Maintenance of Drip Irrigation Systems

A well designed and operated drip irrigation system can provide high water use efficiencies. However, growers may be reluctant to install these systems because of the potentially high maintenance costs caused by clogging.

Dripper blockages can be caused from biological, physical, or mineral (chemical) causes. Surface water sources generally carry more risk of biological or physical blockages, while ground water, with higher mineral content, poses greater risks of mineral clogging hazards.

*Sand particles are considered the most common **physical cause** of emitter clogging, and silt sized particles clumping together another possible cause. Turbidity can give an estimate of the amount of suspended material in a water source, but it isn't a reliable indication of the clogging hazard. The most effective way of dealing with physical clogging of emitters is to install a filtration system. Correctly sized disc and screen filters are the best option, with disc filters being preferred, as they are more resistant to clogging and are easier to clean.*

***Biological growth**, also known as biofilm, occurs in all irrigation systems. Biofilm can cause direct blockages, but can also act as a surface for mineral particles to accumulate on and form particles large enough to clog emitters. The colour of the biofilm will vary and may be reddish, yellowish or grey. Clogging due to biofilm is more common in water with high biological activity and relatively high levels of iron, manganese or sulphides. Biofilm can be managed by the proper use of chlorine and disinfestation procedures, combined with appropriate filtration.*

*High levels of certain elements in the irrigation water may lead to **mineral deposits** accumulating in the system. The solubility of the mineral is the main factor determining if it will cause a clogging hazard. Solubility of a mineral is governed by water temperature (less minerals dissolved at lower temperatures), pH (elements have different solubilities over a range of pHs), how reactive the mineral is (redox potential), and the concentration of the mineral in the water (the more concentrated the more is available to form deposits).*

Calcium, magnesium, iron and manganese are the most common minerals that form deposits. Water that has a pH of more than 7.0 can be more prone to calcium deposits at high levels. Clogging caused by minerals can be reduced by acid injection to reduce the pH of the irrigation water.

Table 1, from the Smart Fertilizer website, gives the clogging potential of water sources in drip irrigation systems—https://www.smart-fertilizer.com/articles/emitter-clogging

Constituent	Level of Concern		
	Low	Moderate	High
pH	<7.0	7.0-8.0	>8.0
Iron (Fe) mg/L	<0.2	0.2-1.5	>1.5
Manganese (Mn) mg/L	<0.1	0.1-1.5	>1.5
Hydrogen Sulfide (H2S) mg/L	<0.2	0.2-2.0	>2.0
Total Dissolved Solids (TDS) mg/L	<500	500-2000	>2000
Total Suspended Solids (TSS) mg/L	<50	50-100	>100
Bacteria Count (#/ml)	<10,000	10,000-50,000	>50,000

Table 1: Clogging potential of water

Fertilisers applied in fertigation may cause clogging, either due to chemical reactions with other fertilisers or minerals in the water, or the fertiliser concentration *being too high. A jar test can determine if any deposits are likely to form when fertilisers are added to the water. Combining sulphate fertilisers with calcium fertilisers will form calcium sulphate (gypsum), which has very low solubility and will cause clogging in the system.*

***Clogging of emitters can be avoided by**:*

- *Performing a full analysis of the irrigation water to establish what minerals are present, and if there are minerals that may react with fertilisers. Tests should cover the three types of clogging risks.*
- *Ensuring filtration systems are removing large particles or aggregates, e.g. sand and clay.*
- *Reducing microorganisms by disinfesting the water.*
- *Preventing minerals and fertilisers coming out of solution (precipitation) by adjusting pH levels, monitoring the solubility of fertilisers and avoiding reactions between fertilisers.*
- *Regularly flushing irrigation lines.*
- *Injecting fertilisers before filters.*
- *Using completely soluble fertilisers.*
- *Daily running of the drippers to minimise precipitation of minerals and fertilisers.*
- *Flushing of lines with chlorine or acid to remove accumulated deposits.*

Other maintenance:

The most effective maintenance programme for a drip irrigation system is applying regular preventative treatments, rather than letting problems develop then trying to rectify them:

- *Monitor overall flow rates for an indication of the degree of clogging across the whole system.*
- *Control rodents/ animals to minimise physical damage to the system.*
- *Check and clean filter systems daily.*
- *Inspect the system for leaks and correct operation of individual emitters.*
- *Flush the system at least monthly, or at any time when the system is running. More frequent flushing may be necessary with poor quality water. Flow velocities in the pipe need to be 0.5 to 0.6 m/second. Flushing also removes air that becomes trapped in the system.*
- *Check the operation of disinfestation and treatment systems. Regular or continuous disinfestation may be required if the water supply contains organic matter such as algae, or more than 0.1 ppm iron. If iron concentrations are higher than 1 ppm It may be more effective to pre-treat the water. Injection of chlorine can effectively reduce biofilm and iron deposits. Aim to maintain chlorine residual levels of 0.5 to 1 ppm at the furthermost emitter. Leave chlorinated water in the system at shutdown.*
- *The time interval between regular disinfestation treatments will depend on water quality. Water supplies with little nutrient and in cold climates may only need chlorination every 6-12 months. Water sources with higher nutrient levels and warmer temperatures may need treatment as frequently as fortnightly, and effluent supplies with high sediment and oxygen levels may require daily treatment.*
- *If the system is not being used to grow a crop, dose weekly by adding 50-100 ppm chlorine, acidifying the water to pH 5, and allow this to remain in the pipes for as long as possible before thoroughly flushing the system. High concentrations of chlorine or low pHs should not be used in systems where crops are being grown. The pH level of the water supply will also influence the effectiveness of the chlorination treatment. If there is already biofilm growing in the pipelines, clogging may be worse as the slime begins to break off. In this case it's important to flush the lines thoroughly before beginning irrigation.*
- *Water containing large amounts of calcium carbonate, more than 1 ppm iron, or with high pH should be acidified to a pH of 5.5 to 6.5. This will keep the minerals in solution and increase the effectiveness of the chlorine. The acid should be injected continuously downstream of the filter. If scale has accumulated, a slug dosing of the system may be required. Inject sufficient acid to lower the pH to 2.0 and shut the system down, leaving the acid in the lines for at least 24 hours before thoroughly flushing the system. Again, this treatment shouldn't be applied in systems with crops growing in them.*

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