

WALNUT BLIGHT CONTROL INVESTIGATIONS TEHAMA 2006

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ABSTRACT

Walnut blight bacteria, *Xanthomonas campestris pv juglandis* can cause significant crop loss particularly in Northern California where environmental conditions favor infection and damage. During the 2006 season, untreated Chandler trees under simulated plus natural rainfall demonstrated 59.27% blight. Four full coverage applications of Kocide 2000 @ 6 lbs. plus Manex at 58 oz./Ac. reduced damage to 12.42%. Four applications of Kocide 2000 @ 6 lbs./Ac. without Manex resulted in 39.75% blight. Consistent with previous results, the Manex technology is working well. The challenge has always been to find an alternative in the event Manex is not available for commercial use. If achievable, a full registration for Manex on walnuts would eliminate the need for continual data to support product use. Even if full registration is achieved, the industry is still based upon a single strategy for disease management. Discovering additional treatment materials and techniques would be beneficial to California walnut culture.

Two rates of the Agriquest product Sonata failed to control walnut blight in the 2006 Tehama experiments. Sonata does not appear to be a viable option at this time. Research with Dupont's experimental product GX569 suggests the amount of metallic copper can be reduced but it is still copper hydroxide technology. Manzate 75DF, also a Dupont product, looked promising in the 2006 research but is also ethylene-bisdithiocarbamate technology similar to Manex.

To look closely at first spray timing we cooperated with Lindow, et.al., in 2005 and 2006 in tagging thousands of walnut buds and applying single sprays at specific bud development times. The Lindow proposal describes the details of that research.

OBJECTIVES

- 1) Evaluate alternative materials for walnut blight control (GX569, Sonata and Manzate) plus variable rates of the bud penetrating material Breakthru.
- 2) Verify if applied copper can be reduced from the 6 lb. rate of Kocide 2000.
- 3) Maintain the over tree sprinkler rainfall simulator.
- 4) Evaluate timing of terminal budbreak (prayer stage) and tagged nuts for blight disease progression.
- 5) Determine efficacy of early season bactericides applied at different stages of bud break and shoot elongation. 2006 was the second year of tagged bud experiments to evaluate disease control based upon bud/shoot development. We cooperated with the Lindow team and the report and results are listed in the Lindow report.

PROCEDURES

Material evaluations were all done under over tree rainfall simulation. The test plot was plumbed with Nelson R-30 sprinklers (application rate: 0.06 inches/hour) to apply water above the tree canopy. Sprinklers were placed 30 feet above ground and were operated (Figure 4) three times. Ten hours per application applied 2.16 inches.

All treatments were applied by hand gun to individual trees. Applications were made at 250 psi to simulate a dilute (400 gal./ac.) application. Trees were sprayed to wet all tissue. Spray applications were made 4/20, 4/28, 5/8 and 5/16.

Experimental design was a randomized complete block with ten treatments and five replicates for the material evaluation comparisons and five treatments with five replicates for the Breakthru rate evaluation. Five additional trees were randomly sampled outside the rainfall simulator to measure percent blight under natural rainfall. Since those trees were not part of the randomized complete block design, they were not included in the statistical analysis.

Data taken:

- 1) Percent blighted walnuts evaluated 5/26/06 by visually inspecting 300 to 500 walnuts per treated tree for blight symptoms. Counts were made randomly within the tree canopy roughly 6-12 feet above ground for the material evaluations. The Breakthru plot was evaluated using canopy counts and visual inspection of walnuts reachable from the ground.
- 2) Phytotoxicity was visually rated using a scale of 0-5 where "0" represents no observable phytotoxicity.
- 3) Disease progression curve by tagging 150 nut pairs and visually rating for walnut blight symptoms every 3-4 days.
- 4) Terminal bud break dates by visual evaluation of 1000 buds per count date.

Treatments for the material evaluation plot:

Treatment	Rate
1. Kocide 2000 ¹	6 lbs./Ac.
2. Kocide 2000 + Manex	6 lbs. + 58 oz./Ac.
3. Kocide 2000 + Manex	4 lbs. + 58 oz./Ac.
4. GX 569 ² + Manex	4.6 lbs. + 58 oz./Ac.
5. GX 569 + Manex	3.5 lbs. + 58 oz./Ac.
6. Kocide 2000 + Manzate 75DF ³	6 lbs. + 2.4 lbs./Ac.
7. Sonata ⁴	4 qts./Ac.
8. Sonata	6 qts./Ac.
9. Sonata + Kocide 2000	6 qts. + 6 lbs./Ac.
10. Control (simulated & natural rainfall)	—
11. Control (natural rainfall)	—

¹Kocide 2000: Dupont Crop Protection, 35% metallic copper

²GX 569: Dupont Crop Protection, 30% metallic copper

³Manzate 75DF: Dupont Crop Protection, zinc ion and manganese ethylene-bisdithiocarbamate

⁴Sonata: AgraQuest, bacillus pumulis strain QST 2808

Figure 1. Spray materials and rates for the Tehama walnut blight plot. Spray applications were made on 4/20, 4/28, 5/8 and 5/16. 33.5% terminal bud break occurred on 4/18 with full bloom on 5/5/06.

Treatments for the Breakthru rate plot:

The first two sprays using ascending rates of Breakthru were applied by Buchner and Gilles with no grower application. After the 5/1/06 application the plot was released for three grower half sprays. Natural rainfall only, no simulated rainfall.

University Treatment (4/24 and 5/1/06)	Rate
1. Kocide 2000 + Manex	6 lbs. + 58 oz./Ac.
2. Kocide 2000 + Manex + Breakthru	6 lbs. + 58 oz./Ac. + 8 oz./100 gal.
3. Kocide 2000 + Manex + Breakthru	6 lbs. + 58 oz./Ac. + 16 oz./100 gal.
4. Kocide 2000 + Manex + Breakthru	6 lbs. + 58 oz./Ac. + 32 oz./100 gal.
5. Kocide 2000 + Manex + Breakthru	6 lbs. + 58 oz./Ac. + 64 oz./100 gal.

Figure 2. Treatments and rates for the first two blight sprays. University application 4/24 and 5/1/06.

Grower Treatment (5/4, 5/14 and 5/24/06)	Rate
1. Kocide 2000 + Manex + Breakthru + KNO3	4.5 lbs. + 58 oz. + 6 oz. + 5 lbs./Ac.

Figure 3. Treatments and rates for the remaining blight sprays applied on 5/4, 5/14 and 5/24/06 (half sprays) by the grower.

Rainfall: natural and simulated for the Tehama blight plot:

Date	Amount (in)	Condition
4/2 – 4/5	1.13	natural ¹
4/7 – 4/12	2.09	natural
4/15 – 4/16	.80	natural
4/22	.17	natural
4/29	.72 (10 hours)	simulated ²
5/10	.72 (10 hours)	simulated
5/17	.72 (10 hours)	simulated
5/19	.25	natural
5/21 – 5/23	.38	natural
5/26	.01	natural

¹Natural rainfall – 7 events for 4.83 inches

²Simulated rainfall – 3 events for 2.16 inches

Figure 4. Natural and simulated rainfall for the Tehama material evaluation experiment.

RESULTS/DISCUSSION

Material Evaluation

Blight disease pressure was high under simulated rain produced by over tree sprinklers. Untreated blight damage was 59.27% under simulated plus natural rain compared to 12.50% damage under natural rainfall (Figure 5).

The addition of Manex to the copper tank mix significantly improved walnut blight disease control. 39.75% blight for Kocide 2000 @ 6 lbs. alone compared to 12.42% blight for Kocide 2000 @ 6 lbs. plus 58 oz. of Manex (Figure 5).

Under relatively high disease pressure the reduced rate of Kocide 2000 did not control blight as well as the 6-pound rate. Applications of Kocide 2000 @ 6 lbs. plus 58 oz. Manex resulted in 12.42% blight compared to 30.61% blight in the Kocide 2000 @ 4 lbs. plus 58 oz. Manex treatment (Figure 5).

GX 569 @ 4.6 lbs. plus 58 oz. of Manex performed as well as the Kocide 2000 @ 6 lbs. plus 58 oz. Manex. 14.54% blight for the GX569 plus Manex compared to 12.42% for the Kocide 2000 plus Manex (Figure 5).

Reducing the rate of GX569 reduced blight control. 14.54% blight at the 4.6 lb. rate compared to 28.85% at the 3.5 lb. rate (Figure 5).

Manzate 75DF @ 2.4 lbs. plus 6 lbs. Kocide 2000 resulted in 19.49% blight compared to 12.42% for the Kocide 2000 @ 6 lbs. + 58 oz. Manex suggesting Manzate 75DF appears to be comparable to Manex (Figure 5)

None of the Sonata treatments reduced disease damage compared to untreated controls (Figure 5).

None of the treatments showed any visible tissue phytotoxicity (Figure 5).

Treatment	% Blight	Phytotoxicity
7. Sonata @ 4 qts.	60.26 a ¹	0
10. Control (simulated and natural rainfall)	59.27 a	0
9. Sonata @ 6 qts. + Kocide @ 6 lbs.	51.39 ab	0
8. Sonata @ 6 qts.	51.22 ab	0
1. Kocide @ 6 lbs.	39.75 abc	0
3. Kocide @ 4 lbs. + Manex ²	30.61 bcd	0
5. GX 569 @ 3.5 lbs. + Manex	28.85 bcd	0
6. Kocide @ 6 lbs. + Manzate @ 2.4 bls.	19.49 cd	0
4. GX 569 @ 4.6 lbs. + Manex	14.54 d	0
2. Kocide @ 6 lbs. + Manex	12.42 d	0
11. Control (natural rainfall) ³	12.50	0

¹Duncan's multiple range test for treatment means at the 5% level.

²Manex @ 58 oz./Ac.

³Non replicated control outside simulated rainfall.

Figure 5. Blight ratings and phytotoxicity for the test treatments and rates.

Breakthru rate evaluation

The addition of Breakthru at 8, 16, 32 or 64 ounces did not improve walnut blight control compared to Kocide 2000 plus Manex alone (Figure 6). Given the relatively low percent blight under natural conditions (12.50%) and a fairly aggressive five spray program any benefits from the Breakthru could have been masked.

Treatment (first 2 sprays)	% Low	% High	% Average
K ¹ + M ² + Breakthru – 0 oz.	6.68 a ³	3.44 a	5.06 a
K + M + Breakthru – 8 oz.	3.42 a	1.62 a	2.52 a
K + M + Breakthru – 16 oz.	4.64 a	1.92 a	3.28 a
K + M + Breakthru – 32 oz.	6.24 a	2.37 a	4.31 a
K + M + Breakthru – 64 oz.	7.92 a	2.41 a	5.17 a
Untreated Control ⁴	17.34	12.49	14.92

¹K = Kocide 2000 @ 6 lbs./Ac.

²M = Manex @ 58 oz./Ac.

³Duncan's multiple range test for treatment means at the 5% level.

⁴Untreated control trees were not part of the randomized complete block design

Figure 6. Blight counts for the Breakthru treatments. First 2 sprays with treatments, 3 additional half sprays applied by the grower.

Terminal Bud Break	
Date	% Bud Break
4/8/06	5.0%
4/13/06	25.9%
4/18/06	33.5%
4/25/06	59.3%
4/28/06	72.8%
5/5/06	73.2% (full bloom)
5/12/06	77.5%

Figure 7. Bud break evaluations for Chandler walnuts in 2006. Cone Grove location.

DATE	5/10	5/15	5/19	5/22	5/25	5/30	6/2	6/5	6/8	6/12	6/15	6/19
% BLIGHTED NUTS	0.0%	12.9%	31.7%	48.3%	53.1%	60.4%	65.2%	69.8%	72.5%	73.5%	73.9%	74.2%

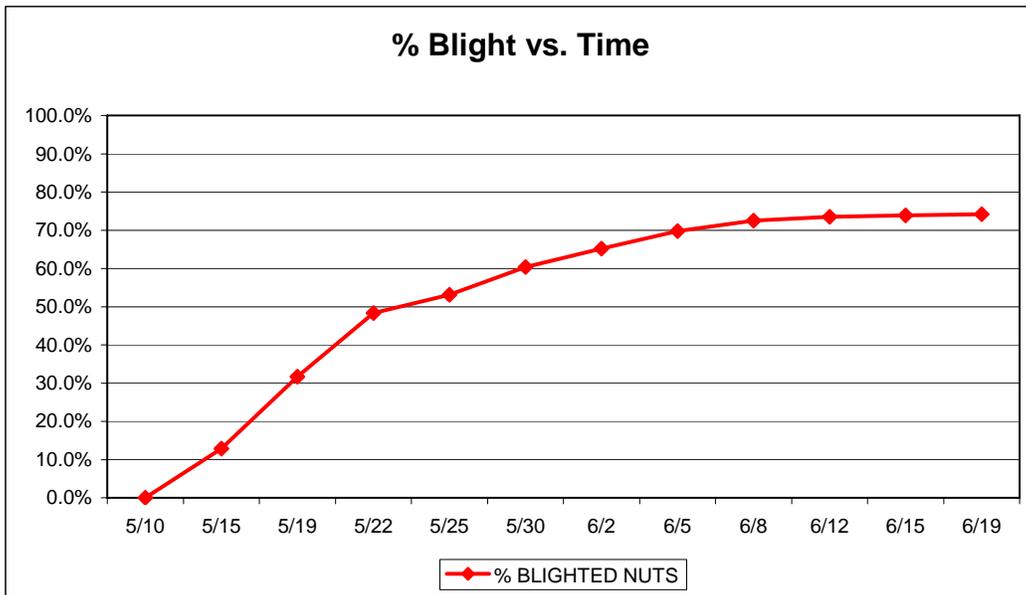


Figure 8. Blight symptoms on walnuts under simulated plus natural rainfall. Disease progression curve.