth of Irrigation	2.57cm

Capacity of sprinkler system{8} {9} {10}

$$Q = (2780 \times A \times d.net)(F \times H \times E)$$

Where

$$A = 3.81 \text{ hct}$$

$$d.net = 14.42 \text{ cm}$$

$$F = 8 \text{ days}$$

$$H = 6 \text{ hrs/day}$$

$$E = 75\%$$

$$= (2780 \times 3.81 \times 2.57)(8 \times 6 \times 75)$$

$$= 7.58 \text{ lps} = 8 \text{ lps}$$

*Power Requirement*

$$H.P = (\text{Discharge} \times \text{total head}) / (75 \times \text{efficiency of motor} \times \text{efficiency of pump})$$

$$= (Q \times H) / (75 \times \text{Motor} \times \text{Pump})$$

$$= (8 \times 41.45) / (75 \times 0.8 \times 0.75)$$

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

Where

$$Q = \text{Discharge of main line, lps}$$

$$H = \text{Total head, m}$$

$$N_{\text{motor}} = \text{efficiency of motor ( assumed 80\%)}$$

$$N_{\text{pump}} = \text{efficiency of pump ( assumed 75\%)}$$

#### IV. CONCLUTIONS

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).

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