In summary, the rooting capacity of juniper cuttings varies greatly throughout the year, and may be different for various localities and species. IBA has little effect when rooting capacity is low, therefore, optimum rooting periods need to be determined for each region and preferably, cultivar involved.

LITERATURE CITED

1 Lanphear, F O and R P Meahl 1963 Influence of endogenous rooting cofactors and environment on the seasonal fluctuations in root initiation of selected evergreen cuttings *Proc Amer Soc Hort Sci* 83 811-818

2 Nelson, S H 1959 Mist propagation of evergreens in the greenhouse during winter *Proc Plant Prop Soc* 9 67-76

3 Nelson, S H 1959 The summer propagation of conifer cuttings under intermittent mist *Proc Plant Prop Soc* 9 61-66

4 Snyder, William E 1953 The fundamentals of juniper propagation *Proc Plant Prop Soc* 3 67-77

TRICKLE IRRIGATION FOR FIELD PRODUCTION

H.G. PONDER

Horticulture Department
Auburn University
Auburn, Alabama 36849

Much has been written about trickle irrigation and drip irrigation. So much has been written in fact, that there has arisen some confusion of how trickle irrigation relates to drip irrigation. The answer is that they are one and the same. Different authors generally choose one of the terms. In this country trickle irrigation seems to be the more popular term and, in fact, more accurately describes this irrigation system. This paper will henceforth use the term "trickle irrigation."

It is now time that we ask ourselves the question — What is trickle irrigation? One definition is that trickle irrigation is the daily maintenance of an adequate portion of the root zone of a plant at, or close to, field capacity during the growing and production cycle (1) For a moment let's take a close look at what is really being said in this definition. First, trickle irrigation works on the principle of the prevention of drought stress, as opposed to correcting an existing water stress. Never allowing a plant to be under moisture stress maximizes growth. Second, it implies that only a portion of the root zone needs to be kept under optimum moisture conditions. Research has shown that ¼ of the root zone kept under good water conditions can sustain the whole plant. From this it can be concluded that the trickle system does not have to wet the whole root zone. These two principles are the foundation of trickle irrigation.

HISTORY OF TRICKLE IRRIGATION

Trickle irrigation is reputed to have been first developed in Israel in the 1930's by Dr. Symcha Blass. The story goes that Dr. Blass observed a tree growing faster than surrounding trees and upon closer inspection found that a water pipe was leaking water next to the tree. He didn't pursue the development of this principle because at that time only metal pipes were available and their expense made an irrigation system impractical. In 1947 another Dr. Blass in England developed what was probably the first trickle irrigation system, which was used on greenhouse tomatoes. In the late 1950's scientists in Israel began working on trickle for field use. By the 1960's trickle had spread into Australia and by the late 1960's had spread into the United States and South Africa Today trickle irrigation can be found throughout much of the world and its usage is continually expanding.

BENEFITS OF TRICKLE

The following are some of the benefits of using trickle irrigation: 1) Increases growth rate by preventing moisture stress; 2) optimizes water usage by placing water directly on the root zone and thereby reduces total amount of water used; 3) reduces weed growth because area between rows is not watered; 4) makes installation easy even for laymen; 5) cuts labor costs; 6) allows for some tailoring of the root system; 7) allows for a reduction in total fertilizer usage as fertilizer can be applied through the system; 8) allows for digging even during dry periods; and 9) wets roots not foliage, thus aiding in disease control.

At this point it might be helpful to briefly discuss a few of the above-mentioned points. It is well documented on several nursery crops that trickle irrigation accelerated growth. For example, on several tree species increased caliper growth has been reported with trickle (2) and on these same trees it was also reported that trickle constricted the root system closer to the trunk (3). The increased caliper will increase the value of the trees and the constricted root system should result in better livability upon transplanting because more of the trees' roots will be retained during digging. Trickle irrigation also allows for easy fertilizer injection through the system. Research has been conducted which would seem to indicate that by injecting fertilizer through the system the total amount of fertilizer used may be reduced by one-half (4) Injection of fertilizer reduces the labor cost of application and the total fertilizer cost for a nursery Trickle also allows for digging during periods that would otherwise be too dry for digging. This allows for more efficient use of labor and extends the digging season.

The benefits of trickle should be carefully considered when contemplating the installation of an irrigation system.

INSTALLATION

Although trickle is used to some extent in greenhouse production systems, its main use is in the field. Having an adequate water source is essential with regard to any type of irrigation including trickle. Trickle, however, uses *considerably* less water than conventional irrigation systems and consequently the water source does not have to have near the capacity. Some of the commonly used water sources are ponds, streams, and wells. As an example of how much less water trickle requires, some nurseries that used 4-inch wells for overhead sprinkler irrigation systems found that 1½-inch wells were adequate for trickle. With trickle, water capacity is usually discussed as gallons per hour (gph) rather than the more commonly used irrigation terminology of gallons per minute (gpm), and usually 2500 to 4500 gph area to be watered is used. Plants generally receive 1 to 2 gph per plant.

It is desirable to have as clean a source of water as possible. Excessive trash in the water can cause plugging with trickle To minimize the chance of plugging, every system should have a filter, preferably one that is self-flushing. In the Eastern States, where the water is fairly clean, a 100 mesh in-line screen is generally all that is needed. The in-line screen should be in the main line before the solenoid valve. When irrigating from a pond or stream sometimes a wooden box covered with nylon mesh is used over the intake as an additional filter

In the Southwest, where they are using Colorado river water, more sophisticated filtration systems are needed. These systems usually consist of sand filters, which are often large and fairly expensive.

Two inch inside diameter (I.D.) black polyethylene pipe or PVC pipe is usually used to convey water to the field. There is nothing magical about using 2-inch pipe, but it is a good general purpose size large enough to accommodate most situations. Once the pipe reaches the field, it should run perpendicular to the rows along one side of the field. This line that runs perpendicular is usually called the header line. Lateral lines are then run down each of the planting rows. The lateral lines are usually ½-inch I.D. 80- to 100-lb test black polyethylene pipe. None of these pipes have to meet drinking water standards

The main line and header lines are generally buried just deep enough to get them out of the way of traffic. The lateral lines are generally left on the surface. Buried lateral lines create problems because of the difficulty in detecting leaks. It is also important to "snake" the line to allow for shrinkage. The line can be laid out and allowed to go through some cold nights and, therefore, shrink before the emitters are installed. If emitters are installed without these precautions, they will not be in the proper locations.

Pump size for a trickle system depends on the acreage and number of plants to be watered. Generally, a 2 or 2½ horsepower pump is adequate.

The system is automated by using solenoid valves and time clocks. Normally-closed 2-inch solenoid valves are installed in the main line. If several fields are involved in which main lines are run to each field, there would be a solenoid valve per main line. The solenoid valve is wired to a time clock, which opens and closes the valve. Very simple inexpensive clocks are available. Also available are multistation zonal time clocks that will switch the water from one field to another. Other hydraulically controlled valves for switching water are available for places where there is no electricity.

An important question is what type of emitter to use. Simply defined, an emitter is a water outlet. There are literally scores of different emitters on the market and this tends to present confusion when it comes time to select an emitter. To lessen the confusion emitters can be broken down into several broad classifications. The first is those emitters which are built into the lateral lines. The buyer can prescribe what distance apart and what flow rate per emitter is desired. These emitters have the advantage of already being in the line, therefore saving the installation labor. They are also a part of the line and don't have parts that could be broken off sticking above the line. The disadvantage of these emitters is that if they malfunction they are difficult to replace. The second type of emitter is those that the individual installs into the line. These emitters have the advantage of allowing the individual to place each emitter exactly where he wants it. They can also be replaced fairly easily if individual emitters fail.

Emitters can further be divided into pressure-compensating and non-pressure-compensating. With non-pressure-compensating emitters flow will vary with changes in elevation since elevation changes cause pressure changes in the lateral. These emitters are fine on flat land, and they are cheaper than pressure-compensating emitters But pressure-compensating emitters provide the same flow rate even with changes in elevation, and even with their additional initial cost they should be used on undulating terrain.

The whole trickle system is put together with elbows, tees, risers, C-clamps, and end plugs All of these components are held together by friction fits supported by the C-clamps.

In summary, the installation of a trickle system is not a complicated process and can be handled by most anyone with a basic understanding of trickle.

LITERATURE CITED

1 Lark, Barry 1971 Trickle Irrigation ICI Australia Limited, Melbourne. 46 p

2 Ponder, H G and A L Kenworthy 1976 Trickle irrigation of shade trees growing in the nursery I Influence on growth *J Amer Soc Hort Sci* 101 100-103

3 Ponder, H G and A L Kenworthy 1976 Trickle irrigation of shade trees growing in the nursery II Influence on root distribution *J Amer Soc Hort Sci* 101 104-107

4 Coston, D C, H G Ponder, and A L Kenworthy 1978 Fertilizing peach trees through a trickle irrigation system Comm in *Soil Sci and Plant Anal* 9(3) 187-191

PRELIMINARY NOTES ON DESICCATION AND VIABILITY OF LIVE OAK ACORNS

DAVID L. MORGAN[1] and EDWARD L. McWILLIAMS[2]

[1]*The Texas Agricultural Experiment Station, Dallas, Texas 75252*

[2]*Texas A&M University, College Station, Texas 77840*

Abstract. Acorns of the live oak (*Quercus virginiana* Mill) failed to germinate when frozen or stored in dry peat moss Stored in moist peat moss at 5°C (41°F), and at 21-30°C (70-86°F), they germinated but were heavily infected with soil-borne fungal pathogens at 3 months, rendering them unsuitable for planting Acorns dried at 34°C (93°F) lost viability as they desiccated A 15% weight loss reduced viability to 66%, and 20% weight loss reduced germination to 4% Acorns collected fresh from tree limbs germinated at higher rates than those collected from the ground, where they presumably had dried over time There was an inverse linear relationship between CO_2 evolution (an indicator of respiration) and percent weight lost through drying Implications of seed storage in controlled atmospheres and at near-freezing temperatures are discussed

REVIEW OF LITERATURE

Due to convenience and tradition, Southern nurserymen propagate the live oak (*Quercus virginiana* Mill.) from seed