Technical Fact Sheet - Fertigation

Fertigation is the application of plant nutrients, fertilisers, soil improvers and soluble fertilisers through an irrigation system.

It is important that fertigation practices and systems are implemented and applied according to manufacture specifications and comply with legislative and departmental regulation standards.

The installation of poor fertigation systems and the application of fertilisers can have adverse and even irreversible affects on surface water and groundwater supplies, including the water you rely upon drinking to survive.

Further information regarding the potential implications of fertigation systems and water resources can be found in the Water Resources Branch Fact Sheet titled '*What is Chemigation and Fertigation and How does it affect Groundwater'*.

This fact sheet presents some of the types of systems available in Australia and the advantages and disadvantages of those systems. It is important that if you are unsure about the information contained within this fact sheet you contact the Water Resources Branch for further explanation.

Some of the advantages and disadvantages of a fertigation system are presented in Table 1

TABLE 1

Advantages	Disadvantages
Very simple to operate as a stock solution does not have to be premixed	Concentration of solution decreases as Fertiliser dissolves, leading to poor placement of nutrients
Easy to install and requires little maintenance	Requires pressure loss in main irrigation line
Changing fertiliser is easy	Tank must be able to withstand irrigation line pressure
Ideal for dry formulations	Proportional fertigation not possible
	Limited capacity

Venturi System

A Venturi System can be installed either as a bypass or directly inline. The venturi causes a rapid change in velocity producing a reduced pressure (vacuum) which draws the fertiliser solution into the line. Some of the advantages and disadvantages of a Venturi System are presented in Table 2.

Table 2

Advantages	Disadvantages
Simple in design with no moving parts	Quantitative fertigation is difficult
Easy to install, requiring little maintenance	Requires pressure loss in main irrigation line (can be 33%)
Fertiliser rates can be controlled with some accuracy (2 to 3000 litres per hour)	Automation is difficult
Low labour, as a month's supply of stock can be mixed in an inexpensive tank	
Low cost	

Suction Injection

Suction Injection involves the suction of fertiliser through the intake of the pump and is often the simplest method of application. A pumping unit develops a negative pressure in its suction pipe. This negative pressure can be used to draw fertiliser solutions into the pump. A pipe or hose delivers the fertiliser solution from an open supply tank to the suction pipe. The rate of delivery is controlled by a valve. This connection must be tight to prevent air entry into the pump. Another hose or pipe connected to the discharge side of the pump can fill the supply tank with water. A high-pressure float valve can be used to regulate inflow into the tank. If necessary the system can be automated with a direct-acting solenoid valve. For multiple block usage, two or more tanks can be set up in sequence and operated when required. Some of the advantages and disadvantages of a Suction Injection system are presented in Table 3.

Table 3

Advantages	Disadvantages
Very simple to operate, a stock solution does not have to be premixed	Concentration of solution decreases as fertiliser dissolves, placing most of the nutrients below the effective root zone if the tank is operational when the irrigation has commenced
Easy to install and requires little maintenance	Proportional fertigation is not possible unless several tanks are used.
Ideal for dry solutions	Limited capacity
	Danger of suction air entering the pump unless all fittings are airtight
	Risk of corrosion of the pump bowl and regular flushing of the system is necessary
	Risk of contamination of the water supply if chemicals flow back down the suction pipe when the pumping unit stops. Check valves are necessary
	Accuracy of application is limited and determined by volume rather than by proportion

The Pump injection method

This is the most common method of injecting fertiliser into irrigation systems. Injection energy is provided by electric motors, impeller-driven power units and water-driven hydraulic motors. The pumps are usually rotary, gear, piston or diaphragm-type which deliver fertiliser solution from the supply tank into the pressurised mainline. The three systems available are electric injection pumps, piston-activated pumps and diaphragm activated pumps. Piston-activated and diaphragm activated pumps are both hydraulic injection pumps and dominate the fertigation market at present. Electric injection pumps include single or multiple piston, diaphragm, gear and roller pumps.

These can be regulated to achieve the desired rate by:

- adjusting the length of the stroke of piston pumps,
- selecting the appropriate pulley diameter,
- using a variable-speed motor,
- Semi-automation to adapt the pump to receive electrical impulses from a water meter which can then be used to apply precise amounts of fertiliser.

Some of the advantages and disadvantages of Pump Injection Method are presented in Table 4

Table 4

Advantages	Disadvantages
Simple and effective	Pumps must develop a minimum mainline pressure to operate
Relatively easy to install and maintain	Need electric power source to operate
Either proportional or quantative fertigation is possible.	Injection rate not easily adjusted
No pressure loss in the main irrigation line. Suitable for high head systems	Pumps are not simple in design and include a number of moving parts so wear and breakdown of parts is more likely to occur
Automation is relatively easy	

Piston-activated pumps

Irrigation water operates a hydraulic motor that pumps the fertiliser solution into the system. Since the pump's maximum rate of injection is proportional to the pressure in the mainline, the required injection rate is adjusted by throttling

the injection line via a valve fitted to the water main. As the injection rate per pulse is known, the exact application of nutrients can be readily calculated. For high injection rates two or more units can be operated in parallel.

Diaphragm-activated pumps

Water pumped into the lower chamber activates a rubber diaphragm in the drive unit which forces the diaphragm and drive rod up, pushing the fertiliser out of the injector into the irrigation system. On the return stroke the spent drive water is discharged from the lower chamber of the drive unit while simultaneously fertiliser solution is drawn into the injector. The cycle is automatically repeated.

Table 5

Advantages	Disadvantages
Very simple to operate, install and maintain. Proportional or quantative fertigation is possible.	Large number of working components.
Rate of Injection is easily adjustable.	Sensitive to air pockets and needs a continuous water discharge to operate the piston or diaphragm.
System is easily portable between paddocks.	Pumps require a minimum line pressure.
No pressure loss in main irrigation line.	Spent 'drive water' is lost and discharged from the system.
Automation is very easy.	Upper limit to pressure available
Not labour intensive.	More difficult to operate in system with high head pressure.

The information contained in this Fact sheet was obtained from the New South Wales Department of Agriculture, Agnote 100-9.

What else do I need to know?

All types of fertigation systems should be placed or stored on a sealed and/or raised platform and not in direct contact with the earth. Ideally they should also be fitted with chemical spill lips/trays (especially mobile units).

For further information refer to the *How to Prevent Groundwater Pollution* and *What is Chemigation and Fertigation and How Does it Effect Groundwater* fact sheets also in this series.

It is essential that you ensure the water supply for fertigation is kept separately from your domestic water supply to avoid contamination resulting in sickness and/or death.

The storage of chemicals and fertilisers should be located at least 100 metres away from the water source, be placed on a sealed platform and adequately shielded from the sun and weather.

It is also a licensing requirement that all systems are approved by the Controller of Water Resources prior to installation.

Contact:

Water Resources Branch

Department of Natural Resources, Environment, the Arts and Sport

Palmerston
4th Floor Goyder Building, PO Box 496,
Palmerston NT 0831 Ph: 8999 3678

Katherine
Randazzo Arcade, 16 Katherine Terrace,
Katherine NT 0850 Ph: 8973 8100

Alice Springs
1st Floor Alice Plaza, Todd Mall, PO Box 1120
Alice Springs NT 0871 Ph: 8951 9215