2007 Irrigation Evaluations
Overall Results and Recommendations

During the summer of 2007, the Casitas Municipal Water District (CMWD) contracted with the Irrigation Training and Research Center (ITRC) of California Polytechnic State University, San Luis Obispo, to conduct field evaluations of drip/micro systems. A team of two students conducted 35 field evaluations.

Measurements focused on two items:

- **Distribution Uniformity (DU)** – DU is a measure of the uniformity of water application to trees throughout a field, with DU = 1.0 being perfect. The measured fields in CMWD had an average DU of 0.66, while the California state average for drip/micro is 0.85.
- **Scheduling of Irrigations –** The ITRC team discovered that many farmers in CMWD apply more water per irrigation event than the soil can store, and they also wait too long between irrigations. Irrigating for shorter durations, but more frequently, will not save water but should give better crop growth.

Irrigation Scheduling

Farmers in CMWD must consider two factors related to irrigation scheduling with drip/micro:

- *Is the correct amount of water being applied per week?* This is related to the evapotranspiration (ET) rate of the trees. About half of the field appeared to be under-irrigated – less water was being applied than what the plants could use.
- *Is the correct amount of water being applied per irrigation event?* This was the biggest problem seen. Farmers tended to irrigate for too many hours at a time, and too infrequently. Understanding the available water holding capacities (AWHC) of soils with drip/micro may help.

Available Water Holding Capacity. Most of the soils in the CMWD cannot store very much irrigation water in the root zone. This is because:

- Most of the soils are rocky.
- Avocados have most of their roots in the upper 12-18".
- Some of the citrus, especially on steep ground, have shallow (22-44" deep) soil.
- The emitters on many fields only wet a small percentage of the soil volume.

The bottom line is that in fields with deflector tabs on microsprinklers, the soils can only hold about 2 hours worth of irrigation, and any more water applied is lost to deep percolation below the root zone. For other fields with a larger wetted pattern, it appeared that12-hour sets, applied more frequently to provide the same total water per month, would be best.

Improving Distribution Uniformity (DU)

In general, there were substantial opportunities to improve the distribution uniformity (DU) of the water to plants throughout a field. An improved DU will minimize over-irrigation in some areas, and reduce under-irrigation in others. Key recommendations that were provided included:

1. Install a pressure regulator at the head of every hose
   With a regular microsprinkler, doubling the pressure causes about 40 percent more water to come out of the nozzle. Pressure regulators are added to have similar pressures throughout the field and thus reduce the risk of over-irrigating portions of the field. On many farms the team observed that the difference between the highest pressures was double or even triple the lowest pressures (40-70% more water). By adding the correct high-quality, pre-set pressure regulators with the correct flow rate rating, the farmer is able to get similar pressures to every nozzle and prevent over-irrigation. The ITRC team specified what type of pressure regulator was needed by looking at the pressure map created from the field measurements.

   For a pressure regulator (PR) to work, more pressure must enter the PR than what the PR is rated for. For example, to use a 25 psi PR, you need at least 27 psi into the PR. All a PR does is reduce pressure; it cannot add pressure.

   The team did observe on some fields that the farmers added pressure regulators at the bottom of the hills to reduce over-irrigation at the low points, which helps create more pressure to go up the hill. The problem with this was that they usually didn't have enough pressure to go all the way uphill and this affected their DU. The solution in that case is to either irrigate fewer trees at a time, place smaller nozzles in the field, or to use PR's that are pre-set to a lower pressure.

   Another problem on hillsides was that some pipes had as much as 100 psi before the PR. A PR can effectively reduce the pressure down to 50%. What was recommended in these fields was to reduce the pressure in the pipe by adding an in-line valve halfway down the hill and throttling it down to a reasonable pressure.

2. Completely replace all microsprinklers with pressure compensating microsprinklers.
   The only irrigation system with a DU better than 0.90 had pressure compensating emitters along with pressure regulators on every riser. Pressure compensating microsprinklers have an internal flexible diaphragm that reduces a pathway as the pressure increases. These allow similar amounts of water to get the trees even if the hoses do not have the same pressures. Whenever the pressure is doubled, 10 percent more water will come out of these emitters, compared to 40 percent more water with a regular microsprinkler. Having pressure compensating emitters would drastically improve the DU in virtually every field in this water district because most irrigation systems were not properly designed for microsprinkler

systems, or because the farmer has altered the original design by adding different-sized nozzles.

3. Reduce plugging problems
   Although most farmers were using water supplied by CMWD, major plugging problems were found on all fields that did not have good filtration. There were also some "within-system" causes of plugging. Almost all of the plugging was from simple dirt or rust, as opposed to bacteria or algae. Recommendations are as follows:
   - Always have a filter at the head of the system. The required mesh size depends on the microsprinkler flow rate, but 120 mesh is a starting point.
   - Remove hose screen washers that are found at the head of hoses, and replace them with regular washers (after installing a filter at the head of the system). The hose screen washers often plug up and cause the hoses to have unequal inlet pressures.
   - Be sure to thoroughly flush hoses after any hose breaks.
   - Double check the type of fertilizer that is being injected, especially any "organic fertilizers". Some of these can plug emitters. In any case, inject the fertilizers upstream of the filters. If the filter plugs up, it is better to have discovered the problem early.
   - Clean the filters frequently. Install pressure gauges upstream and downstream. When the pressure differential (as compared to a clean screen) increases by 3-5 psi, it's time to clean the screen.

   On some citrus orchards there was a big plugging problem caused by insects crawling into the emitters after the water was shut off. Many of the new microsprinkler designs utilize a self-closing mechanism to prevent insects from coming into the nozzle.

Links

- http://www.itrc.org/etdata/irrsched.htm - General irrigation scheduling recommendations (inches required per month)