

Irrigation Efficiency Surges West

By Don Dale in Western Grower & Shipper, February 1994

It's cheap, it's efficient, it's easy to manage. It's a relatively new type of irrigation, and under certain conditions it can compete with drip, sprinkler or level basin methods. It's called surge, and it's slowly headed west.

Actually, surge started out in the West (Utah), headed east (it's big in Kansas), then headed down south (it's huge in Texas), and is slowly surging its way West again. It has shown up in various crops in Arizona and California, often being used for a specific purpose or to cure an irrigation problem.

"The trees are more vigorous," said pecan grower George Eastman in Bowie, AZ. He and brother Dick converted a normal furrow irrigated field - 220 of their 420 acres of trees - to surge irrigation and claim 35 to 40 percent water savings, plus an ease of management not possible with siphon tubes.

The Eastmans converted to surge despite preferring sprinklers. Sprinklers were going to cost them \$1,000 per acre, while the entire surge system cost \$16,400. It was a cheap way to get quick efficiency.

Surge irrigation is a simple method of redirecting furrow irrigation water. By using a valve and gated pipe, a grower applies intermittent surges or pulses of water down the furrow rather than a continuous stream. Thus, the water advances down the furrow in stages, allowing uniform penetration and avoiding tailwater runoff. A gradual sealing and conditioning of the soil with each progressive surge keeps the water from overwatering at any one point, and precise timing shuts it off before it over-flows at the end.

Blaine Hanson, cooperative extension irrigation specialist for the University of California at Davis, is a believer in surge. He has studied its use among a few coastal vegetable growers and San Joaquin Valley cotton growers.

"Unfortunately, it has not been used very much (in California)," Hanson said. His calculation of potential water savings coincide with the Eastmans. He figures that under the right conditions it can save from 30 to 40 percent of water over a regular continuous flow furrow system. Plus, it can stretch available water.

The coastal growers around Santa Maria, Calif., were using surge irrigation on lettuce and cauliflower fields, Hanson said, noting that for farmers who already own gated pipe there may be great potential at very little cost. The valves cost about \$1,500 each, and the Eastmans use six on 220 acres.

"For a minimum investment farmers can convert to surge irrigation," Hanson said. He notes that it works best under certain conditions. "It's more effective in sandier soils, but it also lets you put water on in smaller flows."

Those are two of the problem areas often solved by surge. Sandy soils that suck up way too much water under continuous flow, will settle under progressive surges that allow the soil particles to seal between pulses. And where water is available only in small heads, as in much of Texas, farmers find they can cover more acreage with the same amount of water.

"They're better able to match the amount that infiltrates to the amount they need for soil moisture," he said. And with all the gated pipe being used in California, he doesn't understand why surge hasn't caught on.

One potential problem area is in cracked or compacted clay soils, where poor penetration can thwart surges. Another is that a grower will have to rethink his schedule, because in cutting irrigation time he may run the risk of underwatering. Hanson has developed a manual that is available to anyone interested in converting to surge and the equipment is available through normal irrigation outlets.

Meanwhile, the Eastmans have developed a good working relationship with surge in the three years they have used it (they cut costs even further by getting Soil Conservation Service design and financial assistance).

First, they had special gated pipe turnout boxes designed for their concrete ditches. They also have bought enough pipe to leave it in place during the season-if you aren't moving pipe, this is a system requiring very little labor.

"It's no big deal now," Dick Eastman said. "We just go down there and flip gates."

The timing between the right and left sides of the surge valve is set on a solar/ battery powered electric

controller mounted on the valve itself. The Eastmans said this is easily set to control the timing of each surge, and they further control flow down each furrow by adjusting the gates on their 8-inch PVC pipe.

Each irrigation set is varied to suit an individual field or sector of a field, with eight furrows and gated pipes dedicated to the 40-foot space between tree rows on these 14-year-old pecans. The Eastmans pecan field is irregular in shape and soil type, so it required careful planning and observation to first set a schedule.

"When we're doing the long end of the field we'll run it 22 to 23 hours, but by the time we get down to the short end we'll be down to 15 hours," George Eastman said. The field has half-mile runs, which is why they needed to improve efficiency on an orchard they bought already planted. Timing will also have to be modified for other factors such as the heat of the day and the amount of weeds taking in water.

A typical schedule for the Eastman's sandy pecan fields would be a 40-minute surge on the right side, and 40 minutes on the left. The next surge cycle might be 60 minutes, the next a minute and 20 seconds, and the next two hours. The water advances down the furrow further each time, until it reached the end.

"Then you set a soak-time," George Eastman added. This might be a one-hour shot of water without surge that allows deep penetration. When first setting this schedule the bottom end of the furrow must be watched carefully to avoid runoff; thereafter the timing is programmed into the controller.

"For micromanagement you adjust the individual gates," he reiterates. Unfortunately, when a grower first installs a surge system he simply has to do some guessing on scheduling, refining it as he goes.

Dave Matthews, district conservationist for the Soil Conservation Service, in nearby Willcox, AZ, confirms that water and labor savings are two of the big reasons to consider surge. There are not many surge systems in Arizona, he said, but at least two chili growers have used it successfully as well as the Eastmans on pecans.

"We've been estimating about 70 percent efficiency with surge," Matthews points out, which is 10 to 15 percent above continuous furrow and 5 percent below sprinkler. Efficiency will be higher on leveled and graded fields. With proper management all tailwater can be eliminated.

One benefit the Eastmans have found is that on their sloped fields with long runs, surge has given their trees more vigorous, uniform growth and production.

"I think our trees know the difference," George Eastman said. "They look a lot better than they used to. And we're getting a lot more even yield and growth."