

Introduction to Open Hydroponics

Open Hydroponics is an irrigation and nutrition management program aimed at increasing yield and fruit quality of horticulture crops. The fundamental principle of Open Hydroponics is that nutrients are applied continuously by drip irrigation that is operated at very high frequency. Design, installation, operation, monitoring and control are all critical components of Open Hydroponics. Professor Rafael Martinez (University Miguel Hernández, Spain) was the first to introduce the concepts of Open Hydroponics into Australia. There are now a number of commercial consultants offering advice and services for Open Hydroponics.

Advantages

The expected advantages of Open Hydroponics over a conventional production system include:

- An increase in yield by improving tree health and vigour
- Potential to increase fruit quality by greater control of the concentration and uptake of nutrients in the root zone
- Reduction in transient periods of water stress by better management of soil moisture.

How does it work?

Open Hydroponics is an adaptation of commercial soil-less hydroponics to soil based production. The aim is to reduce the influence of the soil as a storage medium and use the soil to anchor the tree and deliver nutrient solutions to the roots. The key principles of Open Hydroponics compared with a conventional production system are:

- The active root-zone is limited to a small wetted soil volume. This is achieved by reducing the number of drippers per tree.
- A balanced nutrient solution that is pH adjusted is continuously applied into the irrigation. This requires the installation of a proportional injection fertigation system that adjusts the pH of irrigation water by injecting acid.
- The wetted soil volume is always maintained near field capacity. This requires the use of soil moisture monitoring equipment (e.g. capacitance probes) and the installation of a specialised drip irrigation system that is capable of pulsing (e.g. 6 to 9 irrigation pulses per day) or operating continuously throughout the daytime.

What are the risks?

Open Hydroponics has the potential to increase orchard productivity but there are risks that could reduce productivity, increase leakage of nutrients and increase root-zone soil salinity. These risks include an unreliable water supply and inadequate management skill.

Open Hydroponics orchards have restrictive root zones that may only hold a days supply of readily available water (RAW) during high demand periods. A cut to the water supply for a number of days during this period could significantly impact on the productivity of the orchard. On-farm water storage, back up pumps and electric generators are required to reduce the risk. Similarly, an under estimation of irrigation requirements will cause trees to become water stressed. In contrast, an over supply of irrigation will result in waterlogging of trees and/or drainage of water below the root-zone and potential leakage of nutrients.

A misjudgement in nutrient application rates could impact on yield and fruit quality by a deficiency or toxicity of specific nutrients and an increase in root-zone salinity. Strategic leaching irrigations may be required to reduce root-zone salinity. The timing of leaching irrigations will need to be carefully managed to ensure that excessive nutrients are not washed past the root zone.

Management

Open Hydroponics is complex and requires a high level of technical competency. A consultant is normally used to provide advice on Open Hydroponics including the design, installation, basic training in operation, provision of nutrient recipes and injection rates, irrigation scheduling techniques, and the interpretation of data collected by monitoring equipment. Regular visits need to be made by a consultant to fine-tune the irrigation and fertigation program.

Further information

More information about the project assessing open hydroponics is available from the NPSI website in the 'Current Research Projects' section, www.npsi.gov.au/research.asp.

The following fact sheets and papers produced by the project are also available:

- [Adopting Open Hydroponics: Factors to Consider](#) (pdf 70Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1 Project Findings Overview](#) (pdf 70Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1: General Principles and Literature review](#) (pdf 836Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1: Water Nutrient and Salt Balance Report](#) (pdf 535Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1: Water Supply Impact Assessment Report](#) (228Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1: Ecological Risk Assessment Report](#) (301Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1: Final Report](#) (pdf 190Kb)
- [Open Hydroponics: Risks and Opportunities, Stage 1: Workshop Report](#) (pdf 2Mb)

Open Hydroponics: Risks and Opportunities Project Team

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About the Program

The National Program for Sustainable Irrigation focuses research on the development and adoption of sustainable irrigation practices in Australian agriculture. The aim is to address critical emerging environmental management issues, while generating long-term economic and social benefits that ensure irrigation has a viable future. The Program has 14 funding partners: Land & Water Australia (Managing Partner); Sunwater, Queensland; Horticulture Australia Limited; Goulburn-Murray Water, Victoria; Cotton Research and Development Corporation; Harvey Water, Western Australia; Lower Murray Water Authority, Victoria; Wimmera Mallee Water, Victoria; Ord Irrigation Cooperative, Western Australia; Australian Government Department of Agriculture, Fisheries and Forestry; Department of Natural Resources and Mines, Queensland; Department of Primary Industries and Resources South Australia; Department of Environment Water and Catchment, Western Australia; and Department of Agriculture, Western Australia.