

CSIRO Report

Compost as mulch for vineyards

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'Green-Organics', prunings, leaves and lawn-clippings, make up more than 30% of domestic waste in landfill. Many metropolitan councils now encourage separate collections of 'green-organics' with dedicated clean-green bins, collected fortnightly in some areas.

With appropriate processing this home-garden waste may now be of value to the grapegrower. Shredding and composting under controlled conditions to destroy weed-seeds and plant pathogens, provides a substantial source of stabilized organic matter which can be safely used as a mulch under young vines.

The benefits of mulches have been widely recognized. Trials in the Barossa with straw undervine had shown significant increases in earthworm activity, with substantial savings in soil-water and increases in grape-yields (Buckerfield and Webster 1996)a. But growers had concerns over potential frost- and fire-risk, the increased nitrogen-demand as the straw degraded, and the cost of replacement.

Trials conducted by CSIRO Land & Water and Recycle2000b have now demonstrated some of the benefits of composted 'green-organics' as a mulch under vines. Our further studies will investigate the use of other 'clean wastes' such as timber-milling residues which can also be composted to produce a 'safe' mulch.

Contents of report

- [Mulching new plantings, after six months](#)
- [Mulching twelve month-old vines](#)
- [The first harvest ... 18-month old vines](#)
- [Mulching two year-old vines](#)
- [The next harvest ... 30-month old vines](#)
- [Mulching 5-year old vines](#)
- [Could twice as much be too much?](#)
- [The value of compost mulch](#)

Mulching new plantings, after six months

A meeting of local growers on a Rutherglen vineyard in August 1998 saw a convincing demonstration of the benefits of compost as a mulch for the establishment of young vines. In February, compost derived from domestic 'green-organics' had been spread to a depth of a 5cm under rootlings planted the previous August. Monthly measurements on the young Cabernet Sauvignon vines indicated a rapid response to the mulch. By June, the stem diameter after four months under mulch had increased 50% compared with the unmulched 'control' (Fig. 1). On a neighbouring block, similar increases in young Shiraz prompted a vineyard-manager to remark - "the differences are so obvious, like my little finger, compared with the thickness of my thumb for these vines with mulch".

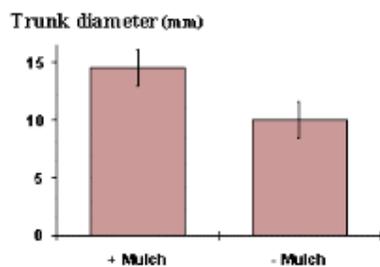


Fig. 1 - Increase in trunk diameter of 6 month-old vines with mulch

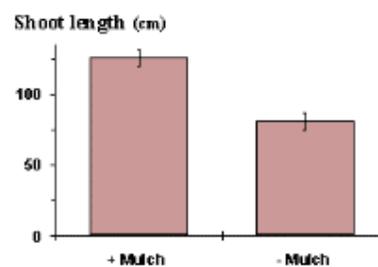


Fig. 2 - Increase in shoot length of 12 month-old vines with mulch

Mulching twelve month-old vines

In response to requests from vineyard-managers, mulch trials had been established on one year-old Cabernet Sauvignon vines at McLaren Vale. Fertilizer-spreaders were modified to spread the 'green-organics' compost to a depth of 7.5cm and 50cm wide along the rows in early November 1997.

Within six weeks the growers had noted changes in leaf-colour and shoot-growth. It was obvious that although adequate water and nutrient was supplied through drip irrigation, the mulching had reduced 'stresses' associated with establishment of vines on a deep sandy soil. By mid-December measurements indicated an additional 70% increase in shoot-extension on the vines which had been mulched (Fig. 2).

The first harvest ... 18-month old vines

Growers had not expected the increased vigour would be reflected at harvest. But by April, less than six months after mulching, grape yields had more than tripled (Fig. 3). It was obvious that although bunch-weight and berry-weight were slightly higher, much of the increased production at the first harvest was due to increased bunch survival. Although the bunches were formed when the mulch was applied, by harvest, bunch number was more than double on the mulched vines (Fig. 4).

The higher yields at the first harvest were achieved without a compromise in juice-quality. Sugar-content increased slightly (Fig. 5) and there was no significant change in juice pH or titratable acidity.

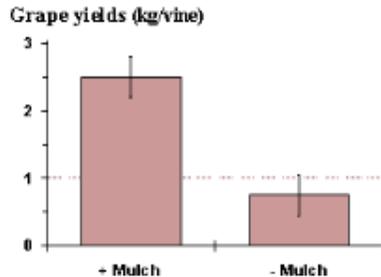


Fig. 3 - Increase in grape yields of 18 month-old vines with mulch

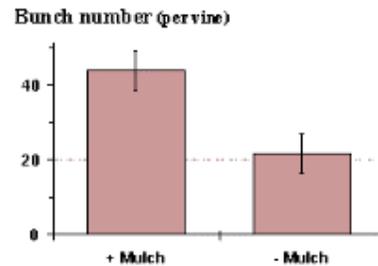


Fig. 4 - Increase in bunch survival on 18 month-old vines with mulch

Mulching two year-old vines

Without modifying the normal management practices we had demonstrated the potential to substantially increase yields of young vines, without a reduction in yield quality.

With this clear evidence of the benefits of the compost, the grower completed mulching the whole vineyard with 7.5cm of mulch to conserve moisture and control weeds during the next winter. During the spring we removed mulch in sections of the vineyard to establish a randomized trial with the 'green-organics' compost

The grower continued to irrigate the whole vineyard in response to the lesser water-demands of vines with 7.5cm of compost; by mid-summer soil-moisture was 30% lower where the mulch had been removed.

The next harvest ... 30-month old vines

When these trial vines were harvested again during the following April, it was obvious that within six months removing the mulch had reduced the yields by 60% compared with the mulched vines (Fig. 6).

The increased vigour of the mulched vines was reflected in trunk growth which was significantly less where the mulch had been removed.

This vineyard was now being managed with 7.5cm of water-conserving mulch, and it appears that the unmulched vines in the trial were receiving inadequate water from irrigation.

Mulching 5-year old vines

In October 1996 composted 'green-organics' was spread at depths of 1 to 15cm, 1 metre wide under established Shiraz at Willunga; straw was spread to a depth of 20cm for comparison. Within six weeks growers reported obvious differences in shoot growth; the weight of prunings had doubled with 5cm of compost mulch. This was clearly related to conservation of soil moisture which was substantially higher with the deeper mulch; in mid-December soil moisture under 15cm of compost was double that with a 5cm compost mulch (Fig. 8). A compost mulch 5cm deep was as effective as a 20cm deep straw mulch in reducing surface evaporation.

The grower was concerned that the extra shoot growth could be detrimental to fruit development. However, when harvested in April, after 6 months of mulch, there were no differences in yield or quality measures.

But by the following harvest in 1997, after 18 months under mulch, yields were clearly related to depth of mulch, with an increase of up to 35% with the 15cm of compost (Fig. 7). The higher yields can be attributed largely to a 30% increase in bunch number and a 15% increase in bunch weight; there was a small but insignificant increase in berry weights. While the increased yield was accompanied by a decrease of 1.5° Brix at harvest, there was also a tendency to lower juice pH with the mulch.

This vineyard was managed without consideration for the changed soil conditions under the mulch. With the additional soil moisture available under mulch, growers can reschedule their irrigation and can better manage juice quality during periods of high temperature and moisture stress.

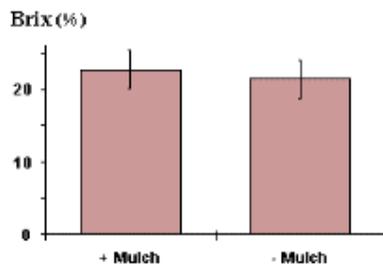


Fig. 5 - No change in juice sugar of 18 month-old vines with mulch

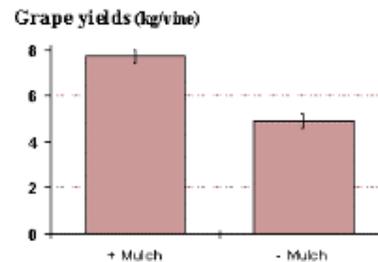


Fig. 6 - Reduction in grape yields of 30 month-old vines with mulch removed

Could twice as much be too much?

The benefits of increasing depth of mulch was evident with the established Shiraz on a clay loam at Willunga; water-savings and yields were significantly higher with rates of compost up to 15cm undervine.

With young Cabernet Sauvignon on sand at McLaren Flat, 7.5cm of compost provided substantial increases in growth and yields over successive seasons, but 15cm of compost had no effect. On this site, the deeper mulch was effective in eliminating weeds and conserving water, but did not appear to benefit fruit development and growth of the young vines.

A mulch trial on a Barossa vineyard showed significant responses in the first harvest of young Chardonnay vines. Grape yields increased with increasing depths of mulch, and were more than doubled with 7.5cm of compost mulch. But with depths of compost mulch greater than 10cm, there was an indication of reduced yields. Water-application should be reduced with the deeper mulch, to maintain soil-moisture at optimal levels for growth and maturity.

In each case, irrigation rates were determined by the demands of the unmulched vines in the remainder of the vineyard. There is potential for significant savings if water input can be reduced with mulches and vine growth and yields can be better managed with the additional water available at critical stages in development.

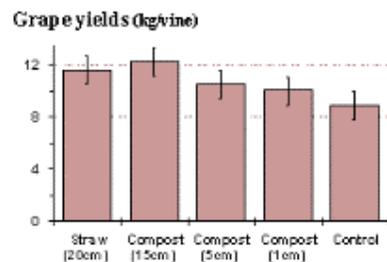


Fig. 7 - Increase in grape yields of 6 year-old vines with increasing depth of mulch

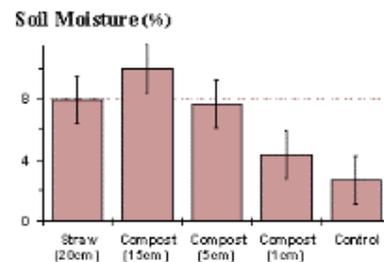


Fig. 8 - Increase in soil-moisture (0-10cm) under vines with increasing depth of mulch

The value of compost mulch

Mulches are effective in controlling weeds and conserving water, important in the establishment and maintenance of vineyards. A surface mulch reduces fluctuations in moisture and temperature in the upper soil with reduced stress evident in greater bunch-survival on young vines.

The increase in trunk-diameter indicates improved soil conditions for the growth of mulched vines. The additional shoot-growth noted in our trials may not be considered desirable, but this vigour can be managed, with reduced water-inputs. A surface mulch significantly enhanced the development of young vines; while growth responses have been evident soon after mulching, yield responses may take longer to develop on established vines. Compost can be considered as an economic alternative to straw mulches - 5cm of composted 'green-organics' were as effective as 20cm of straw in conserving soil moisture undervine.

'Green-organics', composted according to the standards, poses little risk of spreading plant pathogens and weed-seeds and, with a lower C:N ratio, is unlikely to cause the nitrogen-drawdown associated with straw. The compost seems not to be a problem in fire and frost-prone areas, where straw is considered unsuitable.

Finer grades of compost may be appropriate for incorporation in the soil at planting to add organic matter to improve soil structure and water-holding capacity. The longer processing time, additional monitoring, turning and shredding or screening to produce a fine-crumb material will add to the cost and cannot be justified for compost used as a surface mulch, but can be considered for pre-planting soil preparation.

We consider that a mix of coarse and fine 'green-organics' compost is most appropriate for a vineyard mulch - the finer fraction is readily incorporated by earthworms in the soil - the coarser materials will continue to provide protection for the surface. After three years of field observations, it is obvious that residues from 5 - 10cm of this mulch will continue to provide significant benefits to vineyard soils, without reapplication for at least 4-5 years.

An appropriate grade* of compost for new plantings is available from 'green-organics' processors in each state. With prices ranging from \$20m³, 5cm of mulch could be spread 50cm wide undervine for less than \$2000/ha.

Additional research is now investigating blends of 'green-organics' with other organic wastes. Pellets of paper and straw can be made-to-order, incorporating fertilizers, lime and gypsum and other soil amendments. These pelleted formulations which will be easier to transport and spread will be studied to compare performance with the compost mulches.

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- a. Buckerfield, J.C. & Webster, K.A. (1996). Earthworms, Mulching, Soil Moisture and Grape Yields. *The Australian and New Zealand Wine Industry Journal* 11(1): 47-53.
 - b. South Australian Local Government Recycling and Waste Management Board, 1994-1998. South Australian Local Government Recycling and Waste Management Board, 1994-1998.
 - c. Buckerfield, J.C. & Webster, K.A. (1998). Compost as mulch for managing young vines. *The Australian Grapegrower and Winemaker* No. 418, pp 75-78 (October 1998). Buckerfield, J.C. & Webster, K.A. (1998). Compost as mulch for managing young vines. *The Australian Grapegrower and Winemaker* No. 418, pp 75-78 (October 1998).

* It is essential that only compost which complies with the Standard AS-4454 (1999) is used to reduce risks from weed-seeds and plant pathogens. Your local EPA office will have information on licensed compost-processors.

Many of these commercial composters have now achieved NASAA or BFA registration - the 'green-organics' compost can be considered as an appropriate alternative to herbicides for weed-control in organic viticulture.

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