MICHIGAN NURSERYMAN BOASTS OF TRICKLE IRRIGATION BENEFITS

By Dan Hager, Lansing, Michigan

Trickle irrigation may not be for everyone, but as far as David Farley of Farley Bros. Nursery, Inc., of Albion is concerned, it's the best way to go. Eventually his entire stock of deciduous shade trees will be watered by that system. He's also trying it out on spruce and pine.

Trickle irrigation is especially well suited to his type of operation, he feels. He grows his trees larger than most nurserymen and spaces them out more widely in the fields. His soil is also lighter than in many nurseries. It's been classified as a Hillside sandy loam.

But trickle irrigation is a booming technology that has developed far beyond the experimental stage. Most of the early bugs have been worked out. Michigan fruit growers are sold on it and have been converting their orchards to it by thousands of acres per year. For nurserymen it's a technology worth knowing about.

Basically what the systems do is deliver very small amounts of water to the growing stock exactly where it needs it the most — directly to the root zone. Water reaches each such zone through a network of pipes, usually consisting of a large main line and smaller laterals running down the rows of trees. The key to the effectiveness of a trickle irrigation system is the emitter — the tiny opening in the pipe network at each tree, permitting minute amounts of water to trickle out at precisely the correct spot and at precisely the correct rate.

As might be expected, most of the development of trickle irrigation systems was done in arid regions of the world, where a little water has to do a lot of work. The basic concept appears to have originated in greenhouse applications in England, according to Dr. A. L. Kenworthy of the Michigan State University horticulture department, the pioneer trickle irrigation researcher in the Midwest. "The technology was picked up and used in Israel in the late '60s, where it was called drip irrigation," Kenworthy said. "Next it moved to Australia, then it came into the U.S. by way of California, and then to Michigan. As far as the eastern states are concerned, there is more trickle irrigation in Michigan than anywhere else. I'd guess there are 70,000 acres with it now in Michigan orchards."

Farley got involved in 1972. "As far as we know, we were the first in the world to use trickle irrigation in the field production of nursery stock," he said. "There's more interest in it now, and more nurseries are using it."

Farley worked closely with MSU doctoral student Harry Ponder, who wound up his dissertation on trickle irrigation in 1975 after doing all his field research at Farley's nursery. It dealt to some extent with earlier technology, some of which has become superseded in the fast-moving trickle irrigation world. Kenworthy says, "There is a lot of development still going on. They do take a lot of maintenance."

Emitter, inserted directly into laterals through a hole punched at the base of each tree, simplifies and shortens the installation process.

The problems are outweighed by the advantages, however, in the opinion of Farley and his foreman Barry Benson, both of whom take little prodding to start talking enthusiastically of their own trickle system.

"One of the most significant advantages is the capability of tailoring the root system, that's the specific area that excites me the most," Farley said.

"We get a greater root system with a greater root surface. We not only increase the amount of feeder roots, we also get a greater amount of structural roots. We've determined to our satisfaction that we can influence the location of the roots, to where we have them nearly all in the soil ball."

To do so, however, takes precision — "the right rate of water, the right duration, and water directly at the tree." The principle is rather simple, though. The roots develop mostly where the water is, so if the bulk of the moisture is localized within the zone which will make up the eventual ball, the roots will proliferate right there.

That regulated supply of localized moisture leads to another advantage. "Trickle irrigation keeps the soil in a good moisture condition for digging," Farley said. "That's particularly helpful for our summer or early fall balling."

Trickle irrigation also minimizes transplant shock for the trees the first year in the field. "The risk of first-year loss is reduced," Farley said. "Daily watering from the time of planting does the trick." Farley is now able to keep his tree mortality down to about one-tenth of one percent the first year in the field.

The trees even start growing that first year. "Ordinarily their energy goes into the roots the first year to overcome the shock," Benson ex-

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plained. "But under trickle irrigation, we actually get top growth that first year."

The systematic application of adequate amounts of water reduces the stress that accompanies nature's erratic watering pattern, and the trees thrive accordingly. Farley calculates that trickle irrigation boosts tree growth by about 20 percent ahead of normal.

Tree health is also improved by the systematic application of fertilizers, which are introduced into and distributed throughout the trickle irrigation network. There is also grower health involved in that setup — remarkable reductions in fertilizer costs because smaller amounts are used and they're used more effectively. There is practically no wastage because of the targeted applications — just the root zones are fertilized, not the weeds out in the rows and not the nearby creek that gets the runoff. Farley estimates that fertilizer savings of 96 percent can be realized.

It may also be possible to effectively apply pesticides through a trickle irrigation system. Farley is cooperating with MSU entomologists in research on this application. More work will be done next summer. If the efforts prove successful, fruit growers are also likely to adopt the technique.

All these benefits have prompted Farley to plant each year's deciduous tree crop with trickle irrigation — between 20 and 30 acres each year. He has a total of about 120 acres now under the system, with about 50 acres of older trees still with conventional watering. His evergreen shrubs, which constitute about one-third of his plantings, will continue to get overhead irrigation. He's still making up his mind how big to go with trickle irrigation on his evergreen trees, most of which are still watered conventionally.

Farley is now phasing out the system of microtube emitters that he adopted at first. The microtubes are just that — narrow pieces of plastic tubing with very fine openings through the center for the transmission of the water.

But they have presented a lot of headaches and, according to Kenworthy, are not widely used in the industry any more. The fine holes are susceptible to plugging, either from very small sediment particles or mineralization. Farley found that his got fragile too readily and broke. And the birds loved them and apparently pulled some of them out from their connections to the lateral lines. "Maybe the microtubes wiggled and the birds thought they were worms," Farley speculated. "Or maybe the birds were smart enough to know that if they pulled them out, they'd get some water flowing out."

The microtubes also required extensive calculations in order to get the proper amounts of water to trickle out of them. The length of each such tube had to be cut exactly to compensate for differential pressure relating to distance from the water source and slope of the land.

A host of complex pressure-compensating emitters is now on the market, most featuring internal diaphragms and springs. Farley has settled on a less complicated, and hence cheaper, emitter made by Spot Systems of Redmond, Wash. It provides pressure compensation by spinning the water internally through a vortex pattern. "They work real well, and they're relatively inexpensive com-

pared to the other pressure-compensating emitters," Farley said. "They're more expensive than microtubes, but we can justify the extra cost by the better performance and the time saving."

The latter is a major item. The microtube installation required from one to three weeks to allow for land survey, calculations, cutting and insertion of the tubes. With the vortex emitters, the workers can go right down the laterals, punch holes in them where they are adjacent to the tree trunks, and then insert the tiny emitters. And since these laterals are laid at the same time the trees are planted, the whole installation can proceed across a block of trees as smoothly and efficiently as a squad of soldiers across a parade ground. The trees are getting their water almost before they realize they need it.

The laterals are half-inch flexible polyethylene pipe, of relatively lightweight grade, which is adequate because the water flow through them is of low pressure. Farley snakes the laterals S-fashion around each succeeding tree down the row, with a pile of dirt over the pipe between each tree. The intent is to compensate for the detrimental effects of expansion. As the pipe expands and contracts through varying weather, the differential is taken up between the trees, with sidewise movement, and each emitter remains where it's supposed to be — right at the tree trunk. A wandering emitter would lead the roots to wherever it happened to be, and the localized, compact root ball would not develop properly.

For his main lines, Farley uses two-inch poly pipe, rather than rigid PVC pipe as he did earlier. Again the flexibility pays off. The poly pipe can be unreeled and knifed in like a cable layer beneath the surface. "Stay away from PVC pipe simply for the ease of installation," Farley advised. "The subsoiler blade can put in the poly pipe at one-half mile per hour, and you're really whistling Dixie."

Farley also sticks to a maximum diameter of two inches for his main line. If more water is needed, he will install a second line of the same size next to it, rather than putting in a single larger pipe. He keeps friction loss to a minimum that way and avoids having to go to rigid pipe.

Filtration is critical to efficient operation of the system. Farley uses filters with at least 100 mesh per inch to keep even tiny sediment particles out. The vortex emitters can also be back-flushed for easy cleaning, in case sediment does get in.

A typical block of trees might range up to 45 to 50 acres off a single five-inch well with a five-horsepower motor, but Farley also installs time clocks and solenoids so that each block is broken into zones that are individually watered. Nutrients such as liquid nitrogen can be added to trickle irrigation systems either by injection pumps or pressure-drop devices.

The whole network is set up so that the trees get what they need, most efficiently and at a low cost. In a few years, every deciduous tree in the nursery will be getting the advantages of trickle irrigation. **WTT**