Iron in irrigation water

Water intended for irrigation in nursery production can be obtained from many sources such as dams, bores, wells, streams, town supply or recycling wastewater. The quality of irrigation water can have a huge affect on the productivity of a nursery. It is vitally important to the continued successful and efficient operation of a production nursery that the quality of the irrigation water supply is sampled and analyzed by an accredited laboratory before first establishing the site and then regularly throughout the productive life of the nursery. Groundwater from bores and water from some dams that are used for irrigation can sometimes contain high levels of iron that can discolour or stain the foliage of plants, shadecloth, walls, concrete, nursery infrastructure and equipment. Water containing iron levels in excess of one part per million will produce some level of staining.

Iron is an essential micro-nutrient in soils, however dissolved iron in irrigation water can cause problems when it precipitates out on plant leaves or irrigation equipment. Nursery crops with heavy iron staining have a reduced market appeal, and often display a lack of vigour from reduced photosynthesis and poor transpiration.

Iron that is dissolved in groundwater oxidizes to its less soluble form, ferric iron, when the water is exposed to the oxygen in the air. The oxidizing process produces the ferric hydroxide (rust) that settles on any surface and is left behind as the water evaporates. Oxidized iron can also appear as a sticky slime that can be found on the inner surfaces of irrigation pipes and fittings and is the cause of many irrigation valve failures. The conversion of soluble iron to its insoluble ferric form is influenced by both the oxygen content and the pH of the water. Iron is soluble in water containing little or no oxygen and its solubility increases with the acidity of the water. Bores and dams with low oxygen levels can contain high levels of dissolved iron that can become insoluble when exposed to the oxygen in the air. This conversion from soluble to insoluble iron occurs naturally in approximately one hour at pH 7 and one hundred times longer at pH 6 when the water is exposed to air. The conversion process of precipitating the iron out of the irrigation water can be accelerated by increasing the aeration of the water.

Aeration can be a relatively simple and inexpensive process to remove dissolved iron from an irrigation supply. Irrigation water can be pumped into a sedimentation pond allowing the oxygenation of the water and the precipitation of the insoluble iron, but this is a very slow reaction process. Aeration is best achieved by allowing the water to cascade over a large surface and then directing the water into a settling pond or tank to allow the iron to settle out (the iron sludge will require eventual removal) and then filtering the water before use for irrigation. This is a process that incorporates oxidation, sedimentation and filtering to release the dissolved iron. The aeration process begins by mixing the water with air to oxidize the iron, forming solid particles that can settle out in solution. This can be achieved by spraying the water into the air as in a fountain or sprinkler, agitating the water with paddles or propellers, or cascading the water over a series of baffles. Next the water is allowed to settle for a minimum of 30 minutes in a pond or tank to allow the iron to settle out of solution and finally the water destined for irrigation is filtered to remove any iron that has not settled out during the process.

Specialised water softening filters can be used to remove relatively low levels (max 5ppm) of dissolved iron. Water pH must be adjusted to neutral for these water softening filters to be suitable and they require regular backwashing and recharging.

Greensand filters are sometimes used with low levels (max 10ppm) of dissolved iron. These filters operate as a filter to trap the iron using potassium permanganate and manganese greensand to oxidize the iron. Water must be adjusted to neutral for successful operation. These filters have a limited operational life and need recharging regularly.

Chlorination can also be used to remove low levels of dissolved iron and is often used after aeration and sedimentation to remove any iron still dissolved. Water should be adjusted to neutral before chlorination and left for a minimum of 30 minutes before filtering and use in irrigation.

The Nursery Production Farm Management System network can provide growers with sprinkler information and suggestions to meet industry best practice. Contact NGIQ to arrange a Farm Management System Officer visit.

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