NOT FOR PUBLICATION

1986 RESULTS OF APPLE FUNGICIDE TRIALS IN THE HUDSON VALLEY

David A. Rosenberger, Plant Pathologist
N. Y. S. Agricultural Experiment Station
Hudson Valley Laboratory
PO Box 727
Highland, NY, 12528

Temporary Assistants

Jacqueline J. Christiana
Judy L. Christiana

Technical Assistants

Frederick W. Meyer
Peter J. Jentsch
Valerie A. Korjagin

Secretary

Donna J. Clark

FINAL REPORT FOR 1986

INTRODUCTORY COMMENTS

The following report summarizes data we have collected from fungicide tests during the past year. I wish to thank the chemical companies that provided the chemicals and the support which made these trials possible. In addition to the companies providing products used in tests reported here, we are also indebted to the following companies for supplying chemicals used in maintaining test orchards at the Hudson Valley Lab during 1986: Chevron Chemical Company, Ortho Division; Ciba-Geigy Corporation; Dow Chemical; DuPont Agri-chemicals; Elanco; FMC Agricultural Chemical Group, Milton, NY; Merck Company, Inc.; Mobay Chemical Company; Nor-Am Agricultural Products, Inc.; Rohm and Haas Chemical Company; and Stauffer Chemical Company.

The first few pages of this report provide details of weather and apple scab ascospore discharge data collected at the Hudson Valley Laboratory. Both the graphic on page 3 and the table on page 4 show data on apple scab ascospore discharge throughout the season. Spore discharge as monitored with the Burkard spore trap peaked much earlier in the season than would be expected from observations of ascospore maturity made from pseudothecial squash mounts. (A similar phenomenon was noted last season.) The Burkard trap data suggest peak discharge occurred at early tight cluster whereas squash-mount maturity counts suggest peak discharge was at petal fall. The difference in results may develop because the squash mounts measure only potential spore load whereas the Burkard measures the actural numbers of spores in the air. As the season progresses, the growth of orchard ground cover may reduce the number of discharged spores which actually become airborne.

Other highlights from our 1986 report:

- Benzimidazole resistance is widespread in eastern New York and will cause many growers to seek new fungicide programs in 1987 (Page 18).
- 1986 data from commercial orchards support the hypothesis that early-season fungicides are not very important in clean commercial orchards.

Our plans for next season include a mildewcide test similar to that reported on page 15. However, our 1987 mildew trial will probably be conducted in the Champlain Valley. Frank McNicholas, Extension Fruit Specialist in the Champlain Valley, has located a test site consisting of a single long row of Cortland apple trees which were heavily infected with powdery mildew in 1986. We also hope to test fungicides for control of black knot on plum. Very few fungicides are currently registered on plums, and some of the old standards such as dichlone and zineb are no longer available.

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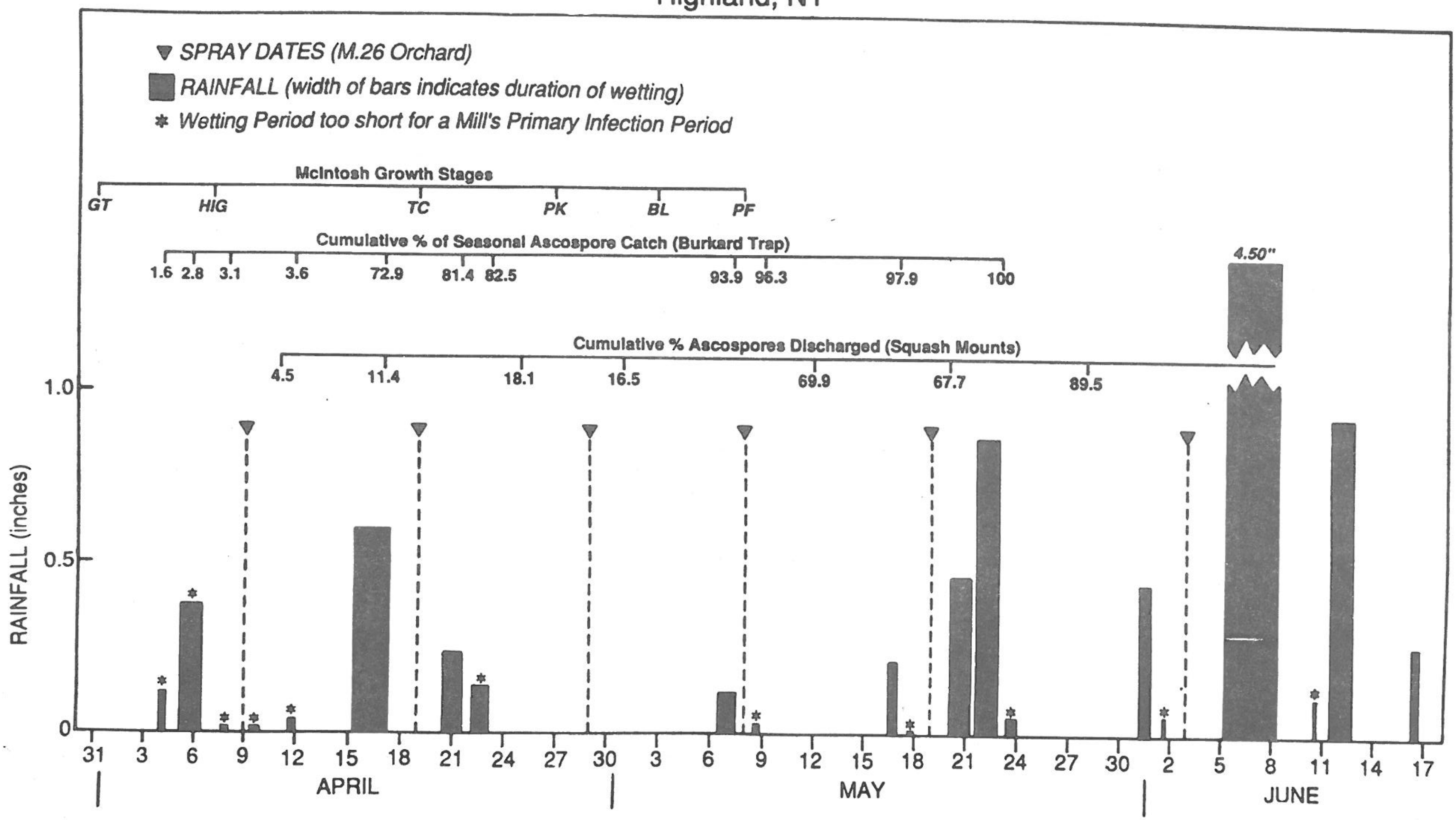
1986 SPRAY DATES & APPLE SCAB INFECTION PERIODS
Highland, NY



1986 SPRAY DATES, INFECTION PERIODS AND SCAB SPORE DISCHARGE DATA

Hudson Valley Laboratory, Highland, NY

Spray Block	Spray Date	McIntosh growth stage	Wetting period: Start Date	Wetting period: Start Time	Wetting period: Duration (hours)	Wetting period: Avg. temp.	Wetting period: Rainfall (inches)	Cum.% [y] scab spores discharged	% of total[z] season's spore catch	Mill's scab infection per. 1°	Mill's scab infection per. 2°	Cedar apple rust infection periods
		GT (3/31)	4/ 4	1100	7	48	0.12		1.6	-		-
			4/ 5	1700	37	38	0.31		1.2	-		-
		HIG (4/ 7)	4/ 8	0230	9	46	0.02		0.3	-		-
M.26	4/ 9		4/ 9	2100	12	39	0.02		0	-		-
			4/12	0200	8	37	0.03	4.5 (4/11)	0.5	-		-
			4/15	1900	42	46	0.60		69.3	H		S
								11.4 (4/17)				
M.26	4/19	TC (4/19)										
			4/21	0130	30.5	49	0.23		8.5	H		S
			4/22	1800	26	35	0.14		1.1	-		-
								18.1 (4/25)				
Pond	4/26	PINK (4/27)										
M.26	4/29											
								18.1 (5/1)				
		BLOOM (5/ 3)										
Pond	5/ 5											
			5/ 6	2200	16	59	0.12		11.4	M		S
M.26	5/8	PETAL FALL (5/8)	5/ 8	1600	7	51	0.03		2.4	-		-
								69.9 (5/12)				
Pond	5/13											
			5/16	2345	10	62	0.21		1.6	L	M	S
			5/18	0215	6	56	Tr.		0.1	-	-	L
M.26	5/19											
			5/20	1300	25	65	0.46	67.7 (5/20)	0	H	H	S
			5/22	0730	26.5	61	.88		1.9	H	H	S
Pond	5/23											
			5/24	0100	10	56	0.05		0	-	M	S
								89.5 (5/28)				
Pond	5/30											
			5/31	1700	16	66	0.88		0	H	H	S
			6/ 2	0600	4	52	0.06		0	-	-	-
M.26	6/ 3											
Pond	6/ 5		6/ 5	1500	75	65	4.50		0	H	H	S
			END OF PRIMARY SCAB SEASON									
Pond	6/10											
			6/11	0600	4	66	0.16			-	-	-
			6/12	0230	32	57	0.94			-	H	S

[y] Cum. % scab spores discharged was determined from squash mounts of perithecia on dates indicated.

[z] % Total season's spore catch was determined using the mean number of scab ascospores per infection period caught on two Burkhard spore traps at different locations in the orchard.

1986 SPRAY DATES, INFECTION PERIODS, ETC.(Continued)

Spray Block	Spray Date	Wetting period: Start Date	Start Time	Duration (hours)	Avg. temp.	Rainfall (inches)	Mill's scab infection per. 1°	2°
M.26	6/14							
		6/16	2200	6	67	0.26	-	L
		6/19	1900	12	61	0.08	-	M
Pond	6/20							
		6/24	1000	3	65	0.10	-	-
		6/27	2200	10	69	0.08	-	M
M.26	6/30							
		7/ 1	2200	17	62	1.26	-	H
		7/ 2	2000	13	58	Tr.	-	M
Pond	7/ 3							
		7/ 9	0300	6	69	0.2	-	L
		7/11	2330	56	62	1.48	-	H
		7/14	1300	2	74	0.08	-	-
M.26	7/16							
Pond	7/17							
		7/26	1130	21.5	72	0.94	-	H
		7/28	1345	2.5	76	0.25	-	-
		7/28	2230	9	71	Tr.	-	M
		7/29	1515	48	66	1.37	-	H
M.26 & Pond	7/30							
		8/ 1	2030	36	67	1.19	-	H
		8/ 6	0930	8	74	0.10	-	M
		8/10	2200	12	71	0.12	-	H
		8/16	0030			0.04		
		8/17	1815	18.5	70	0.15	-	H
		8/18	2215	5	70	0.01	-	-

1986 MAXIMUM AND MINIMUM TEMPERATURES AND PRECIPITATION
Hudson Valley Laboratory, Highland, NY

All readings were taken at 0800 EST on the dates indicated

	April			May			June			July			August			September		
Date	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip
1	68	36		71	43		86	62	0.44	79	47		68	61		78	48	
2	74	46	0.01	71	43		89	51	0.06	81	61	0.66	79	59	0.10	77	55	0.01
3	63	39		53	33		62	39		67	54	0.60	77	65	1.09	76	59	
4	62	37		51	31		68	45		76	46		82	58		73	59	0.03
5	52	36	0.12	60	45		79	58		76	60		81	57		66	59	
6	57	34	0.19	86	53		76	60	2.28	89	69		82	64		70	60	0.06
7	43	35	0.12	85	54	0.09	62	60	2.07	92	66		78	66	0.10	79	49	
8	62	43	0.02	83	48	0.03	66	59	0.07	96	56		80	68		65	44	
9	68	37		66	40	0.03	84	53	0.32	90	67		86	64		70	39	
10	53	35	0.02	65	34		75	45		84	55		85	60		75	45	
11	46	31		72	38		80	64	0.10	80	54		82	69	0.12	77	60	
12	48	33	0.03	73	38		86	60	0.38	76	61	0.59	82	54		84	68	
13	49	24		69	49		60	52	0.62	63	60	0.36	73	50		84	52	0.08
14	60	30		75	38		75	55		75	60	0.54	79	52		80	46	
15	66	36		74	47		80	54		79	58	0.08	81	56		67	39	
16	67	43	0.24	62	54		85	63		83	56		81	67	0.04	70	46	0.02
17	52	43	0.36	71	58	0.21	83	52	0.26	81	60		82	69		62	35	0.01
18	59	47		81	53		73	44		82	69		83	67	0.10	68	39	
19	67	34		88	60		72	48		88	71		81	68	0.06	70	53	
20	69	41		89	58		77	58	0.08	85	64		79	65		74	50	
21	68	47	0.01	72	63	0.18	74	51		78	69		81	64		72	57	0.03
22	58	39	0.22	70	59	0.71	78	50		84	61		71	58	0.15	70	51	
23	56	33	0.11	73	53	0.45	81	62		83	60		77	65		64	56	0.07
24	48	32	0.03	75	50	0.05	86	57		88	57		79	56	0.39	72	61	0.04
25	68	49	0.10	71	53		81	48	0.10	87	68		71	50		79	54	
26	72	52		77	53		71	45		86	70		78	52		74	58	0.07
27	68	55		78	52		80	53		84	69	0.94	80	65	0.17	80	54	0.10
28	73	47		86	58		86	64	0.08	82	69		82	55		61	54	
29	80	49		86	51		86	64		80	69	0.25	64	49	0.01	65	58	
30	80	47	0.01	88	61		85	55		85	66	0.78	67	41		76	66	
31				92	61					73	61	0.59	75	45				

1986 APPLE FUNGICIDE TRIAL: EARLY-SEASON SPRAYS ON A 10-DAY SCHEDULE
M.26 Orchard, Hudson Valley Laboratory, Highland, NY

Fungicides were evaluated using trees of five cultivars propagated on M.26 rootstock and planted in 1978. Treatments were replicated three times in plots containing one tree of each cultivar except that Paulared was present in only two replicates. Fungicides were sprayed to runoff (ca 2805 liters/ha or 400 gal/A) using a handgun at approximately 2758 kPa (400 psi). Our objective was to apply sprays on a regular 10-day schedule during the primary scab season except for two Nustar treatments applied on a 14-day schedule. The 10-day schedule spray dates and corresponding McIntosh growth stages were 9 Apr (half-inch green), 19 Apr (tight cluster), 29 Apr (pink); 8 May (petal fall), 19 May (first cover); 3, 14, 30 Jun; 16, 30 July. Treatment dates for the 14-day schedule were 9, 26 Apr; 8, 22 May; and the same as the 10-day schedule from 3 Jun to 30 Jul. A heavy shower started before the 14-day Nustar applications were completed on 26 Apr, so the treatments were reapplied again later on the same day. Rain began 10 minutes after the the 14-day Nustar treatments completed on 22 May, but trees were not resprayed. A total of eight (six heavy) Mill's apple scab infection periods were recorded during the primary apple scab season, but the first did not occur until nearly tight cluster. An additional 15 secondary scab infection periods occurred between 11 Jun and 18 Aug. Cedar apple rust galls were suspended on poles at a height of one meter above the Golden Delicious tree in each plot on 24 Apr, 5 and 20 May, and some rust galls were present in cedar trees planted between plots. Powdery mildew inoculum was introduced to the block on 28 and 30 Apr, 6-7 and 14-16 May by placing heavily-mildewed potted Rome trees from the greenhouse beneath each Cortland. Data on foliar diseases were collected from all leaves on 20 terminals per tree except that only the youngest 10 leaves were used in the second mildew evaluation. Scab data were collected from McIntosh and Cortland on 18-20 Jun and again on 18-19 Aug. Mildew assessments on Cortland and Paulared were made 19-20 Jun and again 1 Aug. Romes were evaluated for cedar apple rust on 29 Jul. Scab and mildew data from two cultivars were combined in a split-plot analysis. Fruit data were collected from 50-100 Cortland, 100 Romes, and 100 Golden Delicious fruit per tree on 26 Aug, 9 and 25 Sep, respectively. Fruit finish on the latter cultivar was rated on a scale of 1-5 where 1 = very smooth finish, 2 = some enlarged lenticels, 3 = slight russetting between lenticels, 4= moderate russetting, and 5 = severe russetting. The percentage of Golden Delicious fruit with russet (those rated 3, 4, or 5) was also noted for each treatment.

Foliar diseases failed to develop on cluster leaves because of the dry prebloom weather and because of the low level of overwintering apple scab in the block. Incidence of foliar scab on terminal leaves in June was less than 0.5% in all plots except the controls which had means of 27% and 23% infected leaves on McIntosh and Cortland, respectively. Fruit scab was found on 52%, 67%, and 29% of Cortland, Rome, and Golden Delicious fruit, respectively, in the control plots. (McIntosh trees were too small to have many fruit). Incidence of fruit scab was less than 1% in all fungicide treatments and did not differ significantly between fungicides. Excellent season-long mildew control was achieved with Systhane on a full-season program. Late-season mildew control was better with Dikar than with Manzate following early-season Rubigan sprays. Benlate/Manzate provided better late-season mildew control than Topsin/Polyram and the differences could not be attributed to proximity of the respective plots to other effective mildewcide treatments.

Most differences in the incidence of cedar apple rust and some differences in late-season mildew were attributable to the timing of the change from sterol-inhibitor (SI) fungicides to the summer contact fungicide program. Rust infections resulting from a severe infection period on 31 May developed unchecked in plots which received their last SI spray on May 19 whereas those infections were eradicated in plots receiving SI sprays on 3 Jun. Scab might also have developed in plots receiving their last SI spray on 19 May if scab inoculum had been more abundant in the test orchard. The rust infections which occurred during our change-over from SI fungicides to summer protectant programs illustrates a potential problem growers will face when they begin using SI fungicides. The change-over from SI's to protectants will be least difficult if it can be delayed until after mid-June (2nd or 3rd cover sprays) when the rust and primary scab inocula are no longer present and pressure from mildew is of less concern.

Baycor & Captan gave the best fruit finish on Golden Delicious although it was not statistically better than several other treatments. Nustar treatments resulted in acceptable fruit finish except for one of the 14-day treatments. The high incidence of russetting in that Nustar treatment may be related to one of the two applications made during or just prior to rain. The table below shows results of statistical analyses of 1985 and 1986 russet ratings for Golden Delicious after results for each year were pooled for all treatments involving the same compound. Treatments which caused an unusual amount of russetting, such as one 1986 Nustar treatment and the 1985 Rubigan & Ortho X-77 treatment, have been excluded from the analysis. Although the 1986 ratings range only from 2.2 to 3.0, differences of half this magnitude would probably have a significant effect on the economic value of Golden Delicious fruit.

1985 & 1986 GOLDEN DELICIOUS FRUIT FINISH

Material and rate [oz/100 gal]	Mean russet rating † 1986	Mean russet rating † 1985
Control	3.0 d	2.4 ab
Benlate & Manzate	2.8 cd	2.8 c
Topsin M & Polyram	2.4 ab	-- --
Dithane & Bayleton	2.6 bc	2.6 bc
Baycor & Captan	2.2 a	2.3 a
Procure (3 trts in 86, 2 in 85)	2.4 a	2.7 bc
Systhane (2 trts in 86, 2 in 85)	2.6 bc	2.7 c
Rubigan (3 trts in 86, 1 in 85)	2.5 b	2.7 c
Nustar (2 trts in 86, 3 in 85)	2.4 ab	2.5 ab

† Rated on a scale of 1 (no russet) to 5 (severe russet)

SCAB EVALUATIONS: M.26 Orchard, Hudson Valley Laboratory, Highland, NY

Material and rate of formulated product per 100 liters (100 gal)	% of total term lvs infected				Grand means: both cultivars	
	McIntosh June 18	Cortland June 19	McIntosh Aug 19	Cortland Aug 18	Early season	Late season
1. Control	27.2 b	23.3 b	89.9 b	75.8 c	25.2 b	83.4 c
2. Benlate 50W 15 g (2 oz) & Manzate 200 80W 90 g (12 oz)	Tr. a	Tr. a	0.1 a	0.5 ab	Tr. a	0.2 ab
3. Topsin M 70W(FMC) 15 g (2 oz) & Polyram 80W 90 g (12 oz)	Tr. a	0. a	0.1 a	0.6 ab	Tr. a	0.3 ab
4. Dithane M-45 80W 240 g (2 lb) thru 19 May; Dithane M-45 80W 180 g (1.5 lb) 3 Jun to EOS[1] *plus Bayleton 50W 7.5 g (1 oz)19 Apr - 3 Jun	Tr. a	0. a	0.4 a	0.6 ab	Tr. a	0.5 ab
5. Baycor 50W 30 g (4 oz) & Captan 50W 120 g (1 lb) thru 19 May; Baycor 50W 15 g (2 oz) & Captan 50W 120 g (1 lb) 3 Jun to EOS	0. a	0. a	0. a	0.1 ab	0. a	Tr. ab
6. Procure 50W 15 g (2 oz) & Ortho X-77 31.2 ml (4 fl oz) thru 3 Jun[2]	0. a	0. a	0.4 a	1.9 b	0. a	1.0 b
7. Procure 50W 15 g (2 oz) & Manzate 200 80W 90 g (12 oz) thru 3 Jun[2]	0. a	0.1 a	0.2 a	0.4 ab	0. a	0.3 ab
8. Procure 50W 22.5 g (3 oz)& Manzate 200 80W 90 g (12 oz) 3 Jun[2]	0. a	Tr. a	Tr. a	0.1 ab	0. a	0.1 ab
9. Systhane 40W 15 g (2 oz) & Dithane M-45 80W 180 g (1.5 lb)	Tr. a	0. a	Tr. a	0. a	Tr. a	0. a
10. Systhane 40W 18.7 g (2.5 oz) thru 19 May; Dithane M-45 80W 180 g (1.5 lb) 3 Jun to EOS	0. a	0.1 a	0.3 a	0.6 ab	0. a	0.4 ab
11. Rubigan 1EC 7.8 ml (1 fl oz) & Manzate 200 80W 90 g (12 oz) thru 19 May; Dikar 72W 180 g (1.5 lb) 3 Jun to EOS	Tr. a	0. a	0.4 a	0.8 ab	Tr. a	0.5 ab
12. Rubigan 1EC 7.8 ml (1 fl oz) & Manzate 200 80W 180 g (1.5 lb) thru 19 May[2]	0.2 a	0. a	0.6 a	0.2 ab	0.2 a	0.4 ab
13. Rubigan 1EC 11.7 ml (1.5 fl oz) & Manzate 200 80W 90 g (12 oz) thru 19 May[2]	0. a	Tr. a	0.1 a	0.9 ab	0. a	0.4 ab
14. Nustar 20DF 3.1 g (0.41 oz) & Manzate 200 80W 90 g (12 oz) thru 19 May; DPX 965 50W 7.5 g (1 oz) & Manzate 200 80W 90 g (12 oz) 3 Jun to EOS	Tr. a	0. a	0.3 a	0.8 ab	Tr. a	0.5 ab
Extended schedule (14 days) during primary[3]:						
15. Nustar 20DF 3.1 g (0.41 oz) & Manzate 200 80W 90 g (12 oz) thru 22 May; (Same as treatment 14 from 3 Jun to EOS)	0.1 a	0. a	0.1 a	0.7 sb	0.1 a	0.4 ab
16.Nustar 20DF 4.7 g (0.63 oz) & Manzate 200 80W 90 g (12 oz) thru 22 May; (Same as treatment 14 from 3 Jun to EOS)	0. a	0. a	0.3 a	0.4 ab	0. a	0.3 ab

Means within columns followed by the same letter do not differ significantly (DMRT, P=0.05). The angular transformation was used for statistical analysis.

[1]EOS=end of season. [2]Manzate 200 80W 180g (1.5 lb) to EOS. [3]Only 4 sprays applied before June 3 as compared to 5 sprays for other treatments

MILDEW EVALUATIONS: M.26 Orchard, Hudson Valley Laboratory, Highland, NY

Material and rate of formulated product per 100 liters (100 gal)	% of total term lvs infected		% last 10 term lvs infected		Grand means: both cultivars	
	Paulared June 20	Cortland & June 19	Paulared July 31	Cortland Aug 1	Early season	Late season
1. Control	36.5 f	12.8 h	67.9 g	55.7 f	23.8 i	62.6 f
2. Benlate 50W 15 g (2 oz) & Manzate 200 80W 90 g (12 oz).....................	5.0 cde	2.3 cdefg	17.9 bcd	18.3 bcd	3.6 fgh	18.1 bc
3. Topsin M 70W(FMC) 15 g (2 oz) & Polyram 80W 90 g (12 oz)........................	7.9 e	3.4 defg	38.3 f	21.7 cde	4.3 gh	30.3 e
4. Dithane M-45 80W 240 g (2 lb) thru 19 May; Dithane M-45 80W 180 g (1.5 lb) 3 Jun to EOS[1] *plus Bayleton 50W 7.5 g (1 oz)19 Apr - 3 Jun...	1.2 abcd	0.6 abcd	26.7 bcdef	16.9 bcd	0.9 abcd	21.6 bcde
5. Baycor 50W 30 g (4 oz) & Captan 50W 120 g (1 lb) thru 19 May; Baycor 50W 15 g (2 oz) & Captan 50W 120 g (1 lb) 3 Jun to EOS...........	Tr. a	0.6 abcd	17.5 bcd	10.8 b	0.2 ab	14.5 b
6. Procure 50W 15 g (2 oz) & Ortho X-77 31.2 ml (4 fl oz) thru 3 Jun[2]........	0.3 ab	0.5 abc	14.7 b	15.3 bcd	0.7 abc	14.9 b
7. Procure 50W 15 g (2 oz) & Manzate 200 80W 90 g (12 oz) thru 3 Jun[2]........	2.1 abcde	1.2 abcde	17.9 bcd	22.4 cde	1.6 cdef	20.7 bcd
8. Procure 50W 22.5 g (3 oz)& Manzate 200 80W 90 g (12 oz) 3 Jun[2].............	0.2 ab	0.3 abc	16.6 bc	12.6 bc	0.3 abc	14.6 b
9. Systhane 40W 15 g (2 oz) & Dithane M-45 80W 180 g (1.5 lb)	Tr. a	0.1 a	4.6 a	1.3 a	Tr. a	2.7 a
10. Systhane 40W 18.7 g (2.5 oz) thru 19 May; Dithane M-45 80W 180 g (1.5 lb) 3 Jun to EOS....	1.0 abc	1.3 abcdef	36.6 ef	22.6 cde	1.4 bcdef	29.2 de
11. Rubigan 1EC 7.8 ml (1 fl oz) & Manzate 200 80W 90 g (12 oz) thru 19 May; Dikar 72W 180 g (1.5 lb) 3 Jun to EOS...........	2.2 abcde	0.2 ab	17.4 bcd	12.9 bc	1.2 bcde	14.9 b
12. Rubigan 1EC 7.8 ml (1 fl oz) & Manzate 200 80W 180 g (1.5 lb) thru 19 May[2].....	3.3 bcde	2.0 bcdefg	29.7 def	20.8 bcde	2.6 defg	24.7 cde
13. Rubigan 1EC 11.7 ml (1.5 fl oz) & Manzate 200 80W 90 g (12 oz) thru 19 May[2].......	3.1 bcde	3.6 efg	24.3 bcde	31.4 e	3.3 efgh	27.8 de
14. Nustar 20DF 3.1 g (0.41 oz) & Manzate 200 80W 90 g (12 oz) thru 19 May; DPX 965 50W 7.5 g (1 oz) & Manzate 200 80W 90 g (12 oz) 3 Jun to EOS.......	2.4 abcde	3.2 defg	27.0 cdef	24.8 de	2.8 defg	26.3 cde
<u>Extended schedule (14 days) during primary</u>[3]:						
15. Nustar 20DF 3.1 g (0.41 oz) & Manzate 200 80W 90 g (12 oz) thru 22 May; (Same as treatment 14 from 3 Jun to EOS)........	6.3 cde	4.8 fg	29.6 def	22.0 cde	5.1 gh	26.3 cde
16.Nustar 20DF 4.7 g (0.63 oz) & Manzate 200 80W 90 g (12 oz) thru 22 May; (Same as treatment 14 from 3 Jun to EOS)........	6.8 de	5.3 g	36.6 ef	17.9 bcd	6.4 h	26.6 de

Means within columns followed by the same letter do not differ significantly (DMRT, P=0.05). The angular transformation was used for statistical analysis.

[1]EOS=end of season. [2]Manzate 200 80W 180g (1.5 lb) to EOS. [3]Only 4 sprays applied before June 3 as compared to 5 sprays for other treatments

FOLIAR RUST, FRUIT DISEASE, AND FRUIT FINISH EVALUATIONS: M.26 Orchard, Hudson Valley Laboratory, Highland, NY

Material and rate of formulated product per 100 liters (100 gal)	% cedar apple rust: Rome		% fruit with scab		% Golden Del. fruit with		Golden Del. finish rating[4]
	term. lvs. July 29	fruit Sept. 9	Cortland Aug 25	Rome Sept 15	fly speck	russet (finish rated 3,4, or 5)	
1. Control	48.1 f	2.9 b	52.2 b	66.9 b	14.8 b	71.9 d	2.95 e
2. Benlate 50W 15 g (2 oz) & Manzate 200 80W 90 g (12 oz)	11.7 de	0.1 a	0. a	0.5 a	0. a	69.1 d	2.85 cde
3. Topsin M 70W(FMC) 15 g (2 oz) & Polyram 80W 90 g (12 oz)	3.2 bc	0.7 a	0. a	0.5 a	0. a	43.9 abc	2.45 ab
4. Dithane M-45 80W 240 g (2 lb) thru 19 May; Dithane M-45 80W 180 g (1.5 lb) 3 Jun to EOS[1] *plus Bayleton 50W 7.5 g (1 oz)19 Apr - 3 Jun.	Tr. a	0. a	0. a	0. a	0. a	53.1 bcd	2.63 bcd
5. Baycor 50W 30 g (4 oz) & Captan 50W 120 g (1 lb) thru 19 May; Baycor 50W 15 g (2 oz) & Captan 50W 120 g (1 lb) 3 Jun to EOS	0. a	0. a	0. a	0. a	0.2 a	28.4 a	2.25 a
6. Procure 50W 15 g (2 oz) & Ortho X-77 31.2 ml (4 fl oz) thru 3 Jun[2]	5.1 bcd	0. a	0. a	0.1 a	0. a	41.3 ab	2.43 ab
7. Procure 50W 15 g (2 oz) & Manzate 200 80W 90 g (12 oz) thru 3 Jun[2]	3.1 bc	0. a	0. a	0.2 a	0. a	33.7 ab	2.33 ab
8. Procure 50W 22.5 g (3 oz)& Manzate 200 80W 90 g (12 oz) 3 Jun[2]	1.3 ab	0. a	0. a	0.7 a	0. a	35.6 ab	2.36 ab
9. Systhane 40W 15 g (2 oz) & Dithane M-45 80W 180 g (1.5 lb)	0. a	0. a	0. a	0. a	0. a	50.2 abcd	2.57 abc
10. Systhane 40W 18.7 g (2.5 oz) thru 19 May; Dithane M-45 80W 180 g (1.5 lb) 3 Jun to EOS	8.0 cde	0. a	0. a	0. a	0. a	53.5 bcd	2.58 bc
11. Rubigan 1EC 7.8 ml (1 fl oz) & Manzate 200 80W 90 g (12 oz) thru 19 May; Dikar 72W 180 g (1.5 lb) 3 Jun to EOS	16.1 e	0.1 a	0. a	0. a	0. a	57.1 bcd	2.62 bcd
12. Rubigan 1EC 7.8 ml (1 fl oz) & Manzate 200 80W 180 g (1.5 lb) thru 19 May[2]	15.9 e	0. a	0. a	0. a	0. a	54.9 bcd	2.63 bcd
13. Rubigan 1EC 11.7 ml (1.5 fl oz) & Manzate 200 80W 90 g (12 oz) thru 19 May[2]	12.0 de	0. a	0. a	0. a	0. a	37.2 ab	2.39 ab
14. Nustar 20DF 3.1 g (0.41 oz) & Manzate 200 80W 90 g (12 oz) thru 19 May; DPX 965 50W 7.5 g (1 oz) & Manzate 200 80W 90 g (12 oz) 3 Jun to EOS	11.6 de	0. a	0. a	0.3 a	0.5 a	43.2 abc	2.42 ab
Extended schedule (14 days) during primary[3]:							
15. Nustar 20DF 3.1 g (0.41 oz) & Manzate 200 80W 90 g (12 oz) thru 22 May; (Same as treatment 14 from 3 Jun to EOS)	12.9 de	0. a	0.2 a	0.5 a	0. a	65.0 cd	2.91 de
16.Nustar 20DF 4.7 g (0.63 oz) & Manzate 200 80W 90 g (12 oz) thru 22 May; (Same as treatment 14 from 3 Jun to EOS)	14.0 e	0. a	0.3 a	0. a	0. a	41.8 abc	2.41 ab

Means within columns followed by the same letter do not differ significantly (DMRT, P=0.05). The angular transformation was used for all statistical analyses except Golden Delicious fruit russet ratings. [1]EOS=end of season. [2]Manzate 200 80W 180g (1.5 lb) to EOS. [3]Only 4 sprays applied before June 3 as compared to 5 sprays for other treatments. [4]Rated on a scale of 1 (no russet) to 5 (severe russet).

APPLE SCAB CONTROL WITH PRE- AND POSTSYMPTOM ERADICANT SPRAYS

Pond Block, Hudson Valley Lab, Highland, NY

Fungicide applications in a block of 6-yr-old McIntosh trees on M.7 rootstocks were delayed either until tight cluster (TC series) or until petal fall (PF series) to allow comparisons of the eradicant capabilities of several fungicides against apple scab. Treatments started at TC were replicated 3 times on single-tree plots, and those started at PF were replicated 4 times. For the TC series, test fungicides were applied 26 Apr and 5 and 13 May, and Polyram 80W 1.8 g/l was applied 23, 30 May; 5, 10, 20 Jun; and 3, 18, 30 July. For the PF series, test fungicides were applied 13, 23, and 30 May. Polyram sprays starting 5 Jun were the same as for trees in the TC series. The same controls were used for both TC and PF series, and controls were sprayed with Polyram starting 5 Jun. Fungicides were applied by spraying to runoff (ca 2805 liters/ha or 400 gal/A) using a handgun at approximately 2758 kPa (400 psi). Apple scab infection periods occurred 15-17 and 21-22 Apr; 6-7, 17, 20-21, 22, 24, and 31 May. The first scab lesions were noted 7 May, and numerous active lesions were present on cluster leaves before the first spray in the PF series was applied. Foliar scab was evaluated on all leaves of 20 clusters or terminals and 100 fruit per tree. Leaves were considered infected even if infections appeared inactivated, but clorotic and necrotic flecks were not counted as infections. Fruit were considered infected only if obvious scab lesions were present. "Burned out" and healed scab lesions may have been present on some fruit treated with Nustar or Rubigan, but these lesions could not be clearly distinguished from plum curculio and hail damage and therefore were not counted.

One week after each of the three applications in the PF series, conidiospores counts were made using one lesion from each of 10 leaves from each plot. As they were collected, the infected leaves were placed upringht with their petioles in moist sand to minimize contact with the lesions during collection and handling. Lesions were cut from the leaves in the laboratory, were placed in a test tube with 3 ml of 0.5% Tween 20, and were vortexed for 30 seconds. Conidia were counted with a hemacytometer and results were expressed as the numbers of spores per lesion. Because 2.2 cm rain fell during the 24 hrs prior to the 23 May spore collection date, leaves collected 23 May were kept in a humidity chamber in the laboratoy for 24 hours before lesions were removed and washed. No rain occurred for 6 days prior to the 30 May collection date or 3 days prior to the 5 Jun collection. Only cluster leaves were collected on 23 and 30 May. On 5 June, we selected the healthiest-appearing lesions regardless of whether they occurred on cluster leaves or on terminal leaves.

Three weekly applications of Rubigan, Nustar, or Benlate/Manzate effectively arrested apple scab development when applied at either the pre-symptom (TC series) or post-symptom (PF series) stages of scab development. Use of Benlate/Manzate resulted in development of inactivated lesions whereas Rubigan and Nustar prevented lesion development (note the cluster leaf ratings for the TC series and the 13 Jun ratings for the PF series). Most of the terminal leaf scab and some of the fruit scab which developed in the TC series resulted from the 20-22 May infection periods when, because of bad weather, the first Polyram spray had not yet been applied and the spray interval was stretched to 10 days. Benlate/Manzate and Rubigan were significantly more effective in reducing conidiospore production after a single spray (23 May assay) than was Nustar, and this trend continued through subsequent assay dates. Benlate/Manzate provided better protection of foliage in the PF series than did Rubigan.

Eradicant programs involving Benlate/Manzate exert great selection pressure for benzimidazole-resistance because the companion fungicide (Manzate) has no eradicant capabilities. The pond block test orchard was not known to contain benomyl-resistant isolates of scab, but conidia from nine active lesions collected 10 Jul from Benlate-treated trees all grew on agar amended with MBC at 5 μg/ml. Despite the presence of benzimidazole-resistant isolates in the test orchard, the Benlate/Manzate treatments provided better control of fruit scab than Rubigan or Manzate used alone.

APPLE SCAB CONTROL WITH PRE- AND POSTSYMPTOM ERADICANT SPRAYS

Pond Block, Hudson Valley Lab, Highland, NY

Table 1. Ratings for treatments with first application at tight cluster[x]

Material and rate of formulated product per 100 liters (100 gal)	% cluster lvs infected May 30	% terminal leaves infected with scab June 13	July 17	Aug 15	% fruit with scab August 25
1. Check	10.4 b	29.7 c	47.5 c	75.9 b	50.3 c
2. Manzate 200 80W 180 g (24 oz)	14.5 b	5.1 b	5.6 b	7.1 a	5.8 b
3. Benlate 50W 22.5 g (3 oz) & Manzate 200 80W 90 g (12 oz)	10.0 b	2.4 a	1.8 a	1.6 a	0.3 a
4. Rubigan 1EC 17.6 ml (2.25 fl oz)	0.1 a	2.7 a	4.5 ab	4.5 a	0.7 a
5. Nustar 20DF 4.7 g (.63 oz)	0.7 a	2.3 a	3.1 ab	4.3 a	0.3 a

Table 2: Ratings for treatments with first application at petal fall

Material and rate of formulated product per 100 liters (100 gal)	% terminal leaves infected with scab June 13	July 17	Aug 15	Sept. 15	% fruit with scab August 25
1. Check	30.3 d	47.0 d	74.7 d	78.3 c	50.3 d
6. Manzate 200 80W 180 g (24 oz)	10.7 c	10.4 c	12.7 c	15.4 b	6.2 c
7. Benlate 50W 22.5 g (3 oz) & Manzate 200 80W 90 g (12 oz)	3.8 b	4.9 b	4.1 b	4.4 a	1.3 a
8. Rubigan 1EC 17.6 ml (2.25 fl oz)	Tr. a	0.6 a	1.0 a	2.0 a	4.6 bc
9. Nustar 20DF 4.7 g (.63 oz)	0.2 a	0.4 a	0.5 a	2.2 a	1.3 ab

Table 3: Effect of fungicides on spore production (treatments first applied at petal fall)

Material and rate of formulated product per 100 liters (100 gal)	Mean numbers of spores per lesion (X 1000) May 23[z]	May 30[z]	June 5[z]	Grand mean for 3 dates
1. Check	68.7 b	214.3 c	85.7 a	108.1 c
6. Manzate 200 80W 180 g (24 oz)	60.3 b	123.0 bc	59.7 a	76.2 bc
7. Benlate 50W 22.5 g (3 oz) & Manzate 200 80W 90 g (12 oz)	21.6 a	39.7 a	36.9 a	31.6 a
8. Rubigan 1EC 17.6 ml (2.25 fl oz)	23.6 a	74.8 ab	28.8 a	37.1 ab
9. Nustar 20DF 5 g (0.63 oz)	57.5 b	97.9 abc	59.3 a	69.3 bc

Means within columns followed by the same letter do not differ significantly (DMRT, P=0.05). The angular transformation was used for statistical analysis of data in Tables 1 and 2 and the log_{10} transformation was used for analysis of spore counts in Table 3.

[x] Treatments 2-5 were applied on April 26 (tight cluster), May 5 & 13, and all were subsequently treated with Polyram at 1.5 lb/100 gal on May 23, 30, June 5, 10, 20, and July 3, 18, 30.

[y] Treatments 6-9 were applied May 13, 23, &30, and all were subsequently treated with Polyram at 1.5 lb/100 gal June 5, 10, 20, and July 3, 18, 30. The control was also treated with Polyram starting June 5.

[z] Cluster leaves were collected May 23 immediately after a rain and were held in moist chambers for 24 hours before assaying lesions. May 30 cluster leaves were collected 6 days after the last rain. The most active cluster or terminal leaf lesions were collected 3 days after the last rain on June 5.

EXPERIMENT TO EVALUATE FUNGINEX-OIL INTERACTIONS
Delicious/MM.106 Block, Hudson Valley Laboratory, Highland, NY
(In cooperation with R. W. Weires)

This experiment was established to determine if combining Funginex with early-season applications of oil would change the effectiveness of the Funginex for scab control or oil for mite control. Treatments were applied in 100 gallons of water per acre using a small airblast sprayer. The test block contained 5-yr old Delicious apple trees on MM.106 rootstock planted in a long double row. Treatments were replicated two times on each of two different application dates. The first treatments were applied April 15 (1.5 cm green tissue) using 2% oil for the Funginex/oil treatment whereas 1.5% oil was used for the second treatment timing on April 17 (tight cluster). The first apple scab infection period of the season was a severe Mill's period of 42 hours duration which began 12 hours after the April 15 application. Another severe Mill's infection period occurred April 21. (We had hoped to apply sprays 48-72 hours after the first two major infection periods, but the sprays could not be delayed further into the season because of the potential for causing injury with the oil sprays.) All trees including the controls were sprayed with Polyram beginning April 26 (pink). Regular cover sprays of Polyram or mancozeb were applied to all plots throughout the remainder of the season. Plots consisted of 6 or 8 trees: i.e., 3 or 4 trees in each of two adjacent rows. The end trees in each plot were used as buffers. Apple scab disease pressure in this block was low because there was little over-wintering inoculum. Data were collected from 100 fruit and from all leaves on 20 clusters on each of two of trees in each plot. Mites were counted by brushing 25 leaves from each plot. Data were initially analyzed using a split-plot design with treatments split across two application dates. Because application date had no significant effect on the incidence of scab, the data from the two application dates were pooled in a randomized block design with four replicates.

Fruit disease control was similar in the two Funginex treatments, and we therefore conclude that oil had no significant effect on the activity of Funginex. Funginex has very limited protectant capabilities, and the scab in the Funginex treatments may therefore have resulted from the April 21 infection period which occurred 4 days after the last Funginex application. Funginex did not adversely effect the activity of the oil aganist mites.

Material and rate of formulated product per acre	% scab infection		Mean number per 25 leaves: June 16			
	cluster lvs June 9	fruit Oct 1	European red mites	ERM eggs	Two-spotted spider mites	TSM eggs
Control.........................	1.6 a	8.9 b	373 b	1854 b	12.5 b	18.6 a
Funginex 1 EC 40 fl oz......	1.4 a	3.9 a	370 b	1952 b	13.5 b	15.5 a
Funginex 1 EC 40 fl oz& Superior 70° oil........	0.5 a	2.3 a	21 a	68 a	1.0 a	3.0 a

Numbers within columns followed by the same letter do not differ significantly (DMRT, P=0.05). The angular transformation was used for the analyses of the cluster leaf and fruit scab infections.

1986 MILDEW FUNGICIDE TRIAL
Bartolotta Orchards, Germantown, NY
(In cooperation with M. E. C. Concklin,
Columbia County Extension Fruit Agent)

A block of mature Paulared apple trees on MM.106 rootstock was selected for this trial because more than 50% of the terminal leaves were infected with mildew when the orchard was observed in August 1985. The 1986 mildewcide treatments were sprayed to runoff (ca 2805 liters/ha or 400 gal/A) using a handgun at approximately 2758 kPa (400 psi). Treatments were replicated four times on three-tree plots. Our objective was to apply the mildewcide sprays on a regular 10-day schedule from the pink bud stage through first cover. Sprays were applied April 19 (early pink), 29 (early bloom), May 8 (petal fall), and May 19 (first cover). The grower applied his regular insecticide and apple scab fungicide program to the entire block during the time mildewcides were applied and switched the entire block to a Dikar cover spray program after our last mildewcide spray.

Primary mildew was evaluated June 3 by counting the number of clusters or terminals with primary mildew that could be found in a tree during a one-minute search. Data were collected by two observers in the center tree in each plot and one observer in each of the other two trees. Thus, means for each treatment are derived from four counts in each of 4 plots. Significant secondary mildew was not yet evident by June 25, but some mildew did develop later in the summer. Incidence of secondary mildew on the last 6 leaves of 30 terminals in each plot was determined on September 19. Treatments did not differ significantly in the amount of primary mildew observed in June, but all treatments had significantly less mildew than the control in September.

The extremely low incidences of primary and early secondary mildew in this trial were surprising considering the heavy mildew infestation in the test orchard in 1985 and the relatively mild over-wintering conditions. Mildew development in the test orchard may have been reduced by spray drift, by vapor activity of some of the sterol-inhibitor fungicides, or by poor overwintering of mildew on Paulared as compared to Cortland. Sprays were applied under calm conditions, but some spray drift from plot to plot was inevitable because the plots were in adjacent rows. Possibly the test would have been more successful if we had used Cortland treees in a single long row.

Material and rate of formulated product per 100 liter (100 gal)	Mean number of primary powdery mildew strikes counted per tree[1] on June 3	% of last 6 term. lvs. infected with mildew September 22
1. Check	2.25 a	45.0 c
2. Dikar 72W 240 g (2 lb)	2.13 a	24.1 ab
3. Benlate 50W 22.5 g (3 oz)	1.11 a	27.5 b
4. Topsin M 70W 22.5 g (3 oz)	1.88 a	23.4 ab
5. Topsin M 70W 45 g (6 oz)	0.96 a	22.8 ab
6. Bayleton 50W 3.7 g (0.5 oz)	1.11 a	14.7 ab
7. Bayleton 70W 7.5 g (1 oz)	0.44 a	25.8 b
8. Rubigan 1EC 11.7 ml (1.5 fl oz)	0.78 a	27.2 b
9. Rubigan 1EC 17.6 ml (2.25 fl oz)	0.63 a	21.5 ab
10. Systhane 40W 18.7 g (2.5 oz)	0.37 a	13.2 a

[1]Average number of strikes/tree counted by four observers in one minute.

EFFECT OF FALL INOCULUM LEVELS ON INCIDENCE OF PREBLOOM APPLE SCAB INFECTIONS, 1985-86

Plots located in Gardener, Modena, Middlehope, and Highland
(In cooperation with Dr. William MacHardy, University of New Hampshire)

Four commercial orchards and an experimental orchard were selected in October 1985 for a multi-year study to determine the effect of fall inoculum levels on the incidence of prebloom apple scab infections the following year. Lesion density, leaf litter density, and predicted ascospore dose were determined for each test orchard using the methods described by Gadoury and MacHardy (Phytopathology 76:112-118). The scab counts used to determine 1985 lesion density were made in October. During the spring of 1986 replicated plots in each test site were used to test varying delays in timing of the first fungicide spray. Manzate 200 80W 2.4 g/L was applied either 19 and 28 Apr, 28 Apr only, or in combination with Benlate 50W 0.22 g/L on 28 Apr only. Control plots received no fungicide treatment until 6-8 May. After 5 May, all the commercial plots were sprayed by the growers on a protectant schedule using the dilute equivalent of Benlate 50W 0.15 g plus Manzate 200 80W 0.9 g/L. Fungicides were sprayed to runoff (ca 2805 liters/ha or 400 gal/A) using a handgun at approximately 2758 kPa (400 psi). McIntosh buds were at half-inch green 9 Apr, tight cluster 19 Apr, pink 29 Apr, bloom 3 May and petal fall 8 May. Heavy Mill's apple scab infection periods occurred 15-17 and 21-22 Apr and a moderate Mill's period occurred 6-7 May. The first scab lesions were noted in unsprayed trees in the area on 7 May. The incidence of cluster leaf scab was evaluated 30 May by counting infections on 40 clusters per plot. All leaves on from 30 to 75 terminals per plot were evaluated for scab 13-21 Aug. Fruit infection in three of the commercial orchards was evaluated 8-9 Sep by observing 100 fruit per plot, and Delicious fruit in the experimental orchard were similarly evaluated 23 Oct.

Incidence of 1985 leaf scab and 1986 cluster leaf, terminal leaf, and fruit scab was less than 1% in all of the commercial orchard plots including the control plots where no fungicide was applied until full bloom in 1986. However, both the predicted ascospore dose and 1986 scab incidence was much higher in the experimental orchard. Comparing the results of one versus two Manzate sprays on McIntosh in the experimental orchard suggests each of the first two infection periods in 1986 contributed 4-5% cluster leaf scab. One spray of Benlate/Manzate was as good as two sprays of Manzate alone. Results of this study support the hypothesis that the model for predicted ascospore dose developed by Gadoury and MacHardy could prove useful in estimating the need for prebloom scab sprays. Fungicides like Benlate with eradicant and anti-sporulant properties will provide a margin of safety in the event that some early scab infections become established before the first spray is applied.

EFFECTS OF DELAYING EARLY SEASON SCAB SPRAYS ON INCIDENCE OF SCAB DURING 1986

Test orchards located in Gardener, Modena, Middlehope, and Highland, NY

	Orchard						
	LC	GC	BC	DR	HVL		
Orchard data							
Cultivar	McIntosh	McIntosh	McIntosh	Jonamac	Mixed cultivars		
Rootstock	Seedling	Seedling	M.7	M.7	M.2		
Approx. age	>15 yrs	>15 yrs	6 yrs	6 yrs	>15 yrs		
Number of replicates	5	4	4	4	6		
					McIntosh		Jerseymac
% leaves infected 17 Oct 85	0.22	0.22	0.05	0.28	1.5		0.43
Predicted numbers of ascospores/m^2 for 1986	180	303	45	336	1015		235
1986 Cluster leaf scab	% cluster leaves infected with apple scab						
Timing of prebloom fungicides applied					HVL McIntosh	HVL Cortland	HVL Delicious
Two sprays: Manzate 200[1] (TC & KB[2]: 19 & 28 Apr)	0.1 a	Tr. a	Tr. a	0.6 a	4.6 a	3.7 a	3.5 b
One spray: Benlate + Manzate 200[1] (KB: 28 Apr)	0.1 ab	0.1 a	0.1 a	0.5 a	3.5 a	3.8 a	0.1 a
One spray: Manzate 200[1] (KB: 28 Apr)	0.4 bc	0.7 a	0.7 a	1.4 a	10.5 b	8.1 a	2.1 b
No sprays until full bloom (5 May)	0.9 c	0.1 a	0. a	0.6 a	9.5 b	7.1 a	3.5 b
% Terminal leaf scab 14 Aug 86							
No sprays until full bloom	0.9	0.6	0.2	0.5	0.8	--	--
% Fruit scab 8 Sep 86							
No sprays until full bloom	<0.05	<0.05	0.	--	--	--	<0.05

Numbers within columns followed by the same letter do not differ significantly (DMRT, P = 0.05). The angular transformation was used for all statistical analyses.

[1] Manzate 200 80W was applied at 2.4 g/L both alone and in combination with Benlate 50W at 0.22 g/L. After 5 May, grower plots were sprayed by the respective growers using Benlate/Manzate in their normal commercial spray program. The HVL plots at the Hudson Valley Lab were sprayed 6 May with Bayleton/mancozeb and 20 May with Rubigan/mancozeb, and subsequently with a regular mancozeb program. [2]TC = tight cluster; KB = king bloom.

DETECTION OF BENZIMIDAZOLE RESISTANCE IN *VENTURIA INAEQUALIS* IN EASTERN NEW YORK DURING 1986

This work was initiated when IPM scouts noted apple scab leaf infections during early July in several orchards where Benlate/Manzate combination sprays had been used regularly since the early 1970's for control of primary scab. Conidia from lesions in these blocks were resistant to MBC when tested in the lab. Samples were subsequently collected from 48 blocks owned by 32 different growers to determine the prevalence of benzimidazole resistance in eastern New York. Leaves and/or fruit infected with scab were collected in seven counties by IPM scouts, agrichemical fieldmen, and fruit extension agents and specialists. Fifteen lesions from each block were usual'y evaluated for benzimidazole resistance. Evaluations were done by cutting lesions from the leaves with a corkborer and streaking them across divided agar plates containing acidified PDA on one side and acidified PDA amended with 5 µg/ml of MBC on the other. Plates were incubated at 20 C for 24-28 hrs, then stored at 2 C until spore germination could be evaluated under the microscope (usually within 3 days). Germinating spores sensitive to MBC had short curled germ tubes whereas spores resistant to MBC had long germ tubes similar to those observed on the unamended PDA. Many lesions produced no viable spores either because of the age of the lesions, the effect of contact fungicides on the leaf surface, or the effect of dry hot weather prior to the time lesions were collected. In some cases where no viable conidia were found on leaves, viable conidia were later obtained by collecting scabby fruit and holding them in a humidity chamber for 5-10 days before assaying the fruit lesions.

The summary of results in the table below shows that benzimidazole resistance is widespread in eastern New York. The samples we evaluated do not represent a random sampling of benzimidazole users and we do not have complete data on the history of benzimidazole usage in the sampled blocks. Thus, I can only speculate that more resistance was detected in Ulster County than in Columbia County because benzimidazoles were used more widely and more consistently in Ulster County than Columbia County. Many Ulster County growers had also begun to stretch spray intervals because they found they could still achieve excellent scab control when using Benlate/Manzate on an extended schedule. Extended spray timings used in some frozen out blocks in 1985 almost certianly speeded the process of selection for resistance.

The wide-spread incidence of benzimidazole resistant in eastern New York means any grower wishing to continue benzimidazole use in 1987 will need to maintain a tight schedule, use a good contact fungicide with the benzimidazole, and be alert for any sign of fungicide failure. In many blocks, benzimidazoles used in combination with a contact fungicide may still provide better protection against scab than protectant fungicides used alone. However, growers with documented cases of resistance will need to choose an alternative program -- either a straight contact fungicide, dodine & contact fungicide, or Rubigan. Because contact fungicides do not "burn out" infections like the benzimidazoles, contact fungicides used alone will not provide the degree of safety many benzimidazole users have come to expect. Dodine is generally not trusted because of compatibility problems many growers experienced with this compound in the past. Rubigan will be an attractive choice both because of its eradicant capabilities and its activity against powdery mildew.

	Collection sites		Numbers of blocks with lesion assays showing:			Results of individual lesions assays			
County	No. of growers	No. of blocks	All resistant	All sensitive	Mixed S & R	No. resis.	No. sens.	No. not useful*	Total lesions assayed
Ulster	11	21	13	3	5	196	45	85	326
Columbia	11	15	0	9	6	18	75	165	258
Dutchess	1	1	1	0	0	6	0	9	15
Saratoga	3	4	2	1	1	11	11	38	60
Clinton	3	5	2	2	1	13	21	40	75
Essex	2	2	1	0	1	14	9	6	29
Oswego	1	1	0	0	1	4	4	5	13
Totals	32	48	18	15	15	262	165	352	779

*These lesions produced no viable conidia

1985-86 APPLE POSTHARVEST FUNGICIDE TEST

Test of New Sterol-Inhibitor Fungicides

Empire apples were harvested September 26 and were stored in a shed at ambient temperature until the experiment was initiated October 1. Apples were punctured on a single face using 3 small nails mounted in a cork. Punctured fruit were dipped for 20 seconds into a spore suspension containing 50,000 conidia of benzimidazole-sensitive isolates of Penicillium expansum. Approximately an hour after inoculation, fruit were dipped for 30 seconds into fungicide treatment solutions. Apples were then laid out on spring cushion trays with the wounded face up, packed into wooden containers, and stored at 2.2 C for 100 days. A randomized block design was used for the experiment with four replicates of 25 apples for each treatment and blocking based on the four trees from which the apples were harvested. Mean pressure test for 25 fruit on October 3 was 14.0 pounds and mean soluble solids as determined with a refractometer was 11.9%. Fruit were evaluated for decay after 65 and 100 days of storage.

In this trial, only the high rate of Nustar and both rates of Topas and Fungaflor gave control equal to that of the Benlate standard (Table 1). The Benlate standard would have been less effective if benzimidazole-resistant isolates had been included in the inoculum. Systhane was tested at the same concentrations of active ingredient used to test Nustar. A significant rate response was observed with Systhane, and the high rate was just as effective as the low rate of Nustar. Thus, Systhane might be as effective as Nustar against blue mold if it were used at a higher rate such as 2.5 g/100 liters. BAY HWG 1608, RO-14-3169, and Procure were all ineffective at the rates we tested.

Table 1: Efficacy of new fungicides used in a postharvest drench treatment for control of blue mold (*Penicillium expansum*) in inoculated Empire apples stored at 2.2 C.

Material and rate of formulated product per 100 liters (100 gal)	% apples with blue mold decay after 65 days	100 days
Check	71.6 e	77.8 g
Benlate 50W 60 g (8 oz)	1.5 a	1.5ab
Topas 10W 90 g (12 oz)	0. a	1.0 a
Topas 10W 45 g (6 oz)	0. a	0.3 a
Fungaflor 500EC 100 ml (12.8 fl oz)	1.0 a	2.9 ab
Fungaflor 500EC 70 ml (8.96 fl oz)	2.9 a	8.0 bc
Nustar (DPX-H6573) 20DF 18.7 g (2.5 oz)	0.3 a	1.5 ab
Nustar (DPX-H6573) 20DF 9.4 g (1.25 oz)	13.0 b	22.7 d
Systhane (RH-3866) 40W 9.4 g (1.25 oz)	16.4 b	25.5 d
Systhane (RH-3866) 40W 4.7 g (.63 oz)	27.9 bc	48.0 ef
BAYHWG 1608 22.5DF 133.5 g (17.8 oz)	13.4 b	19.1 cd
BAYHWG 1608 22.5DF 66.8 g (8.9 oz)	19.6 bc	30.2 d
RO-14-3169 750EC 12.1 ml (4.27 fl oz)	24.0 bc	33.1 de
RO-14-3169 750EC 6.04 ml (2.13 fl oz)	46.0 d	58.6 f
Procure (UBI-A815) 50W 180 g (24 oz)	24.4 bc	33.9 de
Procure (UBI-A815) 50W 90 g (12 oz)	35.5 cd	51.2 f

Numbers within the columns followed by the same letter do not differ significantly (DMRT; P = 0.05). The angular transformation was used for all statistical analyses.