Management of Summer Bunch Rot on wine grapes: Evaluating Synthetic, Biological, and Organic Fungicides 2024 Field Trial

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Background and Introduction

Grey Mold, also known as Botrytis Bunch Rot, is a significant disease in grape production caused by the fungal pathogen *Botrytis cinerea*. This disease typically affects grape clusters under conditions of high humidity and moderate temperatures, leading to grey fungal growth, rot, and subsequent degradation of berry quality. While Botrytis cinerea is the primary pathogen responsible for Grey Mold, it can sometimes contribute to disease complexes such as Summer Bunch Rot (SBR), which involves other microorganisms, including species of *Aspergillus, Cladosporium*, and *Alternaria.* Together, these diseases pose considerable risks to grape yield and wine quality

This report focuses on the results of a fungicide spray trial aimed at managing Grey Mold/Botrytis Bunch Rot. The trial was conducted at the experimental vineyard at the Plant Pathology Field Station of the University of California, Davis (38°31'21.3" N, 121°45'38.6" W), using Chardonnay vines. The study spanned from May to July 2024, a critical period for both disease development and berry maturation.

Fungicide treatments were applied using mist blower backpack sprayers (Stihl SR 430) to ensure thorough cluster coverage. The trial followed a completely randomized block design with five replicates of two vines each, ensuring reliable and statistically robust results. Spray frequencies were set at one-month intervals, starting on May 24th and concluding on July 17th, timed to berry developmental stages. Disease incidence and severity were evaluated on September 17th, 2024, providing valuable insights into the effectiveness of the fungicide treatments against Grey Mold.

Materials and Methods

A. Experimental design

Table 1. Details of the experimental design, vine spacing, spray volumes and equipment utilized in the trial.

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 (late May) = 1.77 gal**/**5 reps 150 gallons (early June) = 2.65 gal**/**5 reps		
Equipment	Stihl SR 430 mist blower backpack sprayers		

The treatments outlined in this report were implemented strictly for experimental research purposes. It is important to note that crops treated under these conditions may not be suitable for commercial production or other practical applications without further validation and adaptation to real-world scenarios.

D. Vine Management

Throughout the application period, vine irrigation was managed using a combination of drip and sprinkler systems to ensure optimal water delivery and support vine health.E. Data Collection and Statistical Analysis

E. Disease Assessment and Data Analysis:

Disease incidence and severity were evaluated by assessing 25 random clusters per treatment within each block, totaling five blocks (representing five replicates per treatment). Incidence was calculated as the proportion of clusters exhibiting symptoms or signs of bunch rot in relation to the total clusters evaluated per block. Severity was determined by estimating the percentage of the cluster surface affected by bunch rot symptoms. The severity percentages for each block were subsequently averaged.

Data on incidence and severity were analyzed separately using analysis of variance (ANOVA) with generalized linear models. Means were compared using Fisher's LSD test (α = 5%) in InfoStat software (version 2020). The results of these analyses are presented in Table 2.

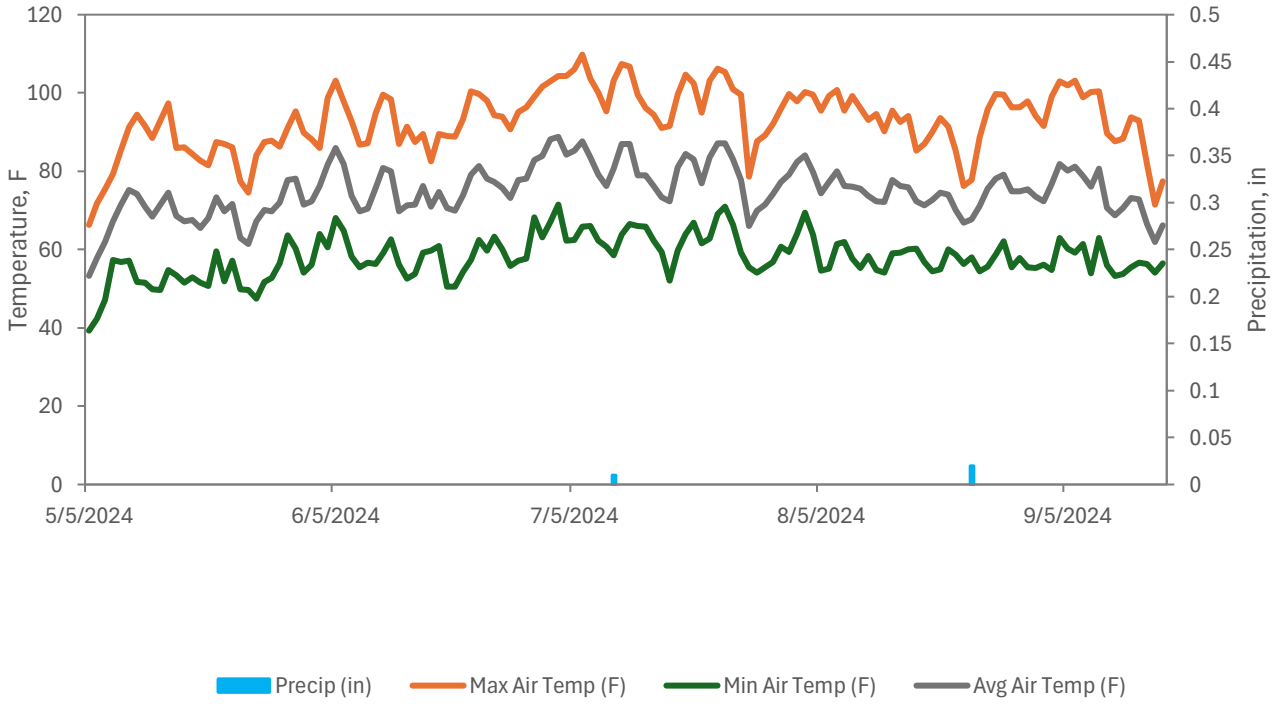

Figure 1. Average daily temperature (°C) and precipitation (mm) from May 19th to September 17th, 2024, from CIMIS, Sacramento Valley, CA.

F. Results

Table 2. Disease incidence and severity associated with treatments of synthetic fungicides and combinations of synthetic fungicides with soft chemistry products. Product names are listed alongside their application rates (per acre).

Treatment			Application interval (days)	SBR on the cluster[Y]	
Nº	Flag	Rate/A[Z]		Incidence (%)	Severity (%)
1	W	Untreated Control		5.6 n.s.	0.07 n.s.
2	K **(IS)**	Switch 14 oz Pristine 23 oz Elevate 16 oz	A B C	4.0	0.11
3	KD	AGS26 (FunThyme) 14 fl oz + Sylcoat 4fl oz / 100 Gal	A,B,C	4.8	0.10
4	KS	AGS26 32 fl oz + Sylcoat 4fl oz / 100 Gallons	A,B,C	6.4	0.30
5	KC	Amara 2 qts + Dyne-Amic 0.125% v/v Switch 14 oz Pristine 23 oz	A,B C D	5.6	0.14
6	O	Amara 2 qts + Dyne-Amic 0.125% v/v	A,B,C	4.8	0.16
7	OS+O	OR-536 4 lb	A,B,C	4.0	0.29
8	OC+O	OR-536 4 lb + OR-097A 16 fl. oz/100 gal	A,B,C	6.4	0.15
9	OKD	OR-536 4 lb + OR-097A 32 fl. oz/100 gal	A,B,C	6.4	0.25
10	OKS	OR-159B 64 fl oz/100 gal + OR-514 32 fl. oz/100 gal	A,B,C	8.8	0.38
11	ONS	OR-159B 128 fl oz/100 gal + OR-514 64 fl. oz/100 gal	A,B,C	8.8	0.3
12	Y	Scala DFO 17 fl oz + Dyne-Amic 6.4 fl oz	A,B,C	9.6	0.39
13	YD	Inspire Super 20 fl oz + Dyne-Amic 6.4 fl oz	A,B,C	7.2	0.21
14	YS	Scala DFO 17 fl oz + Dyne-Amic 6.4 fl oz Miravis Prime 14 fl oz + Dyne-Amic 6.4 fl oz Scala DFO 12 fl oz + Dyne-Amic 6.4 fl oz	A B C	5.6	0.27
15	YC	Inspire Super 20 fl oz + Dyne-Amic 6.4 fl oz Miravis Prime 14 fl oz + Dyne-Amic 6.4 fl oz Inspire Super 20 fl oz + Dyne-Amic 6.4 fl oz	A B C	4.0	0.04
16	YKD	ApF23002 64 fl oz + Dyne-Amic 0.125% v/v	A,B,C	5.6	0.15
17	YKS	ApF23002 32 fl oz Dyne-Amic 0.125% v/v	A,B,C	8.8	0.24
18	YKC	Mevalone 55 fl oz + OSS 0.125%v/v	A,B,C	5.6	0.16
19	YRD	SA-0650004 28 fl oz	A,B,C	3.2	0.13
20	YRS	Mevalone 55 fl oz + OSS 0.125% v/v Miravis Prime 13.4 fl oz + DyneAmic 0.125% v/v	A,C B	3.2	0.18
21	R	SA-0130310 18.5 fl oz	A,B,C	6.4	0.44
22	RD	SA-650120 41 fl oz + NIS 0.125% v/v	A,B,C	6.4	0.44
23	RS+R	Inspire Super 20 fl oz + Dyne-Amic 0.125% v/v Quintec 6.6 fl oz + Dyne-Amic 0.125% v/v Vivando 15.4 fl oz+ Dyne-Amic 0.125% v/v	A B C	8.0	0.19
24	RC+R	AgriTian	A,B	2.4	0.10
25	RKD	AgriTitan	A,B,C	4.8	0.16
26	RKS	NSTKI-028 3 lb	A,B,C	5.6	0.17
27	RKC	NSTKI-028 4 lb	A,B,C	1.6	0.08
28	G	Switch 14 oz + OxiDate 5.0 0.5% v/v Pristine 23 oz+ OxiDate 5.0 0.5% v/v Elevate 16 oz+ OxiDate-5 0.5% v/v	A B C	2.4	0.06
29	GD	Switch 14 oz OxiDate 5.0 1.0% v/v	A B	3.2	0.11

		Elevate 16oz	C		
30	GS	ApF23002 32 fl oz + Dyne-Amic 0.125% v/v Pristine 23 oz Elevate 16 oz	A B C	4.0	0.10
31	GKD	ApF23002 64 fl oz + Dyne-Amic 0.125% v/v Pristine 23 oz Elevate 16 oz	A B C	3.2	0.06
32	GKS	Switch 14 oz Pristine 23 oz ApF23002 32 fl oz + Dyne-Amic 0.125% v/v	A B C	4.8	0.15
33	GKC	Switch 14 oz Pristine 23 oz ApF23002 64 fl oz + Dyne-Amic 0.125% v/v	A B C	4.8	0.13
34	B	Switch 14 oz ApF23002 64 fl oz + Dyne-Amic 0.125% v/v	A B,C	8.0	0.22
35	BD	Miravis Prime 13.4 fl oz + Dyn-Amic 0.125% v/v Vangard 10.0 oz +Dyn-Amic 0.125% v/v Miravis Prime 13.4 fl oz + Dyn-Amic 0.125% v/v	A B C	4.8	0.13
36	BS	Miravis Prime 13.4 fl oz + Dyn-Amic 0.125% v/v Miravis Prime 13.4 fl oz +Dyn-Amic 0.125% v/v Vangard 10.0 oz +Dyn-Amic 0.125% v/v	A B C	3.2	0.06
37	BC	(AF0604-T02-101) 22.41 oz Elevate 16 oz	A,B C	4.0	0.10

[Z] Products with a '+' sign in between indicate a tank mix.
[Y] n.s. = not significant
IS=industry standard

G. Conclusion Based on Treatment Table:

The trials conducted in 2024 demonstrated both successes and limitations in managing sour rot and bunch rot in table grapes. Some treatment programs showcased strong potential, particularly in field trials, but inconsistencies between field and cold storage results highlight the complexity of developing robust solutions. Incorporating findings from this year's trials, we will prioritize the most effective treatments while also integrating new synthetic and biological products available in the market. By refining these approaches, we aim to establish more consistent and sustainable strategies for managing these economically significant diseases in table grapes under varying conditions.

1. Top-Performing Programs

- **Program 27 (RKC):** NSTKI-028 (4 lb) achieved the lowest SBR incidence (1.6%) and severity (0.08%), demonstrating outstanding control and making it highly suitable for high disease pressure scenarios.
- **Program 28 (G):** Switch, Pristine, and Elevate combined with OxiDate 5.0 (0.5% v/v) also exhibited excellent control, with low SBR incidence (2.4%) and severity (0.06%).
- **Program 31 (GKD):** ApF23002 (64 fl oz) with Dyne-Amic, combined with Pristine and Elevate, provided similar results, achieving an SBR incidence of 3.2% and severity of 0.06%.

2. Moderately Effective Programs

- **Program 19 (YRD):** SA-0650004 demonstrated effective control under moderate disease pressure, with an SBR incidence of 3.2% and severity of 0.13%.
- **Program 36 (BS):** Miravis Prime and Vangard combinations were moderately effective, with an incidence of 3.2% and severity of 0.06%, making them a reliable option for moderate SBR conditions.
- **Program 35 (BD):** Miravis Prime combined with Vangard showed moderate control with a 4.8% incidence and 0.13% severity, suitable for rotation programs.

3. Programs with Limited Efficacy

- **Program 12 (Y):** Scala DFO and Dyne-Amic combinations resulted in higher SBR incidence (9.6%) and severity (0.39%), indicating limited effectiveness under these conditions.
- **Program 34 (B):** Switch combined with ApF23002 (64 fl oz) showed relatively high SBR incidence (8.0%) and severity (0.22%), suggesting it requires optimization or enhancement.

4. Control Group

- **Program 1 (W):** The untreated control showed an SBR incidence of 5.6% and severity of 0.07%, highlighting the low disease pressure during the trial. However, these results also underscore the necessity of active fungicide programs to effectively manage Summer Bunch Rot under varying conditions, particularly when disease pressure increases.

Recommendations

1. **Optimal Programs for High Pressure**:
    - Programs **27 (RKC)** and **28 (G)** exhibited the strongest performance and are recommended for severe Summer Bunch Rot conditions.
2. **Programs for Moderate Pressure**:
    - Programs **31 (GKD)** and **19 (YRD)** are effective under moderate conditions and can be incorporated into rotational management plans.
3. **Improving Low-Efficacy Programs**:
    - Programs **12 (Y)** and **34 (B)** require adjustments, such as combining with more potent treatments, improving application timing, or targeting less severe disease pressure.

This trial highlights the importance of tailored fungicide programs to achieve effective Summer Bunch Rot management. Selecting the appropriate treatment combinations based on disease severity and environmental conditions will ensure optimal outcomes.

G. Acknowledgments

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H. Appendix: Materials

Product	Active ingredient(s) and concentration	Manufacturer or distributor	Chemical class (Frac Code)
(AF0604-T02-101)	proprietary	Biotalys	N/A
AgriTitan	proprietary	AgriTitan	N/A
AGS26-FunThyme	proprietary	Agrospheres	N/A
Amara	proprietary	Nichino	N/A
ApF23002	proprietary	Meese	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)
Inspire Super	Difenoconazole + cyprodinil	Syngenta	DMI (3), AP (9)
Mevalone	proprietary	Sipcam	N/A
Miravis Prime	Fludioxonil (21.4%) + pydiflumetofen (12.8%)	Syngenta	PP (12), SDHI (7)
NIS	Adjuvent	N/A	N/A
NSTKI-028	proprietary	NovaSource	N/A
OR-159B	proprietary	Oro-Agri	N/A
OR-097A	proprietary	Oro-Agri	N/A
OR-514	proprietary	Oro-Agri	N/A
OR-536	proprietary	Oro-Agri	N/A
OxiDate 5.0	Peroxyacetic Acid (5%), Hydrogen Peroxide (27%)	BioSafe Systems	N/A
OSS	Adjuvant	N/A	N/A
Quintec	Quinoxyfen	Corteva	Aryloxyquinoline (13)
Pristine	pyraclostrobin (12.8%), boscalid (25.2%)	BASF	QoI(11)/SDHI (7)
SA-0130310	proprietary	Sipcam	N/A
SA-0650004	proprietary	Sipcam	N/A
SA-650120	proprietary	Sipcam	N/A
Scala	Pyrimethanil (54.6%)	Bayer CropScience	AP (9)
Serenade ASO	*Bacillus subtilis* qst 713 (26%)	Bayer CropScience	microbial (44, NC)
Switch	cyprodinil (37.5%), Fludioxonil (25.0%)	Syngenta	AP (9)/ Phenylpyrroles (12)
Syl-Coat	polyether-polymethylsiloxane- copolymer and polyether-100%	Wilbur-Ellis	adjuvant
Vangard	Cyprodinil	Syngenta	AP (9)
Vivando	Metrafenone	BASF	U-08