Grape Powdery Mildew Prevention Trial

Dartmoor Rd, Puketapu, Hawke's Bay

2015-16

Final

November 2016

Chris Henry

Landline 06 874 2921
Mobile 027 294 1490
Email chrishenry@actrix.co.nz

Table of contents

Executive Summary

This was a full season trial (albeit with a late start) looking at grape powdery mildew prevention in a Hawke's Bay vineyard with a very poor history of controlling the disease.

At the end of the previous season, an area adjacent to and within the same block was chosen to screen various products for efficacy against chasmothecia (the fruiting stage of powdery mildew), such was the level of disease. The trial site had not previously been used for trialling. The trial was well replicated, randomised and the data uplifted blind by an expert.

There were 17 treatments in the trial, including an 'untreated' and a robust chemical comparison. No crop was commercially harvested for wine as the trial contained unregistered materials. (Those materials are organically acceptable in the US). Crop was taken from six treatments for microvinification. None have exhibited any issue regarding fermentation or wine quality.

At veraison, the untreated was completely infected with the disease and unharvestable. The chemical comparison performed well, easily within industry norms (5% infection at harvest) as did eight out of the 17 treatments - three exceeded the chemical standard for efficacy. Disease pressure for the season was regarded by most grape growers in Hawke's Bay as being of moderate to high pressure.

There were some significant outcomes:-

- Potassium silicate (HML Silco, also referred to as Silco) as a tank mix addition improved any treatment containing a Protector derivative (HML Red, HML32, HML32 + sulphur, HML White).
- Silco by itself produced low efficacy (not commercial as a standalone) as did several treatments including sulphur.
- HML Red, a provisionally registered product containing Protector with a very low copper rate demonstrated useful commercial efficacy with and without Silco.
- No phytotoxicity was reported for HML Red after 10 applications. In a specific phytotoxicity study in the same block, no phytotoxicity was seen after applications of HML Red at 2 x field concentration sprayed twice a week apart over flowering. neither was yield affected.
- No phytotoxicity was reported for Silco alone after 10 applications. Minor phytotoxicity was noted in a treatment where it accompanied HML32, but HML32 produced similar minor phytotoxicity. A heightened level of spray deposit was noted where Silco accompanied HML32 and sulphur. It should be noted that while 10 applications for grape powdery mildew prevention would now not be uncommon –it would be extremely unlikely that the deposition achieved by 10 handsprayed applications of this combination would ever occur.

1.0 Introduction

This trial was a continuation of research undertaken in seasons previously on preventative control of grape powdery mildew.

There were 17 treatments including an untreated and a robust chemical treatment for comparison.

Some of the materials used were commonly used commercial products for grape powdery mildew prevention - Sulphur, Protector^{hml} and HML32 (potassium soap based products) and synthetic chemistry.

Other materials were unregistered/provisionally registered such as soaps of other metals – zinc, copper and manganese. Potassium silicate (HML Silco or Silco) was included by itself or as an additive to other materials.

2.0 Trial Objectives

The objective of the trial was to evaluate and compare various materials and combinations of them for the prevention of grape powdery mildew infection.

3.0 Trial Site and Conditions

3.1. Vineyard description

The trial site was located in a vineyard on Dartmoor Rd, Puketapu, Hawke's Bay, New Zealand (see Figure 1 and Figure 2).

The variety was Pinot Gris, trellised as 2 cane pruned VSP. The row width was 2.75m with 1.8m between vines. The vines are approximately 15 years old, with variability between vines and missing vines as you would expect in a managed (but not highly managed) vineyard of this age. The vineyard provides fruit grown under contract.

The owner applied the same viticultural attention during the growing season as the rest of the block, including tucking, leaf plucking, mowing and herbicides. Disease control from bud burst was the responsibility of Henry Manufacturing Limited. Henry Manufacturing Limited purchased all crop at the completion of the trial.

Figure 1: Dartmoor Rd powdery mildew prevention trial site (source Google Earth 2016)

Figure 2: Dartmoor Rd powdery mildew prevention trial site

3.2. Previous history of powdery mildew infection

The larger site has a history of grape powdery mildew infections and was severely infected in 2015. At the end of that season (April 2015), it was used as a site to evaluate the efficacy of machine sprayed, end of season treatments for chasmothecia elimination/reduction in the canopy.

For more information on the 2015 trial see: http://www.henrymanufacturing.co.nz/products/hml-32/publications/farmlands-trial-2015.pdf

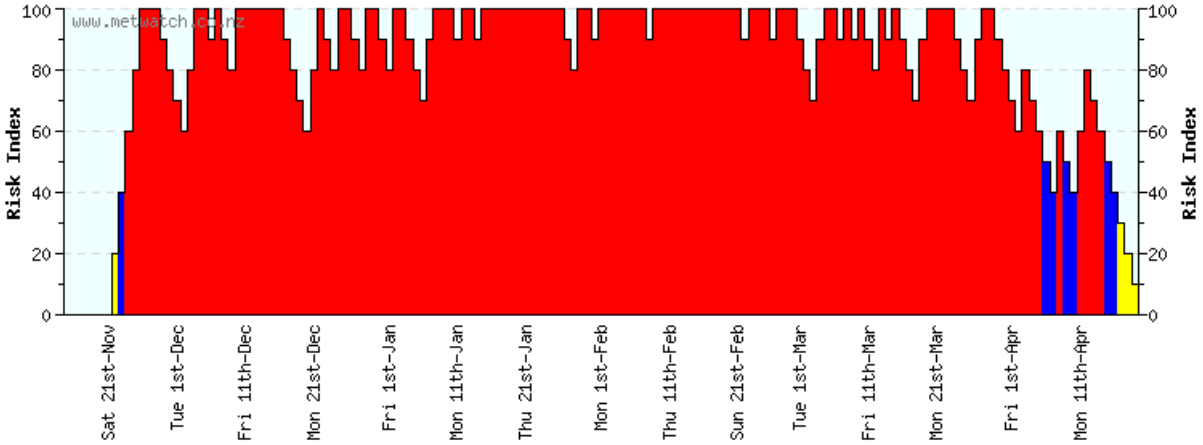
The rows used in this trial had not previously been involved in any trial.

3.3. Seasonal weather conditions

The 2015/2016 season was regarded by most growers in Hawke's Bay as being one of moderate to high pressure for powdery mildew disease. Disease in this trial followed what would be described as normal for Hawke's Bay – the first appearance of powdery mildew was seen in the Untreated Bays on the 23 December 2015 and complete collapse of the same bays near veraison.

Figure 3 discloses the seasonal record per the 'Gubler model' for powdery mildew pressure.

Figure 3: Seasonal Record from the 'Gubler Model' for Powdery Mildew Pressure



4.0 Trial Design

4.1. Treatments

There were 17 treatments in this trial as described in Table 1. The replication was four and the plots were randomly set out within each replication. A plot was one bay (panel), most times containing four vines.

The trial covered 10 rows, each row containing 7 -8 bays.

4.2. Application Dates and Intervals

It should be noted that the trial did not begin at 'bud burst'. The trial program was preceded by applications of lime sulphur, sulphur with an adjuvant rate of Protector and HML32/copper/sulphur, applied by machine sprayer over all treatment sites.

There were ten applications of the trial treatments. Table 2 shows the dates of application and the interval between applications as well as the Chemical Standard sprays for each application.

Table 1: Trial Treatments

Treatment No.	Flag Colour	Treatment
1	Green	Untreated
2	Yellow/Black	Chemical Standard
3	Yellow	Sulphur
4	Yellow + Orange/White	Sulphur + Silco
5	Light Green + Yellow	0.5% Protector + Sulphur
6	Orange/White	Silco
7	Blue	HML32
8	Blue + Orange/White	HML32 +Silco
9	Blue + Yellow	HML 32 +Sulphur
10	Blue + Yellow + Orange/White	HML 32 + Sulphur + Silco
11	White	HML White
12	White + Orange/White	HML White + Silco
13	Black/White	HML Black
14	Black/White + Orange/White	HML Black + Silco
15	Black/White + Black/Pink	HMLBlack +50
16	Red	HML Red
17	Red + Orange/White	HML Red + Silco

Table 2: Application Dates, Interval, Chemical Standard

Application Dates	Interval	Chemical Standard	Comments
26 October 2015	0	HML32 / Sulphur / Copper	
3 November 2015	8	Sulphur / Manzate	Fine, windy, rain expected
6 November 2015	3	Sulphur / Manzate	Re-cover from rain event 4-5 November
14 November 2015	8	HML32 / Sulphur / Copper	Fine
24 November 2015	10	Nando / Pendant	Fine, 5% flowering
5 December 2015	11	Spiral	Fine, 80% flowering
13 December 2015	8	HML32 / Sulphur / Copper	Rain in morning
24 December 2015	11	Sulphur	Fine, showers previous day/night, powdery mildew first detected in an untreated bay
5 January 2016	12	HML32 / Sulphur / Copper	Fine, after 40 mm rain
15 January 2016	10	Sulphur	Fine, windy, 28 degrees

Nando has an active ingredient of 500g/litre fluazinam in the form of a suspension concentrate (NuFarm)
Pendant is a systemic triazole (DMI) fungicide with preventative and curative activity (Orion)
Spiral is a systemic fungicide. Active Ingredient: 500g/litre spiroxamine. (Adria)

Table 3 shows the application rate for each product based on a 100L of water.

Table 3: Product Application Rates

Product	per 100L
Sulphur	150g
0.5% Protector	500ml
Silco (K. silicate)	425g
HML32	1.4kg
HML White	1l
HML Black	1l
HML Black +50	1l
HML Red	1l
Manzate	200g
Nando	100ml
Pendant	12ml
Spiral	120ml

4.3. Application Method

All trial treatments were applied at high volume, to the whole plant, ***to the point of run off in one pass*** by electric pump assisted hand gun from each side of the row. Spray applications were made by Chris Henry. No attempt is made to provide any conversion to machine sprayed litres/ha.

4.4. Assessment

The first signs of powdery mildew infection were noticed around 23 December 2015. The assessment was undertaken once on 25-26 January 2016, 10 days after the last powdery mildew spray (15 January 2016). The vines were about to enter veraison and this period is regarded in New Zealand as being the time that most demonstrates product efficacy for grape powdery mildew.

The trial was field assessed for both powdery mildew incidence and severity by Bridget Wilton, a technical advisor for Farmlands Horticulture. Her qualifications and CV is provided in Appendix 1. **She undertook the assessment blind**. Analysis and statistics were undertaken by Peter Wood, a scientist with Plant and Food Research.

4.4.1. Assessment method

Twenty-five bunches in each plot were closely inspected and assessed for the percentage of powdery mildew infection. The percentage of powdery mildew included both active/fresh powdery mildew (mycelium observed) and areas of powdery mildew scarring (no mycelium observed).

Chasmothecia was observed on one berry in a plot of Treatment 13 but the presence of chasmothecia was not specifically assessed.

Bridget Wilton noted ‘pinprick’ surface scarring on Treatments 7 and 9 and more ‘speckled’ scarring on Treatment 8. She noted a white spray deposit on Treatment 10 as well as some ‘russetting’. She

also noted berries starting to split on Treatment 1 (untreated). Some of these characteristics are shown in Figure 4.

Photographs were taken of each treatment.

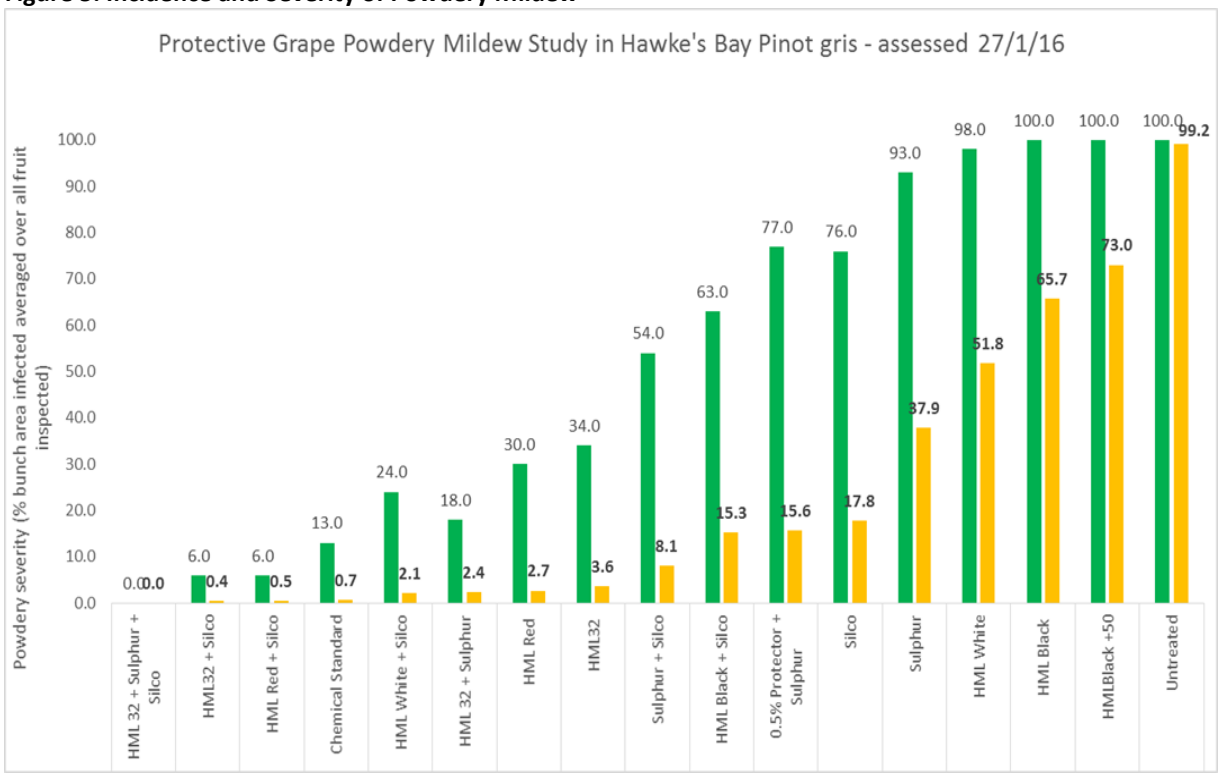
Figure 4: Berry characteristics

Berry Splitting - Untreated	Pinprick scarring - Trt 9 (HML32 and sulphur)	Residue - Trt 10 (HML32, sulphur and Silco)
		

5.0 Efficacy Results

The percentage of powdery mildew incidence and severity from the examination of 100 bunches is shown for each treatment in Figure 5.

Figure 5: Incidence and Severity of Powdery Mildew



The statistical analysis of the treatment results was undertaken by Peter Wood, Plant and Food Research. The statistical analysis is shown in Table 4.

Table 4: Statistical Analysis

Treatment	PM incidence (% bunches)		PM Severity (% crop)	
HML32 + Sulphur + Silco	0	a	0.0	a
HML32 + Silco	6	ab	0.4	a
HML Red + Silco	6	ab	0.5	a
Chemical Standard	13	abc	0.7	a
HML32 + Sulphur	18	abc	2.4	ab
HML White + Silco	24	bc	2.1	ab
HML Red	30	c	2.7	ab
HML32	34	cd	3.6	abc
Sulphur + Silco	54	de	8.1	bcd
HML Black + Silco	63	ef	15.3	cd
0.5% Protector + Sulphur	77	ef	15.6	d
Silco	76	fg	17.8	d
Sulphur	93	gh	37.9	e
HML White	98	gh	51.8	ef
HML Black	100	h	65.7	fg
HMLBlack +50	100	h	73.0	g
Untreated	100	h	99.2	h
LSD	*22.5*		*15.7*	

Within each column, means followed by the same letter are not significantly different (LSD, α = 0.05).

The P value was < 0.001 for both incidence and severity indicating a high level of confidence 99% that treatment effects were real.

Data were analysed using GenStat Release 17.1.0.14713 (PC/Windows XP) Copyright 2014, Lawes Agricultural Trust (Rothamsted Experimental Station). Before analysis incidence and severity data were subjected to angular transformation. The untransformed means are reported in the tables and figures. Analysis of Variance (ANOVA) and Fisher's Protected Least Significant Differences of Means (LSD, α = 0.05) were used to determine statistical differences between treatments.

GRAPH | Treatment differences by name | Trearment differences by trt # | Assessment Sheet | Data for stats

5.1. Summary of Results

The ‘chemical standard’ performed well – easily within acceptable commercial limits.

Three treatments were found to be better than the chemical standard with the statistics showing the difference between them not to be statistically significant. Each of the three treatments showed improved efficacy with the inclusion of Silco.

Figure 6 shows Treatment 1 (untreated) alongside Treatment 17 (HML Red and Silco) showing how well Treatment 17 stood up against such a close source of inoculum.

Sulphur, Protector and Sulphur and Silco alone produced average efficacy – less than commercially acceptable as a standalone treatment.

HML White by itself produced poor efficacy but with the inclusion of Silco, the efficacy obtained was within a commercially acceptable range.

The ‘untreated’ control succumbed completely to the disease, followed closely by HML Black, HML Black+50 and HML White.

The crop from the HML White, HML Black, HML Black +50 and Sulphur treatments were dropped to the ground immediately after assessment to reduce inoculum levels for the rest of the trial crop and the vineyard in general.

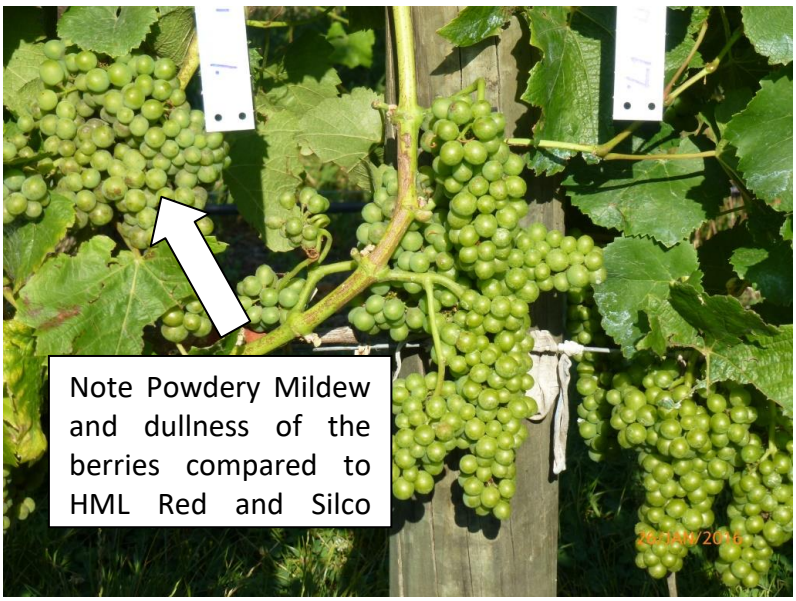


Figure 6: Comparison of Treatment 1 (Untreated) and Treatment 17 (HML Red and Silco)

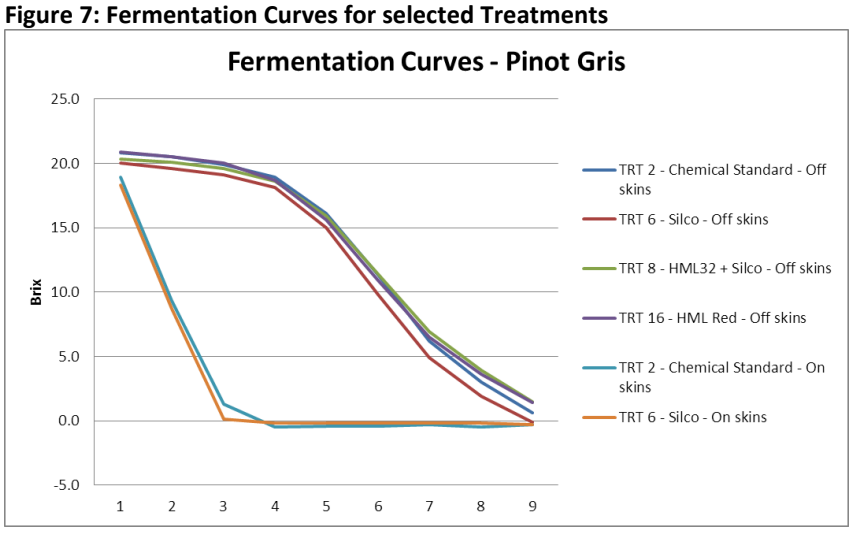
6.0 Wines and Ferments

On 4 April 2016, grapes were harvested from four treatments to allow 'microvins' to be undertaken at Eastern Institute of Technology (EIT). These are shown in Table 5 along with the Brix, pH and TA of the juice tested on 5 April 2016. The fermentation curves for the six treatments shown in Figure 7 disclose nothing unusual.

Table 5: Juice Analysis of four treatments for Microvins

Juice		Brix	pH	TA
Treatment 2 - Chemical Standard	On skin	20.4	3.38	6.90
	Off Skin	20.8	3.42	7.00
Treatment 6 - HML Silco	On skin	19.5	3.36	7.00
	Off skin	20.1	3.42	6.80
Treatment 8 - HML32 and HML Silco	Off skin	21.0	3.45	6.60
Treatment 16 - HML Red	Off skin	20.4	3.50	6.40

Figure 7: Fermentation Curves for selected Treatments



7.0 Conclusions

Many of the outcomes were completely in line with expectations when considering the season, the carry-over background of high infection the previous season, and the as yet not clearly defined complication of ascospore release occurring later than flag shoot infection (possibly through flowering and later).

The comparison between various treatments was as expected such as HML32 compared to HML32 + sulphur, sulphur compared to 0.5% Protector + sulphur, Silco compared to Silco + sulphur, Silco compared to both the untreated and the chemical treatment, or even the untreated compared to HML White and HML Black. In short, this trial was supportive of previous trials and data.

HML Red produced creditable efficacy against powdery mildew in its first real test against the disease.

The area of greatest interest was the effect of additions of potassium silicate as Silco. Silco alone produced its own efficacy but overall performed poorly (in line with other overseas publications).

There can be no doubt that **additional and substantial efficacy is generated by the inclusion of Silco to any of the products that contain Protector^{hml}**.

8.0 Acknowledgements

Chris Henry would like to acknowledge Ron Smith, the owner of the vineyard for allowing this trial to be undertaken and for his assistance at times, Chris Herries (technical manager of Farmlands) for his support, Bridget Wilton (technical advisor, Farmlands) for the field evaluation of powdery mildew and Peter Wood, Plant and Food Research's scientist for his analysis and statistical reporting.

Appendix 1: CV for Bridget Wilton

Curriculum Vitae for Bridget Wilton

Farmlands Horticulture Technical Advisor
Bridget.wilton@farmlands.co.nz

Relevant Qualifications

1997 Bachelor of Applied Science (Horticulture)

Relevant Employment History

Farmlands Horticulture - Technical Advisor (Current position)

Eastern Institute of Technology
Pest, Disease and Disorders in Horticulture Tutor

Constellation New Zealand
Technical Viticulturist and Grower Liaison

Montana Wines – Allied Domeq – Pernod Ricard
Assistant Vineyard Manager
Korokipo Estate, Hawke's Bay
Patutahi Estate, Gisborne

Wainawa River Estate - Vineyard Manager