

APPLE (*Malus xdomestica* 'Jerseymac', 'Ginger Gold')
 Apple scab; *Venturia inaequalis*
 Cedar apple rust; *Gymnosporangium juniperi-virginianae*
 Quince rust; *Gymnosporangium clavipes*
 Powdery mildew; *Podosphaera leucotricha*
 Flyspeck; *Zygophiala jamaicensis*
 Sooty blotch; species complex

D. A. Rosenberger, F. W. Meyer, and K. L. VanCamp
 NY State Agricultural Experiment Station
 Cornell's Hudson Valley Laboratory
 PO Box 727, Highland, NY 12528

Apple disease control with contact fungicides, 2002.

Treatments were applied to 16-yr-old trees on M.9 rootstock. Populations of *V. inaequalis* in the test orchard were still near baseline for sensitivity to DMI fungicides when tested in 1999. High levels of scab inoculum were present in this orchard, but spring was exceptionally dry with no opportunity for apple scab or rust infections until trees were in full bloom. Trickle irrigation was used to maintain tree growth. Treatments were replicated four times in two-tree plots that contained one tree of each cultivar. Application dates with corresponding Jerseymac growth stages were 2 Apr (green tip), 12 Apr (half-in. green), 19 Apr (king bloom), 30 Apr (late bloom); 8 May (petal fall), 20 May (1c); 3 Jun (2c), 19 Jun (3c); and 8 Jul (4c). 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 June (42 hr, 62° F, 2.81 in. rain). Five more secondary scab infection periods occurred between 12 and 30 Jun; four occurred during July. However, July was exceptionally hot and dry with only 1.0 in. of rain. Quince rust on Jerseymac fruitlets was assessed by observing 25 clusters per tree (29 to 89 fruitlets, mean of 55 fruitlets) on 7 Jun. 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 on 24 Jun and 100 (or all available) fruit per tree at harvest. Fruit finish on Ginger Gold was evaluated using a scale of 1-5 wherein 1= no russet, 2= raised lenticels, 3 = net-like russetting sufficient to down-grade fruit from USDA Extra Fancy, 4= heavy net-like russetting, and 5 = very severe russet. After harvest evaluations were completed, all of the sound Ginger Gold fruit were incubated for 14 days at 70 °F and 100% relative humidity to allow quiescent or incubating infections to develop visible signs. *SuperANOVA* software (Abacus Concepts, Berkeley, CA) was used for statistical analyses.

Due to the dry summer and the absence of any scab infection periods prior to full bloom, apple scab was relatively easy to control during the 2002 season. The two lowest concentrations of TD 2448-01 did not provide adequate control of fruit scab on the highly susceptible Jerseymac cultivar. None of the TD 2448-01 treatments adequately controlled rust diseases or mildew. The lowest concentration of TD 2448-01 provided better suppression of rust diseases than the higher concentrations, and the same phenomenon was noted with flyspeck on Ginger Gold fruit following the postharvest incubation period. Although the lowest and highest concentrations produced significantly different levels of flyspeck control, regression analyses of flyspeck incidence from the 20 plots involving TD 1448-01 (4 replicates X 5 treatments) showed that the relationship between rate and flyspeck incidence was not linear ($P=0.69$, $R^2=0.17$). Why the lowest concentration of TD 1448-01 was more effective than the high concentration for control of rust diseases and flyspeck is unknown. The incidence of quince rust in some treatments decreased between the first Jerseymac rating on 7 Jun and the final rating on 23 Jul because many severely infected fruit dropped from the trees before harvest. Rust diseases were not controlled adequately in the treatment involving Vanguard because infections on fruit and leaves occurred prior May 8 when Penncozeb was first applied in those plots. Vanguard was not expected to control mildew or rust diseases; it was used in the first four applications only to demonstrate its activity against apple scab. Two prebloom applications of Cuprofix Disperss Blue did not cause any increase in fruit russetting in this test, but applying Cuprofix MZ in five applications (through petal fall) resulted in a significant increase in russetting on Ginger Gold.

Material and rate of formulated product per 100 gal ^x	% scab on Jerseymac				% scab on Ginger Gold		
	term. lvs		fruit		term lvs	fruit	
	2 Jul	19 Aug	24 Jun	23 Jul	5 Jul	24 Jun	15 Aug
Control	28.1 b ^y	57.4 b	88.0 d	87.1 d	15.8 d	7.5 c	12.2 c
Penncozeb/Penncozeb+Nova/Topsin+Captan ^z	1.0 a	2.6 a	0.0 a	0.3 a	1.7 abc	0.5 ab	0.0 a
Cuprofix Disperss /Penncozeb+Microthiol/ Topsin+Microthiol/Topsin+Ziram ^z	2.0 a	4.0 a	1.0 ab	1.8 ab	1.4 bc	0.0 a	0.3 ab
Cuprofix MZ30/Topsin+Microthiol/Topsin+Ziram ^z	1.8 a	4.6 a	0.0 a	0.9 a	1.6 c	0.0 a	0.3 ab
Vanguard 50W 1.67 oz (2 – 30 Apr) Penncozeb 75DF 1 lb (8 May – 3 Jun) ^z Topsin + Captan 50W 1 lb (19 Jun – 8 Jul)	1.0 a	4.1 a	0.0 a	0.6 a	0.4 abc	1.5 b	0.0 a
TD 2448-01 40SC 1.48 fl oz (2 Apr – 8 Jul)	1.4 a	3.7 a	4.0 c	27.8 c	1.1 abc	0.5 ab	1.0 b
TD 2448-01 40SC 2.22 fl oz (2 Apr – 8 Jul)	0.4 a	1.6 a	2.0 bc	7.6 b	0.9 abc	1.5 b	0.5 ab
TD 2448-01 40SC 2.96 fl oz (2 Apr – 8 Jul)	0.4 a	3.3 a	0.5 ab	3.4 a	0.3 abc	0.0 a	0.6 ab
TD 2448-01 40SC 4.44 fl oz (2 Apr – 8 Jul)	0.2 a	1.7 a	0.0 a	3.2 ab	0.0 a	0.0 a	0.0 a
TD 2448-01 40SC 5.93 fl oz (2 Apr – 8 Jul)	0.2 a	1.3 a	0.5 ab	2.2 a	0.1 ab	0.0 a	0.6 ab

^x Application dates were 2, 12, 19, 30 Apr; 8, 20 May; 3, 19 Jun; 8 Jul.

^y Numbers within columns followed by the same lowercase letter do not differ significantly, Fisher's Protected LSD ($P \leq 0.05$).

The angular transformation was used for the statistical analyses, but arithmetic means are presented in the tables.

^z For details of products tested and spray timing, see the next table.

Material and rate of formulated product per 100 gal ^w	% fruit with quince rust			% cedar apple rust	
	Jerseymac		Ginger Gold	GG lvs	GG fruit
	7 Jun	23 Jul	15 Aug	24 Jul	15 Aug
Control	90.7 d ^x	65.9 cd	45.2 e	73.9 g	25.4 d
Penncozeb 75DF 1 lb (2 - 30 Apr)					
Penncozeb 75DF 1 lb +Nova 40W 1.5 oz (8 May-3 Jun)					
Topsin ^y + Captan 50W 1 lb (19 Jun – 8 Jul)	1.6 a	0.0 a	0.0 a	3.7 a	0.0 a
Cuprofix Disperss Blue 20 DF 3.3 lb (2, 12 Apr)					
Penncozeb 75 DF 1.5 lb +Microthiol ^z (19 Apr; 8 May)					
Penncozeb 75 DF 1.5 lb (30 Apr)					
Topsin ^y + Microthiol ^z (20 May; 3 Jun)					
Topsin ^y + Ziram 76DF 1 lb (19 Jun – 8 Jul).....	1.6 a	1.5 a	1.3 a	47.2 c	0.7 a
Cuprofix MZ30 42DF 2 lb (2 Apr - 8 May)					
Topsin ^y + Microthiol ^z (20 May; 3 Jun)					
Topsin ^y +Ziram 76DF 1 lb (19 Jun – 8 Jul).....	0.7 a	2.1 a	8.0 b	59.9 def	5.8 b
Vanguard 50W 1.67 oz (2 – 30 Apr)					
Penncozeb 75DF 1 lb (8 May – 3 Jun)					
Topsin ^y + Captan 50W 1 lb (19 Jun – 8 Jul).....	48.2 b	27.7 b	40.1 de	49.4 cd	28.9 d
TD 2448-01 40SC 1.48 fl oz (2 Apr – 8 Jul).....	59.6 bc	44.9 bc	13.5 b	24.9 b	9.7 bc
TD 2448-01 40SC 2.22 fl oz (2 Apr – 8 Jul).....	87.0 d	74.8 d	28.0 cd	55.1 cde	20.6 d
TD 2448-01 40SC 2.96 fl oz (2 Apr – 8 Jul).....	81.6 cd	66.5 cd	26.6 cd	65.9 efg	21.0 d
TD 2448-01 40SC 4.44 fl oz (2 Apr – 8 Jul).....	74.9 cd	60.4 cd	28.1 cd	72.0 g	18.6 cd
TD 2448-01 40SC 5.93 fl oz (2 Apr – 8 Jul).....	82.1 d	70.6 d	24.1 c	68.6 fg	19.3 d

^w Application dates were 2, 12, 19, 30 Apr; 8, 20 May; 3, 19 Jun; 8 Jul.

^x Numbers within columns followed by the same lowercase letter do not differ significantly, Fisher's Protected LSD ($P \leq 0.05$). The angular transformation was used for the statistical analyses, but arithmetic means are presented in the tables.

^y Topsin M 70WP 3 oz.

^z Microthiol Disperss 80 DF 1 lb.

Material and rate of formulated product per 100 gal ^u	% JM lvs with mildew 12 Jun	Ginger Gold fruit at harvest		% GG fruit with flyspeck after incubation ^w
		% fruit with flyspeck	russet rating ^v	
Control	70.5 f ^x	8.1 d	2.25 bc	16.9 e
Penncozeb 75DF 1 lb (2 - 30 Apr)				
Penncozeb 75DF 1 lb +Nova 40W 1.5 oz (8 May-3 Jun)				
Topsin ^y + Captan 50W 1 lb (19 Jun – 8 Jul)	0.8 a	0.0 a	1.87 a	1.0 ab
Cuprofix Disperss Blue 20 DF 3.3 lb (2, 12 Apr)				
Penncozeb 75 DF 1.5 lb +Microthiol ^z (19 Apr; 8 May)				
Penncozeb 75 DF 1.5 lb (30 Apr)				
Topsin ^y + Microthiol ^z (20 May; 3 Jun)				
Topsin ^y + Ziram 76DF 1 lb (19 Jun – 8 Jul).....	20.8 bc	0.0 a	1.99 ab	0.9 ab
Cuprofix MZ30 42DF 2 lb (2 Apr - 8 May)				
Topsin ^y + Microthiol ^z (20 May; 3 Jun)				
Topsin ^y +Ziram 76DF 1 lb (19 Jun – 8 Jul).....	13.4 b	0.8 abc	3.61 d	0.0 a
Vanguard 50W 1.67 oz (2 – 30 Apr)				
Penncozeb 75DF 1 lb (8 May – 3 Jun)				
Topsin ^y + Captan 50W 1 lb (19 Jun – 8 Jul).....	51.1 e	0.2 ab	2.13 abc	0.0 a
TD 2448-01 40SC 1.48 fl oz (2 Apr – 8 Jul).....	44.7 de	1.0 bc	1.99 ab	4.4 abc
TD 2448-01 40SC 2.22 fl oz (2 Apr – 8 Jul).....	37.2 de	2.3 c	2.26 c	3.9 bc
TD 2448-01 40SC 2.96 fl oz (2 Apr – 8 Jul).....	37.0 de	1.3 bc	2.18 bc	8.5 cde
TD 2448-01 40SC 4.44 fl oz (2 Apr – 8 Jul).....	26.6 bcd	1.4 bc	2.19 bc	7.1 cd
TD 2448-01 40SC 5.93 fl oz (2 Apr – 8 Jul).....	31.6 cd	2.1 bc	2.11 abc	12.3 de

^u Application dates were 2, 12, 19, 30 Apr; 8, 20 May; 3, 19 Jun; 8 Jul.

^v Fruit russeting was rated for 75 fruit per tree using a scale of 1-5 wherein 1= no russet, 3 = sufficient russet to down-grade fruit from USDA Extra Fancy, and 5 = severe russet.

^w Fruit were held at room temperature and 100% RH for 12 days and re-rated. Incidence of sooty blotch after incubation ranged from 0.6 to 8.2% with no significant differences among treatments ($P=0.19$).

^x Numbers within columns followed by the same lowercase letter do not differ significantly, Fisher's Protected LSD ($P \leq 0.05$). The angular transformation was used for the statistical analyses, but arithmetic means are presented in the tables.

^y Topsin M 70WP 3 oz.

^z Microthiol Disperss 80 DF 1 lb.