AGRONOMIC BULLETIN

BY NEW HOLLAND APAC REGION

DRIP IRRIGATION

WHAT'S INSIDE:

Definitions and comparisons

Definition and basic data

Drip irrigation is a form of localized irrigation whereby the water is emitted from a dropper (nozzle) in drops (fig.1). Droppers are designed to deliver a very low rate of water at the base of the crop. Other words for drip irrigation are trickle, drop, daily flow and micro-irrigation.

With trickle irrigation water is delivered to the plants, drop by drop, via a set of plastic lateral pipes. Pipes are laid on the ground or buried at a depth of 15-30 cm and they are supplied from a head unit through a field main pipeline. The laterals are commonly 15-25 mm in diameter, and are provided with emitters designed to drip water onto the soil. By drip irrigation daily to twice-weekly, soil water in the root zone is kept about field capacity (soil moisture tension of 0.3 to 0.5 bar). Under these conditions, the emitter rate approaches closely the actual crop evapotranspiration (Etcrop).
The rate of emitters is generally in the range from 0.8 to 12 liter/hour, with 1-4 liters per hour on cash crops and up to 12 liters per hour in orchards. Anyway it must not exceed the basic infiltration rate of soil. The working pressure is usually from 1 to 3 atmospheres.

Under trickle irrigation, the wetted portion of the soil is reduced, i.e. the active rooting volume is usually confined to a fraction (often less than 50 per cent) of what would be the normal root zone of an uniformly wetted soil. Consequently the water need for irrigation is reduced by 50 percent or more compared to the above described irrigation methods. With trickle irrigation, it is possible to use salty water (concentration about 1,000 mg/liter salt).
Under optimal management conditions, yield increases of 35 percent and more have been reported, and high product value of 40 per cent or more per unit volume of water.

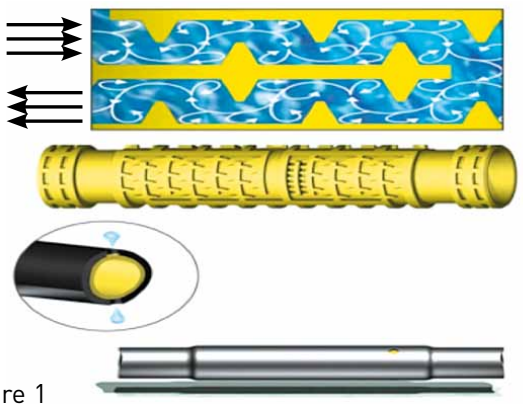

Figure 1

Comparison of drip irrigation with other irrigation systems

Each traditional irrigation system has some negative side. Infiltration and flooding systems require large volumes of water, much man power and it is possible some ponding. As a consequence, diseases can spread in the crop, hitting roots and leaves.

Sprinkler irrigation systems require high power in order to pressurize the system, high initial investments and also some man power: some compaction of soil is possible, and leaves can be soiled with consequent spreading of diseases.

The drip irrigation system is certainly more rational and safe for crops, it requires lesser power and water, but also starting investments are important and manpower is needed.

This system is very suitable in area where winds are constant and strong, and where difference of level in the field can hinder even distribution of water.

Of course drip irrigation is very suitable in green house conditions.

With drip irrigation, it is possible to create and keep ideal conditions for nutrition and growth of plants. Fruit are larger, flowering is improved as well as pollination.

A typical crop where drip irrigation is commonly applied is tomatoes. Leaves are not wetted or soiled, so spreading of diseases is less likely. It is possible to make fertilization using fertilizers dissolved into the irrigation water (fertigation). As a result, productivity increments can be amazing, in some cases up 30-100%. So, a resume of advantages of drip irrigation systems can be:

- **High efficiency in the use of water resource.**
- **Delivering of water just in the radical zone.**
- **Possibility of fertilization when watering.**
- **Less power requirements.**
- **Increasing of the production's quality and quantity.**
- **Labour saving.**
- **Distribution uniformity.**

Equipment

Equipment for drip irrigation

Filtration equipment is crucial for all drip irrigation systems, because water flows in drip lines and drippers that have very thin caliber. Filtration volume is calculated as 2 times the maximum flow volume of the system in liters per hour. Filters have a diameter from 80 to 120 microns (from 100 to 200 meshes):
100-120 microns for auto compensating drip lines, 80 microns for non- auto compensating drip lines.
Several types of filters are used; grit, screen, rotating and hydro cyclone filters are more common. Filters must be back washed on a regular base to get a proper filtration and flow of irrigation water.

Grit filters are suitable for stopping large impurities, as algae: screen filters and disk filters have a thinner diameters of pores, so that they can stop thinner impurities.

Pressure regulators are devices that keep a set pressure into the system after pumps and filters.

Drip lines with drippers are flexible plastic pipes with in-built drippers. Spacing between dripper can be set when pipes are extruded, most commonly is from 30 to 50 cm. Water flow volume varies from 20 to 40 cubic meters per hectare per hour. Drip lines receive the water from a main line which comes from the filtration station.

FITTINGS

In order to manage a drip irrigation system, several valves are needed as ball valves, cylinder valves and T valves. They must be perfectly watertight and not sensible to chemicals as fertilizers and sun rays.

AIR RELEASE VALVE

These valves allow for air to be released out from the system, so avoiding water hammer. They are available in different size, most commonly from ¾ to 2 inches.

Grit filters battery

Screen filter

Disk filter

Fertigation

Fertigation equipment

Fertigation means the possibility of adding to irrigation water fertilizers. This technology has been applied with localized irrigation (drop irrigation or micro-sprinkling), in order to bring fertilizers near to the plants root system. So, droplets containing nutrition elements are delivered to the root system, which allow for precise dosing, lesser doses and better efficiency of fertilizers. It allows also for keeping a proper level of nutrients available for the plants, also depending of the stage of growing of crops.

Advantages

- Fertilization higher efficiency and uniformity.
- Productivity increasing.
- Lower pollution of table waters.
- Manpower saving (operations can be totally automatized).
- Decreasing of fertilizers losses.

Disadvantages

- Operators' better professional preparation is required.

Equipment for fertigation is designed in order to inject liquid fertilizers and acids into the irrigation system and is available for connecting to system from 3/4" to 2", allowing for flows from 8 to 40 cubic meters per hour. Hydraulic dosing pumps are placed at the head of the system: they do not require any power for functioning (fig.2). Electric pumps allow for higher rates but they need power. For higher volumes of water, fertigation units are available.

Figure 2

Filtering station at the head of the system

Water volume calculation

Here is a simple calculation of needed water volume for drip irrigation system

Crops tomatoes
Spacing between rows: 140 centimetres
Spacing between plants: 20 centimetres
Flowing through 1 dipper: 1 litre per hour
Exercise pressure: 1 atmosphere

Calculation
Length of drip pipes on 1 hectare = 10.000 square meters/1,40 meters = 7.143 meters

7.143 meters per hectare / 0,20 meter of spacing per dripper = 35.715 dripper per hectare

Required total flow = 35.715 drippers per hectare or x 1 litre per dripper per hour = 35.715 litres per hectare per hour or 35.7 cubic meters per hectare per hour or 3,57 millimetres of water

If considering that on average only the 50% of surface is wetted, such an irrigation is equal to 3,57 / 0.50 = 7.14 millimetres of available water per hectare with other irrigation systems. Thus the economy of water resources.

What crops for?

Drip irrigation is largely applied on orchards, vineyards and horticultural vegetables. Anyway, drip irrigation is used on tomatoes, potatoes, water melon. There is also a trend to spread this irrigation system on cash crop as corn and cotton.

Drip irrigation and mulching on cotton

Starting stage tomatoes

Corn

Vineyard

Watermelon

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