PROCEEDINGS

61st Cumberland-Shenandoah Fruit Worker's Conference

Held at Cliffside Inn, Harpers Ferry, West Virginia

November 21-22, 1985

Host: Pennsylvania

General Chairman, Dr. Loren D. Tukey
General Secretary, Dr. Edwin G. Rajotte

Section Chairmen

Entomology and
Plant Pathology, Dr. James W. Travis

Pomology, Dr. Robert M. Crassweller

Hosts for Future Meetings

1986	West Virginia
1987	New Jersey-South Carolina
1988	Virginia
1989	Maryland
1990	North Carolina
1991	USDA
1992	Pennsylvania

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61ST ANNUAL MEETING

CUMBERLAND-SHENANDOAH FRUIT WORKERS CONFERENCE

Harpers Ferry, West Virginia

November 21-22, 1985

The 61st Annual Meeting of the Cumberland-Shenandoah Fruit Workers Conference was called to order at 9:00 a.m. on November 21, 1985 by Horticulture Division Coordinator Robert Crassweller. The meeting was hosted by The Pennsylvania State University. Robert Crassweller appointed Steve Blizzard, Tara Baugher, and Joe Barrat as nominating committee to select the 1985 slate of officers. The hosts for the fruit meetings are as follows:

1986 - West Virginia
1987 - New Jersey-South Carolina
1988 - Virginia
1989 - Maryland
1990 - North Carolina
1991 - USDA
1992 - Pennsylvania

The morning joint session began at 9:20 a.m. with 73 persons in attendance. Ed Rajotte served as moderator. There were four papers of general interest presented:

McConnell, R. L. and K. C. Elliot. Measurement of Tree Volume Using Electronic Technology.

Walsh, C. S., F. Allnutt and E. Dutky. Observations on the growth and precocity of scab-immune apple cultivars grown under a range of pesticide schedules.

Jaffee, B. A. and C. A. Powell. Incidence of prunus necrotic ring spot virus in Pennsylvania peach orchards and nurseries.

Hull, L. A., E. H. Beers, G. M. Greene and J. W. Grimm. Effects of mite injury on apple growth and productivity and a model for determining economic injury levels.

Entomology and Plant Pathology met in a joint session following lunch while Horticulture met separately.

An evening session, moderated by Ed Rajotte, concerned the organization of a clearinghouse for fruit management decision making rules. These rules could include pest management action thresholds, nitrogen recommendations using leaf analysis, orchard scouting procedures, etc. Attendants were asked to complete a questionnaire that identified their willingness to contribute to such a database and the types of information they could contribute. Follow-up mail surveys will obtain further detailed information from these participants and identify other fruit specialists who may want to contribute.

Entomology, Plant Pathology, and Horticulture all met separately on the morning of November 22.

Following the submitted paper sessions a joint session was held where representatives of each of the states reviewed events affecting the fruit industry from the past year. Rob Crassweller moderated. Highlights included the effect of extremely cold winter temperatures on trees, the impact of widespread flooding in West Virginia and Maryland, and the approach of brood X of the 17 year cicada.

The closing business meeting was called to order at 11:30 a.m. by Ed Rajotte. Rob Crassweller, division coordinator for Horticulture, Jim Travis for Plant Pathology, and Ed Rajotte for Entomology presented their respective reports. Ed Rajotte also gave the financial report. The nominating committee presented the following slate of officers for the 1986 meeting: Roger Young, chairperson; Henry Hogmire, general secretary; Joe Barrat, Pland Pathology-Entomology division coordinator; Tara Baugher, horticulture division coordinator; Jim Kotcon, Plant Pathology and Entomology secretary; Morris Ingle, Horticulture secretary.

It was decided that the 1986 meeting would also be held at the Cliffside Inn, Harpers Ferry, on November 20-21.

FINANCIAL REPORT

Income	
Balance Forward, November 1983	$ 344.81
Interest	14.67
Registration 79 @ $10.00	790.00
TOTAL	1,149.48
Expenses	
Coffee Breaks	282.75
Stamps	40.00
Nametags	5.76
Registration clerks' lunch	8.88
Federal Withholding Tax	2.94
TOTAL	340.33
GRAND TOTAL, December 31, 1985	809.15

Due to recent legislation requiring withholding from interest on savings accounts we were forced to apply to the Inernal Revenue Service for tax exempt status. This will allow the withheld tax to be refunded to us.

Respectfully submitted,

Edwin G. Rajotte
General Secretary and Treasurer

esr

Papers Presented
at the
61st Cumberland - Shenandoah Fruit Workers' Conference

General Session

Prunus necrotic ring-spot virus in Pennsylvania peach orchards and nurseries.
B. A. Jaffee, C. A. Powell, and M. A. Derr.

Entomology and Plant Pathology Session

Apple, acaricide trial, 1985 - Steeles Tavern.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smothers.

Apple, mite control trial, 1985 - Steeles Tavern.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smothers.

Apple, apollo rate trial, 1985 - Roseland.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smothers.

Apple, savey volume trial, 1985 - Steeles Tavern.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smothers.

Apple, savey - vydate trial, 1985 - Daleville.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smoothers.

Apple, savey/oil mite trial, 1985 - Cana.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smoothers.

Apple, San Jose scale trial, 1985 - Fairfield.
D. G. Pfeiffer, L. F. Ponton, M. W. Varn, T. J. Boucher, and V. Smoothers.

Apple, foliar pest trial, 1985 - Steeles Tavern.
D. G. Pfeiffer, and L. F. Ponton.

Apple, kelthane phytotoxicity trial, 1985 - Fairfield.
D. G. Pfeiffer, L. F. Ponton, and M. W. Varn.

Apple, herbicide effects on mites, 1985 - Steeles Tavern.
D. G. Pfeiffer, L. F. Ponton, and M. W. Varn.

Persimmon psyllid control trial and effect on root growth.
D. G. Pfeiffer, P. J. Smetner, and H. D. Stiles.

Evaluation of Bayleton + Dithane M-45 combinations on Jonathan apple, 1985.
K. S. Yoder, A. E. Cochran II, J. R. Warren, C. M. Schmidt, and N. H. Gray.

Control of penicillium blue mold by post harvest dip treatments, 1984-85.
K. S. Yoder, A. E. Cochran II, and C. M. Schmidt.

Control of leaf curl on Babygold-5 peach, 1985.
K. S. Yoder, A. E. Cochran II, J. R. Warren, N. H. Gray, and C. M. Schmidt.

Apple, full season insecticide evaluation, 1985.
R. L. Horsburgh, and L. J. Cobb.

Apple, evaluation of MO070616 + SD014114 (Vendex) in full season and in post bloom applications, 1985.
R. L. Horsburgh, and L. J. Cobb.

Apple, miticide evaluation, 1985.
R. L. Horsburgh, and L. J. Cobb.

Horticulture Session

Effect of grass herbicides on downy brome growth.
R. S. Young.

Efficacy of different formulations of triclopys for controlling Virginia creeper in apple orchards.
T. J. Tworkoski, R. S. Young, and J. P. Sterrett.

Effect of grass management on soil moisture in an orchard system.
W. V. Welker, Jr., and D. M. Glenn.

Weed control in one-year apple plantings in Virginia: a two-year summary.
C. L. Fox, and H. L. Witt.

The interaction of soil management system and rainfall infiltration in a young peach planting.
D. M. Glenn, and W. V. Welker.

Effect of bud position on time of flowering and fruit quality in peach.
C. Grappadelli L., and D. C. Coston.

Summer pruning effects on canopy development of newly planted peach trees.
S. C. Myers.

Prunus Necrotic Ringspot Virus in Pennsylvania Peach Orchards and Nurseries

B. A. Jaffee [1], C. A. Powell [2], and M. A. Derr [2]

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Researchers have long recognized that Prunus necrotic ringspot virus (PNRSV) is one of the most common viruses found in stone fruits (8). It was generally assumed that the incidence of PNRSV was reduced recently due to the development of virus-indexing programs. However, reports from West Virginia and South Carolina showed that the virus is still common in those states (1,2,4).

PNRSV is a recognized and serious pathogen of cherry but its effect on peach is less clear (8). Some reports indicated that PNRSV reduced yield and induced canker and decline symptoms on peach (8,9,10,13). Most researchers considered PNRSV latent, i.e., the virus was present in the tree but did not induce symptoms after an initial shock period. Researchers recently found that certain isolates of PNRSV induce canker and decline symptoms of peach in Georgia (14). Because peach decline is a serious problem in the east, we are conducting surveys and inoculation experiments to help clarify the contribution of PNRSV to peach decline.

In Pennsylvania in the spring of 1984-85, we assayed and rated 23-30 trees per orchard in four orchards each of cultivars Loring, Redhaven, and Garnet Beauty. ELISA was used to assay for PNRSV, and the trees were rated for canker (none, moderate, or severe) on the trunk or main scaffolds. Within each orchard, we tried to select 10 trees in each canker category. Sixteen percent of 324 trees were positive for PNRSV. Among orchards, the median and range of PNRSV-infected trees were 6% and 0-83%, respectively. If data from all orchards were combined, a correlation between incidence of virus and canker of the trunk or scaffolds was observed. However, no statistical relationship between virus and canker was detected if two orchards with high incidences of PNRSV were removed from the data set.

These correlative data can't prove the involvement or lack of involvement of PNRSV in peach decline. They do show that many declining trees are not infected with the virus and that some apparently healthy trees are infected. The data also show that, as previously reported for West Virginia, South Carolina, and Georgia, the incidence of PNRSV is high in some peach orchards. We believe that more experiments (as opposed to observations or surveys) are needed to clarify the relationship between PNRSV and tree decline in peaches. The role of PNRSV in peach decline remains uncertain for the following reasons:

1. Many different strains of PNRSV exist. The virulence of these strains varies. Some strains may cause no symptoms (3,5,7,8).
2. Symptom expression may be greatly influenced by environment, host status, and cultivar (5,8).
3. Symptom expression may be greatly influenced by the presence of other viruses (11,12).

In August, 1985, we started a long-range experiment to determine the effects of two isolates of PNRSV (one isolate from a tree with severe canker and the other isolate from an apparently healthy tree) on Sunhigh peach trees. In the nursery row, 210 certified Lovell seedlings were budded with noninfected buds or buds infected with either of two isolates of PNRSV. In 1986, the trees will be observed in the nursery, and in 1987 they will be planted in the orchard for long-term research.

PNRSV can be spread via buds, seeds, and pollen (6,8). We suspect that bud and seed transmission account for many PNRSV infections in peaches. In 1985, we assayed a total of 200 Loring and 200 Garnet Beauty peach trees in the nursery row of three Pennsylvania nurseries. Virus incidence ranged from 0-10%. At a subsequent meeting of the Fruit Tree Improvement Advisory Board of Pennsylvania, it was impressed upon the nursery managers that, although the importance of PNRSV remains controversial, it is essential that virus-free trees are provided to growers.

Literature Cited

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Acaricide Trial, 1985 - Steeles Tavern

APPLE; Malus Xdomestica 'Delicious'
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)

APPLE, ACARICIDE TRIAL, 1985: Several acaricides were evaluated against mites in an apple block at Steeles Tavern. Four, single-tree replicates were used in a completely randomized design. Spray dates were Jun 3 and Aug 13. Applications were made using a truck-mounted Swanson sprayer with a handgun attachment. Trees were sprayed to drip (roughly 1869 L/ha (200 gal/A)). Unsprayed buffer trees were left between each replicate. Mites were evaluated using a leaf-brushing machine and 20 leaves per replicate. Because of low ERM densities in all plots, a spray of fenvalerate (1.17 L/ha (1 pt/A)) was applied on Jul 16.

There were no differences in active ERM between treated plots and the control on the first two sampling dates. On Jul 9, UC63152 and the lower rate of UC74425 had higher mite densities than the control. ERM populations in the control had risen by Aug 19. Populations were suppressed by UC72719, UC72718, UC74425, and Plictran.

ERM per leaf*

Material, amt. form/100 gal	Jun 10		Jun 19		Jul 9		Jul 24		Aug 6		Aug 19	
	mites	eggs	mites	eggs	mites	eggs	mites	eggs	mites	eggs	mites	eggs
UC63152 4EC 94.5 ml	9.9c	12.6a	2.3a	4.9ab	12.2a	7.7a	11.3bc	40.1c	78.8c	27.0ab	73.4c	27.8bc
UC63152 236.2 ml	9.4bc	11.8a	3.6a	2.3a	12.4a	11.4a	17.4c	36.8c	114.6bc	64.2bc	15.1ab	19.9abc
UC72719 0.5 EC 757 ml	2.3ab	10.2a	0.1a	3.7ab	0.8b	1.2b	3.5ab	3.7a	9.9a	13.5a	3.5a	19.3abc
UC72719 3785 ml	1.6ab	12.0a	0.5a	3.1ab	0.2b	1.0b	0.4a	3.5a	10.1a	5.3a	1.1a	7.6a
UC72718 0.5EC 757 ml	2.6abc	14.2a	0.1a	2.5a	0.6b	2.0b	0.9a	2.3a	7.3a	13.5a	4.7a	31.4bc
UC72718 3785 ml	7.8bc	17.2a	0.9a	6.8ab	0.8b	1.0b	5.4abc	10.2ab	171.4ab	35.4ab	20.2ab	35.9c
UC74425 0.5EC 378 ml	6.1abc	16.2a	2.4a	10.2b	17.2a	11.7a	45.9d	26.7bc	119.5c	84.0c	20.4ab	79.9d
UC74425 757 ml	0.9a	6.5a	0.2a	1.2a	0.5b	0.5b	2.3ab	3.3a	5.6a	7.3a	6.1a	9.1a
Plictran 50W 114g	2.7bc	6.9a	1.0a	1.1a	0.7b	0.7b	3.7ab	5.9a	21.9ab	5.9a	4.7a	18.6ab
Control	8.6abc	11.2a	0.6a	2.2a	0.5b	0.6b	2.1a	3.0a	9.3a	16.1ab	45.9bc	27.8bc

*Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 5% level).

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Mite Control Trial, 1985 - Steeles Tavern

APPLE: Malus *Xdomestica*
European red mite (ERM): *Panonychus ulmi* (Koch)
Apple rust mite (ARM): *Aculus schlechtendali* (Nalepa)

APPLE, MITE CONTROL TRIAL, 1985: Several acaricides were evaluated against mites in an apple block at Steeles Tavern. The block included the cultivars 'Delicious', 'Golden Delicious', 'Stayman' and 'York'. Four, single-tree replicates were used in a randomized complete block design. Applications were made on June 3, using a truck-mounted Swanson sprayer with handgun attachment. Trees were sprayed to drip (roughly 1869 L/ha (200 gal/A)). Mites were evaluated using a leaf-brushing machine and 20 leaves per replicate. Because of low ERM densities in all plots, a spray of fenvalerate (1.17 L/ha (1 pt/A)) was applied on July 16.

UC72718-treated trees supported greater ERM densities than did the other treatments, especially at the higher rate. Few other differences were evident throughout most of the season, probably due in part to the low pressure from ERM. On the last sampling date, ERM egg density had increased in the control but were significantly lower on all treated trees.

Plictran, Kelthane and Morestan are the only acaricides that lowered ARM densities early in the season. UC74425 at the higher rate was the only treatment which still had ARM densities significantly lower than the control on August 14. On the last sampling date ARM densities had increased somewhat in the control but remained low on all other treatments.

ARM per leaf*

Material, amt form/100 gal	Jun 10	Jun 19	Jul 9	Jul 24	Aug 6	Aug 19
UC63152 4EC 94.5 ml	146.1a	7.4ab	24.0a	18.5ab	4.0ab	0.2a
UC63152 236.2 ml	30.1a	1.7a	1.9ab	4.8a	0.9a	0.6a
UC72719 0.5EC 757 ml	102.0a	29.5bc	71.9abc	51.8bc	13.0ab	13.1b
UC72719 3785 ml	50.7a	23.5bc	106.1bc	101.9c	27.8bc	5.2ab
UC72718 0.5EC 757 ml	206.7a	75.3de	80.0abc	37.2ab	21.3bc	10.3b
UC72718 3785 ml	182.7a	56.9cd	134.6c	46.5bc	51.6c	3.6ab
UC74425 0.5EC 378 ml	206.4a	130.8e	71.3abc	34.2ab	14.4ab	6.9ab
UC74425 757 ml	225.3a	32.2bc	81.0abc	20.4ab	15.3ab	3.7ab
Plictran 50W 114g	347.1a	150.2f	60.3abc	58.7bc	2.3ab	2.2ab
Control	86.8a	12.2ab	35.9ab	46.2bc	23.6bc	39.8c

*Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 5% level).

ERM per leaf*

Material, amt form/100 gal	Jun 12 motile	Jun 12 eggs	Jun 20 motile	Jun 20 eggs	Jul 11 motile	Jul 11 eggs	Aug 14 motile	Aug 14 eggs	Aug 22 motile	Aug 22 eggs	Aug 28 motile	Aug 28 eggs
UC72718 0.5EC 757 ml	8.6a	4.1abc	2.1ab	12.7ab	6.1a	5.3a	11.5a	13.0a	29.2a	11.2b	15.6a	6.3a
UC72718 3785 ml	11.2a	8.0a	5.1a	18.6a	6.5a	5.3a	10.5ab	9.2a	7.3ab	19.6b	11.0a	8.4a
UC74425 0.5EC 378 ml	0.6b	0.6bc	0.0b	0.6b	0.2b	0.6b	2.0c	4.3a	2.7b	11.9b	17.2a	10.5a
UC74425 757 ml	5.8ab	5.9ab	0.6b	2.0b	0.3b	0.6b	8.4ab	9.1a	12.2ab	24.5a	6.1a	13.2a
Plictran 50W 114 g	0.5b	0.2c	0.0b	0.3b	0.3b	0.1b	2.9bc	4.4a	10.1ab	11.5b	11.4a	8.1a
Kelthane 4F 237 ml	3.5ab	2.6abc	0.7ab	1.1b	0.3b	0.7b	5.1abc	9.3a	5.5b	10.2b	10.9a	9.9a
Morestan 25 W 454 g	3.3ab	2.3abc	1.0ab	1.0b	0.6b	0.5b	2.9bc	8.8a	16.7ab	11.7b	22.2a	8.5a
Control	0.3b	0.2c	0.8b	1.3b	0.1b	0.2b	5.2abc	5.3a	18.4ab	9.3b	13.3a	15.6b

*Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 5% level).

ARM per leaf*

Material, amt. form/100 gal	Jun 12	Jun 20	Jul 11	Aug 14	Aug 22	Aug 28
UC72718 0.5EC 757 ml	562.9ab	426.7a	81.6a	3.3ab	1.4a	0.0a
UC72718 3785 ml	749.5a	392.6a	72.2a	2.4ab	6.0a	0.8a
UC74425 0.5EC 378 ml	335.2bc	148.6bc	58.9a	5.2ab	3.3a	1.9b
UC74425 757 ml	441.4abc	251.9b	139.7a	1.5b	4.1a	0.9b
Plictran 50W 114 g	74.8d	54.2c	93.2a	5.7ab	3.6a	3.2b
Kelthane 4F 237 ml	232.3c	125.3bc	78.5a	4.3ab	2.9a	1.8b
Morestan 25W 454 g	255.7c	154.6bc	116.6a	4.09b	2.3a	1.2b
Control	584.0ab	249.6ab	58.9a	6.3a	4.2a	13.8a

*Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 5% level).

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Apollo Rate Trial, 1985 - Roseland

APPLE: Malus Xdomestica 'Rome'
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)
Predatory mite (AF): Amblyseius fallacis (Garman)

APPLE: APOLLO RATE TRIAL, 1985: Four rates of Apollo 50 SC were applied to an apple block at Roseland: 52.5, 105.0, 157.5, and 210.0 g ai/ha (.75, 1.5, 2.25, and 3 oz ai/A, respectively). Treatments were compared with an untreated control. Each plot consisted of 0.24 ha (0.6A). Sprays were applied at the pink stage of bud development (Apr 12). Applications were made with a truck-mounted Swanson sprayer. Applications were made at 551.4 L/ha (59 gal/A) (3x concentration, equivalent to 1645 L/ha (176 gal/A)). Mites were evaluated from four trees per treatment, using a leaf-brushing machine and 20 leaves per replicate.

Data from the first four sampling dates (May 1, 15, Jun 6 and 21) are given in Table 1. On Jun 21 (after leaves were collected), plots 1, 2 and 5 were sprayed with Kelthane 4F because of excessive bronzing in this commercial orchard. Table 2 gives data from subsequent counts in plots 3 and 4. These plots were sprayed with Carzol 92SP when mite densities exceeded a threshold.

The lowest rate of Apollo never gave control of ERM. Although the 105g rate was not different from the control, and had more ERM than the higher rates on the first sampling date, control was evident through June 6, when ERM population density had increased in the control. The 157.5g rate controlled ERM through June 27, and the highest (210g) rate until July 12. No effect was seen on AF.

Mites per leaf*

Table 1:

Treatment	gai/ha	1 May ERM	1 May RME	15 May ERM	15 May RME	6 Jun ERM	6 Jun RME	6 Jun ARM	21 Jun ERM	21 Jun RME	21 Jun ARM	21 Jun AF
Apollo 50SC	52.5	1.2a	7.5a	1.4a	0.4a	10.3a	24.0ab	0.2ab	41.7b	262.6b	0.0a	0.3ab
Apollo 50SC	105.0	0.6a	5.7a	1.1a	0.5ab	7.7a	25.8ab	0.0a	40.4b	256.6b	0.1a	0.8b
Apollo 50SC	157.5	0.0b	0.0b	0.0b	0.0a	3.9a	7.9bc	0.0a	3.9a	39.6a	0.0a	0.0a
Apollo 50SC	210.0	0.0b	0.4b	0.0b	0.0a	0.0a	0.8c	0.26ab	5.9a	61.7a	0.0a	0.2ab
Control		1.0a	11.8a	2.8a	1.2b	22.6b	45.1a	0.28b	66.1b	185.7b	0.0a	0.5ab

*Data transformed for analysis ($\sqrt{x+.5}$). Means followed by the same letter are not significantly different (DMRT; 5% level).

Table 2: Data from unsprayed plots to determine when threshold exceeded*

Treatment	gai/ha	27 Jun ERM	27 Jun RME	27 Jun ARM	27 Jun AF	12 Jul ERM	12 Jul RME	12 Jul ARM	12 Jul AF
Apollo 50SC	157.5	4.4	7.2	0.6	0.0				
Apollo 50SC	210.0	5.0	11.2	0.2	0.6	12.6	15.0	0.1	1.5

*5 mites per leaf until 1 Jul, 10 mites per leaf thereafter

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Savey Volume Trial, 1985 - Steeles Tavern

APPLE: Malus Xdomestica 'Delicious'
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)

APPLE, SAVEY VOLUME TRIAL, 1985: Savey (367.5 g form/ha (5.25 oz/A)) was applied to an apple block at Steeles Tavern, in 3 volumes of water; 1252.3, 654.2 and 233.6 L/ha (134, 70 and 25 gal/A, respectively). Each plot consisted of ca. 0.1 ha (0.25A). Applications were made with a truck-mounted Tifone airblast sprayer. The spray date was Apr 12. Mites were sampled from four 'Delicious' trees per treatment, using a leaf-brushing machine and 20 leaves per replicate.

This rate of Savey gave good control of ERM at all three volumes of water in which the material was applied. Control was sustained through the last sampling date in mid-July. On the first two sampling dates, ARM were present in greater densities on trees receiving the second-highest volume of water.

ERM per leaf*

Material	g form. per ha	L water per ha	May 1 mites	May 1 eggs	May 21 mites	May 21 eggs	Jun 13 mites	Jun 13 eggs	Jul 17 mites	Jul 17 eggs
Savey 50 WP	367.5	1252.3	0.0a	0.0a	0.0a	0.0a	0.0a	0.0a	0.0a	0.4a
Savey 50 WP	367.5	654.2	0.0a	0.3a	0.0a	0.0a	0.3a	0.0a	0.0a	0.2a
Savey 50 WP	367.5	233.6	0.0a	0.1a	0.0a	0.0a	0.3a	0.0a	0.2a	0.0a
Control			0.1a	3.8b	1.4b	1.5b	5.3b	3.3b	1.4b	2.4b

*Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 0.05 level).

ARM per leaf*

Material	g form. per ha	L water per ha	May 1	May 21	Jun 13	Jul 17
Savey 50 WP	367.5	1252.3	10.92a	135.6a	502.4a	38.9a
Savey 50 WP	367.5	654.2	20.6b	207.9b	459.0a	31.4a
Savey 50 WP	367.5	233.6	10.1a	117.0a	519.4a	33.0a
Control			12.4ab	125.7a	229.4a	53.1a

*Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 0.05 level)

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Savey - Vydate Trial, 1985 - Daleville

APPLE: Malus Xdomestica 'Delicious'
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)
Predatory mite (AF): Amblyseius fallacis (Garman)

APPLE, SAVEY - VYDATE TRIAL, 1985: Two rates of Savey 50 WP were evaluated with and without Vydate 2L in an apple block in Daleville, Virginia. Applications were made with a truck-mounted Tifone airblast sprayer, at 140 gal/A, on April 10 (pink stage of bud development). Mites were evaluated using a leaf-brushing machine and 20 leaves from each of four trees per treatment.

ERM pressure was low until June, particularly the last sample date, June 25. However, all treatments were different from the control throughout the season. Neither ARM nor AF were present until the last sampling date; AF were reduced by all treatments relative to the control. Factorial analysis was used to evaluate differences among the Savey-Vydate combinations on June 25. The higher rate of Savey yielded significantly lower ERM densities than the lower rate. However, when Vydate was added, there were greater ERM densities than when Savey was applied alone. There was a highly significant interaction in the factorial analysis; the increase in ERM densities resulting from Vydate was much less pronounced at the higher rate of Savey than at the lower. This effect could have been because of a toxic effect on AF by Vydate; however, AF densities were low and variable, and there were no significant differences.

ERM per leaf*

Material, amt. form./100 gal.	April 30		May 14		June 5		June 25		25 June	
	active	eggs	active	eggs	active	eggs	active	eggs	ARM	AF
Savey 50 WP 42.5 g	0.0a	0.0a	0.2a	0.7a	0.3a	3.6a	1.1a	11.6a	0.6a	0.2a
Savey 50 WP 42.5 g & Vydate 2 L 236.6 ml	0.1a	0.0a	0.1a	0.8a	0.1a	3.7a	10.8b	30.2a	0.8a	0.0a
Savey 50 WP 56.7 g	0.0a	0.0a	0.1a	0.4a	0.1a	0.7a	1.9a	0.9a	0.3a	0.1a
Savey 50 WP 56.7 g & Vydate 2 L 236.6 ml	0.1a	0.1a	0.0a	0.0a	0.2a	2.2a	2.7a	10.9a	1.5a	0.0a
Control	0.7b	3.1b	0.7b	3.4b	5.4b	50.0b	99.2c	330.8b	0.5a	6.6b

*Data transformed for analysis (x+5). Means followed by the same letter are not significantly different (DMRT; 5% level).

Table 2. Factorial analysis for ERM and AF data from Savey/Vydate combinations on June 25. Rates of formulation per 100 gal.[1]

Active ERM per leaf

Savey 50 WP	Vydate 2 L 0.0	Vydate 2 L 236.6 ml	
42.5 g	1.1	14.2	7.6
			*
56.7 g	1.9	2.7	2.3
	1.5	* 8.4	

Interaction **

ERM eggs per leaf

Savey 50 WP	Vydate 2 L 0.0	Vydate 2 L 236.6 ml	
42.5 g	11.6	30.2	20.9
			*
56.7 g	7.4	10.9	9.2
	9.5	+ 20.6	

Interaction n.s.

AF per leaf

Savey 50 WP	Vydate 2 L 0.0	Vydate 2 L 236.6 ml	
42.5 g	0.2	0.0	0.10
			ns
56.7 g	0.1	0.0	0.05
	0.15	ns 0.00	

Interaction n. s.

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[1] Data transformed for analysis ($\sqrt{x+5}$); ** - significant at 1% level, * - significant at 5% level, + - significant at 10% level.

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Savey/Oil Mite Trial, 1985 - Cana

APPLE: Malus Xdomestica 'Delicious'
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)

APPLE, SAVEY/OIL MITE TRIAL, 1985: Two rates of Savey 50 WP were evaluated on apple trees with and without a previous 70 sec. Superior oil application. The oil application was applied on March 26 (delayed dormant), at the rate of 22.71 L/100 gal (a 3x concentration). Savey was applied on 10 April (pink stage of bud development) at 134 gal/A, using a truck-mounted Tifone airblast sprayer. Mites were assessed using a leaf-brushing machine and 20 leaves per tree from four trees per treatment.

Mite pressure was low. Active mite densities ranged between 0.0 and 0.3, and eggs between 0.0 and 0.7, per leaf, on the first three sampling dates, April 29, May 14 and June 5. Data are shown for the last sampling date for ERM, and the last two sampling dates for ARM. All combinations of Savey and oil were effective at reducing ERM densities. Factorial analysis of June 26 data showed no significant difference between rates of Savey, but control was greater with the addition of oil, especially at the higher rate of Savey. ERM eggs were only moderately more reduced by the higher rate of Savey (10% level). Oil application significantly reduced ARM density, but ARM were present in greater density on trees receiving the higher Savey rate.

Material, amt. form/100 gal[2]		ERM per leaf[1] June 26 active	ERM per leaf[1] June 26 eggs	ARM per leaf[1] June 5	ARM per leaf[1] June 26
Savey 50 WP	42.5 g	0.1ab	1.4ab	0.1ab	5.9a
Savey 50 WP & Superior oil 70 sec.	42.5 g 22.7 L	0.2ab	1.6ab	0.4ab	3.4a
Savey 50 WP	56.7 g	0.3b	0.7ab	0.9b	19.9b
Savey 50 WP & Superior oil 70 sec.	56.7 g 27.7 L	0.0a	0.5a	0.1ab	5.3a
Superior oil	22.7 L	0.0a	1.2ab	0.1ab	1.2a
Control		2.1c	2.0b	0.8ab	13.5ab

[1] Data transformed for analysis ($\sqrt{x+5}$). Means followed by the same letter are not significantly different (DMRT; 5% level).

[2] Superior oil applied in a 3x concentrate spray.

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SAN JOSE SCALE TRIAL, 1985 - FAIRFIELD

APPLE: *Malus Xdomestica* 'Delicious'
San Jose scale (SJS): *Quadraspidiotus perniciosus* (Comstock)

APPLE, SAN JOSE SCALE TRIAL, 1985: Two insecticide combinations using Penncap M were compared with Penncap M and an untreated control for the control of SJS crawlers. Pesticides were applied to mature 'Delicious' trees in Fairfield, Va. Two applications were directed against each of two generations of SJS. The spray dates were May 30, Jun 14, Aug 5 and 16. Each treatment included 4 single-tree replicates in a completely randomized design. An unsprayed buffer tree was left between each sprayed tree. Applications were made with a truck-mounted Swanson sprayer with a handgun attachment.

Scale populations were assessed by counting SJS-infested fruit after each generation of scales had settled (on Jul 8 and Sep 16, respectively). Fifty fruit per tree were examined.

The three insecticide treatments gave statistically equivalent control of SJS infestation of fruit. Penncap is a standard insecticide used for SJS; the combinations are sometimes used for other pests (e.g. leafrollers) at approximately the same time as crawler activity periods.

Material, amt. form/100 L	SJS-infested fruit/50 fruit* Jul 8	Sep 16
Penncap 2 FM 125.0 ml	0.0a	0.2a
Penncap 2 FM 47.6 ml & Lorsban 50 W 44.9 g	0.0a	0.0a
Penncap 2 FM 62.5 ml & Lannate 1.8 L 62.5 ml	0.0a	0.5a
Control	0.0a	3.0b

*Data transformed for analysis ($\sqrt{x+5}$); Means followed by the same letter are not significantly different (DMRT, 0.05 level).

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FOLIAR PEST TRIAL, 1985 - STEELES TAVERN

APPLE: Malus Xdomestica
Spotted tentiform leafminer (STLM): Phyllonorycter blancardella (Fabr.)
White apple leafhopper (WALH): Typhlocyba pomaria (McAtee)
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)

APPLE, FOLIAR PEST TRIAL, 1985: Two pyrethroids and an organophosphate combination were evaluated against an untreated control in an apple block at Steeles Tavern, containing four cultivars: 'Delicious', 'Golden Delicious', 'Stayman', and 'York'. Four, single-tree replicates were used in a randomized complete block design. Applications were made using a truck-mounted Swanson sprayer with a handgun attachment. Trees were sprayed to the drip point (roughly 1869 L/ha (200 gal/A)). Spray dates were May 7, 30, Jul 3, 17, Aug 2 and 16. STLM was evaluated on Aug 14 by counting mines seen during a 3-minute examination of a tree's foliage. WALH-damaged shoots per 20 shoots on each tree were counted on Sep 17. Population densities of both of these insects were low. Mites were evaluated using a leaf-brushing machine and 20 leaves per replicate, on Jun 24 and Aug 14. Chlorophyll content was determined on Sep 23 using a hand-held chlorophyll meter.

Both pyrethroids gave excellent control of STLM. All of the pesticides controlled WALH. On the first sampling date, Pounce had induced significantly greater ERM populations than the other pyrethroid, Brigade. By the second sampling dates, this relation still held for ERM eggs; there were no significant differences in motile ERM densities. There were more ARM in the Penncap/Lorsban-treated trees on Jun 24. Chlorophyll analyses showed highest chlorophyll content in foliage treated with Brigade and Penncap/Lorsban. Use of a hand-held chlorophyll meter shows promise as a means of quantifying mite damage. Pending calculation of a standard curve for apple chlorophyll, the data presented are only a relative measure between treatments.

Material, amt. form./100 L	STLM mines per 3 minutes[1,2]	WALH-damaged shoots/20 shoots[1,2]	ERM per leaf[1,2]				TSM per leaf[1,2]	ARM per leaf[1,2]		Relative chlorophyll content[2]
			24 Jun		14 Aug					
			mites	eggs	mites	eggs		24 Jun	14 Aug	
Pounce 25W 44.9 g	0.0a	1.0a	68.0b	57.8b	27.2a	20.5b	2.0a	259a	11.1a	39.4a
Brigade 10W 40.7 g	0.0a	0.0a	6.2a	11.9a	6.5a	7.0a	0.1a	203a	23.2a	43.2b
Penncap 2FM 47.6 ml & Lorsban 50W 44.9 g	1.2ab	2.0a	34.0b	29.2ab	10.6a	19.2b	0.0a	688b	7.3a	41.9b
Control	8.8b	13.2b	7.7ab	10.2a	25.3a	12.2ab	0.0a	300a	18.2a	40.3a

[1] Data transformed ($\sqrt{x+5}$) for analysis.

[2] Means followed by the same letter are not significantly different (DMRT; 0.05 level).

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Kelthane Phytotoxicity Trial, 1985 - Fairfield

APPLE: *Malus Xdomestica* 'Golden Delicious'

APPLE: KELTHANE PHYTOTOXICITY TRIAL, 1985: Two formulations of Kelthane 4F, at two rates each, were applied in an apple block in Fairfield, Virginia. The commercial product and a 4F formulation with lower levels of DDT-related compounds (XF-85017). Applications were made using a truck-mounted Swanson sprayer as a 3x spray at 59 gal/A (176 gal/A dilute equivalent). Each plot was 0.14 A. Phytotoxicity was assessed compared to Plictran 50 and an untreated control. Spray dates were May 6 (petal-fall) and June 4 (second cover). Phytotoxicity was assessed by examining 20 fruit and 20 shoots per tree, from five trees per treatment. Ratings were completed on June 27, August 15, and September 16.

There was no evidence that the formulations of Kelthane (commercial vs XF formulations) were different regarding phytoxicity. Also there was no trend between low and high rates of Kelthane. The differences shown (which were not consistent across formulations or rates) were apparently a result of other factors in the orchard (e.g. drying patterns), because similar patterns were seen in nearby rows (uniformly treated).

Material, amt. form./A		Russeted fruit* per 20 fruit			Burned Shoots* per 20 shoots		
		27 Jun	15 Aug	16 Sep	27 Jun	15 Aug	16 Sep
Kelthane 4F (Commercial)	1.89L	0.0a	11.6a	5.2ab	1.4a	1.4a	0.0a
Kelthane 4F (Commercial)	3.79L	3.2b	9.4ab	6.4a	0.0b	1.2a	0.0a
Kelthane 4F (XF-85017)	1.89L	2.8b	7.2c	3.8ab	0.0b	2.2a	0.0a
Kelthane XF (XF-85017)	3.79L	0.4a	8.4bc	5.8a	0.8ab	2.4a	0.0a
Plictran 50W	340.2g	0.0a	1.4d	1.0c	0.0b	0.8a	0.0a
Control		0.0a	1.8d	2.6bc	0.2b	0.6a	0.0a

*Data transformed for analysis ($\sqrt{x+5}$); Means followed by the same letter are not significantly different (DMRT; 5% level).

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Herbicide Effects on Mites, 1985 - Steeles Tavern

APPLE: Malus Xdomestica 'Delicious'
Predatory mite (AF): Amblyseius fallacis (Garman)
European red mite (ERM): Panonychus ulmi (Koch)
Apple rust mite (ARM): Aculus schlechtendali (Nalepa)

APPLE, HERBICIDE EFFECTS ON MITES, 1985: A 2.5ha (1A) apple block at Steeles Tavern was put on a differential herbicide regime for the second year. Half of the block was treated with simazine, a herbicide which is nontoxic to AF. The remainder of the block was treated with simazine plus paraquat, a herbicide known to be toxic to AF. Applications were made on May 13, using a power-take-off orchard weed sprayer. Label rates were used in (100 gal/A). Both treatments included X-77 surfactant at the rate of 62 ml/100L (8 oz/100 gal).

Mites were sampled on 15 July and 23 July, using one 20-leaf sample from each of six trees per treatment. The paraquat-treated portion had approximately 8-fold and 13-fold higher populations of ERM motile forms and eggs, respectively, on the first sampling date. AF population density, although low, was significantly higher in the portion without paraquat. ERM populations were also higher in the paraquat block on the second sampling date. AF populations had increased, but numbers were too variable to yield statistically significant differences. There were no differences in ARM population densities on either sampling date.

The differences in ERM populations are probably due at least in part to differences in AF densities resulting from paraquat application. Another factor could have been increased foliar nitrogen in the paraquat block, resulting from decreased competition from weeds. This would cause an improved food source for ERM. Leaf samples were collected for N analysis.

		July 15				July 23			
		ERM				ERM			
Herbicide	Form. per 100 L	motile	eggs	AF	ARM	motile	eggs	AF	ARM
Paraquat & Simazine 80W	4.7L 5.6kg	12.5a	10.9a	0.00a	16.1a	3.3a	12.2a	0.1a	21.5a
Simazine	5.6kg	1.6b	0.8b	0.05b	15.9a	0.9b	1.9b	0.3a	24.3a

*Data transformed for analysis ($\sqrt{x+5}$); Means followed by the same letter are not significantly different at 0.05 level (ANOVA).

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PERSIMMON PSYLLID CONTROL TRIAL AND EFFECT ON ROOT GROWTH

PERSIMMON: Diospyros kaki L., D. Virginiana L.
Persimmon psylla (PP): Trioza diospyri (Ashmead)

PERSIMMON, PSYLLID CONTROL TRIAL, 1985: Two insecticides were tested against PP in a small Oriental persimmon block at Southern Piedmont Research and Continuing Education Center (Blackstone). Four, single-tree replicates were used in a randomized complete block design. The spray date was June 21, 1985. This was at the beginning of the second generation of PP. The application was made using a CO_2-powered backpack sprayer with one X-18 hollow cone nozzle at 60 psi. Five hundred ml of spray were applied to each tree.

Psyllid populations were assessed on June 26. Adults were counted on 3 terminal shoots per tree (the section of shoot included in the 5 apical leaves). Eggs and nymphs on 3 leaves per tree were counted under a binocular microscope.

Both Pounce and Cythion provided good control of PP. Nymphs that were found on treated trees were mostly late instar nymphs remaining from the first generation. These nymphs were protected within rolled leaf margins.

Table 1

Material, amt. form/100 L	Adults per 3 shoots*	Eggs* per leaf	Nymphs* per leaf
Pounce 25W 44.9 g	0.0a	1.40a	5.2a
Cythion 57 EC 187.6 ml	0.83ab	4.75a	7.4a
Control	2.42b	29.90b	24.15b

*Data transformed for analysis ($\sqrt{x+2}$); Means followed by the same letter are not significantly different (DMRT, 0.05 level).

First year seedlings of D. Virginiana exposed to naturally occurring populations of first-generation PP in Blackstone were maintained in an insectary at Steeles Tavern. Ten uninfested seedlings were sprayed with permethrin. Three generations of PP were allowed to develop on 10 unsprayed plants, after which plants were removed from pots, cleaned of soil and weighed.

Table 2

Mean No. Nymphs	g fresh weight[1] roots	stems
54.0	4.54a	0.86a
0.0	7.52b	0.82a

[1]t-test; 0.01 level

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Ambrosia Beetle Control Trial, 1985 - Ivy

GRAPE: Vitis vinifera 'Gewurtztraminer'
Ambrosia beetles (AB): Xylosandrus germanus (Blandford)
Xyleborinus saxeseni (Ratzeburg)

GRAPE, AMBROSIA BEETLE CONTROL TRIAL, 1985: Thiodan 50W (120g form/100L (=1 lb/100 gal)) was applied in a vineyard with a history of attack by AB. The spray was applied on Apr 19 using a vineyard airblast sprayer. Four vine rows were sprayed, ca. 0.2ha (0.5A).

Damage was evaluated on May 8 by visually examining vines for entry holes of AB. Twenty vines were examined per treatment.

The Thiodan treatment significantly reduced the number of attacked vines, although control was not complete. Because of the extremely early spring in 1985, some damage may have occurred before the spray date.

Material	amt. form. per 100 L	Percent vines attacked by AS*
Thiodan 50W	120g	35a
Control		70b

*Data transformed ($\sqrt{x+5}$) for analysis. Means followed by different letters are significantly different at 0.05 level (t-test).

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Effect of Rosy Apple Aphids on Photosynthesis and Leaf Chlorophyll

INTRODUCTION

Dysaphis plantaginea (rosy apple aphid), a sporadic and localized pest in Virginia orchards, is the most damaging of the three species of aphids common in apple. In bearing trees the greatest damage is to the fruit which are small and malformed. In non-bearing trees pigtailing of twigs destined to be support limbs or central leaders has been the greatest concern. Our research has shown that infestation by rosy apple aphid also reduces the growth of young apple trees by 50 percent. There are numerous causes of this reduction including water stress, phloem plugging, and reduced photosynthetic rate.

METHODS

Net photosynthesis was inferred from net exchange of carbon dioxide by single leaves using an infrared gas analyzer. Four groups of three leaves each were used. All leaves in each group were located within seven leaves of each other on the same shoot. One leaf in the group had no obvious rosy apple aphid injury, one leaf was curled less than 180 degrees as a result of rosy apple aphid feeding and one leaf was curled more than 360 degrees as a result of rosy apple aphid feeding.

Chlorophyll content was measured by macerating 100 mg fresh apple leaf tissue with ground glass in cold 80 percent (v/v) acetone for two minutes. Samples were centrifuged at 1500 rpm for five minutes and the extract diluted to 7 ml. The absorbance of the diluted extract was measured at 645 and 663 rm using a Bausch and Lomb Spectronic 21 single-beam spectrophotometer. Leaf chlorophyll was calculated after Arnon (1949).

DATA AND RESULTS

Both levels of feeding by rosy apple aphid significantly reduced the rate of photosynthesis (Table 1). There was no difference in the rate of photosynthesis by slightly curled and tightly curled leaves. Leaves previously infested with rosy apple aphids contain significantly less chlorophyll than do leaves with no obvious aphid damage (Table 2).

Table 1. Effect of *D. plantaginea* on net photsynthesis of apple leaves

Treatment	ppm $CO_2/cm^2/sec$
360 degrees	5.34b
180 degrees	8.01b
Control	16.31a

Means followed by the same letter are not significantly different ($P < .05$) (Gabriel 1964)

Table 2. Effect of *D. plantaginea* on leaf chlorophyll

Treatment	mg chlorophyll/g fresh leaf tissue
D. plantaginea	18.03b
Control	24.76a

Means followed by the same letter are not significantly different ($P < .05$) (Gabriel 1964)

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APPLE: Malus domestica Borkh, 'Golden Delicious' 'Stayman'
Apple aphid (AA): Aphis pomi De Geer
Tufted apple budmoth (TABM): Platynota idaeusalis (Walker)
European red mite (ERM): Panonychus ulmi (Koch)
Mite predator: Stethorus punctum (LeConte)

APPLE, SUMMER MANAGEMENT OF PESTS, 1985: Experimental sprays were applied to 4 tree plots in a randomized complete block design. Each plot contained one each of the cultivars Delicious, Golden Delicious, Stayman, and Rome Beauty. Each plot was replicated 4 times. Treatments were applied with a Friend Airmaster 393 airblast sprayer calibrated to deliver 50 gpa, 25 gpa/alternate side spray driven at 2 mph. Tree canopy volume was 287,800 ft^3/acre. The first 5 treatments were applied using the alternate side technique on the following dates: 4, 12, 19, and 27 Jun; 3, 9, 16, and 23 Aug. An application to both sides of the trees was made on 30 Aug. The last 3 treatments were applied to both sides of the trees on the following dates: 4 and 19 Jun; 3, 16, and 30 Aug. Kelthane 4F (1420 ml/acre) was applied to one side of the trees on 29 Jul. The effect of the treatments on ERM was evaluated by counting the mites several times during the season on samples of 20 leaves/tree (cv. Delicious only), 80 leaves/treatment. The effect of sprays on the mite predator S. punctum was evaluated by 3-minute counts of adults and larvae around the periphery of the test trees. Effectiveness of chemicals on TABM was assessed by scoring for injury all drops after 1 Jul and a picked sample of 100 apples/tree on the cvs. Golden Delicious and Stayman on 1 Oct. Pest pressure was heavy.

The high rate of Lorsban alone provided the best control of AA. All treatments failed to adequately control TABM. Resistance by TABM to organophosphate insecticides was identified in this block earlier. This may partially explain the poor TABM control with the organophosphates despite optimum timing of insecticides. No treatment appeared to affect S. punctum.

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Treatment	Rate/Acre (lb AI)	Injuries/100 apples* TABM	AA-infested leaves/terminal * % Clean *	21 Jun
Penncap M 2 F +	946.0 ml (0.5) +			
Thiodan 50 WP	454.0 g (0.5)	33.0a	71.7ab	6.4bcd
Penncap M 2 F +	946.0 ml (0.5) +			
Thiodan 50WP	908.0 g (1.0)	26.1a	76.9a	5.9bc
Lorsban 50WP +	454.0 g (0.5) +			
Penncap M 2 F	710.0 ml (0.375)	34.1a	70.1ab	6.2bcd
Lorsban 50WP +	908.0 g (1.0) +			
Penncap M 2 F	710.0 ml (0.375)	26.6a	75.7ab	5.9b
Alsystin 4F	177.0 ml (0.1875)	45.7b	60.8c	6.7bcd
Lorsban 50WP	227.0 g (0.25)	49.6b	57.5b	7.2cd
Lorsban 50WP	680.0 g (0.75)	32.7a	69.3b	5.7b
Lorsban 50WP	1134.0 g (1.25)	29.0a	73.8ab	4.7a
Control	----	47.8b	58.3c	7.6d

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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Treatment	Rate/Acre (lb AI)	ERM/ leaf * 1 Aug	S. punctum/3 min * Adults 1 Aug	S. punctum/3 min * Larvae 1 Aug	ERM/ leaf * 8 Aug	S. punctum/3 min* Adults 8 Aug	S. punctum/3 min* Larvae 8 Aug
Penncap M 2 F +	946.0 ml (0.5) +						
Thiodan 50WP	454.0 g (0.5)	8.2a	26.5a	27.8a	1.4a	19.5a	1.0a
Penncap M2 F +	946.0 ml (0.5) +						
Thiodan 50WP	908.0 g (1.0)	6.9a	20.0a	17.8a	0.8a	21.8a	2.0a
Lorsban 50WP +	454.0 g (0.5) +						
Penncap M 2 F	710.0 ml (0.375)	4.4a	20.3a	18.5a	1.3a	13.5a	1.5a
Lorsban 50WP +	908.0 g (1.0) +						
Penncap M 2 F	710.0 ml (0.375)	9.7a	18.3a	8.8a	0.4a	8.8a	0.0a
Alsystin 4F	177.0 ml (0.1875)	8.9a	26.0a	20.3a	1.3a	18.5a	1.5a
Lorsban 50WP	227.0 g (0.25)	9.0a	26.8a	19.8a	1.1a	18.3a	1.0a
Lorsban 50WP	680.0 g (0.75)	9.0a	19.8a	23.5a	0.5a	17.8a	2.0a
Lorsban 50WP	1134.0 g (1.25)	7.7a	21.5a	23.5a	0.4a	12.5a	1.0a
Control	-----	15.0a	26.0a	22.0a	0.9a	16.3a	3.8a

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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APPLE: Malus domestica Borkh, 'York Imperial' 'Golden Delicious'
Spotted tentiform leafminer (STLM): Phyllonorycter blancardella (Fabricius)
Tufted apple budmoth (TABM): Platynota idaeusalis (Walker)
Redbanded leafroller (RBL): Argyrotaenia velutinana (Walker)
Obliquebanded leafroller (OBL): Choristoneura rosaceana (Harris)
European red mite (ERM): Panonychus ulmi (Koch)
Mite predator: Stethorus punctum (LeConte)

APPLE, DIMILIN EVALUATION USING TREE ROW VOLUME, 1985: Experimental sprays were applied to replicated (4 times) 0.15 acre plots in a randomized block design. Each plot contained alternating Golden Delicious and York Imperial trees. All treatments were applied as complete sprays with a Myers Mity Mist airblast sprayer calibrated at 50 gpa, driven at 2 mph. Tree canopy volume was 261,360 ft^3/acre. Rates of pesticides/acre were based on the tree row volume formula of Byers and Lyons (1984), where trees were treated with 46% of the recommended rate using a 400 gpa standard. Dilute rate for these trees was 183 gpa. Dates of application for complete sprays were: 7 and 26 Jun, 31 Jul and 20 Aug. During the season, general maintenance sprays of fungicides (Bayleton, Benlate, Captan, Dithane M-45 and Zineb) were applied with a Friend Airmaster sprayer calibrated at 50 gpa and driven at 2.3 mph. The effect of treatments on STLM was evaluated by sampling 10 terminals/tree on each of 2 trees/replicate (York Imperial). ERM and TSSM were evaluated by counting the mites from samples of 20 leaves/tree, 80 leaves/treatment (York Imperial). The predator S. punctum was observed by 3-minute counts of adults and larvae around the periphery of the test trees. Effectiveness of treatments on fruit feeders was assessed by scoring for injury 100 apples from each York Imperial and Golden Delicious tree/replicate at harvest. Pest pressure was moderate throughout the season.

Control of STLM with Dimilin was outstanding regardless of rate. Control of TABM was poor regardless of treatment, although timing of sprays was not optimum for TABM control. There was no effect of Dimilin on S. punctum.

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Treatment	Rate/Acre (lb AI)	STLM/25 leaves * 28 Jun	22 Jul	16 Aug	9 Oct	Injuries/100 apples * RBL	OBL	TABM	% Clean
Dimilin 25WP	52.0 g (0.029)	0.1a	0.1a	0.2a	0.5a	0.0a	0.3a	55.1a	51.1a
Dimilin 25WP	105.0 g (0.058)	0.0a	0.0a	0.2a	0.3a	0.5a	0.1a	57.3a	54.9a
Dimilin 25WP	156.0 g (0.086)	0.1a	0.2a	0.1a	0.4a	0.3a	0.0a	62.5a	47.4a
Guthion 50WP	418.0 g (0.46)	0.4b	0.6b	1.9b	4.6b	0.0a	0.3a	46.5a	60.8a
Control	----	0.2ab	0.5b	3.4c	9.9c	0.0a	0.0a	53.3a	51.8a

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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Treatment	Rate/Acre (lb AI)	ERM/leaf* 22 Jul	S. punctum/3 min* Adults 30 Jul	S. punctum/3 min* Larvae 30 Jul	S. punctum/3 min* Adults 2 Aug	S. punctum/3 min* Larvae 2 Aug
Dimilin 25WP	52.0 g (0.029)	33.8a	26.3a	23.5a	35.0a	27.8a
Dimilin 25WP	105.0 g (0.058)	38.3a	19.0a	30.3a	26.0a	16.3ab
Dimilin 25WP	156.0 g (0.086)	31.9a	23.8a	20.3a	43.0a	20.0ab
Guthion 50WP	418.0 g (0.46)	41.1a	27.0a	27.8a	39.5a	14.0b
Control	—	32.7a	22.5a	28.5a	34.5a	19.0ab

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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APPLE: Malus domestica Borkh, 'Delicious', 'Golden Delicious'
European red mite (ERM): Panonychus ulmi (Koch)
Twospotted spider mite (TSSM): Tetranychus urticae Koch
Predatory mite (AF): Amblyseius fallacis (Garman)

APPLE, DILUTE TEST OF ACARICIDES, 1985: Plots consisted of single trees in a randomized block design with 2 replicates of Golden Delicious and 2 replicates of Delicious, both spur types. Experimental sprays were applied to run-off with a handgun from a truck-mounted John Bean sprayer equipped with a 35 gpm pump. Spray dates were as follows: 5 Apr (CGA-29170 and oil treatments only), 19 Apr (DPX-Y5893 treatments only, no Plictran combination applied), 3 and 14 Jun, 19 Jul (ABG-6162, R_o 08-4947 and Plictran treatments only), 27 Jun (DPX-Y5893 plus Plictran combination treatments only), 9 Jul (DPX-Y5893 treatments only, rate increased on lowest rate). On 3 Jun, the ABG-6162 treatments received only 540, 1080, and 2160 ml/100 gal, respectively. General sprays of fungicides (Cyprex, Benlate, Polyram, Captan, Zineb, Manzate, Bayleton, Dithane), insecticides (Lorsban, Phosphamidon, Guthion, Sevin, Pydrin, Systox), and calcium chloride were made at ca. one- to two-week intervals throughout the experiment with a Friend Airmaster at 50 gpa. Effectiveness of the materials on the mites was evaluated by making several counts on random samples of 25 leaves/tree, 100 leaves per treatment. Mite population pressure was severe throughout the summer. Russet ratings are based on 30 Golden Delicious apples/replicate, 60/treatment. Fruits were rated as 1 (no russeting), 2 (light russeting), 3 (moderate russeting), or 4 (severe russeting). Possible ranges were: 30-60 (none to light), 60-90 (light to moderate), 90-120 (moderate to severe). The ratings are in numerical order and are as follows (first 4 treatments not included): 95, 67, 74, 76, 90, 85, 88, 82, 67, 78, 73, and 64.

The CGA-29170 treatments provided approximately 34 days control; whereas the oil treatment broke after 56 days. The DPX-Y5893 treatments gave approximately 60 days control. The DPX-Y5893 plus Plictran treatments provided seasonal control with one application in early summer as did the DPX-Y5893 treatments alone. R_o 08-4947 provided outstanding residual control of the European red mite. Plictran control was only fair.

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Treatment	Rate/100 gal (lb AI)	ERM/leaf* 14 May	22 May	30 May	7 Jun	13 Jun	19 Jun	25 Jun
CGA-29170 100EC	908.0 ml (0.2)	0.9C	10.5e	22.6c	19.5e	37.2f	107.1d	—
CGA-29170 100EC	1360.0 ml (0.3)	0.5c	5.6e	8.0abc	16.3de	40.9def	76.1cd	—
CGA-29170 100EC	1814.0 ml (0. 4)	0.7bc	5.9cde	11.8abc	15.8de	37.8def	62.0cd	—
Sunspray 6E Oil	7.57 liters	0.1ab	0.7b-e	0.9ab	1.9a-d	8.0a-f	21.6bc	—
DPX-Y5893 50WP	14.2 g (0.015625)	0.1abc	0.3ab	0.4a	0.6ab	3.7a-e	7.8ab	17.8de
DPX-Y5893 50WP	28.4 g (0.03125)							
DPX-Y5893 50WP	28.4 g (0.03125)	0.1a	0.3abc	0.3a	0.4a	1.6a	5.0a	7.5bcd
DPX-Y5893 50 WP	56.8 g (0.0625)	0.1bc	0.1a	0.3a	0.5ab	1.8ab	5.1a	9.4bcd
DPX-Y5893 50WP +	28.4 g (0.03125) +							
Plictran 50WP	86.0 g (0.09375)	0.1bc	0.3a-d	0.7ab	1.0abc	3.1a-d	9.0ab	13.4de
DPX-Y5893 50WP +	56.8 g (0.0625) +							
Plictran 50WP	86.0 g (0.09375)	0.1abc	0.3ab	0.2a	1.0abc	2.6abc	3.7a	11.2cde
ABG-6162	676.0 ml	—	5.3e	8.3bc	9.9de	27.0f	22.5bc	16.7de
ABG-6162	1352.0 ml	—	13.8cde	18.4abc	18.3cde	24.1b-f	14.6ab	10.0bcd
ABG-6162	2704.0 ml	—	3.9de	16.3bc	7.8b-e	21.7def	11.1ab	4.0bc

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Treatment	Rate/100 gal (lb AI)	ERM/leaf* 14 May	22 May	30 May	7 Jun	13 Jun	19 Jun	25 Jun
R_0 08-4947 50WP	152.0 g (0.02%)	—	4.1e	8.9abc	5.9a-e	25.7def	5.5a	3.6ab
R_0 08-4947 250EC	303.0 ml (0.02%)	—	5.9e	12.8abc	13.0a-e	25.6ef	1.8a	1.0a
Plictran 50WP	86.0 g (0.09375)	—	5.1e	9.8c	3.7a-e	16.2c-f	9.6ab	7.7bcd
Control	—	1.1c	12.0cde	17.1abc	17.7a-e	30.1a-f	42.0bc	32.0e

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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		Mites/leaf *								
	Rate/100 gal	5 Jul		8 Jul	12 Jul	12 Jul	18 Jul	18 Jul	25 Jul	25 Jul
Treatment	(lb AI)	ERM	TSSM	ERM	ERM	TSSM	ERM	TSSM	ERM	TSSM
CGA-29170 100EC	908.0 ml (0.2)	—	—	—	—	—	—	—	—	—
CGA-29170 100EC	1360.0 ml (0.3)	—	—	—	—	—	—	—	—	—
CGA-29170 100EC	1814.0 ml (0.4)	—	—	—	—	—	—	—	—	—
Sunspray 6E Oil	7.57 liters	—	—	—	—	—	—	—	—	—
DPX-Y5893 50WP	14.2 g (0.015625)	12.5f	0.4a	41.9c	43.9def	0.6a	4.0bc	0.4a	2.4a	0.1ab
(DPX-Y5893 50WP)	28.4 g (0.03125)									
DPX-Y5893 50WP	28.4 g (0.03125)	9.2ef	0.5a	29.4c	29.5cde	0.8a	3.1bc	0.4a	3.7ab	0.3abc
DPX-Y5893 50WP	56.8 g (0.0625)	2.9bcd	0.1a	28.7c	23.7cd	0.6a	4.7bc	0.2a	3.1ab	0.1ab
DPX-Y5893 50WP +	28.4 g (0.03125) +									
Plictran 50WP	86.0 g (0.09375)	4.5cde	0.0a	10.3b	3.7ab	0.0a	1.6ab	0.0a	1.1a	0.0a
DPX-Y5893 50WP +	56.8 g (0.0625) +									
Plictran 50WP	86.0 g (0.09375)	1.1ab	0.0a	3.3a	1.7a	0.0a	1.6ab	0.1a	1.7a	0.1ab
ABG-6162	676.0 ml	7.3def	0.1a	—	56.0ef	0.3a	45.5e	0.1a	31.5c	0.1ab
ABG-6162	1352.0 ml	2.7bcd	0.0a	—	29.8de	0.1a	14.8d	0.2a	11.5bc	0.0a
ABG-6162	2704.0 ml	2.2bc	0.0a	—	13.4c	0.1a	18.8de	0.3a	16.7c	0.0a

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Treatment	Rate/100 gal (lb AI)	Mites/leaf [a] 5 Jul ERM	5 Jul TSSM	8 Jul ERM	12 Jul ERM	12 Jul TSSM	18 Jul ERM	18 Jul TSSM	25 Jul ERM	25 Jul TSSM
R$_0$08-4947 50WP	152.0 g (0. 02%)	1.1ab	1.3a	—	6.2b	1.8a	4.6c	0.9a	1.9a	1.3d
R$_0$08-4947 250EC	303.0 ml (0.02%)	0.3a	0.1a	—	2.1a	0.3a	1.1a	0.4a	1.5a	0.6bcd
Plictran 50WP	86.0 g (0.09375)	8.8def	0.2a	—	45.0def	0.9a	22.7de	0.2a	15.0bc	0.1ab
Control	—	20.0f	0.6a	59.1c	70.8f	1.3a	50.6de	0.9a	33.1c	0.7cd

[a] Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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Treatment	Rate/100 gal (lb AI)	Mites/leaf ª ERM 9 Aug	TSSM 9 Aug	ERM 20 Aug	TSSM 20 Aug	AF 20 Aug
CGA-29170 100EC	908.0 ml (0.2)	—	—	—	—	—
CGA-29170 100EC	1360.0 ml (0.3)	—	—	—	—	—
CGA-29170 100EC	1814.0 ml (0.4)	—	—	—	—	—
Sunspray 6E Oil	7.57 liters	—	—	—	—	—
DPX-Y5893 50WP	14.2 g (0.015625)	1.1a	0.0a	1.0a	0.0a	0.0b
(DPX-Y5893 50WP)	28.4 g (0.03125)					
DPX-Y5893 50WP	28.4 g (0.03125)	1.9ab	0.1a	0.6a	0.0a	0.1b
DPX-Y5893 50WP	56.8 g (0.0625)	1.1a	0.1ab	1.7a	0.0a	0.1b
DPX-Y5893 50WP +	28.4 g (0.03125) +					
Plictran 50WP	86.0 g (0.09375)	1.4a	0.0a	2.5a	0.0a	0.1b
DPX-Y5893 50WP +	56.8 g (0.0625) +					
Plictran 50WP	86.0 g (0.09375)	1.1a	0.0a	3.5a	0.0a	0.1b
ABG-6162	676.0 ml	33.9e	0.2ab	115.7c	0.2a	0.3ab
ABG-6162	1352.0 ml	18.5de	0.1a	97.0c	0.2a	0.3ab
ABG-6162	2704.0 ml	9.8cd	0.1a	85.3c	0.3a	0.3ab
R_o 08-4947 50WP	152.0 g (0.02%)	1.5a	1.0bc	1.4a	0.9a	0.4ab

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Treatment	Rate/100 gal (lb AI)	Mites/leaf * ERM 9 Aug	TSSM 9 Aug	ERM 20 Aug	TSSM 20 Aug	AF 20 Aug
R_0 08-4947 250EC	303.0 ml (0.02%)	0.6a	1.4c	1.0a	4.7b	0.3ab
Plictran 50WP	86.0 g (0.09375)	6.6bc	0.1ab	36.4b	0.1a	0.7a
Control	—	22.2cd	0.6abc	3.7a	0.0a	0.1b

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

Not for Publication

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APPLE: Malus domestica Borkh, 'York Imperial'
European red mite (ERM): Panonychus ulmi (Koch)
Twospotted spider mite (TSSM): Tetranychus urticae Koch
Mite predator: Stethorus punctum (LeConte)

APPLE, AIRBLAST ACARICIDE EVALUATION TEST, 1985: An experimental acaricide in various combinations with adulticidal acaricides was applied to single 0.15 acre plots in a randomized block design consisting of 4 replicates of York Imperial and Golden Delicious trees (7 yrs old). All treatments were applied as complete sprays with a Myers Mity Mist sprayer calibrated at 50 gpa, 2 mph, 300 psi. Date of application was 25 Jul. During the season, general maintenance sprays of fungicides (Bayleton, Benlate, Captan, Dithane, and Zineb), insecticides (Lorsban, Guthion, Methomyl, Penncap M) as well as calcium chloride were applied with a Friend Airmaster calibrated at 50 gpa and driven 2.3 mph. The effect of treatments on the European red mite and twospotted spider mite was evaluated by counting the mites several times during the season on samples of 25 leaves/tree, 100 leaves/treatment (York Imperial only). The predator S. punctum was observed by 3-min counts of adults and larvae around the periphery of the test trees (York Imperial only). Pest pressure was moderate throughout the season.

All treatments involving Apollo reduced the European red mite populations much faster than the Carzol plus Plictran combination or the control. Apollo plus Plictran reduced the twospotted spider mite populations faster than Apollo or Apollo plus Carzol. No phytotoxicity was observed.

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		Mites/leaf [a]				S. punctum/3 min[a]	Mites/leaf [a]		S. punctum/3 min[a]	
	Rate/Acre	ERM	TSSM	ERM	TSSM	Adults	ERM	TSSM	Adults	Larvae
Treatment	(lb AI)	24 Jul	24 Jul	31 Jul	31 Jul	31 Jul	7 Aug	7 Aug	7 Aug	7 Aug
Apollo 50SC	118.0 ml (0.125)	20.9a	6.4a	11.8a	2.9b	7.3a	2.2b	2.6b	32.5b	0.5a
Apollo 50SC +	118.0 ml (0.125) +									
Carzol 92SP	170.0 g (0.345)	19.6a	7.7a	8.1a	2.6ab	6.0a	3.0b	2.5b	24.8b	0.0a
Apollo 50SC +	118.0 ml (0.125) +									
Plictran 50WP	228.0 g (0.25)	35.0a	8.4a	6.8a	0.5a	1.8a	0.7a	0.0a	7.3c	0.8a
Carzol 92SP +	142.0 g (0.2875) +									
Plictran 50WP	142.0 g (0.15625)	30.9a	9.9a	14.4a	0.9ab	6.0a	18.2c	0.4ab	39.8b	1.5a
Control	——	27.5a	3.5a	21.6a	5.8c	11.5a	38.6d	12.6c	81.5a	0.8a

[a] Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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Treatment	Rate/Acre (lb AI)	Mites/leaf * ERM 15 Aug	Mites/leaf * TSSM 15 Aug	S. punctum/3 min* Adults 15 Aug	S. punctum/3 min* Larvae 15 Aug	Mites/leaf* ERM 21 Aug	Mites/leaf* TSSM 21 Aug	S. punctum/3 min* Adults 21 Aug	S. punctum/3 min* Larvae 21 Aug
Apollo 50SC	118.0 ml (0.125)	1.7a	0.6a	6.8b	0.5bc	1.3a	0.7a	18.8c	0.0b
Apollo 50SC + Carzol 92SP	118.0 ml (0.125) + 170.0 g (0.345)	1.2a	0.4a	10.5b	0.0c	1.2a	0.4a	13.0c	0.0b
Apollo 50SC + Plictran 50WP	118.0 ml (0.125) + 228.0 g (0.25)	0.7a	0.0a	7.0b	0.0c	0.9a	0.0a	13.0c	0.0b
Carzol 92SP + Plictran 50WP	142.0 g (0.2875) + 142.0 g (0.15625)	10.5b	0.1a	43.5a	2.3ab	20.4b	0.6a	96.5b	2.5a
Control	—	41.7c	10.2b	68.5a	2.8a	28.4b	16.9b	164.5a	2.3ab

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

Not for Publication

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APPLE: Malus domestica Borkh 'York Imperial'
European red mite (ERM): Panonychus ulmi (Koch)
Mite predator: Stethorus punctum (LeConte)

APPLE, APOLLO EUP EVALUATION, 1985: The trial was conducted in 2 adjacent blocks (13 acres each) of a commercial apple orchard in the Buchanan Valley, near Arendtsville, PA. One block was further divided into two 6.5 acre blocks which were treated with both rates of Apollo. Six 'York Imperial' apple trees were randomly selected in each block for monitoring. The treatments were applied using the alternate-row middle technique with a Myers airblast sprayer calibrated to deliver 50 gpa at 2 mph. Spray dates for the Apollo treatments were: 20 and 22 Apr; 6 and 18 Jul (only 59 ml/acre rate). Rates of acaricides and application dates for the standard block were Carzol 228 g/acre (3 May both sides), Plictran 363 g/acre (20 and 28 May, 2 half-sprays), Kelthane 1.324 liters/acre (14 Jun, 1 half-spray), Carzol 340 g/acre (25 Jun, 1 half-spray). Amounts are listed as complete sprays. All blocks received the same insecticide and fungicide schedule. The effect of sprays on ERM was evaluated by counting the mites on samples of 15 leaves/tree (6 trees/treatment). The mite predator S. punctum was monitored by making 3-min counts of adults and larvae around the periphery of the trees.

Both rates of Apollo provided approximately 70 days control of the European red mite. Only one additional alternate side treatment of the high rate of Apollo was needed to control the mites in conjunction with S. punctum the remainder of the season.

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Treatment	Rate/acre	ERM/leaf *								
		17 May	29 May	11 Jun	19 Jun	26 Jun	2 Jul	5 Jul	10 Jul	17 Jul
Apollo 50SC	59.0 ml	0.0a	0.1a	0.2a	0.6a	2.0a	9.3a	9.1a	15.5a	31.9b
Apollo 50SC	118.0 ml	0.0a	0.1a	0.1a	0.2a	0.9a	3.2a	3.9a	7.7a	8.3a
Standard		3.1b	19.1a	15.0b	15.7b	22.0b	38.7b	13.1a	17.8a	9.3a

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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Treatment	Rate/acre	ERM/leaf*			
		24 Jul	1 Aug	7 Aug	14 Aug
Apollo 50SC	59.0 ml	38.5b	10.8a	3.6b	1.6a
Apollo 50SC	118.0 ml	6.1a	3.9a	0.5a	0.7a
Standard		19.9a	35.8b	21.7c	7.4b

* Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

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		S. punctum/3 min[a]								
		Adults	Adults	Larvae	Adults	Larvae	Adults	Larvae	Adults	Larvae
Treatment	Rate/acre	17 Jul	24 Jul	24 Jul	1 Aug	1 Aug	7 Aug	7 Aug	14 Aug	14 Aug
Apollo 50 SC	59.0 ml	3.5a	5.7a	9.7a	13.8a	30.2a	14.8b	8.3b	9.2b	3.2b
Apollo 50 SC	118.0 ml	5.8a	7.8a	12.5a	3.8b	2.7b	8.8b	3.3b	3.8c	2.5b
Standard		4.3a	4.7a	4.8a	6.3b	9.7b	23.3a	32.8a	45.3a	40.5a

[a] Means followed by the same letter (s) are not significantly different (P=0.05, DMRT). Data analyzed using a power transformation.

Not for Publication

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APPLE: (Malus domestica 'Rome Beauty')
Apple scab; Venturia inaequalis
Powdery mildew; Podosphaera leucotricha

INCIDENCE OF SCAB AND MILDEW ON TREES SPRAYED WITH STEROL INHIBITOR FUNGICIDES FOR POST INFECTION CONTROL OF SCAB, 1985. Nineteen fungicide treatments were applied in 5 applications each following one or more primary infection periods betweeen 1 May and 16 Jun. Nine ergosterol biosynthesis inhibitor fungicides were evaluated as post infection treatments and were followed by protective type fungicides during the cover sprays. The fungicide treatments were applied dilute to the point of run-off at 12 L./tree (2,800 L./ha) with a single nozzle spray gun at 3,800 kPa (550 psi). Trees used were well pruned, uniformed, mature trees on seedling rootstocks planted 7 X 10.7 m and pruned to a heighth of 5-6 m. Treatments were arranged in a randomized block design with 5 replicates. Application dates of the post infection treatments and number of hours following apple scab infection were as follows: 4 May (72 hr), 19 May (84, 156 hr), 25 May (50, 94 hr), 10 Jun (122 hr), and 19 Jun (80 hr). Protective sprays in the 5th, 6th, and 7th covers were applied on 12, 25 Jul and 6 Aug, respectively. Insecticide treatments were applied separately with a Metters airblast sprayer at 470 L./ha (50 gpa) operated at 4.0 k/hr (2.5 mph). Natural inoculum of the scab and mildew pathogens was uniform throughout the block and was not supplemented. Disease incidence on leaves was obtained by observing all leaves on each of 10 terminals/tree on 11-16 Jul. Disease incidence and diameter and length measurements on fruit at harvest was recorded on 2 Oct. by observing 100 fruits/tree. The data obtained were statistically analyzed using the appropriate transformation, standard analysis of variance for randomized block design and the Waller-Duncan K-ratio test for mean separation. Observations for phytotoxicity on leaves and fruit were made throughout the growing season and at harvest.

Scab incidence was only moderate on both leaves and fruit due to low rainfall during the prebloom period. In spite of 9 infections between 1 May and 8 Jun, scab incidence on untreated fruit was only 18.0%. No significant differences among treatments were detected on either leaves or fruit. Mildew incidence on leaves was moderately high with 61% of the leaves infected by mid Jul. Most of the treatments were not significantly different, however, UBI A-1055 and the Procure 50W 2.0 oz plus Polyram treatment failed to control mildew adequately. Fruit diameter or length was not affected by fungicide treatment. No phytotoxicity to leaves or fruit was noted during these evaluations.

Not for Publication

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Table 1. **DISEASE INCIDENCE ON 'ROME BEAUTY' APPLE SPRAYED DILUTE WITH FUNGICIDES TIMED AS POST-INFECTION FOLLOWED BY PROTECTIVE TREATMENTS IN 1985, BIGLERVILLE, PA.**

Fungicide & Rate mg ai/L (Form/100 Gal)	Spray Timing *	Percent Disease Incidence			Fruit Size cm	
		P. Mildew	Scab			
		Leaves	Leaves	Fruit	Length	Diameter
1) Baycor 50W 150 (4 oz) +						
Captan 50W 600 (1.0 lb)+	PF - 4th C					
Bayleton 50W 19 (0.5 oz)	PF - 3rd C					
Baycor 50W 75 (2.0 oz) +						
Captan 50W 600 (1.0 lb)	5th - 7th C	4.9d	0.2b	0.6b	3.43a	4.14a
2) XE 779 25 W 20 (30 g) +						
Captan 50W 600 (1.0 lb)	PF - 4th C					
Captan 50W 900 (1.5 lb)	5th - 7th C	5.3d	0.0b	2.2 b	3.51a	4.22a
3) Ro 15-1297 4E 37 (1.0 fl oz)	PF - 7th C	0.8d	0.4b	1.6b	3.47a	4.10a
4) Ro 15-1297 4E 37 (1.0 fl oz) +						
Captan 50W 600 (1.00 lb)	PF - 7th C	2.5d	0.0b	2.8b	3.50a	4.24a
5) Ro 15-1297 4E 37 (1.0 fl oz) +						
Polyram 80W 1440 (1.5 lb)	PF - 7th C	1.8d	0.3b	3.2b	3.43a	4.05a
6) Rubigan 1EC 18.8 (2.0 fl oz) +						
Ortho X-77 (4.0 fl oz)	PF - 4th C					
Captan 50W 900 (1.5 lb)	5th - 7th C	2.0d	0.0b	3.4b	3.46a	4.11a
7) Rubigan 1AS 18.8 (2.0 fl oz)+						
Ortho X-77 (4.0 fl oz)	PF - 4th C					
Captan 50W 900 (1.5 lb)	5th - 7th C	4.4d	3.4b	3.4b	3.45a	4.15a

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Table 1. Cont. **DISEASE INCIDENCE ON 'ROME BEAUTY' APPLE SPRAYED DILUTE WITH FUNGICIDES TIMED AS POST-INFECTION FOLLOWED BY PROTECTIVE TREATMENTS IN 1985, BIGLERVILLE, PA.**

Fungicide & Rate mg ai/L (Form/100 Gal)	Spray Timing *	Percent Disease Incidence			Fruit Size cm	
		P. Mildew	Scab			
		Leaves	Leaves	Fruit	Length	Diameter
16) UBI A-1055 10EC 75 (74 ml)	PF - 4th C					
Polyram 80W 1440 (1.5 lb)	5th - 7th C	28.2bc	1.4b	3.2b	3.49a	4.14a
17) Sisthane 40W 37.5 (1.25 oz) +						
Dithane M-45 80W 1440 (1.5 lb)	PF - 4th C					
Dithane M-45 80W 1440 (1.5 lb)	5th - 7th C	3.8d	0.0b	3.0b	3.40a	4.07a
18) Sisthane 40W 75 (2.5 oz)	PF - 4th C					
Dithane M-45 80W 1440 (1.5 lb)	5th - 7th C	0.5d	0.0b	1.0b	3.42a	4.03a
19) Funginex 1.6EC 180 (12 fl oz)	PF - 4th C					
Polyram 80W 1440 (1.5)	5th - 7th C	7.5d	1.0b	2.2b	3.53a	4.21a
20) Untreated		61.1a	24.5a	18.0a	3.38a	4.03a

* Post-infection sprays applied on 4, 19, and 25 May, 10 and 19 Jun, at 72, 84, 94, 122 and 80 hours, respectively.

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Table 1. Cont. **DISEASE INCIDENCE OF 'ROME BEAUTY' APPLE SPRAYED DILUTE WITH FUNGICIDES TIMED AS POST-INFECTION FOLLOWED BY PROTECTIVE TREATMENTS IN 1985, BIGLERVILLE, PA.**

Fungicide & Rate mg ai/L (Form/100 Gal)	Spray Timing *	Percent Disease Incidence P. Mildew Leaves	Scab Leaves	Scab Fruit	Fruit Size cm Length	Fruit Size cm Diameter
8) Procure 50W 75 (2.0 oz)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	10.4d	0.0b	6.8b	3.47a	4.18a
9) Procure 50W 112.5 (3.0 oz)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	7.5d	1.5b	2.6b	3.42a	4.11a
10) Procure 50W 150 (4.0 oz)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	4.9d	0.2b	3.4b	3.46a	4.11a
11) Procure 50W 75 (2.0 oz) +						
Polyram 80W 960 (1.0 lb)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	24.8c	0.7b	3.0b	3.46a	4.21a
12) Procure 50W 112.5 (3.0 oz) +						
Polyram 80W 960 (1.0 lb)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	7.4d	0.7b	5.2b	3.52a	4.21a
13) UBI A-815 30W 75 3.33 oz)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	8.9d	0.4b	2.0b	3.42a	4.06a
14) UBI A-1055 10EC 18.8 (18.5 ml)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	31.5bc	5.7b	5.6b	3.51a	4.18a
15) UBI A-1055 10EC 37.5 (37 ml)........	PF - 4th C					
Polyram 80W 1440 (1.5 lb)........	5th - 7th C	36.5b	0.7b	7.2b	3.41a	4.17a

Not for Publication

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APPLE: (Malus domestica ' Rome Beauty', 'Golden Delicious', 'Delicious')
Apple Scab; Venturia inaequalis
Powdery mildew; Podosphaera leucotricha
Sooty blotch; Gloeodes pomigena
Fly speck; Schizothyrium pomi

DISEASE INCIDENCE ON APPLE TREATED WITH SEASONAL DILUTE SPRAYS OF EXPERIMENTAL FUNGICIDES IN 1985. Ergosterol biosynthesis inhibitor fungicides (EBI) were evaluated in a uniform block of semi-dwarf trees 3 m high planted in groups of three with one each of 3 cultivars in each tree site. Seasonal dilute sprays were applied at 7-day (prebloom) and 14-day (postbloom) intervals. Experimental plots consisted of a single tree and were arranged in a randomized complete block design with 6 replicates. Each fungicide was suspended in water and applied to the point of run-off at 12 L./tree group (2,800 L./ha) with a single nozzle spray gun at 3,800 kPa (550 psi). Spray dates and phenological stages of tree development were as follows: 18 Apr (tight cluster), 25 Apr (bloom), 4 May (petal fall), 1st - 7th covers on 15, 30 May, 14, 27 Jun, 12, 29 Jul, and 12 Aug, respectively. Maintenance insecticides were applied separately with an orchard airblast sprayer at 470 L./ ha (50 gpa) operated at 4.0 k/hr (2.5 mph). Natural inoculum of the pathogens was fairly uniform in the test block and no supplemental applications were made. Scab and mildew incidence were recorded by observing all leaves on 10 terminals/single tree replicate on: 2-3 Jul ('Delicious'); 3-5 Jul ('Rome'). Disease incidence on fruit and fruit size measurements at harvest were recorded by observing 100 fruits/tree on 19 Sep. The data obtained were statistically analyzed using the appropriate transformation, standard analysis of variance for randomized block design and the Waller-Duncan K-ratio test for mean separation.

Scab incidence was light to moderate due to low rainfall during the prebloom period. Although 9 primary scab infection periods occurred between 1 May and 8 Jun, scab incidence on 'Rome' fruit was only 9.0% at harvest. No significant differences was found among the treatments, all of which were significantly different from the untreated check. Powdery mildew incidence was low due to low overwintering primary inoculum and unfavorable environmental conditions during the prebloom period. No significant differences among treatments was found. Sooty blotch and fly speck levels were moderately high on the untreated trees. DPX H6573 used alone failed to provide protection against the disease while this and other EBI fungicides used with a protectant fungicide gave near complete control. Fruit diameter and length measurements on 'Delicious' and 'Rome' fruit indicated no differences among the treatments. Fruit russet on 'Golden Delicious' was relatively low and no differences among treatments was evident. No other form of phytotoxicity was noted among the treatments.

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TABLE 2. **DISEASE INCIDENCE ON APPLE SPRAYED DILUTE WITH EXPERIMENTAL FUNGICIDES AT 7-DAY (PRE-PETAL) AND 14-DAY (COVER SPRAYS) INTERVALS. OLD 3-C BLOCK, BIGLERVILLE, PA**

		Percent Disease Incidence						Fruit Size cm	
			Apple Scab			Sooty	Fly	Rome	
			Leaves		Fruit	blotch	Speck		
Fungicide and Rate mg ai/L (Form/100 Gal)	Spray Timing	P. Mildew Rome	Del.	Rome	Rome	G. Del.	G. Del.	Length	Diameter
1. DPX H6573 40EC 8.2 (8.1 ml)	Seasonal	0.6b	0.0b	0.2b	0.2b	10.4b	16.5b	3.32a	4.00a
2. DPX H6573 40EC 12.5 (12.3 ml).................	Seasonal	0.4b	0.1b	0.2b	0.2b	7.9b	11.4b	3.31a	4.01a
3. DPX H6573 40EC 6.25 (6.2 ml) + Manzate 200 80W 800 (13.3 oz)..............	Seasonal	2.4b	0.2b	0.0b	0.0b	0.0c	0.0c	3.29a	3.91a
4. DPX H6573 40EC 12.5 (12.3 ml).................	TC, B, PF								
Benlate 50W 150 (4 oz) + Manzate 200 80W 719 (12 oz)..................	1st-7th C	0.7b	0.1b	0.1b	0.2b	0.0c	0.0c	3.31a	3.91a
5. Procure 50W 75 (2 oz) + Captan 50W 600 (1:0 lb)	Seasonal	0.9b	0.1b	0.3b	0.0b	0.0c	0.0c	3.26a	3.96a
6. Procure 50W 112.4 (3 0z) + Captan 50W 600 (1.0 lb)..........................	Seasonal	0.7b	0.1b	0.1b	0.0b	0.0c	0.0c	3.43a	4.08a
7. RH-3866 40W 75 (2.5 oz)...........................	TC-2nd C								
Dithane M-45 80W 1438 (1.5 lb)..................	3rd-7th C	0.0b	0.1b	0.0b	0.0b	0.0c	0.0c	3.27a	3.98a

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TABLE 2. Cont. **DISEASE INCIDENCE ON APPLE SPRAYED DILUTE WITH EXPERIMENTAL FUNGICIDES AT 7-DAY (PRE-PETAL) AND 14-DAY (COVER SPRAYS) INTERVALS. OLD 3-C BLOCK, BIGLERVILLE, PA**

		Percent Disease Incidence						Fruit Size cm	
			Apple Scab			Sooty	Fly	Rome	
			Leaves		Fruit	blotch	Speck		
Fungicide and Rate mg ai/L (Form./100	Spray Timing	P. Mildew Rome	Del.	Rome	Rome	G. Del.	G. Del.	Length	Diameter
8. Dithane M-45 80W 1918 (2.0 lb)	TC-2nd C								
Bayleton 50W 37.5 (1.0 Oz)	P, PF, 1st C								
Dithane M-45 80W 1438 (1.5 lb)	3rd-7th C	2.4b	0.7b	0.5b	0.0b	0.0c	0.0c	3.35a	4.00a
9. XE 779 25W 20 (30 g) + Captan 50W 600 (1.0 lb)	Seasonal	0.3b	0.0b	0.1b	0.0b	0.0c	0.0c	3.37a	4.02a
10. Topas 61-MZ 90 (1.0 lb)	Seasonal	0.5b	0.2b	0.0b	0.0b	0.0c	0.0.c	3.27a	3.98a
11. Benlate 50W 150 (4.0 oz) + Manzate 200 80W 960 (1.0 lb)	Seasonal	1.6b	0.3b	0.1b	0.0b	0.0c	0.0c	3.28a	3.89a
12. Funginex 1.6EC 180 (12 fl oz) + Polyram 80W 1440 (1.5 lb)	Seasonal	1.5b	0.2b	0.0b	0.0b	0.0c	0.0c	3.35a	4.02a
13. Untreated		16.6a	23.6a	21.2a	9.0a	35.2a	45.6a	3.28a	3.94a

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APPLE (Malus domestica 'Rome Beauty')
Apple scab; Venturia inaequalis
Powdery mildew; Podosphaera leucotricha

EFFICACY OF PROCURE 50W APPLIED CONCENTRATE FOR CONTROL OF SCAB AND POWDERY MILDEW ON 'ROME BEAUTY' APPLE, 1985. A mature block of well pruned 'Rome Beauty' trees grown on seedling rootstocks were used in evaluating efficacy of Procure 50W applied seasonally as concentrate sprays at different rates. Trees were planted 7 X 10.7 m and pruned to a heighth of 5-6 m. Each treatment plot consisted of 2 trees arranged in a randomized complete block design with an untreated border row between parallel plots. Treatments were applied with a low volume orchard airblast sprayer (Automatic Mist Concentrate - Model 110C). Procure rates of 42, 84, 168, and 252 g ai/ha were applied at 234 L./ha (25 gpa) and compared with 84 g ai/ha applied at 467 L./ha (50 gpa) applied with a Metters 36 inch fan airblast sprayer. The 84 g ai/ha rate was based on tree row volume (TRV) calculations and a base rate of 280 g ai/ha (8.0 oz/A). A calculated TRV of 225,968 ft^3/A, a tree density factor of 0.75, and a concentration factor of 0.7 were used to determine the equivalent dilute rate/A (125 gpa). The Procure treatments were combined with Polyram at rates determined by the same procedure and based on equivalent rates of 3.59 kg ai/ha (4.0 lbs/A). Applications of the combination was applied to both sides of the trees on: 16 Apr (tight cluster), 22 Apr (early bloom), 1 May (petal fall), 1st - 4th cover sprays on 14 and 28 May, 15 and 26 Jun. Scab and mildew incidence were recorded by observing all leaves on 10 terminal shoots/tree (2-3 plots) on each of the 3 replicates on 26 Jun and on the fruit by observing 100 fruits at harvest on 24 Sep. The data were statistically analyzed using the appropriate transformation, standard analysis of variance for randomized block design and the Waller-Duncan K-ratio test for mean separation.

.Scab was light with 21.6% leaf infection and 7.0% fruit infection because of light rainfall during the pre petal-fall period. Nine primary apple scab infection periods occurred between 1 May and 8 Jun but secondary spread was very light and no significant differences among the Procure rates was detected. Powdery mildew incidence was moderately high with 59% of the leaves infected on the untreated trees by 26 Jun. Mildew control provided by Procure was only fair with 27% of leaves infected on the trees receiving the 252 g ai/ha rate. Increased amounts of mildew up to 41% of leaves infected occurred on the 42 g ai/ha rate. No phytotoxicity was observed among the various treatments and no affect of treatment on fruit finish or size was noted.

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Table 3. APPLE SCAB AND POWDERY MILDEW INCIDENCE ON 'ROME BEAUTY' TREES TREATED WITH CONCENTRATIONS OF PROCURE APPLIED AT 25 AND 50 GPA WITH AN AIRBLAST SPRAYER.

Fungicide and Rate g/ai/ha (Form/A)	Application rate (gpa)	% Disease Incidence		
		Scab		P. Mildew
		Leaves	Fruit	
01. Procure 50W 42 (1.2 oz) + Polyram 80W 538 (0.6 lb)	25	1.2b	0.0b	41.0b
02. Procure 50W 84 (2.4 oz) + Polyram 80W 1076 (1.2 lb)	25	0.6b	0.0b	33.0bc
03. Procure 50W 168 (4.8 oz) + Polyram 80W 2151 (2.4 lb)	25	0.5b	0.0b	28.8bc
04. Procure 50W 252 (7.2 oz) + Polyram 80W 3227 (3.6 lb)	25	0.0b	0.0b	26.7c
05. Procure 50W 84 (2.4 oz) + Polyram 80W 1076 (1.2 lb)	50	0.1b	0.0b	31.0bc
06. Untreated		21.6a	7.0a	59.1a

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APPLE (*Malus domestica* 'York Imperial')
Apple scab; *Venturia inaequalis*

EFFECT OF TREE SIZE ON RATE NEEDED AND EFFICACY OF PROCURE/POLYRAM APPLICATIONS FOR SCAB CONTROL ON 'YORK' APPLE, 1985. The effect of tree size, as calculated by tree row volume (TRV), on the rates of a combination of Procure 50W plus Polyram 80W needed for scab control was determined in 4 blocks of mature 'York Imperial'/seedling rootstock trees. The rate of fungicide used in each block was calculated from tree size measurements and a base rate of Procure 50 W 8.0 oz/A plus Polyram 80W 3.0 lbs/A. Rates were adjusted by varying the amount of spray mixture used based on TRV for each block. Variations in TRV, fungicide rates, and volume of spray mixture used are given in the data table for each block. Tree row volume was determined by calculating linear feet of row space/A (43,560 ft^2 ÷ row width), multiplied by the volume of space occupied by the tree (tree height X tree width). The dilute equivalent spray volume (gpa) was determined by multiplying the total tree row volume per acre by factors for tree density (0.7 to 1.0 per 1,000 ft^3) and chemical type (40 to100%; 70% for pesticides). The tree density factors used were 0.85 (Block A) and 0.80 (Block B, C, D). Treated orchard blocks consisted of 3-5 orchard rows of trees with untreated trees located among the tree row. Fungicide treatment was applied with a Metters 36-inch fan airblast sprayer at 50 to120 gpa (467 to 1122 L./ha) of spray mixture when operated at 2.5 mph (4.0 k/hr). Applications were made from the tight-cluster phenological stage through petal-fall at approximately 7-day intervals and at 14-day intervals through 4th cover (26 Jun). Polyram 80W 5.0 lbs/A was applied in the 5th-8th cover sprays ending on 23 Aug. Trees in Block A were larger, more dense, and contained more natural inoculum of the scab pathogen than in other blocks. Scab incidence on leaves was determined on 27-28 Jun by observing all leaves on each of 10 terminal shoots/tree (2 sampled trees/3-5 replicate area/block) collected from the top (5-7 m) and bottom (1-3 m) of each tree. Observations on fruit were made only in Block A by observing 100 fruits/replicate (5 replicates). Samples of treated trees were taken in the vicinity of each of the untreated. Data on the treated vs the untreated trees were compared statistically by t-test comparison. Similarly, the treated and untreated were compared in both the upper and lower areas of the tree for each block.

Mean scab incidence on leaves of untreated trees in Blocks A, B, C, and D was 55,33, 45, and 48%, respectively. The fungicide treatment provided excellent control in Block C (less dense trees), only fair control in Blocks B and D, and poor control in Block A (dense trees with high inoculum). Although there was no statistical comparison of the means among the orchard blocks (fungicide treatments) there appeared to be no difference in control of scab on leaves between Blocks B and C which were sprayed with rates 58 and 84% of the full fungicide rate (amount for standard mature orchard), respectively. Scab control in Block D was somewhat lower than in adjacent Blocks B and C, even though the fungicide was used at full rate. Scab incidence on fruit was 7.7% on the treated section of Block A and 35.6% on the untreated trees.

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Table 4. APPLE SCAB INCIDENCE ON THREE VARIABLE SIZE 'YORK' BLOCKS TREATED WITH PROCURE/POLYRAM TREATMENTS APPLIED WITH AN AIRBLAST SPRAYER IN 1985. PSU ARENDTSVILLE FARM AND HECKENLUBER ORCHARDS, BIGLERVILLE, PA

Orchard Block	Tree Size and Eqvt. Sp. Vol.[1] TRV Total Ft[3]	Tree Size and Eqvt. Sp. Vol.[1] Dil. Eqvt. GPA	Application Rate[2] Form. Amt Per A. Procure 50W	Application Rate[2] Form. Amt Per A. Polyram 80W	Application Rate[2] Spray Vol. GPA	Application Rate[2] Spray Vol. L/HA	Percent Scab on Leaves[3] Upper Tr.	Upper Unt.	Lower Tr.	Lower Unt.	Mean Upp. & Low. Tr.	Mean Upp. & Low. Unt.	Upper vs Lower P Value
A	608,475	362	7.2 oz	2.72 lb	120	1122	31.2b	46.2a	38.7b	62.9a	35.0a	54.5b	0.027
B	599,508	336	6.7 oz	2.52 lb	110	1028	4.5b	30.6a	8.4b	36.2a	6.5b	33.4a	0.118
C	412,482	231	4.6 oz	1.73 lb	75	701	1.4b	36.9a	1.9b	52.2a	1.7b	44.5a	0.009
D	599,508	400	8.0 oz	3.00 lb	50	467	16.5b	45.8a	7.5b	50.6a	12.0b	48.2a	0.700

[1] TRV - Tree row volume determined by calculating linear feet of row space per acre (43,560 ft^2 ÷ row width); multiplied by volume of space occupied by the tree (tree height X tree width).
Dilute equivalent spray volume (GPA) determined by multiplying the total tree row volume per acre by factors for tree density (0.7 to 1.0 per 1000 cu ft) and chemical type (40 to 100%; 70% for pesticides). Tree density factors used were 0.85 (Block A) and 0.80 (Block B,C,D).

[2] Rate based on Procure 50W 8.0 oz/A and Polyram 80W 3.0 lb/A (400 gpa dilute) and applied with a Metters 36" fan airblast sprayer operated at 2.5 mph (4.0 km/hr).

[3] Determined by observing all leaves on each of 10 terminal shoots per tree (2 sampled trees per 3-5 replicated area per block) collected from the top (5-7 m) and bottom (1-3 m) of each tree on Jun 27-28, 1985. Means marked with the same letter are not significantly different at P=0.05 level. Statistical comparisons of means were made within each tree position (upper and lower).

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Apple (Malus domestica 'Red Delicious' spur type on MM106)
Dagger nematode; Xiphinema americanum, Xiphinema rivesi

EVALUATION OF SDS 38697-50 FOR CONTROL OF DAGGER NEMATODES ON APPLE. Treatments were applied April 24, 1984, except for the '8 + 8' treatment (Table 1) for which a second application was made on October 4, 1984. For treatments receiving SDS 38697-50, an 80 ft^2 area around each tree was raked to 3-inch depth before and after application of the chemical. The trees were planted in 1976 in a loam (51% sand, 28% silt, 21% clay, pH = 6.1, organic matter = 1.4%) at the PSU Fruit Lab in Biglerville. The experimental design was a randomized complete block; there were three blocks with a single, four tree plot/treatment/block. The soil contained both X. americanum and X. rivesi. Nematodes were extracted by a combination of elutriation and Baermann funnel. All nematicides significantly suppressed nematode population densities (Table 1). However, SDS 38697-50 appeared to be more effective than Vydate or Nemacur.

Table 1. Suppression of dagger nematodes by the nematicide SDS 38697-50 in an apple orchard.

		Xiphinema per 100 cc soil				
Treatment	lb ai/acre	3/19/84[1]	6/19/84	11/8/84	6/17/85	10/22/85
Control	--	74a[2]	61a	36a	17a	23a
Nemacur 3	15	42a	19b	14b	3b	24a
Vydate L	6	45a	16b	9b	2b	18a
SDS 38697-50	8	41a	2c	0c	0c	2b
SDS 38697-50	16	40a	2c	0c	1b	1b
SDS 38697-50	8 + 8	39a	5bc	0c	0c	1b

[1] Pretreatment

[2] Each value is the mean of 3 replications, 4 trees per replication. Values followed by different letter are significantly different at P=0.05 according to DMRT.

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Apple (Malus domestica 'Red Delicious' and 'Golden Delicious' on MM106 rootstock)
Dagger nematode: Xiphinema americanum, Xiphinema rivesi

EVALUATION OF UC 70480-100 FOR CONTROL OF DAGGER NEMATODES ON APPLE. Treatments were applied April 25, 1984. All plots (including control) were raked to a 3-inch depth before and after application of pesticide. The trees were planted in 1981 in a gravelly loam soil at the PSU Fruit Lab in Arendtsville. The experimental design was a randomized complete block; there were eight blocks (four per cultivar) with a single, one tree plot/treatment/block. Nematodes were extracted by a combination of elutriation and Baermann funnel. The soil contained both X. americanum and X. rivesi. UC 70480-100 suppressed dagger nematode numbers by about 50% when compared with the untreated (but raked) control (Table 1).

Table 1. Effect of the nematicide UC 70480-100 on dagger nematode population density in an apple orchard.

Treatment [1]	Rate lb ai/acre	Xiphinema per 100 cc soil 4/11/84 [2]	6/5/84	11/7/84
Control	---	40a [3]	25a	99a
Nemacur 3	15	34a	16a	40b
UC 70480-100	5	45a	13a	56b
UC 70480-100	10	34a	13a	52b
UC 70480-100	20	28a	15a	62b

[1] Treatments were applied 25 April 1984. All plots were raked to a 3-inch depth before and after application of material.

[2] Pretreatment

[3] Means in a column followed by a different letter are significantly different (P=0.05) according to DMRT.

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Peach (Prunus persica 'Biscoe', 'Jersey Glo', 'Marqueen', 'Cresthaven', 'Redskin')
Dagger Nematode; Xiphinema spp.

EVALUATION OF NEMACUR AND FURADAN FOR CONTROL OF DAGGER NEMATODES IN FIVE COMMERCIAL PEACH ORCHARDS. Trees in five orchards (Table 1) planted in 1980 or 1981 were untreated or treated in April of 1982, 1983, and 1984 with Nemacur 3E (15 lb ai/acre) or Furadan 4F (10 lb ai/acre). Nematicides were sprayed onto the herbicide strip and were not incorporated. Soil samples were collected several times per year and processed by elutriation - Baermann funnel. The dagger nematode counts in Table 2 represent the mean over the 3 years of the experiment. The numbers of dagger nematodes were very low in orchard I and IV. These low counts were expected in orchard I because it was the only orchard of the five that was fumigated. However, orchard IV was not fumigated and the reason(s) for the low numbers is unknown. Orchard II was adjacent to orchard I and had low to moderate nematode numbers. Orchards III and V had relatively high numbers and neither Nemacur nor Furadan significantly reduced the numbers of nematodes in these orchards. In the fall of 1984, eight shoots (neither vertical nor horizontal) per tree were measured and each tree was rated for canker and vigor. Again, neither Nemacur nor Furadan affected shoot lengths, canker, or vigor ratings (data not shown).

Table 1. Characteristics of five commercial orchards treated with Nemacur and Furadan for three consecutive years.

Orchard	County	Variety	Fumigated	Texture	% Soil Organic matter	Soil pH
I	Franklin	Biscoe	Yes	Loam	1.4	5.9
II	Franklin	Jersey Glo	No	Loam	3.1	6.3
III	Adams	Marqueen	No	Loam	1.8	6.5
IV	Berks	Cresthaven	No	Sandy-loam	2.6	5.8
V	York	Redskin	No	Sandy-loam	1.4	6.8

Table 2. The effect of Nemacur and Furadan on dagger nematodes in five commercial peach orchards.[1]

Treatment	Rate (ai/acre)	Dagger nematodes per 100 cm^3 of soil, Orchard I	II	III	IV	V
Control	--	2a	12a	59a	1a	13a
Nemacur 3E	15 lb	1ab	9a	51a	1a	23a
Furadan 4F	10 lb	0b	4b	39a	1a	24a

1) Treatments were applied in a randomized block design. Each treatment was replicated 5 times with 5 trees per replicate. Treatments were applied in April 1982, 1983, and 1984. Means in a colum followed by the same letter are not significantly different (DMRT, $P = 0.05$). The nematode numbers are the means of 7 sample periods from April 1982 to September 1984.

CONTROL OF APPLE DISEASES WITH EXPERIMENTAL FUNGICIDES IN 1985

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Sprays of new fungicides were applied by handgun on 8-year-old apple trees at the South Carolina Agricultural Experiment Station, Clemson University, for control of scab, rust, and summer diseases. Sprays were applied to runoff on single trees replicated four times in a randomized complete block on 13 March (silver tip - Difolatan treatments only), 25 March (half-inch green), 2 April (pink), 11 April (bloom), 18 April (petal fall), and on 3, 15, and 30 May; 13 and 16 June; 10 and 25 July; and 8 August. Insecticides, applied separately by airblast sprayer, were dormant oil (13 March), phosphamidon 4 oz/100 gal on 4 April, Penncap M 1 qt/100 gal on 23 April, 23 May, 25 June; Imidan 50W 1.0 lb/100 gal on 9 April, 8 May, 12 June, and 8 July; and Sevin 80W on 18 June and 8 July. Scab and rust on cluster leaves were determined by examining 100 leaves per tree on 29 May; scab on terminal leaves was determined from all leaves on 10 terminals per tree on 22 August; and the remaining data were obtained from 100 fruits per tree on 28 August. Percentage fruit russet was estimated from 25 fruits per tree on 28 August.

Rainfall was light to moderate early in the season (6.1 cm in April, 9.5 cm in May, and 6.6 cm in June) but was heavy in July and the first 3 weeks in August (24.7 and 15.9 cm, respectively). Primary scab infections were relatively light, but late-season diseases were severe. All treatments controlled scab, but the 8-ml rate of DPX H-6573 was marginally effective late in the season. All treatments controlled rust, but captan was somewhat less effective than the others. Control of sooty blotch and fly speck was excellent with treatments containing mancozeb; captan was not very effective, and DPX H-6573 had no effect. DPX H-6573 seemed to increase the amount of bitter rot. Fruit russet was severe in all treatments.

Treatment and rate per 100 gallons	% scab cluster leaves	% scab terminal leaves	% scab fruit	% rust	% sooty blotch	% flyspeck	% bitter rot	% russet
Difolatan 80 DF 5 lb silver tip; Captan 50W 2 lb pink and following sprays	0.0	2.8	1.0	6.5	13.8	40.0	1.2	24
Difolatan 80 DF 5 lb + oil 1 qt silver tip; Captan 50W 2 lb pink and following sprays	0.0	3.0	0.2	2.5	11.0	46.0	1.2	18
DPX H-6573 40EC 8 ml	0.0	14.2	0.0	0.0	100	100	29.0	24
DPX H-6573 40EC 12 ml	0.0	3.0	0.2	0.0	100	100	26.0	26
RH-3866 40W 1.25 oz; Dithane M-45 80W 1.5 lb beginning 3rd cover	0.0	4.5	1.0	0.0	8.5	2.0	1.0	25
RH-3866 40W 2.5 oz; Dithane M-45 80W 1.5 lb beginning 3rd cover	0.0	2.5	0.2	0.0	4.5	0.0	0.0	27
RH-3866 40W 1.25 oz plus Dithane M-45 2 lb; M-45 1.5 lb beginning 3rd cover	0.0	2.8	0.0	0.0	4.5	0.0	1.0	26
Topas 61W 1.0 lb	0.0	4.3	0.0	0.0	17.7	3.7	0.7	18
Bayleton 25W 1.5 oz plus Dithane M-45 80W 2.0 lb; M-45 1.5 lb beginning 3rd cover	0.0	2.5	0.2	0.0	7.2	0.0	1.5	28
Captan 50W 2.0 lb	0.2	4.0	0.2	5.2	22.2	41.5	2.2	27
Check	8.0	96.2	9.3	43.5	100	100	6.3	18
L.S.D. .05	2.6	6.7	4.9	9.4	14.2	10.6	14.5	N.S.

POSTPLANTING APPLICATIONS OF NEMATICIDES ON PEACH FOR CONTROL OF CRICONEMELLA XENOPLAX

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An experiment to test the effectiveness of certain nematicides as postplanting treatments to control Criconemella xenoplax on peach began in 1979. An old peach orchard site at the Sandhill Experiment Station, Elgin, SC, was fumigated with Telone II, 25 gpa in strips 9 feet wide centered on the tree row. Harvester peach trees on Lovell rootstock were planted in February 1980. The Telone II treatment controlled C. xenoplax in the orchard for ca. 2 years after planting.

Ten postplanting treatments were applied beginning in November 1982 (Table 1). Soil samples collected just before treatment showed that C. xenoplax was reestablished in all plots, although populations were variable (Table 1). Each treatment consisted of four replicates of four trees each in a randomized complete block. Nemacur at 10 lb a.i. per acre was applied once each year (autumn), twice per year (spring and autumn), or once as a split application (autumn). Telone II and Furadan were tested at two rates (20 and 30 gpa and 6 and 14 lb active per acre, respectively). Ridomil plus CGA 12223 were applied in 1982; but because the treatment was ineffective, SDS Biotech DS-38697 5G was substituted in spring, 1984, and in the fall 1984 for Mocap. Telone II was applied by shank injection 4 inches deep and immediately sealed with a tree hoe to reduce vapor loss into the air. Nemacur and Furadan were applied via herbicide sprayer without incorporation. Mocap and DS 38697 were applied with a cyclone-type spreader and incorporated 1-2 inches deep. All treatments were applied in bands 8 feet wide on both sides of the tree row.

After the November 1982 treatments, spring treatments of Nemacur were applied May 11, 1985 and April 19, 1984. All treatments were renewed in late October or early November in 1983 and 1984 except for the substitutions noted above.

For the split application of Nemacur, 19 and 14 days separated the treatments in 1982 and 1983, respectively. Soil was moist and soil temperatures ranged between 57 and 68 F.

Annual applications of Nemacur were insufficient to reduce nematode populations to an acceptable level whether applied once or as a split application (Table 1). In the semi-annual treatment, four applications were required to control the population. Telone II was more effective for rapid reduction of populations to acceptable levels, but populations increased above threshold level within 1 year. Furadan, Mocap, and the Ridomil-CGA 12223 treatments were ineffective. DS 38697 at the 10-lb a.i. rate was effective. Relative effectiveness of nematode control was reflected in tree mortality which was extensive in 1985. No tree loss followed applications of DS 38697 (mortality shown in Table 1 preceded application of this material), and mortality was low in Telone II-treated plots. Treatments did not significantly affect tree growth. Results indicate that Telone II and DS 38697 probably are superior to the Nemacur standard for controlling C. xenoplax and peach tree short life.

Table 1. Control of <u>Criconemella xenoplax</u> following applications of certain nematicides after planting in a peach orchard.

Treatment and rate per acre	C. xenoplax/100cm^3 soil 1982	1983				1984				1985
	11/3 (Pi)	1/20	5/4	7/12	10/21	2/16	5/14	8/13	10/29	Dead Trees per plot
Telone II 20 gallons	140	75	16	28	71	16	97	182	68	.75
Telone II 30 gallons	350	65	39	37	43	44	17	120	59	.25
Nemacur 10 lb ai (fall)	232	141	89	83	188	98	118	171	82	1.75
Nemacur 10 lb ai (fall and spring)	436	429	157	159	150	66	89	36	35	1.75
Nemacur 10 lb ai (split appl. - fall)	120	91	38	65	208	71	63	93	77	3.0
Mocap 10G 400 lb; DS-38697 (5G 100 lb fall, 1984)	129	111	127	201	316	299	271	209	251	3.0
Ridomil 2E 1.0 gal plus CGA 12223 4E 1.5 gal	141	180	91	79	465	283	--	--	--	.75
DS-38697 5G 200 lb[a]	--	--	--	--	--	--	305	35	15	
Furadan 4E 3.3 gal	112	109	38	260	100	317	314	222	59	0.5
Furadan 4E 1.5 gal	134	79	42	98	111	142	202	111	52	1.0
Check	230	64	63	56	118	123	193	88	102	1.5
L.S.D. .05	196	195	99	170	214	153	99	116	--	1.54

[a]Substituted for the Ridomil-CGA 12223 treatment on April 19, 1984.

APPLE FUNGICIDE TESTING - 1985

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The following fungicides were applied to 7-year old Stayman 201/MM106 apple trees planted 20 x 20 feet: DPX H6573 (Nustar, DuPont) 8.87 ml/100 gallons, Dikar 2.0 lb/100 gallons, Topas 61M (Ciba-Geigy) 0.25 lb/100 gallons triflorine (Funginex) 10.0 oz/100 gallons and no spray. The materials were sprayed to drip run-off using a Myers V7710-5E02G hydraulic handgun sprayer generating 175 psi and applied on the following dates: 4/19, 4/24, 5/10, 5/24, 6/7, 6/19, 7/30 and 8/15. Each treatment was replicated six times and randomized.

The data were taken from 50 leaves per tree, counting the number of infected leaves and converting to percent infection per treatment. Foliar apple scab data were taken on 7/16 and 8/29. Powdery mildew data were taken on 8/29. Fruit infection data were taken at harvest time during the week of 9/30. The data were recorded from 50 apples per tree and presented as percent infection. Fruit finish ratings were based on a scale of 1-10 with 1 being poor and 10 excellent (Table 1).

Insecticide applications were made separately on a regular schedule with a Swanson DA400 airblast sprayer at 80 gallons per acre and included the following materials: Ambush, azinphosmethyl 50W, methomyl 1.8L and Carzol.

Table 1. Percent Foliar and Fruit Disease Incidence and Fruit Finish Ratings.

		FOLIAGE			FRUIT			
Materials	Rate/ 100 gal	Apple Scab 7/16	Apple Scab 8/29	Powdery Mildew 8/29	Apple Scab 9/30	Fly Speck 9/30	Sooty Blotch 9/30	Fruit Finish (1-10)
DPX H6573	8.87 ml	2.6	0.66	8.0	0.33	1.33	0.33	8.3
Dikar	2.0 lb	2.32	6.66	5.3	0.5	0.0	0.0	6.6
Topas 61M	0.25 lb	7.2	6.32	13.2	0.0	0.66	0.0	8.16
Triflorine	10.0 oz	2.6	2.32	10.0	0.33	0.33	0.16	7.16
No Spray I		22.6	16.0	8.0	3.0	6.8	8.66	7.83
No Spray II		30.0	27.2	13.6	2.66	5.16	4.66	8.66

APPLE (*Malus sylvestris* 'Delicious', 'Golden Delicious', 'Rome', 'Stayman')
Sooty blotch; *Gloeodes pomigena*
Fly speck; *Microthyriella rubi*
Fruit rots; *Physalospora obtusa*, *Glomerella cingulata* and *Botryosphaeria dothidea*
Apple scab; *Venturia inaequalis*

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APPLE DISEASES AND THEIR CONTROL AT BLACKSBURG, VIRGINIA DURING 1985: Thirteen fungicides and fungicide combinations were evaluated for disease control on 20-year-old semi-dwarf apple cultivars. Two-tree plots replicated four times for each treatment, as well as the unsprayed check trees, were used for the study. The fungicides were applied dilute (1X) with a John Bean conventional high-pressure sprayer delivering 450 psi equipped with a single nozzle hand-gun. The insecticides were applied with an AgTech Model 3002 low volume sprayer delivering 50 gal/A. Demeton 6EC (Systox) 15.0 oz/A concentrate was used in the early and full pink sprays for control of aphids. Azinphosmethyl 50W (Guthion) 1.5 lb/A concentrate was used as the standard insecticidal program. Treatments were applied Apr 11, 18, 26; May 1, 9, 21; Jun 5, 20; Jul 3, 17 and Aug 5, 21 (Aug 21 was applied to 1/2 of trees in each treatment; see tables). Data were recorded May 9 through 23, Jun 12 through 19, Jul 24 through 27, and Aug 27 through Sep 27.

Climatological conditions for high quality fruit production were the worst that I have recorded for the 20-year-old orchard. The ambient temperature surrounding the orchard area was 16°F, night of Apr 9-10 (tight cluster), but the temperature was maintained at 20°F within the orchard with a Tropical Breeze wind machine (100 HP electrical motor with a 360° rotation). There was not a single infection period from green-tip through chemical apple thinning in mid-May. Thus, apple leaf and fruit scab and cedar apple and Quince rusts were absent. Minor terminal scab developed during the later part of Jul, Aug and Sep as a result of heavy rains, and early morning fogs that frequently remained until 11:00 a.m. (Tables 1, 2, 3, 4). As a result of the above average precipitation in Jul, Aug and Sep and the intensive and extensive fogs, sooty blotch and fly speck were destructive throughout the orchard (Tables 1, 2, 3, 4). Rubigan, as an all-season treatment, was the least effective for sooty blotch and fly speck control (Tables 1, 2, 3, 4). The combination of Polyram 80W or Manzate 80W with Rubigan greatly improved sooty blotch and fly speck control. Funginex as an all-season treatment was ineffective for sooty blotch and fly speck control, but a combination with Polyram provided good protection. Reduced concentrations of Bayleton with reduced concentrations of Topsin-M also were ineffective for sooty blotch and fly speck suppression with heavy disease pressure. The data recorded from the sterol inhibitor compounds supports the concept that they are relatively ineffective for summer disease control when applied at the 14-day intervals. In relation to the summer diseases there was considerable difference in disease control when the spray applications were discontinued 8/5/85 versus 8/21/85 (Tables 1, 2, 3, 4). As a whole, fruit finish was good with all treatments of Delicious, Rome, and Stayman. There was some variability in fruit russet of Golden Delicious (Table 1).

Table 1.

Fungicide and rate/100 gal[1/]	% Golden Delicious fruit, leaves or terminals affected with: last spray applied 8/5/85: scab[2/] fruit	scab[2/] leaves	scab[2/] terminal	sooty[3/] blotch	fly[3/] speck	rots[3/]	last spray applied 8/21/85: scab[2/] fruit	scab[2/] leaves	scab[2/] terminal	sooty[3/] blotch	fly[3/] speck	rots[3/]	% Fruit area russeted
Rubigan 1EC 6 oz + Multifilm ..... X-77 .06%/A	0	0	0	100	86	20	0	0	0	58	42	10	10
Rubigan 1AS 6 oz + Multifilm ..... X-77 .06%/A	0	0	0	84	86	2	0	0	0	82	94	4	12
Rubigan 1EC 6 oz + Polyram 80W ... 2.416 ai/A	0	0	0	4	2	1	0	0	0	2	0	1	7
Rubigan 1EC 6 oz + Manzate 80W ... 1.6 lb ai/A	0	0	0	8	4	1	0	0	0	4	2	2	12
Topsin M 70W 2.0 oz + Bayleton ... 50W 0.75 oz	0	0	0	20	52	3	0	0	0	18	16	2	11
T02192 (Topsin M 4.5F) 2.5 oz + .. Bayleton 50W 0.75 oz	0	0	0	18	44	1	0	0	0	16	17	0	13
Dithane M-45 2.0 lb + Bayleton ... 50W 0.5 oz through second cover then reduce Dithane M-45 to 1.5 lb, except heavy rains use 2.0 lb	0	0	3	6	4	0	0	0	0	1	1	2	10
RH3866 40W 1.0 oz through second cover then use Dithane M-45 as treatment above	0	0	0	4	6	1	0	0	0	0	0	1	12
Baycor 50W 1.0 oz ai	0	0	0	10	18	0	0	0	0	4	8	2	11
Baycor 50W 2.0 oz ai gal 72 hrs.. post infection. Continue at no closer than 10 days to petal fall then 1.0 oz rest of season	0	0	0	12	19	1	0	0	0	2	14	1	11
Funginex 1.6EC 8.0 oz	0	0	0	8	42	6	0	0	0	4	12	4	8
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb to petal fall, then Polyram 80W 2.0 lb rest of season	0	0	0	0	0	1	0	0	0	0	2	0	7
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb 72 hr post scab infection, treatments were not made less than 7-day intervals	0	0	0	2	4	6	0	0	0	0	0	0	7
Check	0	0	15	100	100	18	0	0	15	100	100	18	14

1/ All rates are /100 gal except where designated /acre (/A).

2/ Scab data were recorded on 100 fruit/treatment/replicate, primary leaf scab infection on leaves of 10 shoots/tree/treatment/replicate and terminal scab by examining the last 8 initiated leaves of 30 terminals/treatment/replicate.

3/ Rots included black (*Physalospora obtusa*), bitter (*Glomerella cingulata*) and white (*Botryosphaeria dothidea*); rot, sooty blotch and fly speck infections were determined by counting 100 fruit from each treatment and replicate.

4/ Fruit russet was determined by examining 100 fruit/treatment/replicate.

Table 2.

Fungicide and rate/100 gal[1]	% Delicious fruit, leaves or terminals affected with:												% Fruit area russeted
	last spray applied 8/5/85						last spray applied 8/21/85						
	scab[2]			sooty[3]	fly[3]		scab[2]			sooty[3]	fly[3]		
	fruit	leaves	terminal	blotch	speck	rots[3]	fruit	leaves	terminal	blotch	speck	rots[3]	
Rubigan 1EC 6 oz + Multifilm ..... X-77 .06%/A	0	0	0	78	72	0	0	0	0	64	62	0	5
Rubigan 1AS 6 oz + Multifilm ..... X-77 .06%/A	0	0	2	56	66	0	0	0	3	30	56	0	5
Rubigan 1EC 6 oz + Polyram 80W ... 2.416 ai/A	0	0	1	2	1	0	0	0	1	0	0	1	5
Rubigan 1EC 6 oz + Manzate 80W ... 1.6 lb ai/A	0	0	0	2	0	0	0	0	0	0	0	0	5
Topsin M 70W 2.0 oz + Bayleton ... 50W 0.75 oz	0	0	0	4	24	3	0	0	1	8	8	0	5
T02192 (Topsin M 4.5F) 2.5 oz + .. Bayleton 50W 0.75 oz	0	0	2	8	24	1	0	0	2	14	6	0	5
Dithane M-45 2.0 lb + Bayleton ... 50W 0.5 oz through second cover then reduce Dithane M-45 to 1.5 lb, except heavy rains use 2.0 lb	0	0	1	4	6	0	0	0	1	2	1	0	4
RH3866 40W 1.0 oz through second . cover then use Dithane M-45 as treatment above	0	0	2	8	4	2	0	0	0	0	0	0	5
Baycor 50W 1.0 oz ai	0	0	1	11	22	0	0	0	0	4	14	0	5
Baycor 50W 2.0 oz ai 72 hrs ..... post infection. Continue at no closer than 10 days to petal fall then 1.0 oz rest of season	0	0	2	10	44	0	0	0	3	4	18	0	5
Funginex 1.6EC 8.0 oz	0	0	3	21	33	4	0	0	3	15	23	0	6
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb to petal fall, then Polyram 80W 2.0 lb rest of season	0	0	0	4	4	0	0	0	0	2	1	0	5
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb 72 hr post scab infection, treatments were not made less than 7-day intervals	0	0	0	2	14	0	0	0	1	2	4	0	5
Check	0	10	80	92	90	10	0	10	80	92	90	10	7

[1] All rates are /100 gal except where designated /acre (/A).

[2] Scab data were recorded on 100 fruit/treatment/replicate, primary leaf scab infection on leaves of 10 shoots/tree/treatment/replicate and terminal scab by examining the last 8 initiated leaves of 30 terminals/treatment/replicate.

[3] Rots included black (<u>Physalospora obtusa</u>), bitter (<u>Glomerella cingulata</u>) and white (<u>Botryosphaeria dothidea</u>); rot, sooty blotch and fly speck infections were determined by counting 100 fruit from each treatment and replicate.

[4] Fruit russet was determined by examining 100 fruit/treatment/replicate.

Table 3.

Fungicide and rate/100 gal[1/]	% Rome fruit, leaves or terminals affected with: last spray applied 8/5/85: scab[2/] fruit	scab[2/] leaves	scab[2/] terminal	sooty[3/] blotch	fly[3/] speck	rots[3/]	last spray applied 8/21/85: scab[2/] fruit	scab[2/] leaves	scab[2/] terminal	sooty[3/] blotch	fly[3/] speck	rots[3/]	% Fruit area russeted
Rubigan 1EC 6 oz + Multifilm ..... X-77 .06%/A	0	0	0	76	86	1	0	0	0	70	64	0	6
Rubigan 1AS 6 oz + Multifilm ..... X-77 .06%/A	0	0	5	90	67	3	0	0	1	76	86	4	6
Rubigan 1EC 6 oz + Polyram 80W ... 2.416 ai/A	0	0	1	6	6	1	0	0	0	6	6	1	5
Rubigan 1EC 6 oz + Manzate 80W ... 1.6 lb ai/A	0	0	1	16	18	1	0	0	0	12	14	1	5
Topsin M 70W 2.0 oz + Bayleton ... 50W 0.75 oz	0	0	0	18	46	1	0	0	0	7	14	0	5
T02192 (Topsin M 4.5F) 2.5 oz + .. Bayleton 50W 0.75 oz	0	0	5	10	34	2	0	0	1	12	10	1	5
Dithane M-45 2.0 lb + Bayleton ... 50W 0.5 oz through second cover then reduce Dithane M-45 to 1.5 lb, except heavy rains use 2.0 lb	0	0	1	2	6	1	0	0	0	2	2	1	6
RH3866 40W 1.0 oz through second . cover then use Dithane M-45 as treatment above	0	0	1	24	14	3	0	0	3	8	14	3	5
Baycor 50W 1.0 oz ai	0	0	0	14	24	1	0	0	1	10	12	1	5
Baycor 50W 2.0 oz ai 72 hrs ..... post infection. Continue at no closer than 10 days to petal fall then 1.0 oz rest of season	0	0	1	10	19	0	0	0	1	10	14	0	5
Funginex 1.6EC 8.0 oz	0	0	5	19	29	0	0	0	1	0	8	0	6
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb to petal fall, then Polyram 80W 2.0 lb rest of season	0	0	0	4	6	1	0	0	0	2	2	0	6
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb 72 hr post scab infection, treatments were not made less than 7-day intervals	0	0	4	11	21	3	0	0	2	7	12	0	6
Check	0	11	100	100	78	17	0	11	100	100	78	17	8

[1/]All rates are /100 gal except where designated /acre (/A).

[2/]Scab data were recorded on 100 fruit/treatment/replicate, primary leaf scab infection on leaves of 10 shoots/tree/treatment/replicate and terminal scab by examining the last 8 initiated leaves of 30 terminals/treatment/replicate.

[3/]Rots included black (Physalospora obtusa), bitter (Glomerella cingulata) and white (Botryosphaeria dothidea); rot, sooty blotch and fly speck infections were determined by counting 100 fruit from each treatment and replicate.

[4/]Fruit russet was determined by examining 100 fruit/treatment/replicate.

Table 4.

Fungicide and rate/100 gal[1]	% Stayman fruit, leaves or terminals affected with: last spray applied 8/5/85: scab[2] fruit	scab[2] leaves	scab[2] terminal	sooty[3] blotch	fly[3] speck	rots[3]	last spray applied 8/21/85: scab[2] fruit	scab[2] leaves	scab[2] terminal	sooty[3] blotch	fly[3] speck	rots[3]	% Fruit area russeted
Rubigan 1EC 6 oz + Multifilm ..... X-77 .06%/A	0	0	5	86	48	3	0	0	0	73	39	1	6
Rubigan 1AS 6 oz + Multifilm ..... X-77 .06%/A	0	0	1	83	81	3	0	0	0	71	76	2	6
Rubigan 1EC 6 oz + Polyram 80W ... 2.416 ai/A	0	0	1	10	4	4	0	0	0	3	2	1	5
Rubigan 1EC 6 oz + Manzate 80W ... 1.6 lb ai/A	0	0	1	14	17	1	0	0	0	7	5	1	6
Topsin M 70W 2.0 oz + Bayleton ... 50W 0.75 oz	0	0	0	24	36	3	0	0	5	16	32	0	6
T02192 (Topsin M 4.5F) 2.5 oz + .. Bayleton 50W 0.75 oz	0	0	7	26	38	2	0	0	1	20	24	0	6
Dithane M-45 2.0 lb + Bayleton ... 50W 0.5 oz through second cover then reduce Dithane M-45 to 1.5 lb, except heavy rains use 2.0 lb	0	1	4	8	10	3	0	0	2	3	4	1	5
RH3866 40W 1.0 oz through second . cover then use Dithane M-45 as treatment above	0	0	1	34	20	2	0	0	1	24	14	0	6
Baycor 50W 1.0 oz ai	0	-	-	-	-	-	-	-	-	-	-	-	-
Baycor 50W 2.0 oz ai 72 hrs ..... post infection. Continue at no closer than 10 days to petal fall then 1.0 oz rest of season	0	0	3	18	20	1	0	1	3	19	14	0	6
Funginex 1.6EC 8.0 oz	0	0	3	23	43	1	0	0	3	17	23	0	6
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb to petal fall, then Polyram 80W 2.0 lb rest of season	0	0	0	6	4	0	0	0	0	2	2	0	5
Funginex 1.6EC 8 oz + Polyram ... 80W 1.0 lb 72 hr post scab infection, treatments were not made less than 7-day intervals	0	-	-	-	-	-	-	-	-	-	-	-	-
Check	0	9	89	100	100	19	0	9	89	100	100	19	11

[1]All rates are /100 gal except where designated /acre (/A).

[2]Scab data were recorded on 100 fruit/treatment/replicate, primary leaf scab infection on leaves of 10 shoots/tree/treatment/replicate and terminal scab by examining the last 8 initiated leaves of 30 terminals/treatment/replicate.

[3]Rots included black (<u>Physalospora obtusa</u>), bitter (<u>Glomerella cingulata</u>) and white (<u>Botryosphaeria dothidea</u>); rot, sooty blotch and fly speck infections were determined by counting 100 fruit from each treatment and replicate.

[4]Fruit russet was determined by examining 100 fruit/treatment/replicate.

APPLE (*Malus sylvestris* 'Delicious', 'Golden Delicious', 'Rome', 'Stayman')
Apple scab; *Venturia inaequalis*

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SUSCEPTIBILITY OF RED DELICIOUS SPORTS AT BLACKSBURG, VA: Red Delicious is the number one apple cultivar in the United States. There are many mutants (frequently referred to as "sports", "strains", "bud mutations", etc.) within the Red Delicious cultivar. For better understanding and simplicity, however, the mutants will be referred to as "sports" in this paper. In general, the promotion of sports and super sports (super sport, a mutation from another sport) in nursery catalogues have become so numerous that growers are confused as to what sport to grow in relation to profitability. According to the USDA Handbook 291, "Entitled Losses in Agriculture 1965", apple scab is the most destructive disease of apple with an annual loss of approximately 4 percent. Since Red Delicious is the number one apple cultivar in the United States, it is important to gain some knowledge concerning the susceptibility of the various "sports" to apple scab. I have established 34 "sports" of Red Delicious in a semi-high and high-density orchard at Blacksburg, VA.

Red Delicious Sports

Starkrimson	Atwood Spur	Starkspur Supreme	Nured Spur
Starkspur Ultrared	Improved Ryan Red	Starkspur Compact	Early Bright
Topred	Oregon Spur	Rose Red	Bright-in-Early
Redspur	Oregon Spur II	House Spur	Early Red One
Red Chief (both strains)	Scarlet Spur	Chelan	Apex
Miller Sturdy Spur	Nured Royal	Red Queen	Dana
Red Prince	Spured Royal	Prime Red	
Silver Spur	Classic Red	Spur Prime Red	
Hardispur	Ace	Starking Ful Red	

All "sports" were established on clonal rootstocks (MM-111, MM-106, M-26 and M-7A). The trees range in age from 6 to 20 years depending on establishment date, and with at least 5 trees/"sport".

Apple scab susceptibility data were recorded on each of the Delicious "sports" and replicates starting with the second year after establishment. All Delicious "sports" were treated with a minimum threshold level of effectiveness of a standard protectant fungicide (mancozeb, polyram or captan) for an average of climatological conditions. Thus, the trees were in some apple scab stress when the climatological conditions favorable for scab development exceeded the average. The same protectant fungicide was used on all "sports" for any one given season.

Scab susceptibility data were recorded for the reaction of the "sports" from five to nineteen growing seasons depending on establishment data. Although five growing seasons constituted a relatively short period of time for a study of this nature, there were as many as ten situations, during any five-year period, that the climatological conditions favorable for scab stress exceeded the average requirement for infection. Thus, scab infection did occur. Although scab infections occurred on all of the "sports", it was not any more or less severe than on Starkrimson the standard (the oldest "sport" in the orchard). There were differences in severity or extent of scab development with the various replicates of a given sport, but they were site related (low areas with high humidity) rather than susceptibility. When trees from the various "sport" series were used as unsprayed checks with average scab pressure there was no difference in disease development. Even with severe scab development pressure there were no more lesions per leaf on one "sport" than of another. In summary, those characteristics of the Red Delicious cultivar that mutated to some more desirable character (spur, color, stripe, tipey fruit, better maturity, less water-core, etc.) evidently has not changed the susceptibility to apple scab from that of the standard, Starkrimson. Thus, when recommended sprays are applied at the correct time and concentration to any of the sports mentioned in this paper one may expect as good control of scab as that obtained with the standard.

PEACH LEAF CURL CONTROL TRIALS - 1985

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Bravo 500 (SDS Biotech Corp.) and ferbam 76W were compared for the control of peach leaf curl. Both materials were applied at a dilute rate of 300 gallons per acre and a concentrate rate of 80 gallons per acre with a Swanson DA400 airblast sprayer traveling at 1.7 miles per hour.

The materials were applied to two plots. The first plot consisted of two mini-blocks of 36 trees each of 5-year old Redhaven peach trees using three trees per replicate and each trial replicated three times. The replicates were randomized. The second plot consisted of 64 trees in four rows of 15-year old Redskin peach trees using 8 adjacent trees for each trial as single tree replicates to accommodate spray applications.

The peach trees were subject to -11°F with 25 to 30 mile per hour winds on January 21 which caused all peach fruit buds to be killed and also eliminated additional testing for brown rot blossom blight and peach scab control.

The sprays were applied at budbreak on March 26, and the data taken on May 9. Peach leaf curl symptoms were meager and considerably delayed in their appearance.

Table 1. Materials, Rates and Number of Leaves per Tree with Symptoms of Peach Leaf Curl.

	REDHAVEN		REDSKIN	
Applications	No. Trees	Infections/ Tree	Trees	Infections/ Tree
Dilute Bravo 500 4.5 pt/A	9	0.22	7	0.14
Concentrate Bravo 500 4.5 pt/A	8	0.00	9	2.44
Dilute Bravo 500 6.0 pt/A	9	0.44	7	2.57
Concentrate Bravo 500 6.0 pt/A	9	0.11	7	1.87
Dilute ferbam 76W 6.0 lb/A	9	0.33	8	2.00
Concentrate ferbam 76W 6.0 lb/A	9	0.44	8	2.12
Check, No Spray	9	0.22	7	22.42

NOT FOR PUBLICATION
Table 1

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PEACH: <u>Prunus persicae</u>, 'Blake'
Green peach aphid (GPA): <u>Myzus persicae</u> (Sulzer)

PEACH, GREEN PEACH APHID CONTROL, 1985: Insecticides were applied to five single-tree replications of 6-year-old trees in a randomized block design. Sprays were applied to runoff on 18 April (approximately petal fall stage) with a Myers V7710-5E02G hydraulic sprayer equipped with a handgun and operated at a pressure of 200 lb/in^2. Treatment effectiveness was determined on 21 May by counting the number of GPA colonies found on each tree.

Pyrethroid insecticides (Pounce, Pydrin, MO 070616, Spur) and MAT 5927 provided excellent control of GPA. Most GPA colonies were found in leaf clusters around the trunk region.

No.	Treatment and	rate/100 gal	(lb ai)	GPA Colonies/Tree[a]
1	Lannate 1.8L	474 ml	(0.23)	7.4 ab
2	Orthene 75S	242 g	(0.4)	7.8 ab
3	Pounce 3.2EC	60 ml	(0.05)	2.4 bc
4	Pydrin 2.4EC	80 ml	(0.05)	1.6 c
5	MO 070616 1.9EC	25 ml	(.0125)	4.0 bc
6	Spur 22EW	96 ml	(0.05)	1.2 c
7	MAT 5927 50W	140 g	(0.15)	1.8 bc
8	Check	Unsprayed		25.8 a

[a]Means in a given column followed by the same letter are not significantly different (<u>P</u> - 0.05), by LSD. Data were transformed to $\log_{10}(X + 1)$ for analysis.

NOT FOR PUBLICATION
Table 2

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APPLE: *Malus domestica* Borkh., 'Red Chief Delicious'
European red mite (ERM): *Panonychus ulmi* (Koch)

APPLE, SAVEY EVALUATION, 1985: Testing was conducted at Twin Ridge Orchards in Shenandoah Junction, WV under a DuPont Experimental Use Permit. Treatments were applied on 15 April (pink) by DuPont to approximately one-third ha plots of 11 and 12-year-old trees with a Tifone 3-point hitch airblast sprayer delivering 991 l/ha at a travel speed of 3.22 k/hr. Because of a high mite population, the check was treated with a handgun application of Vydate 2L at 947 ml per 100 gallons of water on 27 May. Treatment effectiveness was determined by sampling 25 leaves from the periphery of each of 4 trees, removing mites with a mite-brushing machine and counting active stages with a binocular microscope.

Savey provided excellent mite control for 10½ weeks. All rates of application were equally effective.

Treatment and	rate/acre	(lb ai)	Mean No. ERM/Leaf[a] 7 May	22 May	6 June	27 June
Savey 50WP	99 g	(0.11)	.04 b	.06 b	.04 b	1.46 b
Savey 50WP	149 g	(0.16)	.04 b	.20 b	.12 b	2.14 b
Savey 50WP	198 g	(0.22)	.02 b	0 b	.02 b	1.22 b
Savey 50WP Vydate 2L	149 g 710 ml	(0.16) + (0.38)	0 b	.06 b	.02 b	2.64 b
Check[b]	Unsprayed		.95 a	27.02 a	4.68 a	21.05 a

[a]Means in a given column followed by the same letter are not significantly different (*P* = 0.05), by LSD.

[b]Vydate 2L handgun application at 947 ml/100 gallon on 27 May.

Table 3 continued

No.	Treatment and rate/100 gal		(lb ai)	Time of Application[a]	Mean No. ERM/Leaf[b] 29 May	18 June	1 July	18 July[c]
7	Danitol 2.4EC	160 ml	(0.1)	PF, 7/5	.1 b	1.9 bc	6.4 ab	1.7 bc
8	Check	Unsprayed			2.0 a	5.4 a	11.0 a	28.0 a

No.	Treatment and rate/100 gal		(lb ai)	Time of Application	29 July ERM/Leaf	29 July SP/3 Min	12 August ERM/Leaf	12 August SP/3 Min
1	Apollo 50SC	30 ml	(0.03)	TC, 7/5	.6 c	3.0 bc	.04 b	.6 b
2	Apollo 50SC	30 ml	(0.03)	P	.7 c	3.0 bc	.1 b	.8 b
	Apollo 50SC	15 ml	(0.015) +					
	Carzol 92SP	57 g	(0.12)	7/5				
3	Apollo 50SC	30 ml	(0.03)	PF	.4 c	3.4 bc	.1 b	.2 b
	Apollo 50SC	15 ml	(0.015)	7/5				
4	Savey 50WP	28 g	(0.03)	P	.2 c	1.2 c	.02 b	.4 b
	Savey 50WP	14 g	(0.015)	7/5				
5	Savey 50WP	57 g	(0.06)	P	0 c	1.0 c	0 b	.8 b
	Savey 50WP	28 g	(0.03)	7/5				
6	Carzol 92SP	113 g	(0.24)	PF, 7/5	3.3 b	8.2 ab	.02 b	.6 b
7	Danitol 2.4EC	160 ml	(0.1)	PF, 7/5	11.7 a	4.8 abc	3.8 a	3.4 a
8	Check	Unsprayed			5.6 b	14.8 a	.06 b	.2 b

[a]TC = Tight Cluster (4/8), P = Pink (4/13), PF = Petal Fall (4/26).

[b]Means in a given column followed by the same letter are not significantly different (P = 0.05), by LSD.

[c]Data were transformed to $\log_{10}$ (X + 1) for analysis.

NOT FOR PUBLICATION
Table 3

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APPLE: *Malus domestica* Borkh., 'Triple Red Delicious'
European red mite (ERM): *Panonychus ulmi* (Koch)
Predator of mites (SP): *Stethorus punctum* (LeConte)

APPLE, ACARICIDE EVALUATION, 1985: Acaricides were applied to five single-tree replications of 6-year-old trees in a randomized block design. The first application was made at either the tight cluster (8 April), pink (13 April) or petal fall (26 April) stage, depending upon treatment (see table below). All treatments received a second application on 5 July. Sprays were applied with a Myers V7710-5E02G hydraulic sprayer equipped with a handgun and operated at a pressure of 200 lb/in^2. Treatment effectiveness was determined by sampling 20 leaves from the periphery of each tree (100/treatment), removing mites with a mite-brushing machine and counting active stages with a binocular microscope.

No significant difference in mite control was found between Apollo 50SC and Savey 50WP following an early season application, however, Savey 50WP provided a greater reduction in mites following a summer application. A summer application of Danitol 2.4EC resulted in a mite resurgence following an initial mite reduction.

No.	Treatment and rate/100 gal		(lb ai)	Time of Application[a]	Mean No. ERM/Leaf[b]			
					29 May	18 June	1 July	18 July[c]
1	Apollo 50SC	30 ml	(0.03)	TC, 7/5	.5 b	2.7 bc	5.2 ab	2.2 b
2	Apollo 50SC	30 ml	(0.03)	P	.7 b	2.6 bc	8.9 ab	2.2 b
	Apollo 50SC	15 ml	(0.015) +					
	Carzol 92SP	57 g	(0.12)	7/5				
3	Apollo 50SC	30 ml	(0.03)	PF	.1 b	.8 c	2.8 b	2.2 b
	Apollo 50SC	15 ml	(0.015)	7/5				
4	Savey 50WP	28 g	(0.03)	P	.3 b	1.2 bc	3.0 b	.7 c
	Savey 50WP	14 g	(0.015)	7/5				
5	Savey 50WP	57 g	(0.06)	P	.3 b	1.7 bc	5.3 ab	.6 c
	Savey 50WP	28 g	(0.03)	7/5				
6	Carzol 92SP	113 g	(0.24)	PF, 7/5	.4 b	3.5 ab	9.7 a	2.8 b

NOT FOR PUBLICATION
Table 4

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APPLE: *Malus domestica* Borkh., 'Rome Beauty'
European red mite (ERM): *Panonychus ulmi* (Koch)
Predator of mites (SP): *Stethorus punctum* (LeConte)

APPLE, SUMMER ACARICIDE EVALUATION, 1985: Acaricides were applied to single row plots of 32-year-old trees on 26 June. Application was with a Swanson DA400PT024 airblast sprayer delivering 935 l/ha at a travel speed of 3.86 k/hr. Treatment effect on European red mite was determined by sampling 20 leaves from the periphery of each of five trees, removing mites with a mite-brushing machine and counting active stages with a binocular microscope. The effect of acaricides on *Stethorus punctum* was evaluated by counting the number of adult and larval stages observed during a 3-minute period while walking around the tree periphery.

The only significant difference in mite control between Apollo 50SC and Savey 50WP occurred on 22 July when a higher mite population was recorded in the Apollo 50SC treatment. The larval stage of *Stethorus punctum* increased in abundance following application of Apollo 50SC and Savey 50WP.

				25 June			5 July			22 July		
					SP/3 Min.			SP/3 Min.			SP/3 Min.	
No.	Treatment and	rate/acre	(lb ai)	ERM/Leaf	Adults	Larvae	ERM/Leaf	Adults	Larvae	ERM/Leaf	Adults	Larvae
1	Kelthane 4F	1420 ml	(1.5)	17.3 a	20.2 a	21.4 a	4.1 b	11.2 a	7.2 b	.04 b	0.8 a	0 a
2	Apollo 50SC	118 ml	(.125)	14.6 a	10.4 b	15.2 a	9.1 ab	10.4 a	23.2 a	.24 a	1.2 a	0 a
3	Savey 50WP	113 g	(.125)	24.2 a	7.6 b	18.4 a	13.6 a	8.2 a	31.4 a	.02 b	0.2 a	0 a

Means in a given column followed by the same letter are not significantly different (*P* = 0.05), by LSD.

NOT FOR PUBLICATION

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APPLE: Malus domestica Borkh., 'Rome Beauty'
Apple Aphid (AA): Aphis pomi DeGeer
European red mite (ERM): Panonychus ulmi (Koch)
Predator of mites (SP): Stethorus punctum (LeConte)
Spotted tentiform leafminer (STLM): Phyllonorycter blancardella (Fabr.)
White apple leafhopper (WALH): Typhlocyba pomaria McAtee
Codling moth (CM): Cydia pomonella (Linnaeus)
San Jose scale (SJS): Quadraspidiotus perniciosus (Comstock)
Tufted apple budmoth (TABM): Platynota idaeusalis (Walker)

APPLE, INSECTICIDE EVALUATION, 1985: Insecticides were applied to four single-tree plots of 33-year-old trees in a randomized block design. Applications were made with a Swanson DA400PT024 airblast sprayer which traveled at 3.86 k/hr and delivered 2805 l/ha at the delayed dormant and pre-pink stages, and 935 l/ha for the remainder of the season. Dates of application were 8 Apr. [delayed dormant (DD)], 13 Apr. [pre-pink (PP)], 6 May [petal fall (PF)], 20 May [first cover (1C)], 3 June [second cover (2C)], 17 June [third cover (3C)], 3 July [fourth cover (4C)], 17 July [fifth cover (5C)], 1 and 2 Aug. [sixth cover (6C)], 21 Aug. [seventh cover (7C)], 3 Sep. [eighth cover (8C)]. Other materials applied separately to all treatments were Benlate, Captan, Dikar, Dithane M-45, Dithane Z-78, Solubor, Streptomycin and Topsin-M. Treatment effectiveness was determined for apple aphid by counting the number of infested leaves on 10 top terminals and the number of aphids/most infested leaf/terminal for each tree. Effect of treatments on European red mite was determined by sampling 25 leaves from the periphery of each tree, removing mites with a mite-brushing machine and counting active stages with a binocular microscope. Treatment effect on Stethorus punctum was determined by counting the number of adults and larvae observed during a 3-minute period on the periphery of the test trees. Control of spotted tentiform leafminer was evaluated by counting the number of mines observed in 5 minutes while walking around the periphery of each tree. The effect of treatments on white apple leafhopper was determined by counting the number of nymphs found on 25 leaves selected from the periphery of each tree. Treatment effectiveness on fruit feeding insects was determined by scoring for injury 400 apples per treatment (100/replication) plus all fallen apples sampled on 24 Sep.

Excellent control of apple aphid was provided by Danitol, Penncap-M + Thiodan and MAT 5927. Lorsban, Danitol and Spur were very effective in suppressing European red mites. Spur, at the higher rate, prevented a Stethorus punctum response in July. Danitol and Penncap-M were excellent, while UC27BF24 was poor, in the control of all fruit feeding insects. Lorsban provided excellent control of San Jose scale. Pest pressure was moderate to heavy throughout the season. No phytotoxicity was observed.

NOT FOR PUBLICATION

Table 5

No.	Treatment and	rate/acre	(lb ai)	Time of Application	29 May AA infested leaves/term.	29 May AA/most-infested leaf/term.	24 June AA infested leaves/term.	24 June AA/most-infested leaf/term.
1	Lorsban 4E	1420 ml	(1.50)	DD	0.2 b-e	3.6 c-f	6.9 cd	67.3 ab
	Lorsban 50W Lannate 1.8L	908 g 710 ml	(1.0) + (0.34)	PF				
	Lorsban 50W	908 g	(1.0)	1C-8C				
2	Orthene 75S	606 g	(1.0)	PP,PF	0.1 e	0.2 fg	2.9 efg	16.1 cd
	Danitol 2.4EC	632 ml	(0.4)	1C-8C				
3	Danitol 2.4EC	632 ml	(0.4)	PP-8C	0 e	0 g	1.7 g	9.4 d
4	Ambush 2E	284 ml	(0.15)	PP,PF	0.2 de	2.5 d-g	4.6 de	81.2 a
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C,8C				
5	Spur 22EW	228 ml	(0.12)	PP,PF,2C,3C, 6C,7C,8C	0.2 cde	1.3 efg	3.7 e	35.0 abc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
6	Spur 22EW	342 ml	(0.18)	PP,PF,2C,3C, 6C,7C,8C	0.3 b-e	3.3 c-f	3.3 ef	21.3 bcd
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
7	MO 070616 1.9EC	50 ml	(.025)	PP,PF,8C	0.2 b-e	3.0 d-g	3.1 efg	51.2 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				

Table 5 continued

No.	Treatment and	rate/acre	(lb ai)	Time of Application	29 May AA infested leaves/term.	29 May AA/most-infested leaf/term.	24 June AA infested leaves/term.	24 June AA/most-infested leaf/term.
8	MO 070616 1.9EC	100 ml	(0.05)	PP,PF,8C	0.4 b-e	1.6 d-g	3.1 ef	38.7 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				
9	F4999 15SC	152 ml	(0.05)	PF,2C,3C,6C, 7C,8C	0.7 ab	9.9 ab	10.4 abc	66.9 a
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
10	F4999 15SC	304 ml	(0.1)	PF,2C,3C,6C, 7C,8C	1.1 a	16.2 a	12.1 ab	33.7 abc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
11	Pounce 3.2EC	178 ml	(0.15)	PP,PF	0.2 de	1.4 d-g	1.9 fg	13.1 d
	Penncap-M 2F Thiodan 50W	710 ml 680 g	(0.37) + (0.75)	1C-8C				
12	Pounce 3.2EC	178 ml	(0.15)	PP,PF	0.5 a-d	5.1 bcd	8.5 bc	37.7 ab
	Penncap-M 2F	1420 ml	(0.74)	1C-8C				
13	UC27BF24 50W	454 g	(0.5)	PP-8C	0.5 a-d	4.7 b-e	9.0 abc	51.8 ab
14	MAT 5927 50W	568 g	(0.63)	PP,1C	0.1 e	0.4 fg	3.3 ef	51.0 ab
	Guthion 50W	680 g	(0.75)	PF,1C,4C,5C				
	Guthion 50W Lannate 1.8L	680 g 710 ml	(0.75) + (0.34)	2C,3C,6C,7C,8C				
15	Check	Unsprayed			1.1 abc	10.6 abc	14.2 a	57.8 ab

Means in a given column followed by the same letter are not significantly different (P = 0.05), by LSD.
Data were transformed to $\log_{10}$ (X + 1) for analysis.

NOT FOR PUBLICATION
Table 6

No.	Treatment and	rate/acre	(lb ai)	Time of Application	ERM/Leaf 10 June	SP/3 Min 14 June	ERM/Leaf 8 July	SP/3 Min 11 July
1	Lorsban 4E	1420 ml	(1.50)	DD	5.3 def	0.3 c	7.5 d	17.3 d
	Lorsban 50W Lannate 1.8L	908 g 710 ml	(1.0) + (0.34)	PF				
	Lorsban 50W	908 g	(1.0)	1C-8C				
2	Orthene 75S	606 g	(1.0)	PP,PF	0.1 f	0 c	0.2 e	0 e
	Danitol 2.4EC	632 ml	(0.4)	1C-8C				
3	Danitol 2.4EC	632 ml	(0.4)	PP-8C	0.1 f	0 c	0.1 e	0 e
4	Ambush 2E	284 ml	(0.15)	PP,PF	32.0 abc	0.8 c	46.4 abc	60.5 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C,8C				
5	Spur 22EW	228 ml	(0.12)	PP,PF,2C,3C, 6C,7C,8C	13.5 cde	0.5 c	33.4 bc	19.8 cd
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
6	Spur 22EW	342 ml	(0.18)	PP,PF,2C,3C, 6C,7C,8C	2.5 ef	0 c	24.5 c	1.3 e
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
7	MO 070616 1.9EC	50 ml	(.025)	PP,PF,8C	112.9 ab	0 c	72.4 a	38.8 abc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				

Table 6 continued

No.	Treatment and rate/acre (lb ai)			Time of Application	ERM/Leaf 10 June	SP/3 Min 14 June	ERM/Leaf 8 July	SP/3 Min 11 July
8	MO 070616 1.9EC	100 ml	(0.05)	PP,PF,8C	62.1 ab	0.5 c	65.3 ab	18.5 cd
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				
9	F4999 15SC	152 ml	(0.05)	PF,2C,3C,6C, 7C,8C	38.8 ab	2.5 bc	77.8 a	59.0 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
10	F4999 15SC	304 ml	(0.1)	PF,2C,3C,6C, 7C,8C	109.0 a	10.0 a	56.9 ab	32.0 a-d
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
11	Pounce 3.2EC	178 ml	(0.15)	PP,PF	117.9 a	8.8 a	47.5 abc	62.5 ab
	Penncap-M 2F Thiodan 50W	710 ml 680 g	(0.37) + (0.75)	1C-8C				
12	Pounce 3.2EC	178 ml	(0.15)	PP,PF	117.5 a	7.5 ab	35.6 abc	68.3 a
	Penncap-M 2F	1420 ml	(0.74)	1C-8C				
13	UC27BF24 50W	454 g	(0.5)	PP-8C	74.8 bcd	6.8 bc	29.3 bc	25.3 bcd
14	MAT 5927 50W	568 g	(0.63)	PP,1C	46.0 abc	1.0 c	52.5 abc	70.3 a
	Guthion 50W	680 g	(0.75)	PF,1C,4C,5C				
	Guthion 50W Lannate 1.8L	680 g 710 ml	(0.75) + (0.34)	2C,3C,6C,7C,8C				
15	Check	Unsprayed			41.8 ab	13.8 a	45.3 abc	33.0 abc

Means in a given column followed by the same letter are not significantly different ($\underline{P}$ = 0.05), by LSD. Data were transformed to $\log_{10}$ (X + 1) for analysis.

Table 7 continued

No.	Treatment and	rate/acre	(lb ai)	Time of Application	ERM/Leaf 6 August	SP/3 Min 8 August	STLM Mines/5 Min 14 August	WALH/25 Leaves 23 August
8	MO 070616 1.9EC	100 ml	(0.05)	PP,PF,8C	0.6 c-f	3.3 abc	12.8 bc	0 d
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				
9	F4999 15SC	152 ml	(0.05)	PF,2C,3C,6C, 7C,8C	1.3 bc	1.0 bcd	9.3 bc	3.5 bc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
10	F4999 15SC	304 ml	(0.1)	PF,2C,3C,6C, 7C,8C	0.8 cde	4.0 ab	17.0 ab	21.3 a
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
11	Pounce 3.2EC	178 ml	(0.15)	PP,PF	0.4 e-h	3.0 abc	14.8 ab	0 d
	Penncap-M 2F Thiodan 50W	710 ml 680 g	(0.37) + (0.75)	1C-8C				
12	Pounce 3.2EC	178 ml	(0.15)	PP,PF	0.4 e-h	1.8 a-d	17.0 ab	2.5 b
	Penncap-M 2F	1420 ml	(0.74)	1C-8C				
13	UC27BF24 50W	454 g	(0.5)	PP-8C	0.5 d-h	6.0 a	38.8 a	0 d
14	MAT 5927 50W	568 g	(0.63)	PP,1C	0.6 c-g	1.3 bcd	17.5 bc	0 d
	Guthion 50W	680 g	(0.75)	PF,1C,4C,5C				
	Guthion 50W Lannate 1.8L	680 g 710 ml	(0.75) + (0.34)	2C,3C,6C,7C,8C				
15	Check	Unsprayed			0.1 fgh	3.5 abc	55.0 a	11.0 a

Means in a given column followed by the same letter are not significantly different (P = 0.05), by LSD. Data were transformed to $\log_{10}$ (X + 1) for analysis.

NOT FOR PUBLICATION

Table 7

No.	Treatment and	rate/acre	(lb ai)	Time of Application	ERM/Leaf 6 August	SP/3 Min 8 August	STLM Mines/5 Min 14 August	WALH/25 Leaves 23 August
1	Lorsban 4E	1420 ml	(1.50)	DD	0.1 gh	0.8 bcd	16.3 ab	5.0 b
	Lorsban 50W Lannate 1.8L	908 g 710 ml	(1.0) + (0.34)	PF				
	Lorsban 50W	908 g	(1.0)	1C-8C				
2	Orthene 75S	606 g	(1.0)	PP,PF	0 h	0 d	15.3 abc	0.3 cd
	Danitol 2.4EC	632 ml	(0.4)	1C-8C				
3	Danitol 2.4EC	632 ml	(0.4)	PP-8C	0 h	0 d	3.8 c	0 d
4	Ambush 2E	284 ml	(0.15)	PP,PF	0.2 e-h	0 d	15.3 abc	0 d
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C,8C				
5	Spur 22EW	228 ml	(0.12)	PP,PF,2C,3C, 6C,7C,8C	2.5 b	0.5 cd	22.5 ab	0 d
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
6	Spur 22EW	342 ml	(0.18)	PP,PF,2C,3C, 6C,7C,8C	4.1 a	0.8 bcd	26.5 ab	0 d
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
7	MO 070616 1.9EC	50 ml	(.025)	PP,PF,8C	1.3 bcd	4.5 ab	7.8 bc	0 d
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				

NOT FOR PUBLICATION

Table 8

No.	Treatment and	rate/acre	(lb ai)	Time of Application	% INJURY BY: CM[a]	SJS[a]	TABM[b]	% CLEAN[c]
1	Lorsban 4E	1420 ml	(1.50)	DD	4.9 cd	1.1 g	8.0 b	88.5 ab
	Lorsban 50W Lannate 1.8L	908 g 710 ml	(1.0) + (0.34)	PF				
	Lorsban 50W	908 g	(1.0)	1C-8C				
2	Orthene 75S	606 g	(1.0)	PP,PF	1.0 ef	3.8 efg	1.9 ef	92.3 a
	Danitol 2.4EC	632 ml	(0.4)	1C-8C				
3	Danitol 2.4EC	632 ml	(0.4)	PP-8C	2.3 def	6.0 d-g	1.2 f	91.1 a
4	Ambush 2E	284 ml	(0.15)	PP,PF	1.2 def	7.2 c-f	4.1 b-f	88.2 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C,8C				
5	Spur 22EW	228 ml	(0.12)	PP,PF,2C,3C, 6C,7C,8C	2.9 def	15.2 bcd	7.7 b	77.6 bc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
6	Spur 22EW	342 ml	(0.18)	PP,PF,2C,3C, 6C,7C,8C	3.2 cde	16.2 bcd	4.4 b-e	79.6 abc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
7	MO 070616 1.9EC	50 ml	(.025)	PP,PF,8C	1.3 def	8.5 c-f	4.4 b-e	88.4 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				

Table 8 continued

No.	Treatment and	rate/acre	(lb ai)	Time of Application	% INJURY BY: CM[a]	SJS[a]	TABM[b]	% CLEAN[c]
8	MO 070616 1.9EC	100 ml	(0.05)	PP,PF,8C	1.7 def	12.5 cde	2.6 def	83.8 ab
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
	Lannate 1.8L Penncap-M 2F	710 ml 710 ml	(0.34) + (0.37)	2C,3C,6C,7C				
9	F4999 15SC	152 ml	(0.05)	PF,2C,3C,6C, 7C,8C	1.6 def	18.0 bc	7.2 bc	77.7 bc
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
10	F4999 15SC	304 ml	(0.1)	PF,2C,3C,6C, 7C,8C	4.0 cd	26.6 b	8.9 b	67.3 c
	Guthion 50W	680 g	(0.75)	1C,4C,5C				
11	Pounce 3.2EC	178 ml	(0.15)	PP,PF	2.73 def	9.5 c–f	5.9 bcd	83.8 ab
	Penncap-M 2F Thiodan 50W	710 ml 680 g	(0.37) + (0.75)	1C–8C				
12	Pounce 3.2EC	178 ml	(0.15)	PP,PF	0.9 f	3.3 fg	3.0 c–f	92.8 a
	Penncap-M 2F	1420 ml	(0.74)	1C–8C				
13	UC27BF24 50W	454 g	(0.5)	PP–8C	25.2 b	13.4 bcd	25.8 a	47.2 d
14	MAT 5927 50W	568 g	(0.63)	PP,1C	1.8 def	4.5 fg	7.8 bcd	88.3 ab
	Guthion 50W	680 g	(0.75)	PF,1C,4C,5C				
	Guthion 50W Lannate 1.8L	680 g 710 ml	(0.75) + (0.34)	2C,3C,6C,7C,8C				
15	Check	Unsprayed			50.6 a	45.3 a	31.9 a	16.0 e

Means in a given column followed by the same letter are not significantly different ($P = 0.05$), by LSD.

[a]Data were transformed to arcsin $\sqrt{x}$ for analysis.

[b]Data were transformed to $\log_{10}(X + 1)$ for analysis.

[c]Analysis was run on the raw data.

EVALUATION OF COPAC E FOR FIRE BLIGHT CONTROL - 1985

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Eleven treatments were applied to 5-year old Rome Beauty apple trees for fire blight control at four stages of fruit bud development: dormant 4/3, tight cluster 4/15, pink 4/17 and petal fall 4/29. Three trees per replicate and three randomized replicates were used per treatment. The materials were applied with a Myers 47710-5E02G hydraulic handgun sprayer generating 200 psi and sprayed to drip run-off.

The materials, rates and time of application were:

(1) Copac E (BASF) 2.0 liters/acre dormant, pink and petal fall.

(2) Copac E 3.0 l/acre dormant, pink and petal fall.

(3) Copac E 4.0 l/acre dormant, pink and petal fall.

(4) Copac E 1.0 l/acre dormant, followed by Copac SE 1.0 l/acre tight cluster.

(5) Copac E 2.25 l/acre dormant, followed by Copac SE 2.25 l/acre tight cluster.

(6) Copac E 3.5 l/acre dormant, followed by Copac SE 3.5 l/acre tight cluster.

(7) Copac E 3.0 l/acre dormant, followed by Copac SE 3.0 l/acre tight cluster and Copac SE 2.25 l/acre pink.

(8) Streptomycin sulfate 21.2% (Agri-mycin 17, Pfizer) 1.2 lb/acre dormant, pink and petal fall.

(9) Bordeaux mixture (bluestone or copper sulfate 25.2% Cu plus 325 mesh hydrated agricultural spray lime) 8-8-100 dormant followed by Bordeaux mixture 1-3-100 in pink and petal fall.

(10) Tribasic Copper 53% Cu (4.0 lb Cu plus 8.0 lb 325 mesh hydrated agricultural spray lime) dormant followed by Tribasic Copper 53% Cu 0.5 lb plus 3.0 lb lime per 100 gallons pink and petal fall.

Due to the inconsistency of fire blight occurrence in previous years, the trees were sprayed with a bacterial suspension of Erwinia amylovora with 10,000 spores/ml with a 3-gallon handpump sprayer on 4/21 to induce fire blight infection.

Standard pesticides for fungus diseases, insects and mites were applied separately and included: Dikar, benomyl 50W, mancozeb 80W, Ambush, azinphos-methyl 50W, methomyl 1.8L and Carzol.

Due to excessive fire blight development, the experiment was terminated on 6/7 with an application of Streptomycin at 2.0 lb/acre.

Results

The data were recorded by counting the number of strikes per tree and replicates shortly after blossom cluster infections began to appear on 5/14 and as the infections began to coalesce on 6/6. The data were consolidated and presented in Table 1. There was no significant difference between any of the treatments on May 14. By June 6, trees sprayed with Streptomycin, Bordeaux mixture or tribasic copper + lime showed considerably fewer strikes per tree than all treatments (Nos. 1-7) sprayed with various formulations of Copac E or SE. However, the higher rates of Copac E formulations gave control significantly equal to Streptomycin, Bordeaux mixture and tribasic copper plus lime.

Table 1. Treatment, Rate, Time of Application and Average Number of Fire Blight Strikes per Tree.

	Materials and Rates	Time of Applications	Fire Blight Strikes Per Tree 5/14	6/6
1.	Copac E, 2.0 liters/acre	D, P, PF	2.6 a	110.7 abc
2.	Copac E, 3.0 l/acre	D, P, PF	1.5 a	61.8 cde
3.	Copac E, 4.0 l/acre	D, P, PF	1.6 a	57.0 cde
4.	Copac E, 1.0 l/acre, + Copac SE, 1.0 l/acre	D TC	1.5 a	155.6 a
5.	Copac E. 2.25 l/acre + Copac SE, 2.25 l/acre	D TC	0.6 a	74.5 bcde
6.	Copac E, 3.5 l/acre, + Copac SE, 3.5 l/acre	D TC	1.2 a	101.7 abc
7.	Copac E, 3.0 l/acre + Copac SE 3.0 l/acre + Copac SE 2.25 l/acre	D TC P	2.3 a	133.7 ab
8.	Streptomycin sulfate, 1.2 lb/acre	D, P, PF	1.0 a	15.7 e
9.	Bordeaux mixture 8-8-100, + Bordeaux mixture 1-3-100	D P, PF	0.8 a	18.3 de
10.	Tribasic Copper, 4.0 lb/100 gal, + 325 mesh lime, 8.0 lb/100 gal, + Trib. Cu, 0.5 lb/100 gal + 325 mesh lime, 3.0 lb/100 gal	D P, PF	2.2 a	26.3 de
11.	No Spray	--	2.8 a	90.0 abcd

D = Dormant P = Pink
PF = Petal Fall TC = Tight Cluster

STUDIES ON FIRE BLIGHT CONTROL ON 33-YEAR OLD ROME BEAUTY APPLE TREES - 1985

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Chemical sprays for fire blight control were continued in Block Z in 1985. Block Z consists of 11 rows with 70 trees per row of 33-year old Rome Beauty apple trees. In 1985, only the alternate rows 2, 4, 6, 8 and 10 were used for chemical treatment for fire blight control. Fungus diseases, insects and mite control only were maintained in rows 1, 3, 5, 7, 9 and 11. Each row used was divided into 10 sections of 7 trees each permitting 5 replications for each treatment and 10 treatments per row. Data were taken on the center 5 trees in each 7-tree replicate. The materials were applied with a Swanson DA400 airblast sprayer at 100 psi, traveling at 2.4 mph and delivering 300 gallons per acre.

The experimental design was to test Bordeaux mixture and streptomycin at various times to determine their effectiveness for fire blight control. The sequence of material application is given in Table 1. A pink application was not applied due to machinery breakdown. Regular pesticide control materials included: Cyprex, Dikar, Funginex, captan 50W, azinphosmethyl 50W, methomyl 1.8L, Carzol and Ambush.

RESULTS

The data were collected on May 21, July 15 and September 19 by counting the number of fire blight strikes from each side of the tree to a height of 10 feet and, with the aid of a 19-foot high hydraladder, from 10 feet to the top of the tree. The data were consolidated to give the number of fire blight strikes per tree and are shown in Table 1. The high number of strikes per tree in July was due to the numerous, individual blossom strikes, whereas by September many of these infections had coalesced.

Even though no significant difference was obtained between any of the treatments on the 3 dates, Treatment 9 (2 Bordeaux mixture and 4 streptomycin sprays) has shown the lowest number of strikes per tree on each date. Under the severe blossom blight conditions experienced this year, these data indicate that with only 2 sprays prior to bloom and 1 spray during bloom, Bordeaux mixture and streptomycin were necessary to control blight. We feel that only 1 full bloom spray of streptomycin at 300 gallon/acre (Treatment 8) was insufficient to give better control. Also, Bordeaux mixture may be more effective if applied at 400 gallons/acre in these dense canopy trees.

Table 1. Evaluation of Bordeaux mixture and streptomycin for fire blight control in 33-year old Rome Beauty apple trees - 1985.

Treatment Number	Application: Chemicals	Application: Dates*	Blight Strikes/Tree: May 21	Blight Strikes/Tree: July 15	Blight Strikes/Tree: Sept 19
1.	Check, no spray		21.8	66.8	35.4
2.	Bordeaux (8-8-100)	4/5	16.8	68.5	32.8
3.	Bordeaux (8-8-100) Bordeaux (1-3-100)	4/5 4/15	23.9	64.5	33.6
4.	Bordeaux (8-8-100) Bordeaux (1-3-100)	4/5 4/15, 4/25	15.0	49.6	25.4
5.	Bordeaux (1-3-100)	4/15, 4/25	19.2	57.5	27.8
6.	Bordeaux (8-8-100) Streptomycin (1.2 lb/acre)	4/5 4/25, 5/6	21.5	60.1	29.1
7.	Streptomycin (1.2 lb/acre)	4/25, 5/6	18.9	64.4	29.0
8.	Streptomycin (1.2 lb/acre)	4/15, 4/25, 5/14	22.1	58.5	36.8
9.	Bordeaux (8-8-100) Bordeaux (1-3-100) Streptomycin (1.2 lb/acre)	4/5 4/15 4/25, 5/14, 5/29, 6/10	13.8	47.1	19.8
10.	Bordeaux (8-8-100) Streptomycin (1.2 lb/acre)	4/5 4/15, 4/25, 5/14	17.5	52.0	26.1

Dates*: 4/5 = Green tip, 4/15 = Tight cluster, 4/25 = Full bloom, 5/6 = Petal fall, 5/14 = First cover, 5/29 = Second cover, 6/10 = Third cover

Assessment of Blackberry Psyllid Damage on the Thornless Blackberry in Eastern West Virginia

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Semi-erect thornless blackberry is a relatively new bramble crop for the eastern United States. It is a source of quality fruit for both the processing and fresh market industries. A number of cultivars with high productivity and vigorous growth are currently available for commercial production. Several aspects of their production, physiology, diseases, insect biology, and, in particular, reproductive biology and winter-hardiness have been studied. However, since this is a new crop, not all of the pest problems have been identified.

Blackberry psyllid, *Trioza tripunctata* Fitch, has been considered a minor pest in recent years; however, in the 1920's it was quite troublesome in the northeast, particularly in New Jersey. Damage by blackberry psyllid appears as stunting and malformation of canes, apparently caused by adults feeding early in the season. There is one generation per year, and oviposition occurs in spring. Nymphs feed on blackberry until maturity in fall, and adults migrate to coniferous evergreen trees to overwinter. It is not known whether they overwinter on any broadleaf evergreens. (Peterson, 1923). The purpose of this study was to assess the extent of blackberry psyllid damage on eastern thornless blackberry.

Assessments were made in 1985 in field plots established in 1983 at the Appalachian Fruit Research Station, Kearneysville, WV, on clay loam soil with 'Dirksen Thornless', 'Black Satin', 'Hull Thornless' and 'Thornfree' cultivars. Plots were arranged in a randomized complete block design with 8 plants per plot and 5 replications per cultivar. Planting distance between rows and plants was 3.6 x 2.4 m. Plants were trained onto a 3-wire vertical trellis or a 6-wire open "V" trellis. Canes were manually positioned to give good separation between primocanes and floricanes. Drip irrigation was applied when necessary.

Evaluations were conducted during August by recording total numbers of canes in each experimental unit and the number of primocanes that had malformed, stunted shoots and curled leaves. In addition, inspections of wild blackberries and potential over-wintering sites of *T. tripunctata* were made on and near the Station.

Approximately 1/3 of the primocanes in the experimental field were damaged by *T. tripunctata*. There was no significant difference in damage among the 4 thornless blackberry cultivars (Table 1). Damage occurred throughout the research plots in an aggregated pattern, indicating that insects migrated into the plot. In all plots, some plants were heavily infested while adjacent plants were undamaged. Distribution of damage differed significantly among geographic quadrants (Table 2) and was higher in the quadrants nearest to residential and industrial areas landscaped with evergreens.

The primocanes affected by psyllid feeding were stunted, twisted and deformed to the extent that they cannot provide fruiting laterals for next season and will have to be pruned out. The removal of damaged canes could result in a potential loss of one-third of next year's crop.

Wild blackberry plants in hedgerows at various locations on the station ground and thornless blackberries in a nearby PYO farm were examined. Psyllid damage was not as severe on wild plants as on the cultivated varieties. Most of the damage to wild blackberry was in the form of cupped, twisted leaves and slightly shortened internodes.

In November 1985, various evergreens on and off the Station were sampled for adult psyllids by the beating method. Only a few isolated individuals were found on the Station's ornamental spruces and none on the yews, junipers and boxwood. Large populations were found in spruces in residential and industrial landscapes ca. 400 to 800 m away. Adjacent woods and pastures with wild evergreens may also provide overwintering sites for psyllids.

Currently, there are no published spray recommendations for blackberry psyllid, although some northeastern specialists recommend a bloom spray of Malathion. However, there is no actual information on the time of return migration from evergreens to blackberry, which may occur over several weeks. Complicating the matter further is the fact that most eastern thornless blackberry cultivars bloom over periods of 3-5 weeks. Additional information on winter hosts, migration stimuli and distance traveled is needed in order to formulate an effective pest management program.

Literature Cited:

Peterson, Alvah. 1923. The Blackberry Psyllid, Trioza tripunctata Fitch. New Jersey Agric. Exper. Stat. Bull. 378. 32 pp.

Table 1. Percentage of thornless blackberry canes damaged by blackberry psyllid, *Trioza tripunctata* in eastern West Virginia in 1985.

Cultivar	% Damaged Canes	S.E.
Black Satin	42.0 NS	32.3
Hull Thornless	35.1	33.1
Dirksen	34.7	34.2
Thornfree	35.2	40.7

NS = Not significantly different within column at alpha=0.05 using DMR test.

Table 2. Geographic distribution of blackberry psyllid (*Trioza tripunctata*) damage on thornless blackberry at Appalachian Fruit Research Station in 1985.

Quadrant	% Damaged Canes
Southeast	49.9 A
Northeast	38.5 AB
Northwest	35.6 AB
Southwest	27.6 B

Means followed by different letters are significantly different at alpha=0.05.

Georgia Rabbiteye Blueberry Insect Survey

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Jerry Payne and Ann Amis, USDA, ARS, Byron, GA
Willie Chance, Cooperative Extension Service, Clinch County, GA

Rabbiteye blueberries, *Vaccinium ashei* Reade, are native to south Georgia, north Florida and southeast Alabama (Shoemaker 1978). There are roughly 2700 acres of blueberries, almost all *V. ashei* in Georgia (Crassweller 1983). Insects are not regarded as serious pests of rabbiteye berries. Current Georgia recommendations do not advocate prophylactic insecticide use. This survey, begun in 1985 is to our knowledge the first systematic effort to examine the insects associated with rabbiteye blueberries. Our first year's efforts have allowed for judgements on pest potential, tentative action thresholds, establishment of rudimentary scouting procedures and for a single chemical test.

Observations, mostly by Amis, were made on 45 occasions in 13 counties. Not surprisingly some of the pests we observed are previously documented as problems in highbush berries. The cranberry fruitworm, *Acrobasis vaccinii* Riley, was found in almost all plantings. Infestations that appeared to be severe enough to reduce yield were found in southeast, central and north Georgia. Apparently threatening infestations may have been more uniform in southeast Georgia. Infestations appeared to be initiated in 3-6 week period from late bloom to around 4 weeks after petal fall.

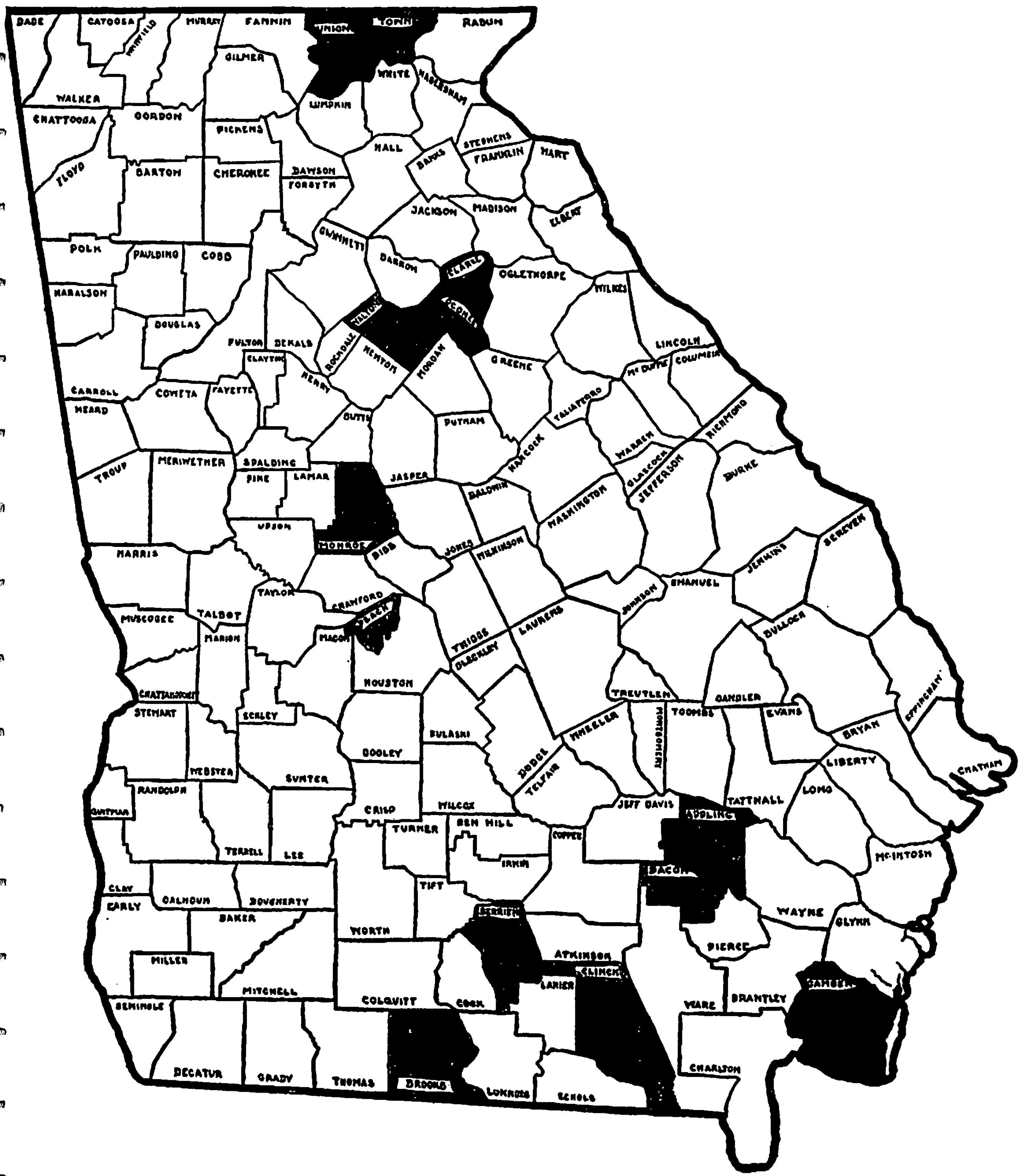
Damaging infestations normally began in our earliest variety, Climax. Growers are now being encouraged to scout berries by closely examining fruit clusters. Initial infestations may be observed as slightly over pin size holes with frass. More mature infested berries will begin to color prematurely. Advanced infestations will have feeding damage, webbing and frass through virtually all the berries in a cluster.

Other arthropods observed were termites, tortricid leafrollers, leaffooted bugs, *Oberea myops* stem borers and a range of omnivorous leaf feeding geomethrid and notodontid caterpillars. The yellow necked caterpillar, *Datana ministra* was most common. *Oberea* borers and Japanese beetles were the most noteworthy pests in north Georgia.

Insecticide use was observed on several farms and a single replicated test was conducted. Malathion, at 1 lb. ai, gave good control of fruitworms that were in their 2-3rd berries. Yield response was limited. This seemed attributed to insufficient replications (3X's) and perhaps more importantly to drought that appeared to render berries lost to fruitworm insignificant. Commercial treatments observed appeared to be worthwhile when a damaging infestation was caught early. Timing is quite obviously very important.

Blueberry Yield
Irma Dean and Dave Walters
Clinch County, Georgia 1985

	Climax		Tif blue	
	Control	Malathion, 1 lb ai @ PF & PF+2 wk	Control	Malathion, 1 lb ai @ PF & PF+2 wk
1st harvest	3.2 lb/plant	2.8 lb/plant	1.5 lb/plant	1.6 lb/plant
	0.28 lb/ft^2	0.26 lb/ft^2	0.17 lb/ft^2	0.22 lb/ft^2
2nd harvest	2.1 lb/plant	1.8 lb/plant	0.3 lb/plant	0.2 lb/plant
	0.18 lb/ft^2	0.29 lb/ft^2* (P=0.05)	0.03 lb/ft^2	0.02 lb/ft^2


DADE
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CHATTOOGA
GORDON
PICKENS
STEPHENS
HALL
BANKS
FRANKLIN
HART
FLOYD
BARTOW
CHEROKEE
DAWSON
FORSYTH
JACKSON
MADISON
ELBERT
GWINNETT
POLK
PAULDING
COBB
BARROW
CLARKE
OGLETHORPE
HARALSON
WALTON
OCONEE
WILKES
DOUGLAS
FULTON
DEKALB
LINCOLN
CLAYTON
ROCKDALE
NEWTON
MORGAN
GREENE
McDUFFIE
COLUMBIA
CARROLL
COWETA
FAYETTE
HENRY
HEARD
BUTTS
PUTNAM
TALIAFERRO
RICHMOND
WARREN
HANCOCK
TROUP
MERIWETHER
SPALDING
PIKE
LAMAR
JASPER
GLASCOCK
JEFFERSON
BURKE
BALDWIN
WASHINGTON
UPSON
SCREVEN
MONROE
BIBB
JONES
WILKINSON
HARRIS
JENKINS
TAYLOR
CRAWFORD
JOHNSON
EMANUEL
MUSCOGEE
TALBOT
PEACH
LAURENS
BULLOCH
MARION
MACON
TWIGGS
BLECKLEY
HOUSTON
CHATTAHOOCHEE
TREUTLEN
CANDLER
EFFINGHAM
STEWART
SCHLEY
TOOMBS
EVANS
MONTGOMERY
WHEELER
BRYAN
PULASKI
DODGE
DOOLEY
WEBSTER
LIBERTY
SUMTER
TELFAIR
CHATHAM
RANDOLPH
LONG
CRISP
WILCOX
JEFF DAVIS
APPLING
TATTNALL
QUITMAN
TURNER
BEN HILL
COFFEE
TERRELL
LEE
IRWIN
McINTOSH
BACON
CLAY
TIFT
CALHOUN
DOUGHERTY
EARLY
WAYNE
BAKER
BERRIEN
GLYNN
WORTH
PIERCE
ATKINSON
MILLER
CLINCH
MITCHELL
LANIER
CAMDEN
BRANTLEY
COLQUITT
COOK
WARE
SEMINOLE
CHARLTON
DECATUR
GRADY
THOMAS
BROOKS
LOWNDES
ECHOLS

Occurrence and Effect of Ambrosia Beetles on Peach Trees in South Carolina

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Introduction

Ambrosia beetles were first positively identified as attacking peach trees in March, 1982 in Florence County, South Carolina. Numerous second leaf trees were in a weak or dying state with sawdust-like frass strands protruding 2 to 4 cm from holes in the lenticels. These holes were caused by *Xylosandrus crassiusculus*. Some trees were dead from the ground up, while others were putting out new leaves and producing large amounts of gum from entry holes. In most cases, the gumming trees overcame the beetle attack and survived.

This paper reports the results of a three year study: 1) to identify what species of ambrosia beetles actually infest peach wood, 2) to determine the seasonal distribution of the two most common ambrosia beetles collected in South Carolina, *Xyleborinus saxeseni* and *Xylosandrus crassiusculus*, and 3) to determine the effect of ambrosia beetles on peach tree growth.

Materials and Methods

To provide data on the number of species actually infesting peach trees, infested peach wood was either dissected or held in the laboratory. Polystyrene vials (7 dram) with 1 cm openings cut in the caps were fastened with staples over individual holes to act as emergence cages since ambrosia beetle progeny exit the tree via parental entrance holes.

Vaned window traps baited with 75% ethanol were used to determine seasonal distribution of *X. saxeseni* and *X. crassiusculus*. The traps were hung in trees 1 to 2 m above the ground in 16 peach-producing counties during 1983-1985. Trap collection bottles were replaced every 7-14 d from mid-February to mid-November and taken to the laboratory for beetle determination.

To study the effect of ambrosia beetles on peach tree growth, 2mm diameter holes were drilled to the center of second and third leaf peach trees at different densities and times to simulate mechanical injury due to beetle tunneling. Fifty holes were drilled in the spring (24 April) and fall (20 November) and 100 holes drilled in the fall in the trunks of 30 peach trees. These dates were selected to correspond to population peaks of *X. saxeseni* and *X. crassiusculus*. Three growth parameters were

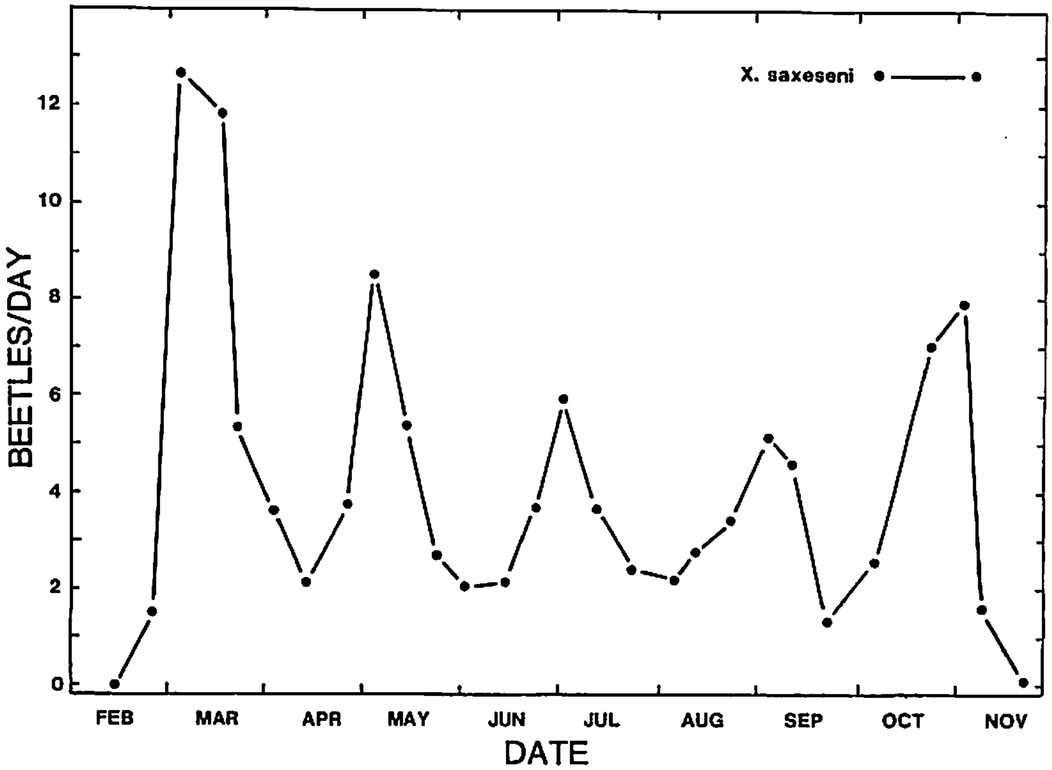

Figure 1. Seasonal distribution of Xyleborinus saxeseni in South Carolina peach orchards (1983-1985).

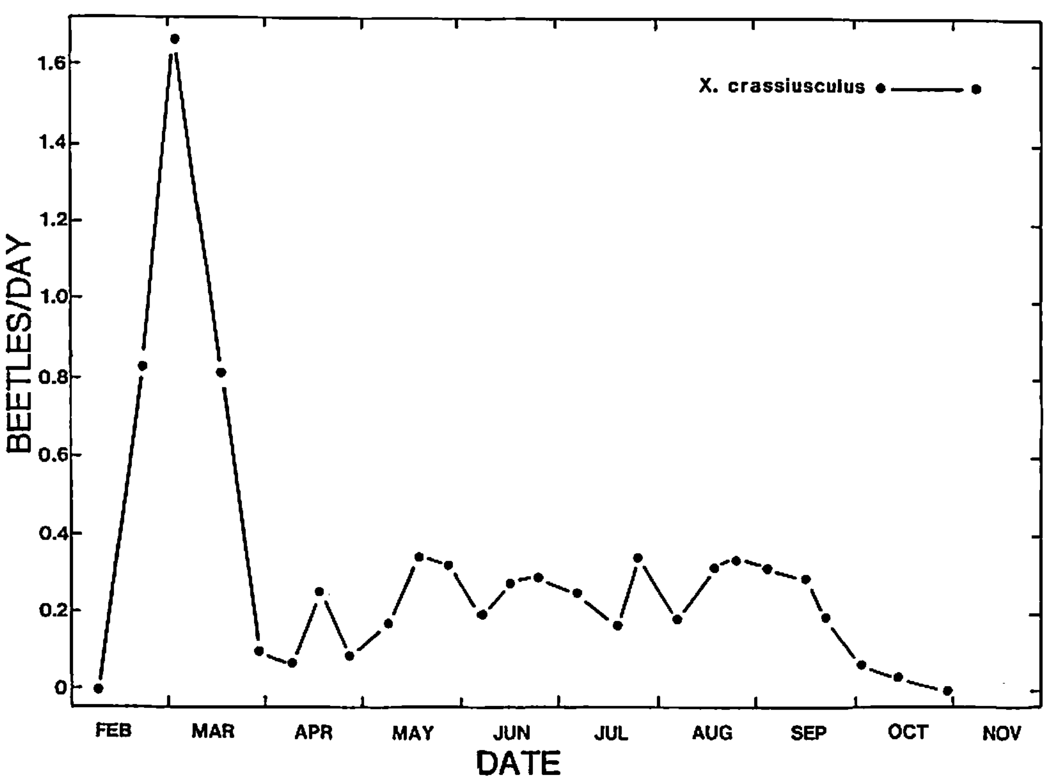

Figure 2. Seasonal distribution of Xylosandrus crassiusculus in South Carolina peach orchards (1983-1985).

measured throughout the growing season to determine the influence of this mechanical injury on tree growth. They were primary growth (average number of leaves/shoot from three shoots/tree), secondary growth (trunk circumference) and yield (flower buds/cm). All data were analyzed statistically and means separated using least square analysis (P = 0.05).

Results

Six species of ambrosia beetles actually infested peach wood. They were *Xyleborinus saxeseni*, *Xylosandrus crassiusculus*, *Ambrosiodmus rubricollis*, *A. tachygraphus*, *Xyleborus dispar*, and *Monarthrum fasciatum*.

X. saxeseni was the most numerous ambrosia beetle collected comprising over 90% of the total trapped population. This species is multivoltine with four to five generations a year in South Carolina (Fig. 1). Females begin emerging from trees during the first or second week of March when high temperatures for two consecutive days exceed 70°F. Subsequent emergence peaks occur every 57 days until November.

X. crassiusculus was first recorded in the continential United States from Dorchester County, South Carolina in 1974. During 1983 and 1984 a total of 739 beetles was collected. In 1985, 1,712 beetles were trapped and it appears this species is on the increase in South Carolina. *X. crassiusculus* is univoltine with peak emergence occurring in early March (Fig. 2). Over 50% of the population was trapped before 1 April in South Carolina.

Table 1. Effect of drilling 2 mm diameter holes on peach tree growth.*

Treatment	1° Growth	2° Growth Circumference (cm)	Yield Flowers/cm Shoot
Control	29.8 a	4.48 a	0.32 a
50 holes (24 April 1985)	38.1 b	5.98 b	0.25 a
50 holes (20 Nov. 1984)	31.7 a	6.42 c	0.31 a
100 holes (20 Nov. 1984)	28.3 a	6.47 d	0.21 a

* means followed by the same letter are not significantly different ($P \simeq 0.05$), LSD.

The drilling of 50 holes in the spring had a stimulatory influence on vegetative growth of young peach trees resulting in more leaves/shoot than control trees. Table 1 shows the results of drilling holes in peach trees. Peach trees with holes drilled in the spring or fall had greater secondary growth than control trees. Greatest secondary growth occurred in trees drilled with 100 noles. Yield in terms of flowers/cm was not affected by drilling up to a 100 holes in the trunk of peach trees.

Discussion

If drilling holes in peach trees actually simulates ambrosia beetle excavation, than this mechanical injury varies with time of attack and density. A hundred ambrosia beetles attacking a young peach tree in the fall would not affect vegetative growth the following season, but secondary growth would increase. This increase in secondary growth is probably due to callus tissue formation. Damage caused by 50 ambrosia beetles in the spring may produce an overcompensatory reaction by the tree resulting in increased vegetative growth. Yield of young healthy peach trees would not be influenced by an attack of up to 100 ambrosia beetles.

Conclusion

The results of this study show that ambrosia beetles are present throughout the year in South Carolina peach orchards but only six species actually infest peach wood. Late winter and early spring are times of peak emergence. It appears that the mechanical injury caused by up to a hundred ambrosia beetle tunnelling into a young healthy peach tree is minimal.

APPLE (Malus sylvestris 'Golden Delicious', 'Red Delicious', 'Rome Beauty'
Powdery mildew; Podosphaera leucotricha
Fruit finish

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EVALUATION OF EXPERIMENTAL FUNGICIDES ON THREE APPLE CULTIVARS, 1985: Sixteen fungicide treatments were evaluated for disease control and fruit finish on a 13-yr-old block of semi-dwarf trees planted in groups with one tree of each cultivar per group. The test was conducted in a randomized block design with four replicate groups per treatment. Treatments were applied as dilute sprays to the runoff point with a single-nozzle handgun at 35 kg/cm^2 (500 psi) as follows: 19 Apr (Rome, open cluster-pink); 1st through 7th covers respectively: 7 May, 24 May, 7 Jun, 21 Jun, 11 Jul, 25 Jul, 8 Aug. Maintenance sprays applied separately included Guthion 50W, Lannate L, Lorsban 50W, and Kelthane 4F.

With very limited rainfall during several long periods throughout the season, wet weather disease pressure was very light. Although overwintering mildew inoculum in the test block was relatively light, weather conditions during late April and early May were quite favorable for mildew development, resulting in a test with moderate mildew pressure. All treatments gave significant control compared to untreated trees, with Ro 15-1297 providing the best control. Dikar, Benlate + Manzate, and XE-779 (through 2nd cover) were among the weakest mildew treatments. Although some treatments provided significantly more or less opalescence or russet than others, none were significantly different from untreated fruit.

Table 1. Evaluation of experimental fungicides, three apple cultivars

Treatment	Rate/ 100 gal[1]	Timing	Mildew, Rome Beauty[2] % leaves	% area
No fungicide	---	---	37.4 c	6.0 c
DPX H6573 40EC	7.8 ml	Pink-5th C...	7.8 ab	1.8 ab
DPX H6573 40EC	11.8 ml	Pink-7th C...	11.4 ab	2.1 ab
DPX H6573 40EC DPX 965-50 50W + Manzate 200 80W	11.8 ml 2.0 oz + 1.0 lb	Pink-2nd C 3rd-5th C ...	8.6 ab	1.5 ab
Benlate 50W + Manzate 200 80W	2 oz + 12 oz	Pink-5th C ...	12.6 b	2.1 ab
RH-3866 40W + Dithane M-45 80W Dithane M-45 80W	1.25 oz + 1.5 lb 1.5 lb	Pink-2nd C 3rd-5th C ...	9.3 ab	1.8 ab
RH-3866 40W Dithane M-45 80W	2.5 oz 1.5 lb	Pink-2nd C 3rd-5th C ...	6.6 ab	1.5 ab
RH-3866 40W Dithane M-45 80W	2.5 oz 1.5 lb	1st-2nd C 3rd-5th C ...	7.0 ab	1.4 ab
Bayleton 50W + Dithane M-45 80W	0.5 oz + 1.5 lb	Pink-5th C ...	6.1 ab	1.4 ab
Funginex 1.6E + Polyram 80W	8 fl oz + 1.0 lb	Pink-5th C ...	9.7 ab	1.7 ab
Ro 15-1297 4E	1.0 fl oz	Pink-5th C...	4.0 a	0.9 a
Ro 15-1297 4E + Polyram 80W	1.0 fl oz + 1.5 lb	Pink-5th C ...	3.5 a	0.9 a
XE-779 25W + Captan 50W	5.7 g + 1.0 lb	Pink-5th C ...	8.3 ab	1.8 ab
XE-779 25W Captan 50W	5.7 g 2.0 lb	Pink-2nd C 3rd-5th C ...	13.7 b	2.4 b
UBI-A 815 50W Dithane M-45 80W	3.0 oz 1.5 lb	Pink-3rd C 4th-5th C ...	11.3 ab	2.4 b
UBI-A 815 50W Dithane M-45 80W	2.0 oz 1.5 lb	Pink-3rd C 4th-5th C ...	10.2 ab	2.0 ab
Dikar 76.7W	2.0 lb	Pink-5th C...	12.3 b	2.2 ab

Mean separation by Duncan's Multiple Range Test ($p = 0.05$).

[1] Formulated product per 100 gal dilute. Applied by handgun to runoff at 500 psi.

[2] Averages of 10 terminal shoots from each of four replications 8 Jul.

Table 2. Fruit finish effects of experimental fungicides, three apple cultivars

Treatment	Rate/ 100 gal*	Timing	Russet rating** G.Del.	Russet rating** R.Del.	Russet rating** Rome	Opalescence** R.Del.	Opalescence** Rome
No fungicide	---	---	2.14 a	1.69 ab	1.48 ab	1.42 abc	1.32 ab
DPX H6573 40EC	7.8 ml	Pink-5th C..	2.25 a	1.57 ab	1.23 ab	1.33 abc	1.41 ab
DPX H6573 40EC	11.8 ml	Pink-7th C..	1.89 a	1.33 ab	1.17 ab	0.63 a	1.58 ab
DPX H6573 40EC DPX 965-50 50W + Manzate 200 80W	11.8 ml 2.0 oz + 1.0 lb	Pink-2nd C 3rd-5th C ..	2.36 a	1.25 ab	1.26 ab	1.19 abc	1.69 ab
Benlate 50W + Manzate 200 80W	2 oz + 12 oz	Pink-5th C ..	2.15 a	1.94 b	1.11 ab	1.90 c	1.66 ab
RH-3866 40W + Dithane M-45 80W Dithane M-45 80W	1.25 oz + 1.5 lb 1.5 lb	Pink-2nd C 3rd-5th C ..	2.03 a	1.85 b	1.52 b	1.08 abc	1.68 ab
RH-3866 40W Dithane M-45 80W	2.5 oz 1.5 lb	Pink-2nd C 3rd-5th C ..	2.02 a	1.39 ab	1.18 ab	1.36 abc	1.34 ab
RH-3866 40W Dithane M-45 80W	2.5 oz 1.5 lb	1st-2nd C 3rd-5th C ..	2.28 a	1.32 ab	0.90 a	1.25 abc	1.32 ab
Bayleton 50W + Dithane M-45 80W	0.5 oz + 1.5 lb	Pink-5th C ..	2.18 a	1.55 ab	1.02 ab	1.27 abc	1.01 a
Funginex 1.6E + Polyram 80W	8 fl oz + 1.0 lb	Pink-5th C ..	1.99 a	1.93 b	1.24 ab	1.31 abc	1.35 ab
Ro 15-1297 4E	1.0 fl oz	Pink-5th C..	1.84 a	1.73 ab	1.31 ab	1.67 bc	1.54 ab
Ro 15-1297 4E + Polyram 80W	1.0 fl oz + 1.5 lb	Pink-5th C ..	2.04 a	1.73 ab	1.49 ab	1.27 abc	1.74 ab
XE-779 25W + Captan 50W	5.7 g + 1.0 lb	Pink-5th C ..	2.02 a	0.89 a	1.23 ab	0.72 a	1.44 ab
XE-779 25W Captan 50W	5.7 g 2.0 lb	Pink-2nd C 3rd-5th C ..	1.84 a	1.35 ab	1.40 ab	1.04 abc	1.35 ab
UBI-A 815 50W Dithane M-45 80W	3.0 oz 1.5 lb	Pink-3rd C 4th-5th C ..	2.17 a	1.42 ab	1.38 ab	1.06 abc	1.60 ab
UBI-A 815 50W Dithane M-45 80W	2.0 oz 1.5 lb	Pink-3rd C 4th-5th C ..	2.17 a	1.73 ab	1.39 ab	1.01 ab	1.39 ab
Dikar 76.7W	2.0 lb	Pink-5th C..	2.16 a	1.98 b	1.47 ab	1.34 abc	2.06 b

Mean separation by Duncan's Multiple Range Test ($p = 0.05$).

*Formulated product per 100 gal dilute. Applied to runoff at 500 psi.

**Averages of 25 fruit from each of four replications (Golden Delicious and Rome Beauty) or three replications (Red Delicious). Rated on a scale of 0-5 (0 = perfect finish; 5 = severe russet or opalescence, excluding presumed mildew russet).

APPLE (Malus sylvestris 'Jonathan', 'Rome Beauty', 'Red Delicious', 'Golden Delicious')
Scab; Venturia inaequalis
Powdery mildew; Podosphaera leucotricha
Cedar-apple rust; Gymnosporangium juniperi-virginianae

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EVALUATION OF FUNGICIDE COMBINATIONS ON FOUR APPLE CULTIVARS, 1985: Combinations involving Bayleton with mancozeb, Benlate, Topsin-M and other combinations involving captan were compared for broad spectrum disease control on mature semi-dwarf trees. Treatments were applied as dilute sprays to the runoff point with a single-nozzle handgun at 35 kg/cm^2 (500 psi) in a four replicate randomized block design as follows: 12 Apr (tight cluster, Rome); 23 Apr (bloom); first through seventh cover sprays, respectively: 9 May, 28 May, 11 Jun, 28 Jun, 11 Jul, 24 Jul and 13 Aug. Cedar galls were suspended over the trees to provide rust inoculum. Insecticides applied separately included Sun Oil 7E, Guthion 50W, Carzol 92SP, Lannate L, Lorsban 50W, Imidan 50W, Penncap-M and Nudrin.

Heavy overwintering inoculum and favorable weather conditions from mid-April through mid-May led to a strong mildew test. Among the best treatments for control of mildew on foliage were Benlate + Bayleton on Jonathan and Baycor + KWG 0519 on Rome. Baycor + Bayleton gave superior mildew control on Rome fruit. Mildew incidence was high on Jonathan fruit with no significant difference in control between treatments, but all giving significant control compared to untreated trees. Overwintering scab inoculum was quite heavy, but early season drought greatly reduced the severity of the test, and much of the scab appeared on leaves near the ends of terminal shoots as growth began to cease in mid to late May. Under light scab pressure, Baycor + captan + KWG 0519 provided the best control. The relatively high incidence of scab on leaves treated with the benzimidazole-fungicides, Topsin-M, TD 2192 and Benlate, was apparently due to the presence of inactivated lesions, not fungal resistance. Under light pressure, all treatments gave good control of rust. Although there were significant differences in fruit finish between treatments, the only significant deleterious effect in comparison to untreated fruit was increased russet on Rome by Topsin-M + Manzate 200 + Bayleton and Dikar.

Table 3. Evaluation of fungicide combinations for foliar disease control

Treatment	Rate/100 gal & timing* TC-2nd C	Rate/100 gal & timing* 3rd-7th C	Mildew incidence (%) Jonathan leaves	Mildew incidence (%) Jonathan area	Mildew incidence (%) Rome Beauty leaves	Mildew incidence (%) Rome Beauty area	Scab, R.Delicious % leaves	Scab, R.Delicious lesions/leaf	Rust, Rome lesions/leaf
Untreated	....	....	69 d	51 c	69 f	61 d	12.1 d	0.28 c	1.17 b
Baycor 50W + Captan 50W + Bayleton 50W	4 oz + 1 lb + 0.5 oz	2 oz + 1 lb + 0.5 oz**...	52 bc	24 ab	32 ab	5 a	3.5 ab	0.04 a	0.02 a
Baycor 50W + Captan 50W + KWG 0519 25DF	4 oz + 1 lb + 1 oz	2 oz + 1 lb + 1 oz**.....	47 ab	25 ab	25 a	5 a	2.6 a	0.04 a	0.10 a
Topsin M 70W + Manzate 200 80W + Bayleton 50W	2 oz + 12 oz + 0.5 oz	2 oz + 12 oz	49 ab	25 ab	35 abc	12 ab	9.3 cd	0.19 abc	0.04 a
TD 2192 4.5F + Manzate 200 80W + Bayleton 50W	2.5 fl oz + 12 oz + 0.5 oz	2.5 fl oz + 12 oz	51 bc	28 abc	43 bcd	20 ab	8.7 cd	0.21 bc	0.02 a
Benlate 50W + Manzate 200 80W + Bayleton 50W	2 oz + 12 oz + 0.5 oz	2 oz + 12 oz	38 a	13 a	37 abc	11 ab	7.0 bcd	0.22 bc	0.03 a
Funginex 1.6E + Captan 50W	8 fl oz + 1 lb	8 fl oz + 1 lb	53 bc	34 abc	53 def	33 bcd	5.0 abc	0.06 ab	0.13 a
Dithane M-45 80W + Bayleton 50W	2 lb + 0.5 oz	2 lb	56 bc	33 abc	64 ef	50 cd	6.3 bc	0.09 ab	0.06 a
Dikar 76.7W	2 lb	2 lb.......	59 cd	37 bc	49 cde	30 bc	4.4 bc	0.11 ab	0.05 a

Mean separation by Duncan's Multiple Range Test (p = 0.05).
Ratings of 10 terminal shoots from each of four replicate trees: Rome, 25 Jun; Jonathan, 27 Jun; Red Delicious, 2 Jul.

*Formulated material per 100 gal dilute. Applied to the point of runoff with a single nozzle handgun at 500 psi.
**Bayleton 50W and KWG 0519 25DF not included in 3rd cover spray.

Table 4. Evaluation of fungicide combinations for fruit disease control and finish effects

Treatment	Rate/100 gal & timing*		Mildew incidence (%)		Fruit finish **					
					Russet			Opalescence		
	TC-2nd C	3rd-7th C	Jonathan	Rome	Rome	Golden Del.	Jonathan	Rome	Jonathan	R.Del.
Untreated			61 b	12 c	1.21 a	2.23 ab	1.04 a	1.50 ab	1.27 abc	1.40 a
Baycor 50W + Captan 50W + Bayleton 50W	4 oz + 1 lb + 0.5 oz	2 oz + 1 lb + 0.5 oz***	39 a	1 a	1.40 ab	2.26 ab	1.12 a	1.36 a	1.00 ab	1.16 a
Baycor 50W + Captan 50W + KWG 0519 25DF	4 oz + 1 lb + 1 oz	2 oz + 1 lb + 1 oz***	29 a	7 abc	1.38 ab	2.13 ab	0.97 a	1.50 ab	0.87 a	1.06 a
Topsin M 70W + Manzate 200 80W + Bayleton 50W	2 oz + 12 oz + 0.5 oz	2 oz + 12 oz	28 a	12 c	1.89 b	2.14 ab	1.22 a	1.77 ab	1.67 c	1.07 a
TD 2192 4.5F + Manzate 200 80W + Bayleton 50W	2.5 fl oz + 12 oz + 0.5 oz	2.5 fl oz + 12 oz	36 a	9 bc	1.70 ab	2.24 ab	1.05 a	2.32 b	1.41 bc	1.38 a
Benlate 50W + Manzate 200 80W + Bayleton 50W	2 oz + 12 oz + 0.5 oz	2 oz + 12 oz	43 a	11 bc	1.56 ab	2.94 b	1.10 a	1.53 ab	1.41 bc	1.58 a
Funginex 1.6E + Captan 50W	8 fl oz + 1 lb	8 fl oz + 1 lb	38 a	3 ab	1.20 a	2.04 a	1.38 a	1.44 a	1.15 abc	1.42 a
Dithane M-45 80W + Bayleton 50W	2 lb + 0.5 oz	2 lb	29 a	11 bc	1.84 ab	2.23 ab	1.14 a	1.70 ab	1.34 abc	1.50 a
Dikar 76.7W	2 lb	2 lb	35 a	10 bc	2.00 b	2.21 ab	1.43 a	2.29 b	1.55 c	1.67 a

Harvest counts of 25 fruit from each of four replications. Mean separation by Duncan's Multiple Range Test ($p = 0.05$).

*Formulated material per 100 gal dilute.

**Fruit finish excluding presumed mildew russet. Rated on a scale of 0-5 (0 = perfect finish; 5 = severe russet or opalescence).

***Bayleton 50W and KWG 0519 25DF not included in 3rd cover spray.

APPLE (*Malus sylvestris* 'Golden Delicious')
Scab; *Venturia inaequalis*
Fruit russet

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EVALUATION OF CONCENTRATE APPLICATIONS OF STEROL-INHIBITOR FUNGICIDES ON GOLDEN DELICIOUS APPLE, 1985: Three experimental and two registered fungicide treatments were evaluated for disease control and fruit finish on a 10-yr-old block of trees spaced 4.6 m X 7.3 m, 4.9 m high and 5.5 m wide. The test was conducted in a randomized block design with four single-tree replications per treatment. Treatments were applied from both sides of the tree row on each application date with a Swanson Model DA-400 airblast sprayer (935 L/ha, 100 gal/A) as follows: 22 Apr (bloom); 9 May (1st cover); 24 May (2nd cover); 7 Jun (3rd cover). Captan 50W 6.5 lb/A was applied to the entire test area including "untreated" trees 28 Jun, and to all except "untreated" 16 Jul, 31 Jul and 14 Aug. Maintenance sprays applied separately with the same equipment included: streptomycin, Guthion 50W, Kelthane 4F, Lannate L, Lorsban 50W, Penncap-M, Omite 30W.

With only one infection period and very limited rainfall through April, primary scab pressure was very light and shoot growth was starting to harden off before secondary infection developed. Under light disease pressure and an extended application schedule, all treatments gave adequate commercial control, although Funginex + Polyram was not significantly better than no treatment during the test period. None of the treatments significantly increased fruit russet and fruit treated with Funginex + Polyram had significantly less russet than untreated fruit.

Table 5.

Treatment through third spray	Rate/A[1]	Scab incidence[2]		Russet[3]
		% leaves	lesions/leaf	
Untreated	--	7.4 b	0.27 a	2.96 b
Rubigan 5110 1E + X-77	6.0 fl oz + 4.0 fl oz	1.6 a	0.02 a	2.84 b
Rubigan 1AS + X-77	6.0 fl oz + 4.0 fl oz	1.4 a	0.02 a	2.38 ab
UBI A-815 50W	12.0 oz	2.1 a	0.02 a	2.72 ab
Funginex 1.6E + Polyram 80W	2.5 pt + 3.25 lb	3.5 ab	0.05 a	2.12 a
Bayleton 50W + Dithane M-45 80W	2.0 oz + 3.25 lb	2.1 a	0.06 a	2.84 b

Mean separation by Duncan's Multiple Range Test ($p = 0.05$).

1 Formulated material per acre.

2 Averages of the leaves on 10 terminal shoots from each of four single-tree replicates 3 Jul.

3 Rated on a scale of 0-5 (0 = perfect finish; 5 = severe russet).

APPLE (*Malus sylvestris* 'Jonathan')
Powdery mildew; *Podosphaera leucotricha*
Brooks spot; *Mycosphaerella pomi*
Fruit finish

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EVALUATION OF BAYLETON + DITHANE M-45 COMBINATIONS ON JONATHAN APPLE, 1985: Combinations of Bayleton and Dithane M-45 were applied at selected rates and intervals to test their residual effectiveness on powdery mildew and other diseases in an 18-yr-old block of trees. The test was conducted in a randomized block design with four single-tree replicates per treatment. Treatments were applied from both sides of the tree row on each application date with a Swanson Model DA-400 airblast sprayer (935 L/ha, 100 gal/A). Dates for treatments of the indicated approximate designated application intervals were as follows: 2 week: 12 Apr (pink), 26 Apr (petal fall), 9 May, 29 May, 17 Jun, 3 Jul. 1 week: All applications for 2 week treatments plus applications on 19 Apr (bloom), 2 May, 20 May, 6 Jun, 24 Jun, 11 Jul. Maintenance sprays applied separately with the same equipment included Sun Oil 7E, streptomycin, Guthion 50W, Lannate L, Lorsban 50W, Kelthane 4F, and Imidan 50W.

Under heavy mildew pressure all treatments significantly reduced mildew incidence on leaves and fruit and leaf area infected. With widely fluctuating rainfall patterns throughout the season, Brooks spot was the only wet weather disease that developed to any extent on untreated fruit. All treatments gave good Brooks spot control with no significant difference between treatments. Compared to untreated fruit, none of the treatments had a deleterious effect on fruit finish.

Table 6. Evaluation of Bayleton + Dithane M-45 application rates and intervals

Treatment	Rate/A[1]	Spray interval	Mildew, foliage[2] % leaves	% area	% fruit infected[3] mildew	Brooks spot	Fruit finish[4] russet	opalescence
Untreated	--	--	61.1 b	36.8 b	73 b	15 b	0.92 a	1.14 ab
Bayleton 50W + Dithane M-45 80W	1.0 oz + 1.5 lb	1 week	14.9 a	2.8 a	37 a	3 a	0.94 a	0.76 a
Bayleton 50W + Dithane M-45 80W	2 oz + 3 lb	1 week	16.2 a	3.9 a	32 a	4 a	0.91 a	0.92 ab
Bayleton 50W + Dithane M-45 80W	2 oz + 3 lb	2 weeks	23.6 a	6.8 a	37 a	6 a	1.15 a	1.27 b
Bayleton 50W + Dithane M-45 80W	4 oz + 6 lb	2 weeks	14.2 a	3.8 a	44 a	3 a	1.27 a	1.06 ab

Mean separation by Duncan's Multiple Range Test (p = 0.05).

1 Formulated material per acre.

2 Averages of 12 terminal shoots from each of four replications, 18 Jun.

3 Harvest counts of 25 fruit from each of four replicate trees 4 Sep.

4 Fruit finish excluding presumed mildew russet. Rated on a scale of 0-5 (0 = perfect finish; 5 = severe russet or opalescence).

APPLE (*Malus sylvestris* 'Starking Delicious', 'Lutz No. 5 Golden Delicious')
Blue mold; *Penicillium expansum*

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CONTROL OF PENICILLIUM BLUE MOLD BY POST HARVEST DIP TREATMENTS, 1984-85: Fruit which had been stored at 2°C for 7 weeks were selected for uniform firmness and maturity. Average firmness and soluble solids were, respectively: Golden Delicious - 15.2 psi, 11.8%; Red Delicious - 14.7 psi, 13.8%. Fruit were randomly grouped into three replicates of 20 fruit each, and punctured in three places to a depth of 7 mm with a 7 mm diam dowel rod. Following inoculation by dipping 20 sec in a suspension containing 5 X 10^4 *P. expansum* benomyl-sensitive conidia/ml, fruit were immediately dipped 30 sec in fungicide suspensions and placed on fiber packing trays in fiber cartons. Following 61 days storage at 2°C, fruit were evaluated for decay and evidence of chemical phytotoxicity. Fruit were again observed for decay and phytotoxicity after an additional 4 days at 13°C.

Test conditions were severe as evidenced by high decay incidence on inoculated fruit treated only with captan. Benlate performed well, as expected, on the benomyl-sensitive fungal strain. DPX H6573 and CGA 71818 also showed good control when Golden Delicious fruit were removed from cold storage. After 4 days exposure to 13°C, DPX H6573-treated fruit had significantly less decay than those treated with CGA 71818. No phytotoxicity was observed in any treatment.

Table 8. Control of *Penicillium* blue mold by post harvest dip treatments

Treatment and rate per 100 gallons	Blue mold incidence (%)* Golden Delicious after 61 days at 2°C	Golden Delicious +4 days at 13°C	Red Delicious after 61 days at 2°C	Red Delicious +4 days at 13°C
Fungaflor 50EC 25.6 fl oz	50 d	57 ef	28 c	40 c
Fungaflor 50EC 12.8 fl oz	40 cd	52 ef	32 c	43 cd
Fungaflor 50EC 10.0 fl oz.....	48 d	60 ef	32 c	38 c
Fungaflor 50EC 6.4 fl oz	45 d	67 f	40 c	58 d
Benlate 50W 8.0 oz	3 a	7 ab	5 ab	15 b
Captan 50W 2.0 lb	95 e	98 g	65 d	88 e
Benlate 50W 4.0 oz + Captan 50W 1.0 lb	7 a	15 bc	2 ab	7 ab
CGA 71818 10W 4.0 oz	13 a	25 cd	- **	-
DPX H6573 40EC 0.3 fl oz	7 a	7 ab	-	-
RH-3866 40W 0.6 oz	27 bc	42 de	-	-
Not wounded, uninoculated.....	0 a	0 a	0 a	0 a
Wounded, dipped in water only.	20 b	50 ef	27 c	41 cd
Not wounded, dipped in water only	0 a	2 a	10 b	12 b

* Averages of three replicates, 20 fruit per replicate.

**Treatments not included on Red Delicious.

PEACH (*Prunus persica* 'Babygold 5')
Leaf curl; *Taphrina deformans*

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CONTROL OF LEAF CURL ON BABYGOLD 5 PEACH, 1985: Fungicide treatments were applied on 21 Nov 84 or 20 Mar 85 in a block of 6-yr-old trees which had been infected with leaf curl the previous two seasons. Plots were arranged in a randomized block design with five single-tree replicates. All fall and spring treatments and untreated trees were randomized throughout each block to facilitate statistical comparison of all the treatments. Treatments were appplied as dilute sprays to the runoff point with a single nozzle handgun at 35 kg/cm^2 (500 psi). Data were taken 29-30 May 85 by assessing percent emerged buds with infected leaves.

Although the early spring weather was drier than normally considered ideal for leaf curl development, some infection appeared, resulting in a moderate test typical of many commercial situations in the region. There was a tendency for fall treatments to give better control than spring treatments. All fall and spring treatments gave significant control compared to untreated trees. The fall ferbam application provided significantly better control than several of the weaker spring treatments including dichlone and copper sulfate + lime.

Table 9. Control of leaf curl on Babygold 5 peach

Treatment	Rate/100 gal	% buds emerging with infected leaves on trees treated on:* 21 Nov 84	20 Mar 85
Untreated	---	-- (20.9 c)	--
Bravo 500	2.25 pt	1.4 ab	3.4 ab
Bravo 500	3.0 pt	1.9 ab	2.1 ab
Ferbam 76W	3.0 lb	--	2.2 ab
Ferbam 76W	2.0 lb	1.2 a	2.7 ab
Lime sulfur 29%	4.0 gal	1.7 ab	6.7 ab
Dichlone 50W	12.0 oz	5.7 ab	7.6 b
Copper sulfate + lime	2.0 lb + 4.0 lb	2.7 ab	7.2 b
Copper sulfate + lime	4.0 lb + 8.0 lb	3.6 ab	7.2 b
Kocide 101 83W	2.0 lb	3.4 ab	3.1 ab

Mean separation of all data by Duncan's Multiple Range Test ($p = 0.05$).

*Averages of 8 shoots from each of five single-tree replications.

REPORT FOR THE 1985 CUMBERLAND-SHENANDOAH FRUIT WORKERS CONFERENCE

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The 1985 growing season was characterized by extremes in temperature and rainfall. Although the mean temperature for April was above the 64 year average at Winchester, a freeze on April 10 killed many king blossoms making thinning decisions difficult and response to hormone thinners somewhat erratic. This resulted in much undersized and non-typical fruit at harvest. Full bloom period (April 17-24) was about 8 days earlier than average. An early bloom plus warm temperatures in late April and early May resulted in an early maturing crop.

	Precipitation (inches)		Mean temperature (°F)	
	1985	72 yr avg	1985	64 yr avg
April	0.96	3.19	56.7	53.9
May	6.39	3.74	65.3	63.7
June	1.90	3.95	70.5	71.8
July	4.16	3.90	74.5	76.7
August	3.14	3.83	72.1	74.2

Rosy aphid populations were readily controlled in most orchards. European red mite populations increased rapidly during late April and again in June. Predator populations increased along with the mites and afforded good control where allowed to reach sufficient numbers. Where predator populations were kept down by harsh pesticides, mites were a problem for much of the season. Spotted tentiform leafminers continued to increase in some orchards and white apple leafhoppers did considerable damage in some commercial blocks and young plantings where adequate control measures were not used. Pheromone traps indicated potentially damaging populations of tufted apple budmoth, variegated leafroller and redbanded leafroller throughout much of the season. Where orchard blocks were monitored and adequate pesticides were used, damage from the leafroller complex was low.

Several unusual pests were encountered during 1985. Gypsy moth infestations continue to increase, but the larvae are well controlled by recommended spray programs in commercial orchards. Isolated infestations of the resplendent shield bearer and the apple and thorn leaf skeletonizer were encountered in Rappahannock County during the year.

Sources of materials used in these tests are:

Abbott Labs: ABG-6162
American Cyanamid: Cygon
Chevron Chemical Company: Danitol, Orthene
Ciba Geigy, Agri. Division: Supracide
Dow Chemical USA: Lorsban 4E, Lorsban 50W
E. I. duPont deNemours & Company: DPX Y5893 (Savey)
Mobay Chemical Corporation: Guthion, Systox
Nor-Am Chemical Company: Apollo, Carzol
Pennwalt Corporation: Penncap M
Rohm & Haas Company: Kelthane
Shell Development Company: MO070616, SD014114 (Vendex)
Union Carbide Corporation: Larvin 3.2F, Larvin LE
Uniroyal, Inc.: Dimilin, Omite 30W, Omite 6E
Zoecon Corporation: Spur

[1] Professor and Superintendent [2] Research Associate

APPLE: *Malus domestica* Borkh 'Gol. Del.'
White apple leafhopper; *Typhlocyba pomaria* McAtee
European red mite; *Panonychus ulmi* (Koch)
Stethorus punctum (LeConte)
Tufted apple budmoth; *Platynota idaeusalis* (Walker)
Variegated leafroller; *Platynota flavedana* Clemens
Redbanded leafroller; *Argyrotaenia velutinana* (Walker)
Plum curculio; *Conotrachelus nenuphar* (Herbst)
Plant bugs; *Lygus* spp.

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APPLE, FULL SEASON INSECTICIDE EVALUATION, 1985; Experimental insecticide treatments were applied in a comparative test to mature semi-dwarf Golden Delicious trees on 4 Apr (delayed dormant), 18 Apr (pink), 8 May (petal-fall), 22 May, 4 June, 18 June, 2 Jul, 22 Jul, and 6 Aug. Treatments were applied with a hand gun using a Bean 35 gal/min hydraulic sprayer operating at 400 psi. Single trees were used and replicated 4 times in a randomized block design. Trees were sprayed to runoff. White apple leafhopper populations were evaluated on 20 May by counting the adults and nymphs found on 25 randomly selected leaves per tree. European red mite populations were evaluated on 28 May, 17 Jul and 12 Aug by randomly selecting 25 leaves/tree, brushing with a modified Henderson-McBurnie mite brushing machine onto glass plates and counting mites and eggs with a binocular microscope. *Stethorus punctum* populations were evaluated on 9 Aug by counting all adults and larvae in a timed count of 3 min/tree. Attempts were made to count rosy apple aphid *Dysaphis plantaginea* (Passerini) and apple aphid *Aphis pomi* DeGeer in this trial, but populations did not develop on the control trees or on any treatments. On 18 Sep, 400 apples/treatment (100/rep) were harvested and evaluated. A fruit finish rating of 1 to 5 (5 being worst) was given each apple.

All treatments suppressed white apple leafhopper when compared to the control. Dimilin (2 rates) and Guthion gave only marginal control, and Lorsban was not commercially acceptable. *Stethorus punctum* responds directly to European red mite density. Established *S. punctum* populations rapidly decrease the ERM populations thereby making data interpretations difficult. The Penncap - Spur combination and the Orthene followed by Danitol effectively controlled mites and *S. punctum* numbers remained low. In plots where Spur was followed by Guthion, Spur kept the mite populations low early in the season, but when Guthion was introduced mite populations rebounded. *S. punctum* was also numerous in these treatments by 9 Aug. Neither rate of Dimilin adequately controlled ERM, but *S. punctum* increased to the point that ERM numbers were reduced to a marginal economic threshold by 12 Aug. *S. punctum* controlled the ERM in both the Guthion and Lorsban plots. Populations of fruit-feeding insects were low throughout the season. Fruit finish was very good on all treatments with Lorsban 50W showing significantly more russet than other treatments.

Materials and amt/100 gal	Timing	28 May		17 Jul		12 Aug	
		ERM/leaf*	Eggs/leaf*	ERM/leaf*	Eggs/leaf*	ERM/leaf*	Eggs/leaf*
Penncap M 2F 8.0 fl oz (236.6 ml) + Spur 2.4 fl oz (70.97 ml)	All applic.	1.70 bcd	3.08 h	0.66 de	5.64 d	1.11 bcd	3.51 bc
Larvin 3.2F 10.0 fl oz (295.7 ml)	P,PF,all cov	5.12 abc	24.15 cd	3.12 bc	23.85 abc	3.62 a	8.37 ab
Larvin LE 3.2F 10.0 fl oz (295.7 ml)	P,PF,all cov	6.21 ab	36.86 abc	9.90 a	35.73 ab	3.92 a	7.15 ab
Spur 2F 1.0 fl oz (29.6 ml), Guthion 50W 8.0 oz (226.8 gm)	PP,P,PF,2-3 cov 1,4-6 cov	1.57 cd	8.43 efg	1.82 bcd	16.13 bc	4.65 a	13.52 a
Spur 2F 2.0 fl oz (59.2 ml), Guthion 50W 8.0 oz (226.8 gm)	PP,P,PF,2-3 cov 1,4-6 cov	3.47 abcd	14.15 def	1.34 cde	10.22 cd	6.24 a	19.60 a
Spur 2F 3.0 fl oz (88.7 ml), Guthion 50W 8.0 oz (226.8 gm)	PP,P,PF,2-3 cov 1,4-6 cov	0.96 d	3.82 gh	1.04 cde	5.49 d	2.98 abc	19.66 a
Orthene 75S 5.28 oz (149.7 gm), Danitol 2.4E 5.33 fl oz (157.6 ml)	PP,P,PF All cov	1.54 cd	3.96 gh	0.22 e	0.60 e	0.23 d	0.09 d
Dimilin 25W 1.0 oz (28.4 gm)	P,PF,all cov	4.50 abc	16.93 de	2.15 bcd	24.68 abc	3.29 ab	12.69 a
Dimilin 25W 3.0 oz (85.2 gm)	P,PF,all cov	4.71 abc	30.18 bcd	5.02 ab	40.39 ab	5.25 a	17.86 a
Guthion 50W 8.0 oz (226.8 gm)	P,PF,all cov	6.62 a	54.04 ab	5.40 ab	30.41 ab	0.92 cd	3.78 bc
Lorsban 4E 16.0 fl oz (473.1 ml), Lorsban 50W 16.0 oz (453.6 gm)	PP P,PF,all cov	2.19 abcd	7.65 fg	1.35 cde	10.72 cd	0.74 d	1.82 c
Check		6.92 a	69.63 a	9.99 a	48.20 a	0.61 d	2.83 bc

Numbers in the same column followed by the same letter are not significantly different ($P < .05$), DMRT.
*Data were transformed to $\log_{10}(x + 0.5)$ for analysis.

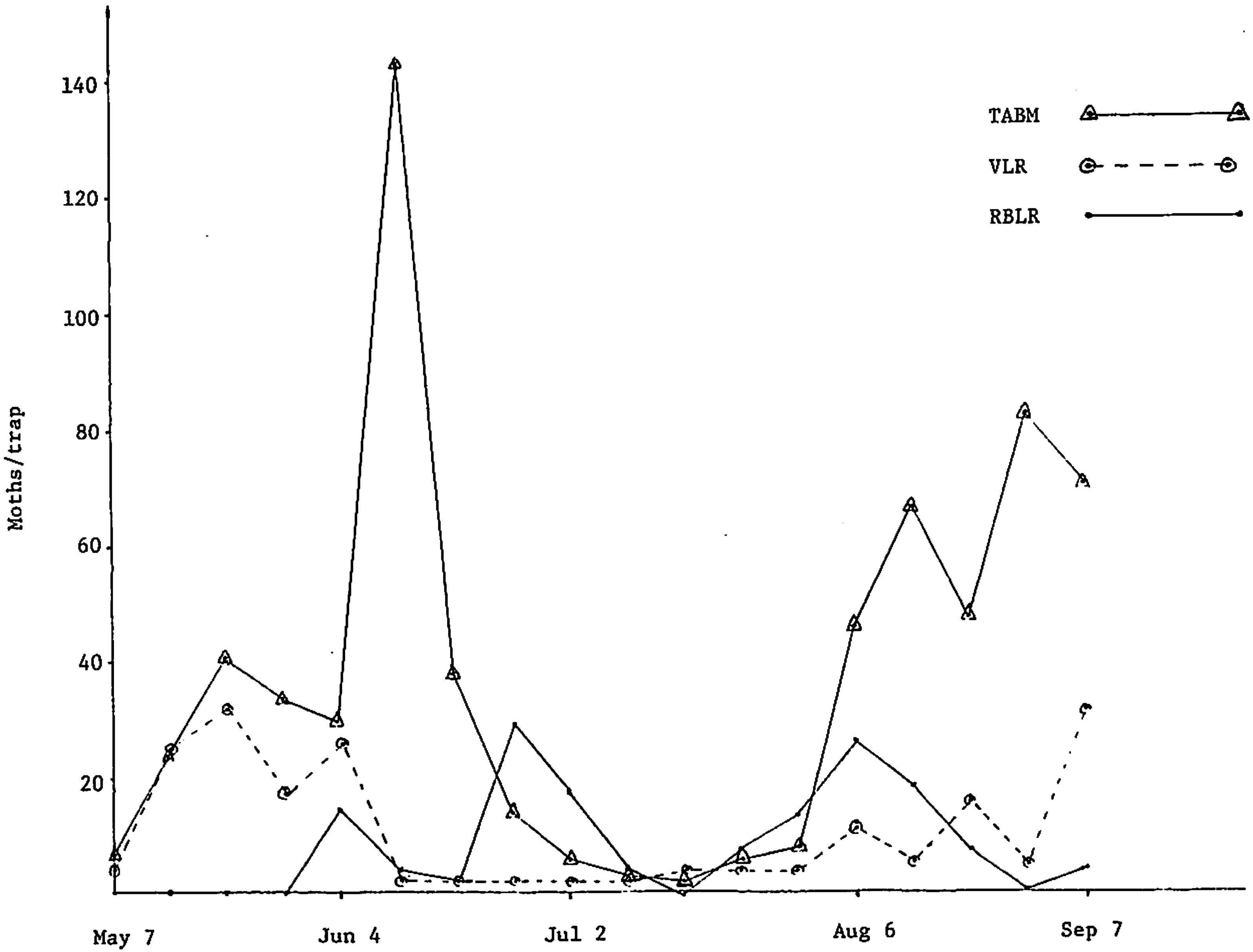
Materials and amt/100 gal	Mean number WALH/leaf* 20 May	Mean number *S. punctum* 13 min/tree* 9 Aug
Penncap M 2F 8.0 fl oz (236.6 ml) + Spur 2F 2.4 fl oz (70.97 ml)	.06 d	.75 d
Larvin 3.2F 10.0 fl oz (295.7 ml)	.12 d	17.75 abc
Larvin LE 3.2F 10.0 fl oz (295.7 ml)	.19 d	11.25 abcd
Spur 2F 1.0 fl oz (29.6 ml) Guthion 50W 8.0 oz (226.8 gm)	.06 d	21.50 ab
Spur 2F 2.0 fl oz (59.2 ml) Guthion 50W 8.0 oz (226.8 gm)	.07 d	11.25 abcd
Spur 2F 3.0 fl oz (88.7 ml) Guthion 50W 8.0 oz (226.8 gm)	.01 d	6.75 cd
Orthene 75S 5.28 oz (149.7 gm) Danitol 2.4E 5.33 fl oz (157.6 ml)	.02 d	1.00 d
Dimilin 25W 1.0 oz (28.4 gm)	.29 cd	17.75 abc
Dimilin 25W 3.0 oz (85.2 gm)	.52 c	24.25 a
Guthion 50W 8.0 oz (226.8 gm)	.56 c	14.75 abcd
Lorsban 4E 16.0 fl oz (473.1 ml) Lorsban 50W 16.0 oz (453.6 gm)	.89 b	7.00 cd
Check	1.46 a	8.00 bcd

Numbers in the same column followed by the same letter are not significantly different ($p < .05$), DMRT.
*Data were not transformed for analysis.

Materials and amt/100 gal	Timing	Percent fruit damaged by: Leafroller complex[1]	Plant bug	Plum curculio	Percent clean fruit	Average finish rating[2,3,4]
Penncap M 2F 8.0 fl oz (236.6 ml) + Spur 2.4 fl oz (70.97 ml)	All applic.	.25	1.5	.25	98.0	1.37 bc
Larvin 3.2F 10.0 fl oz (295.7 ml)	P,PF,all cov	.25	2.0	.25	97.5	1.64 bc
Larvin LE 3.2F 10.0 fl oz (295.7 ml)	P,PF,all cov	.00	2.25	.25	97.5	1.74 b
Spur 2F 1.0 fl oz (29.6 ml), Guthion 50W 8.0 oz (226.8 gm)	PP,P,PF,2-3 cov 1,4-6 cov	.25	1.0	.00	98.8	1.36 bc
Spur 2F 2.0 fl oz (59.2 ml), Guthion 50W 8.0 oz (226.8 gm)	PP,P,PF,2-3 cov 1,4-6 cov	1.00	2.0	.00	97.0	1.27 bc
Spur 2F 3.0 fl oz (88.7 ml), Guthion 50W 8.0 oz (226.8 gm)	PP,P,PF,2-3 cov 1,4-6 cov	.25	0.5	.00	99.2	1.53 bc
Orthene 75S 5.28 oz (149.7 gm), Danitol 2.4E 5.33 fl oz (157.6 ml)	PP,P,PF All cov	.00	0.75	.75	98.5	1.23 c
Dimilin 25W 1.0 oz (28.4 gm)	P,PF,all cov	1.50	0.75	.50	97.2	1.31 bc
Dimilin 25W 3.0 oz (85.2 gm)	P,PF,all cov	.75	1.5	.25	97.5	1.53 bc
Guthion 50W 8.0 oz (226.8 gm)	P,PF,all cov	.00	1.25	.00	98.8	1.54 bc
Lorsban 4E 16.0 fl oz (473.1 ml), Lorsban 50W 16.0 oz (453.6 gm)	PP P,PF,all cov	.00	1.25	.25	98.5	2.35 a
Check		.75	1.5	.25	97.5	1.57 bc

[1]Total fruit damaged by tufted apple budmoth, variegated leafroller and redbanded leafroller.
[2]Analysis was done on untransformed data.
[3]Numbers followed by the same letter are not significantly different ($P < .05$), DMRT.
[4]Each apple was rated 1-5 (5 being the worst).

PHEROMONE TRAP CATCHES AT WEEKLY INTERVALS - 1985



APPLE: *Malus domestica* Borkh 'Red Del.'
European red mite; *Panonychus ulmi* (Koch)
Twospotted spider mite; *Tetranychus urticae* Koch

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APPLE, EVALUATION OF MO070616 + SD014114 (VENDEX) IN FULL SEASON AND IN POST BLOOM APPLICATIONS, 1985: MO070616, a synthetic pyrethroid insecticide, was tank mixed with variable rates of Vendex and applied to mature semi-dwarf 'Red Delicious' trees with a Bean 35 gal/min hydraulic sprayer operating at 400 psi. Single tree treatments were used and replicated 4 times in a randomized block design. Trees were sprayed to runoff. Application dates were 4 Apr (pre-pink), 18 Apr (pink), 1 May (petal-fall), 21 May, 3 Jun, 27 Jun, 10 Jul and 9 Aug. Each rate of Vendex plus MO070616 was tested as a full season treatment and as a post bloom treatment. A standard treatment (Lorsban) was included and the post-bloom plots of MO070616 plus Vendex were treated the same as the standard for pre-bloom applications. European red mite populations were evaluated periodically throughout the season by randomly selecting 25 leaves/tree, brushing with a modified Henderson-McBurnie mite brushing machine onto glass plates and counting motile mites and eggs with a binocular microscope. Full season and post bloom treatments of MO070616 alone, as well as the unsprayed check required one application of Kelthane 4F (16 fl oz/100) on 18 Jun to reduce European red mite to manageable levels.

The objective of this test was to determine if Vendex would prevent potential flares of mite populations caused by repeated use of a synthetic pyrethroid and to determine the most effective rate of Vendex to be used in the combination. MO070616 used alone in both full season and post bloom treatments, as well as the untreated control, permitted European red mites to surpass economic threshold levels by mid June. One application of Kelthane 4F was sufficient to prevent mite buildup for the remainder of the season. The inclusion of Vendex at the two highest rates did prevent excessive mite populations. On the 14.75 ml/100 rate of Vendex, mites exceeded the economic threshold of 5 mites/leaf by early July and had dramatically increased by 1 Aug. Mites on the standard treatment (Cygon + Lorsban) were not adequately controlled. No phytotoxicity was observed in this experiment. Fruit feeding insect damage was very low on all treatments, total damage being below 0.4 percent for all treatments combined.

Materials & amts/100 gal	Timing	May 9** ERM/ leaf	Eggs/ leaf	May 24** ERM/ leaf	Eggs/ leaf	Jun 13** ERM/ leaf	Eggs/ leaf
M0070616 1.9E 24.6 ml + Vendex 4L 59.0 ml	All applic.	0.0 b	1.99 c	0.16 c	0.11 d	1.16 ef	1.72 cdef
M0070616 1.9E 24.6 ml + Vendex 4L 29.5 ml	All applic.	0.0 b	3.69 c	0.53 bc	0.48 cd	1.64 e	1.29 def
M0070616 1.9E 24.6 ml + Vendex 4L 14.75 ml	All applic.	0.43 a	12.35 b	1.47 b	3.23 b	4.81 d	3.15 cd
M0070616 1.9E 24.6 ml*	All applic.	0.22 ab	21.82 ab	4.99 a	9.49 a	44.73 b	44.33 a
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb/100	PP P-5th cover	0.19 ab	4.86 c	1.08 b	1.31 bc	4.55 d	3.90 c
Check*	---	0.48 a	37.59 a	10.07 a	8.60 a	108.77 a	81.06 a
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 59.0 ml	PP P, PF 1st-5th covers	--	--	0.49 bc	0.39 cd	0.47 f	0.54 f
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 29.5 ml	PP P, PF 1st-5th covers	--	--	0.53 bc	2.13 b	1.28 ef	1.90 cde
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 14.75 ml	PP P, PF 1st-5th covers	--	--	0.65 bc	0.31 cd	2.30 de	1.05 ef
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml*	PP P, PF 1st-5th covers	--	--	1.60 b	1.39 bc	11.06 c	11.91 b

Numbers in the same column followed by the same letter are not significantly different ($p < .05$), DMRT.

* Sprayed with Kelthane 4F 16 fl oz/100 on Jun 18.

**Data were transformed to $\log_{10}(X + .05)$ for analysis.

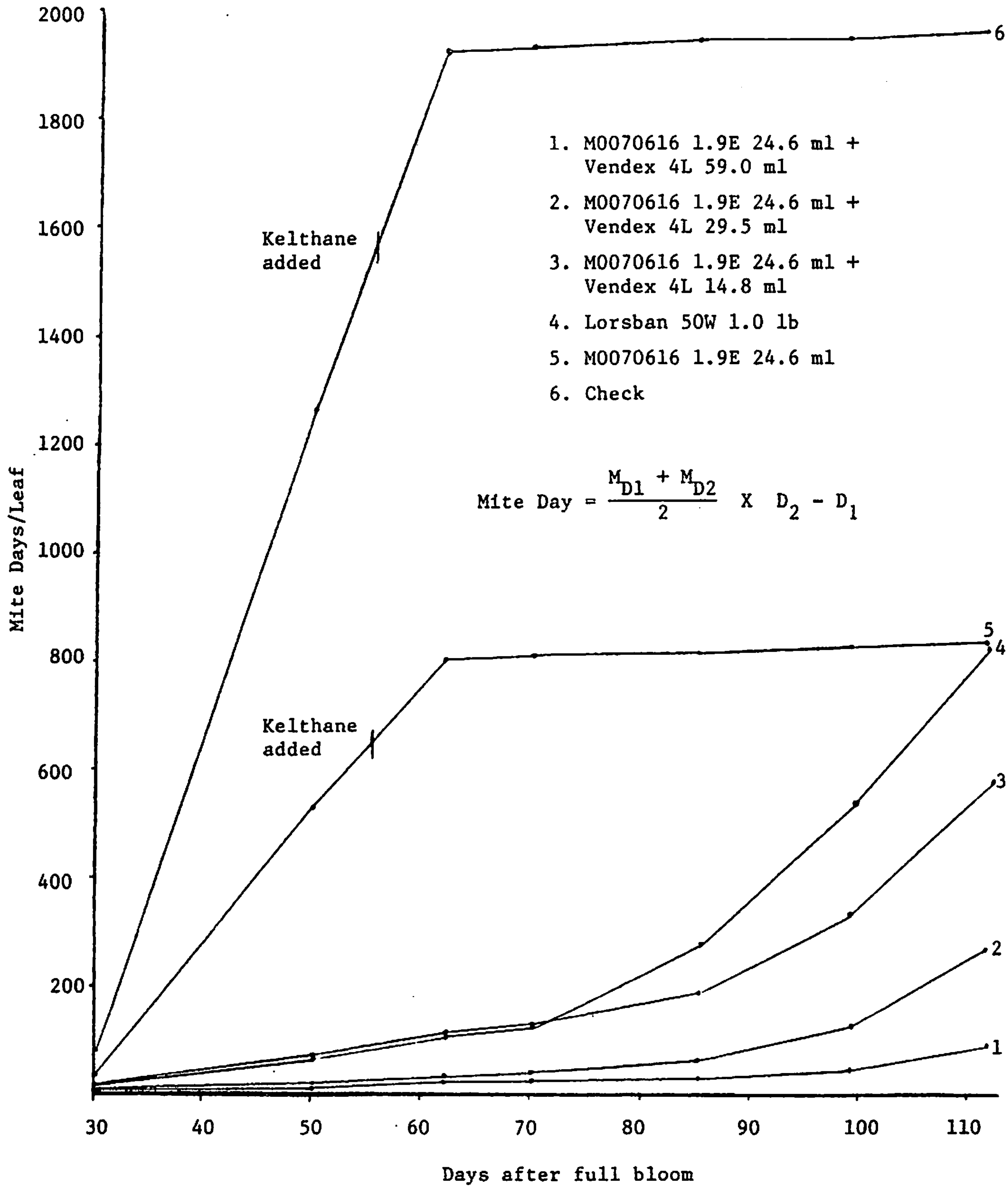
Materials & amts/100 gal	Timing	Jun 25** ERM/ leaf	Jun 25** Eggs/ leaf	Jul 3** ERM/ leaf	Jul 3** Eggs/ leaf	Jul 18** ERM/ leaf	Jul 18** Eggs/ leaf
M0070616 1.9E 24.6 ml + Vendex 4L 59.0 ml	All applic.	0.22 c	2.62 b	0.08 b	0.18 c	0.40 cd	1.77 cd
M0070616 1.9E 24.6 ml + Vendex 4L 29.5 ml	All applic.	0.25 c	3.49 b	0.85 ab	0.80 c	1.85 c	3.64 c
M0070616 1.9E 24.6 ml + Vendex 4L 14.75 ml	All applic.	2.09 a	8.96 b	1.89 a	4.04 ab	5.49 b	14.08 b
M0070616 1.9E 24.6 ml*	All applic.	0.84 bc	4.78 b	0.11 b	0.89 c	0.33 d	1.42 cde
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb/100	PP P-5th cover	2.24 a	33.80 a	2.90 a	5.06 a	17.18 a	36.40 a
Check*	---	1.29 ab	7.04 b	1.09 ab	1.26 bc	0.41 cd	1.27 cde
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 59.0 ml	PP P, PF 1st-5th covers	0.43 c	3.06 b	0.09 b	0.21 c	0.23 d	0.40 e
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 29.5 ml	PP P, PF 1st-5th covers	0.30 c	4.05 b	0.19 b	0.41 c	0.91 cd	1.57 cde
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 14.75 ml	PP P, PF 1st-5th covers	0.43 c	4.16 b	0.33 b	0.73 c	1.23 cd	1.97 cd
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml*	PP P, PF 1st-5th covers	0.81 bc	2.70 b	0.09 b	0.51 c	0.48 cd	0.98 de

Numbers in the same column followed by the same letter are not significantly different ($p < .05$), DMRT.
* Sprayed with Kelthane 4F 16 fl oz/100 on Jun 18.
**Data were transformed to $\log_{10}(X + .05)$ for analysis.

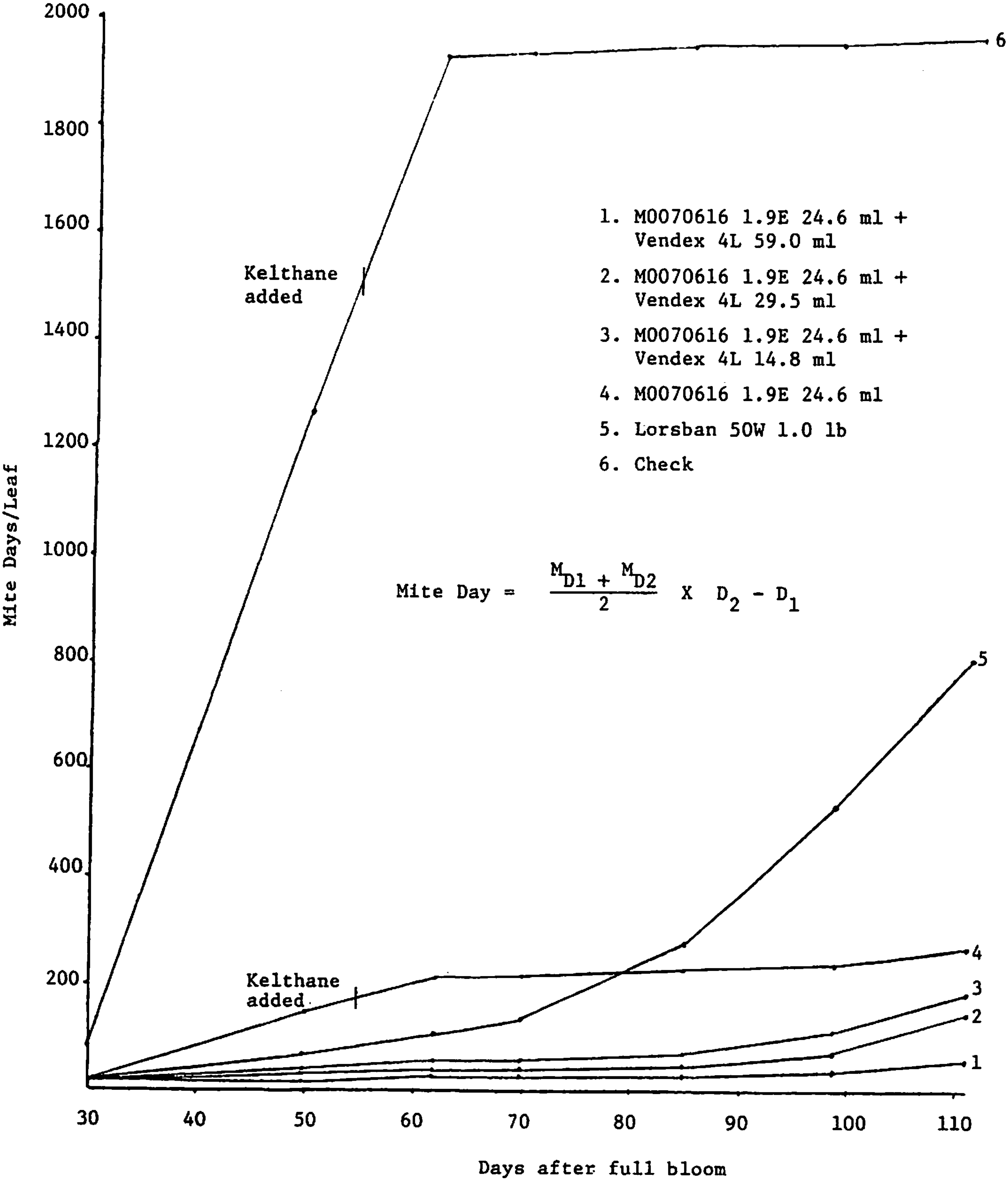
Materials & amts/100 gal	Timing	Aug 1** ERM/ leaf	Aug 1** TSSM/ leaf	Aug 1** Eggs/ leaf	Aug 14** ERM/ leaf	Aug 14** TSSM/ leaf	Aug 14** Eggs/ leaf
M0070616 1.9E 24.6 ml + Vendex 4L 59.0 ml	All applic.	2.03 de	0.00 b	6.72 c	4.38 cde	0.26 b	13.39 bcd
M0070616 1.9E 24.6 ml + Vendex 4L 29.5 ml	All applic.	6.65 bc	0.48 b	39.99 a	15.35 ab	0.51 b	30.63 a
M0070616 1.9E 24.6 ml + Vendex 4L 14.75 ml	All applic.	13.85 ab	1.75 a	50.34 a	20.38 a	0.51 b	29.18 ab
M0070616 1.9E 24.6 ml*	All applic.	0.38 fg	0.00 b	1.35 e	1.18 fg	0.21 b	6.70 def
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb/100	PP P-5th cover	16.23 a	3.01 a	67.86 a	20.43 a	4.29 a	28.92 ab
Check*	---	0.33 g	0.04 b	1.27 e	0.76 g	0.04 b	3.42 f
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 59.0 ml	PP P, PF 1st-5th covers	0.93 efg	0.14 b	3.89 cd	2.19 efg	0.14 b	5.31 ef
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 29.5 ml	PP P, PF 1st-5th covers	2.21 de	0.22 b	14.52 b	8.42 abc	0.40 b	21.75 abc
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml + Vendex 4L 14.75 ml	PP P, PF 1st-5th covers	4.14 cd	0.46 b	17.30 b	6.55 bcd	0.62 b	11.38 cde
Cygon 400 8.0 fl oz Lorsban 50W 1.0 lb M0070616 1.9E 24.6 ml*	PP P, PF 1st-5th covers	1.40 ef	0.04 b	3.08 d	2.85 def	0.25 b	13.04 bcd

Numbers in the same column followed by the same letter are not significantly different ($p < .05$), DMRT.
* Sprayed with Kelthane 4F 16 fl oz/100 on Jun 18.
**Data were transformed to $\log_{10}(X + .05)$ for analysis.

Cumulative Mite Days - FULL SEASON TEST



Cumulative Mite Days - POST BLOOM TREATMENTS



APPLE: *Malus domestica* Borkh 'Red Del.'
European red mite; *Panonychus ulmi* (Koch)
Stethorus punctum (LeConte)

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APPLE, MITICIDE EVALUATIONS, 1985: Treatments were applied to mature 'Red Delicious' trees using single tree plots arranged in a randomized block design and replicated 4 times. Trees were sprayed to runoff using a Bean 35 gal/min hydraulic sprayer operating at 400 psi. DPX Y5893, Apollo, Carzol and Kelthane were applied on 26 Apr (pink). ABG-6162 was applied on 13 May and the Omite treatments on 24 Jun. Mites and eggs were counted by randomly selecting 25 leaves per replicate, brushing onto glass plates with a modified Henderson-McBurnie brushing machine and counting all motile forms and viable eggs with a binocular microscope. *Stethorus punctum* populations were evaluated by counting all adults and larva found in a 3 min search of each tree.

Counts made on 30 May indicate that the single treatments with DPX Y5893 (2 rates); Apollo (2 rates) and Kelthane gave significant control of European red mite when compared to the check. ABG-6162 applied on 13 May also reduced mite numbers significantly at all three treatment rates by 30 May. By 17 Jun the initial control obtained with Carzol had broken down and mite numbers had begun to increase significantly on the trees in the two plots treated with the lower rates of ABG-6162. By 9 Jul conditions were much the same as on 17 Jun, except the existing differences were more pronounced. By 24 Jul control on most of the treatments had broken down. Counts of *Stethorus punctum* made to assist in managing the mite populations roughly corresponded to mite densities. Predators were abundant enough that no additional miticides were applied. No fruit or foliage phytotoxicity was observed. Fruit finish ratings at harvest showed no significant differences between treatments and fruit finish was generally very good.

Materials & amts/ 100 gal	Time of application	May 30* ERM/ leaf		Jun 17* ERM/ leaf		Jul 9* ERM/ leaf		Jul 24** Mean no. SPA/3 min	
		ERM/ leaf	Eggs/ leaf	ERM/ leaf	Eggs/ leaf	ERM/ leaf	Eggs/ leaf	Mean no. SPA/3 min	Mean no. SPL/3 min
DPX Y5893 50W 1.0 oz (28.4 gm)	Apr 26	0.04 d	1.82 b	1.25 d	2.20 bc	2.22 de	24.45 bcde	21.3 cd	9.8 b
DPX Y5893 50W 2.0 oz (56.8 gm)	Apr 26	0.13 cd	1.09 b	0.58 d	2.25 bc	2.88 de	22.75 bcde	14.3 d	8.5 b
Apollo 50SC 1.0 fl oz (29.6 ml)	Apr 26	0.25 cd	1.63 b	1.98 cd	2.33 bc	6.63 bcd	7.49 efg	19.5 cd	15.0 b
Apollo 50SC 2.0 fl oz (59.2 ml)	Apr 26	0.18 cd	0.79 b	1.60 cd	4.30 bc	3.22 de	15.37 bcdef	10.3 d	5.0 b
Carzol 92SP 4.0 oz (113.6 gm)	Apr 26	1.83 ab	13.54 a	23.39 a	40.55 a	19.70 ab	43.92 ab	40.0 a	16.0 b
Kelthane 4F 1.5 pt (709.7 ml)	Apr 26	0.04 d	0.55 b	0.80 d	1.79 c	4.28 cd	9.19 defg	18.3 cd	8.3 b
Omite 30W 1.0 lb (453.6 gm)	Jun 24	--	--	--	--	2.47 de	11.44 cdefg	17.0 d	6.0 b
Omite 30W 1.5 lb (680.4 gm)	Jun 24	--	--	--	--	0.78 e	4.13 g	14.5 d	5.0 b
Omite 6E 6.0 fl oz (177.4 ml)	Jun 24	--	--	--	--	6.49 bcd	15.37 bcdef	33.0 abc	10.3 b
Omite 6E 8.0 fl oz (236.6 ml)	Jun 24	--	--	--	--	1.95 de	5.63 fg	23.0 bcd	7.0 b
ABG-6162 16 gm/qt 10.0 fl oz (295.7 ml)	May 13	0.83 bc	2.39 b	7.67 b	9.58 b	23.64 a	88.95 a	41.8 a	19.3 b
ABG-6162 16 gm/qt 20.0 fl oz (591.4 ml)	May 13	0.33 cd	1.44 b	5.23 bc	7.50 bc	14.92 abc	33.45 abc	23.3 bcd	32.3 a
ABG-6162 16 gm/qt 40.0 fl oz (1182.8 ml)	May 13	0.20 cd	0.82 b	1.76 cd	3.35 bc	4.79 cd	17.15 bcdef	37.3 ab	11.8 b
Check		3.35 a	22.56 a	41.63 a	41.15 a	18.82 ab	28.66 abcd	45.3 a	13.3 b

Numbers in the same column followed by the same letter are not significantly different ($p < .05$), DMRT.
*Data were transformed to $\log_{10}(X + 0.5)$ for analysis. **Data were not transformed for analysis.

EFFECT OF GRASS HERBICIDES ON DOWNY BROME GROWTH

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INTRODUCTION

Downy brome (Bromus tectorum L.) a grass sometimes incorrectly known as cheatgrass is normally a winter annual but sometimes acts as a spring annual or biennial reproducing by seed. It is a prolific seed producing plant with a root system that may extend as deep as three feet, and can keep growing almost to the freezing point of the root. It is found widespread throughout North America. The mature seed is yellow to reddish-brown. Steinbauer and Grigsby (3) reported 100% seed germination of downy brome following eight years of dry storage and Hubert (2) reported 96% seed germination following 11.5 years of storage. In the field, most downy brome seeds germinate during the first year(2, 3) and less than 2% remain viable in the soil for 3 years (1). The life cycle of downy brome is nearly identical to that of winter wheat. It thrives in cold moist soils. It can germinate in the fall to late winter and can become a complete cover of green vegetation by mid-December thus, making an ideal habitat for meadow and pine voles.

Excellent control of downy brome may be accomplished with annual applications of moderate rates (0.9kg/ha) of simazine or terbacil, both of which are commonly used in a herbicide program for apple and peach plantings. Conversely, a herbicide program where diuron is the only residual herbicide used, an excellent growth of downy brome may develop.

A treatment of 3.58 kg ai/ha diuron + 2.24 kg ai/ha glyphosate applied annually for 10 years to 50 spur 'Golden Deliciuos on seedling, M 7 and MM 106 rootstock developed a high population of downy brome. The percent of weed cover observed in late September of 1983 and 1984 for the diuron + glyphosate treatment was 70%. Of the total weed population, 80% in 1983 and 98% in 1984 was downy brome grass.

The purpose of this study was to evaluate two new grass herbicides:
a)fluazifop [(±)- 2-(4-{(5-{trifluoromethyl}-2-pyridimyl)oxy}phenoxy)propionic acid]
b)sethoxydim [2-(1-{ethoximino}butyl)-5-(2-{ethylthio}propyl) 3-hydroxy-2-cyclo-hexen-1-one.

Both of these are selective postemergence annual and perennial grass herbicides which are rapidly absorbed by the foliage and translocated to the meristematic growing point followed by the rapid cessation of growth. These materials are also translocated to the underground plant parts such as the roots, rhizomes, and stolons.

METHODS AND MATERIALS

Ten years of annual applications of 3.58 kg ai/ha diuron + 2.2 kg ai/ha glyphosate to 50 trees of spur 'Golden Delicious' on three rootstocks (seedling, M 7 and MM 106)had developed a 70% weed cover with 80% being downy brome as observed Spetember 28, 1983. Fluazifop and sethoxydim at rates of 0.56 and 1.12 kg/ha + 1% crop oil concentrate (COC) were applied at 262 liters/ha on June 5, 1984 before the annual diuron + glyphosate application (6/19/84). Applications were made with a boom having OC08 and one 11008 flat-fan nozzle tips. Early September observations rated all grass herbicide treated plots as having 70% weed cover of which 98% was seedling downy brome ranging in height from 2 to 15 cm with most being 13 to 15 cm high. A repeat of the June 5 applications of fluazifop and sethoxydim were made September 5, 1984.

The data presented is based upon observation made May 24,1985 from six random areas a half square meter in size for each rate of the two grass herbicides.

RESULTS

All of the fluazifop and sethoxydim treatments suppressed the germination and growth of downy brome (Table 1).

Table 1. Mean number of downy brome grass plants and inflorescence height on May 24, 1985. Treatments of 0.56 and 1.12 kg/ha of fluazifop and sethoxydim were applied June 5, 1984 and September 5, 1984[a].

Treatment	Rate(kg/ha)	Mean plant number/0.5m^2	Inflorescence height(cm)
Fluazifop	0.56	3.5 a	40.0 a
	1.12	1.0 a	40.0 a
Sethoxydim	0.56	12.8 b	40.0 a
	1.12	13.0 b	40.0 a
Control	0.0	48.0 c	60.0 b

[a]Numbers followed by the same letter in each column are not sigificantly different at the 0.05 level by Duncan's multiply range test.

The number of developed downy brome grass plants present in the plots of both rates of fluazifop treatments were significantly lower than the number of plants found in the sethoxydim treatments. The mean plant population which developed in the treated plots was not significantly altered with an increae in the rate of application of either grass herbicide.

The treatments of fluazifop and sethoxydim significantly reduced the inflorescence height of the downy brome as compared to the non-grass herbicide treatment. Increasing the rate of material of either herbicide did not alter the inflorescence height.

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EFFICACY OF DIFFERENT FORMULATIONS OF TRICLOPYR FOR CONTROLLING VIRGINIA CREEPER IN ORCHARDS

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In orchards, Virginia creeper (Parthenocissus quinquefolia Planch.) grows rapidly through unmowed areas, up tree trunks and into crowns, causing a loss of productivity. Two field experiments were conducted to determine the efficacy of different formulations for triclopyr on control of Virginia creeper growing in an apple orchard near Kearneysville, WV. In 1984, ester or amine formulations of triclopyr (Garlon 4 and Garlon 3A) were applied with a low volume sprayer (5 gal/A) at .25 or 1 lb a.i./A, either with or without the growth regulator indolebutyric acid (IBA) (20 mM). In the 1985 experiment, triclopyr ester or a combination of 2,4-D ester and triclopyr ester (Crossbow) were applied at 0.5, 1.0, or 2.0 lb a.i./A in either a high (30 gal/A) or a low (5 gal/A) carrier volume. Both experiments were replicated 4 times.

In the first experiment, only the 1 lb/A triclopyr ester treatment provided satisfactory control. For this treatment, less than 10% of the Virginia creeper survived at the end of 1984. However, by the end of 1985, Virginia creeper had regrown to occupy 50% of the treated area. Untreated areas increased from 75% coverage in 1984 to almost 100% by the end of 1985. All other treatments provided no better than 60% control during 1984, and by the end of 1985, sites were completely occupied by Virginia creeper. In general, IBA had no effect on the efficacy of either triclopyr formulation.

In the second experiment, most treatments provided satisfactory control. The least control (approximately 70%) was achieved with Crossbow at 0.5 lb/A in 5 gal/A. Generally, all other treatments provided better than 90% control by the end of 1985. Slightly, but not significantly, better control was usually obtained at the higher carrier rate.

A third experiment was carried out in a growth chamber to determine the effect of 2 carrier rates (5 or 30 gal/A) on absorption of ^{14}C-triclopyr. One-tenth μCi ^{14}C-triclopyr was applied in 3 (low) or 18 (high) μl water (0.5% Tween 20) to 3 leaf discs contained in a Petri dish. The experiment was replicated 4 times. After 1, 4, and 24 hours, the discs were washed in methanol for 1 min and then rinsed twice. The methanol was evaporated and residue assayed for radioactivity (unabsorbed triclopyr). Leaf discs were assayed for radioactivity (absorbed triclopyr) following combustion. Absorption of triclopyr increased with time: 9, 15, and 43% was absorbed at 1, 4, and 24 hrs, respectively. Carrier rate had no significant effect on triclopyr absorption at any time period. These results are similar to those in the second field experiment; differences in herbicide carrier rate did not strongly affect herbicide efficacy.

These experiments indicate that triclopyr ester alone (Garlon 4), or in combination with 2,4-D (Crossbow) can control Virginia creeper at 1 lb a.i./A. After 24 hrs, leaf absorption of triclopyr was the same for both high and low carrier rates. Generally, with doses of 1 lb or more per acre, carrier rate does not significantly affect efficacy of this herbicide at the end of the first growing season following treatment.

Effect of Grass Management on Soil Moisture in an Orchard System

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ABSTRACT

The use of growth regulators and sub-lethal rates of herbicides have received attention as possible ways to reduce maintenance of grass roadways in orchards. The use of these same materials as tools to manage the availability of water for fruit trees at times of stress pose an interesting possibility. This study was established to measure the effect of chemical and mechanical treatments upon soil water depletion, both in the grass roadway and the adjacent bare soil area.

A randomized complete block design with 5 replications was used. Each plot, 10'x 16', was divided in half. One-half consisted of established Kentucky 31 tall fescue, the other half was vegetation free. The treatments of the grassed areas were: Paraquat at 1/8, 1/4, and 1/2 lb. per acre, mowed at lawn height, and untreated. Soil water content to a 3 foot depth was measured periodically through the growing season using a calibrated neutron probe. Access tubes were located in the center of the sod area and 1 and 3 feet from the edge of the sod in the vegetation-free area. The desired injury range was obtained with the herbicide treatments. The Paraquat treatments were visually distinguishable. The recovery was complete at the 1/8 and 1/4 lb. levels, while the 1/2 lb. per acre treatment resulted in permanent injury to the sod. Weeds invaded the 1/2 lb./acre treatment as the season progressed. Soil water depletion or water conservation within the grass area was impacted by the herbicide treatments. There was a direct relationship between the rate of herbicide and the amount of water conservation. Mowing had little or no effect upon water depletion. None of the treatments had an impact upon soil water depletion in the vegetation-free strip as measured 1 foot from the grassed area.

If fruit trees are raised in sod, management practices such as applying low rates of herbicides to stunt the grass at critical times can have an impact upon the amount of water that the grass will remove from the soil. However, if the trees are grown in the bare soil strip, the management practices studied in this experiment would have no impact on soil water 1 foot from the grass. If the assumption is made that the active roots of the fruit tree are within the vegetation-free strip, then these practices would not impact the growth of the tree.

Weed Control in One-Year Apple Plantings in Virginia:

A Two-Year Summary

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Introduction

Agriculture has been referred to as a "controversy with weeds"! Despite significant advances in devising vegetation management strategies for deciduous orchards, weeds are still with us in abundance and seemingly endless variety.

Until recently, alternatives for the control of a broad spectrum of weed species in first and second year plantings have been limited. Elimination of weed competition is most critical when the trees are young and newly established. The reduction in the growth rate of young trees caused by weed related stress can greatly influence orchard fruit production for many years. The trees may be less winter hardy, slower to reach maturity and may produce less fruit by not being allowed to reach their full growth potential. For many years, we have conducted a continuing program of field evaluation of candidate herbicides for selective weed control in orchards. Recent emphasis has been on young (1 or 2-year-old) plantings. The present report is a two-year summary of these efforts (1984 + 1985) in first year apple plantings.

Materials and Methods

Two separate replicated field experiments were conducted during 1984 and 1985 at Wray's Orchard in Calloway, Virginia (Franklin County). Herbicides or herbicide combinations tested that are not registered for use in Virginia orchards included: PPG-1013 + paraquat, PPG-1013 + oryzalin + paraquat, PPG-1013 + simazine + paraquat, PPG-844 + paraquat, PPG-844 + simazine + paraquat, metalachlor + simazine + glufosinate, glyphosate or paraquat, imazaquin + pendimethalin, imazaquin + pendamethalin + paraquat and oxyfluorfen + paraquat. The following recommended herbicides were applied: paraquat alone or in combination with simazine, napropamide + simazine, norflurazon + simazine, oryzalin + simazine, dichlobenil or pronamide. Terbacil + paraquat (recommended for apple trees established at least three years) and terbacil + diuron + paraquat (recommended for apple trees established at least two years) were also applied in one experiment. Herbicide treatments were applied to clayey soils with soil pH ranging from 6.3 to 6.8 and organic matter ranging from 3.4 to 3.6%. 'Red Chief' Red Delicious apple trees had been established one year when treatments were applied.

Individual plots were 6 feet wide and 15 to 22 feet long (depending on spacing within the row). All treatments were replicated four times and all except dichlobenil were applied as directed sprays in 28 gallons of water per acre using a CO_2-charged hand sprayer equipped with a boom having two 11003 nozzles and delivering 32 psi pressure. The surfactant, Ortho X-77 at 16 oz. per 100 gallons of water was included in all paraquat sprays. Dichlobenil granules were applied by hand (salt shaker method).

(Experiment 1)

Weed species present at the time of treatment on April 12, 1984 were henbit (blooming and the most abundant weed present), mayweed, shepherdspurse (blooming), mouseear chickweed (blooming), plantains and common chickweed.

Weed control ratings and estimates of ground covered by weeds were made June 7, 1984.

(Experiment 2)

Weed species present at the time of treatment on April 3, 1985 were common lambsquarters (1 inch tall or less and the most abundant weed present), orchardgrass (6 inches tall), alfalfa (up to 10 inches tall), fleabanes (4 to 6 inches tall), common chickweed (1½ inches tall), broadleaf dock (4 to 5 inches across), henbit (2 to 3 inches tall), shepherdspurse (3 inches across) and mouseear chickweed (1½ inches tall).

Weed control ratings and estimates of ground covered by broadleaf weeds and grasses were made June 13, 1985.

Results

(Experiment 1) Evaluations on weed control are presented in Table 1. There was very little grass in the treated row area except for a small amount of tall fescue, perennial ryegrass and rye. Rye was an obvious component in some, but not all, checks. Most noticeable was the broad array of annual and perennial broadleaf weeds which included Virginia pepperweed (1 to 2 feet tall and seeding), common ragweed, wild buckwheat, dandelion, red clover, shepherdspurse, campion, henbit, red deadnettle, *Veronica* sp., knotweed, common lambsquarters, pigweeds, thistles and mayweed.

Imazaquin + pendimethalin and paraquat were the weakest treatments against grasses. Imazaquin + pendimenthalin (0.125 + 3.0 lb a.i./A) and paraquat were weak against broadleaf weeds. Good to excellent control of broadleaf weeds and grasses was achieved with other herbicide treatments without injury to apple trees.

(Experiment 2) Evaluations on weed control are presented in Table 2. Approximately 2½ months after treatment, the untreated check plots were completely covered with a wide assortment of weeds including common lambsquarters (up to 24 inches tall), common ragweed (6 to 24 inches tall), prickly lettuce, Virginia pepperweed (6 to 24 inches tall), black nightshade, daisy fleabane, horsenettle (up to 18 inches tall), brambles, wild buckwheat, buckhorn plantain (up to 24 inches tall), orchardgrass (36 inches tall and heading), and alfalfa (36 inches tall and in full bloom).

Large crabgrass and foxtails were the annual grasses present in some treated plots. Alfalfa, common lambsquarters, common ragweed and horsenettle were predominant in many treated plots. Johnsongrass, white campion, Pennsylvania smartweed, Virginia copperleaf, yellow nutsedge, quackgrass, velvetleaf, wild garlic, broadleaf dock and curly dock were also present. Of the recommended treatments, only pronamide did not effectively control the annual broadleaf weeds while PPG-1013 and PPG-844 were the weaker of the non-registered treatments. Moderate to heavy pressure from perennial broadleaf weeds occurred in most plots. All treated plots contained fewer perennial grass plants than did the untreated check plots.

Apple trees were green and vigorous with no herbicide injury symptoms visible.

Conclusion

Of the non-registered herbicides or herbicide combinations tested, metalochlor + simazine used in combination with paraquat, glufosinate or glyphosate, and oxyfluorfen + paraquat showed the most promise for controlling annual weed species with no injury to young apple trees. Imazaquin + pendimethalin + paraquat was somewhat effective on annual broadleaf weeds. PPG-1013 + paraquat and PPG-844 + paraquat generally did not provide adequate weed control, particularly where pressure from annual broadleaf weeds was heavy. Little to no control of the perennial broadleaf weed species encountered was achieved with any of the above treatments.

Table 1. Effect of herbicides on weed control in one-year-old 'Red Chief' Red Delicious apple trees. Calloway, Virginia (Franklin County). Treated April 12, 1984. Data are averages of 4 replicates.[a]

Treatment	Rate	June 7, 1984		
		Weed control[b]		
		Grasses	Broadleaf weeds	Groundcover
	(lb a.i./A)			(%)
1. Simazine (Princep Caliber 90) + paraquat (Ortho Paraquat Plus)	4.0 + 0.5	9.7 a	8.0 bc	13.0 c-e
2. PPG-1013 (0.25E) + paraquat	0.2 + 0.5	9.9 a	8.9 a-c	11.0 c-e
3. PPG-1013 + paraquat	0.4 + 0.5	9.6 a	9.1 a-c	7.0 de
4. PPG-1013 + paraquat	0.8 + 0.5	10.0 a	9.9 a	2.3 e
5. PPG-1013 + oryzalin (Surflan 4AS) + paraquat	0.4 + 3.0 + 0.5	8.5 ab	9.2 a-c	7.3 de
6. Metolachlor (Dual 8E) + simazine + glufosinate (HOE 0661), 1.78 lb/gal)	2.0 + 2.0 + 0.7	8.9 ab	9.4 a-c	6.3 de
7. Metolachlor + simazine + glufosinate	2.0 + 2.0 + 1.0	9.7 a	9.5 ab	3.0 e
8. Metolachlor + simazine + glufosinate	3.0 + 3.0 + 1.0	10.0 a	9.7 a	2.1 e
9. Metolachlor + simazine + paraquat	2.0 + 2.0 + 0.5	10.0 a	8.9 a-c	9.6 c-e
10. Metolachlor + simazine + paraquat	2.0 + 2.0 + 1.0	9.9 a	8.9 a-c	8.0 de
11. Imazaquin (Scepter, 1.5 lb/gal) + pendimethalin (Prowl 4E)	0.125 + 3.0	4.8 c	6.5 d	19.0 cd
12. Imazaquin + pendimethalin	0.25 + 3.0	6.3 c	7.9 c	22.8 c
13. Imazaquin + pendimethalin	0.375 + 3.0	6.3 c	8.9 a-c	10.0 c-e
14. Imazaquin + pendimethalin + paraquat	0.125 + 3.0 + 0.5	8.4 ab	8.8 a-c	4.5 e
15. Imazaquin + pendimethalin + paraquat	0.25 + 3.0 + 0.5	9.3 a	9.7 a	4.0 e
16. Imazaquin + pendimethalin + paraquat	0.375 + 3.0 + 0.5	6.9 bc	9.2 a-c	10.5 c-e
17. Paraquat	0.5	5.5 c	2.4 e	75.3 a
18. Untreated	-------	5.0 c	1.9 e	49.8 b
19. Metolachlor + simazine + glyphosate (Roundup)	2.0 + 2.0 + 1.0	10.0 a	9.7 a	3.3 e
20. Metolachlor + simazine + glyphosate	3.0 + 3.0 + 1.0	10.0 a	9.7 a	3.0 e
21. Oryfluorfen (Goal 2E) + paraquat	1.0 + 0.5	10.0 a	9.6 a	4.0 e
22. Oryflurofen + paraquat	2.0 + 0.5	10.0 a	9.8 a	1.0 e

[a]Means within a column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[b]0-10 scale: 0 = no control and 10 = complete control.

Table 2. Effect of herbicides on weed control in one-year-old apple trees. Franklin County, Virginia. Treated April 3, 1985. Data are averages of 4 replicates.[a]

Treatment[b]	Rate	June 13, 1985 Overall weed control[c]	Groundcover: Broadleaf weeds Annual	Broadleaf weeds Perennial	Grasses Annual	Grasses Perennial
	(lb a.i./A)		(%)			
1. PPG-1013 (0.25EC)	0.4	2.6 f-i	26.3 cd	31.3 a	12.3 a	4.0 b
2. PPG-1013 (0.25EC) + simazine (Princep 4L)	0.4 + 2.0	6.1 a-f	6.0 e	27.0 a	3.0 bc	3.3 b
3. PPG-844 (Cobra 2EC)	0.5	2.0 g-i	48.8 ab	20.5 a	2.5 bc	8.3 ab
4. PPG-844 (Cobra 2EC)	1.0	1.4 hi	35.0 bc	45.0 a	3.8 bc	2.5 b
5. PPG-844 (Cobra 2EC) + simazine	0.5 + 2.0	4.3 c-h	1.3 e	43.5 a	8.8 ab	4.0 b
6. Metolachlor (Dual 8E) + simazine + glufosinate (HOE-0661, 1.78 lb/gal)	2.0 + 2.0 + 1.0	4.7 a-h	16.0 de	25.0 a	0.0 c	6.8 b
7. Metolachlor (Dual 8E) + simazine + glufosinate (HOE-0661, 1.78 lb/gal)	3.0 + 3.0 + 1.0	3.5 d-i	0.0 e	61.5 a	0.8 c	2.0 b
8. Metolachlor (Dual 8E) + simazine	2.0 + 2.0	6.6 a-e	3.6 e	21.3 a	4.4 bc	4.8 b
9. Metolachlor (Dual 8E) + simazine	3.0 + 3.0	5.2 a-g	0.8 e	41.8 a	0.8	4.5 b
10. Oxyfluorfen (Goal 1.6E)	1.0	3.3 e-i	16.3 de	28.8 a	12.0 a	5.5 b
11. Oxyfluorfen (Goal 1.6E)	2.0	4.4 b-h	12.8 de	36.3 a	2.1 bc	3.6 b
12. Napropamide (Devrinol 50W) + simazine	4.0 + 3.0	4.7 a-h	5.3 e	41.5 a	0.0 c	4.3 b
13. Norflurazon (Solicam 80W) + simazine	3.0 + 3.0	7.1 a-d	0.5 e	20.5 a	0.5 c	3.6 b
14. Oryzalin (Surflan 4AS) + simazine	4.0 + 3.0	4.3 c-h	0.5 e	51.8 a	0.3 c	5.0 b
15. Imazaquin (Scepter, 1.5 lb/gal) + pendimethalin (Prowl 4E)	0.25 + 3.0	3.9 d-i	0.3 e	52.0 a	2.5 bc	6.5 b
16. Dichlobenil (Norosac 4G)	6.0	8.2 ab	5.3 e	12.5 a	3.0 bc	2.5 b
17. Pronamide (Kerb 50W)	4.0	3.5 d-i	28.8 cd	25.0 a	2.3 bc	9.0 ab
18. Simazine	3.2	7.7 a-c	0.8 e	19.8 a	1.0 c	2.0 b
19. Terbacil (Sinbar 80W)	3.2	8.6 a	0.0 e	12.8 a	0.0 c	1.5 b
20. Terbacil (Sinbar 80W) + diuron (Karmex 80W)	1.6 + 1.6	8.7 a	0.3 e	12.0 a	0.0 c	2.3 b
21. Untreated	---	0.0 i	55.0 a	27.5 a	0.0 c	16.3 a

[a]Means within a column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[b]Paraquat at 0.5 lb a.i./A + X-77 at 16 oz/100 gal was included in all sprays except treatments 6 and 7.

[c]0-10 scale: 0 = no control and 10 = complete control.

The Interaction of Soil Management System and Rainfall Infiltration in a Young Peach Planting

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Tree fruit crops in the eastern U.S. are grown primarily without the use of supplemental irrigation. The potential for surface runoff is high since trees are generally planted on sloping land. The roughness, porosity, water content, and resistance to aggregate breakdown of the soil surface all interact to determine if rainfall will infiltrate or runoff. Preventing runoff reduces soil loss while increasing the amount of soil water available for fruit production. The objective of this study was to examine the effect of 4 soil management systems (cultivated, herbicide, mowed sod, and killed sod) on rainfall infiltration in a young peach orchard.

The peach cultivars 'Summer Glow' and 'Red Haven' on 'Halford' rootstock were planted in hand-dug holes in 1983 and 1984 respectively. All trees were headed to a height of 100 cm at planting. A randomized complete block experimental design was used with 5 replicates in each year. Each plot contained 3 trees with a guard tree between plots. The treatments included: a) trees planted in Kentucky 31 fescue sod, and b) trees planted in a Kentucky 31 fescue sod that was tilled the fall before planting leaving a bare soil surface. Trees planted in sod were divided into 2 groups. The first group (mowed sod) were maintained in a mowed sod state, while the sod in the second group (killed sod) was treated immediately after planting with glyphosate at a rate of 2.2 kg/ha. When the sod had died, a residual herbicide treatment of 1.1 kg/ha diuron plus 1.1 kg/ha terbacil was applied. Trees planted in the bare soil were also divided into 2 groups. The first group was maintained weed-free by rotatilling and hand-hoeing (cultivated). The second group received no cultivation but was maintained weed-free with the same herbicide treatments applied to the killed sod (herbicide). This study was conducted on a Hagerstown silt loam soil with a 6% slope. Neutron probe access tubes (5.7 cm in diameter, 1 m in length) were installed at a 20° angle from the vertical, 50 cm from the tree in each plot. A calibrated neutron probe determined soil water content to a 90 cm depth. During the 1985 growing season, the infiltration from 14 rainstorms (precipitation 15 mm) was determined from soil moisture measurements collected prior to and immediately following the rainstorms. Runoff from each treatment occurred when the measured increase in soil water after the rainstorm was less than the received level of precipitation.

The soil management system had a significant effect on rainfall infiltration in both the 2- and 3-year-old peach plantings. The mowed sod had the least runoff with 6 rainstorms of the measured 14 resulting in significant runoff. The 3-year-old killed sod system had runoff in 10 events and the 2-year-old system with the killed sod surface had runoff from 8 events. The dead grass mulch of the killed sod treatment established in 1983 had decomposed almost completely by 1985, however, the 1984 planting retained some residue and was effective in reducing runoff. The herbicide system in both the 2- and 3-year-old plantings had runoff in 12 of the 14 events. The cultivated system had runoff in 10 of the 14 events for both plantings. These results demonstrate that runoff from intense rainstorms cannot be prevented with even a thick grass cover. The maintenance of a partially decomposed sod is not as effective as mowed sod in reducing runoff but is more effective than either a cultivated or herbicide system.

The rainfall events that resulted in runoff demonstrated a positive correlation with precipitation amount for the mowed sod, killed sod, and cultivated treatments ($r = 0.93$, 0.80, 0.81 in the 2 year planting; $r = 0.99$, 0.74, and 0.85 in the 3 year planting, respectively). The amount of runoff from the herbicide system did not significantly correlate with the amount of precipitation. This indicates that surface sealing during an intense rainstorm occurs very quickly in the herbicide system, while the structure of the surface in the mowed sod, killed sod, and cultivated systems is sufficiently stable to allow some infiltration during the rainstorm in proportion to the amount of precipitation received.

The management of the soil surface in an orchard can significantly affect the amount of water captured from summer rainfall. During the 1985 growing season, a mowed sod and killed sod system captured approximately 100 mm and 90 mm, respectively, more water than the conventional herbicide system. This increased infiltration of rainfall is available for plant uptake.

Effects of Bud Position on Time of Flowering and Fruit Quality in Peaches

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Introduction

The effect of bud position on flowering and its influence on parameters of fruit quality has not received much attention in peaches. In apples, work has been conducted on the relationship between fruit position within canopy and quality paramater, (1, 4, 5, 6, 8, 9). For peaches, Spencer and Couvillon (10) reported that buds closer to the tip of the shoot bloomed earlier than those farther away, and that the fruit developing from the buds that bloomed earlier attained the highest quality. They measured ovule length throughout the growing season, and found a positive relationship between ovule length and fruit size. This research was aimed at studying the relationship between bud position and its effects on time of flowering, and of different thinning patterns and fruit densities on fruit quality.

Materials and Methods

In March 1984, four uniform 'Red Haven' trees were chosen, and limbs were selected according to shoot length and orientation. Three lengths were considered: 25, 50, 75 cm, and also three orientations of the shoots: South East (SE), South (S), and South West (SW). Nine shoots total were selected on each tree. Each shoot was then divided into three parts, lower, middle, and upper. The total number of flower buds per shoot section was determined, and the number of flowers open was recorded. The experiment was repeated in 1985 on a different cultivar, 'Ranger', because of winter frost damages. The data from both years were analyzed as a randomized complete block (RCB) split-plot.

In June of 1984, limbs on 5 'Redglobe' trees were chosen according to two shoot lengths, 50 and 75 cm. Four thinning patterns and two spacings between fruits were applied, in a RCB factorial design. The spacing between fruits were 10 and 15 cm. The thinning patterns were: fruit concentrated at the bottom, middle or top third of the shoot; or left-scattered along the shoot (control). The number of fruits to be left was determined by dividing the shoot length by the spacing desired. The experiment was repeated in '85, on 'Redhaven' trees, but only one spacing, 15 cm, was used, and the thinning patterns were applied at whole branches, rather than on single limbs. The experimental design in '85 was a RCB. In both years, fruit was harvested at commercial maturity. Fruit diameter, weight, % skin colored with red (blush), ground color according to Delwiche and Baumgardner (3), flesh firmness, and percentage of soluble solids were determined.* In 1985, color intensity was

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*using an Effegi pressure tester (Mod. FT 327, Effegi, 48011, Alfonsine, Italy) and an American Optical 10430 refractometer (American Optical Corp. Buffalo, N.Y. 14215) respectively.

also determined by a "Hunter-lab" colormeter (Model 25A-2, STH, H. Hunter Associates Laboratory, 11495 Sunset Hills Rd., Reston, Va 22090).

Results and Discussion

In both years, flowerbuds closer to the tip of the shoots bloomed earlier (Tables 1 and 2). Blooming proceeded downwards. Longer shoots (50 to 75 cm) bloomed earlier in 1984 (Table 3), while no differences were found in 1985 (Table 4), although shoots 50 and 75 cm long had each 10% more open flowers than those 25 cm long. In 1984, orientation affected flowering only on the first day of blooming (Table 5). More flowers were open on the SE side of the trees. In 1985, this effect lasted longer (Table 6), and was extended not only to the SE but also to the South part of the trees. Chalmers et al. (2) have indicated that peak photosynthetic activity takes place in the morning hours. This could be explained by a better water status in the tree, more open stomates, and low carbohydrate concentration in the leaves. These factors could explain why the parts of the tree that receive light in the morning hours, i.e., SE and S, could better differentiate flower buds than those parts that receive light later in the day.

Because of poor climatic conditions, fruit quality in 1984 was poor, and this is probably why differences were found only for a few parameters, (Tables 7 and 8). Fruits spaced 10 cm apart were smaller and had less soluble solids than those 15 cm wide (Table 9). In both years, fruit closer to the tip were the smallest, had lowest percent soluble solids, and in 1985 were also less colored and had firmer flesh than all the other treatments (Table 8 and 10). In 1985, fruit from the bottom achieved the best quality overall (Table 10), Those from the middle section had values comparable to those from the bottom for size, weight, % blush and ground color, while they were firmer and had less soluble solids. Fruits from the control (scattered) had similar size and weight to those from the bottom, and percent soluble solids, but they had less percent skin colored, and they had firmer flesh.

These results disagree with those of Spencer and Couvillon (10). They found the best fruit closer to the top of the shoots, where the vegetative-reproductive sink competition should be stronger. Chalmers et al. (2) reported a feed-back activity of the fruit on the photosynthetic rates of the leaves. They also demonstrated the importance of photosynthesis translocation by girdling experiments.

Fruits in the lower parts of the shoot might stimulate the production of photosynthesis from the leaves either above them or below, and have enough carbohydrates available to achieve good quality. Johnson (7) demonstrated that very little light is necessary to achieve good skin coloration in peaches, thus the good coloration of fruits further down in the shoot is not surprising . Walter (11) indicated carbohydrate content as an important factor in apple color formation. The higher percent soluble solids found in both years in the fruit in the basal portions of the shoots could indicate the effect of distance from vegetative sinks, and also be reflected in color formation.

In conclusion, bud position affected flowering and fruit quality. The effect on flowering is clearer than that on fruit quality, although the effect of competition between vegetative and reproductive sinks is evident.

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Table 1. Effect of bud position on time of flowering of 'Redhaven' peach, 1984.

Shoot Section	Date: March 16	March 17	March 19	March 22	March 23
	Percent flowers open^z				
Lower	0 a	0 a	1.46 a	31.51 a	23.38 a
Middle	.19 a	0 a	18.40 b	47.92 b	22.48 a
Upper	6.46 b	9.96 b	51.41 c	25.61 a	5.52 b
SEM	.7	1.4	3.7	4.2	3.5

^{z}Means separation in columns by Duncan's Multiple Range test, $\alpha = 0.05$.

Table 2. Effect of bud position on time of flowering of 'Ranger' peach, 1985.

Shoot Part	Date: March 20	March 23	March 25	March 28	April 5
	Percent flowers open^z				
Lower	1.22 a	31.69 a	28.5 a	26.44 a	12.15 a
Middle	11.00 b	48.26 b	22.57 a	16.9 a	1.27 b
Upper	27.94 c	35.93 ab	21.17 a	14.59 a	0.37 b
MSE	4.9	11.9	7.7	6.8	2.8

^{z}Mean separation in columns by Duncan's Multiple Range test, $\alpha = 0.05$.

Table 3. Effect of shoot length on time of flowering of 'Redhaven' peach, 1984.

Shoot Length (cm)	Date				
	March 16	March 17	March 19	March 22	March 23
	Percent flowers open[z]				
25	0 a	.69 a	18.06 a	40.73 a	20.57 a
50	3.54 b	3.66 ab	24.41 a	34.09 a	20.44 a
75	3.11 b	5.61 b	28.80 a	30.23 a	10.37 a
SEM	.7	1.4	3.7	4.2	3.5

[z]Means separation in columns by Duncan's Multiple Range test, $\alpha = 0.05$.

Table 4. Effect of shoot length on time of flowering of 'Ranger' peach, 1985.

Shoot Length (cm)	Date				
	March 20	March 23	March 25	March 28	April 5
	Percent flowers open[z]				
25	7.52 a	41.4 a	23.42 a	24.25 a	3.42 a
50	16.63 a	40.38 a	22.46 a	17.54 a	2.99 a
75	16.54 a	34.49 a	25.94 a	16.30 a	6.74 a
SEM	8.2	13.6	11.5	9.9	2.8

[z]Mean separation in columns by Duncan's Multiple Range test, $\alpha = 0.05$.

Table 5. Effect of orientation on time of flowering of 'Redhaven' peach, 1984.

Orientation	Date				
	March 16	March 17	March 19	March 22	March 23
	Percent flowers open[z]				
SE	4.61 a	5.24 a	20.68 a	28.76 a	20.09 a
SO	.69 b	2.75 a	22.07 a	41.09 a	20.78 a
SW	1.34 b	1.97 a	28.52 a	35.18 a	10.52 a
SEM	.7	1.4	3.7	4.2	3.5

[z]Mean separation in columns by Duncan's Multiple Range test, $\alpha = 0.05$.

Table 6. Effect of orientation on time of flowering of 'Ranger' peach, 1985.

Shoot Orientation	Date				
	March 20	March 23	March 25	March 28	April 5
	Percent open flowers[z]				
SE	17.35 ab	43.82 a	19.31 a	15.75 a	3.77 a
SO	19.02 a	44.82 a	24.46 a	9.77 a	1.94 a
SW	5.18 b	27.34 b	28.05 a	31.83 b	7.6 a
SEM	.08	.136	.115	.099	.028

[z]Mean separation in columns by Duncan's Multiple Range test, $\alpha = 0.05$.

Table 7. Effect of shoot length on fruit size of 'Redglobe' peach, 1984.

Shoot Length (cm)	Fruit Diameter (cm)[z]	SEM
50	6.30 a	.05
75	6.36 b	.04

[z]Mean separation in columns by linear contrast, $\alpha = 0.05$.

Table 8. Effect of thinning pattern on fruit size and % soluble solids of 'Redglobe' peach, 1984.

Thinning Pattern	Fruit Size (cm)[z]	% Soluble Solids[z]
Bottom	6.20 a	8.55 a
Middle	6.42 b	8.17 b
Scattered	6.56 b	8.17 b
Top	6.17 a	7.79 c
SEM	.07	.11

[z]Mean separation in columns by linear contrast, $\alpha = 0.05$.

Table 9. Effect of distance between fruits on fruit size and % soluble solids of 'Redglobe' peach, 1984.

Distance Between Fruits (cm)	Fruit Size (cm)	SEM	% Soluble Solids	SEM
10	6.27 a	.04	7.97 a	.07
15	6.43 b	.04	8.42 b	.09

[z]Mean separation in columns by linear contrast, $\alpha = 0.05$.

Table 10. Effect of thinning pattern on fruit diameter, weight, % blush, % ground color, flesh firmness, % soluble solids of 'Redhaven' peach, 1985.

Thinning Pattern	Fruit Diameter (cm)	Fruit Weight (gr)	Blush % area covered	Ground Color % area covered	Pressure[z] kg/cm^2	% Soluble Solids
Bot	6.23 a	149.05 a	25.34 a	15.08 b	2.87 c	11.87 a
SEM	0.06	4.35	1.3	1.54	.13	.09
Middle	6.18 a	148.04 a	25.53 a	11.56 b	3.30 b	11.44 b
SEM	0.07	4.77	1.28	1.52	.13	.08
Scattered	6.22 a	148.83 a	18.20 b	20.13 a	3.52 b	11.64 ab
SEM	0.07	4.42	1.25	1.46	.13	.08
Top	5.98 b	134.57 b	16.64 b	24.05 a	3.97 a	11.04 c
SEM	0.06	4.53	1.36	1.6	.14	.09

[z]Means separation in columns by LSD, $\alpha = 0.05$.

Summer Pruning Effects on Canopy Development of Newly Planted Peach Trees

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Introduction

Under ideal cultural conditions, newly planted peach trees in middle Georgia easily attain a height of 1.5 m or more. Lateral shoots (primary scaffolds), particularly those immediately below the initial heading cut, exhibit high vegetative vigor (strong apical dominance). By the end of the growing season, scaffolds have developed narrow crotch angles and are very upright. During the first dormant season after planting, pruning is used to develop the open center training system. Because scaffolds of vigorous, well-managed trees are so upright in orientation, rather severe pruning is utilized to "open" trees up to develop an open center. As a result, severe bench cuts are made, vigorous sucker growth induced, and potential for fruit production is reduced.

Selected summer pruning treatments, which might reduce the required amount of dormant pruning by altering canopy development were evaluated.

Procedure

Trees of Coronet peach on Lovell rootstock were planted near Byron, Georgia in a commercial orchard in early February, 1985. Terminal shoot growth began during the third week of March. Unbranched trees were headed at 30 cm and grown under standard fertilization, weed control, and pest control practices but were not irrigated.

On May 16, 1985, peach trees which averaged 70 cm in height, were selected for uniformity. At that time, the following treatments were applied: a) no pruning (control); b) removing two scaffolds immediately below original pruning cut (delayed heading); and c) removing 1/2 the length of two scaffolds immediately below original heading cut (topped center). Each treatment tree was bordered by similarly treated trees. Experimental design was a randomized complete block design with six single tree replications. Data were analyzed by analysis of variance and Duncan's mean separation.

Following the growing season (October 30, 1985), tree height and width were measured, the latter at a 1.5 m distance from the ground (Fig. 1). Trunk diameter was measured at 15 cm from groundline. The angle of the top three primary scaffold limbs was measured (did not include the two pruned limbs in the "topped center" treatment trees). At a 1.0 m distance above groundline, the interior spread (inrow and crossrow) between primary scaffold limbs (canopy interior spread) was measured.

Results

Pruning had no effect on the change in trunk diameter between May 16 and October 30, 1985 (Table 1). In addition, treatments did not alter ultimate tree height or width. The topped center treatment increased the angle of the first scaffold limb below the original heading cut (Table 2). Both pruning treatments increased the angle of the second and third scaffolds below the original heading cut. Only the topped center treatment increased the canopy interior spread compared to the unpruned control.

Time and amount of pruning required to develop a standard open center tree will be recorded during the dormant pruning.

Summary

The topped center treatment followed in 1-2 months by an additional topping of several scaffolds might improve this training technique in developing an open center tree form which would not require extensive dormant pruning.

Table 1. Effect of summer pruning on trunk diameter, tree height and width of one-year old 'Coronet' peach trees.[z]

Treatment (16 May)	Change in Trunk Diameter (cm)	Tree Height (m)	Tree Width[y] (m)
Control	3.3	1.9	1.8
Delayed heading	3.2	1.8	1.9
Topped center	3.4	1.8	2.0

[z] No Significant difference, 5% level.

[y] Measured at a 1.5 m distance from ground.

Table 2. Effect of summer pruning on scaffold angle and width of canopy interior of one-year old 'Coronet' peach trees.[z]

Treatment (16 May)	Scaffold Angle (°)		Canopy Interior Spread at 1 m ht. (cm)
	First	Second & Third (avg.)	
Control	25 b	34 b	51 b
Delayed heading	31 ab	41 a	52 b
Topped center	37 a	43 a	75 a

[z] Compare means within columns by Duncan's multiple range test, 5% level.

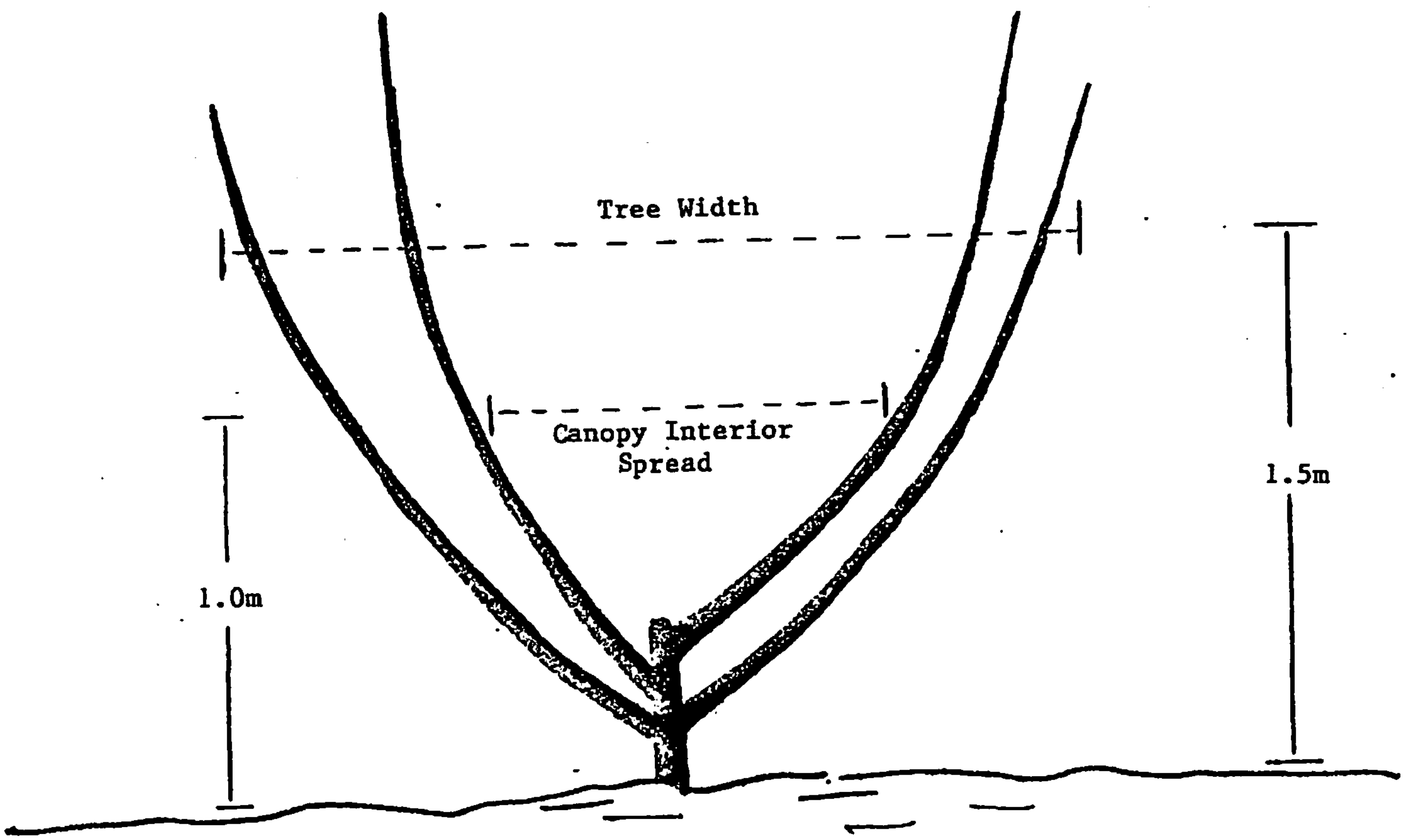

Fig. 1. Measurement of tree width and canopy interior spread.

THE EFFECT OF FRUIT ON THE PHOTOSYNTHETIC RATES OF ADJACENT LEAVES IN PEACH

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Increased photosynthetic rates for leaves near fruit have been reported on apple (5,6,7) and peach (2). No specific distances for this effect were reported on apple but in peach the leaves were affected up to 45 cm along the shoot (2). The growth of peach fruit has 3 stages (9) and its effect on photosynthetic rates of nearby leaves occurs during the third stage or final swell period of development. A study on peach done in Australia did not report on a specific leaf-fruit distance effect but rather found that photosynthetic rates of leaves on the tree as a whole, particularly in the middle of the canopy were increased during stage III of fruit development (1).

Recently, the findings of increased photosynthetic rates in peach leaves during stage III of fruit development have been challenged. DeJong and Doyle, studying the effects of paclobutrazol on tree growth and gas exchange of leaves in nectarine, failed to observe increased photosynthetic rates during fruit development (3). They noted that the photosynthetic rates reported in the earlier studies were lower than theirs and others in current literature. They concluded that the effect of fruit on photosynthesis observed in these earlier studies was induced by some stress factor on those trees.

The purpose of this study was to determine if the presence of fruit had an effect on photosynthetic rates of leaves on the same shoot and if it did, how far along the shoot this effect was measurable.

Materials and Methods

Mature trees of 'Redglobe' and 'Rio Oso Gem' were used in this study. Shoots were selected on the trees with 1 of 3 possible fruit loads: 0, 1, or 3 fruit on 'Redglobe' and 0, 1 or 2 fruit on 'Rio Oso Gem'. Each replicate of 3 shoots (one of each treatment) was on the same tree and there were 4 replicates per cultivar

Mature leaves were selected at distances of 7, 14, 21, 28, and 35 cm from the fruit or the base of the current season's growth on non-fruiting shoots. Photosynthetic rates of these leaves were measured at approximately weekly intervals using a method similar to that used by Ehleringer and Cook (4). Samples were taken in the field using a portable, self-contained cuvette constructed of plexiglass with an internal volume of 610 cc. Air circulation was maintained by 2 small fans driven by 1.2v DC motors. Spring-loaded trigger-activated plastic 10 cc syringes (Becton,Dickinson and Co.) with Luer-Loc tips were mounted on the cuvette and used to take samples.

A Beckman infrared gas analyzer (Model 315B) with flowing reference was used to determine CO_2 concentrations. Samples of 8 cc from each syringe were injected into a carrier gas stream of nitrogen flowing at a rate of 1 liter per minute. A small volume of 'Drierite' was used as a water trap in both sample and reference lines. The analyzer was calibrated using samples from cylinders of known CO_2 concentration. Photosynthetic rates were determined using the depletion of CO_2 in the cuvette for each leaf.

Results and Discussion

Variability in measured rates prohibited detection of a definite influence of fruit number and distance on photosynthetic rates of leaves in both varieties.

The data from this experiment were used to determine the number of samples needed to detect differences in photosynthetic rates of peach leaves (Table I). The range of rates used was 2 to 5 $mgCO_2/dm^2/hr$ and these values were determined for 2 to 5 treatments using the method of Neter and Wasserman (8). In 'Rio Oso Gem' the root of the MSE = 2.87 while in 'Redglobe' it was = 3.44. Because of the larger root MSE in 'Redglobe' this portion of Table I would be more useful since the sample numbers were calculated from data with greater variation.

Detecting a difference of 3 $mgCO_2/dm^2/hr$ with 2 treatments would require 7 samples and increasing treatment numbers require a larger sample size. In this study a total of 60 leaves were sampled on each date. This is the maximum number of leaves that could be reasonably measured in 1 day using the methods described here. Therefore, if these methods are to be used in future experiments careful planning will be required in determining the number of treatments to be used so that useful differences in photosynthetic rates can be determined.

A possible cause for the variability of photosynthetic rates obtained in this study could have been with the methods used. Leaves on the lower sections of the shoots were often partially shaded prior to sampling. Although the leaves were in full sun when photosynthetic rates were measured, the lack of an equilibration period to the increased light level most likely caused measurement of rates below the potential of these leaves.

The results of this study are similiar to those of DeJong and Doyle (3) who also failed to find an effect of stage of fruit development on photosynthetic rates in nectarine. The photosynthetic rates obtained in this study agree with those in current literature for peach and are greater than those reported by Crews et al. (2) who found a fruit effect on photosynthesis in nearby leaves. This supports the argument by DeJong and Doyle that the effect measured by Crews et al. was caused by a stress factor on those trees.

Table I. Sample size required to detect various differences in photosynthetic rates of leaves of "Redglobe" and "Rio Oso Gem" peach for experiments with 2, 3, 4, or 5 treatments.

Cultivar 'Redglobe'	Number of Samples Needed			
Difference ($mgCO_2/dm^2/hr$)	Number of Treatments 2	3	4	5
5	5	5	5	6
4	5	5	6	7
3	7	9	10	11
2	18	20	22	25

Cultivar 'Rio Oso Gem'	Number of Samples Needed			
Difference ($mgCO_2/dm^2/hr$)	Number of Treatments 2	3	4	5
5	5	5	5	5
4	5	5	5	5
3	6	6	8	8
2	11	14	16	18

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GROWTH AND FRUITING OF APPLE TREES AS AFFECTED BY TRUNK LOOPING

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Abstract. Trunk looping of several apple cultivars grafted or budded on seedling roots reduced terminal length and trunk diameter and increased suckers from root systems. Fruit number in the fifth growing season was unaffected by looping, but looping increased fruit number and fruit/cm2 cross sectional area of trunk in the 6th and 7th seasons in ´Golden Delicious´, ´Starkrimson Delicious´ and ´Northwest Greening´. Annual increment growth measurements revealed that trunk size was reduced most in the early years of tree growth. In the 5th, 6th and 7th growing seasons, the increment trunk diameter was no different than the non-looped trees, but the 2nd, 3rd and 4th year differences caused total trunk diameter measurements after 7 seasons to be smaller than non-looped trees. Terminal length was suppressed greatest in the early years and to a lesser extent in the 5th through the 7th growing seasons.

Introduction

Chemical, mechanical, environmental stresses, and rootstocks have been used to dwarf trees and induce earlier flowering and fruiting. McLean (1940) inhibited terminal growth and induced flowering of a two-year-old sweet cherry tree by tying the sapling into a loose knot (loop) in the spring of 1938. The tree flowered in 1939 and formed suckers below the loop. Inhibition of growth was also reported for hemlock, wisteria, chestnut, and apple (McLean 1940). Sax (1957) demonstrated a similar effect by knotting ´McIntosh´ apple scions grafted on a clonal rootstock and an interstock. Trunk cross-sectional-area was decreased and flowering increased by the treatment. The knotting results obtained by Sax (1957) may have been the result of girdling, since trees had grown into a tight knot and data were taken after knots closed.

Extension growth of willow trees was inhibited 68% by looping the trunk of 1-year-old trees (Wareing and Nasr 1961). However, when trees were rooted at the base of the loop, growth of the terminal was equivalent to the non-looped trees. In apple, cherry, plum, and black currant, horizontally grown trees grew less extension growth than vertically grown trees (Wareing and Nasr, 1961). By growing apple trees horizontally, extension growth of the leader was inhibited 67% and lateral buds nearest the root system grew more vigorously than more acropetal buds unless the tree was arched. Lateral bud break in arched trees occurred proximal to the highest point of the arch. They hypothesized that growth stimulating materials were directed to the highest, upwardly-directed meristem with buds closest to the root system having the advantage. Wareing and Nasr (1958) also found an increase in flowering of horizontally grown M-26 apple rootstocks. Spreading of apple branches also has been shown to reduce terminal shoot extension, promote flowering and increase water sprout production (Hamzakheyl, et al 1976). Longman and Wareing (1958) demonstrated that horizontal orientation of 2 to 5-year-old limbs of

Japanese Larch simulated flowering. Bud orientation in a downward or horizontal position greatly enhanced flower development; however, it was not clear whether orientation of the bud or branch to gravity caused the effect.

Apple cultivars propagated on many clonal dwarfing rootstocks have not provided apple plantings as free of insect, disease, virus, and anchorage problems as domestic seedlings (Cummins 1971, Ferree and Hill, Jr. 1982). Rooted cuttings and tissue cultured scion cultivars may provide better field survival than those propagated on clonal rootstocks or seedling, since only the scion cultivar is involved in tree construction. The objective of these experiments was to determine if looping the tree trunk would induce dwarfism and earlier bearing of commercial apple cultivars.

Materials and Methods

Fifteen Stark's Full-red 'Delicious' terminal shoots were looped on 6-year-old trees in the late summer of 1978. Non-looped or looped shoots with loop diameters of 8.5, 12, 14.5 and 17 cm were grafted on seedling rootstocks and planted in a randomized complete block design in the spring of 1979. Fifteen single-tree replicates were used per treatment.

A second experiment was initiated by looping trees in the nursery during the first growing season in order to avoid possible differing growth rates which might have been caused by grafting varying length looped scions as in Expt. 1. In Expt. 2, 5 apple cultivars ('Golden Delicious', Spur 'Delicious', 'York', 'Northwest Greening', and 'Stayman') and one sweet cherry ('Heidelfingen') budded on seedling rootstocks were looped in the nursery in 1979 and planted in the field in 1980. Fifteen trees of each apple cultivar were looped into a single 7.5 cm diameter loop, two 7.5 cm loops, a single 15 cm diameter loop or no loop. Trees of each cultivar were planted in a randomized complete block design with 15 single-tree replicates per cultivar. Sweet cherry trees were either looped into a single 7.5 cm diameter loop or no loop and planted in a randomized complete block design with 10 single-tree replicates per treatment.

Results

In Expt. 1 Stark's Full-red 'Delicious'/seedling terminal lengths were decreased more in the early years (Table 1). Terminal length of the top terminal was reduced 39, 28, 21, 17 and 12 percent for the 17 cm loop size for the years 1980, 1981, 1982, 1983 and 1984, respectively. Even though trunk diameters (Table 1, below the loop #5) were smaller throughout the period (1979-1984) (Table 1), the yearly increment in diameter was greater with looping in 1980, but was reduced in 1981 and 1982, and was nonsignificant in 1983 and 1984 (Table 2, below loop #5).

In Expt. 2 the terminal lengths of the top most terminal (Table 3 not presented) and the 3 top most terminals (Table 4 not presented) were reduced by looping more in the early years of the experiment but looping caused significant reductions in terminal growth in all years and all apple cultivars tested (Table 4 not presented). No statistical differences between looped and non-looped sweet cherry trees were found (Tables 3 and 4 not presented). Trunk diameters were smaller for looped apple trees for all cultivars tested but not for sweet cherry (Table 5 not presented). The increment diameter of trunk growth below the loop was greater in 1980 and 1981 and trends for reduced trunk growth in 1982 and 1983 were mostly non-significant (Table 6 not presented). Looping did not cause differences in sweet cherry trunk diameters or in increment growth (Tables 5 and 6 not presented. In apple, trunk looping also increased the number of shoots arising from the seedling rootstock (Table 7).

Some flowering occurred on apple and cherry trees in 1983, but no differences between treatments were noticed. Some significant differences in flowering were found in 1984, but no definite trends across cultivars were found (Table 8 not presented). Fruit numbers in both experiments did not show an effect on fruit production caused by looping in 1983, but fruit numbers were increased by several looping treatments in 1983 and 1984 (Table 9). When fruit numbers were expressed on a cm2 cross sectional area, greater differences were seen (i.e. Spur Delicious, Table 10, 1985) since tree size was reduced by looping.

The data presented here suggest that the greatest dwarfing effect from looping is in the early years of tree growth. As trees got older the influence of the looping on increment diameter, trunk growth, and terminal length became less. In addition, earlier fruiting was found with some of the treatments in the 6th and 7th seasons, but differences were not as pronounced as expected considering McLean's (1940) and Sax's (1957) results.

Discussion

The early flowering response of looped sweet cherry trees found by McLean (1940) or horizontally grown apple trees found by Nasr and Wareing (1965) was not confirmed in these experiments. However, their experiments were conducted with root-bound potted trees which may have influenced flowering. Suppression of terminal length found by Wareing and Nasr (1961) for horizontally grown trees was similar to the suppression of terminal length and trunk diameter growth by looping in our experiments the first two years. The looping effect on growth was greatest in the early years but by the fourth growing season terminal length suppression was not great and increment trunk cross sectional area between treatments was non-significant.

In our opinion, trunk looping has limited commercial value since: 1) tree growth was controlled mostly in the early years of age, 2) precocity or productivity was not greatly enhanced, 3) looping caused a weakness in the trunk which reduced the trees ability to hold a substantial crop particularly under windy conditions, and 4) root suckering was increased.

Table 1. Effect of looped 'Stark's Full-red Delicious'/seedling apple trees on terminal growth and trunk diameter (grafted loop 1979)

Treatment loop size (cm)	Sum of 3 top terminals (cm)	Top terminal length (cm)	Above loop #1	Bottom of loop #2	Side of loop #3	Top of loop #4	Below loop #5
			Stem diameter (cm) April 25, 1979				
No loop							1.14 a
8.5 cm			.89 a[z]	.69 a	.58 a	.69 a	.79 b
12.0 cm			.79 ab	.61 a	.48 b	.58 a	.71 bc
14.5 cm			.74 bc	.48 b	.38 c	.46 b	.61 c
17.0 cm			.64 c	.46 b	.33 c	.41 b	.51 d
			Stem diameter (cm) April 1, 1980				
No loop		133.6 a					1.75 a
8.5 cm		95.0 b	1.32 a	1.19 a	1.12 a	1.27 a	1.42 b
12.0 cm		92.3 b	1.22 b	1.12 ab	1.04 ab	1.22 ab	1.42 b
14.5 cm		84.2 b	1.14 b	1.01 b	.97 b	1.12 b	1.35 b
17.0 cm		81.9 b	1.12 b	1.04 b	1.01 ab	1.14 ab	1.32 b
			Stem diameter (cm) January 22, 1981				
No loop	490.4 a	167.4 a	--	--	--	--	3.92 a
8.5 cm	395.2 b	137.3 b	2.90 a	3.48 a	3.21 a	3.80 a	3.30 b
12.0 cm	375.5 bc	132.1 bc	2.70 ab	3.27 b	2.91 b	3.60 ab	3.26 b
14.5 cm	361.4 cd	126.3 cd	2.71 b	3.08 bc	2.73 b	3.40 b	3.10 c
17.0 cm	343.3 d	120.8 d	2.46 c	2.86 c	2.50 c	3.08 c	2.91 d
			Stem diameter (cm) January 4, 1982				
No loop	503.8 a	177.7 a	--	--	--	--	5.72 a
8.5 cm	426.3 b	153.3 b	4.67 a	5.84 a	5.46 a	5.99 a	5.05 b
12.0 cm	415.5 bc	147.2 bc	4.47 ab	5.59 ab	4.88 b	5.97 a	4.90 bc
14.5 cm	384.4 d	139.0 c	4.36 bc	5.33 b	4.62 c	5.51 b	4.75 c
17.0 cm	389.1 cd	140.4 c	4.19 c	4.85 c	4.32 d	5.13 c	4.47 d
			Stem diameter (cm) February 1983				
No loop	467.1 a	161.7 a	---	---	---	---	7.52 a
8.5 cm	421.7 b	142.2 b	6.35 a	8.18 a	7.32 a	8.03 a	6.81 b
12.0 cm	418.1 b	146.6 b	6.17 a	7.80 ab	6.86 b	7.98 a	6.60 b
14.5 cm	411.6 b	141.2 b	6.17 a	7.65 b	6.48 bc	7.80 a	6.60 b
17.0 cm	400.5 b	143.2 b	6.12 a	6.83 c	6.15 c	7.19 b	6.17 c
			Stem diameter (cm) March 1984				
No loop	414.2 a	139.5 a	--	--	--	--	9.14 a
8.5 cm	360.9 b	124.3 b	7.79 a	8.91 bc	8.32 a	8.99 b	8.61 b
12.0 cm	353.4 b	122.8 b	7.51 ab	9.23 ab	8.72 a	9.76 a	8.38 bc
14.5 cm	352.6 b	120.7 b	7.38 bc	9.62 a	8.38 a	9.71 a	8.09 bc
17.0 cm	338.1 b	116.0 b	7.16 c	8.72 c	7.69 b	8.96 b	7.98 c

[z] Mean separation between columns within year by Duncan's multiple range test, 5% level.

Table 2. Effect of looped 'Stark's Full-red Delicious'/seedling apple trees on increment diameter growth (grafted loop 1979)

Treatment loop size (cm)	Above loop #1	Bottom of loop #2	Side of loop #3	Top of loop #4	Below loop #5
	Increment diameter (cm) for Summer 1979				
No loop					.61 d
8.5	.43 ab[z]	.50 b	.53 c	.58 c	.64 d
12.0	.41 b	.51 b	.55 bc	.62 c	.69 c
14.5	.42 b	.54 b	.59 ab	.66 b	.73 b
17.0	.45 a	.59 a	.67 a	.74 a	.84 a
	Increment diameter (cm) for Summer 1980				
No loop					2.17 a
8.5	1.60 a	2.29 a	2.08 a	2.52 a	1.88 b
12.0	1.58 a	2.16 ab	1.86 b	2.39 ab	1.85 bc
14.5	1.57 a	2.07 b	1.77 b	2.28 b	1.74 c
17.0	1.36 b	1.83 c	1.49 c	1.79 c	1.59 d
	Increment diameter (cm) for Summer 1981				
No loop					1.80 a
8.5	1.78 a	2.36 a	2.26 a	2.39 a	1.75 ab
12.0	1.65 a	2.31 a	1.98 b	2.18 ab	1.63 ab
14.5	1.65 a	2.24 a	1.88 b	2.13 ab	1.65 ab
17.0	1.70 a	1.96 b	1.80 b	2.03 b	1.57 b
	Increment diameter (cm) for Summer 1982				
No loop	---				1.85 a
8.5	1.65 a	2.34 a	1.98 a	2.26 a	1.78 a
12.0	1.70 a	2.31 a	1.85 a	2.06 a	1.75 a
14.5	1.80 a	2.21 a	1.85 a	2.06 a	1.72 a
17.0	1.91 a	1.98 a	1.83 a	1.98 a	1.70 a
	Increment diameter (cm) for Summer 1983				
No loop	---				1.64 a
8.5	1.44 a	.74 c	1.00 b	.97 b	1.81 a
12.0	1.19 a	1.54 b	1.86 a	1.76 b	1.76 a
14.5	1.34 a	2.01 a	1.89 a	1.78 b	1.41 a
17.0	1.05 a	1.89 ab	1.55 a	1.97 a	1.80 a

[z] Mean separation between columns within year by Duncan's multiple range test, 5% level.

Table 7. Effect of trunk looping on Stark's 'Full-red Delicious' on root sucker development in 1985

Treatment loop size (cm)	Root sucker rating 0-3[y]				
	Golden Delicious	Spur Delicious	York	N.W. Greening	Stayman
No loop	0.5 a[z]	1.1 a	1.2 a	0.3 a	0.3 a
One loop (7.5)	2.0 b	2.4 b	2.1 b	1.8 b	0.7 ab
Two loops (7.5,7.5)	2.3 b	2.8 b	2.3 b	2.1 b	1.1 b
One loop (15.0)	1.9 b	2.7 b	2.3 b	1.7 b	0.4 a

[y] Number of root suckers were rated: 0 = no suckers; 1 = 1-3 suckers; 2 = 4-7 suckers; 3 = 8+ suckers.

[z] Mean separation between columns within year by Duncan's multiple range test, 5% level.

Table 9. Number of fruit harvested from looped apple trees

Treatment loop size (cm)	Fruit number/tree				
	Golden Delicious	Spur Delicious	York	N.W. Greening	Stayman
	September 1983				
No loop	23.0 a[z]	0.3 a	12.3 a	0.5 a	9.4 b
One loop (7.5)	28.6 a	0.5 a	12.7 a	6.9 b	1.6 a
Two loops (7.5,7.5)	29.2 a	1.7 a	12.2 a	1.7 a	--
One loop (15.0)	40.1 a	1.1 a	7.2 a	1.0 a	6.2 ab
	September 1984				
No loop	23.8 a	17.0 a	17.1 a	9.8 a	54.1 a
One loop (7.5)	50.6 b	18.4 a	26.3 a	43.6 b	160.1 b
Two loops (7.5,7.5)	37.5 ab	17.7 a	23.4 a	46.0 b	--
One loop (15.0)	40.4 ab	20.7 a	20.5 a	28.1 ab	45.7 a
	September 1985				
No loop	531 a	238 a	--	202 a	227 a
One loop (7.5)	662 bc	237 a	--	391 b	232 a
Two loops (7.5,7.5)	722 c	156 b	--	379 b	-
One loop (15.0)	620 ab	227 a	--	330 b	119 b

[z] Mean separation between columns within year by Duncan's multiple range test, 5% level.

Table 10. Number of fruit/cm^2 cross sectional area of trunk from looped apple trees

Treatment loop size (cm)	Golden Delicious	Spur Delicious	York	N.W. Greening	Stayman
	Fruit number/cm^2 cross sectional area of trunk				
			September 1983		
No loop	0.8 a[z]	0.0 a	0.4 a	0.0 a	0.4 b
One loop (7.5)	1.4 ab	0.1 a	0.6 a	0.2 b	0.1 ab
Two loops (7.5,7.5)	1.8 b	0.1 a	0.6 a	0.1 a	0.0 a
One loop (15.0)	2.2 b	0.1 a	0.6 a	0.0 a	0.4 b
			September 1984		
No loop	0.6 a	0.4 a	0.4 a	0.2 a	1.4 b
One loop (7.5)	1.5 b	0.7 ab	0.7 a	1.0 b	2.4 c
Two loops (7.5,7.5)	1.3 b	1.2 b	0.7 a	1.1 b	0.5 a
One loop (15.0)	1.2 b	0.9 b	0.6 a	0.6 ab	1.6 b
			September 1985		
No loop	7.7 a	4.0 a	--	2.4 a	3.7 b
One loop (7.5)	12.2 b	5.7 ab	--	5.7 c	4.4 b
Two loops (7.5,7.5)	16.7 c	5.7 ab	--	6.5 c	--
One loop (15.0)	11.4 b	6.2 b	--	4.6 b	2.6 a

[z] Mean separation between columns within year by Duncan's multiple range test, 5% level.

<u>Effect of Tree Training System on Bruising of Apples Harvested With an Over-the-Row Mechanical Harvester</u>. S. S. Miller, D. L. Peterson, B. J. Eldridge, C. Reeder, and T. Kornecki, USDA-ARS, Appalachian Fruit Research Station, Kearneysville, WV

<u>OBJECTIVE</u>: Determine the extent of fruit damage to mechanically harvested apples from 6-year-old, non-spur trees on M 7A rootstock using a continuous moving over-the-row (OTR) mechanical harvester.

<u>BACKGROUND</u>: Mechanical harvesting techniques developed in the 1960's proved unsuccessful because bruise damage was excessive on fruit harvested from large, conventional trained trees with shake-and-catch harvesters. Peterson (1982) and Peterson and Miller (1984) have recently described a continuously moving OTR harvester with potential for harvesting fresh market quality apples from freestanding semi-dwarf fruit trees.

A long range study to develop compatible tree designs and mechanical harvesting techniques was initiated in 1979. Non-spur trees of 'Golden Delicious', 'Delicious', 'York', and 'Stayman' on M 7A rootstock were planted at a spacing of 5.5 X 5.5 m and headed at about 76 cm. Six training systems were initiated in March 1980 to develop the following tree forms: 1) central leader (CL), 2) modified central leader (MCL), 3) modified leader (ML), 4) open center (OC), 5) double T (DT), and 6) natural tree form (no training until March '85). Details of the training methods and growth response had been presented (Miller and Peterson, 1985).

Trees were mechanically harvested beginning in 1983 using the OTR harvester with an inertia shaker; and in 1984 when an impact shaker was developed and tested. Canopy size for all tree forms reached the limitations imposed by the harvester (3.3 m high and 3.3 m wide) by the end of the 4th growing season, except OC trees which were 81% of the maximum allowable height. Fruit damage was determined from a 25 apple sample collected from the harvester immediately after fruit removal from each of 3 to 6 trees. Samples were stored in tray pack boxes for 1 week at room temperature before evaluation. Each fruit was scored in 3 categories: PUNCTURE - 1) none, 2) less than 3.2 mm in length, or 3) greater than 3.2 mm; BRUISE - 1) one bruise, 12.7 mm in diameter or several bruises with a total area not to exceed 284 mm^2, 2) one bruise not to exceed 19 mm in diameter or several bruises whose total area did not exceed 506 mm^2, or 3) total bruise area exceeded that for a level "2" score; STEM - 1) stem present, 2) stem absent, or 3) stem + spur present. To evaluate the damage on fruit caused by position within the canopy, fruit on CL, ML, and OC trees were randomly spray painted with different colors for identification from 4 areas after harvesting: Inside Bottom (IB) - fruit located 0 to 1.7 m above the ground in an area 0 to 90 cm from the center of the canopy; Outside Bottom (OB) - same height above the ground as IB in the area between 90 cm from the canopy center and 165 cm; Inside Top (IT) - fruit located in the top 1.2 m of the canopy and 0 to 45 cm from the center of the canopy; and Outside Top (OT) - same height as IT but between 45 cm from the center of the canopy and 165 cm. A minimum of 40 apples for each color code were marked on each of 6 trees of 'Golden Delicious' and 'Stayman'. Three of the trees were harvested with the inertia shaker and 3 with the impact shaker. Samples of 25 fruit per color code were evaluated as before.

FINDINGS: Preliminary data collected in 1983 - '84 indicated that cultivar, training system, and method of fruit removal (inertia or impact) interact to affect fruit quality. 'Delicious' harvested with an inertia shaker graded on the average less than 5% bruised (scored level "3") in 1984; 72% of the fruit graded fancy/extra fancy (F/EF) and 23% had minor to severe cuts and/or punctures. Mechanical harvesting (inertia removal) resulted in 17% of the 'Golden Delicious' graded as bruised in 1984; cuts and punctures were present on 32% of the fruit and the remaining 51% graded F/EF. 'York' apples generally graded less than 20% cull fruit (bruise + cuts and punctures). A greater percentage of fruit was damaged by inertia removal compared to impact. Field observations suggested that open structured canopy trees such as OC training were likely to result in a greater percentage of high quality fresh market fruit. In a test with CL trained 'Rogers Red McIntosh' (average 3 m in height), 72% of the fruit harvested from the lower half of the canopy graded F/EF compared to 48% from the top half of the tree.

The 1985 data was segregated into the effects of removal method, tree training system, fruit location and cultivar and analyzed using orthogonal contrasts in order to answer specific questions on fruit damage. Data supported initial findings that damage to fruit differs among cultivars and between methods of fruit removal. 'Golden Delicious' exhibited the greatest (51% bruised and/or cut), and 'York' and 'Delicious' the least (22% or less bruised and/or cut) amount of fruit damage. Fruit removed by impacting graded higher in fancy/extra fancy than did fruit harvested by inertia shaking. It should be noted that impacting results in a higher percentage of stem separation from the fruit which is a potential problem for long-term storage.

Tree training system influenced extent of fruit damage. OC trained trees had the highest percent fruit grading F/EF followed by MCL and DT trained trees. In all cases, CL trees had the lowest percent fruit grading F/EF (less than 60% overall). The percentage of fruit grading F/EF for CL 'Goldens' was 44% compared to 55% from OC trees. In contrast, 'Delicious' had 71% and 85% F/EF fruit harvested from CL and OC trees, respectively.

Fruit location in the canopy had a significant effect on the grade of harvested fruit. Fruit from the OB portion of the canopy averaged 80% F/EF fruit compared to 63% for the IB fruit, 48% for OT fruit and 30% for fruit from the IT area of the tree.

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Three Year Trends of Tree Fruit Leaf Analysis Results in Pennsylvania

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Introduction:

The nutritional requirements of fruit trees differ from those of agronomic crops, cover crops and orchard sod, whose needs have been traditionally met with soil tests. Research reports in Pennsylvania have shown that with the exception of pH; soil test results do not correlate to the nutrient status in the trees (6). Commercial fruit growers have been slow to adopt foliar analysis and the database is currently limited. In the last two years efforts have been made to educate the fruit growers of Pennsylvania on the value of leaf analysis and its relation to soil test results. This report summarizes the results of all tree fruit leaf samples collected and analyzed at Penn State.

Materials and Methods:

Leaves collected by the fruit growers were analyzed by the Plant Analysis Lab of the Department of Horticulture at The Pennsylvania State University. Nitrogen was analyzed using a Technicon method outlined by Isaac and Johnson (4). All other elements were analyzed by plasma emission spectrometer methods as outlined by Dahlquist and Knoll (2). The leaf analysis is offered to the fruit growers on a fee basis. Typical analysis results show the percent nitrogen, phosphorus, potassium, calcium, magnesium and ppm copper, boron, iron, manganese, and zinc.

All results of samples submitted from 1983 through 1985 were entered on a microcomputer and tabulated for analysis. The data was sorted each year by county and crop. Averages, minimum, maximum values and standard deviation were computed for each year and for the three year period. No effort was made to select specific blocks or orchards to serve as comparisons. The data in this report has not been seperated by cultivar or tree age.

Results and Discussion:

During the period of 1983 to 1985 a total of 954 samples were submitted to the Plant Analysis Lab. The number of leaf samples analyzed in 1983 and 1984 remained relatively stable with 274 and 264 samples analyzed respectfully. In 1985, however there was a 51% increase and 407 samples were analyzed with the greatest increase (75%) was in the number of peach samples. The majority of the leaf samples submitted were for apples (71.0%), with peaches and nectarines being the next highest (21.8%). The remaining tree fruit crops accounted for 7.2% of the samples submitted.

The average size statewide for commercial apple and peach operations are 49.0 acres; and 22.4 acres, respectfully; based on the 1982 Tree Fruit Survey for Pennsylvania. Each sample over the three year period, therefore, represented 45.9 acres/sample in apples; 47.2 acres/sample in peaches and 55.5 acres/sample in other crops.

Most Extension specialists recommend that soil and leaf analysis should be conducted at no more than three year periods and preferably every year. Based on the number of acres per sample more effort needs to be placed on having peach growers take foliar analysis.

Apples and peaches were the largest number of samples submitted therefore, more meaningful trends can be measured. Nectarines were combined with the peaches because of the few number of samples submitted.

In apples the average nitrogen level on a statewide basis was constant for the three year period at 2.46% dry matter (Table 1). In each year of all the nutrients listed only the calcium levels were consistently below the desired level (1,5). The average for magnesium was at the upper end of the recommended range of Shear and Faust (5). High magnesium has been indicated as a possible cause for reduced calcium in the fruit (5) and, in light of the prevalence of low calcium disorders in this region, is a cause for concern. Of the micronutrients only boron was consistently below the recommended ranges. Mn, Fe, and Zn values were extremely erratic, probably due to contamination from pesticide residues.

In peaches the nitrogen levels varied more than those in apples (Table 2.). The three year average was 3.39 % dry matter. The %N was significantly higher in 1984 as compared to 1983. In 1983 and 1984 the state had a large crop of peaches. The 1985 %N was lower than 1984 but similar to 1983 levels. Phosphorus in 1984 and 1985 was above the recommended range. Potassium increased in all three years from 2.13 to 2.43 percent. As with apples, calcium was below and magnesium above the desired range. Greene et. al. (3) also noted the same trends with Mg in a survey of 50 peach blocks in Pennsylvania. Micronutrient values with the exception of B were too variable to detect any significant trends.

When combining all three years data (Table 3) Ca was below the desired levels in both apples and peaches. Magnesium although not excessive was still at the upper end of the desired range. The N, P, K, Ca, Mn, levels for apples are higher in this three year period than that previously reported by Smith (6). The Mg was similar and Cu and B lower in 1983-85 compared to 1965. In peaches, Smith's values for N, and P levels were lower; while K, Ca, and Cu were higher than those in this present survey. It should be pointed out, however, that the previous work was conducted on two specific cultivars. The results presented in this paper are from a wide range of cultivars and the trends might reflect cultivar differences.

Other data not included showed that there were signficant differences between regions of the state. For example in peaches, Adams county had the highest %N and %K in the leaves among four major peach counties. Magnesium in Adams, Franklin, Lancaster, and Berks counties was all in the excessive range.

Conclusions:

Although three years is not an overly long period to try to determine trends, certain points did stand out. First, the sudden increase in the number of samples submitted in 1985 may indicate that growers are beginning to realize the value of foliar analysis. Continued use of this tool will create a larger data base to follow trends. Many counties only had 2 or 3 samples submitted and to draw any definate conclusions from those areas will take a number of years. Second, magnesium levels in Pennsylvania orchards are consistently high and possibly to the detriment of the calcium levels. In view of the problems most fruit growers have with calcium related fruit disorders efforts must be made to make the growers aware of the possible disadvantage of high magnesium. Third, better sampling techniques are needed when growers are concerned about the micronutrient levels. Too much contamination was evident on the samples based on the range of values measured.

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Table 1. Statewide nutrient averages based on foliar analysis results for apples, 1983-1985.

YEAR	% Dry Matter N	P	K	Ca	Mg	Micrograms/gram Mn	Fe	Cu	B	Zn
1983										
Average:	2.46	0.24	1.42	1.27	0.33	143	96	6	32	52
Minimum:	1.26	0.08	0.66	0.40	0.10	23	41	3	15	3
Maximum:	3.89	0.60	2.40	2.15	2.00	811	323	17	81	424
Standard Deviation:	0.36	0.08	0.28	0.31	0.15	120	46	2	8	59
Number of Apple Samples Analyzed: 202										
1984										
Average:	2.46	0.23	1.44	1.21	0.33	133	73	7	32	44
Minimum:	1.53	0.14	0.77	0.09	0.14	23	41	4	17	4
Maximum:	4.67	0.60	2.67	2.15	0.67	606	197	17	81	537
Standard Deviation:	0.38	0.07	0.31	0.31	0.08	112	18	2	7	56
Number of Apple Samples Analyzed: 193										
1985										
Average:	2.46	0.22	1.43	1.25	0.31	115	99	6	31	72
Minimum:	1.45	0.08	0.70	0.43	0.11	24	35	3	14	8
Maximum:	4.42	0.53	2.93	2.39	0.72	480	646	12	78	850
Standard Deviation:	0.44	0.07	0.29	0.31	0.09	102	62	1	8	132
Number of Apple Samples Analyzed: 277										

Table 2. Statewide nutrient averages based on foliar analysis results for peaches and nectarines.

YEAR	% Dry Matter N	P	K	Ca	Mg	Micrograms/gram Mn	Fe	Cu	B	Zn
1983										
Average:	3.39	0.28	2.11	1.86	0.57	74	117	8	30	26
Minimum:	2.19	0.11	1.09	0.53	0.21	21	8	3	14	8
Maximum:	4.65	0.52	3.18	3.97	1.11	197	1000	11	61	62
Standard Deviation:	0.51	0.08	0.50	0.57	0.15	38	127	2	7	9
Number of Peach and Nectarine Samples Analyzed: 54										
1984										
Average :	3.56	0.31	2.31	1.78	0.55	95	90	9	33	33
Minimum :	2.19	0.22	1.36	0.72	0.16	26	46	0	26	11
Maximum :	4.68	0.43	3.65	4.19	0.94	999	999	16	44	174
Standard Deviation :	0.61	0.05	0.53	0.56	0.15	131	122	2	4	22
Number of Peach and Nectarine Samples Analyzed: 59										
1985										
Average :	3.30	0.32	2.43	1.73	0.52	88	97	8	31	35
Minimum :	1.38	0.12	0.97	0.82	0.16	23	48	5	21	11
Maximum :	4.94	0.67	3.43	3.14	1.04	772	1503	13	59	561
Standard Deviation :	0.69	0.10	0.46	0.52	0.14	91	147	2	5	62
Number of Peach and Nectarine Samples Analyzed: 97										

Table 3. Combined nutrient level averages from foliar analysis results in 1983 through 1985 for Pennsylvania.

	% Dry Matter					Micrograms/gram				
CROP	N	P	K	Ca	Mg	Mn	Fe	Cu	B	Zn
APPLES										
Average :	2.46	0.23	1.43	1.25	0.32	129	91	6	32	59
Minimum Value :	1.26	0.08	0.66	0.09	0.10	23	35	3	14	3
Maximum Value :	4.67	0.60	2.93	2.39	2.00	811	646	17	81	850
Standard Deviation:	0.40	0.07	0.29	0.31	0.11	111	49	1	8	96
Number of Apple leaf samples analyzed: 677										
PEACHES										
Average :	3.39	0.31	2.32	1.78	0.54	87	100	8	32	32
Minimum Value:	1.38	0.11	0.97	0.72	0.16	23	8	0	14	8
Maximum Value:	4.94	0.67	3.65	4.19	1.11	999	1503	16	61	561
Standard Deviation :	0.63	0.08	0.49	0.52	0.14	95	136	2	5	44
Number of Peach and Nectarine leaf samples analyzed: 208										

PEACH ROOT DEVELOPMENT IN GEORGIA AS AFFECTED BY DRIP IRRIGATION AND FUMIGATION

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Only a few of the experiments in the Eastern U.S. have shown increased peach yields from irrigation. A recent 7-year study in Georgia combined a fumigant with drip irrigation and increased yields in most years (2).

'Redglobe'/'Lowell' seedling peaches spaced 6 x 6 m were drip irrigated beginning in May of 1976, during their 2nd-year, through the summer to frost until the trees were in their 9th-year. Emitters rated at 4.2 liters/hr were placed on each side of the tree. They were spaced 90 cm from the trunk in 1976 and 2 additional ones were placed 190 cm from the trunk in 1978. Water applications controlled by automatic tensiometers were begun when the soil matrix potential was 25 kPa and stopped at 20 kPa as sensed at the 20-cm-depth, 20 cm to one side of the emitter. DBCP was applied at the rate of 40.6 kg/ha in the fall of 1975-78 and in the spring of 1981 to control *Criconemella xenoplax* (Raski) Luc & Raski.

The wetted zones averaged about 75 cm in diameter x 45 cm deep, 12 hours after the drip was stopped . Root dry weight under the emitter was 3 X greater than that 40 cm away and weight at the 0-20-cm depth was about 2.5 X and 11 X that in the 20-40 and 40-60-cm depth respectively (1). DBCP decreased nematode populations by 1/4 to 1/80.

To expose a 15-cm root profile along the row to a 75-cm depth, soil was removed and the verticle surface was sheared smooth with a hatchet. Soil was then washed away from the 15-cm profile and pumped out of the trench. Roots were painted white for photographing and collected at various distances from the trunk and depths. The fine feeder roots were washed away by water and the remaining roots were divided into 5-size classes to measure treatment effects. Irrigation doubled the number of roots and irrigation plus fumigation increased the number by about 4.3 X.

Roots from only one tree of each treatment were exposed and sampled. Roots in the wetted zones were more numerous but needed to be sampled at about every other 15-cm distance to show distinct differences. The increase in numbers appear to be the effect of an interaction of healthy roots and water.

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NOT FOR PUBLICATION

WATER APPLICATIONS CONTROLLED BY MATRIX POTENTIAL REFLECT USE BY PEACH TREES

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Little was known of the water usage by peaches in 1975. Knowledge of peach tree water usage is needed to size irrigation pipe and plan for periods of peak water demands in Georgia. The experiment was designed to evaluate the effects of drip irrigation and soil fumigation (DBCP) on production (1) and water usage.

Water applications were controlled by tensiometers, "on" at 25 kPa and "off" at 20 kPa, as described on the previous page (1). Application rates in liters/tree/day = (the cumulative time that emitters were "on") (number of emitters, 2 or 4) (flow rate in liters/hr, 4.2) / (number of trees, 16 per treatment) / (number of days in the period, 7).

Water applications began increasing 30-40 days before harvest, about the beginning of pit hardening and generally peaked about harvest. Application rates usually decreased after harvest and reflected reduced stress and heavy rains that are common then in Georgia. The maximum rate, 180 liters/tree/day, occurred the week before harvest in the 6th year and the next highest rate, 80 liters/tree/day occurred in the 4th year. Fumigation increased the application rate throughout the study. During those years of peak application rate, DBCP increased the rate from 40 to 80 liters/tree/day in 1978 and from 75 to 180 liters/tree/day in 1980 during harvest. A sharp decline in application rates from the 7th - 9th years is partially due to more rainfall, but probably was affected by roots that penetrated deeper into the soil and extracted water from those reservoirs.

If drip irrigation is to be applied, in the South to 'Redglobe' or a peach ripening in July, the irrigation lines should be sized to deliver a minimum of 180 liters/tree/day. Plans should be made to supply the maximum amount of water during the 4 weeks prior to and during harvest.

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THINNING OF SPUR 'DELICIOUS' APPLE WITH TERBACIL AND EFFECT OF OTHER PHOTOSYNTHETIC INHIBITORS ON APPLES AND PEACHES

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Abstract. Shading of 5-year-old spur 'Redchief Delicious' trees 5-15, 10-20, 15-25, 20-30, 25-35, 30-40, and 35-45 days after full bloom (AFB) caused significant fruit abscission. Shading 45-55 days AFB did not significantly affect fruit set. Terbacil (50 ppm) + X-77 (1250 ppm) applied to 5-year-old 'Redchief Delicious' trees at 5, 10, 15, and 20 days AFB reduced fruit set, but later applications at 25, 30, 35 and 40 days AFB were ineffective. The most effective period was 10 days AFB. Whole tree airblast applications of terbacil (50 ppm) + X-77 (1250 ppm) to 'Oregon Spur Delicious' applied at 16 days AFB was an effective fruit thinning agent. Several other photosynthetic inhibitors were applied to apples and peaches. Igram, Terbacil, Caprol, Cotoran, Sancap, Sincore, Basagran, and Bladex have thinning activity and should be further evaluated. Princep, Tenoran, and Milogard were not active peach or apple thinners.

Introduction

Apple fruit abscission after fertilization and during "June drop" is considered a competition for essential metabolites between individual fruitlets, and between fruitlets and vegetative shoots. Fruit abscission caused by shading or chemical photosynthetic inhibition also suggests that natural or chemically induced fruit abscission can be triggered if photosynthesis is limited.

The objectives of these experiments were to 1) investigate the most effective time to shade whole apple trees for promoting fruit abscission, 2) to determine the most effective time for application of terbacil for thinning spur 'Delicious' apple, 3) to determine the site of terbacil absorption that causes fruit abscission (fruit or foliage), and 4) screen other photosynthetic inhibitors for thinning fruit from peach limbs or whole spur 'Delicious' trees.

Results

Figure 1 and 2. Spur 'Redchief Delicious' trees sprayed with terbacil (50 ppm) + X-77 (1250 ppm) with a hand pump sprayer to the point of drip caused greater fruit abscission (Figure 1) than terbacil (400 ppm) + no surfactant when applied to 'Starkrimson Delicious' limbs in a previous season (Figure 2).

Shading of whole trees for 10-day periods in 1985 (Figure 1) was more effective than shading limbs of Spur 'Starkrimson Delicious' in 1984 (Figure 2). These results suggest considerable compensation from adjoining limbs and that whole tree shading or photosynthetic sprays are required to be representative of whole tree responses.

Table 1. Shading of spur 'Redchief' trees did not cause any leaf injury

except red leaf pigments were prominent 5 days after the 5 to 15 day shading. Shading was very effective for fruit removal. Fruit size, color, and soluble solids were not different from hand thinned or control trees. Several treatments caused abscission of most of the fruit and there was not enough fruit for an adequate sample for determination of these parameters.

Terbacil applied 10 days after bloom increased fruit size compared to that of the control and was equivalent to that of the hand thinned control (Table 1). Fruit color, firmness, and soluble solids were similar to the control and hand thinned treatments.

Terbacil was also more effective than a combination of carbaryl, NAA, and superior oil for fruit removal and was as effective as ethephon at 1500 ppm (Table 1). Terbacil did not cause shoot growth reductions as did ethephon.

Table 2. Terbacil (50 ppm) + X-77 (1250 ppm) applied to apple leaves caused similar fruit abscission as that applied only to the leaves. Terbacil applied to fruit only did not promote fruit abscission. This data further supports the concept that terbacil causes fruit abscission by photosynthetic inhibition.

Table 3. Since X-77 (1250 ppm) added to the terbacil treatments on 'Redchief Delicious' apple trees caused more leaf injury than expected, the rates were raised and no surfactant was added when the eleven photosynthetic inhibitors were applied to 'Cresthaven' peach limbs. Also, since a rain occurred during the apple experiment #1, a second experiment (#2) was set up for those treatments that had not dried before the rain. Igram, terbacil, Caprol, Cotoran, Sancap, Sincore, Basagran, and Bladex appeared to have activity and should be further investigated at rates that might be more appropriate for apples and peaches than those used in this study.

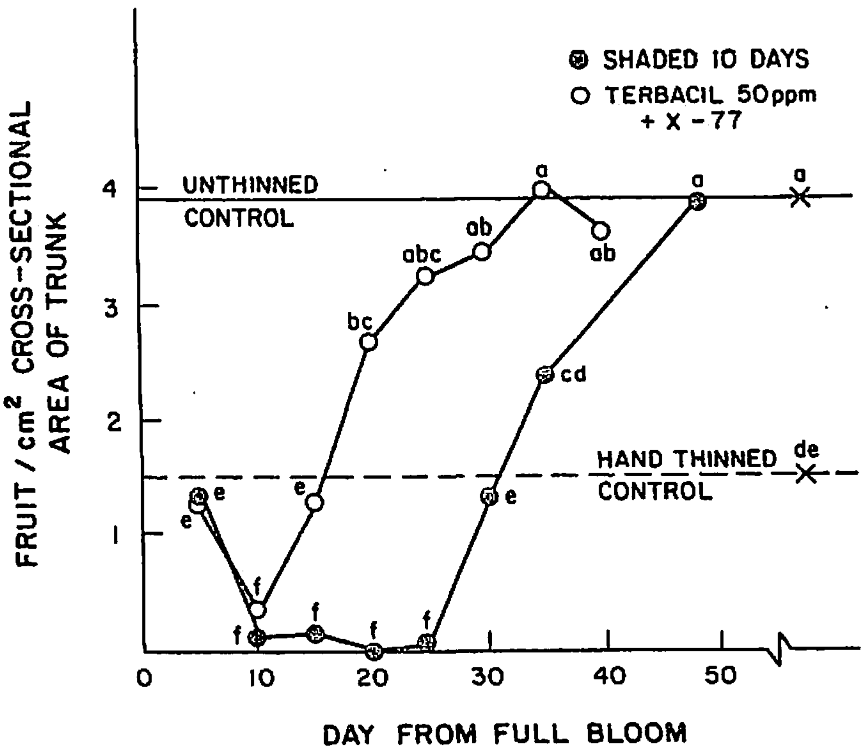

Figure 1. Effect of shading or terbacil sprays on fruit set of 'Redchief Delicious' whole trees. Mean separation between points by Duncan's multiple range test, 5% level.

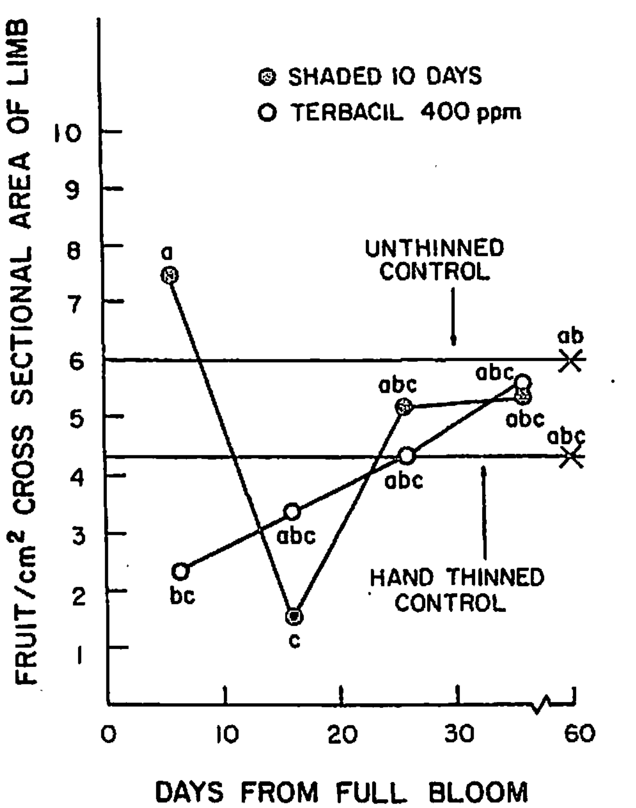

Figure 2. Effect of shading or terbacil sprays on fruit set of 'Starkrimson Delicious' limbs. Mean separation between points by Duncan's multiple range test, 5% level.

Table 1. Effect of shading, terbacil, and other growth regulators on Redchief 'Delicious' apple fruit set, fruit size, and tree growth

Treatment	Rate	Timing (days after full bloom)	Fruit/cm² cross sectional area of trunk (FB + 30)	Fruit diameter (cm)	% Red color	Firmness
Control		--	3.90 a	7.42 ab	70 a	15.7 a
Hand thinned		41	1.51 de	7.98 def	73 a	14.8 b
Shade	92%	5-15	1.36 e	7.57 abcd	71 a	15.4 ab
Shade	92%	10-20	0.10 f	--	--	
Shade	92%	15-25	0.16 f	--	--	
Shade	92%	20-30	0.00 f	--	--	
Shade	92%	25-35	0.08 f	--	--	
Shade	92%	30-40	1.29 e	7.54 abcd	73 a	
Shade	92%	35-45	2.41 cd	7.44 ab	70 a	
Shade	92%	47-57	3.86 a	7.57 abcd	75 a	
Terbacil	50 ppm	5	1.31 e	7.75 bcde	74 a	15.3 ab
Terbacil	50 ppm	10	0.36 f	8.13 ef	78 a	
Terbacil	50 ppm	15	1.29 e	7.54 abcd	69 a	
Terbacil	25 ppm	15		7.52 abcd	74 a	
Terbacil	50 ppm	20	2.72 bc	7.57 abcd	78 a	
Terbacil	50 ppm	25	3.26 abc	7.65 abcd	79 a	
Terbacil	50 ppm	30	3.45 ab	7.67 abcd	76 a	
Terbacil	50 ppm	35	4.00 a	7.75 bcde	75 a	
Terbacil	200 ppm	35	2.87 bc	7.47 abc	73 a	
Terbacil	50 ppm	40	3.61 ab	7.72 bcde	79 a	
Carbaryl +	900 ppm		1.74 de	7.92 cdef	77 a	
NAA +	10 ppm					
70 sec oil	2500 ppm	15	1.74 de	7.92 cdef	77 a	
Ethephon	1500 ppm	15	0.09 f	7.24 a	76 a	
Defruited		15	0.24 f	8.31 f	78 a	
Deblossomed		5	0.08 f	--	--	

[z] Terbacil 80WP (0.063 g/l = 0.05 lbs/100 gal = 50 ppm). Carbaryl 50WP (1.8 g/l = 1.5 lbs/100 gal = 900 ppm).

[y] Full bloom occurred April 19, 1985.

[x] All spray treatments were applied with a hand pump sprayer. Fruit size was 8.95 ± 0.32 mm on May 4 (FB + 15 days).

[w] Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Effect of application site of terbacil (50 ppm) + X-77 (0.125%) on 'Redchief Delicious' apple fruit set and photosynthesis (1985).

Treatment	Fruit/cm^2 cross section of trunk (FB + 17 days)^z	Photosynthesis mg CO_2 dm^{-2} hr^{-1} (FB + 20 days)^x
1. Control - no treatment	4.8 a^w	31 a
2. Fruit + leaves sprayed	2.9 b	4 b
3. Leaves sprayed^y	2.6 b	-
4. Fruit dipped	4.9 a	-

^{z} Full bloom occurred April 19, 1985.

^{y} Fruit were covered with foil prior to spraying of trees.

^{x} Photosynthesis was taken in the field on 3 leaves on each of 2 replicate trees per treatment.

^{w} Mean separation in columns by Duncan's multiple range test, 5% level.

Table 3. Effect of photosynthetic inhibitors on apple and peach fruit thinning, leaf injury, and photosynthesis (1985).

	'Redchief' apple[z]				'Cresthaven' peach[z]			
		Fruit/cm^2 cross section of trunk (FB + 59)[w]						
Treatment[yx] May 2, 1985	Conc.[y] (ppm)	Exp 1	Exp 2	Injury rating (0-10)	Conc. (ppm)	Fruit/cm^2 cross section of limb (FB + 53)[w]	Injury rating (0-10)	Photosynthesis my CO_2 dm^{-2} hr^{-1} (2 hrs after treatment)[v]
Control		4.7 a[u]	2.9 a	-	---	21.0 a	1.2 a	35.3 ab
Igram 80W	50	2.4 bc	--	2	400	2.9 c	8.8 ef	28.7 ab
Terbacil 80W	200	2.0 c	--	2	2000	4.2 c	4.5 c	3.7 e
Princep 80W	50	5.1 a	--	0	400	19.0 a	1.7 a	35.7 a
Caprol 80W	50	3.0 bc	--	2	400	4.2 c	6.5 d	31.7 ab
Tenoran 50W	200	4.0 a	--	0	2000	15.8 ab	1.8 a	34.7 abc
Cotoran 80W	50	2.5 bc	--	0	400	11.7 b	3.3 b	27.3 bcd
Milogard 80W	200	3.9 ab	2.5 ab	0	2000	19.7 a	2.2 a	33.3 abc
Sancap 80W	100	4.0 ab	1.4 bc	0	1000	5.7 c	5.5 cd	27.0 cd
Sincore 75W	100	2.3 bc	0.7 c	0	400	0.6 c	9.8 fg	1.7 e
Basagran 42EC	200	5.3 a	1.6 c	0	2000	0.0 c	10.0 g	20.7 d
Bladex 80W	50	2.6 bc		0	400	4.9 c	8.2 e	29.0 abc

[z] Full bloom occurred on apples April 19 and on peaches April 21.

[y] X-77 at 0.0125% was added as a surfactant to the apple experiments, but not to the peach experiment.

[x] Whole apple trees were sprayed with a hand pump sprayer; Experiment 1 - May 2 (FB + 13 days) and Experiment 2 - May 6 (FB + 17) and peach limbs were sprayed May 21 (FB + 30 days).

[w] Fruit counts were made June 17 (FB + 59 days) on apples and June 13 (FB + 53 days) on peaches.

[v] Photosynthesis was taken in the field on one leaf on each limb of the first 3 replicate peach limbs.

[u] Mean separation within columns by Duncan's multiple range test, 5% level.

Table 4. Effect of apple thinners and terbacil on fruit set and photosynthesis of 'Redchief Delicious' (1985).

Treatment[zyw] (FB + 16)	Fruit/cm² limb cross sectional area (FB + 39)	% Crop load[x] (FB + 43)	Fruit diameter[x] (cm) (FB + 125)	Photosynthesis my CO_2 dm^{-2} hr^{-1} (FB + 19)
Control	9.3 ab	188 a	6.62 ab	31.4 a
Hand thinned (June 13)	4.0 c	88 e	7.01 c	--
Terbacil 50 ppm	8.6 ab	167 abc	6.45 a	22.0 c
Terbacil 50 ppm + X-77 1250 ppm	6.7 bc	127 d	6.76 b	11.1 d
Terbacil 25 ppm + X-77 1250 ppm	10.4 a	179 ab	6.47 a	23.1 bc
Terbacil 12.5 ppm + X-77 1250 ppm	8.1 ab	175 abc	6.45 a	27.2 b
Carbaryl 900 ppm + superior oil 2500 ppm	8.8 ab	148 bcd	6.50 a	--
Ethephon 450 ppm + Sevin 900 ppm	7.6 ab	143 cd	6.60 ab	--

[z] Carbaryl 50WP (1.8 g/l = 1.5 lbs/100 gal = 900 ppm). Terbacil 80WP (0.063 g/l = 0.05 lbs/100 gal = 50 ppm).

[y] Full bloom occurred on April 19, 1985.

[x] Trees with a full crop were equivalent to 100% crop load. Fruit size was taken near harvest (FB + 125).

[w] All treatments were applied with an airblast sprayer at 1683 l/ha (180 gal/acre) May 5 (FB + 16) when fruit size was 10.7 ± 0.2 mm in diameter.

[v] Photosynthesis was taken in the field on 3 leaves on each of 6 replicate trees per treatment on May 8 (FB + 19).

[u] Mean separation within columns by Duncan's multiple range test, 5% level.

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Vegetative and Fruit Effects of Foliar Application of Cultar™ on Apples and Peaches in the Year of Application

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Plant growth regulators that could effectively control vegetative growth in tree fruits would be very beneficial to the industry. The obvious direct benefit would be a reduction in the cost of pruning. Fruit quality would increase due to an improved photosythetic environment which would also increase spur vigor. In addition, effective growth control chemicals would allow the separation of the plant nutrition program and the vigor status of the trees which may also increase spur vigor and fruit bud health.

Cultar, a gibberellin biosynthesis inhibitor, may be one such chemical. Early research with this chemical involved ground applications since it is not very mobile in the phloem, but is readily translocated in the xylem. However, recent development activities in England have involved foliar sprays applied on an "as needed" basis to control excessive vegetative vigor.

The objective of the research reported in this paper was to study the influence of Cultar, applied as whole tree sprays, on the vegetative growth and fruits of apples and peaches in the year of application.

Materials and Methods

Apples

Cultar applications, involving mostly whole tree sprays, were made to Yorking/M26 in their 11th leaf in the orchard. Trees selected for the test were part of a tree spacing study and were growing at the following spacings (trees/acre): 9.5' X 12' (382), 8' X 12' (454), 6' X 12' (605) and 6' X 10' (726).

Sprays were applied at 4 rates at the 50% full-bloom stage, on April 20, and then at various rates and timings from June 4th (petal-fall plus 4 weeks) to July 24th (petal-fall plus 12 weeks). The basic treatment arrangement was to have each early (50% full-bloom) spray rate followed by 1) no sprays, 2) five sprays at 0.5 lbs AI/acre and 3) various numbers of sprays at 0.5 lbs AI/acre on an "as needed" basis to control vegetative growth (Table 1). Sprays were applied dilute to runoff at about 200 GPA on April 20th, 400 GPA on June 4th and at 600 GPA thereafter.

At the normal York harvest period, the weight of 30 apples from each tree was determined and the remaining fruits on the trees were harvested and weighed. In November, 10 vigorous shoots were cut from each tree and their total length was determined. In addition, on shoots that had set a terminal bud during the summer and had resumed growth, the length of each growth segment was determined.

Peaches

A smaller experiment was conducted on peaches to determine the influence of whole tree sprays of Cultar on peach tree vegetative shoot growth. Twenty uniform 'Loring' peach trees in their fifth leaf in the orchard, at the Bear Mountain Orchards, Inc. of Mr. John K. Lott in Aspers, PA were selected for the study. The treatments as listed in Table 2 were applied as dilute sprays (200 GPA).

On August 26, twenty terminals per tree were measured as follows: 2 upright and 2 horizontal terminals in each tree quadrant (north, south, east, and west) and 4 water sprouts from the inner scaffold area). Only a few fruit were produced on the trees in the experiment and they were used by ICI Americas, Inc. for residue studies.

Results and Discussion

Apples

Whole tree sprays of Cultar effectively reduced the total upright vertical growth of vigorous Yorking/M26 apple trees (Table 3). Sprays at the 50% full-bloom stage alone, did not decrease total shoot growth. However, when the early sprays were combined with 5 sprays of 0.5 AI/acre each, they did significantly increase the effectiveness of the later sprays (pair-wise comparison tests, not shown).

Treatments applied on an "as needed" basis until June 17th (treatments 5, 9, and 12) significantly reduced initial and total shoot growth. However, these applications allowed significant regrowth to occur and the treatments had significantly more total growth than treatments receiving applications until July 24th. Treatments 7 and 8 were designed to determine the influence of post-bloom chemical rate on efficacy. Growth control was very similar with both rates indicating that 5 sprays of 0.25 lbs AI/acre were as good as 5 sprays of 0.5 lbs AI/acre.

Generally, treatments with little initial growth control had little regrowth and a low percentage of shoot regrowing. Treatment 13, involved the soil application of the highest rate of chemical that had been applied as a whole tree spray and was designed to simulate a 100% run-off treatment. This treatment had no effect in the year of application.

None of the treatments influenced mean fruit weight in a way related to Cultar treatment

Peaches

Two pounds (AI) per acre of Cultar applied as whole tree sprays significantly reduced the mean shoot growth of 'Loring' peach trees in the year of application. Treated trees grew only about 70% as much as the control trees. Lower rates of the chemical and one sequential spray treatment resulted in about 85% of the growth of the controls that were not significantly different than either the controls or the 2 pound per acre rate. No fruit were available for quality determinations.

The use of Cultar may allow the use of higher rates of nitrogen fertilizer, thereby retaining photosynthetically active leaves longer into the fall, without causing excessive vegetative growth. This experiment will be continued to determine the long term influence of the treatments on tree growth and on fruit production and quality.

Conclusion

Whole tree sprays of Cultar can effectively reduce vegetative growth of peach and apple trees. Apple fruit size was not decreased by the treatments. Long term trials must be continued to prove the long term viability of this application method especially in stone fruits.

Effective growth control chemicals have the potential of reducing pruning costs, increasing fruit quantity and quality, especially in the low light environment of the eastern United States. In addition, they may allow the effective separation of tree vigor and the nutritional program of the tree.

Table 1. List of Cultar treatments applied to Yorking/M26 apple trees in their eleventh leaf in the orchard.

Trmt. No.	Trmt. Code	Spray Dates and Lbs Cultar (AI)					
		50% FPB 4/20	PF + 4 6/4	PF + 6 6/17	PF + 8 6/26	PF + 10 7/12	PF + 12 7/24
1	Check	--	--	--	--	--	--
2	0 + 5 X .5 (2.5)	--	.50	.50	.50	.50	.50
3	0.125 + 0 (.125)	.125	--	--	--	--	--
4	0.125 + 5 X .5 (2.65)	.125	.50	.50	.50	.50	.50
5	0.125 + 2 X .5 (1.125)	.125	--	.50	.50	--	--
6	0.25 + 0 (0.25)	.25	--	--	--	--	--
7	0.25 + 5 X .25 (1.50)	.25	.25	.25	.25	.25	.25
8	0.25 + 5 X .5 (2.75)	.25	.50	.50	.50	.50	.50
9	0.25 + 2 X .5 (1.25)	.25	.50	.50	--	--	--
10	0.5 + 0 (0.5)	.5	--	--	--	--	--
11	0.5 + 5 X .5 (3.0)	.50	.50	.50	.50	.50	.50
12	0.5 + 2 X .5 (1.5)	.50	.50	.50	--	--	--
13	3.0 Ground (3.0)	.50	.50	.50	.50	.50	.50

Table 2. List of Culter whole tree spray treatments applied to Loring peach trees and terminal growth measurements [a].

		Application Dates (Lbs/Acre) Culter (AI)				Term. Growth(cm)
Trmt. No.	Trmt. Name	6/3	6/20	7/2	7/15	8/26
1	Check	0	0	0	0	37.3a
2	One quarter lb X 4	0.25	0.25	0.25	0.25	31.0ab
3	One- half lb	.50	0	0	0	33.5ab
4	One lb	1.0	0	0	0	31.2ab
5	Two lbs	2.0	0	0	0	25.4b

[a] Mean values within each column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

Table 3. Influence of Cultar on tree and fruit characteristics of Yorking/M26 apple trees [a].

Trmt. No.	Trmt. Code	Mean Initial Shoot Growth cm	Mean Shoot Regrowth cm	Mean Total Shoot Growth cm	% Shoots Regrowing	Mean Fruit Weight gm
1	Check	126a	0.3f	126a	3d	175ab
2	0 + 5 X .5 (2.5)	91b	3.1d-f	94de	23b	165ab
3	0.125 + 0 (.125)	123a	0.7ef	123a	5cd	170ab
4	0.125 + 5 X .5 (2.65)	83bc	5.1c-f	88ef	30ab	162ab
5	0.125 + 2 X .5 (1.125)	93b	12.9ab	106b-d	45a	169ab
6	0.25 + 0 (0.25)	121a	0.0f	121a-c	0d	172ab
7	0.25 + 5 X .25 (1.50)	72c	10.0bc	82ef	48a	156b
8	0.25 + 5 X .5 (2.75)	70c	4.9c-f	75ef	38ab	177ab
9	0.25 + 2 X .5 (1.25)	98b	17.3a	115a-c	38ab	165ab
10	0.5 + 0 (0.5)	130a	3.0d-f	133a	3d	164ab
11	0.5 + 5 X .5 (3.0)	65c	6.9b-e	72f	48a	169ab
12	0.5 + 2 X .5 (1.5)	98b	7.4b-d	105cd	22bc	159ab
13	3.0 Ground (3.0)	123a	0.0f	123ab	0d	180a

[a] Mean values within each column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

GROWTH RESPONSES OF PEACH ROOTS AND SHOOTS TO SOIL AND FOLIAR APPLIED PACLOBUTRAZOL

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Introduction

The new plant bioregulant paclobutrazol (ICI-PP333; 1-(4-chlorophenyl)- 4,4 dimethyl-2-(1,2,3-triazol-1-yl)penta-3-01) has reduced vigor in a number of plant species (1, 3, 5, 7, 8). Paclobutrazol is a GA synthesis inhibitor with limited phloem mobility but readily translocated in the xylem (1). Therefore, applications as a soil drench or trunk spray are usually most effective (3, 5, 9). The most widely reported morphological responses to paclobutrazol applications are reduced internode length and reduced leaf size (5, 8, 9). Little information is available on the effect of paclobutrazol on root growth and development. Steffens et al. (7) reported increased root growth and increased root:shoot ratios of apple seedlings treated with paclobutrazol. No information is currently available on the effects of paclobutrazol on peach root growth and development. The purpose of this study was to determine the effects of 3 methods of application of paclobutrazol on root growth and development of peach. Vegetative growth parameters were also measured to further evaluate the overall plant response to paclobutrazol treatments.

Materials and Methods

Nodal cuttings of 'Redhaven' peach were established in root observation boxes placed in a greenhouse. The treatments were applied when a considerable number of actively growing root tips were established at the soil-plexiglass interface. Each of 4 treatments were replicated 3 times utilizing a completely random design. The treatments consisted of foliar, soil, and foliar + soil applied placlobutrazol. The control received a distilled water drench. A total of 0.37 mg a.i. paclobutrazol was applied to each plant for all paclobutrazol treatments. The foliar applied paclobutrazol was suspended in 2 ml of distilled water and applied with a syringe to the upper surface of the 4 upper most fully expanded leaves. The soil applications were applied as a drench in which the paclobutrazol was suspended in 500 ml of distilled water. The foliar + soil treatment consisted of half the paclobutrazol applied to the foliage and half to the soil by the methods described above. Plant height and root extension growth of selected root tips were measured at 2 day intervals. All visible roots were traced at 4 day intervals with colored pens on acetate sheets affixed to the plexiglass front. Twenty-eight days after the treatments were applied, plants were harvested and partitioned into new leaves, pretreatment leaves, shoots and roots. Root tip diameters and unsuberized rootlet lengths were determined for the upper and lower portions of each root system. The roots, leaves and stems were dried at 80 degrees C and dry weights were determined. Representative root tips from each treatment were selected and fixed in 50% FAA for microscopic observation. Tissue 1.5mm to 2.0mm from the root apex was used for microscopic analysis.

Results and Discussion

Paclobutrazol treatments inhibited vegetative growth as measured by leaf emergence, leaf size and plant height (Table 1). Root and shoot dry weights were less for paclobutrazol treatments but root:shoot ratios were enhanced. These responses are in general agreement with those reports previously cited showing paclobutrazol to be a powerful growth retardant. Steffens et al. (7) reported increased root:shoot ratios of apples following treatment with paclobutrazol. However, their data indicate that higher root dry weights contributed to the higher root:shoot ratios obtained from paclobutrazol treatments.

No differences were observed between the application methods for shoot growth parameters as have been reported by other workers (3, 5). Perhaps during the foliar application, some of the compound came in contact with the stems allowing for absorption and translocation through the xylem to the shoot apices. Quinlan (4) and Lever (2) reported application of paclobutrazol to stems or young shoot tips to be more effective at reducing vigor than when the compound was applied to leaves.

No differences were detected for root growth rates or total unsuberized root lengths at most measuring dates (data not reported). All paclobutrazol treatments altered root tip morphology resulting in shortened, fleshy root tips atypical of peach. Root tip diameters were increased by all paclobutrazol treatments but unsuberized root length was shortened only by those treatments containing soil applied paclobutrazol (Table 2). Treatments containing soil applied paclobutrazol also resulted in a greater increase in diameter for those roots closer to the zone of application, classified here as "upper root tips".

Microscopic analysis of root tip cross sections and longitudinal sections indicated paclobutrazol induced modifications of the growth and developement of root cortex and stele (micrographs not shown). Although the diameter of the stele was increased, most of the increase in root diameter may be attributed to increased cortex cell size and radial rather than longitudinal elongation of the innermost cortex parenchyma cells.

Paclobutrazol effects on roots have not been previously reported in detail. We have observed similar effects of paclobutrazol on root growth of peach under field conditions and on African marigold grown in the greenhouse. Steffens et al. (6) noted similar responses for apple grown in nutrient solution. Paclobutrazol induced changes in root growth and development appear to be a general response common to at least several species.

Steffens et al. (9) and Lever (2) have suggested that paclobutrazol alters sink strength within the plant resulting in a redistribution of assimilates to meristematic regions other than shoot apices. Paclobutrazol may alter the balance of endogenous hormones in the developing root tip. Such a change could result from altered synthesis, metabolism, or translocation of one or more hormones or their precursors. Further experimentation is needed to determine if these changes in root growth and development alter root function via changes in water and nutrient absorption, anchorage or hormone production.

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Table 1. Influence of paclobutrazol applications on various growth parameters of peach.

Treatment	Abbreviation	Leaf number	Leat size (cm^2)	Specific leaf wt. (mg/cm^2)	Plant height (cm)	Total dry weight (g)	Root dry weight (g)	Shoot dry weight (g)	Root:shoot ratio
Control	C	54.0	44.9	6.8	81.5	40.6	11.2	29.4	0.39
Foliar	F	14.3	26.1	8.1	32.5	16.7	7.8	8.9	0.87
Soil	S	10.7	30.5	8.5	35.3	16.4	7.6	8.8	0.86
Foliar + soil	F&S	11.3	24.2	9.7	31.0	14.4	6.5	7.9	0.82
SE		5.9	4.2	0.6	3.8	2.6	1.2	1.8	.07
Contrasts									
C vs F+S+(F&S)		**	**	*	**	**	*	**	*
F vs S		NS	NS	NS	NS	NS	NS	NS	NS
F + S vs F & S		NS	NS	NS	NS	NS	NS	NS	NS

NS, *, ** Nonsignificant (NS) or significant at 5% (*) or 1% (**) levels.

Table 2. Effect of paclobutrazol applications on length (cm) and diameter (mm) of peach root tips.

	Unsuberized root length (cm)		Root tip diameter (mm)	
Treatment	Upper roots	Lower roots	Upper roots	Lower roots
Control	1.2 a[z]	1.5 a	0.5 a A[y]	0.4 a A
Foliar	0.7 ab	0.6 b	0.9 b A	0.9 b A
Soil	0.3 b	0.4 b	1.1 c A	0.8 b B
Foliar + Soil	0.3 b	0.4 b	1.0 bc A	0.8 b B

[z]Lower case letters denote mean separation in columns by Duncan's Multiple Range Test, 5% level.

[y]Upper case letters denote mean separation in rows by Duncan's Multiple Range Test, 5% level.

Not For Citation

Growth and Cropping of Peach Following Foliar Applications of Paclobutrazol and Flurprimidol

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Introduction

Paclobutrazol and flurprimidol are two relatively new growth retardants that inhibit gibberellin biosynthesis, but there is little published information on the influence of these materials on peach. The purpose of this report is to present information on how these materials affect peach tree growth and cropping for two seasons following treatment.

Methods

Six-year-old 'Redhaven'/Halford trees were treated with paclobutrazol or flurprimidol on May 24, 1983, 3 weeks after full bloom. Foliage and bark were sprayed to runoff at 0, 500, 1000, 2000, and 3000 ppm plus 0.1% X-77 spreader with 4 liters of solution per tree; this corresponded to 0, 2, 4, 8, and 12 g AI per tree. There were 5-single-tree replicates in a randomized block design, and data were analyzed with regression analysis.

Results

Cropping. Trees had a light to moderate crop in 1983, no crop in 1984 due to a winter freeze, and a heavy crop in 1985. Yield and fruit size were not influenced by either growth retardant in 1983, but flurprimidol-treated trees (500 to 2000 ppm) had increased yields in 1985.

Vegetative growth. Trunk enlargement was negatively related to concentration of both growth retardants in 1983 and 1984, but trunk growth was not affected by the treatments in 1985. Shoot growth was negatively related to concentration of growth retardants in 1983, but only flurprimidol-treated trees exhibited reduced shoot growth in 1984. Shoot length was positively related to concentration of both materials in 1985.

Floral development. In the spring of 1985, bloom was most advanced on trees treated at the higher rates of both materials. All flower buds on 10 shoots per tree were rated on a scale of 1 (dormant bud) to 7 (full bloom). Bloom development was positively related to concentration of both materials; at the higher concentrations, bloom was advanced by 2 or 3 days compared to control trees.

Fruit set. In 1985, buds per meter shoot length were positively related to concentration for flurprimidol but not paclobutrazol. Fruit per meter shoot length was negatively related to concentration of paclobutrazol but not flurprimidol, while fruit set per 100 blossoms was negatively related to concentration of both growth retardants.

Discussion

Paclobutrazol and flurprimidol generally affected peach tree growth and yield in a similar manner. The year of treatment there was a dramatic reduction in shoot and trunk growth, and the effects were less dramatic the year following treatment. Yield and fruit size were not negatively influenced by either material.

The trees seemed to exhibit compensatory growth two seasons after treatment. Although both growth regulators inhibit gibberellin synthesis, the trees grew as if they synthesized greater amounts of gibberellin. Defoliation was slightly delayed in 1984, and treated trees appeared similar to trees treated with GA_3. Trees treated with high concentrations of both materials started to grow and bloom earlier and had greater shoot extension than nontreated trees in 1985. These results appear to support the hypothesis that inhibition of gibberellin synthesis following treatment of these materials results in an increased pool of gibberellin precursors that become available for gibberellin synthesis when the growth retardants are no longer effective.

These results demonstrate that a single foliar application of either paclobutrazol or flurprimidol may alter peach tree growth for several seasons. Because growth may be enhanced as the materials become less effective, annual or biennial applications will probably be needed for continued growth suppression.

THE INFLUENCE OF GIBBERELLIC ACID CONCENTRATION ON FRUITING OF 'REMAILLY', 'LAKEMONT' AND 'INTERLAKEN' SEEDLESS TABLE GRAPES

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Introduction:

Considerable experimentation has taken place using gibberellic acid (GA) as a means to increase fruit size in seedless table grape cultivars (Considine, 1984). However, no testing has been conducted in New Jersey, where seedless table grapes recently released from breeding programs in New York, Arkansas and Canada may have great market potential. This test was conducted to determine the value of gibberellic acid applications at bloom and shatter on one new ('Remailly') and two standard ('Lakemont' and 'Interlaken') seedless grape cultivars under southern New Jersey conditions.

Materials and Methods:

'Remailly' grape vines in their 2nd leaf and mature 'Lakemont' and 'Interlaken' vines were sprayed with 0, 10 or 20 ppm GA (GA_3, Pro-Gibb, Abbott Laboratories) at bloom, or 0, 20 or 40 ppm at shatter, one week later. Branches of vines were treatment units, taking advantage of the fact that GA activity occurs only if applied directly to the fruit (Weaver, 1959). Treatments were arranged in randomized complete blocks, with 4 replications of each treatment. Subsamples of 2-6 clusters (depending on availability) were sampled when grapes were mature. Clusters were weighed, berries counted, and soluble solids measured using a hand-held refractometer. Individual berry size was averaged by dividing cluster weight by berry number. Data was analyzed using an analysis of variance, with means separated by Tukey's New Studentized Range Test, and by regression analysis to determine r^2 values and regression co-efficients.

Results and Discussion:

For 'Remailly' there were no significant differences (alpha = .05) in cluster weight, grape number/cluster or individual grape size for any GA concentration or either timing (Table 1). Soluble solids were slightly higher on the 10 ppm treatment at bloom, and for the control at shatter. The reason for this elevation is not clear, and the authors remain open to discussion on this point.

For 'Interlaken', there were, again, no differences (alpha = .05) in cluster weight, grape number/cluster or individual grape size. Soluble solids were again higher in grapes from the control (shatter) spray than either other concentration. In this case, the increased soluble solids may be due to decreased grape size resulting in a dilution effect on the 20 and 40 ppm treated grapes.

'Lakemont' plants did not respond to GA sprays on any of the parameters measured during bloom. However, at shatter, GA increased cluster weight and grape number/cluster (Figure 1). Individual berry size was increased as GA concentration increased. It should also be noted that soluble solids were not influenced by GA concentration.

There was a high degree of variability in the data from all three cultivars, which may have masked some results. However, it is clear that all cultivars will not respond uniformly to GA treatments. Work at the Pennsylvania State University has shown that some cultivars respond more effectively to Promalin (GA_{3+7} and BA) than GA's. This research will be continued in 1986, expanding cultivars and materials tested.

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Table 1. The influence of GA concentration and timing on 3 seedless table grape cultivars.

REMAILLY

	ppm GA	Cluster Weight	# Grapes/ Cluster	Size (g/grape)	Soluble Solids
Bloom	0	155.5	64.0	3.07 b	17.80 b
	10	184.3	53.2	3.54ab	18.97a
	20	234.7	51.4	3.70a	17.78 b
	p(F)	NS	NS	.10	.04
Shatter	0	224.8	61.5	3.56	18.45a
	20	220.0	64.0	3.47	17.20 b
	40	233.8	77.2	3.06	17.73 b
	p(F)	NS	NS	NS	.06

INTERLAKEN

	ppm GA	Cluster Weight	# Grapes/ Cluster	Size (g/grape)	Soluble Solids
Bloom	0	99.8	45.9	2.10 b	17.71
	10	103.9	47.6	2.16 b	18.14
	20	130.4	52.3	2.35a	17.88
	p(F)	NS	NS	.10	NS
Shatter	0	87.5	40.0	2.17	18.48
	20	130.3	49.1	3.23	17.38
	40	170.7	52.0	3.35	17.56
	p(F)	NS	NS	NS	NS

LAKEMONT

	ppm GA	Cluster Weight	# Grapes/ Cluster	Size (g/grape)	Soluble Solids
Bloom	0	128.9	71.8	1.76	16.95
	10	141.7	67.7	2.03	17.85
	20	126.9	54.0	2.21	17.54
	p(F)	NS	NS	NS	NS
Shatter	0	123.8 b	59.4 b	2.03 c	16.23
	20	201.2a	81.7a	2.49 b	16.67
	40	250.9a	87.1a	2.79a	16.21
	p(F)	.09	.02	.05	NS

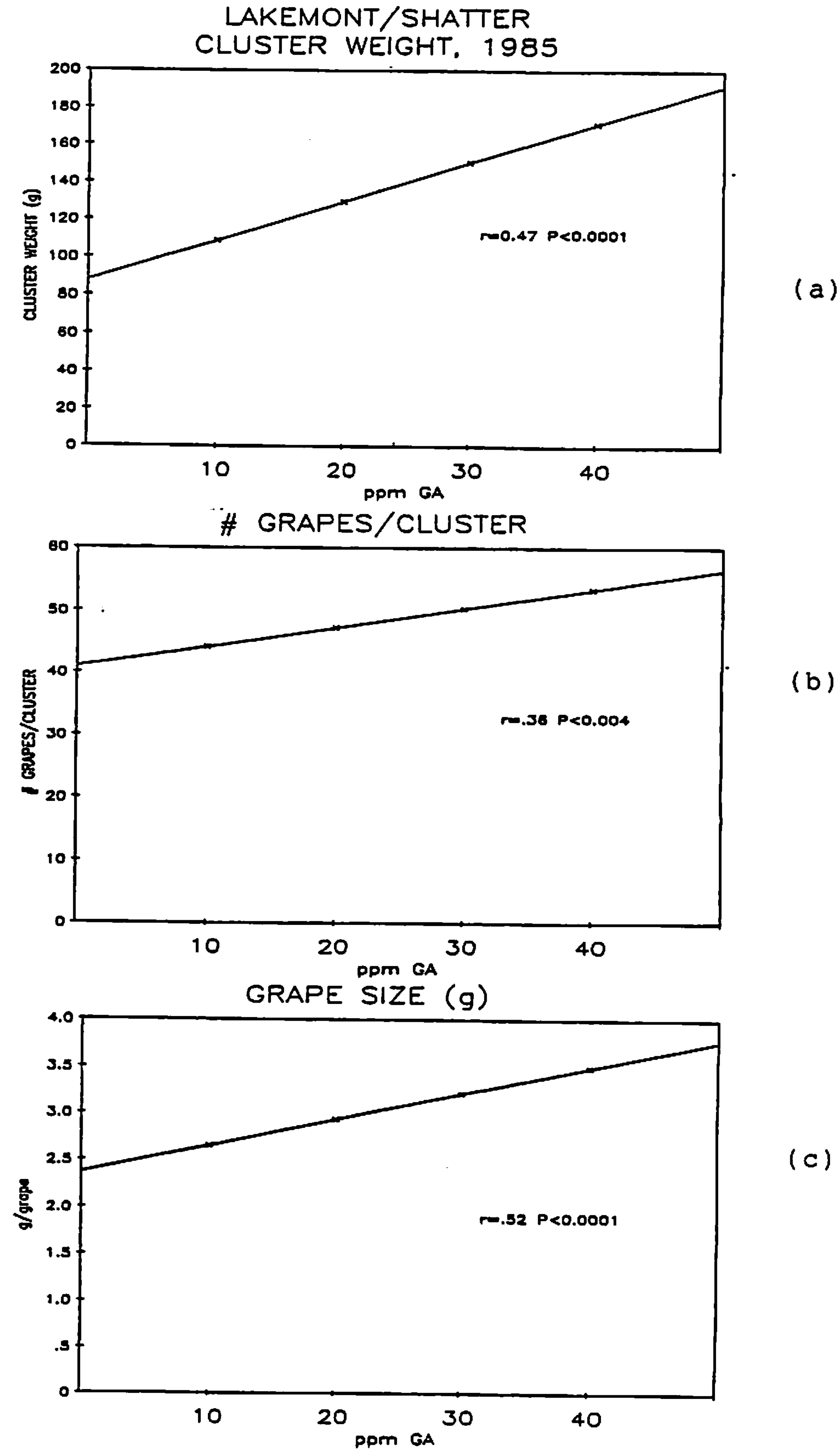

Figure 1. The influence of GA concentration on 'Lakemont' grape cluster weight, grape number/cluster and grape size.

NOT FOR CITATION

Ethylene Formation and Softening of Red Delicious Strains

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It is now partially accepted that there are differences in the rates of development among the approximately 250 named strains or sports of Delicious apples. How to demonstrate and use these differences is far from settled. Changes in internal ethylene concentration or ethylene evolution would seem to have the best physiological base and there are recommended maximum levels at harvest for refrigerated and controlled atmosphere storage of some cultivars. Delicious firmness has been measured for many years between 145 and 155 days after full bloom, which for years was within the period when it is mature or has been thought to have the best storage potential, and at one time was thought to fluctuate rather than decrease consistently.

In 1983 and 1984, Bisbee (Starkrimson), Topred, and Oregon Spur were collected between 132 and 150 days after full bloom from the same orchard, while Royal Red and Red Chief were obtained from 2 blocks about 4 miles away. Ethylene in internal atmospheres obtained from 10 fruits from each of 4 replicates was measured the day of picking. Ten other fruits were placed in sealed containers and the accumulating ethylene measured several times over the next 7 days. Firmness, soluble solids, and starch index (Ontario chart) measurements were completed on the fruits used to determine internal ethylene concentration within 30 hours of picking.

Soluble solids and starch index increased linearly with days after full bloom with the exception of Red Chief which increased up to 140 days after full bloom in 1983 and then decreased 0.2-0.7%. Starch indexes consistently increased significantly over the entire sampling period. All of the strains began softening sometime within the 130-152 days after full bloom but there was limited consistency between years or strains, particularly Oregon Spur and Bisbee. Firmness of Red Chief had begun decreasing by the time of the first collection while Royal Red began a continuing softening 137-140 days after full bloom with significant changes occurring 140 days after full bloom (Fig. 1). After decreasing and then increasing, Topred began softening significantly 145-148 days after full bloom, Oregon Spur after 135 days in 1983 and 145 days in 1984 but changes were significant only after 145 days, and Bisbee after 137 days in both years. With reservations, strains can be identified as relatively early and late softening.

Ethylene climacteristics can be identified both by measurement of internal ethylene concentration at the time of harvest or by ethylene evolution shortly after harvest (Fig. 1). The onset of the climacteristics in days after full bloom is unique for each of the strains with a total separation of as much as 15 days. There was reasonable consistency between the two years. If ethylene regulates or stimulates Red Delicious softening on the tree, it must be by concentrations of less than 0.1 ppm.

Since neither ethylene formation nor softening changed linearly or were correlated with days after full bloom, they were not correlated with each other, nor with soluble solids nor apparent starch concentration (starch index). Firmness after refrigerated storage for 90 or 150 days was correlated with days after full bloom but not internal ethylene concentration, firmness, soluble solids, or starch index at harvest nor with ethylene evolution shortly after harvest.

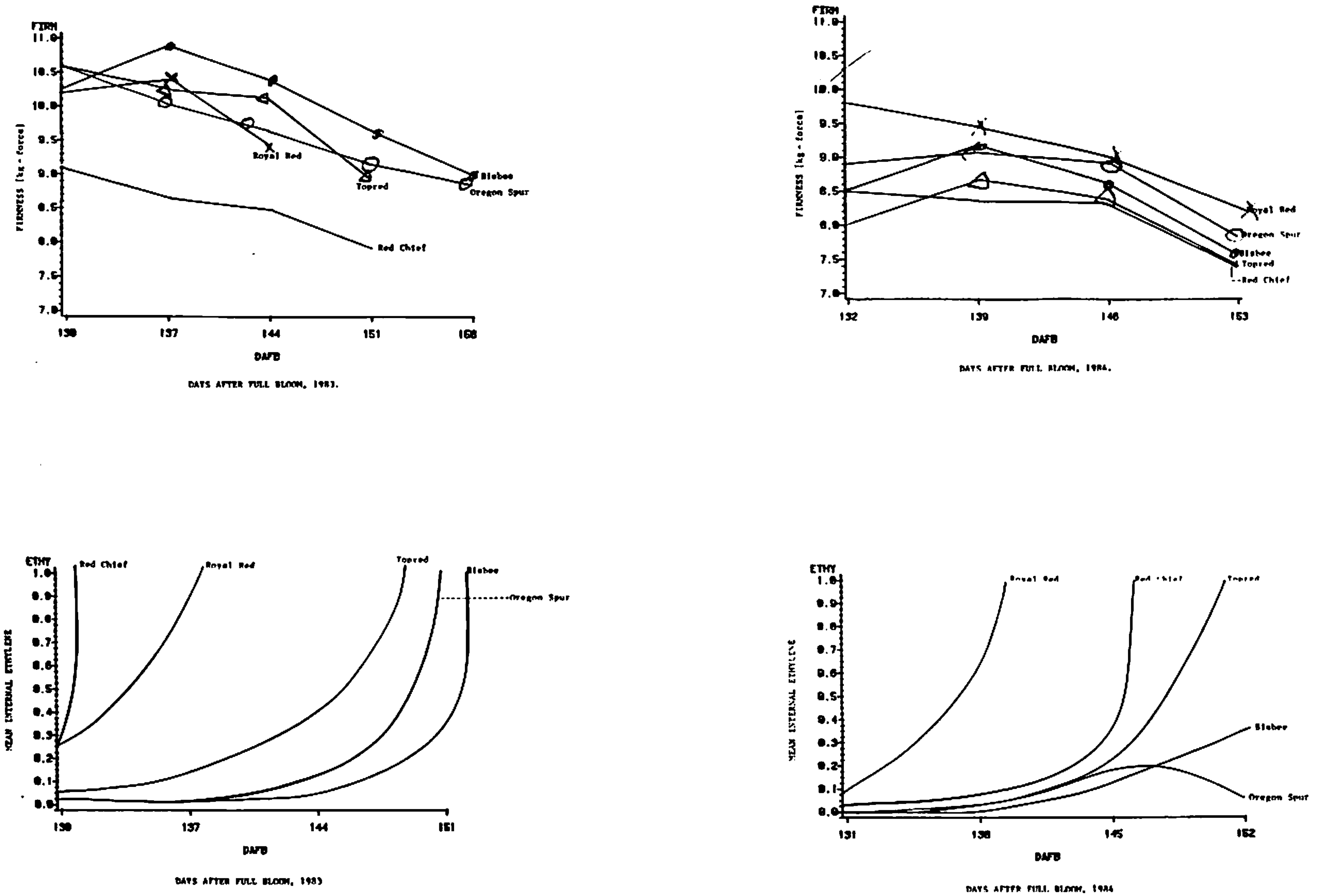

Fig. 1. Changes in firmness and internal ethylene concentration of five Red Delicious strains between 130 and 152 days after full bloom 1983 and 1984.

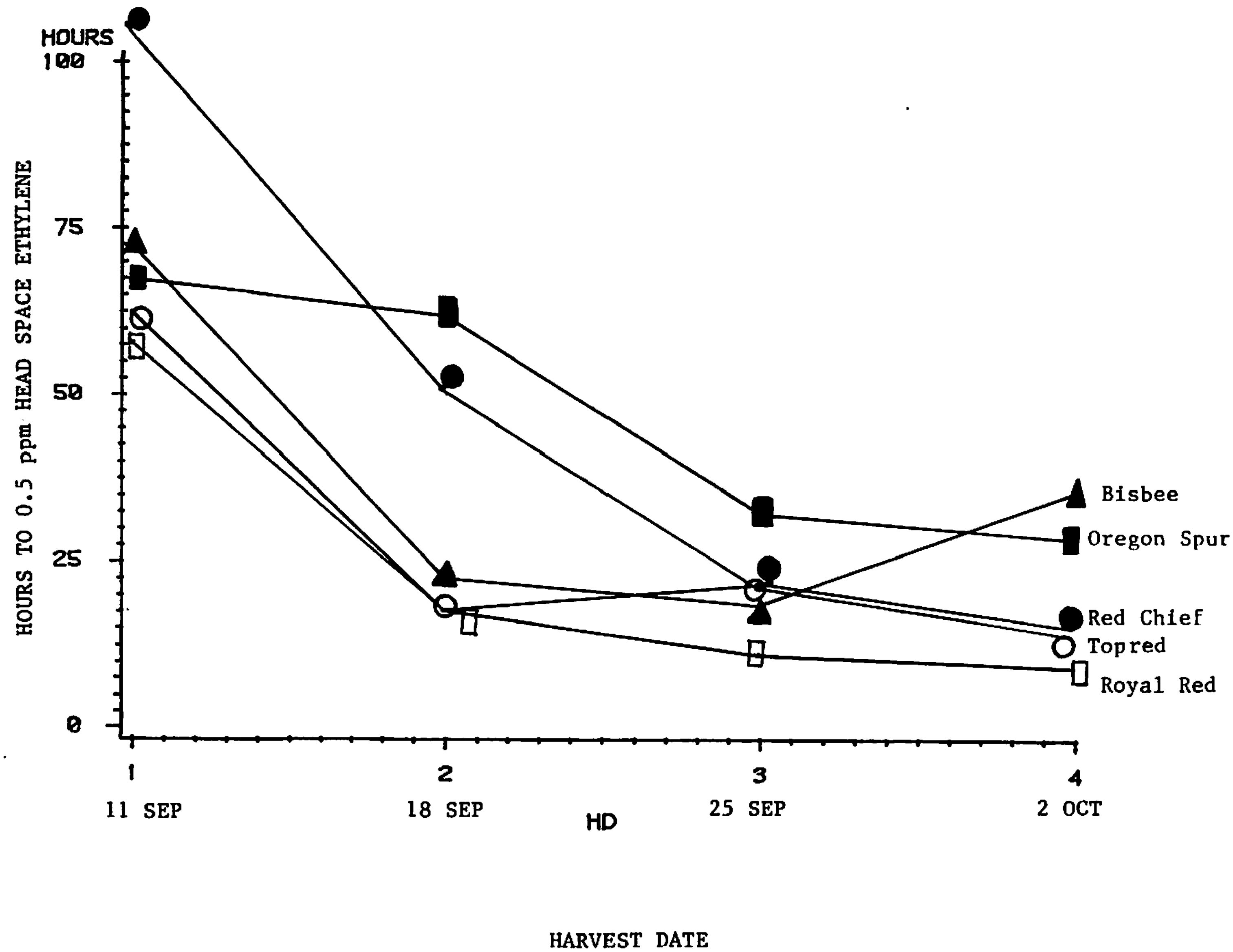

Fig. 2. Effect of harvest date 1985 on ethylene production by 5 Red Delicious strains.