Cultural Perspectives

Treating Irrigation Water

As you all know, water is the life-blood of your nursery. I'm sure that your source of irrigation water was tested when the nursery was developed but water quality does change. Surface water sources can easily become contaminated from runoff and even very deep aquifers that were once considered to be pristine have been found to be contaminated by nitrates or pesticide residues. Therefore, more and more nurseries are installing some sort of water treatment system to protect their crops.

Before you consider buying the same system that your neighbor has, remember that you have to know exactly what contaminants you want to get rid o£ Keep these two points in mind:

* No single water treatment will correct all water quality problems, and so it may be necessary to install several systems in a series. Be wary of vendor claims and talk to water quality specialists and other nurseries before investing in a system.

* All systems have limitations and life expectancies, and require routine maintenance, monitoring, or both.

The performance of the major types of water treatment systems should be compared side by side in terms of how they work, what they remove, and what are their limitations (Table 4).

Distillation

How it works: Impurities are isolated when the water evaporates, and the steam is cooled and condenses into distilled water.

What it removes: Salt, nitrates, heavy metals.

Limitations: Distillation is slow and consumes considerable energy, and is therefore relatively expensive. Distilled water can corrode some metals such as iron and copper.

Activated carbon filters

How it works: Water is filtered through carbon granules that chemically adsorb impurities.

What it removes: Volatile organic chemicals, some pesticides, and odor, color, and taste problems.

Limitations: Filters must be replaced regularly or contaminants will be released back into water. Poorly maintained filters can be breeding grounds for bacteria.

Reverse osmosis (RO)

How it works: A semipermeable membrane filters out dissolved impurities (Figure J).

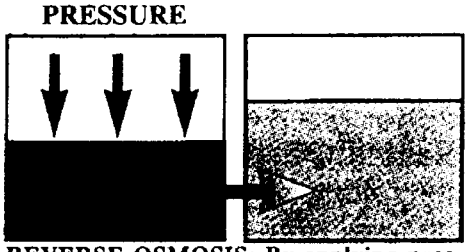

Figure J. Reverse osmosis works by applying pressure and forcing water through a semipermeable membrane (modified from Bienbaum 1994)

Table 4. Comparison of different water treatment options (from Hirschi and others)

Contaminants	Activated carbon filters	Chlorination	Distillation	Cation or anion exchange/ water softener	Mechanical filtrations	Reverse osmosis	Ultraviolet radiation	Ozonation
Chlorine	X							
Coliform bacteria, other microorganisms		X					X	X
Color	X	X		X				X
Hydrogen sulfide		X						X
Inorganics, minerals, and heavy metals (lead, mercury, arsenic , cadmium, barium)	X		X	X		X		
Iron/manganese–dissolved		X		X				X
Iron/manganese–insoluble					X			
Nitrate			X	X		X		
Odor and off-taste	X	X	X	X		X		X
Some pesticides	X					X		
Radium			X	X		X		
Radon gas	X							
Salt			X			X		
Sand, silt, clay (turbidity)					X			
Volatile organic chemicals	X		X			X		
Water hardness				X				

What it removes: Inorganic minerals, especially salts such as sodium, calcium, magnesium, boron etc. Also effective on volatile organics and some pesticides.

Limitations: The main problems are that the process takes time, and so treated water must be accumulated in storage. RO membranes are expensive, and must be regularly maintained. As much as 20-50°io of intake water is discarded and this very saline water needs to be disposed of properly.

Ion exchange systems (e.g. water softeners)

How it works: Canon and anion exchange systems are different and so remove different

minerals. For a typical domestic water softener, water passes through resin beads that are periodically recharged with sodium ions, where they are exchanged for calcium and magnesium ions which are then flushed from the system.

What it removes: Calcium and magnesium (hard water), and iron and manganese in low concentrations. Anion exchange units remove nitrate, but canon exchange units will not.

Limitations: Sodium is added to the water during treatment and so typical water softeners should NEVER be used in a nursery application.

Mechanical filtration

How it works: Many different types are available using sand, filter paper, and other straining materials.

What it removes: Dirt, sediment, weed seeds, and insoluble iron and manganese

Limitations: Mechanical filtration does not remove dissolved salts and, depending on the filter size, smaller pathogens (Figure K).

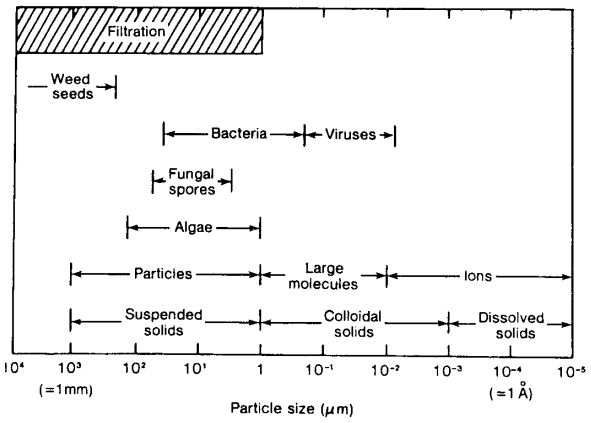

Figure K. Inorganic particles and some pests can be filtered from nursery irrigation water (modified from Tchobanoglous and Schroeder, 1985)

Chlorination (also see section in July, 1994 issue of FNN)

How it works: Liquid injectors meter chlorine into the water in direct proportion to water flow. Granular products can be added to ponds or tanks where they dissolve into reactive chlorine, which remains effective for a period of time.

What it removes: Bacteria, fungi, and other microbial pests

Limitations: The system must be designed to provide adequate contact time. Chlorine is corrosive, and injection systems must be properly maintained.

Ultraviolet (Ul) radiation

How it works: A special light bulb generates UV radiation which kills biological organisms in the water line.

What it removes: Bacteria, fungi, and other microbial pests

Limitations: May not be effective when water flow is too fast or water is clouded with suspended particles. UV does not have a residual effect like chlorine.

Ozonation

How it works: A corona discharge generator converts air to ozone, which is injected into a water line where it kills microbes after a contact time of around 4 minutes.

What it removes: Bacteria, waterborne fungi, nematodes.

Limitations: Ozone does not have a residual effect like chlorine, but is safer to use and can be cheaper.

Sources:
Biernbaum, J. 1994. Treat your water right. Greenhouse Grower 12(2): 31, 33-35.

Hirschi, M.C.; Simmons, F.W.; Peterson, D.; Giles, E. 1994. 50 Ways Farmers Can Protect Their Groundwater. North Regional Extension Pub. 522. Urbana, IL: University of Illinois, Cooperative Extension. 189 p.

Landis, T.D.; Timis, R.W.; McDonald, S.E.; Barnett, J.P. 1989. The Container Tree Nursery Manual, Volume Four: Seedling Nutrition and Irrigation. Agric. Handbk. 674. Washington, DC: U.S. Department of Agriculture, Forest Service: 90-93.

Roberts, D.R. 1993. How to use ozone to eradicate pathogens. Nursery Manager 9(6): 74.

Tchobanoglous,G.; Schroeder, E.D. 1985. Water quality characteristics, modeling, modification. Menlo Park, CA: AddisonWesley Publishing Co. 768 p.

plant, including the roots, is removed and so little organic matter is returned to the soil. Due to the necessity of having to lift bareroot seedlings during the dormant winter period when the weather is often wet, soil structure can be seriously damaged within a relatively few years (Figure L).

Figure L. Seedling harvesting during wet winter weather can seriously damage soil productivity