Agriculture Notes

# Choosing an orchard irrigation system

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***An inevitable question posed at field days after the various types of orchard irrigation systems have been described is, 'Well, now we know how the different methods operate but which is best for me?'***

Unfortunately there is no clear-cut answer to this question because no two situations are the same. Factors such as soil type, crop type, planting density, water quality, irrigation equipment at hand, and economic factors such as the capital cost and operating cost, will all determine the ultimate decision.

This Agriculture Note discusses the most important factors that should be considered when making a choice between the various forms available.

Micro-irrigation systems that apply water to only part of the soil surface (for example, trickle, microspray or microsprinkler) have a number of advantages over more conventional methods of irrigation. These advantages are described below.

## Advantages of micro-irrigation systems

### *Orchard management*

Micro-irrigation systems apply water to the treeline of the orchard only, whereas other irrigation methods (conventional sprinkler, flood and furrow) also wet the traffic-lane between rows.

Irrigating only the treeline ensures traffic access to the orchard at all times for such essential operations as spraying and harvesting.

### *Lower labour requirements*

Less labour should be required to operate piped forms of irrigation. The released labour is then available to perform other tasks around the orchard .

However, this potential benefit may only be realised if the irrigation system is designed with adequate filtration and chlorination and the time saved is not spent cleaning blocked emitters.

### *Control over water and nutrients*

The amount of water applied by micro-irrigation systems can be closely managed to match the requirements of the crop. Therefore the frequency and volume of application are factors that can be used to control the growth of the crop to maximise marketable yield. The option of frequent small applications of water is not available with furrow or flood irrigation. This is because frequent application with either method results in excessive percolation beyond the rootzone in permeable soils or a tendency to waterlogging in less permeable soils. In some cases it may lead to gross inefficiency of water use due to high evaporation losses. Frequent flood or furrow irrigation also increases the access problems already referred to.

Fertiliser can be readily applied through the pipe network of an irrigation system so that the nutrient solution is applied directly to the active rootzone. This reduces the losses of fertiliser that would occur through percolation or uptake by weeds.

### *Control of weeds*

Only small areas of soil are irrigated and so during most of the summer weeds are restricted to localised areas. Such weeds are readily controlled with weedicides and, because the traffic-line is kept dry, access for weed control is available at all times.

### *Use of saline water*

The build-up of salt concentration if the soil dries between conventional irrigations leads to salt uptake by the plant and reduced growth.

Under micro-irrigation, although the whole of the soil is not wetted, the frequent application of water to the wetted area results in the plant being subjected to salt levels not much higher than the level in the irrigation water.

With overhead or poorly placed low-level sprinklers, where salt water is sprayed onto leaves, leaf burn can make the problem worse if salt concentration in the water exceeds about 500 ppm.

### *Irrigation of poor soils*

There are two classes of soils that can cause problems if irrigated by furrow or flood irrigation:

**Soils of high permeability:** Much water is lost due to the rapid percolation of water through the rootzone. This can be both costly and wasteful. In the longer term, watertables are likely to rise, threaten the existence of the orchard and require expensive methods of water-table control. Irrigation systems that apply water to the soil at low rates can be used to reduce the loss of water below the rootzone, where water is applied in daylight hours.

**Soils of low permeability:** Water must be applied for long periods if sufficient water is to enter the root-zone in soils of low permeability. This is likely to lead to aeration problems and restrict orchard access. Micro-irrigation can be operated frequently to overcome this infiltration problem.

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## Disadvantages of micro-irrigation systems

### *Blockage problems*

The main problem that can occur with micro-forms of irrigation is the blockage of the emitter.

Blockages can be prevented provided attention is paid to installing adequate filtration and chlorination systems and operating them in accordance with the manufacturers' instructions.

### *Root development*

There can be problems with lack of root development under some types of micro-irrigation (see next section). This problem can be avoided by selecting the appropriate emitter or number of emitters to ensure that an adequate volume of soil will be wetted and by taking care when the water is applied .

### *Which form of micro-irrigation?*

There are a number of factors that should be considered when deciding between trickle irrigation and some form of irrigation such as microsprays or mini-sprinklers. These are:

• With trickle irrigation there may be excessive losses of water through very permeable soils (if water is applied at night), and through cracking clays if the soil is allowed to dry between applications. In such instances, microjet emitters may be more appropriate.

In other situations, microjet irrigation is likely to suffer higher losses than trickle irrigation because of wind drift and evaporation. However, these losses would be less than with other conventional forms of irrigation.

• Constant ideal moisture conditions for root growth in a restricted volume of wetted soil result in development of a dense mass of roots which will make the plant drought sensitive in times of water shortage. Under these circumstances the crop may suffer moisture stress if there is equipment failure or some other unavoidable reason for withholding water.

The problem can be minimised by using a microjet emitter to increase the reservoir of water held in the soil after irrigation and reducing the frequency of application accordingly .

• There is often a fear that if the rootzone is too small the tree may lack stability in high winds and blow over. However, trees immediately following flood or full scale sprinkling would be more unstable in high winds than trickle or microjet irrigated trees since the whole of the rootzone would be located in soft, water saturated soil. Roots of trees under trickle and microjet irrigation are not entirely restricted to the wetted zone.

• Low oxygen concentrations have been measured in the saturated zone of poorly drained soils that are trickle irrigated and, in extreme cases, trees have died because of waterlogging.

This problem can be avoided by applying water at night and by using tensiometers to match the amount of water applied to the amount of water required. Night application will ensure that the maximum volume of soil will be wetted since plants do not use water at night, and plant use will rapidly reduce the soil water level below saturation when the system is off during the day.

• Blockages can be a major problem with micro-irrigation systems. Microjet emitters have flow paths of comparable diameter to trickle emitters but are much shorter and so the speed of flow is much faster. For this reason they are somewhat less prone to block than trickle emitters.

Microjets are also more readily observed in operation than trickle emitters and so blockages are easier to detect. However, whatever method of micro-irrigation is used, good filtration practices are required.

• Microjets may be knocked from their correct alignment during pruning and harvesting operations. This may result in water being applied to areas that would not normally receive water and where few active plant roots grow. The use of two half-circle microjets attached to galvanised brackets which are nailed to the tree (one on either side) is one way of overcoming this problem.

In high density orchards the irrigation lateral and emitter is often raised above the ground, where knocking from the preferred position is minimised.

• Microjets are likely to wet tree butts; this may cause disease problems in certain situations. Experience in the Goulburn Valley suggests that this is not likely to be a major problem.

• With microjet emitters trees usually only need to be irrigated twice a week to maintain water supply at a tensiometer reading not higher than 50kPa. Growers therefore find it an easier method than trickle.

• Microjet irrigation is usually more expensive to install than trickle irrigation because of the larger pipe sizes required, and more expensive to operate because of the higher pressure used.

## Summing up

Micro-irrigation has a number of advantages over conventional methods of irrigation. The choice between types of micro-irrigation is not as easy and comes down to choosing between trickle and microjet emitters with a wide choice of wetting pattern size and shape.

This choice is made on the basis of:

- cost
- filtration needs (especially on very permeable soils where a large number of outlets, each with a very low flow rate, is required for trickle)
- ability to vary the time of application to night or day depending on whether the soil is poor-draining or free-draining
- willingness to provide a facility to chlorinate the lines
- reliability of the water supply.

Note the difference between a restricted water supply, where trickle is to be preferred, an unreliable supply where microjets may be preferred and a rostered supply where conventional application techniques must be used.