Orchard floor management

Donna Lucas, August 2014

There is no perfect system - the key is to keep the soil covered as much as possible - and also manage competition from weeds and ground covers. Long-term studies have shown that leaving the soil bare all year round (e.g. with regular use of pre-emergent herbicides) does not give the best long-term yields and quality. Less frequent spraying with post emergent herbicides results in better soil quality, better soil water holding capacity, more plant available nutrients, less runoff, and less nitrogen leaching. The best time to control weeds is when the trees are actively growing, so that you remove the weed competition.

Each orchard floor management system has its advantages and disadvantages, and there is no perfect system because we often need to compromise between various objectives.

Orchard floor management includes several components that all interact[i]:

- **Soil** – plant available water, plant available nutrients, erosion control, compaction, nutrient cycling, gas exchange, soil-borne disease control, carbon storage, pesticide decomposition, soil life
- **Water and nutrients** – intake, storage and cycling, minimal nitrate and chemical leaching, water conservation
- **Biodiversity** – potential to control pests via IPM, legumes to fix nitrogen, soil fauna and flora diversity, beneficial organisms
- **Energy** – frost protection, reduced energy inputs for machinery and irrigation

So what are the options?

In Tasmania, it is common practice to use grass alleys with a herbicide strip. Most of the tree roots are along the tree line, so it is important to mange competition for water and nutrients. Often the tree line is sprayed regularly with herbicides. In some orchards, continuous use of herbicides has resulted in soil structure decline (crusted soil surface, compaction, moss, reduced organic matter, Figure 1). This in turn means poorer root growth, reduced soil life and less nutrients and water available for the trees.

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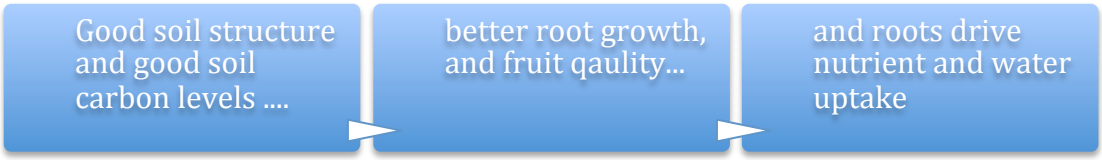


Figure 1: Soil crusting. A typical orchard with grass alleys and herbicide tree-line strip.

An increasing problem in some orchards is the incidence of difficult to manage weeds such as mallows and herbicide resistance (Figure 2).

Figure 2: Mallow can become difficult to manage

A good option is to allow grass, oats or other cover crops to grow along the tree line during the autumn and winter (i.e. a living mulch), and then spray with a knockdown herbicide prior to the growing season for the fruit tree. Advantages of this type of system include:

a) the living mulch protects the soil and provides organic matter inputs; and

b) they can outcompete the more problematic weeds.

A disadvantage of this system can be that the cover crop interferes with sprinklers, and managing the height of living mulches can sometimes be difficult (Figure 3).

Figure 3: Living mulches are a good option if height of the mulch is well managed.

Other mulching methods including side discharge mowers that throw grass cuttings onto the mulched strip. This can help to maintain soil quality and adds organic matter to the tree line. This can improve water use and can also reduce herbicide use and frequency. Note that you should not allow excess material to build up against tree trunks; otherwise trunk rots may become a problem.

If you decide to go down the path of using amendments like composts to build organic carbon, evaluate them carefully, and make sure you consider the costs, logistics, integrity and nutrient composition, especially nitrogen of the product you are applying.

Frequently asked questions:

Will cover crops compete with trees for moisture during summer?

Yes, they can compete for water during summer, so it is best to mow or spray off the cover crops in early spring.

Does clover, as a cover crop, provide too much nitrogen, which can then adversely affect fruit quality?

The amount of nitrogen provided can depend on the type of clover legume and whether it has been inoculated.

Generally, a high nitrogen supply will not be a problem so long as it is balanced with other nutrients, especially calcium (Ca) and potassium (K).

If I use mulch or compost, will there be a nitrogen drawdown, and what should I do?

The carbon:nitrogen ratio (C:N) of mulch materials can vary considerably e.g. young lucerne 13:1, wheat straw 80:1[ii]. If the C:N ratio is higher than about 25:1, nitrogen can be temporarily removed from the soil (because soil microbes will use nitrate from the soil to break down the carbon rich material). The C:N ratio of grass clippings is about 20:1 and does not usually cause any problems, although it is advisable to monitor soil nitrate levels. Mature composts should also not draw down available soil nitrogen.

So, it is important to choose an appropriate mulch, and even more important to monitor soil available nitrogen. There is an easy-to-use, low cost, in-field nitrate test available (Figure 4), which can be used for monitoring and comparing different areas or blocks. This test should

not replace standard available and total soil nitrogen analysis, but can provide a good guide to indicate differences between blocks or treatments and give an indication of trends.

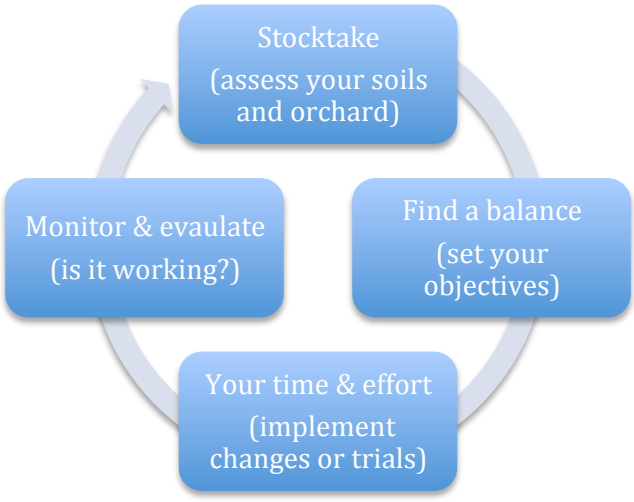
Figure 4: Soil nitrate in-field testing strips

Other considerations

- **Trialling different practices** in a small area is always a good idea, but remember to monitor these areas e.g. through regular photographs, digging and assessing the soil and soil nutrient and water monitoring.
- **Investigate the economics**. Previous research has shown that some types of mulch for example, can provide the best yield results. However, mulch treatments can often be the most expensive systems.
- **Young orchards** require different management to mature orchards. Weed control and management as well as balanced nutrition in the early years is crucial for tree growth. If tree growth is reduced, this will translate into reduced profits and later payback, which is especially important in high-density plantings. Poor tree growth is usually a reflection of poor root growth – take a spade and check where the roots are and whether they are healthy.

There is a lot to consider, how do I put it all together?

While there is no perfect system and no 'one size fits all', this approach can be useful:



- **Stocktake**: Assess your orchard, including:
  - soil condition (structure, soil organic matter, water infiltration, plant roots, nutrients)
  - weed problems
  - nitrogen management plan including fertiliser types and application methods (e.g. fertigation), current nitrogen use efficiency (NUE%)
  - current orchard floor management system including for example: width of herbicide strip, ground cover type and % coverage in alleys, and problem areas
  - *NB issues can change with the age of the orchard.*
- **Find a balance**: Identify the objectives for you and your orchard e.g. reduce soil crusting, improve nitrogen use efficiency, maximise water storage and nutrient cycling
- **Implementation**: implement changes and/or trial different practices
- **Monitor and evaluate**: monitor how it is going and make adjustments; anticipate problems before they occur.

For further information or assistance with soil health assessments contact:

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Further reading:

Washington State University, Organic & Integrated Tree Fruit Production: http://www.tfrec.wsu.edu/pages/organic/Soils