Factsheet

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Cover crop seeding guidelines

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Introduction

While establishing a healthy cover crop stand may not seem difficult, good agronomic practice can increase your chances of success. There are several factors to consider when choosing a cover crop, including:

- climate – temperature and rainfall (total and seasonal distribution)
- soil type – depth, water holding capacity, pH, salinity, texture, susceptibility to erosion
- end use – mown/rolled/cultivated as a green manure, maintained as a regenerating or perennial stand, grazed, insect habitat, mulch, water extraction, visual appeal.

Once the species to be sown has been chosen, the following factors should be considered before sowing:

- seed quality
- soil tests
- time of sowing
- ground preparation
- fertilisers
- equipment
- seed depth
- weed control.

Seed quality

Fresh viable seed should be sown. If you have any doubts about the germination potential of the seed, you can do a simple germination test by placing 50 representative seeds on moist cotton wool or paper towel for a week. This will provide a good indication of the viability of your chosen cover crop species.

Soil tests

If you do not know the level of soil nutrition in the mid-row, a comprehensive soil test can help you decide whether additional fertiliser should be applied with the seed. The soil test can be used as a nutrient monitoring exercise, where the vineyard is sampled every few years from the same rows to determine changes in soil nutrient status. Alternatively, where soil nutrition is suspected of being responsible for poor growth, soil can be sampled from sites displaying high and low production and the results compared. It is important to note, that such variations in production may be due to other factors besides soil nutrition; for example, soil depth, soil-borne disease, nutrient toxicities and foliar pests and diseases can also influence plant growth.

Time of sowing

Where annual crops are grown to maximise biomass production, they need to be sown early (April–May) and when a false break to the season is unlikely. Where weeds are unlikely to be an issue and soil structure permits, seed can be sown while the soil is dry. Otherwise, seeding time will often be dictated by the need for rain to stimulate the germination of weeds to enable their control ahead of sowing. This may, in turn, be dictated by leaf fall, which can delay the application of glyphosate-based herbicide for broad-spectrum knockdown of weeds before sowing. The use of a covered sprayer or a shallow cultivation may be an alternative strategy to prevent the delay in seeding. Seeding into soil that is free of actively growing weeds will enable the cover crop to establish without competition, and then to provide its own competition for newly emerging weeds during the growing season.

Ground preparation

Where possible, direct drilling with minimal soil disturbance is preferable. This conserves soil organic matter, rather than exposing it to the air, which will oxidise it to CO_2. Populations of beneficial soil invertebrates such as ants, millipedes and centipedes, which can predate on pest populations, are also reduced by cultivation (Sharley & Thomson 2005). Where weed seeds lie on the soil surface, their germination will be reduced by leaving them undisturbed through direct drilling. Cultivation, however, will bury some seed at depths that are conducive to

germination, generating a flush of weeds that will need to be removed before sowing.

Fertilisers

The potential biomass production of a cover crop is governed by the genetics of the species planted and the environment in which it is growing (phenotype). Once the most suitable species for the site has been chosen, the agronomic factors need to be addressed if the genetic potential of the plant is to be realised. Optimal access to nutrients is one critical factor that will determine biomass production, but fertiliser application should only be made in conjunction with knowledge of other critical limiting factors such as growing season rainfall, time of sowing, past cropping history and nutrient demands of the crop to be sown.

Most exotic plant species have high nutrient requirements for maximum productivity, whereas native species (grasses, saltbush) are often disadvantaged by added nutrition because weeds will use the nutrients to provide them with a competitive advantage.

Nutrients applied to the mid-row are primarily for the benefit of the cover crop. In higher-rainfall zones, vine roots may access some of the more mobile applied nutrients, such as nitrogen that have leached beyond the main zone of root activity of the cover crop. Applied phosphorus will remain in the top 10 cm of soil, which may be accessible to vine roots in some situations (e.g. high rainfall and non-competitive cover crop).

It is important to note that vines are very economical nutrient users. In total, for a 20 tonne/ha crop, between 28 and 34 kg/ha of N is removed, or about 1.5 kg N/tonne. For other nutrients, the approximate levels for the major elements are (in kg/tonne of fruit) phosphorus 0.3, potassium 3.1, sulphur 0.1, calcium 0.5 and magnesium 0.1 (Glendinning 2000). The trace elements are also vitally important to vine health, and are removed at levels of grams per tonne of fruit. Levels of nutrient requirement by the vines are therefore very modest. Cover crops also need additional fertiliser only rarely because when they are mown or rolled in spring, the nutrients they have used for growth are simply returned to the soil. Some losses of volatile components will occur through oxidation (e.g. of carbon and nitrogen) and leaching of nitrogen, but the stable elements will cycle back into the soil system. Therefore, if there is enough nutrition to grow a cover crop, it is unlikely that fertiliser will need to be applied for many years into the future. Where the cover crop is side-thrown under the vine row (Freeman 1987), the nutrients contained in the tissue will also be transferred. While this will potentially supply adequate nutrition for grape production, it will lead to a depletion of nutrition in the mid-row over time. Maintaining legumes within the cover crop mix or within the rotation will extend the time until a top-up of nutrients is required.

Figure 1: A power harrow fitted with a seed box and compaction roller is an alternative seeding system to the traditional tyne- or disc-based drill.

Equipment

The preferred machine for seeding is a disc seeder, which will ride over or cut through canes rather than blocking, as can happen with tyned machines. Other machines such as rotating harrows with seed boxes mounted on them are also very effective, and generate some soil tilth in the seeding process.

Seed depth

Seeding depth is a function of seed size. With small seeds (e.g. ryegrass, fescues, native grasses, clovers, oilseeds and medics), the preferred depth is 10–15 mm, due to the small energy supplies of the seed, and the short coleoptiles (the first 'leaves') that emerge from the soil surface.

Where annual cereals and grain legume crops are sown, the larger seeds are more forgiving of seeding depth, enabling them to be sown deeper (20–40 mm). The seed must be covered with soil, and then ideally press wheels or a post-seeding roller will provide the seed/soil contact that is needed to gain good germination.

Weed control

Apart from drought, poor weed control is probably the main reason for cover crop failure. In addressing this issue, it is necessary to consider the requirements of both organic and conventional producers.

Organic

Weed control in organic viticulture requires a whole-systems approach (Madge 2005), potentially involving a combination of several approaches and seasons to overcome weed problems. However, it is important to recognise that many plants in a vineyard that are often seen as weeds actually have no detrimental effect on the vines' production, so accepting their presence, as long as they are not undesirable, may be a less stressful approach.

Establishing a cover crop without herbicides may seem a daunting task to many, but in most situations it is possible. There are times, however, when the weed species present do not respond to non-chemical methods, making it necessary to resort to herbicides and break certification, coexist with the weeds in question, or adopt some unconventional practices. For example, bulbous weeds such as soursob *(Oxalis pes-caprae)* and weeds with rhizomes (e.g. couch grass, *Cynodon dactylon*) are very difficult to eradicate mechanically, and doing so requires a lot of cultivation, when the soil is dry, which will destroy soil structure. Alternatively, if the vineyard is fenced, grazing geese and bettongs (Brookman 2006) can be very useful weed control agents. Where recalcitrant weeds such as these are present and animals are not an option, it is much more environmentally friendly to use acceptable herbicides before adopting organic certification.

With regard to other annual weeds, where they are not at high populations, sowing early with competitive species at high seeding rates will often overwhelm the weeds. Cereals (e.g. barley, triticale, oats and wheat) are very competitive in suitable growing environments and, if managed correctly, will provide an effective mulch over the summer period as well.

Figure 2: **Weed control is critical to successful cover crop establishment. Where glyphosate application was intentionally turned off for two panels while seeding barley in May 2008, the cover crop is a complete failure (Nuriootpa, South Australia).**

Figure 3: **Mowing the mid-row and undervine simultaneously is an efficient non-chemical weed management strategy.**

Where a high weed burden is suspected, very shallow cultivation (2–3cm) of newly emerged seedlings followed by a period of dry weather will eradicate the emerged weeds without bringing fresh seed into the zone in which germination and emergence is possible for the smaller weed seeds. This will mean that seeding will be delayed until breaking rains have generated a weed germination. Sowing competitive species at high rates into this clean seedbed, with minimal disturbance and leaving the remaining weed seed at depth, should provide a relatively weed-free cover crop.

Conventional

The range of herbicides permitted for use in viticulture in Australia is restricted; see the Australian Wine Research Institute's Agrochemicals webpage at http://www.awri.com.au/industry_support/viticulture/agrochemicals/ for details. When pre-sowing weed control is required, this is generally achieved by applying a knockdown herbicide spray (e.g. glyphosate, glufosinate ammonium) and then sowing the cover crop soon after. Sowing into soil of optimal nutrition and water content will ensure a rapid germination and establishment. As for organic systems, high seeding rates and competitive species will prevent the need for any post-emergent weed control, which is expensive and in most cases unnecessary.

Weed control post seeding

In organic systems, the choices for post-emergent weed control are essentially limited to mowing and grazing. An organic herbicide made from pine oil (Interceptor®) is available, but its use is restricted to small areas or spot spraying, due to its prohibitive expense. In some situations, mowing may provide the cover crop with

a competitive advantage; making use of the selective grazing capacity of sheep can also be effective.

Of the cover crops grown in vineyards, faba beans (*Vicia faba*) are quite unpalatable to merino sheep, enabling weeds to be grazed from amongst them.

In conventional systems, a range of selective herbicides are registered for use in vineyards, but the standard rules apply for weed control, namely that control is much easier when the weeds are young, and they must be actively growing and not stressed by drought or frost at the time of control.

Summary

Cover crop establishment can be as easy as putting seed in the drill and planting it. Generally, however, more thought and activity are required to establish a satisfactory stand. By following the guidelines provided above, you should be successful in establishing your cover crop, weather permitting.

References

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