

EVALUATION OF PROTECTOR^{hml} AND SULPHUR FOR CONTROL OF POWDERY MILDEW ON GRAPE

Joseph Soler Vineyard – Hastings

Verdelho – 2006/07 and 2007/2008 seasons

Executive Summary

The outcome of the two seasons of study (2006/07 and 2007/08) confirms that the combination of a surfactant rate of Protector^{hml} and light/moderate rates of Sulphur, when used in a protective program, will provide efficacy against powdery mildew to the equivalence of a chemical program including DMI's.

High efficacy is maintained when machine spraying either in a low or high water rates. Indications are that higher water rates may provide improved efficacy for a given weight of Sulphur and/or allow a reduction in the amount of sulphur used.

The Protector/Sulphur combination provides residue free control after flowering . It is expected that Protector will soon be granted approval for use within certified organic vineyards as an adjuvant.

There are clear indications that two high water volume applications (7 to 10 days apart) of Protector/Sulphur or Protector/Copper combinations may deliver eradicant action on powdery outbreaks, but presently there is insufficient data to prove this to a high enough standard.

Objectives of the 2007/08 Trial

The large hand applied replicated trial undertaken over the 2006/07 season indicated that when a surfactant rate of Protector (0.5%) was added to equivalent solutions of 4kg/ha, 3kg/ha or 2kg/ha sulphur, the efficacy of sulphur was improved to be statistically equivalent of the chemical treatments including DMI's. The data from the 2006/07 trial is provided in Appendix 1 and Appendix 2.

The main objective of the 2007/08 trial was to verify that these results could be reliably repeated by using conventional machinery and water rates.

Secondary objective were:

- To begin testing the limits of efficacy of low sulphur rates using Protector as an adjuvant.
- Evaluate the effects of high and low water application rates on powdery mildew control.
- To assess if the different chemical and water rates had any effect on the control of erinose mite (part of the wider study reported separately).

Disease History and Layout of Trial

The Verdelho block was chosen again, as the variety is highly susceptible to powdery mildew.

In the 2005/2006 season, no crop was harvested due to chronic powdery infection.

In the 2006/2007 season, powdery mildew was controlled well with the use of two applications of a DMI and five additional applications of sulphur, except the trial rows. The only chronic powdery mildew infection occurred on the untreated crop in the replicated trial.

In the 2007/2008 season the Verdelho block was fully utilised for this trial. The Verdelho block is 2.5 ha and contains 52 rows. The 4 rows from the previous season's trial site was treated with 4kg sulphur with a low water rate. All treatments were replicated 4 times through the block (4 x 2 rows).

Trial Treatments

There were six treatments:

- low water rate with 2kg S, 3kg S and 4kg S; and,
- high rate rate with 1.5kg S, 2kg S, and 3 kg S.

The surfactant rate of Protector was common to all treatments at 0.5% of the water volume.

No crop was left untreated.

Sprayer Settings

The sprayer used in the trial was a tow behind, over row Sylvan G2 (air shear-large fan model). The sprayer's output was managed by a Farm Scan 2400 controller.

The sprayer was tuned to provide emphasis to the bunch line by slight additional air, orientation of nozzles and slightly more generous jetting. The nozzles were backward facing at about 30 degrees, the tips 70mm from the centre of the canopy.

It was operated at 540 PTO rpm with speeds over ground for all treatments approximately 6.5km/hr except for the first application of the low water rate which went on at approximately 8.5km/hr. The water pump pressure was approximately 80psi (5.5bar).

Application Dates and Water Rates

The application dates and water rates are shown below, along with the spray interval.

Date	Low Water Rate	High Water Rate	Spray interval
26 October	150 l/ha	200 l/ha	
13 November	150 l/ha	300 l/ha	18 days
23 November	200 l/ha	400 l/ha	10 days
11 December	300 l/ha	600 l/ha	18 days
3 January	300 l/ha	600 l/ha	23 days

The method of varying the concentrations of sulphur in the spray tank proved to be very efficient and resulted in only small amounts of sprayer downtime. It also ensured the spray tank volume remained high enough to ensure reliable outputs. Water rate details are provided in Appendix 3.

Assessment

Powdery Mildew infection was assessed on three occasions up to veraison on the basis of examining 20 random bunches in each of 20 predetermined bays within each treatment. This is the Sustainable Wine Growing Standard Method.

No attempt was made to grade severity – any powdery mildew counted.

The weather during the 2007/2008 season is regarded as having provided average conditions for powdery mildew infection on grapes.

Summary of Results

The full results are tabulated in Appendix 4. The following table summarizes these results.

Table 1.0

Treatment	Powdery mildew incidence			
	27/12/07	8/1/08	23/1/08	Total
Low water 2kg S	0	0.25%	2%	0.75%
Low water 3kg S	0	0	0	0
Low water 4kg S	0	0	0.25%	0.08%
High water 1.5 kg S	0	0	0.25%	0.08%
High water 2kg S	0	0	0	0
High water 3kg S	0	0	0	0

- All treatments provided good control of powdery mildew without the use of DMI's.
- The use of high water rates provided the same levels of control with lower sulphur rates (low water 4kg S same control as high water 1.5kg S)

There was no powdery mildew noted in the low water 3kg S/ha treatment, nor in high water 2kg S/ha and 3kg S/ha treatments.

There was one bunch located in the low water 4kg S/ha treatment and 8 bunches in the low water 2.0kg S/ha treatment.

Statistical analysis has not been undertaken at this stage, but it is predicted that there would be no significant differences between any of the treatments, with the unlikely possible exception of the low water 2kg/ha.

There were no visual differences noted between treatments nor was there anything that could be regarded as spray damage.

Verdelho is very resistant to botrytis and no botrytis was found.

See other report for effects on erinose mite control.

Costing Analysis

The costs of a full season (5 applications) powdery mildew spray programme range between \$45.00 and \$78.50. The cost details are contained in Appendix 5. are on the cost basis of \$5.00/ litre for Protector^{hml.} and \$1.75/kg for Sulphur.

Further Areas of Research 2008/09

- To study any effects on botrytis levels with Protector being applied at a low rate but on a regular basis.
- To study the necessary rates of sulphur required for powdery mildew control on less susceptible varieties of grapes – reds as well as whites
- to study the effects of complete removal of powdery mildew sprays out of the 'standard' programme
- to study the effects of varying rates of lime sulphur, other 'soft' insecticides and surfactant rates of Protector with varying rates of sulphur at bud burst on erinose mite infections and/or further study when an outbreak has occurred.

Acknowledgements and Comment

A debt of gratitude is owed to Villa Maria Wines Limited, their viticultural team, the staff and management at Joseph Soler Vineyard, and other third parties, because without their assistance, enthusiasm and knowledge, this project and the benefits of it may not have seen the light of day.

The outcome, contents and any representation made in respect of this report are solely those of the author, Chris Henry, of Henry Manufacturing Limited, the manufacturers of Protector^{hml.}

Appendix 1: Powdery Mildew Protectant Trial – Raw Results – 2006/07

Treatments	Number of infected bunches per bay assessed 6 January	Total number of bunches infected assessed 6 January	Number of infected bunches per bay assessed 27 January	Total number of infected bunches assessed 27 January	Sev 1	Sev 2-5	Sev 6+
Untreated							
a - Untreated Control – (to be double allocation due to number of treatments) - Green	2-6-5-5-1-0-12-3	17(corrected)	10-26-27-25-12-18-27-50	97(corrected)	31	34	32
Standard Treatments							
b - Standard Treatment (1) – Systhane @ 5% capfall and PBC, otherwise Sulphur at nominated rates - Red	0-0-0-0	0	0-0-0-0	0	0	0	0
c - Standard Treatment (2) – Impulse x 2 @ 5% capfall and 80%, Systhane at PBC , otherwise Sulphur at nominated rates - Red/Black.	0-0-0-0	0	1-0-0-1	2	2	0	0
o – Standard Treatment (3) – Systhane @ 5% capfall, Twist at PBC ,otherwise Sulphur at nominated rates - Red/Green.	0-0-0-0	0	0-0-0-0	0	0	0	0
Protector alone							
d - Protector 2% alone – White	0-2-0-7	9	0-2-0-20	22	8	6	8
Sulphur alone							
e - Sulphur (nominated rate to vary 3kg/ha to 6kg/ha)(water rate 200l/ha = 1.5kg/100l to 3kg/100l) – Yellow.	1-1-4-0	6	3-1-8-0	12	4	5	3
Sulphur Treatments with Protector as Surfactant							
f - Protector 0.5% + Sulphur (nominated rate) – White/Yellow.	0-0-0-0	0	0-1-1-0	2	1	0	1
g - Protector 0.5% + Sulphur (75% nominated rate – White/Yellow/Yellow	0-0-0-1	1	0-0-1-2	3	0	1	2
h - Protector 0.5% + Sulphur (50% nominated rate) – White/Yellow/Black	0-0-1-0	1	0-0-0-5	5	2	1	2
Protector and Copper Formulations+A32							
i - Protector 2% + Kocide 2000LF 120ml/100l (0.44kg Cu@ 1000l/ha) White/Blue	0-0-0-0	0	1-0-0-0	1	0	1	0
j - Protector 2% + Kocide 2000LF 90ml/100l (0.33kg Cu@ 1000l/ha) White/Blue/Blue	0-0-0-0	0	0-0-0-0	0	0	0	0
k - Protector 2% + Kocide 2000LF 60ml/100l (0.22kg Cu@ 1000l/ha) White/Blue/Black	0-0-0-0	0	0-0-0-0	0	0	0	0
l - Protector 2% + Kocide 2000LF 30ml/100l (0.11kg Cu@ 1000l/ha)White/Blue/Red	0-2-0-0	2	0-4-0-0	4	0	2	2
Protector and Copper Alternating with Protector and Sulphur							
m - alternating Protector 2% + Kocide 120ml/100l/ Protector 0.5% + Sulphur (nominated rate – see 'e' above) White/Blue White/Yellow	0-0-0-0	0	0-1-0-0	1	1	0	0
n - alternating Protector 2% + Kocide 60ml/100l/ Protector 0.5% + Sulphur (nominated rate – see 'e' above) White/Blue/Blue White/Yellow	0-1-0-0	1	0-2-0-0	2	0	1	1

Appendix 2 – Protectant Trial 2006/07 Statistics

Percentage incidence and severity of powdery mildew on 27 January 2007 in Hawke's Bay Verdelho.

Treatments	Percent total mildew infected bunches	Percent bunches with 1 berry infected	Percent bunches with 2-5 berries infected	Percent bunches with >5 berries infected
a - Untreated Control	36.7 a	10.3 a	11.5 a	10.4 a
b - Standard Treatment (1) – Systhane @ 5% capfall and PBC, otherwise Sulphur	0.0 d	0.0 c	0.0 c	0.0 b
c - Standard Treatment (2) – Impulse @ 5% capfall, Systhane at PBC , otherwise Sulphur	0.6 bcd	0.6 bc	0.0 c	0.0 b
o – Standard Treatment (3) – Systhane @ 5% capfall, Twist at PBC, otherwise Sulphur at nominated rates 'e'	0.0 d	0.0 c	0.0 c	0.0 b
d - Protector 2% alone	3.6 b	1.6 b	0.5 bc	0.7 b
e - Sulphur (nominated rate to vary 3kg/ha to 6kg/ha) (water rate 200l/ha = 1.5kg/100l to 3kg/100l)	3.0 bc	0.8 bc	1.2 b	0.6 b
f - Protector 0.5% + Sulphur (nominated rate)	0.4 bcd	0.1 c	0.0 c	0.1 b
g - Protector 0.5% + Sulphur (75% nominated rate)	1.0 bcd	0.0 c	0.1 bc	0.6 b
h - Protector 0.5% + Sulphur (50% nominated rate)	0.2 bcd	0.1 c	0.1 c	0.1 b
FProb	<.001	<.001	<.001	0.003

¹ Means with the same letter within each column are not significantly different (LSD test, $P < 0.05$)

All data were subjected to ANOVA using GenStat Release 9.1 [(PC/Windows XP) Copyright 2006, Lawes Agricultural Trust (Rothamsted Experimental Station)]. Before ANOVA all data were angular transformed. Mean separation tests were carried out using Fisher's protected LSD at the $P < 0.05$ level of significance on the transformed data. All data are presented as back transformed means.

Appendix 3: Powdery Trial 07/08 - Water Rate Details

Treatments

High Water Rate 200-600 L/Ha

1	1.5kg sulph	plus 0.5% protector
2	2kg sulph	
3	3kg sulph	

Low Water Rate 100-300 L/Ha

4	2kg sulph	plus 0.5% protector
5	3kg sulph	
6	4kg sulph	

Chemical Additions

Application 1

600 L water total plus 3L protector

Treatment	Sulph Add	Spray rate	Spray used	Vol remaining (L)
1	3.6kg	250L/ha	100L	500
2	1kg	250L/ha	100L	400
3	1.6kg	250L/ha	100L	300
4	0.4kg	150L/ha	60L	240
5	1.6kg	150L/ha	60L	180
6	1.2kg	150L/ha	60L	120

Remainder 120L with 4Kg/ha Sulph

Application 2

700L water total plus 3.5L protector

Treatment	Sulph Add	Spray rate	Spray used	Vol remaining (L)
1	3.5kg	300L/ha	120L	580
2	0.9kg	300L/ha	120L	460
3	1.6kg	300L/ha	120L	340
4	1.13kg	150L/ha	60L	280
5	1.9kg	150L/ha	60L	220
6	1.45kg	150L/ha	60L	160

Remainder 160L with 4kg/ha Sulph

Powdery Trial 07/08 cont.

Application 3

1200L water total plus 6L of protector

Treatment	Sulph Add	Spray rate	Spray used	Vol remaining (L)
1	3kg	600L/ha	240L	960
2	0.8kg	600L/ha	240L	720
3	1.2kg	600L/ha	240L	480
4	0.8kg	300L/ha	120L	360
5	1.2kg	300L/ha	120L	240
6	0.8kg	300L/ha	120L	120

Remainder 120L with 4kg/ha Sulp

Appendix 4 - Powdery Mildew Efficacy Data 2007- 08 - Joseph Soler Vineyard, Hawke's Bay

Low Water - 2 kg S and 0.5 % Protector					Low Water - 3 kg S and 0.5 % Protector					Low Water - 4 kg S and 0.5 % Protector				
Row	Bay	27/12/2007	08/01/2008	23/01/2008	Row	Bay	27/12/2007	08/01/2008	23/01/2008	Row	Bay	27/12/2007	08/01/2008	23/01/2008
823	5	0	0	0	790	3	0	0	0	831	6	0	0	0
822	13	0	0	0	791	10	0	0	0	830	12	0	0	0
823	19	0	0	2	790	17	0	0	0	831	19	0	0	0
822	26	0	0	0	791	24	0	0	0	830	26	0	0	0
823	32	0	0	1	790	30	0	0	0	831	32	0	0	1
811	5	0	0	0	803	5	0	0	0	818	5	0	0	0
810	12	0	0	0	802	12	0	0	0	819	12	0	0	0
811	19	0	1	1	803	19	0	0	0	818	19	0	0	0
810	26	0	0	1	802	26	0	0	0	819	26	0	0	0
811	29	0	0	0	803	29	0	0	0	818	32	0	0	0
799	3	0	0	0	814	5	0	0	0	807	5	0	0	0
798	10	0	0	1	815	12	0	0	0	806	12	0	0	0
799	17	0	0	0	814	19	0	0	0	807	19	0	0	0
798	24	0	0	0	815	26	0	0	0	806	26	0	0	0
799	29	0	0	0	814	30	0	0	0	807	29	0	0	0
787	3	0	0	2	827	5	0	0	0	794	3	0	0	0
786	9	0	0	0	826	12	0	0	0	795	10	0	0	0
787	16	0	0	0	827	19	0	0	0	794	17	0	0	0
786	23	0	0	0	826	26	0	0	0	795	24	0	0	0
787	27	0	0	0	827	32	0	0	0	794	29	0	0	0
Total		0	1	8			0	0	0			0	0	1

High Water - 1.5 kg S and 0.5 % Protector					High Water - 2 kg S and 0.5 % Protector					High Water - 3 kg S and 0.5 % Protector				
Row	Bay	27/12/2007	08/01/2008	23/01/2008	Row	Bay	27/12/2007	08/01/2008	23/01/2008	Row	Bay	27/12/2007	08/01/2008	23/01/2008
796	3	0	0	0	825	5	0	0	0	829	5	0	0	0
797	10	0	0	0	824	12	0	0	0	828	12	0	0	0
796	17	0	0	0	825	19	0	0	0	829	19	0	0	0
797	24	0	0	0	824	26	0	0	0	828	26	0	0	0
796	29	0	0	0	825	32	0	0	0	829	32	0	0	0
808	5	0	0	0	801	3	0	0	0	817	5	0	0	0
809	12	0	0	0	800	10	0	0	0	816	12	0	0	0
808	19	0	0	0	801	17	0	0	0	817	19	0	0	0
809	26	0	0	0	800	24	0	0	0	816	26	0	0	0
808	29	0	0	0	801	29	0	0	0	817	32	0	0	0
820	5	0	0	0	789	3	0	0	0	804	5	0	0	0
821	12	0	0	0	788	9	0	0	0	805	12	0	0	0
820	19	0	0	0	789	16	0	0	0	804	19	0	0	0
821	26	0	0	0	788	23	0	0	0	805	26	0	0	0
820	29	0	0	0	789	28	0	0	0	804	29	0	0	0
784	3	0	0	0	813	4	0	0	0	792	3	0	0	0
785	10	0	0	1	812	10	0	0	0	793	10	0	0	0
784	17	0	0	0	813	17	0	0	0	792	17	0	0	0
785	24	0	0	0	812	24	0	0	0	793	24	0	0	0
784	27	0	0	0	813	29	0	0	0	792	29	0	0	0
		0	0	1			0	0	0			0	0	0

Appendix 5: Application Costs per ha - Protector costed at \$5.00/ litre and Sulphur at \$1.75 / kg

Low Water Regime

Application Date	2kg S + 0.5% Protector		3kg S + 0.5% Protector		4kg S + 0.5% Protector	
	l/ha	\$Pro + S/ha	l/ha	\$Pro + S/ha	l/ha	\$Pro + S/ha
26 Oct 07	150	\$7.25	150	\$9.00	150	\$10.75
13 Nov 07	150	\$7.25	150	\$9.00	150	\$10.75
23 Nov 07	200	\$8.50	200	\$10.25	200	\$12.00
11 Dec 07	300	\$11.00	300	\$12.75	300	\$14.50
3 Jan 08	300	\$11.00	300	\$12.75	300	\$14.50
Season's Total		\$45.00		\$53.75		\$62.50

High Water Regime

Application Date	1.5kg S + 0.5% Protector		2Kg S + 0.5% Protector		3kg S + 0.5% Protector	
	l/ha	\$Pro + S/ha	l/ha	\$Pro + S/ha	l/ha	\$Pro + S/ha
26 Oct 07	200	\$7.63	200	\$8.50	200	\$10.25
13 Nov 07	300	\$10.13	300	\$11.00	300	\$12.75
23 Nov 07	400	\$12.63	400	\$13.50	400	\$15.25
11 Dec 07	600	\$17.63	600	\$18.50	600	\$20.25
3 Jan 08	600	\$17.63	600	\$18.50	600	\$20.25
Season's Total		\$65.65		\$70.00		\$78.75

Standard Chemical Programme

	Number of Applications	Cost/Ha
Sulphur @ 3kg/ha	4	
DMI @ 125ml/ha	2	
Season Total		

Quintec Programme

	Number of Application	Cost/Ha
Sulphur @ 3kg/ha	4	
Quintec @ 200ml/ha	2	
Season Total		

Du Wett

Canopy
bunches

Nu film