Mildara Blass trial work on varied management options — an economic case study

Ursula Kennedy
Mildara Blass Ltd

Introduction
Recent years have seen marked improvements in vine cultural practices and factors affecting vine growth and performance. Irrigation, fertilisation, pest and disease management, vine genetic improvement and clonal selection are constantly under research, with the outcome that vine vigour and yield are now not so limited by these cultural and genetic influences. As a result vines may tend to become out of balance, with high vigour leading to shoot crowding and within-canopy shading (Smart 1985), with understood negative fruit quality effects. Further, the wine industry of the future relies on the sustainable and efficient use and management of our natural resources. There is potential for management of vine growth and development through low input means; with resultant economic and fruit quality benefits, which are also environmentally sustainable (Clingeleffer and Sommer 1994).

Projects have been undertaken by the Mildara Blass group to investigate a number of alternative vineyard practices and their effects on yield, fruit quality, disease incidence and final wine quality.

This paper summarises this research and briefly discusses the implications of the effects of these particular options on vineyard economics, environmental and occupational health and safety issues and on final fruit and wine quality. This paper may also provide some food for thought on the significance of different vineyard management choices to a grower's future success.

Trial outline
The trials undertaken on the Mildara Blass vineyards are detailed as follows:

Irrigation restriction
Water application was decreased each season over a number of seasons.
Tamar vineyard (Cabernet Sauvignon and Shiraz)—McLaren Vale
Guthries and Schultz (Cabernet Sauvignon and Shiraz)—South East

Mulching treatment
Two different mulching arrangements were applied to a vineyard and monitored over four years.
Krondorf (Semillon)—Lyndoch

Cover crop/soil surface treatments
Two different cover crop and two soil surface treatments were applied to a vineyard and monitored over four years, along with the two mulching arrangements.
Krondorf (Semillon)—Lyndoch

Heavy vs light/minimal pruning
One vineyard was converted from minimal to machine pruning, and another converted from light to heavy machine pruning during winter 1996.
B3 (Cabernet Sauvignon)—Padthaway
Tamar vineyard (Cabernet Sauvignon and Shiraz)—McLaren Vale

Combination pruning/mulching/irrigation restriction
A combination of heavy pruning, mulching and irrigation restriction were applied to a vineyard, which was monitored over a season.
A5 (Semillon)—Padthaway

Results
Irrigation restriction
Irrigation restriction trials were performed on the Tamar, Guthries and Schultz vineyards. Water application was significantly reduced at Tamar, with little or no negative effect upon yields. Fruit and wine quality was also significantly improved. The total irrigation in the South East vineyards was able to be brought from excess to well below allocation volume over three seasons, despite additional new plantings in the most recent season.

Tamar Vineyard
Over a period of six years the amount of irrigation applied to the Tamar vineyard at McLaren Vale was gradually reduced, as shown in Figure 1, from more than 400 mm/ha in 1993–94 to just over 100 mm/ha in 1998–99. Over the six-year period the yields dropped slightly—from 12.6 t/ha to 8.7 t/ha; however it should be noted that fruit quality was significantly improved—from bulk wine quality to premium bottled wines. Thus only 25% of the irrigation was required with

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Figure 1. Tamar irrigation vs. yield trends
70% of yield being maintained. Indeed, looking at the first two years of this trial only, irrigation was reduced to 60% of the original amount with production remaining at 95% of the original tonnage.

South East Vineyards
Irrigation restriction was also carried out on two vineyards in the South East. As shown in Figure 2, water application on the Guthries vineyard blocks dropped every season from 1996–97 to 1998–99. This vineyard consists of five established Cabernet Sauvignon and Shiraz blocks, with two areas of new plantings in 1998–99.

Water usage on the vineyard was reduced over three seasons from an average of 305 mm/ha in 1996–97 to 83 mm/ha in 1998–99—a reduction of over 70%. The two new developments planted in 1998 increased water demand in the vineyard, requiring on average 138 mm/ha in the 1998–99 season. It should be noted that with the additional requirement of these young vines included, water usage over the three seasons nevertheless dropped by 70%. Water entitlement for this vineyard is 242 mm/ha which was exceeded in the 1996–97 season, however reduction in water usage over the next three seasons has brought the usage down below the allocation level to the current average of 83 mm/ha.

Average water usage across the Schultz vineyard, as shown in Figure 3, was decreased from 229 mm/ha in 1996–97 season to 211 mm/ha in 1998–99—a drop of 8%. This drop in irrigation still allowed for the water requirements of two new 1998 plantings.

Mulching treatment
A mulching trial was carried out on Semillon grown at the Krondorf Lyndoch Valley vineyard. Treatments applied were of straw mulch over the total vineyard floor, straw mulch under the vines, and a non-mulched control. Parameters compared were soil moisture at varying depths (20, 50 and 100 mm) over the 1995–1996 growing season and four year averages of yield, Baume, pH and TA, petiole analysis at harvest, and an inspection of root abundance in the top 20 cm soil zone.

Soil moisture retention
Under-vine mulch maintained the greatest soil moisture capacity at 20 cm (Figure 5) and 50 cm (Figure 6). Of the three treatments imposed, soil moisture retention at 100 cm depth was highest for the total mulch (Figure 7). The control was dry (soil suction of 500 kPa) at 100 cm depth in late December, with under-vine mulch treatment dry in early January and total straw mulch drying out in early February.

Root volume
Both mulched treatments had more abundant roots in the top 20 cm of soil than the control.

Yield
Average yields from the total mulch treatment were 47% higher than yields from the control vines. Undervine mulching generally increased yields by about 23%.
Baume/pH/TA
Fruit from the control treatment was slightly riper than the mulched treatments, however this is understandable as this treatment was also lower yielding. Other fruit quality comparisons for the three treatments were very similar with little difference in pH, and mulching treatments had a slightly higher TA.

Petiole analysis
Petiole analysis of the three treatments concluded that mulched treatments had higher N, P, Zn and Mn and lower Na and Cl than the control.

Cover crop / soil surface treatments
Cover crop and soil surface treatments were also trialled on the Krondorf Lyndoch Valley Semillon block, the four year average results of which (yield, Baume, pH and TA) are summarised in Figure 8. A oat cover crop made little difference to the investigated quality components in comparison to the control. The addition of gypsum to soil surface appeared only to have a negative effect on yield, possibly due to increasing soil porosity and hence a deleterious effect on the soil water-holding capacity. However both medic cover crop and marc spreading increased yields without seeming to have any negative effects on fruit quality. There was slightly lower Baume for fruit grown under these two treatments, however this could be associated with the higher yields. pH remained constant, with TA slightly increasing with medic and dropping with the marc treatment.

Pruning level
Vines displaying excessive vigour, whether through irrigation, nutrition, rootstock, scion, soil depth and fertility or other factors, are generally accepted to be more expensive to manage. Excessive vigour can necessitate more complex and larger trellising; more passes of summer pruning and resultant potential for lateral shoot growth; shoot crowding and shading. Control of excess vigour results in a more open canopy and a more balanced vine. Manipulation of the vine through pruning and trellis design are the most commonly used methods of vigour control (Dry and Loveys 1998). Further to the cost benefit of a simpler trellis, and pruning for maintaining vigour control, examples of a quality benefit of heavier pruning were shown in some Mildara Blass trials.

Tamar
During winter 1996 an area of the Tamar vineyard at McLaren Vale was converted from minimal to machine pruning. With 41% of buds retained on Shiraz vines the resultant yield was 63% compared to minimally pruned vines (Figure 9). However the final wines from machine-pruned vines were regarded to be of superior quality. Cabernet Sauvignon vines did not receive as heavy a clean-up, having a yield drop from 5.1 to 5.0 t/ha, and resultant wine quality did not display this marked improvement.

Padthaway
A positive quality effect of heavier pruning has been demonstrated in a number of trials conducted in Mildara Blass vineyards. One example of this is displayed in Figure 10, showing results from two pruning levels imposed on Cabernet Sauvignon at Padthaway (block B3) in winter 1996. It can be seen that bud and bunch numbers were reduced (down by 45% and 25% respectively), however yields differed by less than 5%. The more heavily pruned vines, although a degree
Pruning, mulching and irrigation combined

At Padthaway in winter 1996 Semillon bud numbers were reduced by 30% to short spurs and straw mulch was applied in spring. Irrigation apart from that used for frost control was limited to two applications in mid-summer. Straw mulch prevented Semillon drying out over the season despite reduced irrigation and bunches remained looser despite a 56% yield increase from season 1995–96. The incidence of botrytis in the Semillon was reduced and higher maturity levels were attained compared to previous years.

Discussion

Irrigation restriction

Results of this trial indicate that there is the potential to reduce water usage with very little yield reduction if maintenance of yield is a requisite. There is also strong evidence that irrigation manipulation can be a valuable tool for improving fruit and wine quality. Viticulturists can potentially achieve an economic gain with reduced irrigation costs, along with a quality bonus.

Irrigation restriction—South East

The example of reduction in water usage in the South East region further indicates the potential for cutting costs of water application. The volume of water applied was well below allocation, thus potentially conserving this valuable resource for further plantings.

Mulch

Soil moisture data for the Semillon mulching trial do not match expectations. The total mulch treatment would be expected to show the highest soil moisture readings at all depths, which is not the observation made here. This may be due to the total straw mulch being finely chopped with some mulch blowing away and some rapidly rotting, affecting the soil moisture retention capacity. Nonetheless, the use of mulch in the two treatments improved the soil moisture retention at all depths. Observation of root density in the top 20 cm of soil showed that mulching seemed to allow vines to exploit this layer of soil for nutrients and water. During drier seasons water must be able to get down to the deeper roots of control vines, and a proportion of applied water is lost through evaporation from this top soil layer. The petiole analysis showed mulched vines have improved nutritional status, possibly due to the increased root density in the top soil layer. Irrigation water in this vineyard is slightly saline (1300–1800 mg/L TDS), thus the reduced petiole Na and Cl may be due to mulched vines taking up less water through improved soil moisture capacity.
and green’ concept of fruit production. Consider how the trial work discussed may assist in maintaining this image by the adoption of vineyard practices which can reduce chemical inputs, therefore effectively reducing risks of chemical residue taint in wines. Furthermore, a grower has the potential for bonus payments for higher quality fruit at harvest; and at the time of contract issue or renewal the advantageous position of having vineyards with a record of producing higher quality fruit. Finally, there can only be great grower satisfaction in knowing that their fruit is going into a high quality product.

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References

