

Summary of Stanislaus County Wine Grape Bunch Rot Research Trials, 1997-1999

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Bunch rot can be a very serious problem for wine grape growers in the San Joaquin Valley. The problem is especially bad in varieties with tight clusters. This disease "complex" usually involves sour rot caused by species of *Acetobacter* bacteria in combination with *Aspergillus niger*, *Botrytis cinerea* and other fungal species. Sour rot is characterized by dripping, sour smelling clusters that are highly attractive to vinegar flies and dried fruit beetles. *Aspergillus* is a fungus with very dark to black spores that resemble soot. The *Botrytis* fungus produces large quantities of fluffy, gray-brown spores. Sour rot and *Aspergillus* prefer hot temperatures and therefore are often the most prevalent components of the bunch rot complex in the San Joaquin Valley. *Botrytis* is a cool-weather fungus and is a problem during unusually cool seasons with late season rains.

Sour rot and *Aspergillus* are not well managed with traditional fungicide materials. In 1997 - 1999, several research trials were conducted in Stanislaus County vineyards with a history of severe bunch rot. The variety 'Zinfandel' trained to a bilateral cordon was used in all trials. Treatments included many standard fungicides registered for use on wine grapes. Also included were many new fungicides labeled for use on commodities other than grapes. We also tested experimental fungicides, biological agents, strategies to reduce insect feeding (Cryolite & Bt), berry crowding (gibberellic acid), and berry splitting (calcium sprays). Most treatments were applied at bloom and again prior to bunch closure. Some were applied between bunch closure and harvest. Most materials were applied at high label rates. Leaf removal was performed by hand at approximately "pea-sized" berry stage. Lists of treatments, rates, and application schedules preclude results for each trial below.

In the trials testing multiple materials, sprays were applied with a motorized backpack mister/blower. The trials testing Botran, COCS and various rates of gibberellic acid were commercial sized tests where treatments were applied to entire or partial rows with a commercial air-blast sprayer. On the date of commercial harvest, clusters were evaluated for bunch rot. Clusters from test vines were harvested by hand into tubs. Twenty-five to one hundred clusters were evaluated per treatment replication. Rot was recorded as the incidence of rot (percentage of clusters with rot) multiplied by the severity of rot (percent rot in affected clusters).

Results / conclusions:

Bunch rot was very severe in 1997 and 1998. Rot levels were very low in 1999 and it is therefore difficult to draw conclusions from this data. As in previously conducted trials, canopy management (i.e. leaf removal) was shown to be very important. Improving air movement in the cluster zone significantly reduces infection and spread of rot. Strategies targeting reduced berry damage also proved to be very effective. This included Cryolite and Bt to control omnivorous leaf roller (OLR) feeding. At the preferred rate of application (5-7.5 ppm in Zinfandel), gibberellic acid (GA) generally reduced

bunch rot by about 50%. GA is a plant growth regulator that elongates the berry stems, resulting in reduced berry crowding and therefore less splitting of the skin.

Most traditional fungicides did not perform well against sour rot or “total rot” (total rot = sour rot + *Botrytis* + *Aspergillus* and other fungal rots) in these trials. Botran 75W, with or without late season applications of Botran 6 or 15-25 copper-sulfur dust (COCS) appears to be the most consistent fungicide tested to reduce sour rot and “total rot”.

Take home message at a glance:

To effectively manage bunch rot in the San Joaquin Valley, growers must employ multiple control strategies. Based on these and other research trials, they are listed in order of importance below:

1. Canopy management
 - a. leaf & sterile shoot removal
 - b. hedging vigorous canes
 - c. avoid over-irrigation
 - d. avoid over-fertilization, especially nitrogen
2. Reduce berry injury
 - a. control insects, especially leaf rollers
 - b. control powdery mildew
 - c. loosen clusters (gibberellic acid)
 - d. avoid rapid berry expansion – do not over-fertilize or over-irrigate
3. Fungicides (the least effective strategy)
 - a. Botran 75 W at bloom and pre-close
 - b. Botran 6 dust or COCS from pre-close through harvest

Botrytis is controlled fairly easily with fungicides such as Benlate, Vanguard, and Rovral but these materials are not generally very effective in the San Joaquin Valley due to their lack of efficacy on sour rot.

1997 Wine Grape Bunch Rot Trial, Stanislaus County

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Table 1. List of treatments, rates, and times of application.

<u>Treatments:</u>	<u>Time of Application</u>
1) Untreated	--
2) Gibberellic acid (GA) - 5 ppm	2 weeks before bloom
3) COCS 15-25 copper sulfur dust (25 lb)	preclose & 3 weeks preharv
4) Leaf Removal	pea-size berries
5) GA	2 weeks before bloom
+ COCS	preclose & 3 weeks preharv
6) GA	2 weeks before bloom
+ Leaf Removal	pea-size berries
+ COCS	preclose & 3 weeks preharv
7) Rovral 4F (0.75 lb a.i. = 2 pints)	bloom & preclose
8) Rovral 4F	bloom & preclose
+ COCS	preclose & 3 weeks preharv
9) Botran 75W (2.7 lb)	bloom & preclose
10) Botran 75W	bloom & preclose
+ COCS	preclose & 3 weeks preharv
11) Rovral 4F + Botran 75W	bloom & preclose
12) Botran 6% dust (30 lb)	preclose & 3 weeks preharv
13) Botran 75W	bloom & preclose
+ Botran 6% dust	preclose & 3 weeks preharv
14) Dithane F-45	bloom
+ Botran 75W	preclose
15) Kocide DF (2 lb)	preclose & 3 weeks preharv
16) Hydrated Lime (40 lb)	preclose & 3 weeks preharv
17) Captan 50 W (4 lb)	bloom & preclose
18) Benlate SP (24 oz) + Captan	bloom & preclose
19) Abound 2.08 F (0.25 lb a.i. = 1 pint)	bloom & preclose
20) Elite 45 DF (6 oz)	bloom & preclose
21) NZYM (60 ppm)	bloom & preclose
22) NZYM (100 ppm)	bloom & preclose
23) Blight Ban (<i>P. fluorescence</i> @ 5 oz)	bloom & preclose
24) Cladosporium	preclose, & veraison
25) Cryolite (8 lb)	bloom
+ Bt	second generation (June 26)
26) Nutra-phos Super Mg (5 lb)	fruit set
+ Seniphos (2 qt) + Stopit calcium(3 qt)	veraison & 2 wk post-veraison
27) Shurcrop	veraison & 2 wk post-veraison

Materials applied with an Echo® brand motorized backpack sprayer/mister. Gibberellic acid applied April 15 in 75 GPA. Bloom sprays applied May 5 in 80 GPA. Fruit set application May 12 in 100 GPA. Preclose application June 6 in 150 GPA. Veraison application June 26 in 150 GPA. Two week post-veraison application July 14 in 150 GPA.

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 cv. Zinfandel; bilateral cordon with two-wire vertical trellis; spur pruned.
 Hughson, CA, (Stanislaus County)

Table 3. Efficacy of 27 treatments for the control of bunch rot in winegrapes.

Treatment	Total Rot (%) ^{1,2}	Sour Rot (%) ¹	Botrytis (%) ¹
ShurCrop	36.1 a ³	26.0 a	7.8 bc
Untreated	34.3 ab	19.2 abc	14.8 a
Foliar Calcium + Mg	31.0 abc	21.5 ab	8.0 bc
Elite 45 DF	29.5 abc	21.3 ab	6.2 bcde
Kocide DF	25.6 bcd	16.9 bcde	6.8 bcde
Abound 2.08 F	24.7 cde	17.2 bcd	6.6 bcde
Botran 75W + Dithane 45	24.6 cde	16.9 bcde	5.5 bcde
NZYM (60 ppm)	24.4 cde	16.1 bcdef	7.0 bcde
Botran 6% dust	24.0 cdef	14.5 bcdefgh	7.7 bc
Botran 75W + Rovral 4F	22.2 cdefg	16.2 bcdef	4.4 bcdef
Rovral 4F	22.0 cdefg	15.5 bcdefg	5.4 bcde
Lime	19.9 defgh	10.0 efghij	8.2 b
<i>Cladosporium</i> sp.	19.8 defgh	10.8 defghij	7.2 bcde
Rovral 4F + COCS	19.1 defgh	10.8 defghij	6.0 bcde
Captan 50W	18.5 defgh	12.5 cdefghi	5.5 bcde
COCS	17.9 defgh	9.6 efghij	7.6 bcd
NZYM (100 ppm)	17.2 defgh	9.5 efghij	6.0 bcde
GA + COCS	16.6 defghi	8.1 ghij	6.0 bcde
Blight Ban	16.5 defghi	9.1 fghij	6.6 bcde
Benlate SP + Captan 50W	16.3 efghi	14.2 bcdefgh	0.8 f
Cryolite + Bt	15.2 fghi	7.6 hij	6.6 bcde
Botran 75W	15.0 fghi	9.2 fghij	4.9 bcdef
GA	15.0 fghi	10.0 efghij	3.5 def
Botran 75W + Botran 6 dust	13.6 ghi	8.3 ghij	3.9 cdef
Botran 75W + COCS	13.4 ghi	8.1 ghij	4.1 bcdef
Leaf removal	11.0 hi	5.2 ij	4.4 bcdef
GA + Leaf removal + COCS	7.9 i	4.3 j	3.2 ef
LSD	9.15	7.50	4.18

¹Percent rot was determined by multiplying rot incidence (percent of sampled clusters with rot) by rot severity (estimated percentage of berries rotted in an affected cluster).

²Total rot is the cumulative total of sour rot, Botrytis rot, Aspergillus rot, and rots by other less significant fungal taxa.

³Data followed by the same letters in each column are not statistically different according to the Duncan's Multiple Range Test.

1998 Bunch Rot Trial - Stanislaus County

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<i>Treatments:</i>	Color	May 27 Bloom	July 2 Preclose	July 31 Veraison	Aug 20 3 weeks Preharv
1. Untreated	White				
2. Abound 2.08 F (0.25 lb a.i. = 1 pint)	Orange dot	*	*		
3. Botran 75W (2.7 lb)	Yellow	*	*		
4. COCS (25 lb)	Pink		*		*
5. Leaf Removal	Green	pea-size berries			
6. Leaf removal + COCS	Pink + Green	"	*		*
7. Cryolite (8 lb) at bloom + Bt at 700-900 DD	Black/Wht st. + green	*		*	
8. Stopit foliar calcium (3 qt/app)	Yllw/Blck st.	*	*	*	Aug
9. CAN 17 + Stopit	Orng/Blck st.	*	*	*	Aug
10. Nutra-phos Super Mg (5 lb)	Blu dot + pnk	fruit set			
11. Ultra Champ DF (3 lb)	Blue dot		*		*
12. Micronized sulfur (3 lb)	red dot		*		*
13. Ultra Champ DF (3 lb) + micronized sulfur (3 lb)	Blue dot + red dot		*		*
14. Champ 2F (2 2/3 pints) + micronized sulfur (3 lb)	Blue/Wht st. + red dot		*		*
15. Captan 50W (4 lb)	Red	*	*		
16. Benlate SP (24 oz) + Captan	Red + Blue	*	*		
17. Vanguard (10 oz)	blck/white st.	*	*		
18. Vanguard (10 oz)	red/white st.		*		*
19. Blight Ban (5 oz)	green/blck st	*	*		*
20. Trichodex	yellow/wht st	*	*		*
21. Biological agent 3 (5 grams / liter)	orange	*	*		*
22. Biological agent 3 (10 grams / liter)	orang + white	*	*		*
23. Biological agent 3 (20 grams / liter)	orange + gren	*	*		*

Materials were applied with an Echo Brand, motorized, backpack mister/blower in the equivalent of 80 gallons of water per acre (bloom spray) or 100 gpa (preclose through preharvest sprays). The trial was conducted in a commercial 'Zinfandel' wine grape vineyard, arranged in a randomized complete block design with five replications of three treated vines each. At the date of commercial harvest (September 9), 25 clusters were randomly removed from the data vines and evaluated for incidence and severity of sour rot and rots caused by Botrytis, Aspergillus, and other fungal genera.

1998 Bunch Rot Harvest Data Stanislaus County - Berryhill Zinfandel

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Treatment	Total Rot (%)	Sour Rot (%)	Botrytis (%)
Untreated	44.5 a	38.1 a	6.2 ab
Biological agent 3 (5 g/l)	41.0 ab	33.2 ab	6.8 ab
Champ 2F + sulfur	40.2 ab	30.3 ab	8.6 a
Ultra Champ DF	36.6 abc	31.5 ab	4.9 abc
Botran 75W	36.5 abc	29.4 ab	6.4 ab
Vanguard late	35.1 abc	30.4 ab	4.6 abc
COCS 15-25 dust	34.7 abc	26.1 ab	8.3 a
Nutraphos Mg foliar	34.4 abc	30.2 ab	4.0 abc
Ultra Champ DF + sulfur	34.3 abc	27.9 ab	6.0 abc
Vanguard early	33.9 abc	32.0 ab	1.7 c
Captan	31.9 abc	26.5 ab	4.1 abc
CAN 17 + foliar Ca	31.3 abc	24.1 ab	6.9 ab
Benlate + Captan	31.0 abc	27.7 ab	2.2 bc
Trichodex	30.3 abc	26.4 ab	2.6 bc
Biological agent 3 (20 g/l)	28.4 abc	23.6 ab	4.5 abc
Abound	28.3 abc	23.5 ab	4.6 abc
Blight Ban	28.2 abc	20.5 b	4.3 abc
Stopit foliar Ca	28.0 abc	21.6 b	6.0 abc
Leaf removal	26.4 bc	20.3 b	5.3 abc
leaf removal + COCS	24.6 bc	22.0 b	1.9 bc
Wettable sulfur	24.4 bc	19.8 b	4.1 abc
Biological agent 3 (10 g/l)	24.1 bc	20.3 b	3.5 abc
Cryolite + Bt	22.5 c	21.8 b	0.6 c
<i>LSD</i>	13.8	12.2	4.4

Bunch Rot Trial 1999

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 Cooperators: Jim DiMartini, grower
 Severo Lazcano, foreman

The whole plot was sprayed for omnivorous leaf roller to reduce damage and subsequent rot from insect feeding (May 25). GA was applied May 1. Biological agents were applied May 26 @ 40-50% bloom. Other bloom treatments applied May 28 @ 90-100% bloom. Leaf removal on June 15 (pea-sized berries). Preclose spray applied June 24 & 25. Veraison spray July 30 (⁰Brix = 8.3). Preharvest sprays applied August 20 (⁰Brix = 15.2).

Table 1. List of Treatment Timings and Rates for Stanislaus County 1999 Bunch Rot Trial.

Treatments:	Color	Application Schedule			
		Bloom	Precise	Veraison	Preharvest
1. Untreated	White				
2. Gibberellic acid (7.5 ppm)	Red				
3. COCS (25 lb)	Blue		*		*
4. Leaf removal	Green				
5. GA + COCS + Leaf removal	Blu+gren+red		*		*
6. Champ 2 + sulfur	Yllw+blue		*		*
7. Dithane @ 2 lb + Latron B 1956 @ 0.06% v/v (bloom only)	Orng/blk	*			
8. Dithane @ 2 lb + Latron B 1956 @ 0.06% v/v + Champ + sulfur at bloom; Champ & sulfur later	Orng//blk + yellow + blue	*	*		*
9. Micronized sulfur (3 lb)	Yellow	*	*		*
10. Champ 2 (2 2/3 pint)	Orange	*	*		*
11. Champ 2 + sulfur	Orng+yellow	*	*		*
12. Elevate (1 lb)	Blue dot	*	*		
13. Vanguard (10 oz)	Red dot	*	*		
14. Vanguard (10 oz)	Orange dot		*		*
15. Botran 75W (2.7 lb)	Pink/black	*	*		
16. Stopit Foliar CaCl (3 qt)	Pink	*	*	*	*
17. Blight Ban (5 oz)	Black/white	*			
18. Blight Ban (5 oz)	Yellow/white	*	*		*
19. Biological agent 2 WP @ 4 lb	White+red dot	*	*		*
20. Biological agent 2 WP @ 8 lb	Blue + red dot	*	*		*
21. Biological agent 2 AS @ 1 gal	Orng + red dot	*	*		*
22. Biological agent 2 AS @ 3 gal	Gren + red dot	*	*		*
23. Auxigrow @ 4 oz + 0.05% Breakthru	Pink + green	*	*	*	

Materials applied with an Echo Brand, motorized, backpack mister/blower in the equivalent of 75 gallons of water per acre (bloom sprays) or 100 gpa (preclose through preharvest sprays). The trial was conducted in a commercial 'Zinfandel' wine grape vineyard, arranged in a randomized complete block design with five replications of 3 treated vines each. At the date of commercial harvest, clusters were removed from data vines and evaluated for incidence and severity of sour rot and rots caused by Botrytis, Aspergillus, and other fungal genera.

1999 Winegrape Bunch Rot Trial DeMartini Farms

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Table 2. Summary of bunch rot on vines treated with 23 treatments.

Treatment	Total Rot (%)	Sour Rot (%)	Botrytis (%)
Blight Ban 3 times	10.0 a	6.2 a	3.7
Blight Ban @ bloom	9.2 ab	2.5 b	6.6 a
Biological agent 2 AS @ 3 gal	9.2 ab	2.8 b	6.4 ab
Biological agent 2 WP @ 4 lb	8.3 abc	2.5 b	5.7 abc
Champ + sulfur 3 times	8.0 abc	2.1 b	5.7 abc
Biological agent 2 WP @ 8 lb	7.1 abc	1.4 b	5.6 abc
Dithane + Champ & sulfur	5.6 abc	1.2 b	4.3 abc
Untreated	4.9 abc	1.9 b	3.0 abc
Auxigrow	4.7 abc	0.1 b	4.5 abc
Foliar calcium	4.6 abc	0 b	4.5 abc
Micronized sulfur	4.5 abc	1.4 b	3.0 abc
Champ + micro sulfur late	4.1 abc	0.4 b	3.6 abc
Champ	4.0 abc	0.2 b	3.8 abc
Elevate	3.5 abc	1.6 b	1.8 abc
Gibberellic acid (7.5 ppm)	3.5 abc	0.1 b	3.4 abc
Vanguard early	3.2 abc	1.0 b	2.0 abc
COCS @ 25 lb	2.9 abc	0.2 b	2.6 abc
Vanguard late	2.8 abc	1.5 b	1.3 abc
Biological agent 2 AS @ 1 gal	2.8 abc	1.3 b	1.5 abc
Botran 75W	2.3 bc	0.8 b	1.4 abc
LR + GA + COCS	1.4 c	0 b	1.4 abc
Dithane	1.3 c	0.5 b	0.9 c
Leaf removal	1.0 c	0 b	1.0 bc
<i>LSD</i>	6.0	3.4	4.4

Gibberellic Acid / Bunch Rot Trial 1998

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Variety: **Zinfandel** ca. 15 years old grafted on French Columbard roots
Vine spacing = 7'x12'
Bilateral cordon trained, spur pruned

Treatments applied April 20, 1998 in 100 gallons of water per acre with a commercial airblast sprayer.

Treatments:

- 1) No GA
- 2) 5.0 ppm (2 oz. per 100 gallons water)
- 3) 7.5 ppm (3 oz. per 100 gallons water)
- 4) 10.0 ppm (4 oz. per 100 gallons water)

Each treatment is replicated 4 times in the vineyard. One replication equals one entire row of 107 vines (0.21 acres). Treated rows are separated by two buffer rows to prevent affects from spray drift.

Bunch Rot Rating – 1998 Harvest

Treatment	Total Rot (%)	Sour Rot (%)	Botrytis (%)
<i>Untreated</i>	27.5 a	14.1 a	12.7 a
5.0 ppm GA	19.8 ab	9.9 ab	9.4 ab
7.5 ppm GA	13.3 b	5.7 b	7.1 b
10 ppm GA	11.9 b	5.6 b	5.7 b

Total rot = Sour rot plus rots involving *Botrytis*, *Aspergillus*, *Penicillium* spp., etc.

DiMartini Botran Bunch Rot Trial 1998 Harvest Data

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Variety: Zinfandel, bilateral cordon, cane pruned

Commercial application with speed sprayer and duster.
Botran 75W applied in 75 gallons per acre.

Treatments:

- 1) Untreated
- 2) Botran 75W @ 2.7 lb (2 lb a.i.) at bloom & preclose + Botran 6 dust @ 24 lb
- 3) Botran 5F @ 0.4 gal (2 lb a.i.) at bloom & preclose + Botran 6 dust @ 24 lb
- 4) 15-25 copper-sulfur dust (COCS) – grower's standard practice @ 24 lb

Botran 6 dust and COCS applied July 17, August 6, August 27, September 15.
Harvest: September 24.

Treatment	Total Rot (%)	Sour Rot (%)	Botrytis (%)
<i>Untreated</i>	40.8 a	19.8 a	20.0 a
Botran 75W + dust	31.0 b	17.5 ab	13.4 b
COCS	30.3 b	12.7 ab	16.8 ab
Botran 5F + dust	24.6 b	11.8 b	12.5 b
LSD	8.2	6.8	4.6

Total rot = Sour rot plus rots involving *Botrytis*, *Aspergillus*, *Penicillium* spp., etc.