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Irrigation Methods to Crops- Past, Present and Future

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ABSTRACT:

Agriculture is the one, which provide 54.6% of total employment to growing population of India and it alone consumes more than 90% of total groundwater draft in irrigation. However,irrigation toagriculture is not new to the Indian Agriculture. Irrigation to the crops was reported from Vedas and then irrigation definitions are changing from time to time. Irrigation was done through flooding in 1950 to 2000 later on moved to the micro irrigations such as drip, sprinkler and ruled over a period of two decades viz., 2006-2020.Now irrigation concept is become more précised with the advanced methods of irrigation such as rainport irrigation, laser irrigation so on. In coming future, the crop management is coupled with advanced micro irrigation methods though automatization only way to sustain and enhance the yields.

***Key words:** Drip irrigation, Sprinkler Irrigation, Rainport irrigation, Laser Irrigation,Automatization*

INTRODUCTION

Vedas first reported about the irrigation in mythology as Earliest mentions of irrigation were found in Rig Veda. It has mentions of "kupa" and "avata" wells from where the water is drawn by "varatra" (rope strap) and "chakra" (wheel) pull "kosa"

(pails) of water. Later on, few of the experts quoted in 1980s as nurture the soil with nutrients and water to harvest more.In the beginning of the 20th century the definition of the irrigation taken new trek as a Feed the crop- Not Soil. At present scenario the irrigation to the crops changed to Feed the Root – Not crop and in future the definition may changes to a new direction.

How the corporates deal with irrigation at present:

Though the irrigating the crops with these above definitions but the same things were deal by the corporates with the different concepts.

Netafim- Grow More with less

Jain Irrigation-More crop Per Drop

Finolex – Every drop counts

Importance of Irrigation in Present context:

Irrigation to the crops through the micro irrigation and other methods enhanced the irrigated area through government policy decisions and reached grass root level. Though irrigated area is increasing excessive draft has also created problems especially in the over exploited regions of Punjab, Haryana, Rajasthan and Gujarat such as falling water tables, waste in the use of water particularly for irrigation, water logging and salinity (Vaibhav and Mathew,2014). Hence, it's high time to think ***Before irrigating to the crop, we need understand that the plant is not a fish and soil is not a camel.***

Different methods of Irrigations and Practical feasibility at Present:

1. Sprinkler irrigation
2. Drip irrigation
3. Rain port irrigation
4. Laser irrigation
5. Net flex for Mains/submain with drip irrigation/Sprinkler Irrigation

1. Sprinkler Irrigation:

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.

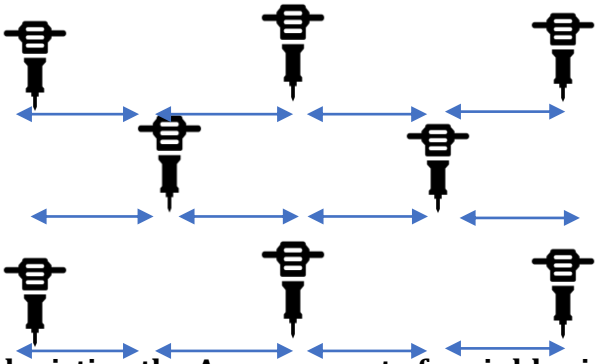

Fig.1. Field layout depicting the Arrangement of sprinkler irrigation System

Practical Layout and Applicability of the Sprinkler for Groundnut crop as Example

a) Any pipe with ISI marking is having the length of 6m/ 20 feet length
b) Each sprinkler raised head discharges approximately 1800lit of water per hour.
c) Throwing radius of each sprinkler raised head -12 m (operates at 2.5 kg/cm^{2}pressure normally)
d) In the Sprinkler irrigation the arrangement should be in a triangular pattern for achieve higher uniformity as depicted in Fig.1.
e) Each sprinkler covers to an area -144m^2 = 144 m^2 X 10 Sprinklers = 1440 m^2 = 1/3 acre approximately
f) 16 Pipes and 8 raisers required if we want achieve 95 % uniformity of 1/3 of acre i.e., 1440m^2
g) Groundnut irrigation requirement is 450 to 500mm on varied cropCoefficients, ET and plant water demands depending on the conditions.
h) No of irrigations required for the Groundnut – 8-9 approximately. (9 irrigations X 50mm each through flooding= 450mm) such as sowing, flowering (up to 20-25DAS) 02 irrigations,Pegging to Pod formation (around 30-90 DAS)06 irrigations are required and one irrigation 15 days before harvest.
i) With the same principle and 9 irrigations through sprinkler irrigation of 40mm each to 9 irrigations by maintaining the ASM in root we can save around 100 mm depth of water for one ha.

2. Drip Irrigation:

Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation. Two important things need to know before application of the drip irrigation such as how much quantity of water to be applied and how much time is required to discharge the desired quantity of water.

These can be achieved broadly with these following formulae.
How much of water (mm) to applied-?

$$\textit{Application rate} = \frac{\textit{Discharge of Drippers (lph)}}{\textit{Row to row spacing (m) X Plant to plant spacing (m)}}$$

How much time required for irrigation-?

$$\textit{Time of operation of Drip System} = \frac{\textit{Water Requirement (mm)}}{\textit{Application Rate (mm/hr)}}$$

Table: 01. Discharge depth and operation hours for drip and sprinkler irrigation

Type	Discharge depth	Time of operation
Sprinklers	10mm	60min
Drip	10mm- 4lph 10mm-2lph	60min 120min

3. **Rain Port Irrigation System:**
   Rain portsprinkler systems is a mini-irrigation system i.e., laterals and sprinklers can be easily shifted from one place to other. Reinstallation of the system is also easy and consumes less time and labour. **The approximate cost for 1 hectare installation is around 45000 INR.**
   It overcomes all the limitations of conventional sprinkler irrigation system and yet meets the high standards of effective irrigation principles such as:

a) High distribution uniformity.
b) Controlled application rate.
c) Gentle precipitation, low droplet impact on soil structure and no foliage damage.
d) Short irrigation cycles to provide optimal growing conditions with highly accessible water and nutrient in controlled wetted and aerated soil profile. In rain portirrigation system, flexible polyethylene tubes are used as a lateral and high-performance low weight plastic sprinkler are connected to these tubes using easily detachable connectors. Sprinklers are fixed on MS riser rods.

Practical Layout and Applicability of the Rain port System

a) Rain port system was made with the Linear Low Density Poly ethylene materials and easily flexible and suitable to transport and layout.
b) The operating pressure required for the rain port system- 1.5 kg/cm^2
c) Throwing radius of each rain port sprinkler - 10 m (operates at 1.5 kg/cm$^{2)}$
d) Distance between each rain port sprinkler for the effective uniformity- 8mX 8m
e) Each rain port sprinkler covers around 64 m^2 area X 10 Sprinklers = 640 m^2
f) For 1 acre with the rain port system with 8m X 8m spacing, it requires 63 rain port sprinklers
g) The discharge of each rain port sprinkler is around 540 l/ hr
h) Depth of irrigation achieved with one rain port sprinkler is- 2.7 mm/hr
i) The available diameter size of the rain port sprinklers is - 25 mm and 32mm
j) The minimum and maximum operating pressure required for the rain port irrigation system is 2 to 4 kg/cm^2

Table: 02. Discharge and uniformity of the rain port system at different operating pressures

Nozzle mm / Colour	Pressure kg/cm²	Flow m³/h	Dia. m	Precipitation (mm/h) / spacing (m) 9x9	9x10	10x10	9x12	10x12	12x12	*No. of Sprinklers 25mm	32mm
2.4 Yellow (square nozzle)	2.5	0.360	19.0	4.4	4.0	3.6	3.3	3.0	2.5	6	10
	3.0	0.390	19.0	4.8	4.3	3.9	3.6	3.2	2.7		
	3.5	0.430	19.0	5.3	4.8	4.3	4.0	3.6	3.0		
	4.0	0.460	19.0	5.7	5.1	4.6	4.3	3.8	3.2		
2.3 x 1.8 Silver x green	2.5	0.520	22.0	6.5	5.8	5.3	4.9	4.4	3.6	5	8
	3.0	0.580	22.0	7.2	6.4	5.8	5.4	4.8	4.0		
	3.5	0.620	22.0	7.7	6.9	6.2	5.7	5.2	4.3		
	4.0	0.670	22.0	8.3	7.4	6.7	6.2	5.6	4.7		
2.4 x 1.8 yellow x green (square nozzle)	2.5	0.520	20.0	6.5	5.8	5.3	4.9	4.4	3.6	5	8
	3.0	0.560	20.0	6.9	6.2	5.6	5.2	4.7	3.9		
	3.5	0.620	20.0	7.7	6.9	6.2	5.7	5.2	4.3		
	4.0	0.650	20.0	8.0	7.2	6.5	6.0	5.4	4.5		
2.5 x 1.8 Purple x green	2.5	0.560	21.0	6.9	6.2	5.6	5.2	4.7	3.9	5	8
	3.0	0.620	21.0	7.6	6.9	6.2	5.7	5.2	4.3		
	3.5	0.670	22.0	8.3	7.4	6.7	6.2	5.6	4.6		
	4.0	0.720	22.0	8.9	8.0	7.2	6.7	6.0	5.0		

Colour code - Distribution uniformity

CU < 85% CU = 85-88% CU = 88-92% CU > 92%

* Maximum No. of sprinklers for given polytube size are calculated for 10% discharge variation and for flat ground.

4. Laser Irrigation

Laser irrigation is the system in which laser punched pipe for spraying water. An innovative irrigation system which wets water like rain, substitute for mini sprinkler.It is the best drip irrigation system for small-plot farmers - affordable, high quality, and easy-to-use. Without the need for expensive and complex emitters. These are priced at least 50% lower than traditional commercially available drip irrigation systems. After buying this system, farmers can recoup their initial investment in less than 6 months, with significant increases in income over the next 3-5 years -- the lifespan of the product. It can also be easily scaled up or down depending on the size of the field, thus giving it a technological advantage over both capital-intensive commercial drip irrigation and water intensive flood irrigation.It consists of the two types of the irrigation system such as laser spray and laser drip irrigation systems.

a) Laser Drip Irrigation System:

i. The diameter of Laser drip system lateral is 32 mm
ii. Discharge of the system – 2/4 lph
iii. Operating Pressure required for laser drip system is 0.2 kg.cm^2
iv. Spacing of Laser punch- 30,40,60,75,90 cm
v. Length of best operation for the laser drip for 2lph discharge for with 40 cm dripper spacing for length of 76 m and for 4lph discharge for with 40 cm dripper spacing for length of 54 m

b) **Laser Spray system:**

i. The Diameter of Laser spray lateral is available in the market are 32 /40 mm
ii. Discharge for the laser spray system is 172-175 lph

iii. The operating Pressure required for the laser spray system is 0.7 kg/cm^2
iv. Spacing of each laser punching available in the market are - 30,40,60,75,90 cm
v. The Length of best operation for the laser spray system is 55m approximately depending on the operating pressure and other field conditions.
vi. The wetting diameter of each laser spray system is 8m.
vii. The approximate cost for 100 mts of laser spray lateral is 1300 INR.

5. **Net flex for Mains/submain with drip irrigation/Sprinkler Irrigation**
   Net flex is an innovative mainline and sub-mainline piping solutions that are easy to install, recoil and relocate. It may reduce labour through simple and fast installation and retrieval that is achieved due to the product weight, pre-ordered welded outlets at a spacing that match farmer needs, and specially-designed dripper line connectors that require no glue or Teflon. **The approximate cost for installation of one hectare of submains/mains is approximately is 40,000 INR and the flex net per meter cost is around 83 INR.**
6. **Automatization of Irrigation systems:**
   Automatization of drip, sprinkler and rain port system enables to achieve higher water use and nutrient use efficiency with a minimum human intervention and saving energy.

CONCLUSION:

Irrigation to the crops is not a new science though it has taken a long trek in saga of Indian agriculture food basket from imports to self-sufficiency and further exports to the other countries with upscaled irrigated area is one of the instrumental issuesthat was addressed through the various micro irrigation techniques as discussed. In future automatization is plays a pivot role to continue the upgraded, healthy and quality food basket.

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