

APPLE (*Malus × domestica* 'Empire', 'Jonagold')
Apple scab; *Venturia inaequalis*
Powdery mildew; *Podosphaera leucotricha*

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Evaluation of fungicide programs for management of apple scab and powdery mildew, 2003.

Trials were conducted in a 8-year-old orchard of Empire on M.9 rootstock and Jonagold on M.111 rootstock in Geneva, NY. Trees were alternated within rows such that individual plots consisted of two trees, one Empire and one Jonagold. Treatments were arranged in a randomized complete block design with four replications. All treatments were applied to drip using a handgun and high-pressure pump. Cover sprays were applied with an airblast sprayer at 3X concentration. Daily ascospore release was monitored from 1 Apr through 1 Jun with a Burkard spore trap in a neighboring orchard to estimate disease pressure. Five major release events were identified. For each of these five events the following information is given: date of event, hours of leaf wetness and the average temperature during that period, amount of precipitation, and cumulative ascospores released as a percent of the seasonal total. Individual leaf wetness periods were added together if separated by a drying period less than 24 hr. The events were: (1) 21-23 Apr, 40 hr, 45°F, 0.21 in., 47%; (2) 1-2 May, 11 hr, 50°F, 1.04 in., 51%; (3) 5-8 May, 24 hr, 54°F, 0.35 in., 66%; (4) 11-13 May, 29 hr, 53°F, 1.71 in., 96%; and (5) 15-16 May, 31 hr, 52 °F, 0.23 in., 99%. Apple scab incidence (presence/absence) was evaluated on Empire trees only by examining the five largest leaves on 10 clusters per tree on 14 Jun and on the first 10 fully expanded leaves (i.e., oldest leaves) on each of 10 terminal branches on 20 Aug. Fifty fruit per tree were examined for the presence or absence of scab on 3 Jul and 20 Aug. Powdery mildew incidence was evaluated on Jonagold trees only by examining 50 fruit per tree for russet symptoms on 20 Aug and on the first 10 fully expanded leaves on each of 10 terminal branches on 18 Sep. Data were transformed using the arcsin square root transformation. Transformed data were analyzed in an ANOVA and treatment means were separated using Fisher's Protected LSD test ($P < 0.05$).

Apple scab pressure was very high during the entire season; powdery mildew pressure was moderate. Strictly protectant programs (# 1,2,4,5) provided control of both terminal and fruit scab equivalent to the strobilurin programs (#7 thru 12). The addition of Nova 40W to the protectant programs (#3,6) did not markedly improve scab control; however, we suspect that this may be attributable to resistance to the DMI fungicide class, to which Nova 40W belongs. The orchard will be tested for resistance next season. Substituting Dodine 400F for Dithane RSNT at green tip and half-inch green (#14,16) or, particularly, at tight cluster and pink (#15) improved scab control. The 30 fl oz rate used here is approximately three times the proposed label rate. Trials in a neighboring McIntosh-Cortland orchard failed to give equivalent control when Dodine 400F was applied at the 8 oz rate at the same timings. Scala programs with Flint performed well (#18,19) with the higher rate of Scala giving better fruit scab control than the lower rate, but not better than the same Flint program without Scala (#17). When the first critical spray was omitted and then was followed by two application of either Dodine 400F or Scala 60SC (#24-25), final fruit scab was significantly lower than the equivalent Dithane program (#23). Oxidate, a formulation of hydrogen dioxide, gave very poor control of apple scab and powdery mildew. There was some indication of phytotoxicity on Jonagold, however this was confounded with russet symptoms resulting from mildew infections. Powdery mildew was difficult to control through the season. Most programs kept foliar mildew under 25%. The strobilurin programs (#7-12), in general, had the least fruit russet, but this was not consistent across all programs with a strobilurin component.

Product, Rate/100 gal	Timing**	% Foliar scab [% control]		% Fruit scab [% control]		Powdery mildew [% control]	
		Cluster leaves	Terminals	Early fruit	Late Fruit	Terminals	Fruit
		14 Jun	20 Aug	3 Jul	20 Aug	18 Sep	20 Aug
Protectant programs							
1. Captan 50WP 2 lb	1-6	0.5 a [94]	4.0 abcd [94]	0.0 a [100]	2.0 a [97]	25.8 bcde [38]	16.0 abcde [58]
2. Captan 50WP 1 lb	1-6	0.3 a [97]	2.8 abc [96]	1.0 a [99]	2.0 a [97]	20.0 abcd [52]	10.5 abcd [73]
3. Captan 50WP 1 lb	1,2,5						
Nova 40W 1.5 oz + Captan 50WP 1 lb.....	3,4,6,7	0.0 a [100]	1.8 ab [97]	2.5 abc [97]	5.0 a [94]	18.0 abc [57]	8.0 abc [79]
4. Dithane RSNT 2 lb.....	1-6	1.0 a [89]	2.8 abc [96]	1.5 a [98]	2.5 a [97]	12.3 a [71]	12.5 abcd [68]
5. Dithane RSNT 1 lb.....	1-6	2.5 a [71]	7.0 abcdef [89]	5.5 abcd [94]	6.0 a [92]	16.3 abc [61]	24.0 def [38]
6. Dithane RSNT 1 lb.....	1,2,5						
Nova 40W 1.5 oz + Dithane RSNT 1 lb.....	3,4,6,7	1.5 a [83]	9.8 def [85]	5.5 abcd [94]	12.5 ab [84]	18.0 abc [57]	19.5 bcdef [49]
Strobilurin programs							
7. Dithane RSNT 1 lb.....	1,2,5						
Sovran 50WG 1.33 oz	3,4,6,7	0.0 a [100]	1.3 a [98]	0.0 a [100]	3.0 a [96]	17.1 abc [59]	11.5 abcd [70]
8. Dithane RSNT 75DF 1 lb	1,2,5						
Sovran 50WG 2.1 oz	3,4,6,7	0.0 a [100]	1.5 a [98]	0.0 a [100]	0.5 a [99]	26.8 bcde [36]	7.5 ab [81]
9. Dithane RSNT 1 lb.....	1,2,5						
Sovran 50WG 1.33 oz + Dithane RSNT 1 lb	3,4,6,7	0.0 a [100]	0.8 a [99]	0.0 a [100]	1.5 a [98]	11.8 a [72]	4.5 a [88]
10. Dithane RSNT 1 lb.....	1,2,5						
Flint 50WG 0.67 oz.....	3,4,6,7	0.0 a [100]	0.8 a [99]	1.5 a [98]	4.5 a [94]	24.9 abcde [40]	7.5 abc [81]
11. Dithane RSNT 1 lb.....	1,2,5						
Flint 50WG 1.00 oz.....	3,4,6,7	0.0 a [100]	1.3 a [98]	0.5 a [99]	1.0 a [99]	19.0 abcd [55]	8.0 abc [79]
12. Dithane RSNT 1 lb.....	1,2,5						
Flint 50WG 0.67 oz + Dithane RSNT 1 lb	3,4,6,7	0.0 a [100]	1.5 a [98]	0.0 a [100]	0.5 a [99]	13.3 abc [68]	17.0 bcde [56]
Dodine programs							
13. Dithane RSNT 1 lb.....	1,2,5,6						
Nova 40W 1.5 oz + Dithane RSNT 1 lb.....	3,4	2.5 a [71]	13.0 f [80]	9.2 cde [90]	23.5 bc [70]	12.5 ab [70]	19.0 bcdef [51]
14. Dodine 400F 30 fl oz.....	1,2						
Nova 40W 1.5 oz + Dithane RSNT 1 lb.....	3,4						
Dithane RSNT 1 lb.....	5,6	2.0 a [77]	14.0 f [78]	6.5 abcd [93]	10.5 ab [86]	25.3 bcde [39]	33.0 ef [14]
15. Dithane RSNT 1 lb.....	1,2,5,6						
Dodine 440F 30 fl oz + Nova 40WP 1.5 oz.....	3,4	0.5 a [94]	9.6 bcdef [85]	0.5 a [99]	4.5 a [94]	25.0 abcde [40]	19.0 bcde [51]
16. Dodine 400F 30 fl oz.....	1,2						
Dithane RSNT 1 lb.....	3-6	2.3 a [74]	9.5 bcdef [85]	10.0 de [90]	13.5 ab [83]	15.8 abc [62]	20.0 bcdef [48]
Scala programs							
17. Dithane RSNT 1 lb.....	1,2,5,6						
Flint 50WG 0.67 oz.....	3,4	0.25 a [97]	5.0 abcde [92]	1.0 a [99]	1.0 a [99]	23.3 abcd [44]	10.5 abcd [73]
18. Scala 60SC 44.5 ml.....	1,2						
Flint 50WG 0.67 oz.....	3,4						
Dithane RSNT 1 lb.....	5,6	0.0 a [100]	2.3 abc [96]	2.0 ab [98]	7.0 a [91]	28.4 bcde [32]	13.5 abcd [65]
19. Scala 60SC 66.7 ml.....	1,2						
Flint 50WG 0.67 oz.....	3,4						
Dithane RSNT 1 lb.....	5,6	0.0 a [100]	3.2 abcd [95]	1.0 a [99]	2.5 a [97]	24.8 abcde [41]	21.0 bcde [45]
Procure programs							
20. Dithane RSNT 1 lb.....	1,2,5						
Sovran 50WG 1.33 oz.....	3,6						
Procure 50WS 3.33 oz + Dithane RSNT 1 lb	4,7	0.0 a [100]	4.3 abcde [93]	1.0 a [99]	4.0 a [95]	18.0 abc [57]	13.0 abcd [66]
21. Dithane RSNT 1 lb.....	1-3,5,6						
Procure 50WS 3.33 oz + Dithane RSNT 1 lb	4,7	0.8 a [91]	6.5 abcdef [90]	6.5 abcd [93]	9.0 ab [88]	26.5 bcde [37]	11.5 abcd [70]
22. Dithane RSNT 1 lb.....	1-3,5,6						
Nova 40W 1.5 oz + Dithane RSNT 1 lb.....	4,7	1.0 a [89]	11.8 ef [82]	10.4 de [89]	6.0 a [92]	18.8 abcd [55]	23.0 cdef [40]
Delayed-spray programs							
23. Dithane RSNT 1 lb.....	2-6	9.8 b [-11]	8.0 abcdef [88]	15.0 e [85]	32.0 cd [59]	34.4 de [18]	19.5 bcdef [49]
24. Scala 60SC 66.7 ml.....	2,3						
Dithane RSNT 1 lb.....	4,5,6	1.8 a [80]	11.0 def [83]	8.5 bcde [91]	12.0 ab [85]	24.3 abcd [42]	18.0 bcdef [53]
25. Dodine 400F 30 fl oz.....	2,3						
Dithane RSNT 1 lb.....	4,5,6	1.3 a [86]	6.8 abcdef [89]	4.0 abcd [96]	9.0 ab [88]	28.5 bcde [32]	11.0 abcd [71]
26. Oxidate 128 fl oz.....	1-7**	3.0 a [66]	13.3 f [79]	27.5 f [72]	44.0 d [43]	26.0 bcde [38]	32.5 ef [16]
27. Untreated check		8.8 b [0]	64.3 g [0]	96.81 g [0]	77.5 e [0]	41.8 e [0]	38.5 f [0]

* Mean disease incidence values from four replicate plots per treatment are shown. Means within a column not followed by a common letter are significantly different.

** Timing designations for all trials *except* Oxidate are as follows: #1= 16 Apr (green tip) #2 = 24 Apr (1/2-inch green); #3 = 30 Apr (tight cluster); #4 = 7 May (pink); #5 = 15 May (bloom); #6 = 22 May (petal fall); and #7 = 29 May (first cover). The Oxidate program timings are as follows: #1= 21 Apr (green tip) #2 = 28 Apr (1/2-inch green); #3 = 2 May (tight cluster); #4 = 7 May (pink); #5 = 15 May (bloom); #6 = 22 May (petal fall); and #7 = 29 May (first cover). Unless otherwise noted, six (#7-#13) additional cover sprays of Topsin M 70WSB (3 oz/100gal) + Captan 50W (1 lb/100gal) were applied on 10, 23 Jun, 8, 16, 25 Jul, and 8 Aug; respectively. Agrimycin 17 (8 oz/100 gal) was applied for fire blight control on 21 May.