Evaluation of Biological and Chemical Pruning Wound Protectants Against Selected Fungi Associated with Grapevine Trunk Diseases: 2022 field trials

Karina Elfar, Karen Alarcon, Carlos Carachure, Marcelo Bustamante, Molly Arreguin, and Akif Eskalen

Department of Plant Pathology, University of California, Davis, CA, 95616

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Department of Plant Pathology,
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Report Summary

Grapevine trunk diseases (GTDs) include Botryosphaeria dieback, Eutypa dieback, Dothiorella dieback, Esca complex, Petri disease, and black foot disease, are among the most economically important diseases affecting the grapevine industry worldwide. Several taxonomically unrelated Ascomycete fungi cause GTDs on grapevines. Following precipitation events, fungal spores from pycnidia and perithecia become airborne for dissemination. Pruning wounds are the main point of entry of these fungal pathogens and, thus, disease control is focused on preventative pruning wound protection by chemical products or biological control agents (BCAs). In this study, we evaluated a broad variety of chemical products and BCA's already registered or at the experimental stage in field trials for the protection of table and wine grapevines against infection by *Neofusicoccum parvum* one of the major pathogens responsible for Botryosphaeria dieback (1,2, 3, 4, 5).

Materials and Methods

A. Experimental design

This trial was conducted at the University of California Davis Plant Pathology Fieldhouse Facility (38.522591, -121.760719) from March to September 2022. In this study a total of four vines were used per treatment with 5 spurs used per vine, organized in a completely randomized block design. Vines were trained to bilateral cordons typically 5 spurs per cordon. The experimental unit for this trial was 1 vine with 5 spurs. Vines were spur pruned (3 buds) in early March, and immediately treated with by spraying the liquid treatments with a 1-liter hand-held spray bottle on the pruning wound until runoff. After 5 day, the treated canes were inoculated with a 20 µl solution (~10000 spores) of *N. parvum*.

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.

C. Vine Management

During the application period, vines were irrigated by drip irrigation.

D. Data Collection and Statistics

Treated spurs were allowed to stand for 6 months before collection and laboratory analysis. After we collected the spurs, we split each one with a knife longitudinally and then cultured six small tissue pieces (three from the pith and three from the margin of the dead wood or from any area exhibiting discoloration) on APDA. After incubating the tissues at room temperature for 7 to 14 days, we recorded the recovery of the fungal pathogens by means of their morphological

characteristics. 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 was a total of 3 replicates (3 vines) with 5 spurs. Treatments were compared against the untreated control and a standard control. Means comparisons were made using Fisher's least significant difference test ($P < 0.05$). Mean incidence and severity values for each treatment were computed.

Daily temperature and precipitation were obtained from a CIMIS weather station in west Davis (CI006). The data is shown in Figure 1.

Trial models were analyzed using the ANOVA Tests for data. Means comparisons were made using Fisher's LSD with α=0.05.

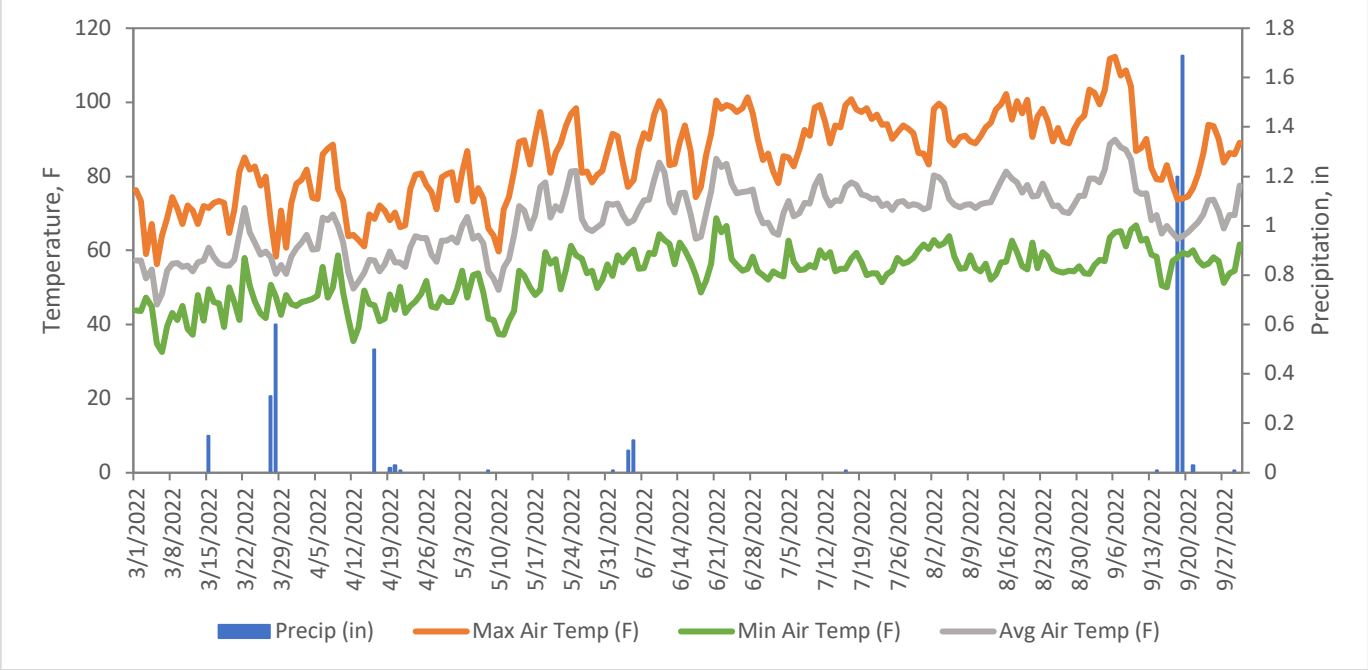

Figure 1. Average daily temperature (°C) and precipitation (mm) from March 1 to September 31, 2022, from CIMIS station Davis, CA.

E. Results

Table 1. Evaluation of pruning wound treatments mean percent infection (MPI) rates with *N. parvum* located at UC Davis Plant Pathology Field Station, 2022. Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's LSD at α=0.05.

Treatment flag	Product name	Active Ingredient	Manufacturer	MPI, %[z]	
PWC	Untreated (non-inoculated)	-	-	0.0	f
PKC	Esendo, 2.8 lbs	pre-mix of Howler and azoxystrobin	AgBiome Innovations	6.7	ef
PWD	Parade, 4.7 fl oz	pyraziflumid	Nichino America	6.7	ef
O	Luna Sensation, 7.6 oz	fluopyram (17.54%), tebuconazole (17.54%)	Bayer CropScience	8.3	ef
YRD	1 L Vitiseal ready-to-use (V-RTU). This is NOT to be diluted.	Acrylic Co-Polymer	VitiSeal International LLC	11.1	ef
BKS	UCD 8189 + 8344, $1x10^5$ cfu/ml	*Aureobasidium pullulans-8189+8344*	N/A	12.2	def
KC	Topsin M 1.25 lbs	Triophanate-methyl	United Phosphorus Inc.	13.3	cdef
RD	Guarda, 2.56 fl oz/ga	thyme oil	BioSafe Systems, LLC	13.3	cdef
GKC	Biotam, 2 lbs	*Trichoderma asperellum* (ICC 012) + *Trichoderma gamsii* (ICC 080)	Isagro USA	13.3	cdef
BD	Vintec, 2.8 oz	*Trichoderma atroviride* strain SC1	Bi-PA	24.4	bcdef
GKD	Botector, 8 oz	*Aureobasidium pullulans* strain DSM14940/14941 1	Westbridge Agricultural Products	25.0	bcdef
RKS	Crab Life Powder, 0.5 lbs	Chitin	Conchazul de Mexico	26.7	bcdef
Y	PerCarb, 4 lbs	sodium carbonate peroxyhydrate (85%)	BioSafe Systems, LLC	28.9	abcdef
YRS	2 X 0.5 L experimental new Vitiseal formulation, ready-to-use (X-RTU). This is NOT to be diluted.	Acrylic Co-Polymer	VitiSeal International LLC	31.1	abcdef
KS	Rhyme, 5 fl oz (applied as pruning wound spray)	Flutriafol (22.7 %)	FMC	33.3	abcdef
BS	TrichosSymBio, 25.6 fl oz	*Trichoderma harzianum* T78 (of 5 x 10^{11} cfu)	Symborg	33.3	abcdef

BKC	UCD-10631, 10% fermented product	*Bacillus velezensis* UCD-10631	N/A	33.3	abcdef
RKD	Parade, 3.1 fl oz	Pyraziflumid	Nichino America	35.6	abcdef
BKD	UCD 8717, (1x10^5 cfu/ml)	*Trichoderma hamatum* - 8717	N/A	35.6	abcdef
KD	Positive Control (Inoculated with N. parvum)	-	-	40.0	abcde
OKS	Baby detergent 2%	Dreft Stage 1 Liquid Detergent	Dreft	43.3	abcde
YKC	microSURE (Agriwash), 4.36 gal	Proprietary	Strategia Project Management Inc	43.3	abcde
RKC	CS2005, 32 fl oz	Copper Sulfate Pentahydrate	Magna-Bon	48.3	abcd
BC	GCM (Gelatinise and Chitinase Microorganism)	*Bacillus velezensis* CE100	N/A	50.0	abc
PKS	Theia, 3 lbs	*Bacillus subtilis* strain AFS032321	AgBiome Innovations	51.1	ab
P	UCD-10719, 10% fermented product	*Serratia plymuthica* UCD-10719	N/A	52.2	ab
R	Vitiseal ready-to-use (V-RTU) applied using FELCO 19 - Special application - FELCO 8 with spraying device	Acrylic Co-Polymer	VitiSeal International LLC	53.3	ab
PKD	Howler, 5 lbs	*Pseudomonas chlororaphis* strain AFS009	AgBiome Innovations	56.7	ab
Pu	UCD-10763, 10% fermented product	*Pseudomonas chlororaphis* UCD-10763	N/A	64.4	a

[Z] Means followed by the same letter within a column are not significantly different according to Fisher's LSD test (α=0.05).

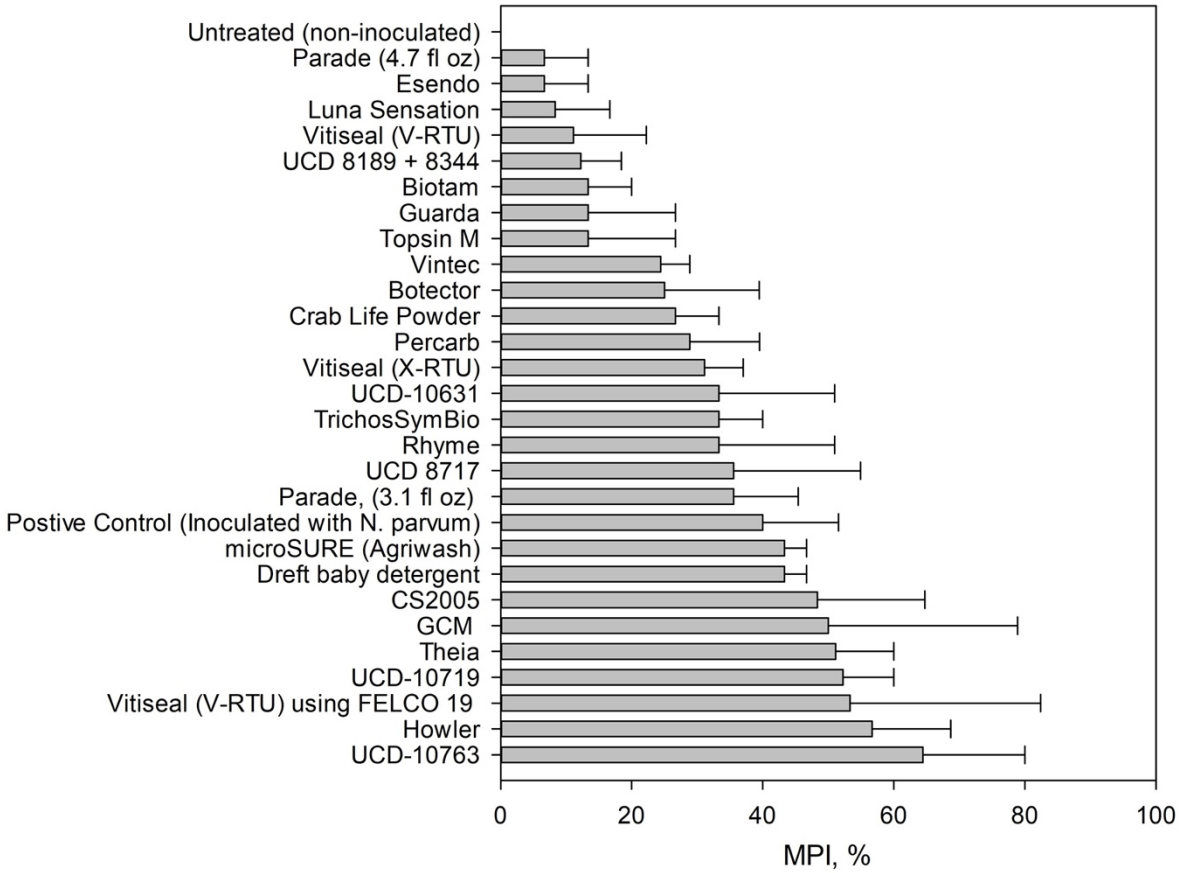

Figure 2. Evaluation of pruning wound treatments mean percent infection (MPI) rates with *N. parvum* located at UC Davis Plant Pathology Field Station, 2022. Bars = standard errors.

F. Acknowledgements

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G. Literature Cited

1. Blundell, R., Eskalen, A. 2021. Evaluation of Biological and Chemical Pruning Wound Protectants to Control Grapevine Trunk Diseases Pathogens *Eutypa lata* and *Neofusicoccum parvum*. APS Plant Health Progress.

2. Eskalen, A., A.J. Feliciano, and W.D. Gubler. 2007. Susceptibility of grapevine pruning wounds and symptom development in response to infection by *Phaeoacremonium aleophilum* and *Phaeomoniella chlamydospora*. Plant Dis.91:1100-1104.

3. Moller, W.J., and A.N. Kasimatis. 1978. Dieback of grapevines caused by *Eutypa armeniacae*. Plant Dis. Rep. 62:254258.

4. Petzoldt, C.H., M.A. Sall, and W.J. Moller. 1983. Factors determining the relative number of ascospores released by *Eutypa armeniacae* in California. Plant Dis. 67:857-860.

5. Rooney-Latham, S., A. Eskalen, and W.D. Gubler. 2005. Occurrence of *Togninia minima* perithecia in esca-affected vineyards in California. Plant Dis. 89:867-871.

6. Úrbez-Torres, J.R., and W.D Gubler. 2008. Double pruning, a potential method to control Bot canker disease of grapes, and susceptibility of grapevine pruning wounds to infection by Botryosphaeriaceae. Abstr. Phytopathol. Mediterr. 48:185.