How to keep your irrigation system properly maintained

By Davie Kadyampakeni and Arnold Schumann

Figure 1. A ¾-inch PVC coupling found in plumbing-supply stores serves well as an in-line glass slide holder. Observing the amount, type and rate of scale deposition occurring on a clean side (inset) can help determine the scaling potential of the irrigation water and the effect of injected scale-inhibiting chemicals.
(Source: Obreza et al., 2017)

Irrigation system maintenance is critical for proper and efficient delivery of water in citrus and other irrigated crops. A well maintained and functional irrigation system will deliver the required amounts of water to the root zone when needed and help growers optimize crop production.

If an irrigation system is not working optimally, crops can wilt and result in reduced yield and decreased quality due to low water supply. This article highlights some of the common problems associated with irrigation systems that require routine maintenance and discusses the recommended solutions.

COMMON PROBLEMS

Irrigation system problems can result largely from issues with water quality, system operation and environmental conditions. For example, dripper or microsprinkler plugging is often caused by the presence of sediments or soil from the water source. Another common problem in operating irrigation systems is the presence of algae, bacteria, small plants, arthropods (e.g., ants) and aquatic animals that can pass through filters. If such living organisms multiply, they can form clumps in the tubing or clog emitters or microjets.

Thus, before installing an irrigation system, it is important to conduct a chemical test to evaluate the quality of the irrigation water (Table 1). Water tests can be done in commercial labs such as Central Florida Soil Lab in Bartow, Florida, the Waters Ag Lab in Camilla, Georgia, or University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Analytical Research Laboratory in Gainesville, Florida.

Another problem associated with irrigation water quality that must be managed is scaling (Figure 1). Scaling is caused by the presence of calcium carbonate, iron or manganese oxides. The presence of such compounds can form precipitates with liquid fertilizers and ultimately plug emitters and limit the efficiency of the irrigation system.

RECOMMENDED SOLUTIONS

Filtration Systems

To prevent the entry and build-up of sediments in an irrigation system, it is recommended to use a filtration system that can eliminate most particulate matter from the water source. Use of a very efficient filtration system is the first line of defense against any particles entering an irrigation system.

Table 1. Interpretations to be used with laboratory water testing results, indicating the potential hazard from plugging of micro-irrigation systems

		Plugging Hazard Based on Concentration		
Measurement	**Units**	**Slight**	**Moderate**	**Severe**
Suspended solids[1]	ppm	<50	50-100	>100
pH		<7.0	7.0-7.5	>7.5
Total dissolved solids[1]	ppm	<500	500-2000	>2,000
Iron[1]	ppm	<0.1	0.1-1.5	>1.5
Manganese[1]	ppm	<0.1	0.1-1.5	>1.5
Calcium[1]	ppm	<40	40-80	>80
Alkalinity as $CaCO_3$[1]	ppm	<150	150-300	>300
Hydrogen sulfide[1]	ppm	<0.2	0.2-2.0	>2.0
Bacteria	#/mL	<10,000	10,000-50,000	>50,000

[1]Concentration as milligrams per liter or parts per million (ppm). It is recommended to measure pH, iron, alkalinity and hydrogen sulfide in the field to account for field conditions as much as possible.
(Source: Obreza et al., 2017)

Photo by Davie Kadyampakeni

Figure 2. A screen filtration system is used with microsprinkler irrigation and fertigation.

Figure 3. Example of a Disc-Kleen filter (Source: Netafim, 2012)

Screen filters (Figure 2) help in removing particles from the water source before entering the pipes and tubing.

This filter traps inorganic materials and will clog if elevated levels of organic materials enter the upstream side of the filter. Besides screen filters, disk filters also target inorganic particles by trapping them in adjacent disks and letting filtered water flow in a central conduit and leaving the debris between the disks (Figure 3).

Sand media filters help in removing inorganic and organic materials. The sand is placed in a container or some form of a retaining vessel to allow the irrigation water to move slowly through it from the water source, thereby removing particles in the process.

All of the above-mentioned filters require routine cleaning or flushing to remove the entrapped debris and keep them performing optimally. Some computerized irrigation installations have automatic filter-cleaning cycles, and most modern filters for large irrigation systems can be cleaned in-situ.

Pressure Gauges

A reliable method to show the need for filter cleaning is to install a pressure gauge before and after the filter. A clean filter will show little resistance to the water flow and therefore the pressure measured after the filter will be similar to the pressure before the filter. As the filter collects debris, the pressure differential will increase. A portion of the screening element will become caked and clogged, forcing water through a smaller area. If the filter is not cleaned, some debris will then be squeezed through the screening element under higher pressure and under extreme conditions can rupture it. In general, a pressure difference of 5 to 7 pounds per square inch indicates that the filter should be cleaned.

Acidification

Routine acidification of the irrigation water to reduce the pH to about 6.5 and to neutralize bicarbonates will effectively prevent calcium carbonate scale formation (prevention is better than cure). Injection of chemicals such as sodium hydrosulfite, citric acid, sulfuric acid or a chelating agent has also been shown to be effective at removing scale caused by iron in irrigation lines. Also, injection of dilute forms of sulfuric, hydrochloric or phosphoric acids can help in removing both iron and calcium scale or precipitates from an irrigation system.

Precautions that come with some of these chemicals need to be observed to protect the individuals applying them and the environment. Always wear goggles and chemical-resistant clothing whenever handling these acids as a key safety precaution. Detailed procedures for acid injection are provided in the references below.

Chlorination

The common strategy for solving the problem of living organisms in irrigation water is the use of chlorine. Liquid sodium hypochlorite is injected into the microsprinkler or drip irrigation system to achieve about 1 part per million (ppm) residual-free chlorine at the far end of the irrigation system each time it is used. Alternatively, a weekly injection of chlorine can be done at a higher concentration so that as much as 500 ppm free chlorine is measured at the end of the irrigation system or zone. However, caution should be exercised when using super-chlorination or high chlorine concentration to avoid salinity injury in plants. Detailed procedures for chlorine injection are provided in the references below. Safety precautions need to be observed with respect to other plants and individuals applying the chlorine.

Flushing

Before injecting chemicals for removing chemical scale or biological debris from the irrigation system, it should be thoroughly flushed. For drip systems, flush the lines approximately every other week and after chemigation and fertigation applications. Begin by cleaning the filters, then flush the mainlines, followed by submains, then laterals. Check the clarity of the water in the lines that are farthest from the pump. If the flush water is dirty, lines need to be flushed more frequently; if the water is clear, the current flushing schedule is sufficient.

CONCLUDING REMARKS

An irrigation system that works efficiently is important for optimizing citrus grove production. Common problems in irrigation systems include irrigation emitter plugging, scaling in irrigation lines and other problems caused by living organisms.

Solutions for improving the irrigation system include use of good filtration systems, periodic injection of acids and routine flushing of the irrigation system. If routine maintenance measures are not followed, irrigation efficiency decreases and results in yield reduction. It is costly in terms of labor, equipment and personnel to replace malfunctioning irrigation systems, so keeping them properly maintained is important.

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For further reading

- **Netafim USA, 2012. Drip system operation and maintenance.** https://www.netafimusa.com/bynder/315B6CDD-68DA-4A15-AC82FA9C2FDAB129-a012-drip-system-ops-maint.pdf
- **Obreza, T., E. Hanlon and M. Zekri. 2017.** Dealing with Iron and Other Micro-Irrigation Plugging Problems. SL265. http://edis.ifas.ufl.edu/pdffiles/SS/SS48700.pdf

A Glorious Time of the Year

By Rick Dantzler, CRDF chief operating officer

I'm working from home as I write this, and the country is coming off one of its most tumultuous weeks ever. The stock market was seesawing 3,000 points in a swing. Business owners were facing an uncertain future. Hundreds of thousands of employees were laid off. The American economy was on the verge of shutting down. Governors were issuing orders for entire states to "shelter in place," and even life itself seemed far from certain.

I followed a lady out of Harvest Meat Market whose shopping cart was completely full of meat. I asked the checkout person if she was cooking for a church. "No," the person said. "People have been doing this for days."

Strange times, indeed.

We don't know where the plans to deal with coronavirus will lead us, and it's easy to conclude that our leaders are overacting. I understand the thinking of our leaders, though. I analogize this to advertising spending: A business can never know when it spent too much but can always tell when it didn't spend enough. If we take these draconian actions to deal with coronavirus and the worst is avoided, we'll never know if we overreacted. But if we don't take these actions and things get as bad as many predict, we'll know we didn't do enough.

With coronavirus, once again we are relying on science. We're relying on science to find a vaccine, to guide us in preventing its spread and to get us well if we get sick.

It's the same with citrus. We are relying on science to help us grow the best and most fruit. We want fruit and the juice from it that is so good it brings consumption back to levels approximating the good old days.

Gosh, I love this industry. While I was never a grower per se, my father had groves and I owned a 20-acre grove off Water Tank Road east of Lake Hamilton for a while, but I never depended on it for my living. My work in the groves was more as a day laborer or, perhaps more accurately, a summer laborer. I've been mostly an observer, helping the industry from the Legislature whenever I could and marveling at all that it is.

When a Ben Hill Griffin or a Joe Marlin Hilliard would come into my office, I'd sit amazed, thinking of what they and their families had accomplished. Or I'd sit around the fire at the hunting camp with a Fred Klote or a Herbie Pollard, growers of far fewer acres but who were providing for their families, nonetheless, and I'd think of all that this industry has provided for so many.

It's the time of the year when bloom and Valencias are on the tree together. Is there anything more beautiful? This industry is worth fighting for. This country is worth fighting for. We'll whip HLB and coronavirus and anything else that has the misfortune of getting in our way. Mark my words.

CRDF Grower Dollars at work for you

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