Agriculture Notes

Minisprinkler and microspray irrigation for orchards

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In the last decade there has been a proliferation of minisprinkler and microspray irrigation emitters. As a result virtually any irrigation situation can be accommodated by one form of emitter or another.

Emitters available are commonly known as microsprinklers, microjets, minijets, minisprays and sprayjets. Such terms are best understood by realising that a **sprinkler** uses a moving part to distribute the water while a **jet** or **spray** has no moving part but rather interferes with the water stream to cause it to be distributed over an area.

The prefixes, micro and mini, signify that such emitters have discharge rates of less than 200 litres per hour. The properties of such emitters as they relate to orchard irrigation are as follows.

1. Operating pressure. Almost all the above emitters will operate from pressures as low as 75 kPa up to 400 kPa. Because of the cost of pumping it is usual to operate them between 100 kPa and 150 kPa.

2. Discharge rates. Commercially available emitters discharge water at rates from 20 litres per hour to 200 litres per hour. This wide range of rates allows the selection of an emitter to suit the particular requirements of irrigation frequency and soil type. The lowest rates would generally require two or three irrigations per week.

3. Water distribution. There are as many patterns of water distribution as there are emitters. For this reason it is essential that the person designing the irrigation system is familiar with the various types of emitters.

Most of the spray or jet emitters apply water over small (diameters of 2 metres) areas within which are localised areas receiving much heavier applications. Consequently, it is important that the areas receiving the bulk of the water are in the vicinity of the plant roots.

Minisprinklers generally apply water over a larger area (diameters of from four to 10 metres) and, apart from an area near the emitter which receives more water, the water is uniformly distributed. Such emitters can be used for a wide range of crops and planting distances.

4. Application rates. Rates are calculated from the discharge rate and the water distribution and are relevant only to the wetted surface area. Again there is a wide choice. Rates can vary from 2 mm per hour to 50 mm per hour. Many minisprinklers apply water at an average rate of 2 to 5 mm per hour.

5. Lateral sizes. Because these emitters discharge water at a greater rate than most trickle emitters, the piping has to be larger. This leads to increased cost of the system. However, because of the method of operation of these emitters, there can usually be a greater variability of pressure within the lateral. This particularly applies if pressures above 175 kPa are used.

By utilising these facts you can minimise the capital cost of such a system but the running cost will increase proportionally with the increase in pressure. There have been instances of growers successfully changing from trickle irrigation to minisprinkler irrigation by merely changing the emitters and raising the operating pressure slightly. This depends, however, very much on the particular orchard.

6. Filtration. Because minisprinkler and microspray emitters use orifices of diameters of 1mm or more, blockages caused by silt sized particles or algae should not occur as frequently as with trickle irrigation.

However, filtration is still required since plant fibre in the water is very often of 1mm size and can become lodged in the orifice. Mesh filters finer than 30 - 40 mesh should be satisfactory, and chlorination should still be carried out occasionally as a safeguard.

7. Period of operation. The maximum length of time that the irrigation system is operated depends upon the soil type (the water holding capacity of the soil), the irrigated root depth and the soil dryness when an irrigation is due.

The actual length of time that the irrigation system is operated should be calculated from pan evaporation (or reference crop evapotranspiration - ET_o), crop factors (or crop coefficients - K_c), the planting square, the emitter discharge rate and the number of emitters per tree. Usually an extra 10 to 20% water is applied at each irrigation to allow for losses from surface evaporation.

The irrigation interval depends on how quickly the plants use up the irrigation water applied. That is, the orchard water use.

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Orchard water use is calculated from evaporation, crop factors and the planting square. Soil moisture should also be measured to help determine when an irrigation is due and to avoid over or under irrigation. Crop factors may need adjustment due to local conditions and measuring soil moisture will aid the adjustment.

Comparison with trickle systems

The main difference between minisprinkler/ microspray systems and trickle systems of irrigation is the wetting of a larger soil volume by the spray or jet emitters. This occurs by virtue of the water being distributed over a larger area of soil; trickle systems apply water to the one point and rely on the soil properties for distribution of the water.

The wetting of a larger surface of soil is important on sandy soils where little lateral movement occurs within the soil, and on some clay soils where cracking of the soil is severe.

The wetting of a larger soil volume should result in bigger trees but not necessary more productive trees. Wetting a larger soil volume makes for a safer system because the interval between irrigations is longer and hence, there is less risk from excessive soil dryness if, for example, the pump breaks down.

Comparison with conventional sprinklers

All forms of micro-irrigation offer advantages over conventional sprinklers in that micro-irrigation systems apply water to each tree individually along the tree-line where the concentration of roots is the highest.

A system with one mini-sprinkler per tree (or two trees in the case of close plantings), plus hilled-up tree-lines for maximum root growth and surface drainage, appears to offer many advantages as a system of orchard management. However, because of the great range and cost of the emitters available, and the conditions under which they operate, it is most important that the irrigation system be designed by someone who is familiar with the particular irrigation method. This ensures efficiency of operation and minimises the overall cost of the system.