California Avocado Society 1970 Yearbook 54: 17-20

DRIP IRRIGATION

C. D. Gustafson
Farm Advisor, AES, San Diego County

Presented at Drip-Irrigation Seminar, Escondido, California, July 16, 1970 *Agricultural Extension Service, University of California.*

Introduction

Drip irrigation is not new. It is an old concept of watering crops, but the present-day application of the system is new. Shortly after the end of World War II in the United Kingdom the basic development of this concept was started, and it was for use in glasshouse watering and fertilization. One of the two men responsible for the development of this system was Dr. Symcha Blass, who later moved to Israel, and in 1959 began the work on a drip irrigation system. Even though most of the development work was done in Israel, other countries such as Australia, England, Italy, Denmark, Hawaii, Japan, Mexico and USA have been working on drip irrigation to he applied to various crops, both in the field and in greenhouses.

The original work was carried out in the arid regions of the Negev Desert in Israel. In the early trials, using very saline water, one grower reported harvesting 16 tons per acre of winter tomatoes using sprinklers, and almost 26 tons per acre using the drip irrigation. With melons there was an increase in excess of 70% in production when the drip system was used. Grapes showed a 30% increase. Orchard yields increased between 20 and 50% and many vegetable crops increased 50 to 100%.

For a number of years the ornamental nursery growers, who produce most of their plants in containers, have used a type of drip irrigation system. Nurserymen growing commercial fruit and ornamental trees have, likewise, used a modified drip system to irrigate thousands of trees growing in containers, either in greenhouses or outside on raised benches.

What is Drip Irrigation?

Drip irrigation can be defined as the daily maintenance of an adequate section of the root zone of a plant with moisture somewhere between saturation and field capacity during the growing season. This system provides a soil-water-plant relationship that is conducive to better growth and better yields. Plants not subject to extremes in wetting and drying of the soil result in being healthier and more productive.

How Does It Work?

The drip irrigation system consists of several components: (1) A "head," connected to the water supply includes filters, control valves, couplings, water meter, pressure gauge, and connections for a fertilizer applicator. (2) Conducting pipes of proper diameter, according to distance and discharge. (3) Distribution tubes (laterals) of small diameter, generally ½" to ¾“ connected to submains. (4) Nozzles, emitters, or droppers. (5) A fertilizer applicator which connects to the main water line to carry dissolved fertilizer material into the pipes at each irrigation.

Key to the proper operation of this system is the filter. Because of the small orifices of the droppers, the water has to be clean. The amount of water passing through the system should be measured by the use of a volume control unit. All system components other than the "head" and the fertilizer apparatus are generally of plastic material. The laterals, with the droppers in them, are placed on top of the soil. One or more droppers are placed at the base of the plant, depending on whether it is a small tomato plant or a young avocado tree. For a tree, three droppers are used, one at the trunk of the tree, and one on either side of the trunk, about two feet away. The droppers are engineered to discharge one-half, one or two gallons per hour. In Australia this system is called a "daily flow" system, which is designed to replace the water used by a plant the previous day. Drip irrigation, therefore, places the moisture in an area where the root system can obtain it and water loss is minimized. This system utilizes the labor-saving factor of fertilizer application by applying fertilizer while irrigating.

Potential Advantages

Preliminary reports from researchers using drip irrigation indicate the system has the following potential advantages: (1) Increased yields, (2) accelerated growth in young trees or plants, (3) root zone remains moist all the time, (4) plant is not subject to continual cycles of soil saturation to wilting point and the consequent setbacks to growth, (5) water and fertilizers can be applied at the same time, (6) significant water conservation, (7) area between rows remains firm and dry, assisting in spraying and harvesting operations, (8) weed growth between the rows is reduced greatly, (9) particularly useful on hillsides and rolling ground, (10) improved quality of crops, (11) use of poor quality water —- high saline waters have been used with far less damage than comparable waters used with sprinklers, (12) irrigation can he carried out 24 hours a day.

Possible Problems

People working with this system are optimistic that there will not be as many disadvantages as there are advantages. However, there are some areas which need further study and investigation: (1) Salinity and the buildup of salts in the drip pattern must be determined, (2) the effects of saving water should be investigated, (3) the development of a good filtration system, (4) the basic need at the present time is for obtaining information on the wetting zone of different soil types with different discharge rates; (5) knowing the discharge rates and wetting zones for different soil types, a set of recommendations could be given for how much water to apply, how often, how long to

run the system, how much interval required between the droppers in the line; (6) since this system incorporates a continuous fertilizer program, there should be a study to determine how much benefit is being derived from the frequent irrigations with usual fertilizer methods as compared to the frequent irrigations with frequent fertilizer application.

Salinity

The important question that is asked in regard to drip irrigation is "What about salinity?" In Israel the water used ranges from 400 to 500 ppm in total salts to over 3000 ppm total. The chloride content ranges from about 150 ppm to 800 ppm. The outstanding yields that they have been able to obtain in areas using the high saline water is explained by the high soil moisture content (salt is diluted), and the leaching of the salts from the relatively small root zone. The dilution of any salt in the soil by the constant application of moisture permits plants to grow satisfactorily in that soil even though the water contains high salts.

Salt accumulates in the upper few inches of the soil, at the outer edges of the boundaries of the wetted area and in the lower soil due to leaching. In areas of normal or heavy rainfall, the salts that have accumulated during the irrigation season will be leached sufficiently during the periods of rainfall. In areas where insufficient rainfall occurs, a portable irrigation system will be required to wet the entire soil area in order to leach out the salts prior to the next season's operation.

Summary

The great interest in drip irrigation for use on crops grown in California warrants further investigation of this concept. From what has been reported and from what has been observed in countries experimenting with this type of irrigation system, it indicates a breakthrough to improved irrigation practices at a reduced cost. With all the plus factors reviewed, there still are many questions yet to be answered. Some of these questions can be listed as follows:

What effect does salt accumulation in the wetted area have on plants?

How is the salt distributed in the soil?

Where are the highest concentration of salts?

How high can the salt content in water be without detrimental results?

What is the recommended discharge rate from droppers for different soil types and different agricultural crops?

What is the wetting pattern with different discharge rates?

How much water is actually saved when using the drip system, compared to the standard sprinkler system or furrow method?

Are increased yields and improved fruit quality possible?

Can the growing period be shortened, resulting in early maturing?

What effect does frequent fertilizing have on plants, as compared to less frequent applications of fertilizer material?

It's obvious there are many questions that must be answered for conditions under California climates, in California soils, with California crops.