Final Report: Evaluation of Biological and Chemical Pruning Wound Protectants Against Selected Fungi Associated with Grapevine Trunk Diseases

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Report Summary

Grapevine trunk diseases (GTDs) represent a major threat to the future economic sustainability of table grapes and wine grapes. Several taxonomically unrelated groups of Ascomycete fungi cause trunk diseases in grapevines including *Eutypa lata* and *Neofusicoccum parvum*.[1] Following precipitation events, fungal spores (sexual and asexual) become airborne and colonize exposed wood vessels caused by pruning. Total disease control is virtually unattainable because of the huge number of wounds made on an individual grapevine and extended period of wound susceptibility but one mitigation practice is to apply a protectant to exposed pruning wounds.[2, 3, 4, 5]

This trial was conducted at the UC Davis Plant Pathology Field-house Facility (38.522591, -121.760719) from March to September 2019. Treatments were a randomized block design. The trial was performed in a 8 year old Sauvignon Blanc vineyard.

Materials and Methods

A. Experimental Design

Experimental Design	Complete randomized block design
Experimental Unit	2 spurs of each = 1 plot x 10
Plot Area	110 ft^2 (row spacing = 11 ft; vine spacing = 7 ft)
Application Method	Hand held spray bottle

B. Experimental Treatments

The treatments described in this report were conducted for experimental purposes only and crops treated in a similar manner may not be suitable for commercial or other use.

Flag	Treatment	Application Rate (per acre)	FP/10 Vines (0.6L spray bottle)	Pathogen Interval
W	Untreated control	N/A	N/A	1 day after pruning
K	Spur Shield	1.5 qt/A	1.12 ml	1 day after pruning
RKD	Vitiseal	0.5 gal/A	1.5 ml	1 day after pruning
GKD	Vitiseal + EMP Polymer	0.5 gal/A	1.5 ml + 6 ml	1 day after pruning
KD	EMP Polymer	1%	6 ml	1 day after pruning
YKD	Terramera Biological	2.4 (%v/v)	14.4 ml	1 day after pruning
KS	Terramera Biological & EMP Polymer	2.4 (%v/v) + 1%	14.4 ml + 6 ml	1 day after pruning
PU	Luna Sensation	5.0 fl oz/A	0.12 ml	1 day after pruning
P	Luna Experience	6 fl oz/A	0.14 ml	1 day after pruning
OKD	Rally + Topsin M + Organosilicone	2.25 oz + 1.25 lbs + 2 qt/A	0.05 g + 0.45 g + 12 ml	1 day after pruning
OKS	Rally + Organosilicone	2.25 oz + 1.25 lbs/A	0.05 g + 12 ml	1 day after pruning
GKS	Rally + Spur Shield	2.25 oz + 1.25 lbs/A	0.05 g + 1.5 ml	1 day after pruning
PKS	Rally + Topsin M + Spur Shield	2.25 oz + 2 qt/A	1.05 g + 0.45 g + 1.5 ml	1 day after pruning
BKS	Rally + Vitiseal	2.25 oz + 1.25 lbs + 2 qt/A	0.05 g + 1.5 ml	1 day after pruning
BC	Bio-Tam + Crab Life-Powder	2.25 oz + 2 qt/A	1.43 gr + 0.35 g	7 day after pruning
B	Crab Life-Powder	2 lb/A + 0.5 lb/100 gal	0.35 g	7 day after pruning
GS	Bio-Tam	0.5 lb/100 gal	1.43 g	7 day after pruning
YS	GCM (*Bacillus velezensis*)	2 lb/100 gal	Apply fermented product	1 day after pruning
BS	Lalitha 21	12 fl oz/A	0.28 ml	1 day after pruning
GD	Vintec	0.7 oz/A	0.3 g	7 day after pruning
KC	Vintec	1.4 oz/A	0.6 g	7 day after pruning
YKC	Vintec	2.8 oz/A	1.2 g	7 day after pruning

C. Map

15	B	W	GS	BC	GS	W	B	BC	GS	W	B	BC	x	GS	B	BC	W	W	B	BC	GS	W	BC	GS	B	GS	W	BC	B	x	x	x
14	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	BS	Y	PKC	x
13	x	KD	OKD	Pu	O	x	OKD	BC	x	x	GKC	x	W	BD	BKS	PKS	x	OC	RKD	GKS	x	KS	Pu	GD	B	GKC	YKC	K	YS		x	x
12	x	KD	YKD	GKD	Pu	GKC	B	OKS	K	YD	GS	PBC	PB	Y	YKD	RKD	OKD	KS	BD	PKS	YS	GD	O	GKS	W	KD	BC	YKC	Pu	BKS	x	x
11	KD	GKD	YD	K	O	KS	BKS	BD	YKC	PKC	GKS	BS	KC	GD	GKC	OC	P	RS	PGS	YS	PB	PBC	x	OKS	W	x	Pu	YKD	OC	BKS	KC	x
10	x	GS	Y	B	PKS	BC	PBC	RS	Y	GS	W	GD	KC	BC	OC	PKC	KS	GKD	x	GKC	BKS	YKD	BS	BD	OKD	RKD	PKS	PBC	KD	YS	PGS	x
9	GD	GKD	KD	PGS	BC	OKD	O	GS	YKC	RKD	PBC	PB	OC	GKS	KS	PGS	RS	PKS	x	B	YD	OKS	GKS	Pu	K	O	B	P	YKC	x	YD	x
8	PBC	PB	K	W	GKC	KC	YKD	Y	YKC	Pu	P	BKS	BD	BS	GS	RS	Pu	YKD	O	PKS	GD	BC	BKS	YS	PKC	GKC	OC	KC	PBC	OKS	x	x
7	K	BKS	W	GKD	YS	BS	YKC	PKC	OKS	OC	KS	OKD	RKD	GKC	RS	O	K	YD	GKS	BS	PBC	P	BD	W	GKD	KS	KD	YKC	B	Y	x	x
6	BC	KC	x	x	GS	Pu	PB	PBC	YD	GKS	x	GD	PGS	PKS	Y	B	YKD	P	KD	PB	BC	PKS	B	Y	OKD	BD	BS	GS	KD	BC	PGS	x
5	RKD	YS	YKD	OKD	YKC	BKS	PKS	O	Pu	KC	W	YKC	K	YD	PKS	P	GKS	GKD	KS	BKS	GKC	O	RKD	RS	YS	OKS	OC	GD	PBC	YKD	PB	PB
4	GS	GKC	PB	Pu	GKD	GKS	RS	PKC	x	x	B	KC	W	BC	YD	OC	K	GD	Y	BS	KS	P	KD	OKS	BD	YKD	GKS	K	P	PKC	PGS	x
3	K	P	KD	BKS	YD	OKS	GKD	GS	PKC	YS	O	W	KS	KC	BD	YKC	GD	Pu	YD	BKS	BC	PKS	OC	RS	GKC	PBC	BS	RKD	B	Y	PGS	x
2	PKS	YKC	x	RS	OKD	KS	GD	OC	YD	GKC	x	B	W	Pu	YS	BD	KD	BS	GKS	RKD	PKC	PGS	O	GS	KC	Y	O	OKS	GKD	BC	PB	x
1	GKC	PKC	x	Y	Pu	PKS	GS	GD	YKD	KS	BD	W	OKD	RKD	KD	OC	P	BC	GKD	KC	YS	RS	B	K	OKS	YKC	BS	BKS	YD	GKS	PBC	x

D. Application Calendar

Flag	Treatment Name	March 21
W	Untreated control	
K	Spur Shield	X
RKD	Vitiseal	X
GKD	Vitiseal + EMP Polymer	X
KD	EMP Polymer	X
YKD	Terramera Biological	X
KS	Terramera Biological & EMP Polymer	X
PU	Luna Sensation	X
P	Luna Experience	X
OKD	Rally + Topsin M + Organosilicone	X
OKS	Rally + Organosilicone	X
GKS	Rally + Spur Shield	X
PKS	Rally + Topsin M + Spur Shield	X
BKS	Rally + Vitiseal	X
BC	Bio-Tam + Crab Life-Powder	X
B	Crab Life-Powder	X
GS	Bio-Tam	X
GD	Vintec 0.7 oz/A	X
YS	GCM (*Bacillus velezensis*)	X
BS	Lalitha 21	X
YKC	Vintec 2.8 oz/A	X
KC	Vintec 1.4 oz/A	X

E. Vine Management

During the application period, vines were irrigated by drip irrigation. Sucker shoot removal and leafing were done during the duration of trial.

F. Data Collection and Statistics

The efficacy of the treatments controlling the GTDs were recorded as the Mean Percentage of Infection (MPI). This was calculated by: (Number of GTD infected samples/Number of total samples) x 100. There were a total of 20 repetitions per GTD per treatment. Treatments were compared against the untreated control and a standard control. Means comparisons were made using Dunnett's test α = 0.05.

Results

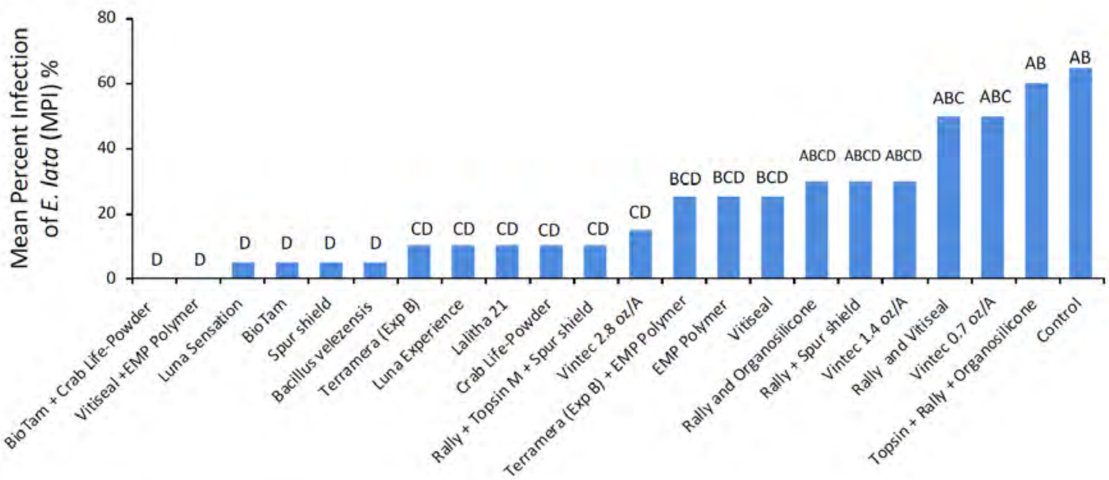

Figure 1. Evaluation of pruning wound treatments mean percent infection (MPI) rates with *E. lata* located at UC Davis Plant Pathology Field House, 2019. Bars represent the least mean square of percent infection. Bars with a different letter are different according to Dunnett's test (p = 0.05).

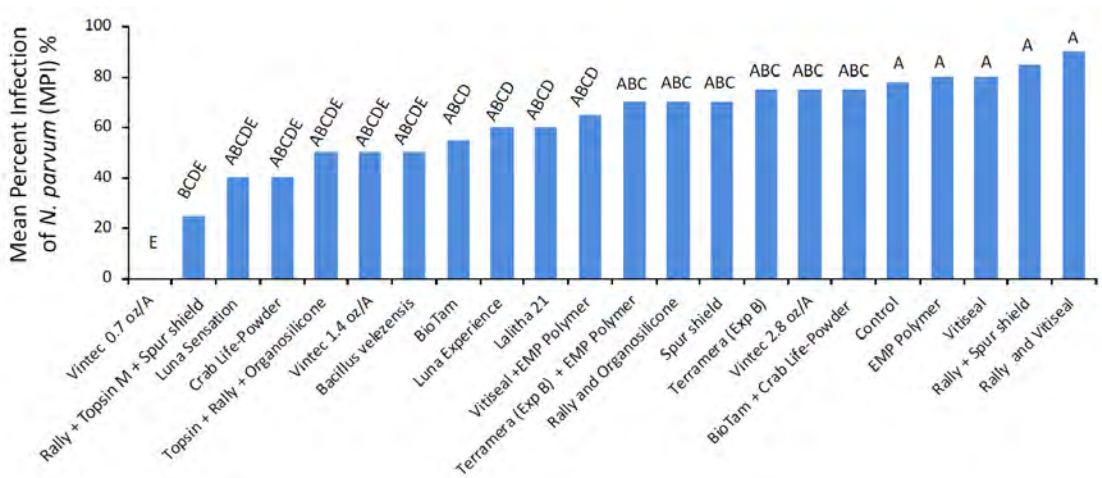

Figure 2. Evaluation of pruning wound treatments mean percent infection (MPI) rates with *N. parvum* located at UC Davis Plant Pathology Field House, 2019. Bars represent the least mean square of percent infection. Bars with a different letter are different according to Dunnett's test (p = 0.05).

The efficacy of the pruning wound protectants can also be reported as mean percent disease control (MPDC).

Table 2. Evaluation of pruning wound treatments mean percent disease control (MPDC) rates with *E. lata* and *N. parvum* located at UC Davis Plant Pathology Field House, 2019. MPDC calculated on the basis of MPI of the control treatment as (100x(1-(MPI treatment/MPI control).

	MPDC	
	E. lata	***N. parvum***
BioTam + Crab Life-Powder	100	3.85
Vitiseal + EMP Polymer	100	16.67
Luna Sensation	92.31	48.72
Bio-Tam	92.31	29.49
Spur Shield	92.31	10.26
GCM (*Bacillus velezensis*)	92.31	35.9
Terramera Biological	84.62	3.85
Luna Experience	84.62	23.08
Lalitha 21	84.62	23.08
Crab Life-Powder	84.62	48.72
Rally + Topsin M + Spur Shield	84.62	67.95

	MPDC	
	E. lata	***N. parvum***
Vintec 2.8 oz/A	76.92	3.85
Terramera Biological & EMP Polymer	61.54	10.26
EMP Polymer	61.54	0
Vitiseal	61.54	0
Rally and Organosilicone	53.85	10.26
Rally + Spur Shield	53.85	0
Vintec 1.4 oz/A	53.85	35.9
Rally and Vitiseal	23.08	0
Vintec 0.7 oz/A	23.08	100
Topsin + Rally + Organosilicone	7.69	35.9
Control	0	0

Acknowledgements

Thanks to the various industry donors for providing testing materials. Thanks to Bryan Pellissier and Lexi Sommers-Miller for their field support.

Appendix

Treatment	Active Ingredient	Manufacturer
Untreated Control	N/A	N/A
Spur Shield	Polymer of Cyclohexane	Miller Chemical, Inc.
Vitiseal	Acrylic Copolymer	Vitiseal International, LLC
EMP Barrier	Co-polymer emulsion	Gemm Ag Solutions
Terramera Biological	50% Neem & 25% fatty acid	Terramera Inc.
Luna Sensation	Fluopyram/Trifloxystrobin	Bayer CropScience
Luna Experience	Fluopyram	Bayer CropScience
Rally	Myclobutanil	DOW AgroSciences, LLC
Topsin M	Thiophanate-methyl	DOW AgroSciences, LLC
Crab Life-Powder	A blend of crab and lobster shell powder	Conchazul de Mexico
Bio-Tam	*Trichoderma asperellum* & *Trichoderma gamsii*	Isagro, USA
Vintec	*Trichoderma atroviride* SC1	Bi-PA, Biological Prodcucs of Agriculture
Gelatinase and chitinase producing microorganism (GCM)	*Bacillus velezensis*	GCM, South Korea
Lalitha 21	*Trichoderma* spp., *Bacillus subtilis, Azospirillium brasilense*	Acela Biotek

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