



Nursery & Garden Industry  
Queensland

## Injection systems

*When applying fertigation, or disinfecting water, the selection of the correct injection equipment is just as important as choosing the correct nutrients, or the most suitable method of water disinfection. The following describes the methods used to inject solutions into irrigation water, and some of the other factors that need to be considered when deciding on an appropriate system.*

*In production nurseries there are three methods used to inject solutions into irrigation water, each with their advantages and disadvantages.*

**Pressure differential venturi systems** work on the principle of a low pressure being created in a chamber, and the resulting difference in pressure between the chamber and atmospheric pressure causing the solution to be drawn into the irrigation line. These types of injectors don't require an external source of power, as they rely on the flow of water through a narrow chamber to create the pressure differential. These systems are simple to operate, easy to install, require little maintenance, are relatively low cost, and can provide accurate control of fertiliser rates when irrigation flow rates are consistent.

*Venturi systems are most accurate where irrigation flow rates don't vary significantly, so while they may be relatively cheap, they are not as accurate as proportional or pump injection systems when variable flow rates are encountered. These systems also cause some reduction in operating pressure of the system, due to the flow of water being restricted as it passes through the injection unit. As these systems have a fixed rate of injection at a given flow rate, the adjustment of the amount of solution injected into the system has to be made by adjusting the concentration of the stock solution.*

**Proportional injectors** rely on water pressure in the irrigation system to drive a plunger, which in turn

*operates a diaphragm drawing the solution into the unit, before pumping it into the irrigation line. These injectors don't require electricity to operate, and have adjustable injection rates, but as these units use water pressure to drive them, they'll cause a reduction in the operating pressure of the irrigation system, which may reduce system efficiency if not accounted for.*

**Pump injection** is the most common method of injection of fertiliser and chlorine into irrigation systems. The pump delivers the solution from the supply tank directly into the pressurised mainline as a measured dose. Electric injection pumps can be installed to receive an electrical pulse from a water meter to deliver a precise measure of the stock solution.

*Pump injection systems are simple and effective, relatively easy to install and maintain, suitable for*



Proportional injector—Higgs Horticulture

high pressure systems, allow proportional or quantitative injection, and can be automated.

The decision on which injection pump best suits the situation needs to consider accuracy, price, maintenance costs and reliability of the units.

**The accuracy** of an injection system is important to ensure the solution is being injected uniformly. The accuracy of venturi systems is dependant on the variation in flow rates in the system, whereas proportional and pump injectors will provide a much higher degree of accuracy if flow rates are variable.

Units need to be sized correctly to ensure they are able to cope with the range of injection rates likely to be encountered. Aim to size the unit so it is able to provide the maximum injection rate required, but most of the time, it should be operating on a medium setting. Oversizing the unit can cause a reduction in accuracy and loss of prime due to chlorine gassing (see below) when operating at very low injection rates.

**Price** is a major determining factor in choosing a unit, but installing a cheap unit may be false economy if it isn't accurate and causes crop damage through over or under dosing.

**Maintenance costs**, particularly the cost of maintenance kits, should be investigated before the unit is installed. Proportional and pump injectors require a regular maintenance programme. While maintenance kits may seem expensive, it's false economy to not have a regular maintenance programme in place. Failure of components such as delivery tubes can result in corrosive chlorine or fertiliser being sprayed over sensitive electrical components, leading to expensive failures and repairs to the pumping system.

**Reliability** of injection pumps is critical to the effective operation of the system. Ensure the injection pump is made of materials that can

withstand the substance being injected. Chlorine is very corrosive, and may require different injection pump components to fertilisers. Liquid chlorine produces gas, which can accumulate in pipework or pump chambers, causing the pump to lose prime. Pipework needs to be installed in such a way that the pump can purge the gas during normal operation. Some units may be able to purge the gas more effectively than others.

**Other componentry** that may be required is dependant on the degree of automation necessary. Flow meters, flow sensors and monitoring sensors are able to be integrated with pump injection systems to fully automate them. Proportional injectors and venturi systems are not able to achieve these levels of automation.

**Flow meters** are used to enable injection pumps to accurately inject the correct amount of liquid, regardless of variations in flow rate. Many water meters have sensors on them that can be connected to injection pumps to activate this function.

**Flow sensors** will be necessary on pump injection systems where flow rates don't vary and the injection rate is constant.

**Monitoring sensors** that can measure levels of pH, electrical conductivity or chlorine (Oxidation Reduction Potential (ORP) sensors) can allow the system to automatically adjust the injection rate based on the concentration or reaction of the injected solution in the irrigation water.

Steve Hart and Lex McMullin  
Farm Management Systems Officers  
Nursery & Garden Industry Queensland

Published April 2017