

Technology of Pressurized Irrigation Systems

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A pressure irrigation system is a network installation made up of pipes, fittings, and other equipment that are appropriately planned and built to provide water under pressure from the water source to the irrigable region. Piped irrigation systems are categorised based on the operating pressure, the manner of providing water to plants, and the kind of installation.

Pressure:

Piped irrigation systems are categorised based on the operating pressure, the manner of providing water to plants, and the kind of installation. Systems can be classed as:

Pressure Systems	Pressure Required (Bar)
low pressure systems	2.0-3.5
medium pressure systems	3.5-5.0
high pressure systems	>5.0

Water delivery method:

Delivery method is the way the water is distributed to the plants.

Delivery Type	Details
Sprinkler irrigation (Overhead irrigation)	The water is delivered in the form of raindrops precipitated over the entire area. There are many variations of this method in terms of the discharge and diameter coverage, the height of the water jet above ground (overhead, under the foliage), the type of sprinkler mechanism, etc.
Surface irrigation (Furrow, basin, border)	The water is delivered to the field plots direct from the main or sub main pipelines through the hydrants and it is spread all over the area, or it is side applied.
Micro-irrigation	The water is delivered to the plants without being spread

<p>(Localized irrigation) by drippers, sprayers, bubblers, microjets, etc.</p>	<p>over the entire area but by being applied in low rates to a limited soil surface area around the plants.</p>
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Sprinkler Irrigation/ Overhead Irrigation

Sprinkler irrigation is any irrigation that employs a pressurised system to deliver water to the soil surface in a manner similar to rainfall. A network of pipelines or hoses transports water to a farmer's fields, and the water is generally pressurised using a pumping system. Sprinkler irrigation systems can be temporary, mobile, or permanent.



Figure 1: Sprinkler Irrigation

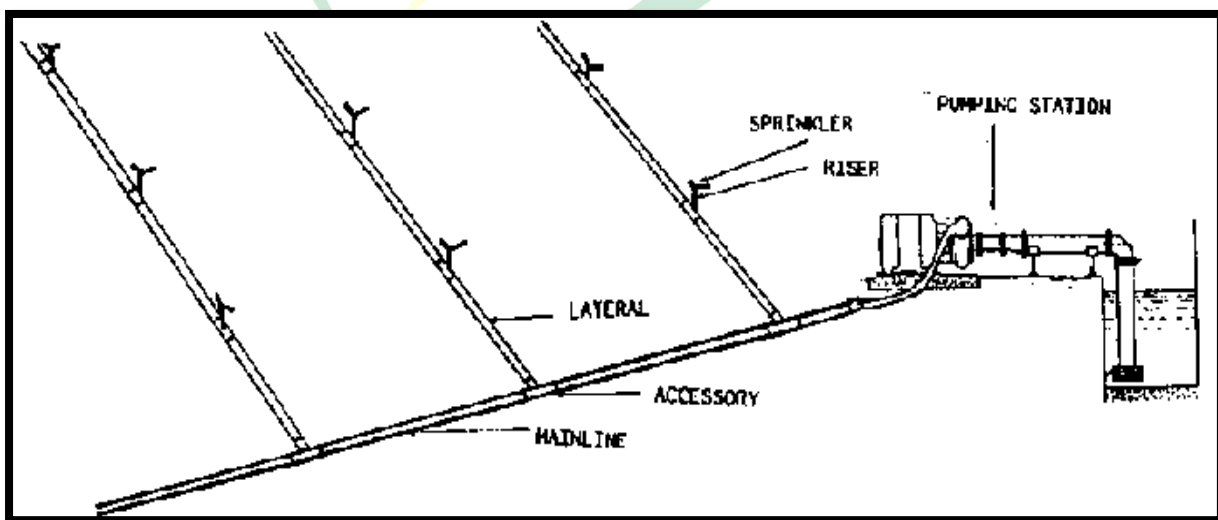


Figure 2: Sprinkler Irrigation System outlay

Classification of sprinkler systems:

Sprinkler systems are classified into the following two major types (on the basis of the arrangement for spray of irrigation water).

1. Rotating head or revolving sprinkler system.
2. Perforated pipe system.

Components of sprinkler irrigation system:

Components	Details
Pump	A unit that extracts water from the source and produces pressure for discharge into the pipe system. The pump must be able to supply water at the appropriate pressure so that the water is discharged at an optimum rate and volume suitable to the crop and soil type.
Principal pipes and secondary pipes	These carry water from the pump to the laterals. In some cases, these pipelines are installed on the soil surface or buried below the land surface. In some cases, they are temporary and can be transferred from one field to another. The primary materials used for the pipe include asbestos cement, plastic, or aluminium alloy.
Laterals	They transport water from pipes to the sprinklers. They can be permanent, but mostly they are portable and made of aluminium alloy or plastic so that they can be moved quickly.
Sprinklers	They are water-emitting devices that transform and disperse the water jet into tiny droplets. The arrangement of sprinklers is made so as to wet the soil surface in the desired area as evenly as possible.

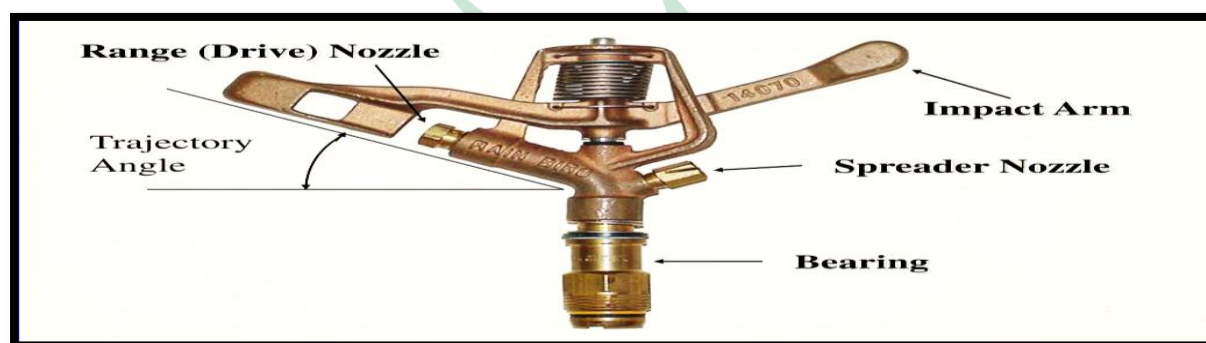


Figure 3: sprinkler head

Wetting pattern of sprinkler:

The wetting pattern from a single rotary sprinkler is not very uniform. Normally the area wetted is circular (see topview/ figure 4). The heaviest wetting is close to the sprinkler (see sideview/ Figure 5). For good uniformity several sprinklers must be operated close together so that their patterns overlap (Figure 6). For good uniformity the overlap should be at least 65% of the wetted diameter. This determines the maximum spacing between sprinklers.

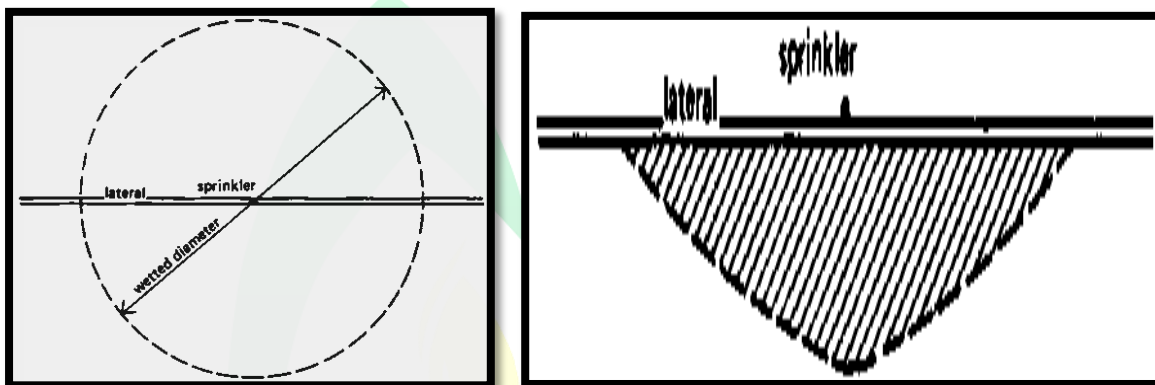


Figure 4: Top view (wetting pattern) Figure 5: Side view (wetting pattern)

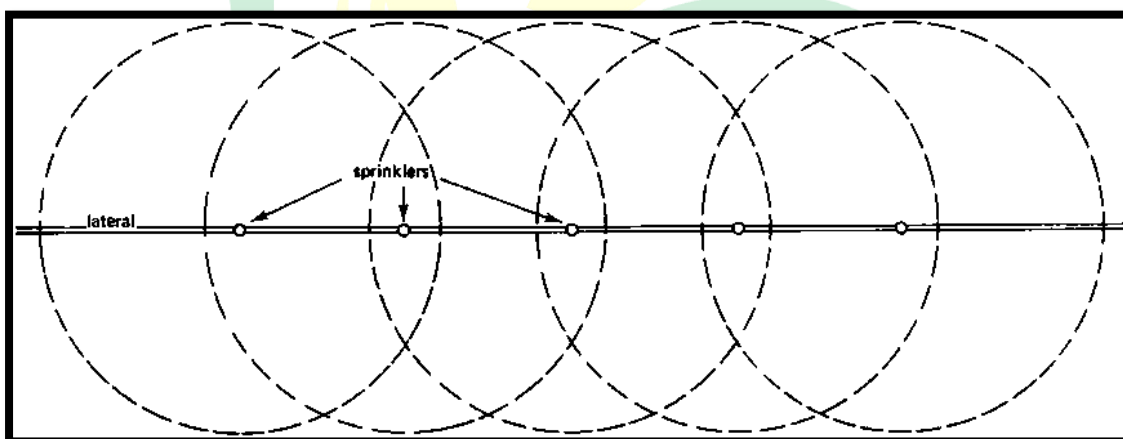


Figure 6: overlapping view (wetting pattern)

Rain Gun:

A rain gun is a high-performance micro-irrigation device that is intended for a wide range of purposes and applications requiring relatively strong flows and an extended radius of water throw.



Figure 7: Rain gun

Rain gun sprinklers are available with operating pressures ranging from 2.0-7.5 kg/cm² and flow rates ranging from 3-30 lps (liter per second). The majority of them have nozzle diameters ranging from 10-30 mm and wetting radiuses ranging from 27-60 meters. Used for irrigating the large area in one time. Its major feature is that it is used for irrigating large field areas at once. The guns irrigate the land with minimum labor and electricity requirements. While rain gun irrigation, pests, and insects get washed away. Normally Rain guns are nothing but an upgraded sprinkler. Due to its huge area coverage and quick wetting, it's getting popular these days.

Drip Irrigation System

Drip irrigation is the most effective method of delivering water and nutrients to crops. It provides water and nutrients straight to the root zone of the plant in the proper amounts and at the right time, ensuring that each plant receives precisely what it requires, when it requires it, to grow effectively. Farmers may increase yields while conserving water, fertilizer, electricity, and even crop protection goods by using drip irrigation. Drip irrigation, also known as trickle irrigation, involves pouring water into the soil at very low rates (2-20 liters/hour) through a network of tiny diameter plastic pipes connected with emitters or drippers. Water is administered near to plants, soaking just the soil in which the roots develop, as opposed to surface and sprinkler irrigation, which wets the whole soil profile. Drip irrigation water treatments are more frequent (often every 1-3 days) than other systems, resulting in a highly advantageous high moisture content in the soil where plants may thrive.

Drip irrigation is best suited for row crops (vegetables, fruit), tree and vine crops with one or more emitters per plant. Because of the high capital expenditures of building a drip system, only high-value crops are often selected.



Figure 8: Laterals and emitters/drippers lying over the field in drip irrigation system

A typical drip irrigation system is shown in Figure 9 and consists of the following components:

- Pump unit
- Control head
- Main and submain lines
- Laterals
- Emitters or drippers

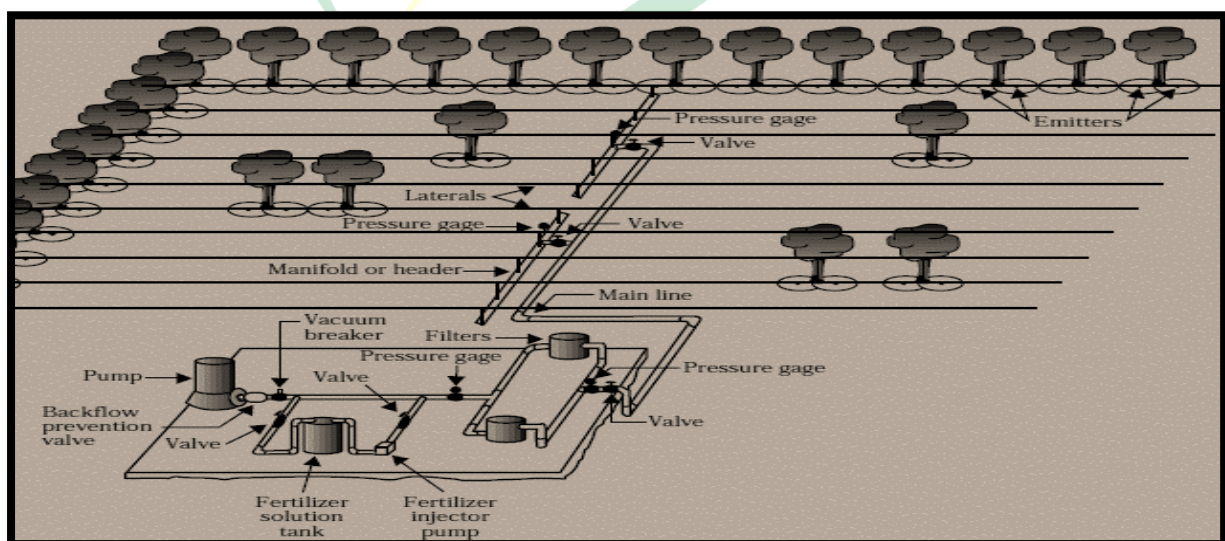


Figure 9: Drip irrigation system outlay

Installation costs

The cost of installation in pressurized irrigation system varies. A typical drip irrigation setup costs around 50000-75000 rupees per acre. A typical single sprinkler irrigation system cost around 3500-7500. For 1 acre, sprinkler irrigation setup ranges between 60000-90000. A typical single rain gun cost around 2500-10000 rupees.

Way forward:

Major advantage for pressurized irrigation system is conservation of water. The techniques of pressurized irrigation system are costly and marginal farmers could not purchase it. But the water use efficiency is higher in these pressurized irrigation techniques as compared to traditional techniques. Farmers aim to save significant quantities of water, raise yields, and enhance crop quality by investing in technology for improved irrigation practices. Water conservation is and will be a top priority for farmers, business, and governments.