FACTSHEET JULY 2012

Cover crops and water use

Mr Chris Penfold and Dr Cassandra Collins
The University of Adelaide

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Grape and Wine Research and Development Corporation

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Green cover growing between the vines will use water, but even in a dry grapegrowing environment this should not be a deterrent to growing cover crops.

Freeman and McLachlan (1988) recognised the need to reduce tillage in vineyards but were concerned about the potential water use of a permanent sod, while van Huyssteen and Weber (1980) also found significant yield reductions from a permanent sward. Such concerns were justified, as exotic species are very effective at removing water that might otherwise be used by the vines. In some cases, however, where excessive vegetative growth leads to poorer-quality fruit, vigour control is necessary and may be possible through irrigation and/or nutrient management. In the Coonawarra, on soils of high water holding capacity that receive high rainfall, Proffitt (2000) explored the potential for cover crops to utilise soil water and thereby reduce vine vigour. While soil moisture content was reduced, and more so by chicory than perennial ryegrass/cocksfoot mix, there was no significant difference in yield compared to that from a bare-soil control. This was possibly due to the sown cover crop being only 1.5 m wide, leaving 1.3 m of bare soil in the mid-row to provide a soil moisture reserve. Vine roots also accessed moisture from beyond a depth of 60 cm. As shown by McDonald and coworkers (2010), varying the width of a perennial/annual cover crop mix at a high-rainfall site in Western Australia significantly affected vine vigour and yield. An inverse relationship was established between vine vigour and cover crop width. Maximum vine vigour was evident with no cover crop, and vigour decreased with 1.6 m and 2.4 m of cover in the mid-row competing for soil moisture. The latter treatment displayed a desirable 30% reduction in yield, along with a more open canopy, thereby satisfying the requirements of the grapegrowers at this high-rainfall site.

The relative influence of cover crop species on yield was investigated at a Clare vineyard where black, cracking clays were responsible for excessive vigour (Penfold 2006). Water use by chicory again led to a dramatic reduction in yield, as did the perennial ryegrass and fescue mix (Figure 1). Annual clovers and medics also continued to grow into spring, causing significant yield reductions. This can partly be explained by the management imposed in this trial. The triticale was mown, as per standard grower practice, on 4 October, while the other treatments were mown on 16 November, thereby using a considerable amount of soil moisture for spring growth. Mowing and rolling are very effective management tools to regulate soil moisture levels under cover crops. In wet seasons, cover crops can be left undisturbed with a large leaf area, but in dry seasons, leaf removal by mowing will decrease the evapotranspiration of the cover crop quite effectively.

Numerous vineyard trials have been conducted globally over many years, investigating a wide range of species and their impacts on aspects of vineyard cultural management. A unique trial in southeastern Australia investigated the potential for native ground cover species to fulfil the role of a desirable cover crop (Penfold 2010). With regard to water use and the impact of these species on yield, there were significant differences between species and regions. For example, creeping saltbush (*Atriplex semibaccata*) and ruby saltbush (*Enchylaena tomentosa*) grown in the mid-row of a young vineyard in the Barossa Valley reduced yield by 50% (Table 1). The same species growing in the warm, dry environments of the Riverland of South Australia and Swan Hill in Victoria had little or no impact on yield. The young vines in the Barossa were very susceptible to competition, especially during the droughts that were occurring at the time of the experiment. Older, well established vines at the

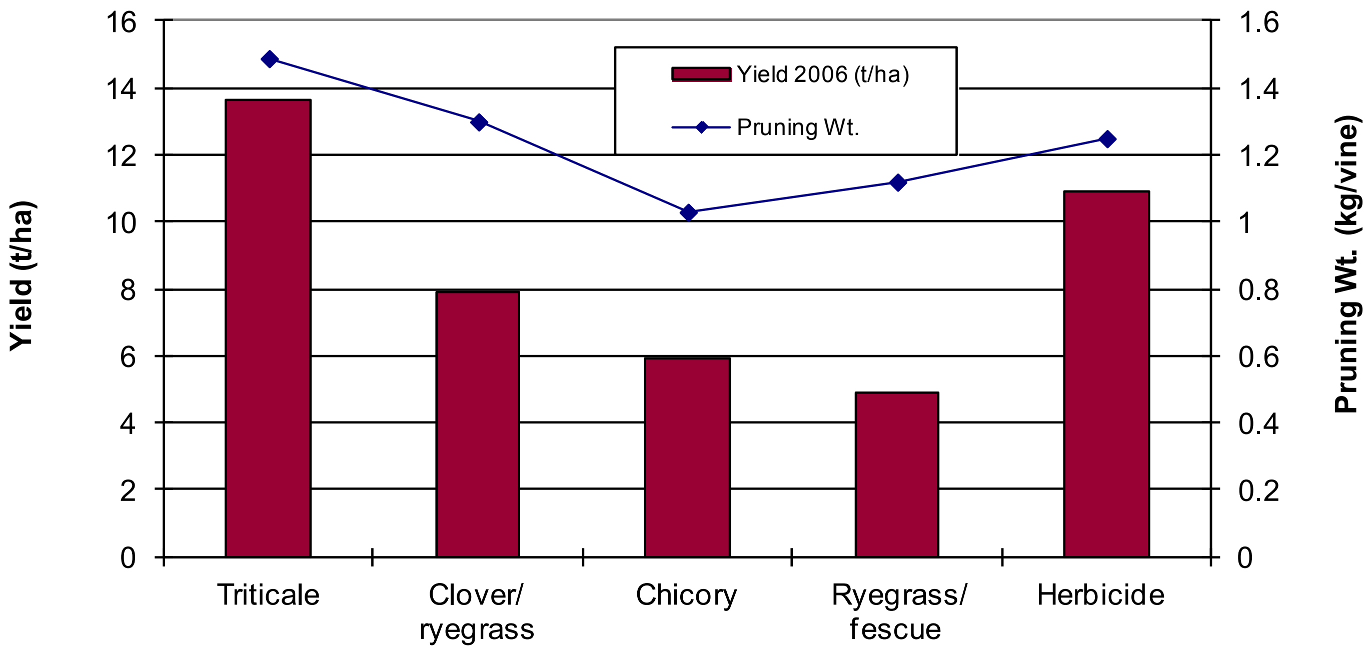

Figure 1: Cover crop species can have a significant impact on pruning weight and yield (Clare, South Australia, 2006).

Variable	Control	*Danthonia*	Saltbush
Yield (2009, kg/vine)	7.9	5.6	4.3
Yield (2011, kg/vine)	5.9	8.5	Saltbush removed

Table 1: Impact of annual vs native perennial cover crop species on yield (kg/vine) from 4-year-old Shiraz vines (Nuriootpa, South Australia).

other two sites relied on drip irrigation for their water supply, with vine roots restricted to the vine row. As such, saltbush was able to grow in the mid-row during the period of active vine growth, provide ground cover and enhance invertebrate biodiversity with little impact on grape yield.

Wallaby grass (*Austrodanthonia richardsonii*) was also investigated with young vines in the Barossa Valley site and very old dry-grown vines in the Coonawarra wine region. At the Barossa site, yields were reduced by 30% in 2009 but this position was reversed in the wet 2010/11 season (Table 1). In the Coonawarra, there was no yield imposition despite seasons of below average rainfall. Again, the young age of the Barossa vines made them very susceptible to moisture stress, and the wallaby grass was not managed to reduce moisture uptake. The Coonawarra vines, with strong, well established root systems, accessed their water from beyond the rooting zone of the wallaby grass. A similar finding was made by Morlat and Jacquet (2003), who investigated the rooting patterns of grapevines after 15 years of either a perennial fescue sward or bare soil. The sward restricted root access to the mid-row, but a greater concentration of roots occurred in the vine row, and larger roots penetrated deeper into the soil profile. While a yield reduction of 15% still occurred, grape quality improvement and reduced *Botrytis* following rainy periods during ripening were positive outcomes.

Summary

As shown above, cover crops can have a dramatic effect on the vines' access to water, and a consequent impact on vine vigour and yield. The species selection and management of cover crops can therefore have a significant impact on vineyard productivity and grape quality. However, even with the best information on selection, what works well in most years may in others be unsuitable. For example, a cereal mown in spring to conserve moisture will not respond to heavy rains over the spring–autumn period, so will not reduce the moisture profile in the same way that a perennial species would. Perennials do have the advantage that they can be managed by mowing to reduce water use in dry years, but they will still restrict yields compared to those from dead mulch in the mid-row. The impact of climate change will add greater complexity to vineyard management, but with the forecast increased severity of summer rainfall events, the requirement for maintaining soil cover will be greater still.

Practical implications

Cover crops provide a very effective tool for manipulating soil moisture availability to the vines in many instances. In the dry inland regions, however, prostrate native saltbushes grow in a separate soil environment to the vine roots, which concentrate under the drippers. They can therefore provide the benefits of biodiversity enhancement and weed suppression without a negative impact on yield. By contrast, where vine roots access the mid-row, cover crops will impact on moisture availability. By selecting cover crop species with the desired attributes for a particular vineyard and grape variety, and managing them according to weather conditions, growers can positively influence both vine production and grape quality.

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Grape and Wine Research and Development Corporation
Industry House, Cnr Botanic and Hackney Roads, Adelaide SA 5000
PO Box 610, Kent Town SA 5071
Telephone (08) 8273 0500
Facsimile (08) 8373 6608
Email gwrdc@gwrdc.com.au
Website www.gwrdc.com.au