APPLE (*Malus* × *domestica* 'Golden Delicious', 'Jerseymac', 'Redcort')
Apple scab; *Venturia inaequalis*
Cedar apple rust; *Gymnosporangium juniperi-virginianae*
Quince rust; *Gymnosporangium clavipes*
Powdery mildew; *Podosphaera leucotricha*
Summer rots; *Botryosphaeria* species
Flyspeck; *Zygophiala jamaicensis*
Sooty blotch; species complex

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Apple disease control with DMI and strobilurin fungicides, 2002.

Treatments were compared using three-tree plots containing one tree of each cultivar on M.9 rootstocks. Treatments were replicated four times. Unsprayed buffer rows were maintained between sprayed rows. Plots within rows were separated by cedar trees that provided inoculum for cedar apple rust and minimized drift between plots. Populations of *V. inaequalis* in the test orchard were still near baseline for sensitivity to DMI fungicides when tested in 1999. Fungicide treatments were sprayed to runoff using a handgun at 220 psi. Application dates with corresponding Jerseymac growth stages were 16 Apr (tight cluster), 24 Apr (full bloom); 4 May (petal fall), 16 May (1c); 28 May (2c), 11 Jun (3c); 27 Jun (4c), 19 Jul (5c); 13 Aug (6c). Spring was exceptionally dry with the first apple scab and rust infections occurring during a rain that started on 28 April. Primary apple scab infection periods occurred 28-29 April (31 hr wetting, 47° F, 1.36 in. rain), 2-3 May (24 hr, 49° F, 0.35 in. rain), and 12-14 May (47 hr, 50° F, 2.11 in. rain). Important secondary scab infection periods occurred 17-18 May (15 hr, 43° F, 1.05 in. rain), 26 May (8 hr, 53° F, 0.10 in. rain), 28-29 May (30 hr, 64° F, 0.42 in. rain), 31 May (19 hr, 63° F, 1.47 in. rain), and 5-7 Jun (42 hr, 62° F, 2.81 in. rain). Five more secondary scab infection periods occurred between 12 and 30 Jun; four occurred during July, and four more occurred during August. However, July and August were exceptionally hot and dry with only 1.56 in. of rain between 30 Jun and 18 Aug. Trickle irrigation was used to maintain tree growth. Incidence of foliar diseases was evaluated by observing all leaves on 20 clusters or terminals per tree except that only the eight youngest leaves on 20 terminals were used to assess powdery mildew. Disease on fruit was assessed by observing 50 fruitlets per tree in June and 100 fruit per tree at harvest. Fruit finish on Golden Delicious was evaluated using a scale of 1-5 wherein 1= no russet, 2= raised lenticels, 3 = net-like russeting sufficient to down-grade fruit from USDA Extra Fancy, 4= heavy net-like russetting, and 5 = very severe russet. All harvested fruit were rated twice for fruit decay. The first rating was done at the time of harvest. The second rating was done following a 10-day incubation period at 70° F and 100% relative humidity to allow quiescent or incubating infections to develop visible symptoms. The incidence of decays at harvest and after incubation was analyzed in a repeated-measures analysis to determine treatment effects on fruit decays (mostly *Botryosphaeria* species). Statistical analyses were performed using *SuperANOVA* software (Abacus Concepts, Berkeley, CA).

Because of the dry summer, the absence of any scab infections prior to full bloom, and the low carry-over inoculum in this test orchard, apple scab was relatively easy to control during the 2002 season. BAS 516 is a prepackaged mix of BAS 500 and BAS 510, so the two components were tested separately in treatments 10 and 11 using the same rates that were present in BAS 516 as used in treatment 9. BAS 500 used alone was as effective as BAS 516 (the mixture) for all diseases except powdery mildew on Jerseymac. BAS 516 provided better control of mildew on Jerseymac than either component used alone. The fact that BAS 516 provided better mildew control than most other treatments with DMI and strobilurin fungicides is partially attributable to the fact that BAS 516 was applied on June 11 (7-8 days before mildew was evaluated) whereas most other treatments received only Captan on June 11. The season-long program of contact fungicides (treatment 2) was less effective against early terminal leaf scab on Jerseymac than any of the other treatments except BAS 510, presumably because most treatments provided post-infection control of scab infections initiated during rains on 12-14 May and 26 May whereas the contact fungicides did not. Procure 4SC was slightly less effective than Procure 50W (treatment 5 vs. 4) as judged by terminal leaf scab on Redcort and cedar apple rust on Golden Delicious fruit. None of the treatments provided complete control of cedar apple rust on terminal leaves, because some rust infections occurred during June when Captan was applied in most of the plots. Incidence of rust on leaves was significantly higher in treatment 8 where Sovran was applied in two consecutive sprays (16 and 28 May) than in treatments 4, 5, or 7 where Sovran was applied on only one of those dates. Thus, for the second consecutive year, alternating strobilurin and DMI fungicides provided better rust control than programs where strobilurin fungicides were used in consecutive sprays (see Fungic. Nematicide Tests 57:pf-15). The mean fruit finish rating on Golden Delicious for the standard Nova-Dithane-Captan program (treatment 3) was 2.4. Other treatments had russet ratings ranging from 2.2-2.6 and were not significantly different from treatment 3, except that treatment 10 had a significantly higher russet rating of 2.9 (data not shown in tables). Reasons for increased fruit russetting in treatment 10 are unknown. Very little flyspeck, sooty blotch, or summer fruit rot developed in any treatments because of the hot, dry summer.

Material and rate of formulated product per 100 gal	Application dates: Apr 16	Apr 24	May 4	May 16	May 28	Jun 11	Jun 27	Jul 19	Aug 13	% scab infection on Jerseymac: terminal leaves 25 Jun	terminal leaves 20 Aug	fruit 24 Jun	fruit 22 Jul
1. Control	-	-	-	-	-	-	-	-	-	64.2 e[x]	91.8 e	93.0 c	99.3 c
2. Dithane 75DF RSNT 1 lb	x	x	x	x	x	-	-	-	-				
Captan 50W 1 lb	-	-	-	-	-	x	x	x	x	7.4 c	9.7 c	0.5 a	3.8 a
3. Nova 40W 1.5 oz + Dithane[y]	x	x	x	x	x	-	-	-	-				
Captan 50 W 1 lb[z]	-	-	-	-	-	x	x	x[z]	x[z]	1.0 ab	2.3 abc	0.0 a	0.3 a
4. Sovran 50WG 1.33 oz	x	-	-	x	-	-	-	-	-				
Procure 50W 3.3 oz + Dithane[y]	-	x	x	-	x	-	-	-	-				
Captan 50W 1 lb	-	-	-	-	-	x	x	x	x	2.0 ab	3.3 abc	0.0 a	0.8 a
5. Sovran 50WG 1.33 oz	x	-	-	x	-	-	-	-	-				
Procure 4SC 3.3 fl oz + Dithane[y]	-	x	x	-	x	-	-	-	-				
Captan 50W 1 lb	-	-	-	-	-	x	x	x	x	3.6 bc	7.3 bc	0.0 a	0.3 a
6. Flint 50WG 0.67 oz	x	-	x	-	x	-	-	-	-				
Nova 40W 1.5 oz + Dithane[y]	-	x	-	x	-	-	-	-	-				
Captan 50W 1 lb[z]	-	-	-	-	-	x	x	x	x[z]	0.7 a	1.0 ab	0.0 a	1.3 a
7. Sovran 50WG 1.33 oz	x	-	x	-	x	-	-	-	-				
Nova 40W 1.5 oz + Dithane[y]	-	x	-	x	-	-	-	-	-				
Captan 50W 1 lb[z]	-	-	-	-	-	x	x	x	x[z]	2.0 ab	2.4 abc	0.0 a	0.5 a
8. Sovran 50WG 1.33 oz	x	-	-	x	x	-	-	x	-				
Nova 1.5 oz + Polyram 80DF 1 lb	-	x	x	-	-	-	-	-	-				
Captan 50W 1 lb[z]	-	-	-	-	-	x	x	-	x[z]	1.9 ab	3.8 abc	0.0 a	0.3 a
9. BAS 516 0.349 lb	x	x	x	x	x	x	x	x	x	0.8 a	1.4 ab	0.0 a	0.3 a
10. BAS 500 0.25 lb	x	x	x	x	x	x	x	x	x	1.0 ab	0.4 a	0.0 a	0.3 a
11. BAS 510 0.142 lb	x	x	x	x	x	x	x	x	x	14.6 d	33.0 d	3.5 b	25.0 b

See footnotes at bottom of page.

Material and rate of formulated product per 100 gal	% scab infection on Redcort: terminal lvs 25 Jun	fruit 24 Jun	fruit 5 Sep	% terminal leaves with mildew: Redcort 18 Jun	Jerseymac 19 Jun
1. Control	53.9 e[x]	9.7 b	51.1 b	66.7 d	55.9 e
2. Dithane[y] // Captan 50W 1 lb	7.4 bcd	0.0 a	0.2 a	38.3 c	42.5 d
3. Nova 40W 1.5 oz + Dithane[y] Captan 50 W 1 lb[z]	3.4 abc	0.0 a	0.2 a	7.7 ab	11.4 bc
4. Sovran 50WG 1.33 oz Procure 50W 3.3 oz + Dithane[y] Captan 50W 1 lb	2.1 ab	0.0 a	0.0 a	6.9 ab	13.1 bc
5. Sovran 50WG 1.33 oz Procure 4SC 3.3 fl oz + Dithane[y] Captan 50W 1 lb	8.7 cd	0.0 a	0.0 a	10.6 b	18.6 c
6. Flint 50WG 0.67 oz Nova 40W 1.5 oz + Dithane[y] Captan 50W 1 lb[z]	1.3 a	0.0 a	0.0 a	5.6 ab	12.0 bc
7. Sovran 50WG 1.33 oz Nova 40W 1.5 oz + Dithane[y] Captan 50W 1 lb[z]	1.7 a	0.0 a	0.0 a	7.2 ab	9.1 ab
8. Sovran 50WG 1.33 oz Nova 1.5 oz + Polyram 80DF 1 lb Captan 50W 1 lb[z]	2.6 ab	0.0 a	0.0 a	8.1 b	14.2 bc
9. BAS 516 0.349 lb	1.5 a	0.0 a	0.0 a	2.5 a	3.8 a
10. BAS 500 0.25 lb	1.4 a	1.7 a	0.7 a	4.1 ab	12.2 bc
11. BAS 510 0.142 lb	13.7 d	0.0 a	1.5 a	8.1 b	15.3 bc

[x] Within columns, means followed by the same small letter do not differ significantly ($P \leq 0.05$) as determined using Fisher's Protected LSD applied to arc-sine transformed data. Arithmetic means are shown in the table.

[y] Dithane 75DF RSNT 1 lb.

[z] Topsin M 70W 3 oz was added to Captan in the last one or two sprays as indicated on the spray application table.

Material and rate of formulated product per 100 gal	Application dates Apr 16	24	May 4	16	28	Jun 11	27	Jul 19	Aug 13	% Golden Delicious with cedar apple rust term. lvs. 16 Jul	fruit 26 Sep	% fruit with quince rust Jerseymac 22 July	Redcort 5 Sep
1. Control	-	-	-	-	-	-	-	-	-	70.7 e[x]	7.3 d	47.2 c	10.4 b
2. Dithane 75DF RSNT 1 lb	x	x	x	x	x	-	-	-	-				
Captan 50W 1 lb	-	-	-	-	-	x	x	x	x	12.8 ab	1.0 ab	0.3 ab	0.0 a
3. Nova 40W 1.5 oz + Dithane[y]	x	x	x	x	x	-	-	-	-				
Captan 50 W 1 lb[z]	-	-	-	-	-	x	x	x[z]	x[z]	10.4 a	1.0 ab	0.0 a	0.0 a
4. Sovran 50WG 1.33 oz	x	-	-	x	-	-	-	-	-				
Procure 50W 3.3 oz + Dithane[y]	-	x	x	-	x	-	-	-	-				
Captan 50W 1 lb	-	-	-	-	-	x	x	x	x	13.3 ab	1.2 ab	0.0 a	0.2 a
5. Sovran 50WG 1.33 oz	x	-	-	x	-	-	-	-	-				
Procure 4SC 3.3 fl oz + Dithane[y]	-	x	x	-	x	-	-	-	-				
Captan 50W 1 lb	-	-	-	-	-	x	x	x	x	10.9 ab	4.4 cd	0.0 a	0.3 a
6. Flint 50WG 0.67 oz	x	-	x	-	x	-	-	-	-				
Nova 40W 1.5 oz + Dithane[y]	-	x	-	x	-	-	-	-	-				
Captan 50W 1 lb[z]	-	-	-	-	-	x	x	x	x[z]	11.4 ab	1.0 ab	0.0 a	0.7 a
7. Sovran 50WG 1.33 oz	x	-	x	-	x	-	-	-	-				
Nova 40W 1.5 oz + Dithane[y]	-	x	-	x	-	-	-	-	-				
Captan 50W 1 lb[z]	-	-	-	-	-	x	x	x	x[z]	16.5 b	0.7 ab	0.0 a	0.2 a
8. Sovran 50WG 1.33 oz	x	-	-	x	x	-	-	x	-				
Nova 1.5 oz + Polyram 80DF 1 lb	-	x	x	-	-	-	-	-	-				
Captan 50W 1 lb[z]	-	-	-	-	-	x	x	-	x[z]	26.9 c	1.2 ab	0.0 a	0.6 a
9. BAS 516 0.349 lb	x	x	x	x	x	x	x	x	x	15.6 b	1.9 bc	1.9 b	0.6 a
10. BAS 500 0.25 lb	x	x	x	x	x	x	x	x	x	13.7 ab	0.2 a	1.5 ab	0.0 a
11. BAS 510 0.142 lb	x	x	x	x	x	x	x	x	x	53.8 d	1.6 ab	48.5 c	7.4 b

See footnotes at bottom of page.

Material and rate of formulated product per 100 gal	% fruit with flyspeck Redcort 5 Sep	Golden Delicious 26 Sep	Golden Delicious incubated[w]	% Golden Del. with sooty blotch after incubation	% Golden Delicious with decay
1. Control	8.0 c[x]	6.1 b	20.9 c	21.4 b	12.2 c
2. Dithane[y] // Captan 50W 1 lb	0.5 ab	0.0 a	0.0 a	0.3 a	2.6 ab
3. Nova 40W 1.5 oz + Dithane[y] Captan 50 W 1 lb[z]	1.0 ab	0.0 a	0.7 ab	1.0 a	0.7 a
4. Sovran 50WG 1.33 oz Procure 50W 3.3 oz + Dithane[y] Captan 50W 1 lb	1.5 ab	0.5 a	1.6 ab	0.7 a	2.5 ab
5. Sovran 50WG 1.33 oz Procure 4SC 3.3 fl oz + Dithane[y] Captan 50W 1 lb	0.5 ab	0.0 a	1.9 b	0.3 a	2.6 ab
6. Flint 50WG 0.67 oz Nova 40W 1.5 oz + Dithane[y] Captan 50W 1 lb[z]	1.7 b	0.0 a	2.8 ab	0.8 a	3.0 b
7. Sovran 50WG 1.33 oz Nova 40W 1.5 oz + Dithane[y] Captan 50W 1 lb[z]	1.1 ab	0.2 a	2.0 b	0.5 a	1.1 ab
8. Sovran 50WG 1.33 oz Nova 1.5 oz + Polyram 80DF 1 lb Captan 50W 1 lb[z]	0.8 ab	0.0 a	0.5 ab	0.0 a	2.0 ab
9. BAS 516 0.349 lb	0.2 ab	0.0 a	0.0 a	0.0 a	2.2 ab
10. BAS 500 0.25 lb	0.4 ab	0.0 a	0.5 ab	0.0 a	0.7 a
11. BAS 510 0.142 lb	0.0 a	0.6 a	0.6 ab	0.3 a	3.3 ab

[w] Fruit were incubated at 70° F and 100% relative humidity for 10 days prior to evaluation.

[x] Within columns, means followed by the same small letter do not differ significantly ($P \leq 0.05$) as determined using Fisher's Protected LSD applied to arc-sine transformed data. Arithmetic means are shown in the table.

[y] Dithane 75DF RSNT 1 lb.

[z] Topsin M 70W 3 oz was added to Captan in the final one or two sprays as indicated on the spray application table.