UDC 631.344.8

GREENHOUSE IRRIGATION SYSTEM

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Abstract. This article presents a review of irrigation management in soil and soilless crop production in greenhouses. A brief account is given of subirrigation systems. The article is of interest to specialists in the field of «Agriculture Crop Production and Rural Environment».

Keywords: greenhouse irrigation system, subirrigation, capillary mat, regards overhead, ebb and flood benches, movable trays.

A Greenhouse Irrigation System is a type of micro-irrigation system. The objective of a Greenhouse Irrigation System is to deliver optimum water and nutrient levels directly into the root zone and reduce wastage and evaporation. It dispenses water through a network of valves, pipes, tubing, and emitters. Greenhouse irrigation systems are used to fulfill the watering requirements of a greenhouse farming system. These systems are suitable for both vegetable crops, fruits, and flowers. With best climate control systems, having efficient watering is also very important. Greenhouse irrigation systems are crucial for the cultivation of healthy crop yield. Though the market has a number of basic hand watering systems, the shift towards sustainable and automated greenhouse irrigation systems is on the rise. Greenhouse irrigation systems are selected depending on the size of the greenhouse. Greenhouse crops are irrigated either by hand using a hose or through drip tubes, overhead sprinklers & booms or through sub-irrigation. A combination of these delivery systems can also be used.

It should be remembered that Greenhouse Irrigation System is more efficient than other types of irrigation systems, such as surface irrigation or sprinkler irrigation, depending on how well the system is outlined, placed, maintained, and operated.

Irrigation management is typically expected to achieve maximum water supply for plant growth and production, with soil or substrate water content being maintained close to field capacity [1]. Even in soilless cultivation systems, irrigation represents a very large and potentially important loss of nutrients and a source of environmental pollution (i.e., drain to waste hydroponics systems) as a surplus of 20% to 50% of the plant's water uptake in each irrigation cycle is often recommended [2]. Indeed, annual use of irrigation water ranges from 150 to 200 mm (e.g., leafy vegetable) in soil-based greenhouse crops to 1000 to 1500 mm in soilless-grown (e.g., Solanaceae, cucurbits) [1].

In addition, several authors indicated that increasing the irrigation intervals in soilless culture with the same daily amount of water applied positively influenced crop growth and production and minimized the outflow of water and nutrients from the greenhouse into the environment. However, that is not always the case, because results are often crop and substrate specific, and are also dependent on the experimental conditions and the limiting growth factor(s) [3].

It should be noted that there are several types of irrigation systems.

Of particular interest is Water Trays and Saucers. In this system, water is applied to the surface and is collected under the container through collection trays or saucers Water trays and saucers, depending on their shape and spacing on the bench, can greatly reduce runoff and leaching by containing the water draining from pots and holding the water which misses the pot during overhead watering. They are inexpensive and reusable. Water which collects in them should be given adequate time to evaporate or be absorbed by the plant before further irrigation. Avoid tight plant spacing and poor ventilation to prevent disease problems when using this technique.

Subirrigation systems are also well known. They are an environmentally responsibly alternative that conserves water and fertilizers. Greenhouse growers to improve product quality, achieve more uniform growth and increase production efficiency are installing them. In subirrigation systems, water and nutrient solution provided at the base of the container rises by capillary action through holes in the bottom and is absorbed by the growing media. These systems are adaptable to crops grown in pots or flats [4].

Let us start by examples of Subirrigation Systems: capillary mat systems, trough system, Ebb and flood benches and movable trays.

In a capillary mat system the pots are set on a mat that is kept constantly wet with a nutrient solution. Several styles of fabric mats are available from ¼” to ½” thick. The pots take up the solution through holes in the bottom. The mat is places on a level bench over a layer of plastic. Water is supplied from drip tubes laid on top of the fabric. To keep algae under control, a layer of perforated film plastic is sometimes placed over the top of the mat. Algicides are also used. Some growers turn the mat over when a new crop is started. Containers holding nutrient solution and piping should be enclosed in black plastic or painted black to eliminate light and algae formation.

In trough system, plastic or metal troughs are placed on existing benches or supported overhead from the greenhouse structure. The troughs are installed at a slight slope (3” to 6” per 100’) from one end to the other. Pots are spaced along the trough. Nutrient solution, supplied from spaghetti tubes, is pumped to the high end, flows past the base of the pots and is collected in a cross gutter at the low end. The solution returns to a storage tank under the benches or below ground to be recycled. One advantage to this system over other ebb and flow systems is the air circulation that occurs between the troughs. Another is the ability to space the troughs for different size pots. Trough systems tend to be less Trough System Photo: Douglas Cox, UMass expensive than bench systems and can be easily installed in existing greenhouses [5].

Ebb and flood benches and movable trays system uses 4' to 6' wide watertight benches or water-tight movable trays to contain the nutrient solution. The benches, usually of plastic or fiberglass construction are installed perfectly level to maintain a uniform depth of liquid. They can be installed as either fixed or movable depending on the crops to be grown. Channels in the bottom of the bench allow the water to distribute evenly and to drain rapidly when the water supply is shut off. This allows the bench top to dry reducing algae growth and disease potential. In operation nutrient solution is pumped from a holding tank to a level of ¾" to 1" depth in the bench and held there for 10 minutes or long enough for the media in the container to absorb the solution. A valve is then opened and the liquid is quickly drained by gravity back into the tank. Low cost PVC pipe is used as it is not affected by the fertilizer in the water. A filter removes any solid matter. The holding tank, usually located in the floor below the benches should have a capacity for about ½ gallon/sq ft of bench area. The nutrient solution is used over again but adjustments in pH and soluble salts may have to be made as water is added. Water treatment with chlorine, ultra violet (UV) light or ozone is used by some growers to prevent diseases. Control of the nutrients and flow can be manual or with a controller. Watering may be once or twice a week to several times a day depending on the weather and the size of the crop [6].

As regards overhead sprinkler system, we must say, that this system is more popular for nurseries like seedling units where the spacing remains very close, plants are too small and density is very high. The main advantage of overhead irrigation is the schemes capacity to irrigate larges areas for relatively little capital outlay. However, the accuracy and uniformity of overhead irrigation is much less than other forms of irrigation. Whilst it is the cheapest form of irrigation on initial setup, It is also the least efficient when it comes to water usage and the large droplets could damage certain crops.

Finally it should be noted, that Greenhouse Irrigation System is more efficient than other types of irrigation systems. There are several types of irrigation systems, which you can use according to how much water the plant needs.

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UDC 530.12:531.51

INVENTORS OF PERPETUAL MOTION MACHINE

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Abstract. The article describes different inventors of perpetual motion machine. It highlights the idea that all ideas of perpetual motion machines violate one or more of the fundamental laws of thermodynamics.
Keywords: perpetual motion machine, engine, inventor, thermodynamics, laws, energy.

Throughout the history of mankind people were looking for a perpetual motion machine. What are perpetual motion machines? These are not the engines that will run forever, nothing is possible forever. It is assumed that some machine have an efficiency of more than 100 percent. And people have been looking for this perpetual motion machine for a long time, which has been started once and it will work by itself.

Around 1159 A.D., a mathematician called Bhaskara the Learned sketched a design for a wheel containing curved reservoirs of mercury. He reasoned that as the wheels spun, the mercury would flow to the bottom of each reservoir, leaving one side of the wheel perpetually heavier than the other. The imbalance would keep the wheel turning forever. Bhaskara's drawing was one of the earliest designs for a perpetual motion machine, a device that could do work without any external energy source.

Ideas for perpetual motion machines all violate one or more fundamental laws of thermodynamics, the branch of physics that describes the relationship between different forms of energy. The first law of thermodynamics says that energy can't