

# Fundamentals of covercropping for drought conditions

Yasmin Chalmers , 2009

Soils that can provide moisture and nutrients to the vineyard will be the best remedy to the current drought conditions that many Australian viticulture regions are experiencing. Covercrops are a perfect solution to improving and preserving soil structure, productivity condition and water-holding capacity.

Covercrops have a number of potential advantages and disadvantages that need to be kept in mind when establishing or maintaining under drought conditions.

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>Improved water penetration and infiltration</li> <li>Maintain soil organic matter that improves soil structure and water holding capacity</li> <li>Increase effectiveness of rainfall events in leaching salts when the mid-rows are cover cropped</li> <li>Reduce reflected heat resulting in higher humidity and lower vineyard temperatures</li> <li>Improve soil fertility – legumes contribute to soil nitrogen levels</li> <li>Reduce soil compaction and crusting</li> <li>Stabilise soil to reduce soil erosion and water run-off</li> <li>Improve weed control</li> <li>Reduce dust</li> <li>Improve insect control by providing good habitat for beneficial predators</li> </ul>	<ul style="list-style-type: none"> <li>Difficult to establish and maintain under drip-irrigation and low rainfall areas as the mid-row remains dry and possibly saline</li> <li>May compete with vines for soil moisture and nutrients. This is more so for sprinkler irrigated vines as under drip, as the wetted strip is away from the cover cropped area</li> <li>Certain weeds may become a problem in permanent swards</li> <li>May allow the build-up of some pests e.g. Snails, light brown apple moth in legumes</li> <li>Can increase frost risk if not managed properly</li> </ul>

## Covercrop Selection

The most important part of the selection process is to choose a covercrop for the purposes that have been identified as integral to the goals and objectives of the vineyard's management. For example, soil binding to reduce erosion will require plants with strong stolons and rhizomes needed to cover the ground quickly and effectively.

The process of selecting the right covercrop species begins with a close look at cultural practices. A key consideration is whether the covercrop will be mowed or cultivated.

The next important point to consider is the amount of rainfall and irrigation that is available during the year for the covercrop. This determines whether the covercrop will be grown in winter, summer, or not at all. Full irrigation with sprinklers allows a wide range of choices, whereas drip limits the choices to winter annuals or drought-tolerant perennials.



Vineyard characteristics must also be considered so the covercrop does not create problems with vineyard management. Even with surface irrigation, a sandy soil will support a covercrop such as barley or rye better than oats. A vineyard on sandy soil with a drip irrigation system cannot support a perennial sward unless there is sufficient rainfall throughout the season. Some plants are very specific in their pH requirements and while most will do well on slightly acid soils, when the pH climbs above 8.0 the choices are limited to barley, medics, fescues, strawberry clover and other alkaline adapted plants.

Factors to consider before establishing include: rainfall (when, how much), irrigation system (ability to irrigate mid-row section), soil type, vineyard topography, frost risk area, weed pressure and vineyard resources (cost, establishment time).

Covercrops need to satisfy a number of factors and unfortunately, there is not one type suitable for every situation. However, covercrops with the following characteristics are more desirable:

- Drought tolerant.
- Not highly competitive for nutrients.
- Good winter/spring growth.
- Dormant in summer.
- Low growing.
- Ability to self seed.

Perennial/permanent swards can provide a green ground cover all year round. These can include planted perennial grasses, clovers or annual medics. Natural stands of grasses and broadleaf weeds can also be grown this way.

Green manure is an annual covercrop for maximum biomass production that will improve soil organic matter. This crop is sown in autumn and then mowed or desiccated before budburst. Cereals (oats, barley, rye) and legumes (faba bean, field pea, medics, clover, lupins and vetches) are the main green manure cover crops.

During drought conditions a covercrop will help to:

- Stabilise soil structure.
- Produce biomass for the vineyard.
- Reduce reflected heat into the canopy.
- Improve water holding capacity or infiltration rates.
- Reduce vineyard temperatures.

With the persistent drought conditions and increasing use of drip irrigation, growers are seeking alternative covercrops that are tolerable to drier conditions. Native perennial ground covers and grasses may have considerable potential as mid-row covercrops. They tend to be well adapted to a wide range of environments, and their water use and weed competitiveness suggests they could be well suited to vineyards. A drawback though is that currently, native covercrops are expensive to establish. Seed treatment techniques are currently being developed for a range of native species to enable ready establishment through conventional seeding equipment. This has not stopped the adoption of several native perennial trials across vineyards in South Australia and North-West Victoria.

#### Saltbush Trial

The Murray Valley Winegrowers Inc. (MVW) in co-operation with New South Wales Department of Primary Industries has established and maintained an ongoing native covercrop trial in a drip irrigated Chardonnay vineyard under water stress conditions. Demonstration sites were established in the Coomealla and Robinvale regions and planted with a seed mix of the *Atriplex semibaccata* (Creeping Saltbush), *Atriplex suberecta* (Sprawling Saltbush) and *Enchylaena tomentosa* (Ruby Saltbush or Barrier Saltbush) varieties, though at present, there is only one trial site at Dareton Research Station, Coomealla. The main reasons for this trial were due to the increase of vineyard irrigation conversions to drip irrigation, and the request from growers for covercrop options that would reduce soil erosion, maintain inter-row cover and not require irrigation, which was no longer an option under drip.

A mix of saltbush varieties was used for biodiversity purposes. The Creeping Saltbush and Sprawling Saltbush grow relatively low to the ground and only require occasional slashing. The Ruby Saltbush is a taller, woody variety and is not as suitable as a permanent covercrop.

The saltbush varieties were either planted as seedlings or seeds that were direct drilled. The notable differences between the Coomealla and Robinvale site was establishment. The Coomealla site was direct drilled and established well. The Robinvale site was sown with a seeder box and a drag chain and this did not create the correct conditions for a high percentage establishment.

Two sections were sown during the winter of 2007. Section one had little to no ground cover when sowing occurred and subsequently established a mid-row saltbush covercrop. Section two had a thick ground cover present when sowing occurred and displayed little to no germination of saltbush until much later in the season and only in small isolated patches. A possible explanation for this could be that the

thick ground cover prevented the saltbush from receiving heat and sun requirements needed for germination or the saltbush seed may have germinated but could not grow through the ground cover.

The trials at Dareton illustrated that successful saltbush establishment was dependant on the amount of ground cover present at the time of sowing. MVW industry development officer Liz McGuire observed that once established, the saltbush required minimal management with only the occasional slashing to keep the vineyard looking tidy.

"Certainly, the mid-row sown saltbush demonstrated how little moisture is required for it to survive," Liz said. "This suggests that saltbush could be a good selection as a permanent cover in drip irrigated vineyards. While the seedling saltbush had the luxury of water from irrigation to aid its establishment, it has not established any quicker than the mid-row sown saltbush."

Some tall weeds were seen to emerge in the seedling-established saltbush, but very few overall.

"The emergence of taller weeds on the vine bank is a concern as they cannot be removed by chemical means without killing the saltbush. This may limit the usefulness of saltbush as an under-story variety, reverting rather to the conventional clean vine bank or established mid-row ground cover," Liz said.

Preliminary observations showed promising results with soil temperatures being reduced in the rows containing native covercrop. The measurements were taken using a penetration thermometer and a penetration soil moisture monitor, both featuring probes about 15cm long. Measurements were taken once a week for a period of six weeks.

"While the results are not scientifically viable, they are interesting. We are hoping in future seasons to measure water use, vineyard temperature under covercrop and insect life attracted to the saltbush," Liz said.

For further information, contact Liz McGuire at Murray Valley Winegrowers Inc.

#### Native Grasses

Henschke Wines in the Barossa Valley have been experimenting with native grass covercrops for several years, moving completely away from mechanical soil disturbance to using a permanent sward. In several of the vineyards where natural rainfall of 400-500mm occurs, there has been success in growing a mix of local *Danthonia* species, *Atriplex semibaccata* (Creeping Saltbush) and *Chloris truncate* (Windmill grass), helped along with an early slash to reduce moisture usage. These covercrops are not cultivated and only sprayed with an organic herbicide to control broadleaf weeds.

A range of soil health attributes is being examined as part of the CSIRO Ecosystem Services trial with Dr Harpinder Sandhu and Jackie Ouzman. Over the next four years, the performance of Creeping Saltbush and *Austrodanthonia spp* (Wallaby grass) will be evaluated in regards to soil health, weed suppression, carbon sequestration and biological control of pests and diseases in Henschke's Schillings vineyard in the Eden Valley.

The soil type of the Schillings vineyard is a red brown earth over lime, which is typically sodic and low in organic matter, but quite fertile, so the primary benefit has initially come

from the change over from annual cultivation to a permanent sward.

"This permanent cover has protected the soil from waterlogging, hard setting and wind erosion, and has given better trafficability, particularly in early spring. The choice of species depends on the availability and dependence of the vines on irrigation. Our Shiraz vineyard receives very little irrigation – less than 0.3ML/yr – and so the choice of *Austradanthonia* (Wallaby grass) was deliberate because of the low moisture usage during winter and early dormancy in late spring, as it flowers from early-mid November," Prue Henschke said.

"The native grasses are winding down as the vines are going into their maximum growth phase. As is the case with any grass cover, there is better infiltration of rainfall into the soil profile than bare earth."

Wallaby grasses vary from short to tall and some prefer heavy soil types or lighter soil types. The grass forms clumps rather than a continuous mat and has a short growing phase compared with many exotic grass species, such as perennial rye and cocksfoot. Wallaby grasses also have a reduced soil moisture usage in the mid-season of vine growth.

"There is talk of root exudates helping to build the soil micro-flora by supplying them with a carbohydrate source and, in turn, they release nutrients back to the roots, which are a form of carbon sequestration that is still in discussion," Prue said. "Annual covercrops require cultivation and re-seeding which reduces the level of recycling of organic matter to soil carbon."

From observations between the native grasses and the Creeping Saltbush, the native grasses are less aggressive moisture users and can be mown down to reduce water use in dry seasons, or left to grow in wetter seasons. In general, native grasses are more adaptable. The use of native covercrop species that are acclimatised to a region and have low water-use characteristics may be an alternative solution to maintain and improve soil health in the vineyard.

"Windmill grass responds well in a sandy soil after heavy rain, so the best timing for sowing is just prior to heavy rain in spring, when the soils have started to warm up," Prue said. "Wallaby grasses, on the other hand, are cool season-growing grasses and are sown in June. Some Wallaby grass species like *Austrodanthonia fulva* prefer heavier soils whereas the *A.caespitosa* and *A.setacea* prefer lighter, drier soils."

Prue said the flower-heads of Wallaby grass attract a large number of insects that could include beneficial insects for the control of vine pests such as light brown apple moth. The Ecosystems Services project will offer more accurate information as data becomes available.

For more information, contact Prue Henschke at Henschke Wines.

#### Further Reading

Quirk, L. & Somers T. (2008) *Grapevine Management Guide 2008-09*. NSW Department of Primary Industries. Agdex 214/10. pp 35-37.

Stafford, J. (2008) *Native grasses in the vineyards*. <http://www.henschke.com.au/vineyards/nativegrasses/>