

Irrigation is a cultural process which is certainly required to do so as to obtain more yields from the unit area. The history of the irrigation is at least as old as the history of the agriculture. While human being was irrigating by means of driving water to the agricultural areas with appeal for hundreds of years, many irrigation methods were developed by using the means of technology today. One of these is the drip irrigation system.

DRIP IRRIGATION METHOD

The basic principle in drip irrigation is to apply irrigation water at frequent time intervals and with less amount of water. Irrigation is started at the high soil moist level. Thus, a tension originated from the moist lack in the soil is not created in the grown plant. Exclusively, water is given to the environment to ensure the growth of the plant roots at the sufficient level. Generally, the daily or a few days' water requirement of the plant is met with this method. The irrigation water which is taken from the source is refined from sand, sediment, floating substances and very small particles in the filtering unit. When needed, the plant nutriment element is mixed into the irrigation water via fertilizer injection unit. Furthermore, system flow and system pressure is examined. The irrigation water is conveyed to the drips which are placed close to the plant through pressured pipe network. Water which is given to soil surface in drops form under the low pressure and low flow penetrates into soil by infiltration from here and diffuses with the effects of gravity and capillary forces and wets the soil volume where the plant capillary roots are grown. Generally, a wet strap is obtained along with the plant rows and not-wet dry area remains between the rows deep infiltration or surface flow is never the case with a well-designing and application. Thus, the existing water source is effectively benefited.

1) THE ADVANTAGES OF DRIP IRRIGATION METHOD

The advantages of drip irrigation method over the other irrigation methods can be listed as in the following;

- a.** The evaporation from the soil surface and thus plant water consumption is generally at very low level with the drip irrigation method in comparison with the irrigation methods wetting all area. The reason for this is that there are dry areas remaining between the plant rows and the wet section is generally shadowed by the plant. Also, an equal water distribution is provided all parts of the area which is well-designed and well-operated irrigation and a high water application extraction is obtained. All these factors result a low irrigation water requirement for the unit area. Depending on this, unit area system flow decreases and much wider area can be irrigated in the manner to meet full water requirement especially at the limited water source conditions.
- b.** In the drip irrigation method, the irrigation is started when less amount of the available water capturing capacity in the effective plant root depth is consumed (generally 30-40%). In another word, irrigation is carried out when high soil damp is available in the root zone. Hence, the plant is not put in a tension originated from moist lack in the soil and gets water easily without disbursing much energy. This provides much better plant growth and usually much more amount and quality product is obtained.
- c.** The plant nutrient elements are given through fertilizer injection unit by mixing the irrigation water in the drip irrigation method. This provides the possibility to apply the macro or micro nutrient elements that the plant is in need during the growth season at the requested time and amount. In this way, an extremely effective fertilizing is provided. Consequently, also high yield and quality product is obtained.
- d.** The irrigation water is applied in well-regulation at requested time and amount with the drip irrigation method. The operation of the system is extremely easy and the irrigation workmanship costs are at the minimum level.
- e.** The salt existed in the soil is carried to the parietes of the wet soil volume with the effect of the gravity and the capillary force and environment where the plant capillary roots are grown is purified from salt at a certain ratio. Therefore, even the plants which are sensitive to salt can be grown confidently on the salty soil conditions under the drip water irrigation method.
- f.** On the salty irrigation water condition; although the osmotic pressure caused by dissolved salt in soil water is high, the power of water to be held by soil particles (matrix tension) is at lower level as a continuous high soil moist is point at issue during the growth season. The plant can get water through its roots at the soil moist tension which is the total of these two values. In conclusion, the salty irrigation water which cannot be applied with the other watering methods can be applied with drip irrigation method.
- g.** As the on-soil organs are not wetted, the plant diseases are avoided to spread; besides, weed struggling is carried out more easily as the weed grown is limited to the wetted area.
- h.** Utilizing from the dry area between the plant rows, some agricultural instruments and machines can be operated and pesticide, harvesting, etc. agricultural processes can be carried out during the irrigation.
- i.** As in the sprinkle watering method, the drip irrigation method can also be applied to the soils where the surface watering methods cannot be applied, high sloped, wavy, light textured or superficial safe.
- j.** The energy cost is low with the drip irrigation method in comparison with the sprinkle irrigation method as the operation pressure is much lower.
- k.** In the drip irrigation method, even extremely low capacity water sources can be benefitted.

2) FACTORS LIMITING THE APPLICATION OF DRIP IRRIGATION METHOD AND THEIR SOLUTIONS

Beside the advantages of the drip irrigation method listed above, some factors which limit its application are point at issue. These factors and the solutions for some of them are listed as in the following.

- a. As the cross section of the water flow way of the drips is too narrow, the most important problem with this method is the blockage of the drips. The blockage is caused by accumulation of chemical matters with the substances such as sand, sediment, moss, etc. and formation of the organic materials. For the solution of the problem, the irrigation water is infiltrated in the hydro-cyclone (sand-separator) which is existed in the control unit right before releasing water to the system; the sand-pebbles are filtered in the filter and sieve filter in stages and all the physical matters which may exist in water is bowdlerized. In order to avoid the chemical matter accumulation and formation of organic materials in the drips, it is necessary to operate the system at the pressure to provide the fast flow of water in the flow way of the drips within the bounds of the possibility, and also give lime solvent diluted hydrochloric or orthophosphoric acid a few times to the system utilizing from the fertilizer tank in the control unit during the watering season. After diluted acid application, water is let go out for some time by removing the pipe stoppers at the end of the pipes and the system is washed.
- b. Even though the irrigation water which is applied to the drip irrigation method is good quality water, it contains some amount of salt. Also there is salt in the soil. As the water moves towards the parietes of the wetted soil volume with the effect of the gravity and capillary forces, these salts is moved to the parietes of this wet volume together with water and accumulates here. As this local salt accumulation may cause problem, it may be needed to wash away under the root zone. In the regions where the annual rainfall is more than 300 mm, it generally causes no problems as the winter falls wash the salt in question under root zone. However, it may be necessary to give wash water additionally so as to wash away the salt accumulated in soil in the regions where the annual rainfall is low or on the salty soil and low-quality watering water conditions. This process is mainly realized via a portable sprinkle system which will make available in the organization out of watering season.
- c. The first establishment costs are quite high in the drip irrigation. Beside this, a continuous energy cost is also point at issue on the conditions where a pump unit is required to provide the operation pressure during the watering season. That's why, the drip irrigation systems are necessary to be planned and operated to require low cost as much as possible on condition of being suitable to its technique. Especially, it is extremely important that the planning of the system, sizing the system elements and introducing the operational principles procedures should be made by experts who are specialized on the issue.

3) THE CONDITIONS WHERE THE DRIP IRRIGATION METHODS WOULD BE APPLIED

Soil, topography, plant and water source features to which the drip irrigation method can be applied are described below.

Soil and Topography features :

The drip irrigation method can be applied to soils from sandy to clayey, all sort of soil structure classes, with the superficial soils where the ground water or impermeable layer is too close, with salty soil, and beside this with the low or high sloped fields and wavy topography. However, the system arrangement should be made suitable to the topographic conditions of the field to be irrigated.

Plant Features:

The drip irrigation method generally can be used for watering all the field and garden plants except the grain, lawn and pasture plants. However, watering some field plants via drip irrigation method may not be economical due to high system cost. The method is especially suitable to vegetable, vineyard, fruit trees, plants which are grown under cover and ornamental plants which are sensitive to moist lack in the soil and whose market value is high. On the conditions where the water source is limited, the drip irrigation method can be applied to the filed plants such as cotton, maize, potatoes as much wider area can be watered in comparison to other watering methods.

Water Source Features:

In the drip irrigation method, all sort of aboveground and underground water sources can be benefitted even though they are of low capacity. The low quality irrigation water consisting of high percentage of salt can be used in drip irrigation. Only when the aboveground water source is benefitted, it is necessary to use the water not consisting more amount of sediment and floating matters or use after the sediment is precipitated in the pools and the floating matter are infiltrated in the filtering systems.

4) DRIP IRRIGATION SYSTEM

The drip irrigation systems are of pressured and consists of the necessary structure, machine, pipe, instruments and tools for receiving water from the source, filtering, mixing plant nutrient elements with water using fertilizer injection unit, conveying to the field to be watered, distribution in the field and giving to the plant root zone in controlled way. It is generally in fixed system form. The system elements remain in the same position during the watering season. However, some elements are removed from the elements at the end of the watering season.

Some examples of the products to which the drip irrigation is applied; Corn, cotton, orchard, citrus fruit, thyme, etc.

