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OUTSIDE RESEARCH OR DEVELOPMENT GROUPS

FRUIT INSECT AND MITE CONTROL STUDIES IN EASTERN NEW YORK

1989

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MATERIALS TESTED

Agri-Mek .15EC.....Merck & Co.
Andalin 1.0 & 2.1L.....Uniroyal Chemical Co.
Asana XL .66EC.....E.I. duPont de Nemours & Co.
Carzol 90SP.....Nor-Am America, Inc.
Danitol 2.4EC.....Valent USA Corp.
DB-8518829 10SC.....Dow Chemical U.S.A.
Dimilin 25WP.....Uniroyal Chemical Co.
Dithane M-45 80WP.....Rohm and Hass Co.
EF-667 5% ECDow Chemical U.S.A.
EL-436 1.5EC.....Lilly Research Laboratories
Ethion 4M.....FMC Corp.
Guthion 35WP.....Mobay Chemical Corp.
Imidan 50WP.....ICI Americas Inc..
Kelthane 4F, 35WP.....Rohm and Haas Co.
Larvin 3.2F.....Rhône - Poulenc, Inc.
Lorsban 50WP.....Dow Chemical U.S.A.
Manzate 200DF.....E.I. duPont de Nemours & Co.
Metasystox-R 2SC.....Mobay Chemical Corp.
Mitac 1.5EC.....Nor-Am America, Inc.
Morestan 25WP.....Mobay Chemical Corp.
Omite 6EC, 30WP.....Uniroyal Chemical Co.
Orthene 75SP.....Valent USA Corp.
Safer Insecticidal Soap Concentrate.....Safer, Inc.
Savey 50DF.....E.I. duPont de Nemours & Co.
Sevin 80SP.....Rhône - Poulenc, Inc.
Sunspray 6E & 6E+, spray oils.....Sun Oil Co.

Materials Tested (cont.)

SurfelRhône - Poulenc, Inc.
Supracide 2E.....Ciba-Geigy, Inc.
Volck Supreme, spray oilValent USA Corp.
Vydate 2LE.I. duPont de Nemours & Co.

1989 MAXIMUM AND MINIMUM TEMPERATURES AND PRECIPITATION
Hudson Valley Laboratory, Highland, NY

All readings were taken at 0800 EST on the dates indicated

Date	APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER		
	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip	Max	Min	Precip
1	44	37		74	48		84	64		80	52		78	60	0.07?	80	54	
2	47	29		64	52	1.32	90	62	0.23	84	58		84	59		80	65	
3	58	42		67	45	0.34	87	56		90	56		85	62		78	46	
4	48	37	0.12	60	37		85	63		89	64		90	68		75	43	
5	66	43	0.06	71	42		82	46	0.07	80	63	0.13	94	75	0.07?	73	43	
6	62	45	0.56	58	51	2.08	78	61	0.10	68	64	0.65	94	70		72	47	
7	45	36	0.26	74	51		64	57	0.30	80	65		94	65		76	51	
8	55	39		58	38	0.01	64	59	0.56	90	66	0.32	75	47	0.49	82	53	
9	53	37		54	38		73	59	0.44	78	56		72	46		83	58	
10	47	26	0.12	67	48	0.26	65	56	0.98	86	64		75	48		88	62	
11	48	25		50	43	2.00	80	57		87	67	0.09	80	56		96	69	
12	50	28		54	44	0.02	75	54		87	54		61	58	1.84	84	61	
13	55	30		65	45		82	58	0.23	78	53		69	60	0.32	76	54	
14	52	30	0.17	65	40		61	54	0.10	78	59		78	67	0.26	83	58	
15	55	31		65	49		64	52	0.65	79	52	0.08	85	67		68	57	
16	46	40	0.58	74	52	0.30	56	52	0.62	80	56		85	69	0.01	73	56	
17	48	31	0.16	56	53	2.82	76	56	0.09	74	60	0.05	88	62		64	57	
18	74	38		78	51		81	56		74	57		83	59		69	56	
19	66	41	0.02	86	56		81	57		82	59		76	62		64	57	
20	60	32		87	52		84	60		86	63		73	65	0.10	65	58	
21	62	38		88	62	0.01	84	66	0.09	68	62	0.33	82	66		74	64	
22	69	37		82	46	0.02	80	68		70	63		88	63		72	67	
23	47	28		82	47		86	65		86	67		85	64		78	72	
24	54	30		74	53	0.61	89	63	1.67	87	60		89	55		76	38	
25	60	39		59	51	0.52	80	63	0.09	90	66		80	50		61	32	
26	65	39		81	57		84	60		93	70		72	44		64	42	
27	72	44		77	58	0.04	88	65	0.64	94	69	0.06	77	46		66	36	
28	72	35		68	42	0.11	88	67	0.01	93	68	0.14	75	58		56	34	
29	64	43		70	41		78	62	0.07	84	53	0.13	80	66		66	38	
30	55	46	0.08	78	54		72	54		80	55		74	63	0.35	76	43	
31				73	62	0.02				81	60		86	57				
Monthly Total Precip	2.13			10.48			6.94			1.98			3.51					

R A I N G A G E O U T O F O R D E R

APPLE: *Malus domestica*

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Apple aphid: *Aphis pomi* De Geer

European red mite: *Panonychus ulmi* Koch

Rosy apple aphid: *Dysaphis plantaginea* (Comstock)

A predatory coccinellid: *Stethorus punctum* LeConte

APPLE, MITE CONTROL WITH PETROLEUM OILS AND INSECTICIDAL SOAP, MILTON, NY, 1989: The objectives of this study were to: 1) evaluate the efficacy of several petroleum oil products and an insecticidal soap concentrate on overwintering European red mite (ERM) eggs in laboratory dip tests; 2) compare the efficacy of the aforementioned products applied prior to the hatch of overwintering ERM eggs in field experiments; 3) determine the efficacy and potential feasibility of the aforementioned products for use in summer sprays for the control of mite populations; and 4) evaluate the effects of such products on the leaves and fruits of trees treated throughout the season.

METHODS: A 2.7 acre block containing 'Red Delicious', 'Rome beauty', and 'Spartan' apple cultivars was selected near Milton, Ulster County, NY, after finding a large population of overwintering ERM eggs present. Laboratory tests on ERM eggs found on the 'Red Delicious' cultivar were initiated on 8 Apr, using branches collected from the block the previous day. These branches were cut into approximately 4 inch sections and all of the ERM eggs on each segment of wood were counted using a dissecting microscope. The segments were then impaled on nails which had been driven through plexiglass boards. Each plexiglass board contained 3-5 segments with 50-150 eggs per segment or 400 eggs per board. Each plexiglass board was dipped in an appropriate treatment for three seconds, swirling the board until its contents were completely coated. The treatments included 1% and 2% solutions of Sunspray 6E, Sunspray 6E plus, Volck Supreme, and Safers Insecticidal Soap Concentrate. Treatments were mixed with distilled water and distilled water was used as the check solution. The treated boards were placed in plastic crispers with watersoaked sponges to provide humidity. The crispers were kept in a rearing room at 27°C, 80% RH, and 16:8 photoperiod. Eggs were checked for hatch and when hatch appeared to be completed in the checks, all the boards were counted for hatched ERM.

The Milton block was divided into 12 tree plots (.08 acre each) for treatments applied with a Friend® airblast sprayer. Three tree plots were used for the high pressure handgun plots applied with the same sprayer. All treatments, including untreated checks in both the handgun and airblast sections, were replicated three times. Treatments were applied to plots of the 'Red Delicious' cultivar, with the other cultivars serving as windbreaks between plots. Treatments applied with the airblast consisted of Sunspray 6E and Sunspray 6E plus both applied at dilute (239 gal/acre based on tree-row-volume) and concentrate (3X or 82 gal/acre) sprays. The dilute rate used was 1 gal of formulation per 100 gal of water, while the concentrate rate used was 3 gal per 100, resulting in per acre application rates of 2.4-2.5 gal per acre, respectively, for the first three applications of 16 Apr, 2 Jun, and 10 Jul. These rates were increased in the final summer (31 Jul) application to 2.8 (dilute) and 3.4 (concentrate) gal per acre. The handgun applications included both 1 gal and 3 gal rates per 100 gal for each of the materials tested, including Sunspray 6E, Sunspray 6E plus, Volck Supreme, and Safers Insecticidal Soap Concentrate. The handgun applications resulted in the delivery of 405 gal spray per application on a per acre basis, or rates of 4.1 (1 gal dilute) and 12.2 (3 gal dilute) gal of formulated product per acre per application. Handgun applications were made dilute to runoff using 350 psi on 16 Apr, 2 Jun, and 10 Jul.

Following the 26 Apr application, branches containing the treated eggs were cut from the middle tree in each plot. These branches were cut into sections and impaled on plexiglass boards in the same manner as in the previous laboratory trial. The field-treated segments were kept in crispers in the rearing room until hatch in the untreated checks was observed to be over. Hatched ERM were then counted on each board and the numbers recorded.

Mite populations were evaluated in the field by collecting 25 leaves per tree from one 'Red Delicious' tree per plot. These leaves were brought back to the laboratory where they were brushed and all the mites and mite eggs counted. These counts were made at approximately one-two week intervals throughout the season. In addition to the mite counts, two aphid species and a predatory lady bird beetle, *Stethorus punctum* LeConte, were evaluated by examining 25 shoots per tree for live aphid colonies, or making a three minute count of all live adult beetles from one 'Red Delicious' tree per plot.

Bloom was evaluated by examining the stage of bloom on one 'Red Delicious' tree in each plot on 14 May. Leaves were rated for necrotic spotting by counting the number of spots on 10 to 25 leaves from one 'Red Delicious' tree per plot on 23 May, 20 Jul, 24 Aug. Fruit was evaluated at harvest by examining 100 apples from one 'Red Delicious' tree per plot on 7 Sep. Each fruit was rated twice, first for lenticel enlargement then for color loss or 'bleaching'. The same scale was used for each rating and ranged from 1-3, with 1 being the best (least enlarged lenticels or color loss) and 3 being the worst (most enlarged lenticels or greatest color loss) category.

RESULTS: The Sunspray 6E provided the greatest egg mortality in the laboratory dip test, followed by the Volck Supreme, and Sunspray 6E plus (table 1a). The Safers Insecticidal Soap Concentrate provided only slightly greater egg mortality than the check. The 2% solution of the Sunspray 6E plus was significantly more effective than the 1% solution. The field applications of the same materials provided significantly less control than the laboratory dip tests. The best control was obtained with the 3% solutions of each product applied with the handgun, followed by the 1% solutions applied by handgun, with the airblast applications giving the least control (table 1b). The Safers Insecticidal Soap Concentrate gave the least control among the various materials tested. During the season the airblast plots had the greatest ERM buildup, but the oil applications kept the mites from exceeding population levels which resulted in bronzing of the leaves in the check plots (table 2). Control of the two aphid species was greatest with the Insecticidal Soap applications, followed by the Sunspray 6E handgun applications (table 2). None of the treatments adversely affected the ladybird beetle predator (*Stethorus punctum*), which increased first in the checks then migrated into the remaining plots where it provided effective biological control of the mites late in the season.

No differences in bloom development were noted among any of the treatments. Necrotic lesions were most obvious where the 3% solutions were applied with the handgun, and appeared to be greatest where the Volck Supreme oil was used (table 3). This may have been due to the fact that West Coast oils (such as the Volck product) are usually more naphthenic than oils produced on the East Coast. Necrotic spotting, with leaf yellowing, followed by leaf drop, occurred in virtually all of the treatments. The yellowing occurred usually one week following the application, with the leaf drop being over approximately two weeks after the application. The exception to this was the Safers Insecticidal Soap Concentrate treatments, where the yellowing and leaf drop were one week behind the other treatments. Fruit finish ratings found that enlarged lenticels were least on the handgun check, greatest on the Safers 3 gal rate, and not much different on the rest of the treatments (table 4). Fruit color loss or 'bleaching' was greatest in the handgun treatments, especially those treated with the 3 gal rates.

Laboratory dip tests provided much greater mortality of the overwintering ERM eggs than did field applications of the same materials, while high pressure handgun treatments provided better control than the air blast treatments, leading us to conclude that the better the coverage the better the control of ERM with these products. The second obvious conclusion is that the more product used the better the control. Unfortunately, the choice for growers becomes a matter of balancing the risks of phytotoxicity, poor fruit finish, and increased costs, resulting from the use of higher per acre rates, with the advantages of greater, or longer lasting mite suppression. With respect to the individual products tested we would conclude the following: 1) Safers Insecticidal Soap Concentrate provided the least adequate ERM suppression, apparently due to its inability to control the egg stage, 2) although the Volck supreme oil provides suppression of ERM similar to that of the other materials, the risks of fruit finish or leaf injury is greatest with this material, and 3) the Sunspray 6E and 6E plus formulations provided similar levels of ERM suppression during the summer trials, but the 6E formulation gave better control of overwintering ERM eggs prebloom.

Table 1a. Overwintering European Red Mite Egg Dip Test (7 April)

Treatment	ml oil/ 3000 ml water	<i>n</i>	No. ERME* Hatched	% Hatch of ERME
1. Sunspray 6E 1%	30.0 ml	1202	0	0.0a
2. Sunspray 6E 2%	60.0 ml	1168	0	0.0a
3. Sunspray 6E+ 1%	30.0 ml	1259	90	7.1b
4. Sunspray 6E+ 2%	60.0 ml	1160	13	1.1ab
5. Volck supreme 1%	30.0 ml	1194	1	0.1a
6. Volck supreme 2%	60.0 ml	1261	10	0.8a
7. Safers Insect. Conc. 1%	30.0 ml	1303	759	58.3cd
8. Safers Insect. Conc. 2%	60.0 ml	1310	647	49.4c
9. Check	60.0 ml	1263	869	68.7d

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Percent data were transformed using the arcsine transformation. Untransformed data are presented.

* ERME = European red mite eggs.

Table 1b. Overwintering European Red Mite Egg Field Trial

Treatment	Spray /Acre (gal)	Rate form. /100 gal dilute	Rate form. /Acre	Appl. date	<i>n</i>	No. ERME* Hatched	% ERME Hatch
Air Blast							
1. Sunspray 6E	239 gal	1.0 gal	2.4 gal	26 April	741	228	30.8de
2. Sunspray 6E	82 gal	3.0 gal	2.5 gal	26 April	1008	247	24.5cd
3. Sunspray 6E+	239 gal	1.0 gal	2.4 gal	26 April	923	277	30.0cd
4. Sunspray 6E+	82 gal	3.0 gal	2.5 gal	26 April	1158	394	34.0de
5. Check					855	605	70.8f
Handgun							
6. Sunspray 6E	405 gal	1.0 gal	4.1 gal	26 April	959	229	23.9cd
7. Sunspray 6E	405 gal	3.0 gal	12.2 gal	26 April	933	67	7.2a
8. Sunspray 6E+	405 gal	1.0 gal	4.1 gal	26 April	840	99	11.8ab
9. Sunspray 6E+	405 gal	3.0 gal	12.2 gal	26 April	820	54	6.6a
10. Volck supreme	405 gal	1.0 gal	4.1 gal	26 April	864	167	19.3cd
11. Volck supreme	405 gal	3.0 gal	12.2 gal	26 April	841	69	8.2ab
12. Safers Insect. Conc.	405 gal	1.0 gal	4.1 gal	26 April	774	330	42.6e
13. Safers Insect. Conc.	405 gal	3.0 gal	12.2 gal	26 April	1044	246	23.6d
14 Check					868	619	71.1f

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Percent data were transformed using the arcsine transformation. Untransformed data are presented.

* ERME = European red mite eggs.

Table 2.

Season long mite and insect evaluations

Season-long mite and insect evaluations												
Treatment	Spray /Acre (gal)	Rate form /100 gal dilute	Rate form. /Acre	Appl. date	Mean number of mites* or eggs/leaf**				Mean no. shoots with live aphid* colonies/25			
					23 May		31 May		1 Jun		5 Jun	
					ERM	ERME	ERM	ERME	RAA	GAA	RAA	GAA
Air Blast												
1. Sunspray 6E	239	1.0 gal	2.4 gal	26 Apr	1.7def	0.9bcd	1.3ef	17.2cd	4.7bcd	11.0a	2 Jun	3.3bc 10.7b
2. Sunspray 6E	82	3.0 gal	2.5 gal	26 Apr	2.8fgh	1.2cde	1.2ef	19.6d	3.7abcd	12.0a	2 Jun	3.0ab 11.0b
3. Sunspray 6E+	239	1.0 gal	2.4 gal	26 Apr	2.8fgh	1.3de	1.5f	28.1de	1.3abc	14.0a	2 Jun	2.0ab 8.3b
4. Sunspray 6E+	82	3.0 gal	2.5 gal	26 Apr	3.3fgh	1.7e	1.2ef	18.8cd	4.0abc	13.0a	2 Jun	2.0ab 9.3b
5. Check					4.3h	5.5f	1.6f	43.4e	10.3de	15.7a		9.7cd 10.0b
Handgun												
6. Sunspray 6E	405	1.0 gal	4.1 gal	26 Apr	1.1abcde	0.5ab	0.6bcde	4.7ab	2.0abc	7.7a	2 Jun	2.7ab 1.3a
7. Sunspray 6E	405	3.0 gal	12.2 gal	26 Apr	0.3ab	0.1a	0.1a	2.5a	4.0bcde	12.3a	2 Jun	0.3ab 0.7a
8. Sunspray 6E+	405	1.0 gal	4.1 gal	26 Apr	1.5cdef	0.6abc	0.5abcd	10.5bc	5.0cde	12.0a	2 Jun	2.3abc 7.7b
9. Sunspray 6E+	405	3.0 gal	12.2 gal	26 Apr	0.5abc	0.1a	0.3ab	5.5ab	0.3ab	12.3a	2 Jun	0.3ab 2.3a
10. Volck supreme	405	1.0 gal	4.1 gal	26 Apr	0.7abcd	0.2ab	0.2ab	3.8a	3.3abc	11.0a	2 Jun	1.7ab 8.7b
11. Volck supreme	405	3.0 gal	12.2 gal	26 Apr	0.3a	0.1a	0.2ab	2.5a	0.0a	9.3a	2 Jun	0.0a 3.3a
12. Safers Insect. Conc.	405	1.0 gal	4.1 gal	26 Apr	2.0efg	1.4de	1.1def	18.5cd	1.3abc	10.0a	2 Jun	0.0a 1.0a
13. Safers Insect. Conc.	405	3.0 gal	12.2 gal	26 Apr	1.3bcde	0.7bcd	0.5abc	15.4cd	1.7abc	15.0a	2 Jun	0.3ab 2.0a
14. Check					3.6gh	5.8f	1.0cdef	22.5d	13.3e	13.3a		14.3d 8.7b

Mean number of mites* or eggs/leaf**

Treatment	12 Jun				27 Jun				9 Jul				17 Jul			
	ERM		ERME		ERM		ERME		ERM		ERME		ERM		ERME	
	ERM	ERME	ERM	ERME	ERM	ERME	ERM	ERME	ERM	ERME	ERM	ERME	ERM	ERME	ERM	ERME
Air Blast																
1. Sunspray 6E	1.4de	1.9bcd	1.1cdef	13.5de	1.1cdef	13.5de	30.4de	71.6cde	30.4de	71.6cde	10 Jul	2.1d	2.1d	14.2c		
2. Sunspray 6E	2.1ef	2.0bcd	2.2ef	10.0d	2.2ef	10.0d	23.7de	64.5cde	23.7de	64.5cde	10 Jul	1.3bcd	1.3bcd	21.0c		
3. Sunspray 6E+	4.3g	2.2cd	1.6ef	10.4d	1.6ef	10.4d	39.5e	112.7ef	39.5e	112.7ef	10 Jul	2.0cd	2.0cd	21.1c		
4. Sunspray 6E+	1.8e	2.6d	1.3def	12.6d	1.3def	12.6d	30.6de	82.8de	30.6de	82.8de	10 Jul	0.5ab	0.5ab	13.5c		
5. Check	10.4h	7.2e	7.3g	21.7ef	7.3g	21.7ef	88.4f	214.0f	88.4f	214.0f		24.7e	24.7e	82.5d		
Handgun																
6. Sunspray 6E	0.2abc	0.6ab	0.4abcd	3.4c	0.4abcd	3.4c	6.1bc	24.9b	6.1bc	24.9b	10 Jul	0.3ab	0.3ab	1.9ab		
7. Sunspray 6E	0.1a	0.4a	0.3abc	1.9b	0.3abc	1.9b	3.4ab	13.0a	3.4ab	13.0a	10 Jul	0.0a	0.0a	0.6a		
8. Sunspray 6E+	0.8bcd	0.5ab	0.8bcde	3.7c	0.8bcde	3.7c	6.7bc	23.2b	6.7bc	23.2b	10 Jul	0.6abc	0.6abc	2.4ab		
9. Sunspray 6E+	0.1a	0.3a	0.0a	1.0ab	0.0a	1.0ab	2.3a	9.2a	2.3a	9.2a	10 Jul	0.1a	0.1a	0.8a		
10. Volck supreme	0.2ab	0.7ab	0.1ab	1.6ab	0.1ab	1.6ab	3.0ab	17.9ab	3.0ab	17.9ab	10 Jul	0.2ab	0.2ab	1.3ab		
11. Volck supreme	0.1a	0.2a	0.1ab	0.6a	0.1ab	0.6a	1.9a	11.7a	1.9a	11.7a	10 Jul	0.2ab	0.2ab	1.1ab		
12. Safers Insect. Conc.	3.1fg	1.1abc	2.5f	13.4de	2.5f	13.4de	14.7cd	31.0bc	14.7cd	31.0bc	10 Jul	0.5ab	0.5ab	3.9b		
13. Safers Insect. Conc.	0.7cd	0.3a	0.8abcde	4.8c	0.8abcde	4.8c	14.2cd	40.4bcd	14.2cd	40.4bcd	10 Jul	0.0a	0.0a	0.8ab		
14. Check	13.0h	2.4cd	11.2g	23.9f	11.2g	23.9f	51.4ef	198.9f	51.4ef	198.9f		17.0e	17.0e	63.6d		

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

* ERM = European red mite, ERME = Rosy apple aphid, GAA = Green apple aphid.

** Based on 25 leaves/ tree, from one Red Delicious tree in each of three replicates/ treatment.

Table 2. cont.

Treatment	Spray /Acre (gal)	Rate form. /100 gal dilute	Rate form. /Acre	Mean number of mites* or eggs/leaf**									
				30 Jul		Appl. date***	1 Aug		7 Aug		24 Aug		
				ERM	ERME		ERM	ERME	ERM	ERME	ERM	ERME	
				S. punctum****									
Air Blast													
1. Sunspray 6E	283	1.0 gal	2.8 gal	2.2abcde	32.9e	31 Jul	6.3d	2.7a	6.2cdef	0.3a	0.7a	0.3a	0.7a
2. Sunspray 6E	112	3.0 gal	3.4 gal	3.2cde	25.0e	31 Jul	9.0d	1.6a	4.5bcdef	0.1a	1.3a	0.1a	1.3a
3. Sunspray 6E+	283	1.0 gal	2.8 gal	5.5e	7.3bcd	31 Jul	5.7cd	1.1a	2.1abcd	0.3a	1.3a	0.3a	1.3a
4. Sunspray 6E+	112	3.0 gal	3.4 gal	3.4de	9.8cde	31 Jul	2.3bcd	1.6a	10.4fg	0.3a	1.1a	0.3a	1.1a
5. Check				6.6e	12.5de		20.3e	1.4a	17.3g	0.2a	5.0b	0.2a	5.0b
Handgun													
6. Sunspray 6E				0.6abcd	2.4ab		0.0a	2.5a	5.8bcdef	0.4a	0.3a	0.4a	0.3a
7. Sunspray 6E				0.2a	1.3ab		0.0a	0.9a	2.8abcde	0.7a	1.0a	0.7a	1.0a
8. Sunspray 6E+				0.3a	1.3ab		0.0a	1.4a	2.3abcde	0.3a	0.5a	0.3a	0.5a
9. Sunspray 6E+				0.6abcd	4.7abc		0.0a	0.4a	1.5ab	0.5a	0.9a	0.5a	0.9a
10. Volck supreme				0.3ab	4.4abcd		0.3a	1.0a	2.1abc	0.2a	1.1a	0.2a	1.1a
11. Volck supreme				0.1a	1.2a		0.0a	0.4a	0.6a	0.5a	0.5a	0.5a	0.5a
12. Safers Insect. Conc.				0.3a	2.7abc		1.3abc	2.2a	7.5defg	0.2a	1.4a	0.2a	1.4a
13. Safers Insect. Conc.				0.5abc	2.0ab		0.7ab	2.9a	5.0bcdef	0.3a	0.4a	0.3a	0.4a
14 Check				2.8bcde	9.2abcd		33.7e	2.3a	9.0efg	0.1a	2.0a	0.1a	2.0a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

* ERM = European red mite, ERME = ERM eggs.

** Based on 25 leaves/ tree, from one Red Delicious tree in each of three replicates/ treatment.

*** July 31 application was only applied to the air blast portion of the study.

**** Based on one three minutes samples for adult *Stethorus punctum* from one Red Delicious tree in each of three replicates/treatment.

Table 3.

Oil Test Leaf Injury Evaluation and Bloom Ratings

Treatment	Rate form. /100 gal dilute	Appl. date		Appl. date		Bloom Rating** 14 May	Mean No. necrotic lesions/leaf***		
		16 Apr, 2 Jun, 10 Jul Gal spray/A	Gal form./A	31 Jul.* Gal spray/A	Gal form./A		23 May	20 July	24 Aug
Air Blast									
1. Sunspray 6E	1.0 gal	239 gal	2.4 gal	283 gal	2.8 gal	3.0a	2.07a	1.33a	0.13ab
2. Sunspray 6E	3.0 gal	82 gal	2.5 gal	112 gal	3.4 gal	2.7a	3.73a	0.53a	0.13ab
3. Sunspray 6E+	1.0 gal	239 gal	2.4 gal	283 gal	2.8 gal	3.0a	0.97a	0.83a	0.48ab
4. Sunspray 6E+	3.0 gal	82 gal	2.5 gal	112 gal	3.4 gal	3.0a	1.73a	1.60a	0.16ab
5. Check						3.0a	1.93a	1.77a	0.07a
Handgun									
6. Sunspray 6E	1.0 gal	405 gal	4.1 gal			3.0a	3.13a	0.43a	0.16ab
7. Sunspray 6E	3.0 gal	405 gal	12.2 gal			3.0a	3.83a	15.23bc	1.70d
8. Sunspray 6E+	1.0 gal	405 gal	4.1 gal			3.0a	1.10a	0.90a	0.35ab
9. Sunspray 6E+	3.0 gal	405 gal	12.2 gal			3.0a	3.77a	13.93b	2.28d
10. Volck supreme	1.0 gal	405 gal	4.1 gal			3.0a	1.93a	0.93a	1.01cd
11. Volck supreme	3.0 gal	405 gal	12.2 gal			3.0a	1.10a	29.87c	7.84e
12. Safers Insect. Conc.	1.0 gal	405 gal	4.1 gal			3.0a	2.23a	0.70a	0.27ab
13. Safers Insect. Conc.	3.0 gal	405 gal	12.2 gal			3.0a	1.90a	19.97bc	0.71bc
14. Check						3.0a	1.93a	1.90a	0.17ab

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed using a $\log_{10}(X)$ transformation.

* July 31 application was only applied in air blast portion of study.

** Bloom data based on scale of 0-3 with; 0 = pink, 1 = full pink, 2 = bloom, 3 = full bloom, from a visual rating of one Red Delicious tree in each of three replicates/treatment.

*** Based on the number of necrotic lesions from 10 spur (23May), 10 shoot (20 July) and 25 spur (24 Aug) leaves per tree, from one Red Delicious tree in each of three replicates/treatment.

Table 4.

Fruit Finish Ratings (7 Sep)

Treatment	Rate form./ 100 gal dilute	Appl. date		Appl. date		7 Sep	
		26 Apr, 2 Jun, 10 Jul		31 Jul*		Enl. Lenticels**	7 Sep Color Loss***
		Gal spray/A	Gal form/A	Gal spray/A	Gal form./A		
Air Blast							
1. Sunspray 6E	1.0 gal	239 gal	2.4 gal	283 gal	2.8 gal	1.9a	1.5ab
2. Sunspray 6E	3.0 gal	82 gal	2.5 gal	112 gal	3.4 gal	1.8a	1.7abcd
3. Sunspray 6E+	1.0 gal	239 gal	2.4 gal	283 gal	2.8 gal	1.8a	1.5ab
4. Sunspray 6E+	3.0 gal	82 gal	2.5 gal	112 gal	3.4 gal	1.9a	1.6abc
5. Check						1.8a	1.4ab
Handgun							
6. Sunspray 6E	1.0 gal	405 gal	4.1 gal			1.9a	1.8bcd
7. Sunspray 6E	3.0 gal	405 gal	12.2 gal			1.8a	2.1d
8. Sunspray 6E+	1.0 gal	405 gal	4.1 gal			1.9a	1.9cd
9. Sunspray 6E+	3.0 gal	405 gal	12.2 gal			1.8a	2.1d
10. Volck supreme	1.0 gal	405 gal	4.1 gal			1.7a	1.7bcd
11. Volck supreme	3.0 gal	405 gal	12.2 gal			1.7a	2.7e
12. Safers Insect. Conc.	1.0 gal	405 gal	4.1 gal			1.8a	1.7abcd
13. Safers Insect. Conc.	3.0 gal	405 gal	12.2 gal			2.3a	2.1d
14. Check						1.6a	1.2a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD).

* July 31 application was only applied in air blast portion of study.

** Enlarged lenticel rating is based on a scale ranging from 1-3 with 1 being an apple with few small, smooth lenticels and 3 being an apple with many large, raised white lenticels. An average of these numbers from one hundred fruits from each of three replicates/treatment is reported.

*** Color loss ratings is based on a scale ranging from 1 - 3 with 1 being a deep red color and 3 being a bleached, hazy red color. An average of these numbers from one hundred fruits from each of three replicates/treatment is reported.

APPLE: *Malus domestica*

R. W. Weires & D. Scott Lawson
Hudson Valley Laboratory
N.Y.S. Agric. Exp. Station
Highland, New York, 12528

Apple aphid: *Aphis pomi* De Geer

Apple maggot: *Rhagoletis pomonella* (Walsh)

Codling moth: *Laspeyresia pomonella* (L.)

European apple sawfly: *Hoplocampa testudinea* (Klug)

Green fruitworm: *Lithophane antennata* (Walker)

Plum curculio: *Conotrachelus nenuphar* (Herbst)

Rosy apple aphid: *Dysaphis plantaginea* (Passerini)

San Jose scale: *Quadraspidiotus perniciosus* (Comstock)

Spirea aphid: *Aphis citricola* Van der Goot

Spotted tentiform leafminer: *Phyllonorycter blancardella* (Fabr.)

Tarnished plant bug: *Lygus lineolaris* (P. de B.)

Variegated leafroller: *Platynota flavedana* Clemens

White apple leafhopper: *Typhlocyba pomaria* McAtee

APPLE, INSECT CONTROL, HUDSON VALLEY LAB, HIGHLAND, NY, 1989:

Treatments were applied to eight tree plots replicated three times in a randomized complete block design. All treatments were applied dilute to runoff using a high-pressure handgun sprayer at 400 psi delivering from 2.7 to 4.2 gal spray/tree or 262 to 407 gal/acre, depending upon foliage present and weather conditions. Trees were 25 years-old, 10 ft high, spaced 15 by 30 ft, and on the EMII rootstock. The EXP-60145A treatments were all tested in a seasonal program with sprays applied at pink, 4 May, petal fall, 22 May, and in cover sprays on 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, and 24 Aug. DB-8518829 was applied 4 May, 22 Jun, and 8 Aug, while Imidan was applied at 24.0 oz/100 gal on 22 May and 7 Jun, and 16.0 oz/100 gal on 7 Jul, 24 Jul, and 24 Aug. Danitol was applied 4 May, 22 May, 7 Jul, and 8 Aug, with Guthion applied in the remaining cover sprays. Orthene was applied 4 May and 7 Jun with Guthion applied in the remaining sprays. Additional treatments included: Morestan applied 4 May along with Guthion and followed by Guthion in all succeeding sprays; Andalin 2.1 L applied at the 4 and 8 oz/100 gal rates on 22 June with Guthion in all other sprays starting at 22 May; Andalin 1L at 8 oz on 22 Jun followed by Andalin 2L 8 oz/100 gal on 24 Jul, with Guthion in other cover sprays; and Safer Insecticidal Concentrate plus Sunspray oil 6E+ applied 22 May, 7 Jun, and 7 Jul. Applications over the entire block primarily for disease control included: Agway Spray oil 6E 1 gal/100 plus Supracide 2E 1 qt/100 gal plus Difolatan 80S 5 lb/100 gal, 11 Apr; Rubigan 1EC 3.0 oz/acre plus Dithane M45 80W 1.5 lb/acre, 4 May and 14 May; Rubigan 1EC 9 oz/acre plus Dithane M45 80W 6 lb/acre, 24 May and 1 Jun; Nova 60W 2 oz/acre, 8 Jun; Polyram 80DF 4 lb/acre, 23 Jun; Manzate 200 80DF 4 lb/acre, 15 Jul; and Benlate 50W 6 oz/acre plus Captan 50W 6 lb/acre, 17 Aug. Naphthaleneacetic acid (Klingtite® formulation) was applied in thinning sprays on 25 May using from 42 to 96 ml/100 gal, depending upon the cultivar and apparent fruit set. European apple sawfly and plum curculio were evaluated prior to "Jun drop" by examining all of the fruits in 50 fruiting clusters on one "Northwest Greening" tree/plot on 5 Jun. Apple aphid and/or spirea aphids were evaluated by examining 25 terminals for the presence of live aphid colonies on one "McIntosh" tree/plot on 2 Jun and 10 Jun. Rosy apple aphids were evaluated in a similar manner on 2 Jun using "Cortland" as the cultivar. Spotted tentiform leafminer was evaluated 19 Jun by counting the number of mines on 25 "McIntosh" leaves/plot. White apple leafhopper was evaluated by counting the number of nymphs on 25 "Empire" leaves/plot on 14 Jun. Insect damage to the fruit was assessed at harvest by examining 100 fruits/cultivar/plot from "Jersey Mac", 4 Aug; "McIntosh", 18 Sep; and "Golden Delicious", 26 Sep. "Golden Delicious" fruit finish was evaluated using a russet rating from 1 (best finish) to 3 (worst finish). Temperatures were generally cooler than normal due to the continually overcast conditions found during much of the summer. An extended bloom period resulted in greater than normal insect pressure especially from European apple sawfly and plum curculio. Rainfall was above normal during May, Jun and Aug.

Danitol provided excellent control of the white apple leafhopper and spotted tentiform leafminer. The EXP-60145A material also provided excellent leafhopper and leafminer control on a rate basis, i.e. the highest rate providing the best control. The danitol and EXP-60145A treatments gave the best overall control of insects damaging the fruit, most notably plum curculio and European apple sawfly, but both materials appeared to be weak against San Jose scale. The EXP-60145A treatments also had more apple maggot injury than did the others. The Safer Insecticidal Soap Concentrate plus Sunspray oil combination was discontinued when severe injury to the fruit and foliage were noted. This injury apparently resulted when the thinning spray of Klingtite® was applied on 25 May following the 22 May Soap and oil application.

Treatment	Rate form. /100 gal.	Application dates	Mean no. infested terminals/ 25			Mean no. infested fruit clusters/ 50			Mean no. nymphs or mines/ 25 leaves			
			Apple aphid/ spirea aphid		Rosy apple aphid 2 Jun	E. apple sawfly 5 Jun	Plum curculio 5 Jun	White apple leafhopper 14 Jun	Spotted tentiform leafminer 19 Jun			
			2 Jun	10 Jul								
			McIntosh	Cortland	Greening	Greening	Empire	McIntosh				
1. DB-8518829 10SC Imidan 50W24.0 oz Imidan 50W16.0 oz	1.2 oz 22 May, 7 Jun 7 Jul, 24 Jul, 24 Aug	4 May, 22 Jun, 8 Aug	9.3abc	6.0a	1.3a	3.3bcd	7.7a	10.0de	8.7cd			
2. Danitol 2.4EC 5.3 oz Guthion 35W8.6 oz	4 May, 22 May, 7 Jul, 8 Aug 7 Jun, 24 Jul, 24 Aug		7.3a	0.0a	0.7a	1.7abc	8.3a	0.3a	0.0a			
3. Orthene 75SP5.3 oz Guthion 35W8.6 oz	4 May, 7 Jun 22 May, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug		20.7d	7.7a	0.0a	4.7cd	7.7a	2.0ab	6.7bcd			
4. Morestan 25W Guthion 35W	8.0 oz 8.6 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	10.0abc	5.0a	0.7a	9.0de	3.7a	21.3e	7.3cd			
5. EXP-60145A	1.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	10.0abc	12.0a	0.7a	1.0ab	4.7a	4.0bc	3.3bcd			
6. EXP-60145A	2.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	12.0abcd	7.0a	0.0a	0.3a	2.3a	1.7ab	2.0ab			
7. EXP-60145A	4.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	11.0abc	5.7a	0.0a	0.0a	3.3a	0.3a	0.0a			
8. Andalin 2.1L Guthion 35W	4.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	15.3cd	6.7a	1.3a	6.0cd	16.7a	17.3e	3.3abc			
9. Andalin 2.1L Guthion 35W	8.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	14.7cd	5.3a	1.7a	7.0cd	14.7a	14.3e	7.3cd			
10. Andalin 1.0L Andalin 2.1L Guthion 35W	8.0 oz 8.0 oz 8.6 oz	22 Jun, 8 Aug 24 Jul	12.3abcd	6.3a	1.0a	4.7bcd	8.3a	10.7de	5.3bcd			
11. Safer Insecticide conc. + SunSpray oil 6E+	128.0 oz 128.0 oz	22 May, 7 Jun, 7 Jul 22 May, 7 Jun, 7 Jul	7.7ab	6.3a	0.7a	17.3ef	31.7a	3.7bcd	3.7abcd			
12. Check			13.0bcd	13.3a	1.0a	27.3f	20.3a	7.3cde	10.3d			

Treatment means followed by the same letter are not significantly different (p< 0.05; LSD). Data were transformed to log₁₀(X + 1) for analysis. Untransformed data are presented.

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis. Untransformed data are presented.

% Injured Fruit (Jersey Macs) 4 Aug.

Treatment	Rate form. /100 gal.	Application dates	Tarnished plant bug	Plum curculio	European apple sawfly	Green fruit worm	Codling moth	San Jose scale	Variegated leafroller	Apple maggot punct.	Apple tunnel	% Clean fruit
1. DB-8518829 10SC Imidan 50W Imidan 50W	1.2 oz 24.0 oz 16.0 oz	4 May, 22 Jun, 8 Aug 22 May, 7 Jun 7 Jul, 24 Jul, 24 Aug	.....6.7cd	31.7bcd	18.3de	1.3a	0.7a	0.0a	0.0a	0.0a	0.0a	47.0abcd
2. Danitol 2.4EC Guthion 35W	5.3 oz 8.6 oz	4 May, 22 May, 7 Jul, 8 Aug 7 Jun, 22 Jun, 24 Jul, 24 Aug	.....2.7abc	23.3abcd	8.0abc	1.0a	0.0a	0.3a	0.0a	0.3a	0.0a	68.3cde
3. Orthene 75SP Guthion 35W	5.3 oz 8.6 oz	4 May, 7 Jun 22 May, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....3.3bc	21.3abc	13.7bcde	1.0a	0.3a	0.0a	0.0a	1.0a	1.0a	61.3cde
4. Morestan 25W Guthion 35W	8.0 oz 8.6 oz	4 May 4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....5.0bcd	24.3abcd	13.3bcde	0.7a	0.7a	0.0a	0.0a	0.0a	0.0a	59.3cde
5. EXP-60145A	1.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....5.7cd	11.0ab	10.3abcd	1.0a	0.0a	0.0a	0.3a	0.3a	0.3a	73.0de
6. EXP-60145A	2.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....5.0bcd	13.7ab	6.7ab	0.0a	0.0a	0.0a	0.0a	0.7a	0.3a	75.3e
7. EXP-601A	4.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....9.0d	8.3a	6.3a	0.7a	0.0a	0.0a	0.0a	1.0a	0.7a	76.0e
8. Andalin 2.1L Guthion 35W	4.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	.....2.0ab	23.7abcd	18.7e	0.0a	0.0a	0.3a	0.0a	0.0a	0.0a	59.3cde
9. Andalin 2.1L Guthion 35W	8.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	.....5.3cd	31.7bcd	16.0de	1.3a	0.0a	0.0a	0.0a	0.0a	0.0a	51.7bcde
10. Andalin 1.0L Andalin 2.1L Guthion 35W	8.0 oz 8.0 oz 8.6 oz	22 Jun, 8 Aug 24 Jul 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	.....6.3cd	40.3cd	14.7cde	0.7a	0.3a	0.0a	0.3a	0.0a	0.0a	46.0abc
11. Safer Insect. Conc. + SunSpray Oil 6E+	128.0 oz 128.0 oz	22 May, 7 Jun, 7 Jul 22 May, 7 Jun, 7 Jul	.....0.7a	52.0d	19.0e	2.0a	10.0b	0.0a	5.3b	1.0a	1.0a	33.3ab
12. Check			.....3.0abc	42.7cd	38.7f	2.7a	12.7b	0.3a	3.0b	2.7a	2.3a	25.3a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD).
Data were transformed using the arcsine transformation for analysis. Untransformed data are presented.

% Injured Fruit (McIntosh) 18 Sept.

Treatment	Rate form. /100 gal.	Application dates	Tarnished plant bug	Plum curculio	European apple sawfly	Green fruit worm	Codling moth	San Jose scale	Variegated leafroller	Apple maggot punct.	Apple Clean fruit
1. DB-8518829 10SC Imidan 50W Imidan 50W	1.2 oz 24.0 oz 16.0 oz	4 May, 22 Jun, 8 Aug 22 May, 7 Jun 7 Jul, 24 Jul, 24 Aug	2.3a	14.3ab	19.7bcd	0.7a	0.0a	1.7abcd	0.7ab	1.0a	64.0bc
2. Danitol 2.4EC Guthion 35W	5.3 oz 8.6 oz	4 May, 22 May, 7 Jul, 8 Aug 7 Jun, 22 Jun, 24 Jul, 24 Aug	2.7a	13.7ab	7.7ab	1.0a	0.0a	4.0abcde	0.0a	0.0a	74.3c
3. Orthene 75SP Guthion 35W	5.3 oz 8.6 oz	4 May, 7 Jun 22 May, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	2.7a	13.3ab	20.3bcd	0.3a	0.0a	5.7bcde	0.0a	0.0a	62.0bc
4. Morestan 25W Guthion 35W	8.0 oz 8.6 oz	4 May 4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	8.3a	9.3a	16.0abcd	0.3a	0.3a	0.0a	0.0a	0.0a	66.7bc
5. EXP-60145A	1.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	5.3a	18.7ab	19.3bcd	0.0a	0.0a	8.0cde	1.0ab	0.0a	57.3bc
6. EXP-60145A	2.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 July, 24 July, 8 Aug	6.3a	8.0a	4.0a	0.0a	0.3a	9.0de	0.3a	2.7a	72.3c
7. EXP-60145A	4.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	6.3a	9.0a	24.7cd	1.0a	0.0a	9.3e	0.3a	0.0a	56.0bc
8. Andalin 2.1L Guthion 35W	4.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	9.3a	29.7bcd	15.0abcd	2.3a	0.7a	0.0a	0.0a	0.0a	49.7b
9. Andalin 2.1L Guthion 35W	8.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	5.0a	22.7abc	29.7d	1.7a	0.0a	1.0abc	0.0a	0.0a	49.0b
10. Andalin 1.0L Andalin 2.1 L Guthion 35W	8.0 oz 8.0 oz 8.6 oz	22 Jun, 8 Aug 24 Jul 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	5.0a	18.0ab	15.7abcd	1.7a	0.0a	0.3ab	0.7ab	0.7a	62.0bc
11. Safer Insecticide conc. 128.0 oz + SunSpray oil 6E+. 128.0 oz	128.0 oz 128.0 oz	22 May, 7 Jun, 7 Jul 22 May, 7 Jun, 7 Jul	5.3a	53.7d	8.7abc	0.7a	12.0b	2.0abc	2.7b	0.0a	23.3a
12. Check			7.7a	49.3cd	4.3a	0.7a	10.0b	7.0bcde	6.7c	0.7a	31.3a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD).
Data were transformed using the arcsine transformation for analysis. Untransformed data are presented.

Treatment	Rate form. /100 gal.	Application dates	% Injured Fruit (Golden Delicious) 26 Sep									
			Tarnished plant bug	Plum curculio	European apple sawfly	Green fruit worm	Codling moth	San Jose scale	Variegated leafroller	% Clean fruit	Mean Russet rating*/fruit	
1. DB-8518829 10SC Imidan 50W Imidan 50W	1.2 oz..... 24.0 oz..... 16.0 oz.....	4 May, 22 Jun, 8 Aug 22 May, 7 Jun 7 Jul, 24 Jul, 24 Aug	.....	7.3a	17.3a	3.0a	0.0a	1.3a	0.3a	63.7b	1.5a
2. Danitol 2.4EC Guthion 35W	5.3 oz..... 8.6 oz.....	4 May, 22 May, 7 Jul, 8 Aug 7 Jun, 22 Jun, 24 Jul, 24 Aug	.....10.7a	7.3a	9.0a	1.7a	0.0a	1.3a	0.0a	72.3b	1.3a
3. Orthene 75SP Guthion 35W	5.3 oz..... 8.6 oz.....	4 May, 7 Jun 22 May, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....12.3a	10.7a	15.7a	1.0a	2.0a	0.7a	0.0a	60.3b	1.4a
4. Morestan 25W Guthion 35W	8.0 oz..... 8.6 oz.....	4 May 4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....11.7a	5.7a	11.3a	1.3a	1.3a	0.3a	0.0a	72.0b	1.6a
5. EXP 60145A	1.0 oz.....	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....17.7a	1.7a	4.7a	0.0a	1.7a	1.3a	0.0a	75.0b	1.4a
6. EXP 60145A	2.0 oz.....	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....22.0a	5.0a	4.7a	0.3a	0.3a	2.0a	0.7a	66.0b	1.5a
7. EXP 60145A	4.0 oz.....	4 May, 22 May, 7 Jun, 22 Jun 7 Jul, 24 Jul, 8 Aug, 24 Aug	.....11.0a	1.3a	11.3a	0.3a	0.0a	1.3a	0.0a	76.7b	1.5a
8. Andalin 2.1L Guthion 35W	4.0 oz..... 8.6 oz.....	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	.....16.3a	2.7a	7.0a	1.0a	0.7a	0.3a	0.3a	72.3b	1.7a
9. Andalin 2.1L Guthion 35W	8.0 oz..... 8.6 oz.....	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	.....10.0a	7.0a	25.7a	3.0a	0.7a	0.7a	0.3a	56.7b	1.3a
10. Andalin 1.0L Andalin 2.1L Guthion 35W	8.0 oz..... 8.0 oz..... 8.6 oz.....	22 Jun, 24 Jul, 8 Aug 24 Jul 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug	.....17.5a	5.0a	12.0a	0.0a	1.0a	1.0a	0.0a	66.0b	1.5a
11. Safer Insecticide conc. 128.0 oz + SunSpray oil 6E+.. 128.0 oz	128.0 oz..... 128.0 oz.....	22 May, 7 Jun, 7 Jul 22 May, 7 Jun, 7 Jul	.....5.4a	30.0a	10.0a	0.0a	55.0b	4.7a	0.0a	25.7a	1.1a
12. Check			.....16.4a	18.5a	10.6a	1.5a	37.7b	3.7a	14.9b	24.9a	1.1a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD).
Percent data were transformed using the arcsine transformation for analysis. Untransformed data are presented.
* 1 = best, 3 = worst.

APPLE: *Malus domestica*

Apple rust mite: *Aculus schlechtendali* (Nalepa)
A predatory phytoseid: *Amblyseius fallacis* (Garman)
European red mite: *Panonychus ulmi* (Koch)
Twospotted spider mite: *Tetranychus urticae* Koch
A predatory stigmatid: *Zetzellia mali* (Ewing)
A predatory coccinellid: *Stethorus punctum* LeConte

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APPLE, MITE CONTROL WITH INSECTICIDES, HUDSON VALLEY LAB, HIGHLAND, NY, 1989: Treatments were applied to eight tree plots replicated three times in a randomized complete block design. All treatments were applied dilute to runoff using a high-pressure handgun sprayer at 400 psi delivering from 2.7 to 4.2 gal spray/tree or 262 to 407 gal/acre, depending upon foliage present and weather conditions. Trees were 25 years-old, 10 ft high, spaced 15 by 30 ft, and on the EMII rootstock. The EXP-60145A treatments were all tested in a seasonal program with sprays applied at pink, 4 May, petal fall, 22 May, and in cover sprays on 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, and 24 Aug. DB-8518829 was applied 4 May, 22 Jun, and 8 Aug, while Imidan was applied at 24.0 oz/100 gal on 22 May and 7 Jun, and 16.0 oz/100 gal on 7 Jul, 24 Jul, and 24 Aug. Danitol was applied 4 May, 22 May, 7 Jul, and 8 Aug, with Guthion applied in the remaining cover sprays. Orthene was applied 4 May and 7 Jun with Guthion applied in the remaining sprays. Additional treatments included: Morestan applied 4 May along with Guthion and followed by Guthion in all succeeding sprays; Andalin 2.1 L applied at the 4 and 8 oz/100 gal rates on 22 June with Guthion in all other sprays starting at 22 May; Andalin 1L at 8 oz on 22 Jun followed by Andalin 2L 8 oz/100 gal on 24 Jul, with Guthion in other cover sprays; and Safer Insecticidal Concentrate plus Sunspray oil 6E+ applied 22 May, 7 Jun, and 7 Jul. Applications over the entire block primarily for disease control included: Agway Spray oil 6E 1 gal/100 plus Supracide 2E 1 qt/100 gal plus Difolatan 80S 5 lb/100 gal, 11 Apr; Rubigan 1EC 3.0 oz/acre plus Dithane M45 80W 1.5 lb/acre, 4 May and 14 May; Rubigan 1EC 9 oz/acre plus Dithane M45 80W 6 lb/acre, 24 May and 1 Jun; Nova 60W 2 oz/acre, 8 Jun; Polyram 80DF 4 lb/acre, 23 Jun; Manzate 200 80DF 4 lb/acre, 15 Jul; and Benlate 50W 6 oz/acre plus Captan 50W 6 lb/acre, 17 Aug. Naphthaleneacetic acid (Kling-tite formulation) was applied in thinning sprays on 25 May using from 42 to 96 ml/100 gal, depending upon the cultivar and apparent fruit set. Mite populations were evaluated by sampling 25 leaves from one "Red Delicious" tree/plot at biweekly intervals throughout the summer. The leaves were brought into the laboratory where they were brushed with a mite brushing machine, and the mites and eggs examined and counted using a binocular scope. *Stethorus punctum* populations were assessed by counting all of the adults seen in a three minute search around the perimeter of one "Red Delicious" tree/plot. Rainfall was above normal during May, Jun and Aug. Temperatures were generally cooler than normal due to the continually overcast conditions found during much of the summer. Mite pressure developed rather slowly in the block due in part to epizootic outbreaks of microbial pathogens, which were favored by the cool, humid conditions found during much of the season, and also as a result of the early season application of spray oil.

European red mite population increases were noted in the DB-8518829, Orthene, and Andalin 1L treatments by mid-Jul. The EXP-60145A treatments broke with respect to mite control in a rate-wise fashion during the first week of Aug, the highest rate having the fewest mites. The Andalin 2L treatments broke during mid-Aug. The Danitol and Morestan treatments sustained very few spider mites during the season, with the Danitol providing direct suppression and the Morestan providing early suppression while permitting the build-up of *Zetzellia mali* during the later part of the season. Apple rust mite and *Amblyseius fallacis* populations were quite low in the EXP-60145A treatments, while both *Stethorus punctum* and *Zetzellia mali* populations responded to the mite build-up in these treatments. The *Stethorus punctum* response to the spider mite build-up in early August may have been adversely affected by the DB-8518829 and the EXP-60145A treatments, as counts were lower in these treatments compared to the Morestan treatment. The low mite counts in the Safer Insecticidal Soap Concentrate plus sunspray oil treatment was attributed primarily to the severe leaf injury noted in these plots in Jun. This injury apparently resulted when the thinning spray of Klingtite® was applied on 25 May following the 22 May Soap and oil application.

Treatment	Rate form. /100 gal.	Application dates	Mean no. of mites* or eggs/ leaf**			
			12 Jun		27 Jun	
			ERM	ERME	ZM	ERME
1. DB-8518829 10SC Imidan 50W Imidan 50W	1.2 oz 24.0 oz 16.0 oz	4 May, 22 Jun, 8 Aug 22 May, 7 Jun 7 Jul, 24 Jul, 24 Aug				
			0.2a	0.0a	0.0a	0.4bc
2. Danitol 2.4EC Guthion 35W	5.3 oz 8.6 oz	4 May, 22 May, 7 Jul, 8 Aug 7 Jun, 22 Jun, 24 Jul, 24 Aug				
			0.0a	0.0a	0.0a	0.0a
3. Orthene 75SP Guthion 35W	5.3 oz 8.6 oz	4 May, 7 Jun 22 May, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug				
			1.2bc	0.0a	0.0a	0.7c
4. Morestan 25W Guthion 35W	8.0 oz 8.6 oz	4 May 4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug				
			0.0a	0.1a	0.0a	0.0a
5. EXP-60145A	1.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug				
			0.1a	0.0a	1.3ab	0.2ab
6. EXP-60145A	2.0 oz	4 May, 22 May, 7 Jun, 22 Jun, 7 Jul, 24 Jul, 8 Aug, 24 Aug				
			0.2a	0.2a	0.5a	0.3ab
7. EXP-60145A	4.0 oz	4 May, 22 May, 7 Jun, 22 Jun 7 Jul, 24 Jul, 8 Aug, 24 Aug				
			0.0a	0.1a	0.2a	0.0a
8. Andalin 2.1L Guthion 35W	4.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul 24 Jul, 24 Aug				
			0.0a	0.0a	0.1a	0.0a
9. Andalin 2.1L Guthion 35W	8.0 oz 8.6 oz	22 Jun, 8 Aug 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug				
			0.0a	0.0a	0.0a	0.0a
10. Andalin 1.0L Andalin 2.1L Guthion 35W	8.0 oz 8.0 oz 8.6 oz	22 Jun, 8 Aug 24 Jul 22 May, 7 Jun, 7 Jul, 24 Jul, 24 Aug				
			2.2c	0.0a	4.3bc	0.6c
11. Safer Insecticide conc. + SunSpray oil 6E+	128.0 oz 128.0 oz	22 May, 7 Jun, 7 Jul 22 May, 7 Jun, 7 Jul				
			0.0a	0.0a	0.0a	0.0a
12. Check			0.6ab	0.4a	0.0a	0.0a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

* ERM = European red mite, ERME = ERM eggs, ZM = Zetzellia mali.

** Based on 25 leaves/ tree, from one Red Delicious tree in each of three replicates/ treatment.

Mean no. of mites* or eggs/leaf**

Treatment	11 Jul				2 Aug								
	ERM	ERME	ZM	ZME	ARM	ERM	ERME	TSM	TSME	AMB	ZM	ZME	ARM
1.....	4.0bc	11.7cde	0.0a	0.0a	6.0b	28.2d	27.4de	0.2a	1.9a	0.00a	0.2abc	0.3a	4.9ab
2.....	0.1a	0.1a	0.0a	0.0a	0.7ab	1.1a	2.7ab	0.4a	1.1a	0.03a	0.0a	0.0a	19.2b
3.....	10.0c	21.1de	0.0a	0.0a	18.5c	22.7cd	37.1e	0.2a	0.4a	0.12a	0.1ab	0.0a	207.8c
4.....	0.2a	0.8ab	0.1a	0.1a	6.5b	1.1a	4.5ab	1.4a	5.3a	0.14a	0.4bcd	0.5a	100.2b
5.....	3.5bc	6.8bcd	0.0a	0.0a	1.3ab	19.0cd	20.0cde	2.7a	2.1a	0.01a	0.0a	0.2a	0.6a
6.....	2.5ab	3.4abc	0.3a	0.2a	3.0b	11.5bcd	8.6bcd	2.2a	3.6a	0.00a	0.7d	0.7a	6.9ab
7.....	1.1ab	2.2ab	0.0a	0.1a	0.0a	6.9abcd	6.1abc	2.4a	3.6a	0.01a	0.4cd	1.3a	3.4ab
8.....	0.1a	0.4a	0.0a	0.1a	0.2a	2.0ab	2.5ab	0.1a	1.1a	0.00a	0.0a	0.0a	5.2ab
9.....	0.1a	0.6a	0.0a	0.0a	0.2a	1.0a	2.6ab	0.8a	2.1a	0.00a	0.0a	0.0a	5.4ab
10.....	13.1c	43.0e	0.0a	0.0a	0.0a	4.0abc	19.9cde	0.3a	2.4a	0.00a	0.0a	0.0a	1.1a
11.....	0.1a	0.1a	0.0a	0.0a	4.3b	1.0a	1.2a	0.0a	0.1a	0.01a	0.1abc	0.8a	31.4bc
12.....	0.7ab	1.3ab	0.0a	0.0a	1.3ab	1.2a	1.8ab	0.0a	0.6a	0.00a	0.1abc	0.0a	34.7bc

Mean no. Stethorus (adults) /3 minute count

Mean no. of mites* or eggs/ leaf**												
Treatment	3 Aug				22 Aug							
	Red Delicious	Cortland	ERM	ERME	TSM	TSME	AMB	ZM	ZME	ARM		
1.....	0.7a	0.3a	17.5c	31.3e	0.6a	5.0a	0.11bc	0.6ab	1.6bc	44.1bc		
2.....	0.0a	0.0a	0.4a	4.2abc	0.5a	2.6a	0.00a	0.0a	0.0a	51.8bcd		
3.....	9.0b	6.3b	13.3abc	6.8bcd	0.5a	0.3a	0.19c	0.5ab	0.6ab	150.3d		
4.....	0.7a	0.3a	1.7ab	24.9cde	0.4a	5.8a	0.07ab	1.3bc	1.6bc	160.2cd		
5.....	1.7a	0.3a	6.8bc	23.9de	1.2a	6.5a	0.00a	0.3a	0.3ab	0.9a		
6.....	2.7a	1.7ab	0.8ab	11.6cde	0.1a	2.8a	0.00a	2.2c	4.1c	5.6ab		
7.....	0.7a	0.0a	6.1bc	34.9de	2.3a	12.0a	0.00a	1.3bc	5.0c	2.6ab		
8.....	0.0a	0.0a	1.7ab	16.4cde	0.5a	11.0a	0.09abc	0.0a	0.1a	5.2ab		
9.....	0.0a	0.0a	6.7abc	16.3cde	1.7a	4.1a	0.10ab	0.0a	0.0a	13.4ab		
10.....	0.3a	0.0a	2.1ab	25.6de	1.8a	4.6a	0.01ab	0.0a	0.0a	0.2a		
11.....	0.0a	0.0a	0.3a	1.0ab	0.0a	0.3a	0.00a	0.2a	0.5ab	118.2cd		
12.....	0.0a	0.0a	0.3a	0.4a	0.0a	0.0a	0.00a	0.0a	0.0a	135.7cd		
Treatment means followed by the same letter are not significantly different (p< 0.05; LSD). Data were transformed to log ₁₀ (X + 1) for analysis.												
Untransformed data are presented												

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

* ERM = European red mite, ERME = ERM eggs, TSM = Twospotted spider mite, TSME = TSM eggs, ARM = Apple rust mite, AMB = Amblyseius fallacis, ZM = Zetzellia mali, ZME = ZM eggs.

** Based on 25 leaves/ tree, from one Red Delicious tree in each of three replicates/ treatment.

APPLE: *Malus domestica*

Apple rust mite: *Aculus schlechtendali* (Nalepa)

A predatory phytoseid: *Amblyseius fallacis* (Garman)

European red mite: *Panonychus ulmi* (Koch)

Twospotted spider mite: *Tetranychus urticae* Koch

A predatory stigmaeid: *Zetzellia mali* (Ewing)

Spotted tentiform leafminer: *Phyllonorycter blancardella* (Fabr.)

White apple leafhopper: *Typhlocyba pomaria* McAtee

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APPLE, MITE CONTROL, MITICIDE BLOCK, HUDSON VALLEY LAB, HIGHLAND, NY, 1989: Treatments were applied to eight tree plots replicated three times in a randomized complete block design. All treatments were applied dilute to runoff using a high-pressure handgun sprayer at 400 psi delivering from 3.4 to 3.9 gal spray/tree or 330 to 378 gal/acre. Trees were 25 years-old, 10 ft high, 12 ft width, spaced 15 by 30 ft, and on the EMII rootstock. Treatments, consisting of five rates of EL-436, three rates of the 1.7EC formulation of Product X, and one rate of the 20W formulation of Product X, were applied 23 Jun, while Kelthane plus the AG 44M adjuvant, were applied 24 Jun. Considerable foaming was noted in the tank containing the Kelthane and AG 44M combination. Agway Spray oil 6E 1 gal/100 plus Supracide 2E 1 qt/100 gal plus Difolatan 80S 5 lb/100 gal were all applied dilute to runoff over the entire block on 11 Apr, primarily for the control of San Jose Scale. Additional materials applied over the entire block for disease control included: Rubigan 1EC 3.0 oz/acre plus Dithane M45 80W 1.5 lb/acre, 4 May and 14 May; Rubigan 1EC 9 oz/acre plus Dithane M45 80W 6 lb/acre, 24 May and 1 Jun; Nova 60W 2 oz/acre, 8 Jun; Polyram 80DF 4 lb/acre, 23 Jun; Manzate 200 80DF 4 lb/acre, 15 Jul; and Benlate 50W 6 oz/acre plus Captan 50W 6 lb/acre, 17 Aug. The forementioned materials were all applied by airblast sprayer delivering from 60 to 100 gal spray/acre. Insecticides applied dilute to runoff for insect control in all treatments except the check included: Guthion 35W 8.6 oz/100 gal, 23 May, 8 Jun, and 17 Aug; and Sevin 80S 1 lb/100 gal, 27 Jul. Kling Tite® (Naphthaleneacetic acid) was applied 25 May to all treatments at rates ranging from 42 to 96 ml/100 gal dilute, depending upon the cultivar. Mite populations were evaluated by sampling 25 leaves from one "Red Delicious" tree/plot at biweekly intervals throughout the summer. The leaves were brought into the laboratory where they were brushed onto a glued plate with a mite brushing machine. The plate was examined with the aid of a binocular scope for mites and eggs, which were counted and recorded. Spotted tentiform leafminer and white apple leafhopper were evaluated on 14 Aug by counting the number of leafminer mines and rating leafhopper injury from 25 McIntosh leaves/tree/plot. Rainfall was above normal during May, Jun and Aug. Temperatures were generally cooler than normal due to the continually overcast conditions found during much of the summer. Mite pressure was less than normal throughout the block, in part due to epizootic outbreaks of microbial pathogens which were favored by the cool, overcast, and humid conditions found during much of the season.

European red mite counts were quite erratic prior to the first miticide application, but all treatments provided a reduction in motile forms, with the exception of the Savey treatment, which showed an increase in motile forms but decrease in eggs on the post-treatment count. Mite populations declined in all treatments until the final 21 Aug count, at which time the EL-463 and Kelthane treatments had similar spider mite populations, while the Product X and Savey treatments had similar low counts. Apple rust mite populations were more prevalent in the EL-463, Savey and untreated check treatments than in the others. The Kelthane treatment virtually eliminated the *Zetzellia mali* population, which was found throughout the other treatments. *Amblyseius fallacis* populations were highest on the final count in EL-436 treatments where spider mite populations were highest. No differences were noted between treatments with respect to spotted tentiform leafminer populations or white apple leafhopper leaf injury.

Mean no. of mites* or eggs/leaf**

Treatment	Rate form. /100 gal	5 Jun					19 Jun				
		ERM	ERME	ERM	ERME	AMB	ZM	ZME	ARM		
1. EL-436 1.5 EC + AG 98	0.53 oz 3.2 oz	7.1a	2.7a	1.7a	16.6a	0.01a	0.0a	0.1a	3.5a		
2. EL-436 1.5 EC + AG 98	1.07 oz 3.2 oz	0.1a	0.2a	0.2a	1.9a	0.00a	0.1a	0.0a	0.7a		
3. EL-463 1.5 EC + AG 98	2.13 oz 3.2 oz	7.9a	8.9a	19.3a	86.9a	0.03a	0.0a	0.0a	5.8a		
4. EL-436 1.5 EC + AG 98	3.2 oz 3.2 oz	2.0a	2.4a	3.8a	14.1a	0.01a	0.1a	0.1a	2.4a		
5. EL-436 1.5 EC + AG 98	4.27 oz 3.2 oz	6.2a	6.6a	5.2a	24.9a	0.01a	0.1a	0.0a	3.2a		
6. Product X 1.7 EC	3.2 oz	6.2a	8.1a	6.9a	30.1a	0.04a	0.1a	0.0a	5.2a		
7. Product X 1.7 EC	6.4 oz	0.2a	0.2a	0.1a	1.5a	0.00a	0.0a	0.1a	8.0a		
8. Product X 1.7 EC	12.8 oz	0.2a	0.0a	0.1a	1.4a	0.00a	0.0a	0.0a	1.8a		
9. Product X 20 W	6.6 oz	2.9a	5.5a	2.9a	13.3a	0.01a	0.0a	0.0a	1.7a		
10. Kelthane 4F + Triton Ag 44M	12.0 oz 2.0 oz	5.8a	4.1a	2.6a	16.4a	0.08a	0.0a	0.0a	1.3a		
11. Savey 50 DF	1.0 oz	5.9a	6.7a	4.8a	25.3a	0.00a	0.0a	0.0a	3.9a		
12. Check		0.2a	0.6a	0.6a	2.7a	0.01a	0.0a	0.0a	4.7a		

Mean no. of mites* or eggs/leaf**

Treatment	Application date	6 Jul					19 Jul				
		ERM	ERME	TSM	TSME	AMB	ZM	ZME	ARM	ERM	ERME
1.	23 Jun	7.0a	3.6a	0.9a	0.8a	0.00a	0.0a	0.0a	8.8a	2.1d	2.0a
2.	23 Jun	0.3a	1.0a	0.1a	0.0a	0.01a	0.0a	0.0a	7.4a	1.2cd	1.1a
3.	23 Jun	2.1a	8.9a	0.1a	0.2a	0.00a	0.0a	0.0a	4.9a	1.7bcd	1.3a
4.	23 Jun	0.8a	5.0a	0.1a	0.1a	0.00a	0.0a	0.0a	2.6a	0.5abc	3.8a
5.	23 Jun	1.2a	6.9a	0.1a	0.0a	0.00a	0.0a	0.1a	15.9a	0.6abc	1.9a
6.	23 Jun	1.3a	16.7a	0.6a	0.6a	0.05a	0.0a	0.3a	15.7a	0.5abc	3.4a
7.	23 Jun	0.1a	0.6a	0.0a	0.0a	0.18a	0.1a	0.0a	11.8a	0.0a	0.3a
8.	23 Jun	0.1a	0.3a	0.0a	0.0a	0.00a	0.0a	0.1a	3.0a	0.1a	0.2a
9.	23 Jun	1.8a	16.6a	0.3a	0.0a	0.04a	0.0a	0.1a	3.2a	0.1ab	4.7a
10.	24 Jun	2.6a	1.0a	0.2a	0.2a	0.01a	0.0a	0.0a	0.4a	0.8abcd	1.0a
11.	23 Jun	10.1a	17.2a	0.1a	0.0a	0.02a	0.1a	0.1a	29.7a	0.0a	0.1a
12.	23 Jun	1.6a	1.8a	0.0a	0.0a	0.00a	0.2a	0.1a	49.1a	0.9abcd	1.2a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

* ERM = European red mite, ERME = ERM eggs, TSM = Twospotted spider mite, TSME = TSM eggs, ARM = Apple rust mite, AMB = *Amblyseius fallacis*, ZM = *Zetzellia mali*, ZME = ZM eggs.

** Based on 25 leaves/ tree, from one Red Delicious tree in each of three replicates/ treatment.

Mean no. of mites* or eggs/leaf**

Treatment	Rate form. /100 gal	mean no. of mites* or eggs/leaf**															
		31 Jul								21 Aug							
		ERM	ERME	TSM	TSME	AMB	ZM	ZME	ARM	ERM	ERME	TSM	TSME	AMB	ZM	ZME	ARM
1. EL-436 1.5 EC.....	0.53 oz.....	0.9a	3.5a	1.8b	1.5a	0.07b	0.1a	0.3a	3.5ab.....	13.1de	25.2c	7.2a	5.9cde	0.17a	0.7b	1.0d	4.5a
2. EL-436 1.5 EC.....	3.2 oz.....																
+ AG 98.....	1.07 oz.....	0.9a	4.5a	0.1a	0.4a	0.00a	0.1a	0.1a	2.6ab.....	0.9abc	17.4c	4.3a	8.7ef	0.00a	0.3ab	0.5abcd	4.5a
3. EL-463 1.5 EC.....	3.2 oz.....																
+ AG 98.....	2.13oz.....	0.4a	8.3a	0.0a	0.1a	0.00a	0.0a	0.0a	2.1ab.....	18.6cde	29.9c	9.3a	8.5def	0.03a	0.1ab	0.2abc	3.9a
4. EL-436 1.5 EC.....	3.2 oz.....	0.9a	12.1a	1.5b	4.7a	0.00a	0.0a	0.0a	6.0b.....	9.3bcde	19.3c	6.7a	24.2f	0.21a	0.0a	0.1ab	9.7a
+ AG 98.....	3.2 oz.....																
5. EL-436 1.5 EC.....	4.27 oz.....	0.5a	2.8a	0.0a	0.1a	0.00a	0.1a	0.2a	4.5b.....	13.8e	19.9c	0.6a	2.0abc	0.13a	0.5ab	0.7bcd	29.3a
+ AG 98.....	3.2 oz.....																
6. Product X 1.7 EC.....	3.2 oz.....	0.8a	4.5a	0.1a	0.7a	0.00a	0.3a	0.9a	2.2ab.....	1.4abcd	14.8bc	0.6a	5.4bcde	0.07a	0.4ab	1.4d	11.2a
7. Product X 1.7 EC.....	6.4 oz.....	0.1a	1.2a	0.0a	0.0a	0.00a	0.2a	0.4a	0.0a.....	0.8abc	2.7ab	1.6a	2.6abcd	0.04a	0.4ab	0.5abcd	3.7a
8. Product X 1.7 EC...	12.8 oz.....	0.1a	0.8a	0.0a	0.2a	0.00a	0.0a	0.0a	1.5ab.....	2.8abcde	4.7ab	0.1a	0.6ab	0.03a	0.1a	0.3abc	5.2a
9. Product X 20 W.....	6.6 oz.....	0.3a	4.1a	0.0a	0.1a	0.00a	0.1a	0.3a	1.9ab.....	0.9abc	8.2abc	0.6a	2.2abc	0.00a	0.2ab	0.9cd	9.3a
10. Kelthane 4F.....	12.0 oz.....	0.9a	4.5a	0.0a	0.0a	0.00a	0.0a	0.0a	0.0a.....	7.4bcde	24.3c	0.7a	7.4cdef	0.03a	0.0a	0.0a	0.4a
+ Triton Ag 44M																	
11. Savey 50 DF.....	1.0 oz.....	0.0a	1.5a	0.0a	0.0a	0.00a	0.0a	0.1a	3.0ab.....	0.1a	1.2a	0.5a	0.5ab	0.03a	0.1ab	0.1ab	4.7a
12. Check.....		0.8a	2.0a	0.0a	0.0a	0.00a	0.6a	0.8a	48.4c.....	0.3ab	4.9ab	0.1a	0.2a	0.03a	2.0c	3.2e	36.6a

14 Aug

Treatment	Rate form. /100 gal	Mean no. STLM*** mines/25 clusters	Mean injury rating****/leaf	
			White	apple leafhopper
1. EL-436 1.5 EC.....	0.53 oz.....	11.3a		1.4a
+ AG 98.....	3.2 oz.....			
2. EL-436 1.5 EC.....	1.07 oz.....	14.7a		1.7a
+ AG 98.....	3.2 oz.....			
3. EL-463 1.5 EC.....	2.13oz.....	9.0a		1.8a
+ AG 98.....	3.2 oz.....			
4. EL-436 1.5 EC.....	3.20 oz.....	8.0a		1.5a
+ AG 98.....	3.2 oz.....			
5. EL-436 1.5 EC.....	4.27 oz.....	10.0a		1.7a
+ AG 98.....	3.2 oz.....			
6. Product X 1.7 EC.....	3.2 oz.....	10.7a		2.0a
7. Product X 1.7 EC.....	6.4 oz.....	10.3a		1.6a
8. Product X 1.7 EC.....	12.8 oz.....	6.7a		1.6a
9. Product X 20 W.....	6.6 oz.....	11.0a		1.1a
10. Kelthane 4F.....	12.0 oz.....	10.0a		1.3a
+ Triton Ag 44M				
11. Savey 50 DF.....	1.0 oz.....	6.3a		1.8a
12. Check.....		9.7a		1.8a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

* ERM = European red mite, ERME = ERM eggs, TSM = Twospotted spider mite, TSME = TSM eggs, ARM = Apple rust mite, AMB = *Amblyseius fallacis*, ZM = *Zetzellia mali*, ZME = ZM eggs.

** Based on 25 leaves/tree, from one Red Delicious tree in each of three replicates/ treatments.

***STLM = Spotted tentiform leafminer.

**** 0=best, 3=worst.

APPLE: *Malus domestica*

Apple rust mite: *Aculus schlechtendali* (Nalepa)
A predatory phytoseid: *Amblyseius fallacis* (Garman)
European red mite: *Panonychus ulmi* (Koch)
A predatory stigmaeid: *Zetzellia mali* (Ewing)
Apple aphid: *Aphis pomi* De Geer
Apple maggot: *Rhagoletis pomonella* (Walsh)
Codling moth: *Laspeyresia pomonella* (L.)
San Jose scale: *Quadraspidiotus perniciosus* (Comstock)
Spotted tentiform leafminer: *Phyllonorycter blancardella* (Fabr.)
Variegated leafroller: *Platynota flavedana* Clemens
White apple leafhopper: *Typhlocyba pomaria* McAtee

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APPLE, INSECT AND MITE CONTROL, MILTON, NY, 1989: Treatments were applied to 4-8 tree plots replicated four times in a randomized complete block design. One replicate consisted of the "Tydeman" cultivar, another of the "Paula Red" cultivar, and two of the "Red Delicious" cultivar. All treatments were applied dilute to runoff using a high-pressure handgun sprayer at 300 psi delivering from 2.6 to 2.9 gal spray/tree or 364 to 406 gal/acre. Trees were approximately 15 years-old, 16 ft high, 14 ft width, spaced 13 by 24 ft, and on the MM-111 rootstock. Treatments consisted of Larvin 3.2F 10.0 oz/100 gal plus Surfel 32.0 oz/100 gal; Larvin 3.2F 10.0 oz/100 gal plus Guthion 35W 5.7 oz/100 gal plus Surfel 32.0 oz/100 gal; Sevin 80S 10.0 oz/100 gal plus Surfel 32.0 oz/100 gal; Sevin 80S 10.0 oz/100 gal plus Guthion 35W 5.7 oz/100 gal plus Surfel 32.0 oz/100 gal; Guthion 35W 8.6 oz/100 gal; and the untreated check. Treatments were not initiated until a petal fall, 24 May, and first cover spray, 9 Jun, of Guthion 35W 1.6 lb form./acre, had been applied over the entire block by airblast sprayer. Treatments were then applied on 22 Jun, 7 Jul, 24 Jul, and 10 Aug. Fungicides applied by airblast sprayer over the entire block for disease control included: Rubigan 1EC 6.0 oz/acre, 26 Apr; Rubigan 1EC 6.0 oz/acre plus Dithane M45 80W 1.5 lb/acre, 4 May and 14 May; Rubigan 1EC 9 oz/acre plus Dithane M45 80W 6 lb/acre, 24 May and 11 Jun; Nova 60W 2 oz/acre, 9 Jun; and Manzate 200 80DF 4 lb/acre, 15 Jul. Mite populations were evaluated by sampling 25 leaves from the center tree in each plot on 22 Jun, 1 Aug, and 16 Aug. The leaves were brought into the laboratory where they were brushed onto a glued plate with a mite brushing machine. The plate was examined with the aid of a binocular scope for mites and eggs, which were counted and recorded. Spotted tentiform leafminer and white apple leafhopper were evaluated by counting the number of leafminer mines or leafhopper nymphs on 25 leaves from the center tree in each plot. Aphids were evaluated by examining the number of terminals infested with live aphid colonies from 25 terminals on the center tree in each plot. The fruit was evaluated for insect injury as it became ripe, thus the "Paula Red" and "Tydeman" cultivars were harvested 16 Aug, while the "Red Delicious" cultivar was harvested 7 Sep. 100 fruits were checked for insect injury from each plot in the test.

Pest mite populations remained low throughout the season in the check and Guthion treatments, where *Zetzellia mali* (Ewing) became the predominant mite species. *Z. Mali* as well as other mite species were at very low population levels in the other treatments, apparently as a result of the physical action of the Surfel, which had been included in these treatments. White apple leafhopper control was best with the two Sevin treatments and the larvin plus Guthion plus Surfel, followed by the Larvin plus Surfel and the Guthion treatments. Spotted tentiform leafminer control was slightly better with the Sevin treatments than the Larvin treatments, while the reverse was found with aphid control. A greater percentage of the fruit treated with Sevin plus Surfel combinations had russet rings than did that treated with the Larvin plus Surfel combinations. The addition of the Guthion in the combinations appeared to lessen the percentage of russeted fruit. Codling moth and variegated leafroller injury was significantly greater in the check treatment, while San Jose scale was only found in the check and the Guthion treatments. Apple maggot punctures were found in all of the treatments, but only in the larvin plus Surfel treatment were maggot tunnels found to the same extent as were found in the check.

Treatment	Rate form. /100 gal.	Application dates	Mean no. of mites* or eggs/leaf**												
			22 Jun						1 Aug						
			ERM	ERME	AMB	ZM	ZME	ARM	ERM	ERME	AMB	ZM	ZME	ARM	
1. Larvin 3.2F	10.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug													
Surfel	32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug	0.1a	1.7a	0.00a	0.5a	0.1a	59.8a	0.1a	0.7a	0.02a	0.3a	0.2a	8.5a	
2. Larvin 3.2F	10.0 oz	22 Jun, 7 Jul, 24 Jul 10 Aug													
Guthion 35W	5.7 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug													
Surfel	32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug	0.3a	1.9a	0.01a	0.4a	0.1a	108.0a	0.0a	0.3a	0.00a	0.3a	0.3a	4.8a	
3. Sevin 80S	10.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug													
Surfel	32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug	0.4a	2.2a	0.02a	0.5a	0.2a	81.3a	0.1a	0.4a	0.00a	0.1a	0.2a	2.2a	
4. Sevin 80 S	10.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug													
Guthion 35W	5.7 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug													
Surfel	32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug	0.1a	0.6a	0.02a	0.9a	0.3a	53.9a	0.0a	0.3a	0.00a	0.2a	0.1a	1.5a	
5. Guthion 35W	8.6 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug													
Surfel			0.3a	2.3a	0.00a	0.8a	0.1a	97.4a	0.1a	1.2a	0.00a	2.4b	3.1b	1.8a	
6. Check			0.2a	2.2a	0.00a	0.6a	0.3a	86.8a	0.1a	0.9a	0.00a	2.4b	3.2b	26.7a	

Treatments	Mean no. of mites* or eggs/leaf**				Mean no.				Mean no.	
	16 Aug				White apple leafhopper				Spotted tentiform leafminer	
	ERM	ERME	ZM	ZME	nymphs/25 leaves				mines/25 leaves	
1	0.3a	0.2a	0.5a	0.3a	22 Jun	14 Jul	1 Aug	1 Aug	infested terminals/25	
2	0.1a	0.2a	0.5a	0.3a	5.0a	2.0ab	2.8bcd	10.8ab	14 Jul	
3	0.3a	0.3a	0.5a	0.8a	7.5a	0.0a	0.5abc	3.5a	5.0a	
4	0.1a	0.2a	0.2a	0.1a	5.3a	0.0a	0.3ab	8.3a	0.0a	
5	0.1a	0.1a	1.7b	0.4a	11.5a	0.5a	0.0a	3.5a	4.0a	
6	0.0a	0.1a	3.2c	0.4a	12.5a	1.5ab	2.5cd	26.5c	7.0a	
					7.5a	15.3b	8.0d	21.8bc	16.0a	
									12.0a	

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis. Untransformed data are presented.

* ERM = European red mite, ERME = ERM eggs, ARM = Apple rust mite, AMB = *Amblyseius fallacis*, ZM = *Zetzellia mali*, ZME = ZM eggs.
 ** Based on 25 leaves/ tree, from one tree in each of four replicates/ treatment.

Treatment	Rate form. /100 gal.	Application dates	% Injured Fruit					% Fruit with russet rings
			Codling moth	San Jose scale	Variegated leafroller	Apple maggot puncture	Apple maggot tunnel	
1. Larvin 3.2F Surfel	10.0 oz 32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug 22 Jun, 7 Jul, 24 Jul, 10 Aug	0.0a	0.0a	0.0a	2.8a	2.8a	19.0ab
2. Larvin 3.2F Guthion 35W Surfel	10.0 oz 5.7 oz 32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug 22 Jun, 7 Jul, 24 Jul, 10 Aug 22 Jun, 7 Jul, 24 Jul, 10 Aug	0.0a	0.0a	1.5a	0.8a	0.5a	11.3b
3. Sevin 80S Surfel	10.0 oz 32.0 oz	22 Jul, 7 Jul, 24 July 10 Aug 22 Jun, 7 Jul, 24 Jul, 10 Aug	0.0a	0.0a	1.3a	1.3a	0.0a	28.5c
4. Sevin 80 S Guthion 35W Surfel	10.0 oz 5.7 oz 32.0 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug 22 Jun, 7 Jul, 24 Jul, 10 Aug 22 Jun, 7 Jul, 24 Jul, 10 Aug	0.0a	0.0a	0.0a	0.8a	0.3a	22.8bc
5. Guthion 35W	8.6 oz	22 Jun, 7 Jul, 24 Jul, 10 Aug	0.3a	0.3a	0.0a	2.0a	0.3a	1.5a
6. Check			6.0b	1.5a	7.8b	3.0a	2.8a	0.0a

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD).
Data were transformed using the arcsine transformation for analysis. Untransformed data are presented.

APPLE: *Malus domestica*

European red mite: *Panonychus ulmi* (Koch)

Green fruitworm: *Lithophane antennata* (Walker)

Phytoseid predator: *Amblyseius fallacis* (Garman)

Plum curculio: *Conotrachelus nenuphar* (Herbst)

Spotted tentiform leafminer: *Phyllonorycter blancardella* (Fabr.)

Tarnished plant bug: *Lygus lineolaris* (P. de B.)

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APPLE, EARLY SEASON MITE AND INSECT CONTROL, POUGHKEEPSIE, NEW YORK, 1989: A ten acre block of 'Red Delicious', 'Cortland', and 'Stayman' apple cultivars on the standard rootstock was divided into 3 unreplicated plots ranging in size from 3.1 to 3.3 acres. Twelve trees of the 'Cortland' and 12 of the 'Red Delicious' cultivar were left untreated as a check. The trees were approximately 25-years-old, were spaced 18 by 32 ft and were approximately 18 ft in both height and width. Prebloom treatments were applied 26 April (tight cluster) by the grower with a Bean® airblast sprayer, delivering 167 gal/acre, at a speed of 2.5 mph. The treatments consisted of Supracide 2E 4 pt/acre plus oil, Asana XL 10.4 oz/acre plus oil, and Lorsban 4E 4 pt/acre plus oil. Mite populations were evaluated at two-week intervals throughout the season by collecting 25 leaves/tree from 4 'Red Delicious' trees/plot. These leaf samples were brought back to the laboratory where they were brushed with a mite brushing machine and all live mites and eggs counted with the aid of a binocular scope. Spotted tentiform leafminer was evaluated 5 Jun by examining all the leaves on 25 fruiting clusters from 10 'Stayman' trees per plot. Early season fruit injury was evaluated by examining 100 'Cortland' and 100 'Red Delicious' fruits from each of four trees/plot on 18 Aug.

European red mite populations increased slowly due to the effective oil application, but were highest first in the check and Asana plots. The predatory phytoseiid, *Amblyseius fallacis* was found in all of the treatments, but was most abundant in the Supracide and check plots. Spotted tentiform leafminer mines were least in the Asana plot. Very little difference in insect injury was found between treatments in the 'Cortland' cultivar, while the check had considerably more plum curculio injury than the other treatments and the Lorsban treatment had less injury from tarnished plant bug than the other treatments when the 'Red Delicious' cultivar was considered.

Treatments	Rate form. /100 gal	Application date	Mean no. mites* or eggs/leaf**							
			26 May		5 Jun		26 Jun		12 Jul	
			ERM	ERME	ERM	ERME	ERM	ERME	ERM	ERME
1. Supracide 2E.....16.0 oz +Spray oil.....128.0 oz		26 Apr	0.1	0.2	0.0	0.7	0.5	3.7	1.2	11.1
2. Asana XL.....2.6 oz +Spray oil.....128.0 oz		26 Apr	0.2	0.3	0.3	1.8	1.4	8.5	7.0	35.8
3. Lorsban 4E.....16.0 oz +Spray oil.....128.0 oz		26 Apr	0.1	0.2	0.2	1.1	0.7	4.3	2.6	15.8
4. Check			0.1	0.4	0.3	1.6	2.6	16.8	8.1	36.9

Treatment	5 Jun Mean no. STLM*** mines/25 cluster	% Injured Fruit (18 Aug)				% Injured Fruit (18 Aug)			
		Cortland		Red Delicious		Tarnished		Plum	
		Tarnished plant bug	Green Fruit worm	Plum curculio	%Clean fruit	plant bug	Early lep.	curculio	%Clean fruit
1.....	5.5	1.0	0.0	0.8	98.2	4.8	0.8	0.5	93.9
2.....	1.6	0.3	0.0	0.0	99.7	3.5	0.5	0.0	96.0
3.....	4.1	1.3	0.0	0.0	98.7	1.8	0.0	0.0	98.2
4.....	8.4	0.8	0.3	0.0	98.9	2.3	0.0	4.0	93.7

* ERM = European red mite, ERME = ERM eggs, AMB = *Amblyseius fallacis*.

** Based on 25 leaves/ tree in four replicates.

***STLM = Spotted tentiform leafminer.

APPLE: *Malus domestica*

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European red mite: *Panonychus ulmi* (Koch)
Green fruitworm: *Lithophane antennata* (Walker)
European apple sawfly: *Hoplocampa testudinea* (Klug)
Plum curculio: *Conotrachelus nenuphar* (Herbst)
Spotted tentiform leafminer: *Phyllonorycter blancardella* (Fabr.)
Tarnished plant bug: *Lygus lineolaris* (P. de B.)
Twospotted spider mite: *Tetranychus urticae* Koch
White apple leafhopper: *Typhlocyba pomaria* McAtee

APPLE, EARLY SEASON MITE AND INSECT CONTROL, WALDEN, NEW YORK, 1989: A fifteen acre block of 'Rome Beauty' and 'Tydeman' apple cultivars on the MM111 rootstock was divided into 4 unreplicated plots ranging in size from 2.4 to 3.3 acres. A 0.7 acre portion of the block consisting of the 'Rome Beauty' cultivar was left untreated prebloom as a check. The trees were approximately 15-years-old, were spaced 13 by 20 ft, and were approximately 11 ft in both height and width. Prebloom treatments were applied 28 April (tight cluster) by the grower with a Rears® airblast sprayer, delivering 280 gal/acre, at a speed of 2.5 mph. The treatments consisted of Supracide 2E 44.8 oz/acre plus gal oil/acre, Asana XL 7.5 oz/acre plus 371.2 oz oil/acre, Ethion 4M 27.8 oz/acre plus 371.2 oz oil/acre, and Lorsban 4E 44.8 oz/acre plus 371.2 oz oil/acre. Mite populations were evaluated at two week intervals throughout the season by collecting 25 leaves/tree from 4 'Rome Beauty' trees/plot. These leaf samples were brought back to the laboratory where they were brushed with a mite brushing machine and all live mites and eggs counted with the aid of a binocular scope. Spotted tentiform leafminer and white apple leafhopper were evaluated 8 Jun by recording the number of fruiting clusters infested from 25 clusters per tree from six 'Rome Beauty' trees per plot. Early season fruit injury was evaluated by examining 100 'Rome Beauty' and 100 'Tydeman' fruits from each of four trees/plot on 18 Aug.

European red mite populations remained below action threshold numbers in all treatments except the check throughout the entire summer. Spotted tentiform leafminers were virtually nonexistent in all treatments, while the white apple leafhopper was found to be more abundant in the check than in the other treatments. Tarnished plant bug dimples and scabs constituted the major category of early season insect injury, but there was virtually no difference in injury levels between cultivars or treatments, possibly due in part to the exceptionally long (3 week) bloom period following the treatments.

Treatment	Rate form. /100 gal.	Rate form. /Acre	Application date	Mean no. of mites* or eggs/leaf**											
				26 May			14 Jun			26 Jun			7 Jul		
				ERM	ERME		ERM	ERME		ERM	ERME		ERM	ERME	
1. Lorsban 4E + Spray oil...	16.0 oz 128.0 oz	44.8 oz 371.2 oz	28 April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2. Asana XL + Spray oil...	2.6 oz 128.0 oz	7.5 oz 371.2 oz	28 April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
3. Supracide 2E + Spray oil...	16.0 oz 128.0 oz	44.8 oz 371.2 oz	28 April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
4. Ethion 4M + Spray oil...	9.6 oz 128.0 oz	27.8 oz 371.2 oz	28 April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
5. Check				0.4	0.1	0.7	1.0	0.3	5.9	5.1	2.7	0.5	0.3	7.5	11.5

Treatment	8 Jun			% Injured Fruit (18 Aug)						% Injured Fruit (18 Aug)					
	Mean no. Spotted tentiform leafminer mines/25 clusters	Mean no. White apple leafhoppers/25 clusters		Rome Beauty			Tydemant***			European			European		
				Tarnished plant bug	Green fruit worm	Plum curculio	European apple sawfly	% Clean fruit	Tarnished plant bug	Green fruit worm	Plum curculio	European apple sawfly	% Clean fruit		
1.....	0.0	7.8	4.0	0.5	0.0	0.5	95.0	3.5	0.3	0.3	0.0	96.0	3.5	0.3	0.0
2.....	0.0	8.7	4.8	0.0	0.5	0.3	94.5	4.5	0.0	0.0	0.3	95.3	4.5	0.0	0.0
3.....	0.0	4.5	3.5	0.3	0.0	0.3	96.0	2.5	0.5	0.0	0.0	97.0	2.5	0.5	0.0
4.....	0.0	5.2	4.5	0.0	0.0	0.0	95.5	4.3	0.3	1.0	0.0	94.5	4.3	0.3	0.0
5.....	0.7	10.5	3.5	0.3	0.0	0.0	96.3	---	---	---	---	---	---	---	---

* ERM = European red mite, ERME = ERM eggs, TSM = Twospotted spider mite, TSME = TSM eggs.
*** Based on 25 leaves/tree from four trees/treatment.

* ERM = European red mite, ERME = ERM eggs, TSM = Twospotted spider mite, TSME = TSM eggs.
 ** Based on 25 leaves/tree from four trees/treatment.

APPLE: *Malus domestica*

European red mite: *Panonychus ulmi* (Koch)

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APPLE, DICOFOL RESISTANCE STUDIES, NEW PALTZ, MODENA, AND GARDINER, NEW YORK, 1989: Three cooperating growers were located and blocks of apples reserved so that no miticides would be applied until bioassays were taken of the developing European red mite populations. Most of the blocks had been treated with prebloom oil and as such the mites did not reach treatment threshold numbers until mid-late Jul. The New Paltz block consisted of "Empire" and "McIntosh" cultivars spaced 12x14 ft, approximately 8 ft in height, and 12 ft in width. The mites were collected and bioassayed on 5 Jul, thereafter the block was treated on 6 Jul after a leaf sample was taken and brushed to determine the population size. The dicofol treatment was applied with a Bean® airblast sprayer using 75 gal of spray/acre. The treatment provided initial control, but by the third week following treatment the population has reached threshold levels again. A bioassay at this time indicated that the population was less susceptible to dicofol than had been found earlier. Two bioassays were conducted at the Modena site prior to the first application. The first bioassay had much greater mortality in the check than the second, thus more credence was given to the second, which indicated that the population's susceptibility to dicofol was borderline. The dicofol treatment was applied with a Swanson® airblast sprayer delivering 100 gal/acre of spray at 2.25 mph. The trees were approximately 9-years-old, "Empire" and "Red Delicious" cultivars, spaced 12x14 ft, 14 ft in height, and 14 ft in width. The population was initially controlled but by the third week following the application it had bounced back and exceeded the earlier population. A bioassay taken at this time had too great a mortality in the check to be of much use. The Gardiner site consisted of a five acre plot of 20-year-old "Red Delicious" spaced 15x26 ft, 16 ft in height, and 16 ft in width. Dicofol treatment was made by airblast sprayer delivering 100 gal/acre at a speed of 2.5 mph. The initial bioassay indicated that the population was moderately susceptible to dicofol, and good initial knockdown of the population was noted. Vydate was applied for leafminer control and may have also contributed to the mite control. Followup visits to the plot indicated that no further miticide treatments were required, especially in light of the fact that a ladybird beetle predator, *Stethorus punctum* LeConte, was present on the farm and migrating to block where mite populations were increasing. Because of the low mite population, no followup bioassay was possible at the Gardiner site.

		ERM Bioassay*				NewPatz									
		% Mortality				Mean no mites** or eggs/leaf***									
Rate Form./ Acre		Application Dates				5 Jul				6 Jul		11 Jul		17 Jul	
Kelthane 35W	4.5 lb	Check	Carzol	Dicofol	Omite	ERM	ERME	TSM	ERM	ERME	ERM	ERME	ERM	ERME	
		17.8	93.4	73.1	100.0	13.9	24.5	2.6	2.1	22.3	1.6	25.4			
Omite 35W	7.5 lb	25 Jul				25 Jul		4 Aug							
		Check	Carzol	Dicofol	Omite	ERM	ERME	ERM	ERME						
		23.5	95.3	48.9	98.8	10.7	48.8	3.8	21.2						
Modena															
Kelthane 35W	4lb	6 Jun				25 Jul		26 Jul		4 Aug					
		Check	Carzol	Dicofol	Omite	Check	Carzol	Dicofol	Omite	ERM	ERME	ERM	ERME		
		67.1	100.0	93.7	100.0	21.7	93.1	80.7	98.6	5.8	22.5	0.9	8.9		
Omite 35W	4lb	14 Aug				14 Aug									
		Check	Carzol	Dicofol	Omite	ERM	ERME								
		68.8	97.7	100.0	100.0	7.5	16.1								
Gardner															
Kelthane 35W Vydate 1.8L	5lb 1.5 qt	27 Jul				27 Jul		4 Aug							
		Check	Carzol	Dicofol	Omite	ERM	ERME	ERM	ERME	ERM	ERME				
		20.7	98.6	90.6	98.6	15.3	15.7	0.9	29.6						

* Bioassay results based on average of four replicates of 20 adult female ERM per replicate.

* Bioassay results based on average of four replicates of 20 adult female ERM per replicate.

** ERM = European red mite, ERME = ERM eggs

*** Based on 25 leaves/ tree, from four trees/plot.

PEAR: *Pyrus communis*

Pear Psylla: *Psylla pyricola* Forester

Pear rust mite: *Eptitrimerus pyri* (Nalepa)

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PEAR, PEAR INSECT AND MITE CONTROL, HUDSON VALLEY LAB, HIGHLAND, NEW YORK, 1989: Treatments were applied to 8 tree plots replicated 3 times in a randomized complete block design. Each plot contained 4 'Bartlett' and 4 'Bosc' cultivars, spaced 12 x 18 ft., 12 ft. in height and 15 years old. Treatments were applied by high-pressure handgun sprayer dilute to runoff at 350 psi using from 1.9 to 2.1 gal/tree (380 to 421 gal/acre). Treatments were applied at white bud, 2 May, petal fall, 14 May, and/or in cover sprays on 7 Jun, 14 Jun, and 4 Jul. Supracide 2EC 2 pt/100 gal plus Sunspray oil 6E 1 gal/100 gal were applied by handgun on 13 Apr over the entire block for San Jose scale control. Additional applications made for disease control over the entire block included: Captan 50W 2 lb/100 gal, on 25 May, 8 Jun, 23 Jun, and 15 Jul. Pear psylla were evaluated by collecting 5 Bartlett spurs (25 leaves) from each plot on 25 May and 8 Jun, and thereafter 5 Bartlett shoots (25 leaves) from each plot on 20 Jun, 30 Jun, 13 Jul, 24 Jul, and 9 Aug. All live pear psylla nymphs and eggs on each leaf were counted in the laboratory using a binocular scope. Pear rust mite populations were assessed by examining the same leaves used in most of the preceding psylla samples. These leaves were viewed with the aid of a binocular scope and all live mites counted. Temperatures were generally cooler than normal due to the continually overcast conditions found during much of the summer. Rainfall was above normal during May, Jun and Aug. The constant rainfall resulted in continual infections of fabrea leaf spot, which eventually defoliated several of the plots.

The Agri-Mek plus oil applications provided the best control of pear psylla and pear rust mite throughout the season. Metasystox-R provided suppression of the pear rust mite but not of the pear psylla. The combination of increased pear psylla and pear rust mite activity in the other plots resulted in an increased incidence of fabrea leaf spot in these plots. Defoliation was quite common at the end of August in the check, EF-667, and DB-8518829 treatments.

Treatment	Rate form /100 gal.	Application dates	Mean no. Pear psylla nymphs or eggs & Pear rust mites (PRM)/ 5 spurs or shoots					
			25 May		8 Jun		20 Jun	
			Nymphs	Eggs	PRM	Nymphs	Eggs	PRM
1. Metasystox-R 2SC.....	16.0 oz.....	14 Jun						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun						
Mitac 1.5 EC.....	16.0 oz.....	4 Jul.....	14.7a	27.7a	57.0a	17.3a	320.0a	20.7a
							119.7a	650.3a
								71.0a
2. EF-667 5% EC.....	4.8 oz.....	2 May, 14 Jun, 4 Jul						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun.....	8.3a	13.0a	5.0a	11.0a	152.0a	43.7a
							24.0a	425.3a
								73.7a
3. DB-8518829 10SC.....	2.4 oz.....	2 May, 14 Jun, 4 Jul						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun.....	8.3a	14.3a	25.0a	14.0a	270.3a	60.7a
							90.0a	571.7a
								396.0a
4. EF-667 5% EC.....	4.8 oz.....	14 Jun, 4 Jul						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun.....	8.0a	3.3a	31.0a	13.7a	252.6a	159.0a
							67.0a	458.7a
								475.0a
5. DB-8518829 10SC.....	2.4 oz.....	14 Jun, 4 Jul						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun.....	12.3a	5.0a	29.0a	6.3a	188.3a	52.0a
							103.3a	627.7a
								315.0a
6. Agri-Mek .15EC.....	2.5 oz.....	14 Jun, 4 Jul						
Clean Crop Supreme Oil.....	32.0 oz.....	14 Jun, 4 Jul						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun.....	40.3a	2.7a	8.3a	31.3a	193.0a	16.7a
							55.0a	197.7a
								5.3a
7. Agri-Mek .15EC.....	5.0 oz.....	14 Jun, 4 Jul						
Clean Crop Supreme Oil.....	32.0 oz.....	14 Jun, 4 Jul						
Guthion 35W.....	8.6 oz.....	14 May, 7 Jun.....	28.0a	1.7a	0.3a	23.0a	330.3a	91.3a
							81.0a	308.7a
								12.0a
8. Check.....			19.0a	2.7a	5.0a	7.7a	293.0a	27.3a
							101.7a	417.0a
								41.7a

Mean no. Pear psylla nymphs or eggs & Pear rust mite (PRM)/ 5 spurs or shoots

Treatment	30 Jun			13 Jul			24 Jul			9 Aug		
	Nymphs		Eggs	Nymphs		Eggs	Nymphs		Eggs	Nymphs		Eggs
1.....	134.0a	529.0a	5.7a	45.7a	14.7ab	160.0a	29.0a	24.3a	32.3a	299.0a		
2.....	90.3a	429.3a	21.7a	217.3cd	306.0b	203.3a	94.3a	509.0b	94.0a	457.0a		
3.....	140.7a	441.3a	45.3a	434.7d	440.0b	522.0a	74.0a	1719.3b	108.7a	672.3a		
4.....	175.3a	554.0a	12.3a	194.3bc	1036.0b	162.3a	27.0a	649.0b	31.3a	334.7a		
5.....	155.0a	288.3a	45.3a	348.0cd	96.7ab	292.3a	68.3a	582.0b	176.7a	699.7a		
6.....	36.0a	198.7a	16.0a	20.0a	0.0a	196.0a	19.3a	2.3a	132.7a	270.3a		
7.....	56.3a	307.0a	17.3a	54.7ab	0.0a	151.0a	50.7a	2.0a	110.0a	315.3a		
8.....	100.3a	242.7a	34.3a	185.7cd	169.0ab	229.3a	20.7a	728.3b	58.7a	312.0a		

Treatment means followed by the same letter are not significantly different ($p < 0.05$; LSD). Data were transformed to $\log_{10}(X + 1)$ for analysis.

Untransformed data are presented.

PEAR: *Pyrus communis*

Comstock mealybug: *Pseudococcus comstocki* (Kuwana)

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PEAR, COMSTOCK MEALYBUG CONTROL, MARLBORO, NEW YORK, 1989: A twenty-five-year-old pear block containing the "Bosc" and "Bartlett" cultivars was located near Marlboro, NY, and had a recent history of infection by comstock mealybug. The trees were spaced 17 by 20 ft, were 16 feet high, and 12.5 ft wide. The block was divided into 9-12 tree (.07-.09 acre) plots, arranged in a 3x3 or 3x4 configuration, so that trees would serve as buffers during airblast sprays. Two airblast treatments and a check were arranged in a randomized block design with three replicates. Situated within the check plot borders were single tree plots replicated three times for the Lorsban handgun applications. This was done so that as little fruit as possible would be destroyed at harvest since Lorsban was not registered for use on pears. San Jose scale crawler traps (black plastic tape wrapped around the trunk or branches of a tree and coated with a thin strip of cockstop grease down the middle of the tape) were deployed at petal fall throughout the orchard, and checked on a weekly to bi-weekly basis for comstock mealybug activity. Mealybug activity was first noted on 10 Jul, and the first treatments were applied on 15 Jul. Dilute rates were concentrated two times and delivered at per acre rates of 180 (15 Jul) and 284 (27 Jul) gal per acre with a Friend® airblast sprayer traveling at 2.5 mph. This resulted in per acre rates of 64.0 oz (15 Jul) and 91.0 oz (27 Jul) of formulated PennCap M, and 72.0 oz (15 Jul) and 117.0 oz (27 Jul) of formulated Sevin 80S. Per acre rates of formulated Lorsban 50W were 6.4 lb (15 Jul) and 6.8 lb (27 Jul) based on applying 5 gal spray/tree of the 1.0 lb/100 gal dilute spray. The grower applied PennCap M in a single application to the remainder of the block at the rate of 106.6 oz of formulated material per acre on 17 Jul. Additional applications over the entire block made by the grower with an airblast sprayer using 80 gal spray/acre at 2.5 mph included: Guthion 35W 1.5 lb/acre, 26 Apr, 20 May, and 8 Jun; Manzate 200 4.5 lb/acre, 26 Apr, 8 Jun, and 8 Jul; Mitac 1.5E 4.5 pt/acre, 22 Jun, 8 Jul, and 16 Aug; Carzol 92SP 1.0 lb/acre, 20 May; Morestan 25W 4.5 lb/acre, 26 Apr; Captan 50W 6.0 lb/acre, 17 Jul, and 16 Aug; and Imidan 50W 3.0 lb/acre, 16 Aug. Comstock mealybug was evaluated in the block on 26 Jul and again on 23 Aug by harvesting 50 "Bartlett" fruits from a tree in the middle of each plot. The fruits were brought back to the laboratory where they were cut in half and the calyx end of each half examined for the presence of live or dead mealybugs.

The Lorsban applied by handgun sprayer resulted in the most complete control of comstock mealybug at both evaluation times. At the first evaluation most of the mealybug infested fruit which had been treated with the Lorsban contained dead larvae. The two applications of PennCap provided slightly better control of the mealybug than did the single application applied by the grower. The slightly higher rate used in the second application as well as the increased spray gallonage improved the control of both the PennCap and Sevin compared with the first evaluation. Overall, the Sevin applications were least effective for mealybug control.

Treatment	Rate Form /Acre	Application dates	26 Jul				26 Jul			
			% Comstock mealybug Live mealy bugs	Infested Fruit Dead mealybug	% Clean fruit	% Comstock mealybug Live mealy bugs	Infested Fruit Dead mealybug	% Clean fruit	% Comstock mealybug Live mealy bugs	% Clean fruit
1. Pennncap M*	64.0 oz	15 Jul	11.3	16.0	72.7	2.7	10.0	87.3		
	91.0 oz	27 Jul								
2. Sevin 80S*	72.0 oz	15 Jul	51.0	13.3	36.0	21.3	26.0	53.3		
	117.0 oz	27 Jul								
3. Lorsban 50W**	6.4 oz	15 Jul	1.0	14.7	85.3	0.0	0.0	100.0		
	6.8 oz	27 Jul								
4. Pennncap M***	106.6 oz	17 Jul				6.0	20.0	74.0		
5. Check			74.0	2.7	23.3	45.3	20.6	34.0		

* Applied by airblast sprayer

** Applied by handgun.

***Applied by airblast sprayer (grower's).