Fertigation in Olive Groves

by Greg O'Sullivan

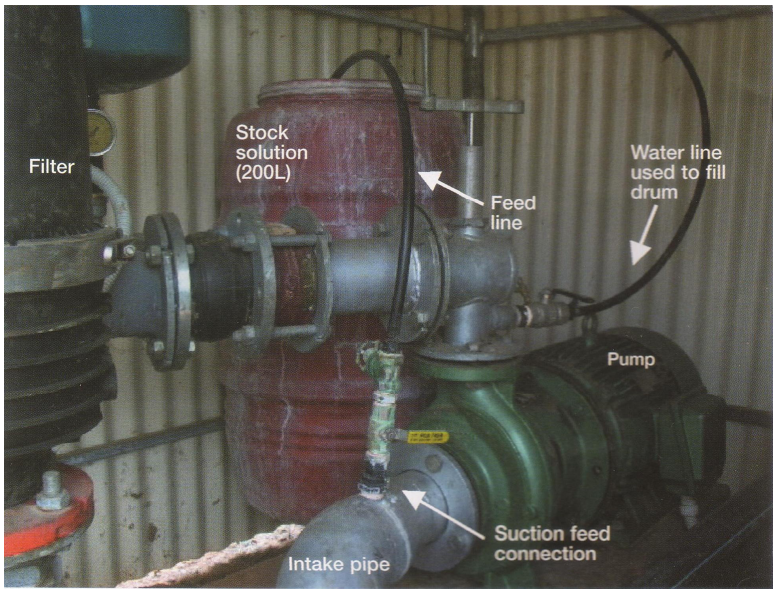
Fertigation is the practice of supplying small amounts of soluble fertilisers through the irrigation system directly to the tree's root zone.

A well-designed fertigation system can reduce fertiliser application costs considerably and supply nutrients in precise and uniform amounts to the wetted irrigation zone around the tree where the active feeder roots are concentrated. Applying timely doses of small amounts of nutrients to the trees throughout the growing season has significant advantages over conventional fertiliser practices.

When plants receive conventional broadcast applications of granular fertiliser applied once or twice a year they get a large quantity of fertiliser that is in excess of what they require at the time it is applied. This can result in salt damage to roots, excessive fertiliser losses through leaching and volatilisation to the atmosphere and can be toxic to beneficial soil microorganisms and fauna such as earthworms. Generally with the use of conventional fertiliser spreaders much of the fertiliser is placed outside wetted irrigation zone in areas not exploited by the tree roots.

The main drawbacks associated with fertigation are the initial set-up costs and the need to monitor the operation carefully to ensure that irrigation and injection systems are working correctly. Water quality can limit the use of fertigation; irrigation waters that are high in salts are not suitable for fertigation. Generally the concentration of salts in the fertigation solution should not exceed 3000 microSiemens per centimetre (µs/cm).

A Simple Direct Suction Feed System



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Fertigation systems

A fertigation system consists primarily of a storage tank for the concentrated fertiliser solution, a unit for injecting the solution into the irrigation system and check valves to prevent backflow into the water supply. The main types of injection units are Venturi systems, direct suction feed, proportioner injectioners and electrical injection pumps.

A Venturi is a simple pressure-differentiating device that is attached on the discharge side of the pump either in-line or on a bypass. As water passes through the tapered orifice of the Venturi a vacuum is created which draws the fertiliser solution from the storage tank. It requires no external power source and is low in cost.

A direct suction feed is a simple low-cost system that incorporates a valve and small-diameter feed line on the intake side of the pump. The fertiliser solution is drawn through the line from the storage tank as water is pumped from the dam or bore.

The main drawbacks to this system are that the concentrated fertiliser solution passing through the pump may increase wear or corrosion to the pump's internal components, and in the situation of a pump failure the risk of the fertiliser solution siphoning back into the water source is high. This risk can be reduced by installing a solenoid valve on the injection line that is interlocked with the pump power supply, and ensuring there is a check valve between the water source and the pump.

Proportional injection pumps (Dosatron, Chemilizer) use the water flow in the irrigation system to drive the injection process. The metering device on the pump automatically adjusts the injection rate with the flow rate of the irrigation system. It requires no external power source and offers a high degree of accuracy.

Electronic injection pumps are piston or diaphragm pumps that inject at a constant rate regardless of flow or pressure changes in the system. Once these pumps are calibrated to a given rate, they are accurate but will need to be checked and recalibrated over time as a result of wear to the pumping components.

Fertigation practice

There is no simple formula for determining fertigation rates and frequencies for olive groves. Rates usually correspond to those used for granular application but frequency of application may range from weekly to fortnightly to monthly.

More frequent applications ensure that nutrients are being supplied to the tree in adequate amounts and reduce the problems associated with salt damage and leaching losses. Since fertigating is generally part of the normal irrigation programme there is little extra cost associated with more frequent applications.

Annual leaf analysis should form the basis of any fertigation programme. In general terms the annual fertiliser recommendation for a mature high-yielding olive grove is about 400 grams of nitrogen (N), 80g of phosphorus (P) and 400g of potassium (K) per tree. Instead of one or two applications of granular fertiliser this could be split into 20 applications of 20g N, 4g P and 20g K spread throughout spring, early summer and mid-autumn.

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Table 1: Analysis Of Fertilisers used in Fertigation

Fertiliser	Percent of Nutrients (w/w)	Solubilty in Water (g/L)	pH Reaction
Urea	N: 46.7%	1000	Acidic
Ammonium nitrate	N: 35%	1183	Acidic
Calcium nitrate	N: 11.9% Ca: 17%	2660	Alkaline
Phophoric acid	P: 31%	5480	Acidic
Monoammonium phosphate (MAP)	P: 26% N: 11.8%	227	Acidic
Potassium nitrate	K: 38.7% N: 13.8%	133	Alkaline
Potassium dihydrogen phosphate	K: 28.7% P: 23.5%	330	Acidic

Typically, N, K, and to a lesser extent P are the main nutrients supplied through fertigation. All plant nutrients can be injected through the system if required. But trace elements are generally more efficiently applied to the trees in foliage spray.

It is important when considering fertilisers for use in fertigation that only highly soluble or technical-grade formulations designed specifically for fertigation are used. Fertilisers have a solubility limit, which refers to the quantity of fertiliser that can be dissolved in water. If this limit is exceeded the fertiliser will settle out in the tank and can cause clogging of equipment such as filters, drippers and sprinklers. Keeping the intake end of the suction line about 150 millimetres above the bottom of the container and putting a small screen over the tube will prevent any undissolved solids from entering the system.

The solubility and the analysis of some of the main fertilisers used to supply NPK in fertigation systems are presented in Table 1.

Fertigation is not restricted to the use of inorganic fertilisers. Organic fertilisers suitable for use in a fertigation system include fish emulsion, liquid manures, worm juice and kelp extracts.

When fertigating, the irrigation lines must be filled with water before injection begins. This will take 5-15 minutes depending on the size of main lines, and the size of block to be irrigated. When injection is complete approximately 30 minutes of continued irrigation is required to ensure uniform distribution of the fertiliser and to flush out the lines.

Effective fertigation is reliant on correctly calibrating the injector system and accurately calculating fertiliser rates of the stock solution. Local agriculture departments, equipment suppliers and horticultural advisers need to be consulted when setting up and developing a fertigation programme.