INVESTIGATION OF MANAGEMENT PRACTICES AND ECONOMIC VIABILITY OF VINEYARDS FOR ORGANIC WINE PRODUCTION

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SUMMARY
This paper reports the findings of two components of a research investigating the viability of organic wine grape production. Firstly the results of a survey of Australian organic wine grape growers' management practices and secondly the first year findings of an experimental organic vineyard compared to an associated conventional vineyard. The survey found a heavy reliance on sulphur and copper sprays for powdery and downy mildew control. The experimental vineyard showed similar yields to conventional growing and in many cases higher sugar, though some increase in botrytis in organic Shiraz.

INTRODUCTION
Dumaresq (1996) identified a large untapped market demand for Australian organic produce including organic wine. Since that time there has been steady growth in the organic wine industry such that Australia now has about 75 organic wine grape growers and 20 organic wineries (Innovation Australia 2005). Organic wine is now a significant industry but lacks research data specific to organic wine grape production. Dumaresq (1996) also pointed out that there is a wealth of knowledge on how to successfully farm organically, but that much of this knowledge is practitioner based and not readily available. Dunstone *et al* (2001), in a survey of participants to a workshop on organic viticulture in Victoria, showed that the greatest constraint limiting conversion to organic was the lack of knowledge or skills.

This paper is based on a research project as part of a Professional Doctorate in Agriculture at the University of New England. The research is concerned with the viability of organic wine grape production and management strategies used to overcome key production constraints such as fungal diseases and weeds. In this paper we report the results of a survey of Australian organic wine grape growers' management practices. We also present preliminary results from an experimental organic vineyard located in the Granite Belt (28.66° S, 151.9° E, 800 m above sea-level) in south-east Queensland.

METHODOLOGY
Survey. A survey of Australian growers was designed to collect data about general vineyard and demographic information, and management practices used by the growers, especially techniques used to control weeds, fungal diseases, vine nutrition and insect pests in organic vineyards. After an initial literature review, a pilot survey was conducted amongst several growers and researchers, and a final questionnaire prepared. Only three organisations are significantly involved in organic wine grape certification in Australia. These are the Biological Farmers of Australia (BFA), National Association for Sustainable Agriculture (NASAA) and the Biodynamic Research Institute (BDRI). The BDRI would not provide any information about their members and were therefore not included in the survey. Privacy Act considerations, prevented the BFA and NASAA from providing mailing addresses directly, but agreed to post the survey to relevant members. The questionnaire was mailed in February 2005 to about 70 certified organic vineyard owners in Australia. The survey will be followed by a case study to assess practices based on several selected vineyards, results of which will not be reported here.

Experimental vineyard. An experimental plot of about 150 Shiraz and Merlot vines grown organically was used to test several management techniques in the four key areas identified above. The plot was adjacent to a conventional commercial vineyard growing Shiraz and Merlot grapes. There were 3 rows of 16 Shiraz plants and 3 rows of 16 Merlot plants (i.e. 48 plants of each variety) in the organic plot and the results for the conventional were from data pooled for the whole plot. The 2004/05 season was the first year of the study. Comparisons have been made with the yield, quality and cost of grapes grown in the adjacent commercial blocks. Cost data is not included in this paper. Disease incidence has also been monitored at various stages. The focus of this part of the study is on fungal diseases of the Granite Belt in Queensland, as these have been identified as the main constraint preventing organic production in the region.

The experimental plot was previously treated the same as the adjacent conventional vineyard. The last date that prohibited chemicals were used was on 13 September 2004 when glyphosate was used under vines before budburst. The experimental vineyard was treated the same as the conventional vineyard with the following exceptions.

Weed control treatments: All experimental rows were mowed for weeds as necessary. The conventional vineyard was treated with 3 applications of glyphosate under vines.
Row 1 Shiraz - treated with a mulch of decomposing grape bunch stems from the previous year's crushing
Row 2 Shiraz - mulch of grass gathered from slashing a nearby paddock was applied
Row 3 Shiraz - hand hoeing to simulate cultivation
Row 4 Merlot - hand hoeing to simulate cultivation
Row 5 Merlot - mulch of grass gathered from slashing a nearby paddock was applied
Row 6 Merlot – mowed to simulate grazing

Fungal diseases: For downy mildew, protective sprays were applied 4 times during the season. The organic plot used only cupric hydroxide, whereas in the conventional vineyard the first 2 sprays were with Mancozeb® (dithane), which also provides protection against phomopsis. For powdery mildew, the same regime in both vineyards was used, being 4 applications of sulphur. For botrytis, no special treatment in the organic plot compared to 2 applications of Rovral® (dicarboximide group) in the conventional vineyard, at veraison and 2 weeks before harvest.

Nutrition: Organic chicken manure fertiliser (Organic Life® 250g/plant) was applied to vines in both vineyards. No other fertilisers were applied to the organic plot but 2 applications of potassium phosphate carbonate were applied as a foliar spray to the conventional vineyard during the rapid berry expansion phase to reduce crop-induced potassium deficiency. (Leaf petiole and soil tests were not done in the first year but will be included in the next season's study.)

Insect control: No insecticides were used in either the organic plots or the conventional vineyard, as there has been no problem with insects in the past.

Irrigation: Although drip irrigation is available it was only turned on once during the season because of adequate rainfall throughout the season.

RESULTS AND DISCUSSSION

Survey. Of 70 questionnaires sent, 3 respondents indicated they were either no longer growing grapes organically or had only just commenced. A total of 24 useful responses were received, giving a response rate of 36%. The average vineyard size of respondents was 7.3 Ha (range: 0.3 - 28 Ha) and the average length of time growing grapes organically was 10 years. Almost 90% of respondents were fully certified, 42% of respondents also had an associated winery and 25% were exporters of organic wine.

Davidson (1990) relates that yields for organic production are often significantly reduced compared to conventional production. Yields of the three most popular varieties reported in the survey are shown in Figure 1. A comparison is made to the national average yield in 2002 for these varieties. While the organic yields are lower for Cabernet Sauvignon and Shiraz, they are higher for Pinot Noir.

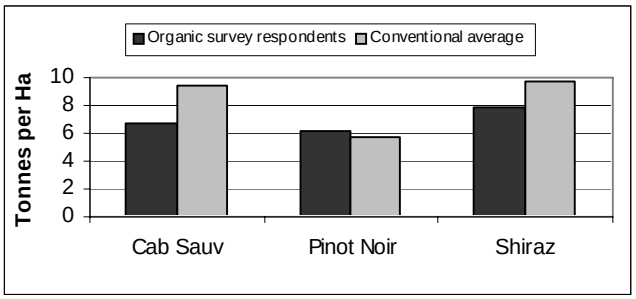

Figure 1. Comparison of yields for selected varieties (Cabernet Sauvignon, Pinot Noir and Shiraz) reported by organic survey respondents with Australian average in 2002 (Source: ABS 2002)

The results of some of the key findings about organic viticultural methods are presented in Table 1. The fact that 58% of growers in the survey use cultivation in the control of weeds and that on average growers cultivate twice a year is of some concern in the light of research and other literature advocating reduction in cultivation. McCarthy (1991) identified the urgent need to reduce cultivation in vineyards and to adopt conservation tillage systems. No growers were currently using flame and only one was using steam weeding. Two growers indicated they had tried these methods but that they weren't satisfactory. Half of the participants are using organic mulches, which have a number of other potential benefits in addition to weed suppression. In particular they increase organic matter and improve soil structure (Tassie *et al* 1990). They also provide better water retention, reducing the need for irrigation and considerably increase earthworm activity (Buckerfield and Webster 1996).

Table 1 Number and percentage of respondents using various organic viticultural methods

Weed control methods	No.	%
Mowing	20	83
Cultivation	14	58
Mulch	12	50
Cover crops	12	50
"Whipper snip" (line trimmer or "weed eater"	11	46
Hand/Hoe	11	46
Grazing	5	21
Steam	1	4
Flame	0	0
Downy Mildew control		
Cupric hydroxide	13	54
Potassium bicarbonate	8	33
Bordeaux mix	1	4

Powdery Mildew control	No.	%
Sulphur	17	71
Potassium bicarbonate	8	33
Vegetable oil	8	33
Milk by-products	6	25
Botrytis control		
Canopy management	8	33
Potassium bicarbonate	5	21
Fertiliser		
Compost	14	58
Seaweed	13	54
Chicken manure	12	50
Fish products	9	38

One of the key findings of this survey is the extent to which growers are still reliant on copper sprays (58%) for downy mildew and sulphur (71%) for powdery mildew. This reliance will become a problem in the case of copper, which will be phased out for organic production in Europe from 2006 (Department for Environment, Food and Rural Affairs 2003). Sulphur is also under a cloud owing to human health issues and its effect on beneficial insect species (Madge 2004). The effectiveness of alternatives still requires substantial independent research. The only alternatives to copper for downy mildew being employed by growers in the survey is potassium bicarbonate (33%) and 2 growers listed Casuarina tea. Several growers also expressed concern about this issue in their general comments to the survey. In the case of powdery mildew there are several alternatives being used; potassium bicarbonate (33%), vegetable oil (33%) and milk by-products (25%). Again, the effectiveness of these methods is unclear, though some of the "softer" alternatives were found to be effective by Magarey (1992), particularly bicarbonates against powdery mildew.

Methods of botrytis control were restricted to canopy management (33%) and potassium bicarbonate (21%). Some growers also said that botrytis was not such a problem where vines were healthy without too much foliage (i.e. not too much nitrogen).

More than half of the growers in the survey rely on chicken manure fertiliser, seaweed products and compost and 38% list fish products mainly in the form of fish emulsion. Nine respondents (38%) also indicated that they used biodynamic preparations and four (17%) also used Guano Gold® (a certified organic product high in calcium and phosphate).

Growers indicated that insects were not a problem although 21% indicated that they used Dipel® *(Bacillus thuringiensis*) when countering problems with caterpillars.

Experimental vineyard. The results of the first year of study compare the yield and quality of grapes grown in organic plots with the adjacent conventional vineyard. Table 2 shows yields, grape sugar and total acid (TA) levels as well as botrytis incidence at harvest (21 March 2005).

Table 2: Results of harvest data comparing organic and conventional plots.

	Shiraz Row 1	Shiraz Row 2	Shiraz Row 3	Shiraz conv.	Merlot Row 4	Merlot Row 5	Merlot Row 6	Merlot conv.
Baumé	11.8	12.2	11.8	11.6	12.6	12.7	12.2	12.3
pH	3.21	3.20	3.23	3.10	3.23	3.20	3.15	3.25
TA (g/litre)	7.2	7.5	6.7	8.8	8.8	8.8	8.6	8.6
Yield (kg/plant)	6.2	4.4	5.6	6.0	8.1	8.1	6.9	6.9
Botrytis (bunches affected)	10%	25%	10%	2%	10%	10%	10%	10%

The sugar levels at harvest date were higher for organic plots than for conventional except for Merlot Row 6 that had only whipper snipping for weed control. The pH was lower for the conventional Shiraz and the TA higher than the organic Shiraz. This is consistent with the lower ripeness indicated by the sugar (Baumé) reading. Merlot acidity, both pH and TA, are similar between treatments. Yields were comparable between organic and conventional treatments and two of the Merlot organic rows actually had higher yields despite also having higher sugar content. The only organic row that had a significantly lower yield was Shiraz Row 2 which was more affected by botrytis than other rows.

Botrytis in all cases resulted from berry splitting caused by heavy rain about three weeks before harvest (56mm in about half an hour). Incidence was mainly where there was a lack of foliage and grapes were therefore exposed to the rain. There was no greater incidence of botrytis in the organic Merlot than in conventional despite the use of Rovral in the conventional vineyard following the rain. The Shiraz however did have higher incidence in the organic vineyard. This may have been due to the lower foliage in the organic vineyard as well as the use of the systemic spray in the conventional vineyard.

CONCLUSIONS

The survey shows there is a need to find and assess suitable alternatives to copper and sulphur for the control of downy mildew and powdery mildew respectively. The relatively high level of cultivation still being employed by organic vineyards also indicates a need to find economic alternatives for weed control. Yields are apparently lower than conventional vineyards for some key varieties indicating a need to obtain a price premium for organic wine. The experimental vineyard has shown, in the first year of conversion, that Merlot was not adversely affected by using organic methods and in most cases the fruit had higher sugar at harvest than conventional. The Shiraz also had higher sugar levels at harvest but also a higher incidence of botrytis than the conventional vineyard.

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