HAWKES BAY FOCUS VINEYARD TRIALS
Final Report 2007

Effects of Applications of RPR and a range of Common Soil Amendments in two Hawkes Bay Vineyards

AgConsult Limited

Gerard Besamusca
Mirjam Besamusca
Contact: info@agconsult.co.nz

Executive Summary

Trials were laid down in two different Hawkes Bay vineyards as part of the Focus vineyard scheme. One trial investigated the use of RPR (Reactive Phosphate Rock) and a mycorrhizal stimulant (Mycorrcin) to increase the phosphorus status of a Merlot vineyard on the Gimblett Gravels. The results suggest that both treatments are effective in lifting the soil and vine phosphorus status. Grinding down RPR to a small particle size enhanced response. The use of RPR and the promotion of mycorrhizal fungi are likely to benefit the environment compared with the conventional approach of applying soluble phosphorus on these high gravel content soils. Microvins were made from this trail in 2005, 2006 and 2007. The 2005 and 2006 microvins suggested increased wine quality for the Mycorrhizal treatment (2007 not released yet). YAN levels also increased.

The second trial investigated a number of commonly used products that are thought to stimulate soil biological activity or otherwise improve soil health and fertility. Treatments included compost tea, compost, a combined compost and compost tea treatment, mycorrhizal stimulant, humic acid, and elemental sulphur prills. All treatments increased soil available nitrogen and the ratio of available to total nitrogen in the soil compared with control. This increase in nitrogen was not reflected in increased vigour (as measured by pruning weights at the end of the trial). A number of treatments may also have improved soil structure (reduced compaction). None of the treatments substantially increased yield, except for the compost treatment (first year after application). The application of elemental sulphur resulted in smaller berries and bunches, but a higher number of bunches per vine in year two.

Introduction

Two trials have been conducted in Hawkes Bay in association with the Focus Vineyard Project. Both involved assessing the effects of commonly used soil treatments which target soil health and improve nutrient availability and sustainable soil management.

Merlot Trial

This trial is also supported by Villa Maria and Bio-Start. It comprises of three separate trials, a pilot trial (Trial A which started in 2003), a replicated trial in 2004 (Trial B), and another replicated (fertigation) trial started in 2005 (Trail F). The trial site is on the Gimblett Gravels, variety is Merlot.

The treatments for Trial B which started in 2004 are:

1 Untreated
2 RPR-S + Myc (Suspension Reactive Phosphate Rock in fine particle form)
3 Myc (Mycorrhizal stimulant - Mycorrcin)

and for the 2005 fertigation trial (Trial F):

4 Fertigation NPK
5 Fertigation NPK + Mycorrcin
6 Fertigation NPK (3/4 rate) + Mycorrcin

The objective initially was to improve the phosphorus status of the soil and vines using non-soluble phosphorus inputs and to promote mycorrhizal fungi which can assist the vine with phosphorus uptake. During the trial, the focus shifted to include aspects of wine quality.

Chardonnay Trial

This trial was carried out at the Prospect vineyard. The vines there are Chardonnay on rootstock SO4, planted in 1995.

The following treatments were applied:

1 Control
2 Bark based compost
3 Bark based compost + Compost tea
4 Compost tea
5 Mycorrhizal stimulant (Mycorrcin)
6 Humic acid (Humax)
7 Sulphur (Sulphur prills)

MATERIALS and METHODS

The Merlot trials involved treatments to improve phosphorus status of the vines and used two approaches to reach this objective; the application of RPR (reactive phosphate Rock) to lift soil phosphorus levels, and the application of Mycorrcin, a commercial bio stimulant that increases mycorrhizal colonisation of vine roots and, as a result, improves phosphorus uptake.

For the Merlot 2004 trial (replictaed 3 times) the RPR was processed by grinding the material down to a fine consistency, which was then applied by specialised equipment as a suspension. Suspension was applied annually pre budburst. In the combined treatment, Mycorrcin was applied to the suspension mix, and reapplied with weedspray applications to the undervine weed strip (two applications per season).

The Merlot 2005 trial was based on applications through fertigation (replicated 3 times). The fertigation system was adapted to enable the application of three different treatments in a replicated manner (three replicates per treatment). The treatments were based on the normal NPK fertigation program (typically two weekly applications of NPK and magnesium sulphate product totalling around 50 kg/ha/yr), but at 75% of the standard application rates, with Mycorrcin being added to these applications at 400 ml/ha, and a treatment where only Mycorrcin was applied (400 ml/ha every 14 days). Total Mycorrcin applications over the growing period amounted to around 14 L/ha.

The applications for the Chardonnay trial (replictaed 5 times) were started in Spring 2005. Bark based compost was applied once at the start of the trial (applied at 20 m^3/ha). Sulphur prills were applied yearly, Mycorrcin and Humic acid were applied three monthly and the Compost tea program involved three applications per year. The treatments were applied following programs based on label or supplier information.

Monitoring for both the trials included petiole and blade sampling at flowering and veraison. Soil samples were collected at harvest. Extensive soil analysis was undertaken including comprehensive soil analysis through Hill Laboratories. Saturated paste extractions were also done at the end of the trial, and soil bacterial and fungal biomass (active and total) were determined postharvest 2006 and 2007 (selected treatments) by Soil Foodweb Institute NZ Limited in Roxburgh. Root samples were collected from selected treatments to determine the rate of mycorrhizal colonisation (BioCult Laboratories in Cambridge).

Harvest monitoring was based on sub sampling vines within each replicate (50-80 bunches). Bunch weight, bunch length, and berry weights were determined and, where relevant, disease presence was assessed. Juice pH, TA and brix were determined using the Ersloh Easylabs. YAN and Polyphenols were also determined for selected treatments.

In addition, sub samples from the Merlot trials were used for microvinification through the EIT in Hawkes Bay in both 2006 and 2007.

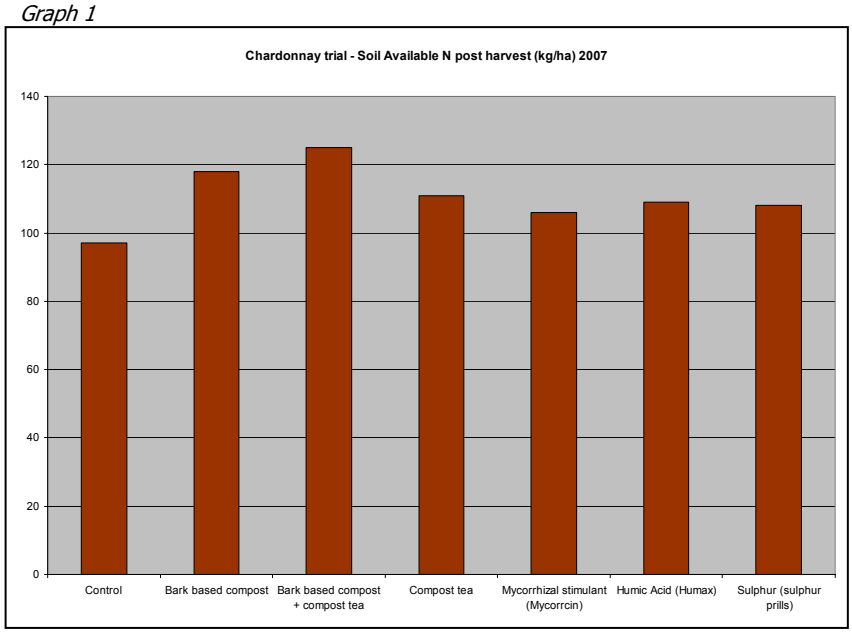
For the Chardonnay trial, soil compaction, pruning weights and cane diameters were determined at completion of the trial. These were not part of the original monitoring schedule, but were a response to the interim findings in this trial.

RESULTS

Soil and Tissue Results

The Merlot trial showed responses to the application of RPR and Mycorrcin as increase soil Olsen P and Resin P. These increases in available phosphorus in the soil showed up as increased phosphorus levels in the petiole and blade samples taken the year after application, but this was not consistent over all years and trials

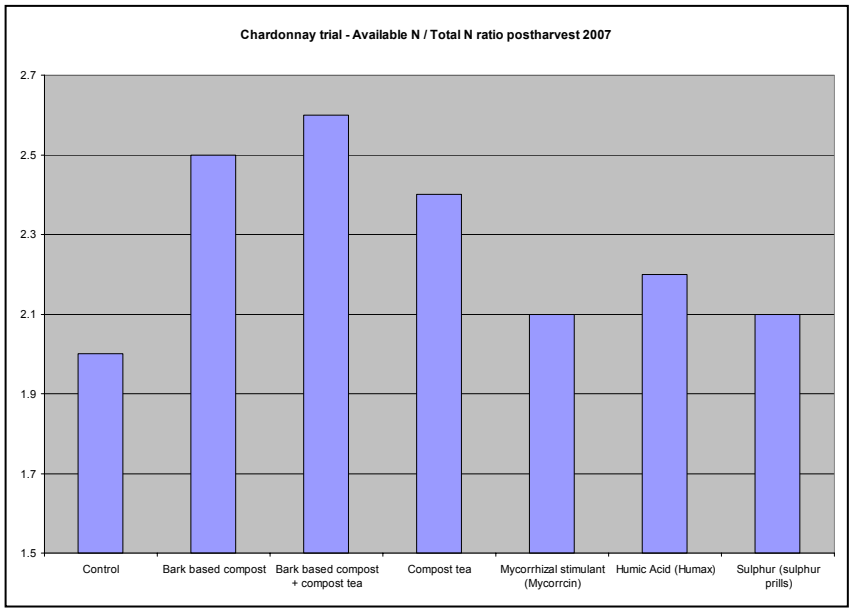
Graph 1



One of the findings is shown in the Graph 1. All treatments in the Chardonnay trial increased soil available nitrogen levels in the 2007 postharvest soil samples.

Because these were all treatments based on promoting soil biological activity, this is not surprising.

Graph 2



The ratio between available and total nitrogen was also measured, as it is a reflection of nitrogen mineralisation as a result of the breakdown of soil organic matter by soil micro-organisms. The treatments showed higher ratios than Control, reflecting the higher levels of available nitrogen.

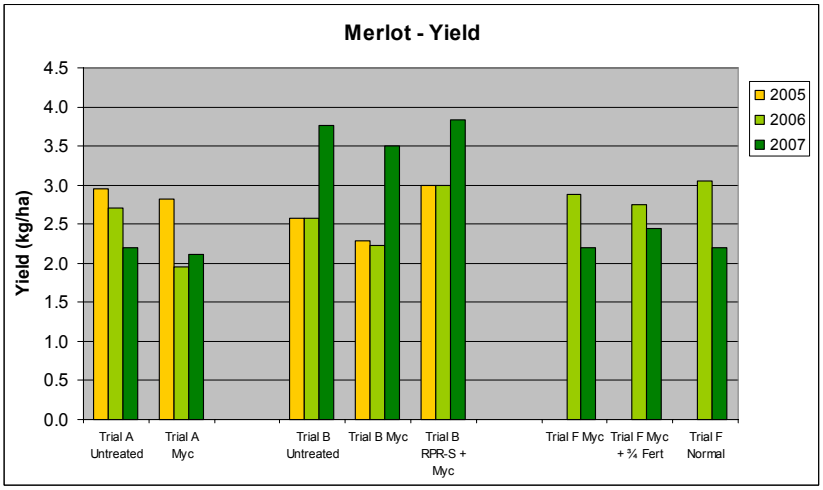
All the soil and tissue results will be available on the Integrape website (www.integrape.com).

Harvest Results

The Merlot vineyard site on the gravels is highly variable, making it difficult to distinguish any trends.

The vines in the fertigation trial treatment using only the mycorrhizal stimulant held up well, despite the fact that no NPK (fertigation) inputs were used here at all for two years. No significant differences were found in terms of vigour, tissue nutrient levels or yield parameters.

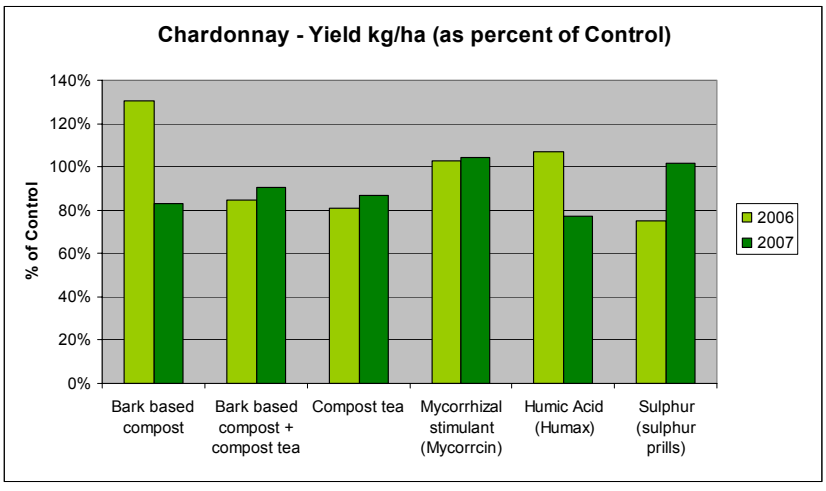
Graph 3



It appears the mycorrhizal treatment on its own may have margianlly lowered yields. The Suspension RPR + Mycorrcin appeared to have the highest yield for both monitored years in the 2004 trial. In the 2005 trial there were mixed trends.

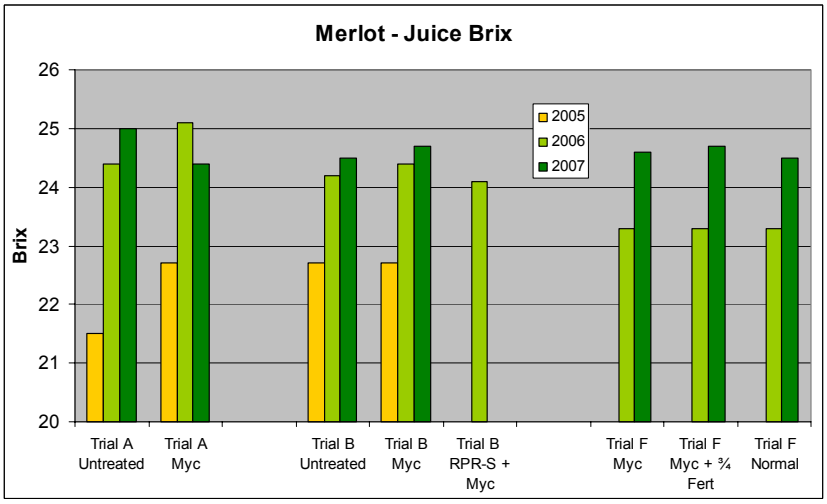
In the final year of the 2005 fertigation trial, the Mycorrcin treated vines had the heaviest and longest bunches, but also the lowest number of bunches (data not shown).

Graph 4



The yield at the Chardonnay trial is graphed as a percent of Control as there was a marked difference of yield between the two years after changing pruning methods. The Bark based compost had the highest yield in 2006, followed by the Humic acid and Mycorrcin treatments. In both years, the Sulphur treated vines had the smallest berries, and the shortest and lightest bunches, however in 2007 they had the highest number of bunches/vine. Bunches umbers per vine were 29 % higher in the Sulphur treatment than in the Control vines. The two Bark compost treatments and the Humic acid treatment had the largest bunches (both in weight and length) in 2007.

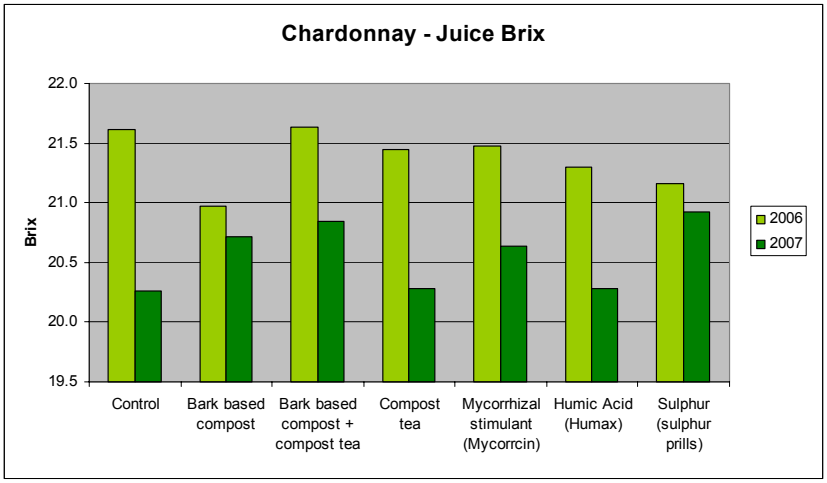
Graph 5



In trial A and B, the mycorrhizal treatment tended to increase Brix except in the trial A 2007 vintage. There were small increases in trial F for the mycorrhizal treatments in 2007.

The combination RPR and mycorrhizal treatment in Trial B was not microvinified in all years.

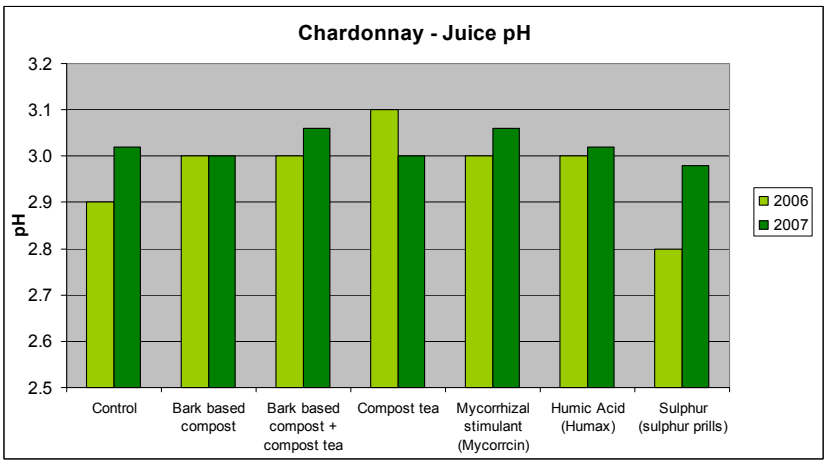
Graph 6



The Brix at harvest at the Chardonnay trial had variable results. In the second year the Sulphur treatment showed higher Brix. All treatments had higher Brix than Control.

The juice pH was measured for all treatments but no significant differences were found in the Merlot trial.

Graph 7

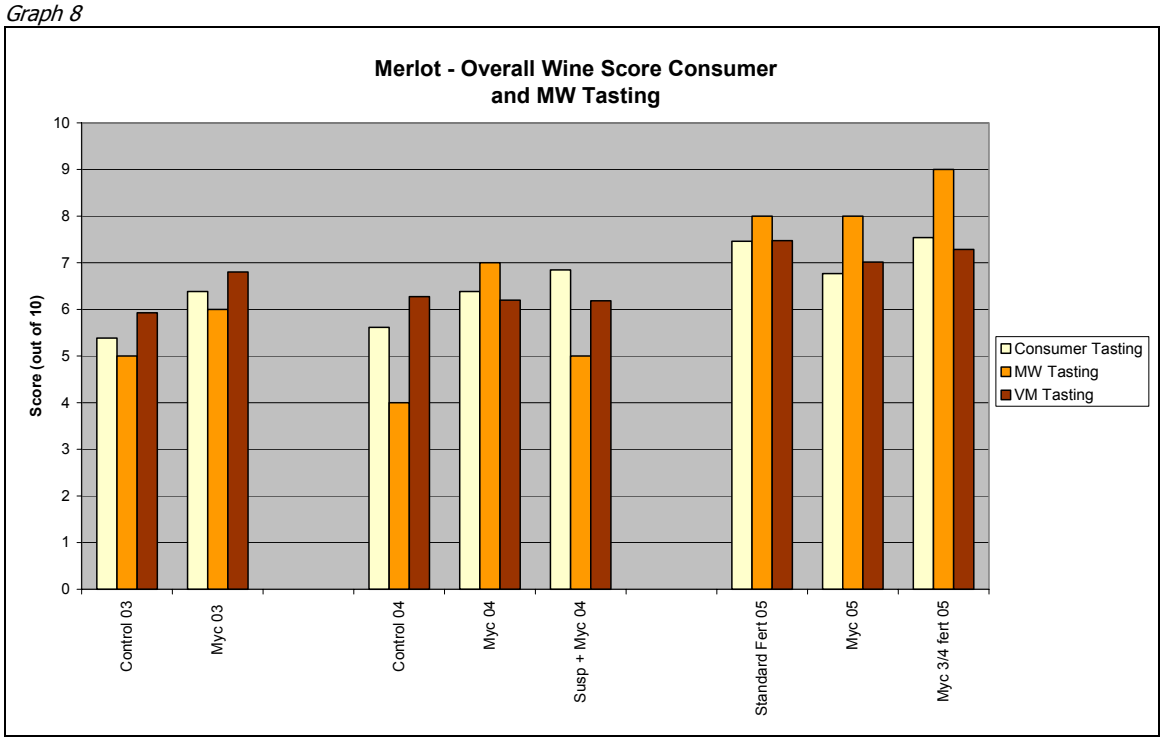


In the Chardonnay trial the 2006 data showed Sulphur with the lowest pH, followed by Control. The Compost tea treatment had the highest pH in 2006. There was less variation between the treatments in 2007.

Microvin Results

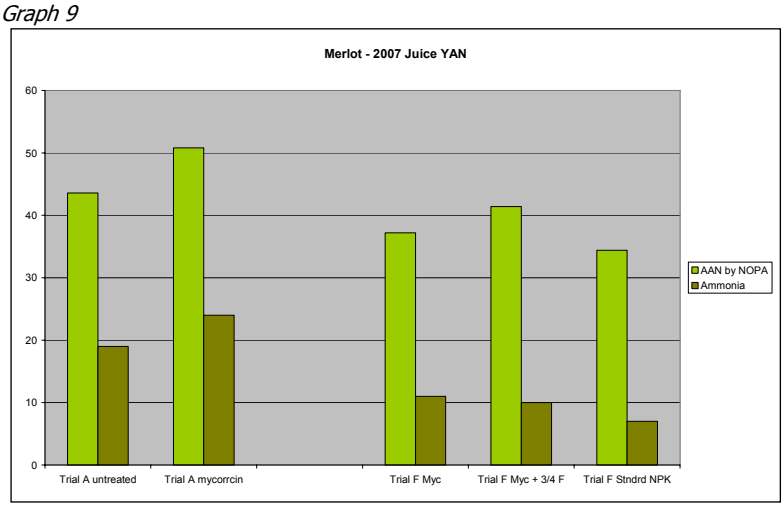
The results suggested that there may be some effects on wine quality. Microvins have been made from selected treatments in the Merlot trials in 2005, 2006 and 2007. The 2006 microvins generally showed the same trends as the 2005 microvins. Microvins from Trial A and B showed generally higher scores than their respective control microvins, suggesting that the treatments improved wine quality.

Graph 8



2006 Vintage - Blind wine tastings by a group of 13 wine consumers, a Master of Wine, and a panel of 14 winemakers and viticulturists from a major NZ wine producer.

Graph 9



There was a high level of agreement amongst groups that have tasted these wines that the vines treated with the mycorrhizal stimulant appear to have produced slightly better wines in the standard soil treatments. In the fertigation trial, the combined mycorrhizal treatment and standard fertigation mix applied at 75% of the standard fertigation rate, also appeared to be slightly better in quality and had higher Brix levels. The 2007 vintage microvins were not available for tasting yet.

The mycorrhizal treatment increased YAN, even in trial F where either no fertigation N or less fertigation N inputs were made in comparison with the standard treatment. (See Graph 9).

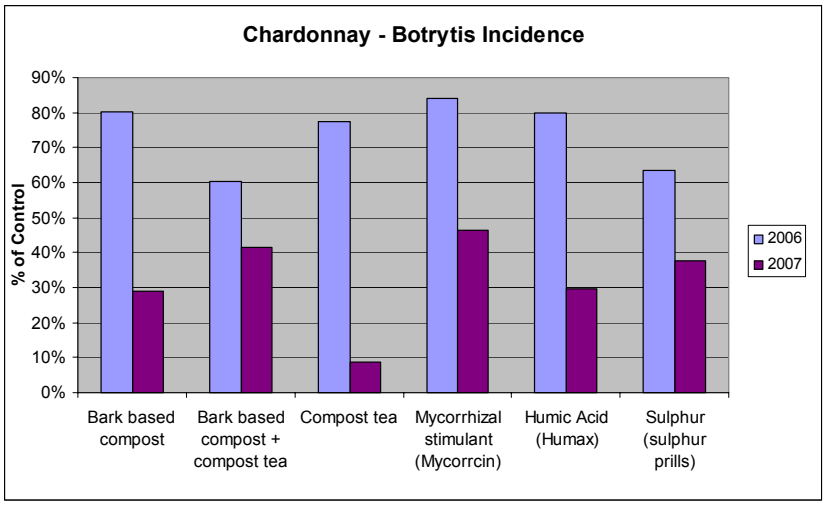
The juice data suggest that the Mycorrhizal treatments may lower Malic acid in the juice. In the 2006 trial A and trial B the analyses find slightly higher levels of polyphenols in the mycorrhizal treatment, but that was not repeated in trial F (fertigation).

The microvin 2007 juice was tested for phosphorus content; the treated vines did not show higher phosphorus levels in the berries.

Disease

Botrytis pressure was low in both 2006 and 2007. The graph below shows the result of the Botrytis assessments in the Chardonnay trial. These assessments suggested that most treatments had a beneficial effect in reducing Botrytis.

Graph 10



This graph compares the Botrytis incidence between the treatments at the Chardonnay trial. *The assessments were made two days after harvest therefore are not representative of the levels at harvest.* The treatments all had a lower incidence of Botrytis. In 2007, the Compost tea had less than 10% the Botrytis incidence of Control.

Soil Biological Activity and Mycorrhizal Colonisation

Biological tests show an increase in mycorrhizal colonisation of the roots where the mycorrhizal inoculant was used, although the results were not fully consistent. Mycorrhizal colonisation was tested on a number of occasions. It also transpired that there may have been changes in the "quality" or density of mycorrhizal colonisation (comments by Karin Watson, BioCult).

The soil biological tests from the Chardonnay trial show some positive effects on mycorrhizae.

2007	% EM Ectomycorrhizal Colonization & layer density		% VAM (Vesicular Arbuscular Myc.Col.)	
Control	20%	very thin layers	50%	weak
Bark based compost + Compost tea	13%	very thin layers	93%	strong
Mycorrhizal inoculant (Mycorrcin)	7%	very thin layers	70%	strong

Table 1 - Chardonnay trial

Similar trends were found for the mycorrhizal stimulant in the Merlot trial. Only selected treatments were tested for mycorrhizal effects.

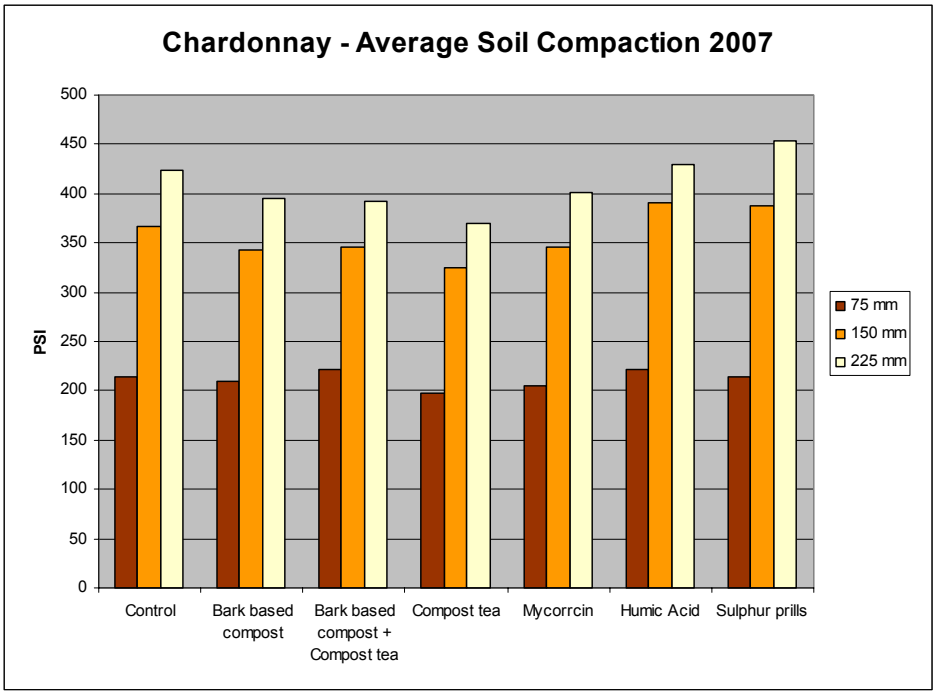
Soil bacterial and fungal Biomass determinations were made for selected treatments. It was found that the fungal biomass in the Chardonnay trial was low. The tested treatments (Compost and compost tea, and Mycorrcin) did not increase fungal biomass in the Chardonnay trial in 2007. However the Mycorrhizal stimulant may have had a beneficial effect on fungal biomass in the Merlot trial (Table 2).

2007	Active Bacterial Biomass (µg/g)	Total Bacterial Biomass (µg/g)	Active Fungal Biomass (µg/g)	Total Fungal Biomass (µg/g)	Hyphal Diameter (µm)
Trial B Untreated	1.60	702	0.000	164	2.5
Trial B Myc	2.61	303	1.62	271	2.75
Trial F Standard Fert	2.69	535	1.52	369	2.75
Trial F Myc + ¾ Fert	6.03	315	12.1	370	2.75
Desired Range	1 - 10	100 - 300	10 - 25	200 - 600	

Table 2 – Merlot trial

Soil Compaction

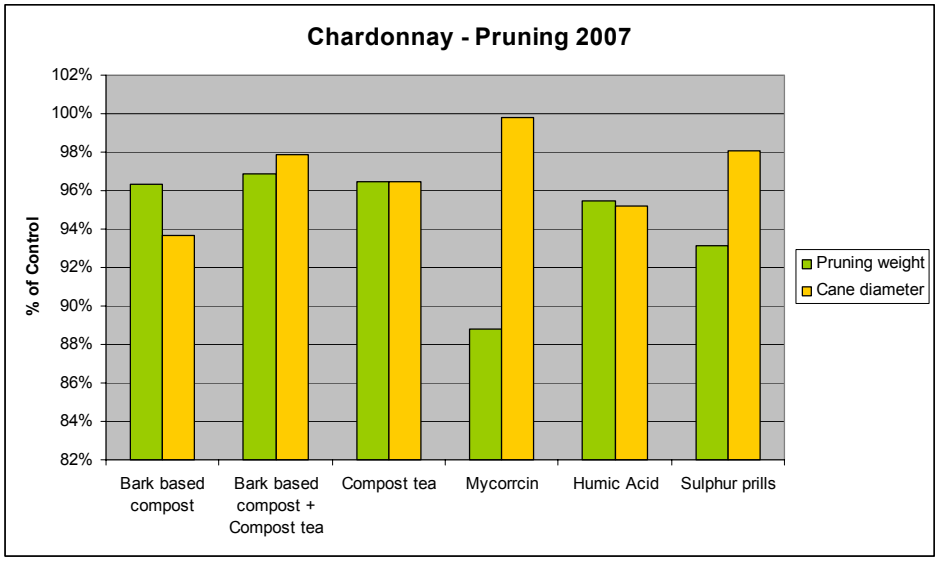
Graph 11



Pruning

The prunings at the Chardonnay trial were weighed in 2007. The Mycorrcin treatment had significantly lower pruning weights than Control, which had the highest pruning weight. Interestingly, even though Mycorrcin had the lowest pruning weight, it had the thickest cane diameter of all treatments (except Control). The Bark based compost treated vines had significantly thinner canes than Control. Control showed the greater canopy vigour with highest pruning weight and the largest cane diameters (cane diameter results not shown).

Graph 12



The yield results there may have been a negative effect on yield in some of the treatments, despite higher soil nitrogen levels. The reason for this is not clear, but possibly soil biomass responses or root growth responses acted as a nutrient sink competing with the vines. Only the mycorrhizal stimulant and sulphur treatments maintained yield at the same level as the Control. These results were not in line with last years yield data. This year the bunch numbers per vine in the Sulphur treatments were significantly higher than in the other trials (not shown). This is a potentially interesting finding because of the generally low sulphur status of New Zealand soils, but needs to be confirmed in other trials.

NOTE: Analytical results will be available online (www.integrape.com).

* Statistically significantly different to Control at a 95% confidence level