# Irrigation

It is important that any intensive pear orchard has a secure supply of good quality irrigation water. Water plays a key role in all stages of pear tree growth and development. Irrigation management in an intensive pear orchard should aim to achieve full production potential with the most efficient use of irrigation water. This means selecting the most suitable irrigation system, understanding tree water use, and scheduling and monitoring irrigation using the appropriate techniques.

## Selecting an irrigation system

*Figure 1: Installing irrigation*

Suitability of an irrigation system will depend on: soil type, crop type, planting density, water quality and supply, irrigation equipment availability and economic factors such as capital and operating costs.

In frost prone areas it's important to consider the effectiveness of the irrigation system for frost protection.

There are many irrigation systems available for use in orchards and each has its own advantages and disadvantages. For high density orchards, favoured systems are mini-sprinkler or drip irrigation.

Irrigation systems should be designed by someone who is familiar with the irrigation method and orchard conditions.

*Figure 2: Mini-sprinkler irrigation*

## Irrigation monitoring and scheduling

Irrigation scheduling determines the volume and frequency of water to be applied to an orchard. The aim of an irrigation scheduling plan is to calculate tree water use and determine the length of time it will take for trees to deplete soil moisture between irrigations. This means understanding climatic conditions (evaporation), soil moisture and tree water use at different growth stages.

Irrigation scheduling is largely based on soil moisture. Calculations for scheduling irrigations are based on:

- Readily Available Water (RAW) – using the size of the wetting pattern, the root zone depth and water holding capacity of the soil.
- Tree Water Use – using Pan Evaporation, Crop Factors (which relate tree water use at a particular stage of growth to the amount of pan Evaporation) and the planting square.
- Monitoring of soil moisture to determine if irrigation amounts are accurate is often done through soil moisture monitoring devices that measure soil suction (e.g. tensiometers, gypsum blocks) or soil moisture content (e.g. EnviroScan®). The positioning of these devices in an orchard needs to be carefully selected in order to allow for soil and crop variations.

In more recent years, investigations into precision irrigation have looked at incorporating adjustments for tree canopy cover to determine water use and use of tools that directly measure plant water stress such as pressure bombs. It is also worth noting that recent research has shown that pear water use is not constant over production and cropping periods and can be reduced significantly immediately after harvest .

### Scheduling for Regulated Deficit Irrigation (RDI)

Reducing water use without affecting yield and fruit quality has received much attention over the past 20 years, particularly Regulated Deficit Irrigation (RDI). RDI restricts water availability during periods of slow fruit growth and rapid shoot growth to save water as well as reduce vegetative vigour. RDI is known to restrict vegetative growth and increase yield in pears if applied at the correct

level and time. In basic terms, RDI scheduling involves applying less water at the same frequency during the period of vigorous shoot growth. During this period fruit growth is slow and less sensitive to water. In pears this is generally from the start of November until six to eight weeks before harvest.

RDI has been widely investigated and used in moderate to low density pear orchards where it has proven to be a useful tool. In intensive pear orchards, potentially on less vigorous rootstocks, the risk of water shortage inducing heavy stress is higher and could cause reduction of fruit quality and flowering capacity for the next year.

Recent postharvest applications of RDI for Conference have been successful but the imposed stress must be moderate, as severe water stress can reduce yield. What constitutes moderate or severe water stress varies between varieties and it's important not to assume that what works for one variety will work for all.

This means that any irrigation management strategy will need to be adjusted to suit. The best time to apply RDI varies between varieties and regions. Growers should consult an irrigation expert for further assistance with irrigation scheduling and monitoring in their orchards.

## Water Quality

Water intended for irrigation should be tested, as poor water quality can impact negatively on plant health and productivity, as well as irrigation equipment.

### Salinity

Salinity is a measure of the amount of dissolved salts in water. High salinity levels make it difficult for cells to absorb water and dehydration can occur. The level of dissolved salts can be measured through weighing the amount of dissolved solids per litre of water (mg/L). This is referred to as the total dissolved solids (TDS). Electrical conductivity (EC) of water is also a measure of the salinity level. The most desirable level of salinity for pears on loamy soils is <700 EC (or, <TDS 500). However actual irrigation salinity thresholds will be site specific, varying with climate, soil conditions and cultural practices.

### pH

Ideal water pH is in the range 6.5 to 7.5. Water acidity (<6) or alkalinity (>8) will not necessarily rule it out for irrigation use. However, it may influence the choice of fertilisers for fertigation and pesticides in spray tanks as low or high pH can alter efficacy. Acid and alkaline waters can also affect irrigation equipment efficiency.

## Maintenance of irrigation systems

It is important that regular monitoring of irrigation systems is undertaken to ensure that the correct amount of water is consistently delivered across the orchard. Growers need to check flow rates and pressure regularly and ensure that the system does not have blockages, broken pipes and damaged or missing emitters. See further information for details on maintaining irrigation systems.

## Irrigation Trials in the Pear Field Laboratory DEPI Tatura

The irrigation experimental block was planted in September 2012 with a red-blushed pear from the Australian National Pear Breeding Program (ANPBP). Trees were trained with four-leaders to an Open Tatura trellis and irrigated by either drip or microjet systems. Irrigation was managed to ensure all trees were well-watered and commenced in late-September 2012. Irrigation was applied at either 'standard' or 'pulse' frequencies. Recent results have shown that drip irrigation uses significantly less water than microspray and may improve precocity and decrease vegetative growth in young pear trees. However, weed growth in trials was more pronounced under drip, making weed management a priority.

## Further information

These Australian and international sites may be useful for growers. However they are intended as an information source only. Any specific recommendations may be outdated or irrelevant for Australian conditions and growers should seek local advice.

## Australian Resources

A range of useful articles on orchard irrigation for Australian growers can be found in *Tree Fruit* magazine: http://www.treefruit.com.au/index.php

Selecting an irrigation system for your crop : information from savewater.com.au
http://www.savewater.com.au/

Choosing an orchard irrigation system : Victorian Department of Environment & Primary Industries AgNote AGO 192: http://www.depi.vic.gov.au/agriculture-and-food/horticulture/fruit-and-nuts/orchard-management/choosing-an-orchard-irrigation-system

Minisprinkler and microspray irrigation for orchards: Victorian Department of Environment & Primary Industries AgNote AGO 296: http://www.depi.vic.gov.au/agriculture-and-food/horticulture/fruit-and-nuts/orchard-management/minisprinkler-microspray-irrigation-for-orchards.

Why water fruit trees?: Victorian Department of Environment & Primary Industries AgNote AGO 297: http://www.depi.vic.gov.au/agriculture-and-food/horticulture/fruit-and-nuts/orchard-management/why-water-fruit-trees

Costing an irrigation system:
http://www.dpi.nsw.gov.au/agriculture/resources/water/irrigation/costs/cost-calculator

**Irrigation monitoring and scheduling**

Gypsum blocks for measuring the dryness of soils: Victorian Department of Environment & Primary Industries AgNote AGO 294: http://www.depi.vic.gov.au/agriculture-and-food/farm-management/soil-and-water/soils/gypsum-blocks-for-measuring-the-dryness-of-soil

How to use tensiometers : Victorian Department of Primary Industries AgNote AGO 298: http://www.depi.vic.gov.au/agriculture-and-food/horticulture/vegetables/vegetable-growing-and-management/how-to-use-tensiometers.

Irrigation scheduling for regulated deficit irrigation (RDI) : Victorian Department of Primary Industries AgNote AGO 299: http://www.depi.vic.gov.au/agriculture-and-food/farm-management/soil-and-water/irrigation/irrigation-scheduling-for-regulated-deficit-irrigation-rdi

Calculating available water: https://www.agric.wa.gov.au/water-management/calculating-readily-available-water

Converting readily available water to litres: https://www.agric.wa.gov.au/water-management/converting-readily-available-water-litres-drip-irrigation

**Water quality**

Testing and interpretation of salinity and pH : Victorian Department of Primary Industries AgNote AGO 244: http://www.depi.vic.gov.au/agriculture-and-food/farm-management/soil-and-water/salinity/testing-and-interpretation-of-salinity-and-ph

Salinity : NSW Department of Primary Industries resources http://www.dpi.nsw.gov.au/agriculture/horticulture/vegetables/translated/water-chemical/irrigation-water-quality

**Maintenance of irrigation systems**

Maintenance of micro-irrigation systems : Victorian Department of Primary Industries AgNote AGO 137: http://www.depi.vic.gov.au/agriculture-and-food/horticulture/vegetables/vegetable-growing-and-management/maintenance-of-micro-irrigation-systems

## References (Note full access may incur a fee)

Goodwin, I., Whitfield, D.M. and Connor, D.J. (2006) Effects of tree size on water use of peach (*Prunus persica* L. *Batsch*). Irrigation Science 24: 59-68

Marsal, J., Lopez, G., Mata, M. and Girona,J. (2012) Postharvest deficit irrigation in 'Conference' pear: Effects on subsequent yield and fruit quality. Agriculture Water Management 103: 1-7.

Sansavini S, Ancarini, V. and Neri, D. (2008) Overview of intensive pear culture: Planting density, rootstocks, orchard management, soil-water relations and fruit quality. Acta Horticulturae 800: 35-50.