
Control of grape powdery mildew with synthetic, biological, and organic fungicides: 2023 field trials

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University of California Cooperative Extension,
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University of California, Davis, July 2023

Report Summary

Powdery mildew is caused by the biotrophic fungus *Erysiphe necator*¹; this polycyclic disease of grape causes losses to crop quality and yield and is considered one of the most economically important diseases of grapes worldwide. This report details the findings of our annual powdery mildew fungicide trials on grapevine (*Vitis vinifera*, Cultivar Chenin Blanc – 12- yrs-old). Along with Chardonnay, Muscat Blanc, Roussanne and Carignane, Chenin Blanc is one of the highly susceptible wine varieties². This trial was conducted at the University of California Davis Plant Pathology Fieldhouse Facility (38.522591, -121.760719) from May to July 2023. Treatments were applied to run-off using a mist blower backpack sprayer (Stihl SR 430). Treatments were performed in a complete randomized block design with five replicates of two vines each. Trial I consisted of synthetic fungicides and combinations of soft chemistry and synthetic products. Trial II consisted of soft chemistry products, including biologicals, sulfurs, nutrient applications, oils, and other organic materials. Spray frequencies varied from 7-day to 21-day intervals. Spraying was completed on July 13th based on the berry brix level and treatments were evaluated for disease incidence and severity on July 25th, 2023.

Materials and Methods

A. Experimental design

Table 1. Experimental design

Experimental design	Randomized complete block design with 5 replicates		
Experimental unit	2 adjacent vines = 1 plot		
Row and tree spacing	11 ft (row) and 7 ft (vine)	Plot unit area	154 ft ²
Area/treatment	770 ft ² or 0.0177 acre/treatment (5 replicates = 1 treatment)		
Volume water/Acre	50 gallons = 0.88 gal/5 reps 100 gallons (mid May,) = 1.77 gal/5 reps 150 gallons (early June) = 2.65 gal/5 reps		
Equipment	Stihl SR 430 mist blower backpack sprayers		

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.

Acknowledgements

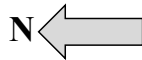
Thanks to Andrew Richards, Jamel Edduozi, Sophie Demaisy, Thomas Zaninovich, Marcelo Bustamante, Bryan Pellissier, Alexa (Lexi) Sommers-Miller, Maxwell Schapper, Fernando, and the various industry donors. Thanks to the Department of Plant Pathology, UC Davis for providing space and service for the trials.

¹ Wilcox, Wayne Frank, et al. Compendium of Grape Diseases, Disorders, and Pests. Second Edition. APS Press, The American Phytopathological Society, 2015.

² Vasquez, Stephen. n.d. Grape Cultivar Susceptibility to Grapevine Powdery Mildew. UC Cooperative Extension.

C. Map

BLOCK 5							BLOCK 4					BLOCK 3					BLOCK 2				BLOCK 1					ROW VINE					
27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	ROW VINE				
-31	X	X	X	X	13-YD	X	X	X	X	19-YRD	X	32-GKS	43-PWS	X	X	18-YKC	X	X	18-YKC	26-RKS	X	17-YKS	X	X	X	X	-31				
-30	36-BS	30-GS	X	X	X	X	47-PKC	X	26-RKS	37-BC	X	X	X	X	51-B+O	P	4-KS	1-W	X	X	P	10-OKS	26-RKS	18-YKC	29-GD	19-YRD	-30				
-29			X	X	X	55-Pu+Y		P	X	44-PWC	X	4-KS	53-B+W	16-YKD	X	P	X	1-W	X	57-Pu+O	P	10-OKS	16-YKD	46-PKS	4-KS	-29					
-28	P	P	11-ONS	P	X	X	P	X	X	5-KC	49-B+Y	X	X	X	13-YD	1-W	39-BKS	16-YKD	54-Pu+K	32-GKS	31-GKD	41-Pu	11-ONS	31-GKD	46-PKS	4-KS	-28				
-27					54-Pu+K	X		34-B	X			X	X	X				52-B+R	27-RKC	9-OKD	31-GKD	41-Pu	11-ONS	31-GKD	53-B+W	22-RD+R	X	-27			
-26	38-BKD	58-Pu+R	50-B+G	X		53-B+W	X	X	28-G	25-RKD	54-Pu+K	27-RKC	8-OC+O	P			29-GD				45-PKD	37-BC	P	27-RKC	50-B+G		-26				
-25		X			34-B		X	X							X												-25				
-24	26-RKS	X			PWD	P	X	2-K										P	14-YS	22-RD+R	P	11-ONS	57-Pu+O	49-B+Y	42-PWD	X	-24				
-23		8-OC+O			P	X	40-BKC	X		36-BS	3-KD	22-RD+R	36-BS	P	37-BC	27-RKC											-23				
-22	X		46-PKS			X		X	X									12-Y	50-B+G	10-OKS			12-Y	2-K			-22				
-21	X	3-KD			20-YRS	2-K	56-Pu+G	55-Pu+Y	X												P	36-BS	55-Pu+Y	35-BD	48-B+K		-21				
-20	4-KS		X		7-OS+O				P	23-RS+R	7-OS+O	10-OKS	55-Pu+Y	42-PWD	52-B+R	33-GKC	P	X		47-PKC		36-BS	55-Pu+Y	33-GKC	3-KD	35-BD	-20				
-19		X			X	X	X	X										X	X							X	-19				
-18	X		29-GD			X	X	X	X		12-Y	13-YD	24-RC+R	P	45-PKD	X	9-OKD		X								-18				
-17	X	44-PWC			47-PKC	9-OKD	51-B+O	58-Pu+R	43-PWS	9-OKD		X	X	X			19-YRD	43-PWS	20-YRS	44-PWC		17-YKS	51-B+O	41-Pu	44-PWC	P	-17				
-16			28-G		X		51-B+O	58-Pu+R	43-PWS	9-OKD		X	X	X													-16				
-15	12-Y	37-BC			41-Pu		X	X			33-GKC	6-O	46-PKS					3-KD	7-OS+O								-15				
-14	18-YKC	X	43-PWS		P	15-YC	19-YRD	X	X	45-PKD	15-YC	52-B+R	X	X				25-RKD	55-Pu+Y								-14				
-13		X	x			5-KC	X	X	38-BKD	X				X													-13				
-12	27-RKC	31-GKD	x	X	24-RC+R		X	X	8-OC+O	53-B+W	P		X	31-GKD	28-G	X		35-BD	49-B+Y								-12				
-11						32-GKS	X	41-Pu																			-11				
-10	X	X	35-BD																								-10				
-9	14-YS	X	X		57-Pu+O	39-BKS	X	20-YRS	X		29-GD	X	30-GS														-9				
-8		X		X																							-8				
-7	X	X	48-B+K		10-OKS	23-RS+R	X		50-B+G	14-YS		P	6-O	4-KS													-7				
-6	X																										-6				
-5		16-YKD	6-O		22-RD+R	X	49-B+Y	42-PWD	11-ONS																		-5				
-4	17-YKS	X	X	X																							-4				
-3		52-B+R	X	X	25-RKD	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD																	-3				
-2	33-GKC	X	X	X	1-W	X	X	X	X	X																	-2				
-1		X	X	X																							-1				
VINE	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	VINE			
ROW		BLOCK 5										BLOCK 4					BLOCK 3					BLOCK 2				BLOCK 1					ROW



Color			
B	Blue	Pu	Purple
G	Green	R	Red
K	Black	Y	Yellow
O	Orange	W	White
P	Pink	N	Gray

Pattern	
C	Checker
D	Dot
S	Stripe

D. Vine Management

During the application period, vines were irrigated by drip and sprinkler irrigation. Sucker shoot removal and leafing were done on July 20st.

E. Data Collection and Statistics

Daily temperature and precipitation were obtained from a CIMIS weather station number 226. The data is shown in Figure 1. Thomas-Gubler Risk Index data was obtained from IPM.UCANR (Figure 2).

Signs of powdery mildew were observed at the beginning of June on berries.

Powdery mildew incidence and severity were assessed in each treatment by evaluating twenty-five random clusters. **Incidence** was defined as the proportion of clusters in a plot having some symptoms and/or signs of powdery mildew. **Severity** was determined by estimating the percentage of area of a cluster that was infected; the severity value of all clusters was then averaged to give a plot-wide estimate of disease severity. Mean incidence and severity values for each treatment were computed. Trial models were analyzed using the ANOVA Tests for data. Means comparisons were made using Fisher's LSD with $\alpha=0.05$.

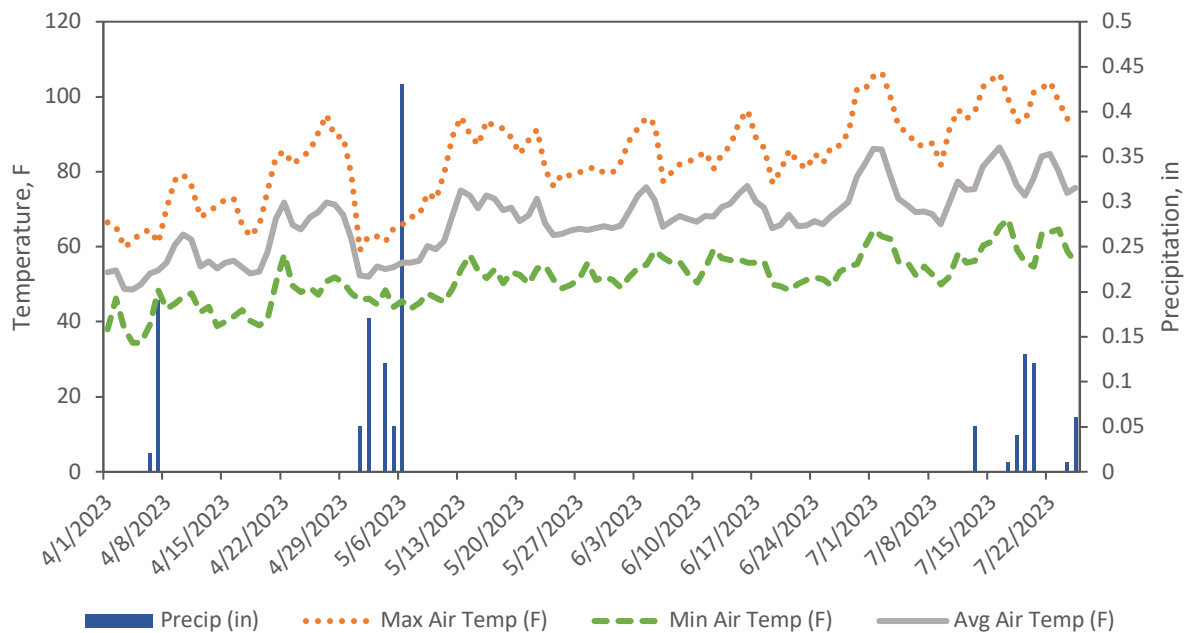


Figure 1. Average daily temperature (°C) and precipitation (mm) from Apr 1 to July 25, 2023, from CIMIS station #226.

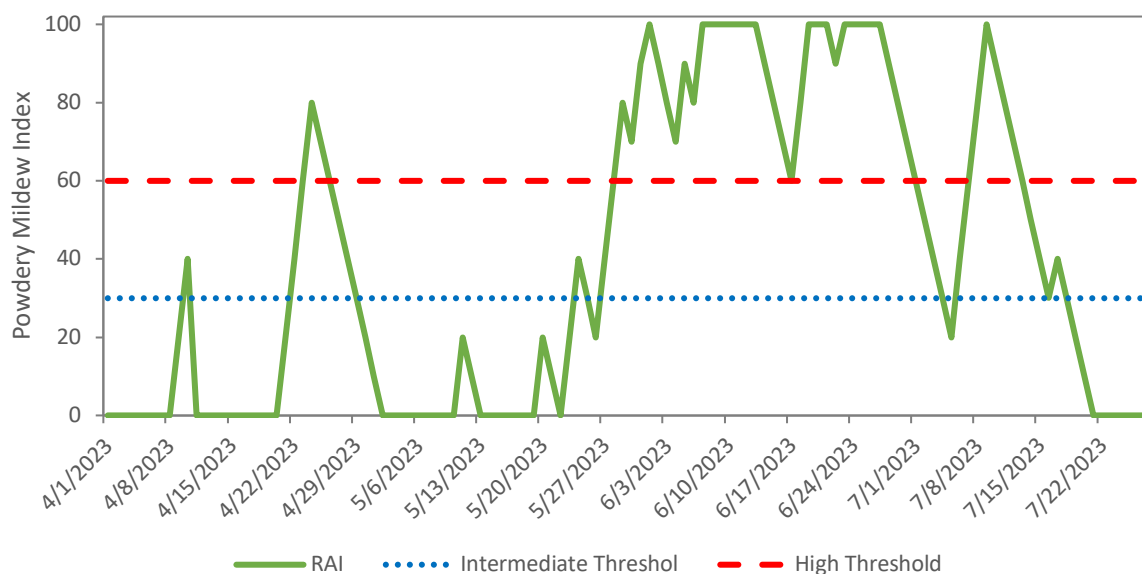


Figure 2. Thomas-Gubler Risk Index data from April 1 to July 27. The Red line data points indicate risk index > 60, between blue and red data points indicate risk index data between 30 and 60 and blue data points are values below 30.

F. Pictures of Treatments

Pictures of each treatment can be reached by clicking on the active link on each trial number in the result tables.

G. Results

Trial I

Table 1. Disease incidence and severity of **synthetic fungicides** and combinations of soft chemistry and synthetic products. 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 $\alpha=0.05$.

Treatment		Application date (Julian day)	Powdery mildew on the cluster ^x	
Pictures	Flag ^z	Rate/A ^y	Incidence, Severity, % %	
8	OC+O	Luna Experience 8.6 fl oz	124	
		Pristine 23 oz	138	
		Endura 2.8 oz	152, 165	4e 0.1 b
		Torjan 4 floz	181	
		Quintec 6 fl oz	194	

23	RS+R	Cevya 4 floz + Syl-Coat 4 fl oz/100 gal	124	5e	0.2b
		Gatten 6.4 floz+ Syl-Coat 4 fl oz/100 gal	138		
		Luna sensation 5 floz + Syl-Coat 4 fl oz/100 gal	152		
		Vivando 15.4 floz+ Syl-Coat 4 fl oz/100 gal	165		
		Inspire super 16 floz+ Syl-Coat 4 fl oz/100 gal	181		
		Prolivo 4 floz+ Syl-Coat 4 fl oz/100 gal	194		
37	BC	Inspire Super 20 fl oz + Dyne-Amic 0.125% v/v	124, 194	4e	0.2b
		Aprovia Top 13.3 fl oz + Dyne-Amic 0.125% v/v	138		
		Quintec 6.6 fl oz + Dyne-Amic 0.125% v/v	152		
		Miravis Prime 13.4 fl oz + Dyne-Amic 0.125% v/v	165		
		Aprovia Top 13.3 fl oz + Dyne-Amic 0.125% v/v	181		
39	BKS	Aprovia Top + A9180A 13.3 fl oz + 1.0 oz + Dyne-Amic 0.125% v/v	165, 194	5e	0.2b
		Quintec + A9180A 6.6 fl oz + 1.0 oz + Dyne-Amic 0.125% v/v	124		
		Miravis Prime + A9180A 13.4 fl oz/+ 1.0 oz + Dyne-Amic 0.125% v/v	138		
		Inspire Super + A9180A 20.0 fl oz + 1.0 oz + Dyne-Amic 0.125% v/v	152		
		Miravis Prime + A9180A 13.4 fl oz + 1.0 oz + Dyne-Amic 0.125% v/v	181		
10	OKS	Sulfur Dry Flowable 5 lb	123, 130, 137, 144	10e	0.3b
		V6M-5-7 27.4 fl oz + Dyne-Amic 0.125% v/v	150		
		Luna Experience 8.6 fl oz	164		
		Pristine 23 oz	180		
		Elevate 16oz	193		
38	BKD	Aprovia Top 13.3 fl oz + Dyne-Amic 0.125% v/v	165, 194	7e	0.3b
		Quintec 6.6 fl oz+ Dyne-Amic 0.125% v/v	124		
		Miravis Prime 13.4 fl oz + Dyne-Amic 0.125% v/v	138		
		Inspire Super 20 fl oz+ Dyne-Amic 0.125% v/v	152		
		Miravis Prime 13.4 fl oz + Dyne-Amic 0.125% v/v	181		
29	GD	Parade 3.1 fl oz + Dyne-Amic 0.25% v/v	123, 137, 150, 164, 180, 193	6e	0.3b
7	OS+O	Luna Experience 8.6 fl oz	124	13e	0.5b
		Pristine 23 oz	138		
		Endura 2 oz	152, 165		
		Trojan 2.8 fl oz	181		
		Quintec 6 fl oz	194		
45	PKD	Luna Experience: 8.6 fl oz	123, 137, 150, 164, 180, 193	11e	0.5b
9	OKD	Luna Experience 8.6 fl oz	124	15de	0.6b
		Pristine 23 oz	138		
		Luna Experience 8.6 fl oz	152		
		Quintec 6 fl oz	165		
		Rhyme 5 fl oz	181		
		Torino 3.4 fl oz	194		

6	O	Luna Experience 8.6 fl oz	124	13 de	0.8 b
		Pristine 23 oz	138		
		Endura 1.6 oz	152, 165		
		Trojan 2.3 fl oz	181		
		Quintec 6 fl oz	194		
5	KC	Luna Experience 8.6 fl oz	124	20 de	0.9 b
		Pristine 23 oz	138		
		SA-0650004 28 fl oz	152		
		Quintec 6 fl oz	165		
		Rhyme 5 fl oz	181		
		Torino 3.4 fl oz	194		
22	RD	Cevya 4fl oz + Syl-Coat 4 fl oz/100 gal	124	24 cde	1.1 b
		Serenade ASO 3 qts + Syl-Coat 4 fl oz/100 gal	138		
		Luna sensation 5 fl oz + Syl-Coat 4 fl oz/100 gal	152		
		Serifel 12 oz + Syl-Coat 4 fl oz/100 gal	165		
		Inspire super 16 fl oz + Syl-Coat 4 fl oz/100 gal	181		
		Sonata 3 qts + Syl-Coat 4 fl oz/100 gal	194		
4	KS	Luna Experience 8.6 fl oz	124	34 bcde	1.6 b
		Pristine 23 oz	138		
		Mevalone 55 fl oz + Dyne-Amic 0.125% v/v	152		
		Quintec 6 fl oz	165		
		Rhyme 5 fl oz	181		
		Torino 3.4 fl oz	194		
17	YKS	Regev (MD5504) + Dyne-Amic 0.125% v/v	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	22 cde	1.6 b
44	PWC	Prolivo 5 fl oz + Syl-Coat 4 fl oz	138	28 bcde	1.7 b
		Kenja 22 fl oz + Rally 4 oz + Syl-Coat 4 fl oz	152		
		Quintec 4 oz + Syl-Coat 4 fl oz	124, 165		
		Torino 3.4 oz + Syl-Coat 4 fl oz	181		
		Merivon 4 oz + Syl-Coat 4 fl oz	194		
3	KD	Ninja 2% 8 oz	123, 150, 180	25 Cde	1.9 b
		Luna Experience 8.6 fl oz	137, 164, 193		
28	G	Gatten 6.4 fl oz + Dyne-Amic 0.25% v/v	123, 137, 150, 164, 180, 193	31 bcde	2.2 b
36	BS	Luna Experience: 8.6 fl oz	124, 165	25 cde	2.5 b
		Pristine 23 oz	138, 181		
		Elevate 16 oz	152		
		Berezi 5 lb	194		
20	YRS	Nordox + JMS Stylet 1% v/v + Kinetic 0.125% v/v	123, 137	39 bcd	2.9 b
		Abound 15.5 fl oz + Syl-Coat 4 fl oz	150		
		Prolivo 5 fl oz + Syl-Coat 4 fl oz	164		
		Rally 4 oz + Syl-Coat 4 fl oz	180		
		Theia 1.5 lb/A + Syl-Coat 4 fl oz	193		
19	YRD	Nordox 2lb + MS Stylet 1% v/v + Dyne-Amic 0.125% v/v	123, 137	52 bc	4.6 b
		Abound 15.5 fl oz + Syl-Coat 4 fl oz	150		

		Prolivo 5 fl oz + Syl-Coat 4 fl oz	164		
		Rally 4 oz + Syl-Coat 4 fl oz	180		
		Theia 1.5 lb + Quintec 2 oz + Syl-Coat 4 fl oz	193		
16	YKD	Prolivo 5.0 oz + Dyne-Amic 0.125% v/v	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	33 bcde	5.2 b
18	YKC	Nordox 2lb+ MS Stylet 1% v/v + Dyne-Amic 0.125% v/v	123, 137		
		Abound 15.5 fl oz + Syl-Coat 4 fl oz	150	77 ab	27.2 b
		Prolivo 5 fl oz + Syl-Coat 4 fl oz	164		
		Rally 4 oz + Syl-Coat 4 fl oz	180		
		Theia 1.5 lb/A + Syl-Coat 4 fl oz	193		
1	W	Untreated Control-UTC	N/A	100 a	99.9 a

^z ** = Phytotoxicity on berries.

^y Products with a '+' sign in between indicate a tank mix.

^x Means followed by the same letter within a column are not significantly different according to Fisher's LSD test ($\alpha=0.05$).

Trial II

Table 2. Disease incidence and severity of **soft chemistry products**, including biologicals, sulfurs, nutrient applications, oils, and other materials. 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 $\alpha=0.05$.

Treatment		Application date (Julian day)	Powdery mildew on the cluster ^x	
Pictures	Flag ^z	Rate/A ^y	Incidence, %	Severity, %
41	Pu	Sulfur 5lb Saponel 0.5% + Sulphur 5lb Saponel 1% + Kobber 30g/100L HML32 1.25L/100L + Kobber 30g/100L + Sulphur 5lb	124, 138 150 158 164, 172, 180, 188, 193	24 f 1.4 f
15	YC	Shielder (OR-536) 4 lbs/a + Oroboost (OR-097A) 32 fl. oz/100 gal	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	63 cde 6.7 ef
40	BKC	Sulfur 5lb Saponel 0.5% + Sulphur 5lb Saponel 1% + Kobber 30g/100L HML32 1.25L/100L + Kobber 30g/100L + Potum 300g/100L	124, 138 150 158 164, 172, 180, 188, 193	61 de 7.7 ef
35	BD	Sulfur dry Kaligreen 5lb	123, 130, 137, 144, 158 164, 172, 180, 188, 193	63 cde 9.2 ef

12	Y	Milagrum Plus (OR-488) 40 fl oz/100 gal + Oroboost (OR-097A) 32 fl oz/100gal	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	67bcde	11.1 ef
47	PKC	Sulfur DF 5 lb	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	56e	12.0ef
43	PWS	Sulfur 5lb NSA 1% + Kobber 33g/100L +HML Silco (225ml/100L or 100g/100L	124, 138 150, 158, 165, 172, 180, 188, 193	72abcde	12.4 ef
42	PWD	Sulfur 5lb Saponel 0.5% + Sulphur 5lb Saponel 1% + Kobber 30g/100L HML32 1.25L/100L + Kobber 30g/100L + HML Silco 225ml/100L Saponel 1% + Kobber 30g/100L + HML Silco (225ml/100L or 100g/100L)	124, 138 150 158 164, 193 172, 188	67bcde	16.9 ef
25	RKD	Cinnaction (OR-489-E) 50 fl oz/100 gal + Attitude (OR-278F) 32 fl oz/100 gal	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	78abcde	20.9 ef
46	PKS	PureSpray Green 1 gal Sulfur Dry-Flowable 5 lb	123, 130, 137, 144 150, 158, 164, 172, 180, 188, 193	78abcde	21.7
11	ONS	Bio Project S10 68 fl oz + Bio Project ID 0.9 27 fl oz Bio Project S10 27 fl oz + Bio Project ID 0.9 27 fl oz Bio Project ID 0.9 27 fl oz + Bio Project MT 0.9 27 fl oz Bio Project S10 68 fl oz + Bio Project MT 0.9 27 fl oz Bio Project S10 68 fl oz + Bio Project ID 0.9 34 fl oz + Bio Project MT 0.9 34 fl oz Bio Project ID 0.9 34 fl oz + Bio Project MT 0.9 34 fl oz	124 138 152 165 180 194	60de	28.6 def
14	YS	Thymic (OR-491) 50 fl oz/100 gal + Oroboost (OR-097A) 32 fl oz/100gal	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	93 ab	32.3 def
13	YD	Cinnaction (OR-489) 50 fl oz/100 gal + Attitude (OR-278F) 32 fl oz/100 gal	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	86abcd	32.4 def
26	RKS	Thymic (OR-491-B) 50 fl oz/100 gal + Oroboost (OR-097A) 32 fl oz/100gal	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	85abcde	35.4 de
2	K	Ninja 2% 8 oz	123, 137, 150, 164, 180, 193	93 ab	37.7 de
34	B	NSTKI-037 6 lb/A	124, 152, 165, 181, 194	91 abc	38.6 de
33	GKC	NSTKI-037 4 lb/A	124, 152, 165, 181, 194	100 a	66.8 cd

<u>30</u>	GS	X7N68-R009 16 fl oz	123, 130, 137, 144, 150, 158, 164, 172, 180, 188, 193	100 a	80.3 bc
<u>27</u>	RKC	Sulfur 5lb Fun-Thyme 0.5% v/v	124, 138 152, 165, 180, 194	100 a	90.2 ab
<u>52</u>	B+R	30% Hydrogen peroxide + Fitor 20ml + Phosful 10 ml	138, 152, 165, 181, 194	100 a	95.1 ab
<u>1</u>	W	Untreated Control- UTC	N/A	100 a	99.9 a

^z **= Phytotoxicity observed on berries.

^y Products with a '+' sign in between indicate a tank mix.

^x Means followed by the same letter within a column are not significantly different according to Fisher's LSD test ($\alpha=0.05$).

H. Appendix: Materials

Product	Active ingredient(s) and concentration	Manufacturer or distributor	Chemical class (Frac Code)
Abound	azoxystrobin	Syngenta	QoI (11)
Aprovia	benzovindiflupyr	Syngenta Crop Protection, Inc.	SDHI (7)
Aprovia Top	difenoconazole (10.95%), benzovindiflupyr (7.30%)	Syngenta Crop Protection, Inc.	DMI (3) / SDHI (7)
Attitude (OR-278F)	Citric Acid 15.90%	Oro-Agri	N/A
Berezi	proprietary	NovaSource	N/A
Bio Project ID 0.9	proprietary	Fp Invest	N/A
Bio Project MT 0.9	proprietary	Fp Invest	N/A
Bio Project S10	proprietary	Fp Invest	N/A
Cevya	mefentrifluconazole	BASF	DMI (3)
Cinnaction (OR-489)	Cinnamon Oil 10%	Oro-Agri	N/A
Cinnaction (OR-489-E)	Cinnamon Oil 10%	Oro-Agri	N/A
Dyne-Amic	polyalkyleneoxide modified polydimethylsiloxane, nonionic emulsifiers, methyl ester of c16-c18 fatty acids (99%)	Helena Chemical Co.	adjuvant
Elevate 50 WG	fenhexamid	Arysta LifeScience North America LLC	KRI (17)
Elite	Tebuconazole (45%)	Bayer Crop Science	DMI (3)
Endura	boscalid	BASF	SDHI (7)
Fitor	proprietary	Innaco	N/A
FunThyme	proprietary	Agrospheres	N/A
Gatten	flutianil	Nichino America	thiazolidine (U13)
HML Silco	proprietary	Belchim Crop Protection	N/A
HML32	proprietary	Belchim Crop Protection	N/A
Hydrogen peroxide 30%	Hydrogen peroxide	N/A	N/A
Inspire Super	difenoconazole (8.4%), cyprodinil (24.1%)	Syngenta Crop Protection, Inc.	DMI-triazole (3)/AP(9)
JMS Stylet-oil	paraffinic oil	JMS Flower Farms	mineral oil (NC)
Kaligreen	Potassium bicarbonate (81.9%)	OAT Agrio Co	NC
Kenja 400SC	isofetamid	Summit Agro USA	SDHI (7)
Kinetic	polyoxyethylene-polyoxypropylene copolymer, polyether modified (99%) heptamethyltrisiloxane	Helena Agri-Enterprises, LLC	adjuvant
Kobber	Proprietary	Belchim Crop Protection	N/A

Luna Experience	fluopyram (17.54%), tebuconazole (17.54%)	Bayer CropScience	SDHI (7)/DMI- triazole (3)
Luna Sensation	trifloxystrobin (21.4%), fluopyram (21.4%)	Bayer CropScience	QoI (11) / SDHI (7)
Merivon	pyraclostrobin (21.26%), fluxapyroxad (21.26%)	BASF	QoI (11) / SDHI (7)
Mevalone	Thymol (6.42%), Geraniol (6.42%), Eugenol (3.21%)	Sipcam Agro USA	BM (1)
Milagrum Plus (OR- 488)	Bacillus subtilis strain IAB/BS03 0.30%	Oro-Agri	N/A
Miravis Prime	fludioxonil (21.4%), pydiflumetofen (12.8%)	Syngenta	phenylpyrroles (12) / SDHI (7)
Ninja	Proprietary	Sepro	N/A
Nordox	Cuprous oxide Cu ₂ O (83.9%)	Nordox Industries	
NSA	Proprietary	Belchim Crop Protection	N/A
NSTKI-037	Proprietary	Novasource	N/A
Oroboost (OR-097-A)	Alcohol Ethoxylate 13.58%	Oro-Agri	N/A
Parade	Pyraziflumid	Nichino America	SDHI(7)
PerCarb	Sodium Carbonate Peroxyhydrate (85%)	BioSafe Systems	N/A
Phosful	proprietary	Innaco	N/A
Potum	proprietary	Belchim Crop Protection	N/A
Pristine	pyraclostrobin (12.8%), boscalid (25.2%)	BASF	QoI(11)/SDHI (7)
Prolivo	pyriofenone	Summit Agro USA	benzoylpyridine (50)
PureSpray Green	mineral oil (98%)	Intelligro	mineral oil (NC)
Quintec	quinoxifen (22.6%)	Dow AgroSciences LLC	aryloxyquinoline (13)
Rally	myclobutanil (40%)	Dow AgroSciences LLC	DMI-triazole (3)
Regev (MD5504)	Tea Tree Oil (40.6%) Difenoconazole (20.3%)	Summit Agro USA	DMI-triazole (3) / BM 01
Rhyme	flutriafol (22.7 %)	FMC Corporation	DMI-triazole (3)
SA-0650004	proprietary	Sipcam Agro	N/A
Saponel	Proprietary	Belchim Crop Protection	N/A
Serenade ASO	<i>Bacillus subtilis</i> qst 713 (26%)	Bayer CropScience	microbial (44, NC)
Serifel	<i>Bacillus amyloliquefaciens</i> , strain MBI 600	BASF Corporation	microbial (44)
Shielder (OR-536)	Bacillus subtilis strain IAB/BS03 0.01%	Oro-Agri	N/A
Sonata	<i>Bacillus pumilis</i> strain QST 2808	Bayer CropScience	microbial (44, NC)
Sulfur Dry flowable	sulfur (80%)	Wilbur-Ellis	inorganic (M2)
Syl-Coat	polyether- polymethylsiloxane-	Wilbur-Ellis	adjuvant

	copolymer and polyether-100%		
Theia	<i>Bacillus subtilis</i> strain AFS032321	Agbiome	BM (2)
Thymic (OR-491)	Thyme Oil 10%	Oro-Agri	N/A
Thymic (OR-491-B)	Thyme Oil 10%	Oro-Agri	N/A
Torino	cyflufenamid (10%)	Gowan Co.	phenyl-acetamide (U06)
Trojan	Tetraconazole (13.8%)	Sipcam Agro	DMI-triazole (3)
V6M-5-7	proprietary	Corteva	N/A
Vivando	metrafenone (25.2%)	BASF	benzophenone (50)
X7N68-R009	proprietary	FMC Corporation	N/A

I. Appendix: Julian Date Calendar for Year 2023

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	32	60	91	121	152	182	213	244	274	305	335
2	2	33	61	92	122	153	183	214	245	275	306	336
3	3	34	62	93	123	154	184	215	246	276	307	337
4	4	35	63	94	124	155	185	216	247	277	308	338
5	5	36	64	95	125	156	186	217	248	278	309	339
6	6	37	65	96	126	157	187	218	249	279	310	340
7	7	38	66	97	127	158	188	219	250	280	311	341
8	8	39	67	98	128	159	189	220	251	281	312	342
9	9	40	68	99	129	160	190	221	252	282	313	343
10	10	41	69	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12	12	43	71	102	132	163	193	224	255	285	316	346
13	13	44	72	103	133	164	194	225	256	286	317	347
14	14	45	73	104	134	165	195	226	257	287	318	348
15	15	46	74	105	135	166	196	227	258	288	319	349
16	16	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19	19	50	78	109	139	170	200	231	262	292	323	353
20	20	51	79	110	140	171	201	232	263	293	324	354
21	21	52	80	111	141	172	202	233	264	294	325	355
22	22	53	81	112	142	173	203	234	265	295	326	356
23	23	54	82	113	143	174	204	235	266	296	327	357
24	24	55	83	114	144	175	205	236	267	297	328	358
25	25	56	84	115	145	176	206	237	268	298	329	359
26	26	57	85	116	146	177	207	238	269	299	330	360
27	27	58	86	117	147	178	208	239	270	300	331	361
28	28	59	87	118	148	179	209	240	271	301	332	362
29	29		88	119	149	180	210	241	272	302	333	363
30	30		89	120	150	181	211	242	273	303	334	364
31	31		90		151		212	243		304		365