ABSTRACTS OF REPORTS FROM THE

47th ANNUAL WESTERN COOPERATIVE SPRAY PROJECT

Imperial Hotel, Portland, Oregon

Hilton Hotel, Portland, Oregon

January 10-11, 1973

These abstracts of progress reports on research conducted on the principal insect and disease pests of tree fruits and nuts in the states of California, Colorado, Idaho, Montana, Oregon, Utah and Washington, and the Province of British Columbia, are not intended to be recommendations of the project. Official recommendations can only be made by public service entomologists and plant pathologists from their respective areas.

This report is reproduced by the Oregon State University Cooperative Extension Service and the Western Agricultural Chemicals Association.

Abstracts of Reports from the
47th Annual Western Cooperative Spray Project

TABLE OF CONTENTS

LEPIDOPTEROUS INSECTS -- Section I
- Codling Moth - Apples . . . 1
- Codling Moth - Apples and Pears . . . 2
- Codling Moth - Apples, Pears and Walnuts. . . . 2
- Codling Moth - Apples, Plums and Walnuts. . . . 3
- Codling Moth - Pears. . . . 3
- Codling Moth - Walnuts. . . . 4
- Codling Moth and Navel Orangeworm - Walnuts . . . 4
- Fruit Tree Leafroller - Apple . . . 4
- Oriental Fruit Moth . . . 5
- Peach Twig Borer. . . . 6
- Cutworms. . . . 6

ORCHARD MITES -- SECTION II
- Phytophagous Mites. . . . 8
- Predaceous Mites. . . . 9
- Integrated Control. . . . 10

OTHER INSECT PESTS -- Section III
- Apple Aphid . . . 11
- Bruce Spanworm - Apple. . . . 11
- Campylomma verbasci - Apples. . . . 11
- Cherry Fruit Fly. . . . 11
- Pear Psylla - Pear. . . . 12
- Stink Bugs. . . . 12
- San Jose Scale. . . . 12
- Thrips. . . . 13
- White Apple Leafhopper. . . . 14

SPRAY RESIDUES, COMPATIBILITY, PHYTOSICITY, BEE POISONING & POLLINATION, CONCENTRATE SPRAYING AND OCCUPATIONAL EXPOSURE -- Section IV. . . . 16

DISEASES OF STONE FRUITS -- Section V . . . 18

DISEASES OF POME FRUITS -- Section VI . . . 24

CONTRIBUTORS TO ABOVE ABSTRACTS . . . 30

S E C T I O N I

LEPIDOPTUROUS INSECTS

CODLING MOTH -- APPLES

S. Hoyt:

Zolone at 1 or 1½ pounds per 100, Zolone plus Guthion, Imidan, Guthion at 1/3 or ¼ pound per 100, Penncap M and Phosvel all provided good control of codling moth in an orchard with a moderate infestation. Four sprays of all treatments were required because of extended second brood activities.

H. F. Madsen and J. M. Vakenti:

Six orchards were monitored with pheromone traps baited with Codlemone. Need and timing of treatments for codling moth control were based on trap catches. One trap per acre was used. These were arrayed to monitor peripheral and interior areas. First and second brood entries were also monitored. The results indicated that the moth catch in peripheral traps compared to interior traps is as important as total trap catch. In one orchard the catch ranged from 3 to 12 moths per trap per week but the interior catch was consistantly higher than the border catch, indicating a source within the orchard. In spite of three cover sprays injury at harvest was 4.4%. In another orchard the catch ranged from 2 to 17, but most of the catch was in border traps, indicating an outside source. One first brood spray was applied and because no entries were observed no further sprays were applied. No entries or stings were found at harvest.

H. F. Madsen and J. M. Vakenti:

Seven types of codling moth traps baited with Codlemone were evaluated. Each type was replicated 5 times in a completely randomized block design. The season's catch for each trap was:

U. C. Pherotrap - 321	Pherotrap 1 - 343
Sectar 2 - 346	Pherotrap 1C - 441
Cylindrical Carton - 559	Sectar 1 (blue) - 767
Sectar 1 (white) - 793	

Certain types were more difficult to service than others and some were more prone to interference by birds, bats, fallen leaves,etc.

A. D. McMechan and A. P. Gaunce:

Application of pesticides through overtree sprinklers was compared with application by two types of air-blast sprays for control of codling moth and white apple leafhopper. Three sprays of azinphosmethyl and one of endosulfan were applied. Amounts of pesticide per acre were equal for each method of application. Both air-blast sprayer applications gave 100% control of leafhopper but overtree application only gave 50% control. At harvest the per cent injury by codling moth in untreated blocks averaged 17.5%, in the blocks sprayed with air-blast sprays 1.2% and in the overtree application blocks 3.1%.

M. D. Proverbs:

For the fourth consecutive year irradiated codling moths were released by helicopter in a 100-acre orchard. Per cent codling moth injured apples at harvest was 0.0005 compared with 0.007 in 1971, 0.02 in 1970, 0.05 in 1969 and 0.1 in 1968. Sterile males were released in an additional 300 acres comprised of 18 blocks for the second consecutive year. One codling moth spray was applied in three of these blocks intentionally and in two others growers applied a spray unnecessarily. Per cent codling moth injury in the remaining unsprayed area was 0.3 in one, 0.03 in two and 0.01 in ten blocks.

CODLING MOTH - APPLES (continued)

R. W. Zwick and G. J. Fields:

Synthetic codling moth pheromone lures supplied by Zoecon Corporation caught 52 moths in 2 traps which have been identified as Grapholitha sp. probably near lunatana Walsm. of the family Olethreutidae. These were taken in one orchard south of Hood River.

CODLING MOTH -- APPLES AND PEARS

B. A. Butt and H. R. Moffitt:

Six types of codling moth traps baited with 1 mg of (E,E)-8-10, dodecadien-1-ol (Codlemone) were hung in an orchard for 140 days. The pheromone was not renewed during this period. All traps were attractive, but the Sectar 1 (with both ends folded up) and BAB traps caught more moths than did the covered wing, U. C., open wing, or European standard.

Open and covered wing traps were baited with 1 mg of Codlemone alone or in combination with an anti-oxident, or the equivalent of 1 mg of (E,E)-8-10-dodecadien-1-ol from a mixture containing ~85% E,E isomer. These materials were impregnated on several substrates, the Zoecon red rubber cap, or a rubber band. Codlemone was more attractive than the 85% compound (adjusted to 1 mg of E,E-8-10, dodecadien-1-ol) and the red rubber septum was a more effective substrate than was the rubber band. Attractancy lasted longer in covered traps and when an anti-oxident was added to the Codlemone.

B. A. Butt, L. D. White, H. R. Moffitt, and D. O. Hathaway:

During the 1972 season (April 15 - September 25), 1.89 million sterile codling moths were released in the Wenas Valley in 111 releases. As in 1971, the noncommercial trees were sprayed for codling moth. One commercial orchard (10 acres) received the first cover spray; the other two commercial orchards (405 acres) received no sprays for codling moth control. One small (17 acres) commercial orchard was removed at the end of the 1971 season. While the numbers of overwintering larvae in noncommercial trees remained near zero going into the 1972-73 winter the numbers of overwintering larvae in the commercial orchards showed a considerable increase (> 100X).

D. O. Hathaway, M. Beroza, L. M. Mc Donough, and H. R. Moffitt:

In field tests, several compounds were found to be 95-100% effective as inhibitors of the response of male codling moths to both (E,E)-8-10,dodecadien-1-ol and female moths. The combination of the two inhibitors was only slightly more effective than the better inhibitor alone.

R. B. Hutt and L. D. White:

Male codling moths in varying age groups of 1-5 days mate less frequently when treated with 38 krad of gamma radiation than do untreated males. Also, treated males mate fewer times in their lifetime than do untreated males.

L. D. White, R. B. Hutt, and B. A. Butt:

In July, 1971, a release of 336 laboratory-reared nonirradiated codling moths (1:1 sex ratio) was made in a 77-acre orchard. Approximately 90% of all entries were within 1000 feet of the point of release but some entries were found near the farthest limits of the orchard (as far as 2000 feet from the point of release).

CODLING MOTH - APPLES, PEARS, WALNUTS

W. C. Batiste:

Timed catches made in UV light traps and in sex traps baited with live females or with codlemone show that none of the traps were linear for estimating population density. Flight occurred only

W. C. Batiste: (continued)

when the temperature gate was open and the threshold values were ca. 55 and 80°F. Males were responsive to either the natural or synthetic pheromone for about 5 hours/day, and this rhythm of responsiveness was entrained to light conditions. Daylight intensity per se did not seem to limit the mating flight. On the other hand, light traps were not attractive to moths until daylight intensity fell to levels encountered at sunset. Both sexes were responsive to light traps from sunset to sunrise. Periodicity of catch varied greatly over the season and between locations and could be predicted to a large extent by taking into account the time of daily responsiveness and the local weather patterns. The pheromone trap has proven to be very valuable as a surveillance tool; however, catches must be interpreted in the light of local weather and orchard conditions. Replicated plot studies and experience with a number of commercial orchards has indicated that pheromone trap catches by themselves do not provide a reliable basis for timing the first application against codling moth. Results have indicated that sprays were not needed for control of codling moth prior to the time of first egg hatch. With additional study, it seems plausible that time of egg hatch could be predicted from pheromone trap catches and subsequent accumulated thermal units.

CODLING MOTH - APPLE, PLUM, AND WALNUTS

P. Phillips and M. M. Barnes:

Studies have been conducted on strains of codling moth field collected from apples, walnuts, and plums in the same geographical area. These studies show that these strains are behaviorally distinct with respect to preference of host with respect to oviposition. The apple and walnut strains strongly prefer their own host foliage for egg laying but the strain on plums is apparently a walnut strain in the process of adapting as it prefers walnut foliage for oviposition. The strains differ in their response to photoperiod in induction of diapause.

CODLING MOTH - PEARS

J. L. Joos, W. C. Batiste and C. S. Davis:

A ten acre orchard of pears was treated with Volck Supreme oil at specific intervals for the control of codling moth egg hatch. Treatment timing was based on pheromone and live female trapping methods for peak adult populations and time interval necessary for egg hatch. All tests included four ½ acre treatments and controls. Two tests consisted of three treatments and one test of two treatments. Peak flight for first adult populations was April 28, 1972 and second peak flight on June 5, 1972. Allowance was made for adult flight through egg maturity and black head stage and first instar larvae prior to treatments. Harvest date was August 8 and 9. Degree of control was obtained by counting infested fruit at harvest (number of larval strikes). The best control with oil treatments was the first test on May 23, May 30 and July 13, 1972, a reduction down to the mean of .178% second best control was May 23, June 6 and July 13, 1972 treatment with a reduction down to the mean of .86% and least effective control was the treatment on May 23 and July 13, 1972 with a reduction down to the mean of 1.6%. The untreated area averaged 19% infested fruit.

J. L. Joos, W. C. Batiste, and C. S. Davis:

Female and male codling moths were placed in 36 organdy cloth and wire cages which were fastened over individual leaf-bearing twigs on the inside and outside canopy of pear trees. Observations were made at time intervals for egg laying and maturity through black head stage. At the appearance of black heads, one half of the cages were removed and the orchard trees sprayed with a conventional air carrier sprayer. After five days counts were made on live and dead black heads and live larvae. A high degree of control was obtained. Oil treatments included 1 gal. of Volck Supreme oil in 100 gal. of water at 400 gal. per acre.

CODLING MOTH - WALNUTS

D. Culver and M. M. Barnes:

All trap studies were with the Zoecon Pherotrap I. Over a five week period, codlemone caps were superior to five caged live females obtained from a commerical source by an average factor of 80X (per female). Codlemone caps charged with 10 mg. were inferior in catching males to 1 mg. and .1 mg. Three week or older codlemone caps charged with 1 mg. are 30-40% as effective as fresh caps. Of the alternate cap types investigated none were better than the standard rubber septum. Codlemone traps placed in the orchard after codling moth emergence began had a "trapping out" effect, yielding high initial catches. This effect must be taken into consideration if one is attempting to determine population density based on trap catch. Codlemone traps were a very good indicator of brood emergences. Preliminary results indicate that levels of trap catch are a good indicator of potential damage. 1972 results indicate that the best timing of second brood sprays was 5-10 days after traps indicated moths of first brood had begun to emerge. Another possible means of timing on an individual orchard basis is to apply treatment when average trap catch reaches five per night over a three night period.

CODLING MOTH AND NAVEL ORANGEWORM - WALNUTS

D. Bruce and M. M. Barnes:

It was formerly assumed that control of codling moth was perhaps the most important factor in navel orangeworm control, because populations of the latter build up on codling moth infested walnuts. The navel orangeworm moths then oviposit on walnuts as hull crack begins, resulting in primary infestation. Studies in 1972 show that while codling moth treatments suppress navel orangeworm populations, there is sufficient survival on stick-tight walnuts, heat damaged walnuts, blighted walnuts, etc. to insure problem infestations as hulls crack. Therefore, attention will now be paid to additional treatments when hull crack occurs. Treatments of chlordimeform (Fundal or Galecron) against codling moth do not interfere with the walnut aphid parasite and control two-spotted mite.

FRUIT TREE LEAFROLLER - APPLE

H. F. Madsen and J. M. Vakenti:

Fruit tree leafroller males were attracted to traps baited with combinations of cis-11-tetradecenyl acetate and dodecyl acetate. Archips rosanus males responded to combinations of cis-11-tetradecenyl acetate and cis-11-tetradecen-1-ol. Fruit tree leafroller males responded best to virgin female-baited traps but A. rosanus males were not attracted to traps baited with virgin females of that species. Three trap designs were tested with a pheromone specific for fruit tree leafroller. Total male moth catches were:

Cylindrical Carton - 390	Sectar 1 (white) - 78
Pherotrap 1C - 325	

H. F. Madsen and J. M. Vakenti:

Two species of leafrollers occur in British Columbia apple orchards, the fruit tree leafroller Archips argyrospilus and the European leafroller Archips rosanus. Seventeen formulations of synthetic sex pheromone were evaluated for attractiveness to A. argyrospilus and A. rosanus. Five replicates of each formulation were tested using Pherotrap 1 traps baited with plastic wicks impregnated with the various lures. Traps containing five virgin females of the two species were used as a standard.

A. argyrospilus males were attracted to lures containing a combination of cis-11-tetradecenyl acetate and dodecyl acetate. Female-baited traps captured more male moths than any of the lures.

A. rosanus males were attracted to lures with a combination of cis-11-tetradecenyl acetate and cis-11-tetradecen-1-ol. Males were not attracted to traps containing virgin female A. rosanus which is in contrast to the behavior of A. argyrospilus males.

H. F. Madsen and J. M. Vakenti: (continued)

Apparently, the sex pheromones of leafrollers are combinations of closely related compounds rather than a single compound as in the codling moth. The practical use of leafroller sex pheromone traps has not been determined but they may be useful to detect and perhaps control low populations of leafrollers.

D. F. Mayer:

In the Okanagan Valley of British Columbia seven species of leaf rollers: Archips rosanus (L.), Archips argyrospila (Wlk.), Pandemis limitata (Rob.), Platynota idaeusalis (Wlk.), Syndemis affictana (Wlk.), Argyrotanenai dorsalana (Dyar), and Choristoneura rosaceana (Harr.) feed on apple.

The relative abundance of the species varied depending primarily on the environment that apple was growing in and to a secondary extent on the application of sprays.

Each species add different alternate host plants. Rose is the major alternate host plant of all the species. Other important alternate host plants were privet for A. rosanus, dogwood for P. limitata, and antelope bush for A. argyrospila.

Thirty-eight species of parasites were reared from leaf rollers. Eight of these were important while the other thirty species were only incidentally associated with the leaf rollers. The incidence of parasitism varied between 1.0% and 32.4% apparently depending on the amount of spraying. On unsprayed host plants the incidence of parasitism averaged 25%. It is doubtful if the present parasite complex of leaf rollers in the Okanagan Valley is exerting significant biological pressure on the leaf rollers.

There has been a change in the relative abundance of leaf roller species from that found 50 years ago. This change is due to increased urbanization and increasing land cultivation that decreases the arid type environment of the Valley.

Urbanization and cultivation are continuing to increase while spraying is decreasing as more integrated control programs are developed. Because of this the relative abundance of the species will probably change in the future. A. rosanus and P. limitata will become dominant over A. argyrospila. The abundance of the minor species will also increase.

ORIENTAL FRUIT MOTH

W. W. Barnett and G. R. Post:

A synthetic sex pheromone of the Oriental Fruit Moth was compared with the standard Terpenyl Acetate bait pan. There were no differences in numbers caught when the pheromone was changed every two weeks or when the same cap was used all season. There were no differences in number caught between the B. A. Butt trap and the Pherotrap 1. Less male moths were caught in the Sectar trap and the Pherotrap 11. Numbers caught in the Terphnyl Acetate trap equalled or exceeded the sex pheromone in 3 of 4 tests.

J. E. Dibble:

Spring applications of Diazinon, Supracide, Galecron, Imidan and Fundal all provided satisfactory (shoot strike) control. However, Diazinon and Supracide were superior to the others listed by a small margin. Lannate and Vydate were not satisfactory nor was Dipel. Guthion continued to provide satisfactory control. The higher rates of PGSO-2, Volck Supreme and Sun 7E or 11E (5-6 gpa in low volume applications) oil appeared to show some suppression of OFM egg hatch.

R. E. Rice and R. A. Jones:

Dilute sprays applied on August 2 to Fay Elberta peaches showed that Imidan, Guthion, and Galecron provided superior control of OFM larvae compared to Dylox, CGA-13608 and Supracide.

ORIENTAL FRUIT MOTH (continued)

R. E. Rice:

Season-long trapping of OFM with synthetic pheromones showed the Zoecon Pherotrap I-C to be superior to other trap designs. More moths were collected from the southern (downwind) tree quadrant than from other quadrants; and at a 10 ft. height rather than at 4 or 7 ft. Optimum wick longevity (rubber septum wicks) was ca. 6 weeks under mid-summer field conditions. Maximum male moth activity occurred between 30 minutes before sunset to 1 hour after sunset. Following the spring emergence flight, four distinct moth flights occurred between May 1 and October 1, with peak collections in pheromone traps ca. 4-5 days ahead of peaks in terpinyl acetate bait traps. Other species collected in the OFM pheromone traps included the garden tortrix, Clepsis peritana (Clemens) and the lesser appleworm, Grapholitha prunivora (Walsh).

PEACH TWIG BORER

J. E. Dibble: ALMONDS AND PEACHES

Delayed dormant tests would rate as follows: Diazinon, Supracide, Galecron, Fundal, Imidan and Sevin. All gave very good control of the summer brood. The above evaluations were made in regard to shoot strikes. When evaluated on the basis of fruit injury, Diazinon and Fundal looked best followed by Supracide, SN 334, Galecron and Imidan. Lannate and Vydate were last. Dibrom generally looked very good as a dormant or spring treatment.

R. E. Rice and R. A. Jones: ALMONDS

Insecticides and oil applied as dormant sprays to third leaf almonds resulted in Diazinon, Dursban, Dowco 214, Imidan, Pirimiphosmethyl and Supracide providing good control; Furadan and Lannate did not perform satisfactorily.

E. W. Anthon: PEACHES

A synthetic pheromone for peach twig borer developed by Dr. Wendel Roelofs was tested in three separate field tests this summer and gave very encouraging results. The pheromone did not attract the male moth as effectively as the live females, but was good enough to warrant further investigations. In some trials a number of the fractions attracted a few females.

W. W. Barnett and D. H. Chaney: PEACHES

Dormant sprays of insecticides with and without oil were applied by handgun to third leaf peach trees in Sutter County. Results were evaluated by disecting hibernating larvae and noting the number dead. A shoot strike count was also made in May after the overwintering brood was completed. Diazinon, Parthion, and Dibrom gave good control both with and without oil. Control with Guthion, Fundal, Imidan and oil alone was unsatisfactory.

CUTWORMS

E. W. Anthon:

Twenty-two different materials were tested both in the greenhouse and in the field for control of cutworms. A large acreage treated with DDT in the field gave good results. A few baits tested in the field under dry conditions showed promise for the control of this insect.

CUTWORMS (continued)

S. Hoyt:

Evaluation of delayed dormant treatments for the control of cutworms (primarily spotted cutworms) indicated that none of the treatments were consistently effective. Lannate and Sevin baits gave some degree of control, dieldrin was less effective and Dylox and Bacillus thuringiensis gave little control. Against a summer population of cutworms (spotted cutworm and Pseudaletia unipuncta) sprays of Lannate and Phosvel provided excellent control, Dursban gave good control and partial control was given by Lannate bait and sprays of Thiodan and Dylox.

S E C T I O N I I

ORCHARD MITES

PHYTOPHAGOUS MITES

J. E. Dibble:

Summer mite control was excellent with Omite, Plictran, Galecron/Fundal, Carzol and Zolone. Highly satisfactory with 6 gpa of the superior oils (PGSO-2, Sun 7E and Sun 11E) as well as with Volck Supreme and Kelthane plus oil. Moderate control with Kelthane alone and Benlate plus oil. Poor performance was seen with the oils at 3 gpa, Cygon, Lannate, Vydate and Benlate.

J. E. Dibble: BROWN MITE

Spring applications for the control of this pest showed unusually good initial control with Supracide, Imidan, and the high rate of Lannate. These materials were followed by Vydate, Galecron, SN 334 and Fundal.

J. E. Dibble:

Of those materials tested for winter worm control, Diazinon, Supracide, Galecron and Imidan, none were of much value for ERM egg control except when combined with oil. Benlate plus oil appeared to give greater egg hatch suppression than the above.

R. S. Downing:

Triazid (UC 36059) at 1 pt. 20% E.C. per 100 gallons gave excellent initial and residual control of European red mite, pear rust mite and pear psylla. 0.5 pt. per 100 gallons controlled European red mite but was toxic to Typhlodromus occidentalis. Carzol 92% S.P. at 6 oz. per 100 gallons controlled European red mite and pear rust mite. Animert tested in orchards with European red mite resistant to Tedion failed to give control.

S. Hoyt:

Carzol and SD14114 reduced populations of apple rust mite to low levels and held them low for in excess of one month. Thiodan provided little control while ethion and Zolone gave the reduction desired in an integrated program.

John L. Joos and C. S. Davis:

Lime sulfur plus oil, Kelthane MF, Thiodan plus oil, Thiodan and Diazinon plus oil were applied as a full cover post harvest spray to control pear rust mite. The test plot included a 6 x 6 latin square with pretreatment and post treatment counts. Excellent control was obtained with Lime sulfur and oil and Kelthane MF. Very good control was also obtained with Thiodan and oil and Diazinon and oil.

J. L. Joos, D. Twilleager, C. S. Davis:

Kelthane MF was injected into the main line for three separate treatments of three 2 acre blocks (6 acres total treatment). Each two acre treatment required a total of 33 minutes per application. Injection made with a conventional sprayer holding 60 gallons of water plus materials. The main line 72 psi, sprayer pressure 90 psi, operational sprinklers at 55 psi, Rainbird 30 sprinkler head, 1/8 inch nozzle, 60 ft. x 60 ft. - spacing, hedge row planting. A high degree of control was obtained. Pretreatment counts on 7/4/72 included 1,774 pear rust mite in the treatment area (100 leaves on 10 trees at random), and 967 in the controls (100 leaves). Post treatment counts on 7/7/72 showed 2 pear rust mite in the treated area and 384 in controls. Control trees are from the center of nonfunctional sprinkler areas. Six 1 cm. circles were used on each leaf for counts.

PHYTOPHAGOUS MITES (continued)

R. W. Zwick and G. J. Fields:

One new tin acaricide, Stauffer R-28627, and an American Cyanamid compound, U-36, 059 were promising in evaluations except the latter was poor against two spotted mites. A tin Proctor and Gamble product was innocuous to Typhlodromus but also poor against phytophagous species. Ethion EC was no better against ERM than the WP formulation. After 2 years of no sprays, pear rust mites developed damaging populations which marked fruit on an overhead-sprinkled experimental block.

PREDACEOUS MITES

D. W. Davis:

Heavy spring freezing virtually eliminated the fruit crop in most Utah orchards. In the absence of codling moth sprays, spider mites were of minor importance. A series of acaricides and insecticides was applied to one orchard to determine the effects on the relative populations of McDaniel mites and the predator Typhlodromus occidentalis. The Imidan treatment showed an increased ratio of predators per spider mites. All other treatments showed a decrease in this ratio. Folimet and Fundal (both SP and EC) were most detrimental. Morestan, SD 14114, Omite, and methyl parathion were within acceptable levels. Zolone, Plictran, and Carzol were marginal.

R. S. Downing:

An organophosphate resistant strain of the predaceous phytoseiid, Amblyseius fallacis (Garman) from Michigan was reared in the laboratory in the winter, in a greenhouse in the spring, and then released in an apple orchard in late May and early June. In labortary comparisons with an organophosphate resistant strain of Typhlodromus occidentalis, Nesbitt, A. fallacis reproduced faster and consumed more prey than T. occidentalis when reared on detached apple leaves infested with European red mite. Both predators were equally resistant to spray applications of Diazinon 50 EC at 0.5 ml per litre. The two species were compared as predators of European red mite on small Delicious apple trees in a greenhouse and were approximately equal in effectiveness.

S. Hoyt:

Omite, Plictran, SD14114, S15126, UC41305A and U36059 gave good control of McDaniel spider mite but U36059 and S15126 appeared to be toxic to predators. PG123 was relatively low in toxicity to McDaniel spider mite, but allowed sufficient survival of predators that good control was obtained. Vydate L and Carzol were low in toxicity to McDaniel spider mite, but high in toxicity to predators.

R. E. Rice and R. A. Jones:

Plictran, Vendex, and Imidan applied to Santa Rosa plums gave good reduction of Pacific mite populations; predaceous thrips and mites reappeared in these treatments 3-4 weeks after application. Carzol also gave good Pacific mite control, but predators did not reappear through 6 weeks post-application. Other materials providing less satisfactory control were U-36059, UC 41305 A, Bay 2709, Vydate, SD 32963, SD 34048, and SD 29416-xm. Predaceous thrips were little affected by the last two materials listed.

R. W. Zwick and G. J. Fields:

The following acaricides allowed survival of Typhlodromus: PG-123, SD 34048, Plictran, Omite formetanate, UC 41305. Morestan at 2#/A controlled spider mites and allowed Typhlodromus to survive in good numbers on cherries. Low rates of Plictran (4 oz./100) allowed predator mites to survive and increase within a month after application. Two Omite (1#/100) applications within a month prevented Typhlodromus from increasing.

INTEGRATED CONTROL

E. W. Anthon:

Studies of an integrated mite control on prunes the past 6 years have shown that a delayed dormant spray of ethion and oil will control San Jose Scale and European Red Mite. If plum rust mite, twig borer or leafhoppers became a problem Thiodan has given good control. This past year all four prune experimental plots received only a delayed dormant spray. There was upsurge of plum rust mite, but the predator mite Typhlodomous occidentalist gave good control of this mite.

J. Eves and L. C. Keenan:

The U. S. Department of Agriculture initiated its direct support of Cooperative Pest Management Projects in 1971 with the funding of two projects, one on cotton in Arizona and a second on tobacco in North Carolina. The program effort was expanded in 1972 to include some twenty additional projects and several additional crops.

The Washington State Pest Management Program's intensive study area is located in the diversified deciduous tree fruits area of the Yakima Valley, Yakima County.

The Pest Management Program objectives include (1) the development and implementation of an effective, integrated approach to pest suppression, including biological, cultural, and chemical methods of control to be used in conjunction with various pest population monitoring devices and procedures, (2) field testing combination of pest suppression techniques for practical on-farm application , and (3) development of a computerized data collection, use, storage, and retrieval system to provide cooperators and program personnel with immediate feedback information.

R. E. Rice and R. A. Jones:

Leaf samples were taken from March to October in an untreated orchard at 2 or 4 week intervals from several varieties and types of deciduous stone fruits. Brushing machine counts showed that plums and prunes generally had the highest populations of eriophyids (Diptilomiopus gigantorhynchus), phytoseiids (Neoseiulus caudiglans, Amblyseius hibisci, Metaseiulus occidentalis), and stigmaeids (Zetzellia mali). Peaches and/or nectarines had intermediate populations of eriophyids and phytoseiids, and very low or no populations of stigmaeids. Apricots had relatively high populations of eriophyids and stigmaeids, and low populations of phytoseiids. As in 1971, almonds had the lowest populations of eriophyids and phytoseiids, and no stigmaeids. Pacific mites and European red mites were rather uniformly distributed at low densities among all varieties and types of trees. Distribution patterns of these mites on trees showed the eriophyids and stigmaeids concentrated on the outer third (periphery) of the limbs, while the phytoseiids were distributed more uniformly throughout the tree.

SECTION III

OTHER INSECT PESTS

APPLE APHID

S. Hoyt:

Good knockdown of apple aphid and four to five weeks of control was given by K840, RE15223, Zolone, Thiodan, Phosphamidon and Bay Hox 1901. Zr512 did not give the knockdown provided by the other treatments but appeared low in toxicity to Chrysopa nigricornis and Deraeocoris brevis, and after three weeks populations of aphids were relatively low.

BRUCE SPANWORM - APPLE

R. D. McMullen:

Guthion 50% W.P. at 2.5 pounds per acre, diazinon 50% W.P. at 4.0 pounds per acre and Thiodan 50% W.P. at 3.0 pounds per acre applied at tight cluster bud stage gave 100% control. Guthion and diazinon at one-half the above rates gave 98 and 96% control.

Campylomma verbasci - APPLES

R. D. McMullen:

Guthion 50% W.P. at 1.25 pounds per acre and diazinon at 2.0 pounds per acre were the minimum rates required to give 100% reduction of nymphs at petal fall. Thiodan 50% W.P., Imidan 50% W.P., and Zolone 30% W.P. all at 3.0 pounds per acre gave 98, 61, and 41% reduction respectively.

CHERRY FRUIT FLY

Edward W. Anthon:

In 1971 seven ultra-low-volume applications of 1 pint of malathion per acre were applied at weekly intervals. This program gave good control of cherry fruit fly. In 1972, with the use of trapping and timing of cherry fruit fly emergence, only four applications were necessary.

Preliminary conventional spray applications for control of this insect also gave good control with the use of the following materials: Guthion, Cygon, Zolone, and parathion.

F. L. Banham:

Sprays of dimethoate 40% E.C. applied 7 days after trapping the first adult fly, or 7 days and again at 15 days resulted in the following pupal counts from 5 pound samples of harvested fruit: single application 2.7, double application 0.0, and untreated 391.9.

F. L. Banham:

Four trap types, 14 colours including iridescents and aluminum and 3 baits were tested for attractiveness to cherry fruit flies in a stand of native bitter cherry, Prunus emarginata, at Salmon Arm, B.C., and in an abandoned cherry orchard at Creston, B.C. In the bitter cherry, Sectar I daylight yellow traps baited with Seclur CF and Pherotrap IC-Y yellow traps baited with Maggottract II caught the most flies averaging 21.5 and 23.6 per trap per week. Seclur bait increased the attractiveness 4.7 times. Based on "catching surface area", unbaited, vivid yellow, 4-vaned traps did not increase fly catches over standard, vivid yellow sticky board traps. The latter were equivalent to unbaited Sectar traps and were 4 times as attractive as brilliant greenish-yellow sticky board traps, the second most attractive colour.

In the cherry orchard, unbaited Pherotraps averaged 47.4 flies per trap per week compared to 15.8 and 12.1 flies for unbaited Sectar or yellow sticky board traps. Pherotrap attractiveness was increased by Maggottract I bait to 57.8 flies and by Maggottract II to 70.9 flies. Seclur bait increased catches of Sectar traps 2.6 times. Brilliant greenish yellow sticky board traps caught 3.2 times more flies than yellow sticky boards.

CHERRY FRUIT FLY (continued)

F. L. Banham:

A 1:1 dilution of dimethoate 4 EC brushed in 6-inch bands on branches of bearing cherry trees showed systemic action against eggs and adults. Bioassays exposing flies to foliage and fruit sampled 14 days after treatment averaged 48% mortality 6 inches above the bands and 13% 36 inches above. At 28 days, mortalities averaged 59% and 41% at the 6- and 36-inch sites and at 35 days 48% and 48%. Mortalities dropped sharply after 42 days.

F. L. Banham:

Zoecon Pherotrap IC double-wing traps baited with Zoecon Packardimone II caught 4 times as many fruitworm moths as the same trap baited with Packardimone I. The pheromone capsules were replaced at 6-week intervals. Moths were trapped from June 12 to July 4 with peak flights June 19 to 30. No moths were caught on unbaited 5½ X 11½ inch yellow sticky board traps.

R. D. McMullen:

The adults of Taeniothrips orionis overwinter in dry plant litter in protected sites. Dispersal from hibernation sites and feeding coincided with the flowering of the earliest blooming wild flowers. No reproduction was noted on the early blooming herbaceous plants. The major wild hosts on which reproduction was observed were saskatoon, chokecherry,wild rose and hawthorn. On sweet cherry, oviposition commenced with the opening of the earliest blossoms and continued for at least two weeks after petal fall. Eggs were oviposited in the hypanthium, ovary and style with the latter receiving the greatest proportion of eggs. Oviposition into the ovary results in the dimple injury on fruits. Approximately 75 per cent of the oviposition occurred prior to petal fall. These observations suggest that control will require the use of a persistent pesticide applied just prior to bloom or one compatible with pollinators applied during bloom.

PEAR PSYLLA - PEAR

E. Burts:

Of the materials evaluated for dormant season control of overwintered adult pear psylla, Zectran and Zectran plus oil were the most effective treatments. American Cyanimid U36509 was the most effective pesticide in summer screening trials. Juvenile hormone mimics ZR512 and R20458 reduced adult emergence but did not provide satisfactory control in single tree replications, partially due to the influx of adults from nearby trees. However, in laboratory and caged field trials these materials were very toxic to young nymphs; older nymphs not killed by the treatment either died moulting to adults or developed into deformed adults. Galecron 4#/gal. E.C. applied by a helicopter equipped with Beecomist dispensers gave good control of both nymphs and adults.

Overtree sprinkling did not significantly affect pear psylla populations compared to standard low angle sprinkling when this method was used to apply about 30 inches of irrigation water during the growing season.

Studies of the predators and parasites that regulate populations of pear psylla show these factors to be ineffective in preventing economic injury from the first summer generation. When dormant and delayed dormant sprays are applied, the natural enemies of pear psylla are able to keep populations below economic injury levels if no summer sprays are applied which destroy the beneficial species. However, several years without summer sprays are necessary to establish this natural control.

Camplylomma verbasci was observed for the first time in an unsprayed block of pears this year in sufficient numbers to be of value in reducing pear psylla populations.

D. W. Davis:

The pear psylla spread northward in Utah and now occurs from the Idaho border on the north to Salt Lake City on the south. So far it has not been collected in Utah County, the major pear producing area.

D. W. Davis: (continued)

The pear production in most Utah orchards was frozen out in 1972. One major pear producer in the original psylla infested area decided to limit his spray program to the dormant oil plus perthane. During late May and early June the psylla nymphs were numerous. By late June many predators, especially Anthocoris spp., were present. During early July the honeydew crystallized. By late July through September there was a nearly complete absence of the pear psylla with almost no visible injury.

G. J. Fields and R. W. Zwick:

Preseason lab tests showed half rates of Perthane plus Thiodan (with and without oil), and full rates of Zectran (with and without oil) to be the only effective materials against adult psyllids. However, Zectran when applied with oil in the field, was ineffective. The best early season control of nymphs was obtained with a delayed dormant application of Perthane plus Thiodan (plus oil), a Pink application of Morestan and a petal fall application of chlorphenamidine. The most effective cover applications were Imidan plus oil, half rates of chlorphenamidine plus Dithane M-45, and half rates of chlorphenamidine SP plus Imidan WP. The materials giving the poorest control were Phosvel EC, ethion and Mesurol. Mesurol was applied 3 times commercially and failed to give economic control. Ineffective experimental compounds were NIA 18739, CGA-13068, RE 15223 and the juvenile hormone R-20458. The most promising new compound is American Cyanamid's U-36059. In repeated trials control was excellent and lasted through 6 weeks.

G. J. Fields and R. W. Zwick:

The use of frequent, short-interval overtree irrigation was tested as a control for psylla-caused honeydew damage. A 4-tree plot was irrigated for 1 hour every two days with the end result of 11.2% damage compared to 59.7% in the check and 7.3% in the best commercially kept orchard. This test will be expanded and repeated during 1973.

STINK BUGS

E. W. Anthon:

This past year seven different species of stink bugs were collected and reared in the laboratory. Three of these species were caged on cherries at various growth stages to determine the type of damage they would cause to cherries. All species caused external damage of varying degrees, but the green soldier bug caused severely deformed fruit in the field and internal damage before and during simulated transportation experiments.

Applications of DDT, Thiodan and dieldrin applied May 8 to 12 gave good control of this insect.

J. E. Dibble:

March treatments made against both adults and hatching nymphs showed Methyl parathion in combination with Thiodan to give the best control of the adults. This was followed by Methyl parathion plus superior oil and Carzol. Dylox plus oil and Sevin were moderately successful. Methyl parathion alone, Thiodan and Dibrom were of little value. Orthene and Supracide, however, showed some activity. All treatments except Thiodan were effective on the nymphs.

SAN JOSE SCALE

J. E. Dibble:

Dormant tests showed as good scale control in April evaluations with oil alone (Volck or PGSO-2) as when combined with Diazinon, Supracide, Galecron, Imidan, Dibrom, or Dursban.

SAN JOSE SCALE (continued)

J. E. Dibble:

Spring crawler applications again showed a very high degree of control with oil alone. Supracide, Dylox, and Imidan alone were poor. Diazinon alone performed satisfactory as did each of the above when combined with oil.

S. Hoyt:

Of eight materials tested for the control of San Jose scale crawlers, none provided adequate control. The best control obtained was 77.7% with Parathion.

R. W. Zwick and G. J. Fields:

Parathion, encapsulated methyl parathion and by diazinon were the most effective against crawlers and newly-settled scales in field applications but a single late July application would not reduce the population sufficiently to be considered for commerical control due to their limited residual control.

THRIPS

R. D. McMullen:

Apple blossoms became attractive to overwintered adult thrips as soon as the petals opened sufficiently to allow entry and lost attractiveness at petal fall. Flowers of McIntosh, Spartan and Red Delicious were equally attractive but Golden Delicious blossoms were much less so. In descending order of frequency, eggs were found in the following flower parts; sepals, style, peduncle, filament, hypanthium and petals. Pansy spot results only from oviposition in the hypanthium.

At petal fall 4.2, 4.5, 3.6 and 0.1 percent of the fruits of McIntosh, Spartan, Red Delicious and Golden Delicious respectively had eggs in, or oviposition scars on, the hypanthium. Not all of the oviposition marks resulted in pansy spot and the pansy spot persisted through to harvest only on McIntosh and Spartan. During the last two weeks of June new oviposition marks were noted, presumably made by first brood females. The percent fruits marked by first brood and later females was not assessed but judged to be small. At harvest the percent fruits with pansy spot on McIntosh and Spartan was 4.7 and 4.8 respectively. This suggests that oviposition during bloom contributed the greatest proportion of the injury.

R. E. Rice, J. H. LaRue, R. A. Jones:

Adult populations of flower thrips, Frankliniella spp., were monitored with colored sticky traps in a Fresno County nectarine orchard. Light blue or white traps collected significantly more thrips than pink, turquoise, yellow, orange, red, green, or black traps.

R. W. Zwick and G. J. Fields:

None of the insecticides applied in commercial applications were effective in reducing thrips numbers or preventing over 20% damage to Golden Delicious and Newtown apples under conditions of high populations of what is believed to be the western flower thrips.

WHITE APPLE LEAFHOPPER

R. D. McMullen:

Thiodan 50% WP at 3.0 lbs. per acre, Rogor 40% EC at 4.5 pt. per acre and Systox 50% EC at 2 qts. per acre applied Aug. 3 when the population consisted of adults, eggs and early instars all gave 100% control. On August 22 when the population consisted of mostly third and fourth instar nymphs, Thiodan 50% WP at 3.0, 2.0, and 1.0 lb. per acre gave 100, 95, and 39 percent control respectively.

S E C T I O N I V

SPRAY RESIDUES, COMPATIBILITY, PHYTOXICITY, BEE POISONING AND POLLINATION, CONCENTRATE SPRAYING AND OCCUPATIONAL EXPOSURE

E. Burts:

Guthion EC applied by helicopter or fixed wing aircraft equipped with Beecomist dispensers was an effective cover spray on apple for codling moth control. This treatment was compared to aerial sprays of Guthion WP in 8 gallons of water per acre. Aerial ULV sprays of Phosphamidon, Cygon and Thiodan provided excellent control of apple aphid on both young and mature trees. Galecron EC applied undiluted by helicopter using dispensers was as effective as ground dilute sprays for control of pear psylla in mid-summer. None of the ULV applications produced any injury to fruit or foliage of these two crops but Phosphamidon drift onto cherry caused leaf yellowing and defoliation. A comparison of drift from aerially applied ULV sprays and conventional aerial sprays indicated ULV sprays drift more under windy conditions, but showed there to be little difference in drift under normal spray conditions.

J. E. Dibble:

Sevin, Guthion, and Diazinon each applied at the same rate concentrate and dilute and also concentrate at 25% less all showed a high degree of control on both pests. There was essentially no difference between application gallonages or rates. Sevimol and Imidan also showed little difference between their application as concentrate or dilute, but were less effective in control than the other three materials. High volume was applied at 400 gpa and low at 40 gpa.

J. E. Dibble:

Span Spray sprayer applications at 50 gpa with the 4 fans at the normal position gave satisfactory mite control, but not quite as good as that obtained with the Kinkelder or Bean 200TR. After fan adjustments the Span Spray performance was not significantly different than the other two units. Fewer adjustments appear necessary with the 6 fan model and dye coverage trials show a more uniform coverage.

J. E. Dibble:

Averaging all accumulative residue data - regardless of crop, chemical, chemical rate (low volume applied at a less rate in some cases), application or sampling time - the low volume/high volume residues show in 18 comparisions of ground surface residue 54.8% less with the low volume. In 37 fruit residue comparisions 38.2% less with the low volume. In 177 leaf residue comparisions there was an average of 2.9% more with the low volume. Comparing spray oil residues (supreme and superior) 52 joint samples showed 17.3% more residue deposit in the low volume as compared with the high volume.

C. Johansen and C. Baird:

Bee Poisoning and Pollination

Material	Contact toxicity hazard to honey bees
UNI K-840	nil
Galecron	nil
Omite	nil
Comite	nil
ZR-512	nil
Pirimor	low
BAY HOX 1901	low
Lannate	low

C. Johansen and C. Baird: (continued)

Material	Contact toxicity hazard to honey bees
Carzol	low
Vydate	low
Cygon (2-4 oz)	low
Phosvel	low-moderate
Orthene	moderate
Pirimiphos-methyl	moderate
Monitor	moderate
Cidial	high
Pirimiphos-ethyl	high
Supracide	high
Azodrin	high
BAY HOX 2709	high
Pencap M	high

C. V. G. Morgan and A. P. Gauce:

The initial dose of ethylene dibromide (EDB) required to kill European red mite winter eggs in semi-commercial tests is much higher than in the laboratory. This difference is due to absorption on apples, boxes, and chamber walls. These absorption factors have been worked out so that it is possible to calculate the initial dose required for any set of conditions. However, mortality is more correctly related to average concentration rather than initial dose. Winter eggs of the European red mite, were killed by an average concentration of 4.0 mg/l maintained for 4 hours at room temperature. McDaniel spider mite winter adults were also killed but remained moribund for 2 to 3 weeks. High concentrations of EDB were not effective against the San Jose scale or the European fruit scale.

R. E. Rice:

Banomite applied to NePlus and Nonpareil almonds at 6, 12, and 18 oz. 75W/100 gallons water resulted in no phytotoxicity at the 1x rate, and slight chlorosis at the 2x and 3x rates 5 days post-treatment. The 1x rate showed light chlorosis and necrosis 18 days post-treatment, while the 2x and 3x rates showed moderate to heavy speckled chlorosis, general necrosis, leaf drop, and some distortion of terminals. Zolone applied to Summerset peaches at 1x, 2x, 4x, and 6x label rate showed no phytotoxicity at the 1x and 2x rates 20 days post-treatment; the 4x and 6x rates showed moderate to severe marginal and leaf tip necrosis, heavy leaf drop (est. 20-25%), but no fruit drop. Furadan 10G was drilled into irrigation furrows in late February at 1.0, 4.0, and 8.0 lbs. a.i. per acre. The 1.0 lb. rate generally showed no foliar phytotoxicity in late April to almonds, peaches, or nectarines, but the higher rates resulted in varying degrees of chlorosis, necrosis, leaf and fruit drop, and leaf distortion. Almond varieties were generally less susceptible to phytotoxicity than were peach or nectarine varieties.

R. W. Zwick and G. J. Fields:

Morestan + chlorphenamidine applied in early June burned brown spots on leaves and some fruit on Anjou and Bartlett pears. The combination of EL-241 + phosalone + dodine + chlorphenamidine produced ring spot russet on Golden and newtown apples, however, when formetanate was substituted for chlorphenamidine no russet was produced. D-048 produced necrotic spots on leaves and brown-black spots on Bartlett and Anjou fruit.

S E C T I O N V

DISEASES OF STONE FRUITS

H. R. Cameron:

Four tree plots, replicated six times, were sprayed the second week of October 1971 and the third week of January 1972. Results were read during bloom, March 29, 1972. Kocide, HPMTS liquid and Bordeaux appeared to be of equal value. It is unlikely that either Kocide or HPMTS liquid will be appreciably better than Bordeaux but additional data should be obtained under more normal disease conditions.

The spring of 1972 was very wet and cool, producing conditions that were favorable for bacterial infection. This, coupled with depressed fruit prices, resulted in minimum control programs in most orchards. The usual program consisting of two applications of 12-12-100 Bordeaux failed to give satisfactory control due to the cold wet weather. A third application probably would have resulted in satisfactory control, applied in early March. In an average year two Bordeaux sprays would have resulted in 5-15 dead buds per 300 bud sample.

Treatment and rate per 100 gallons	Average number of buds dead per 300 bud samples
Kocide 101 45W 6 lbs. + 1 pt. Triton B 1956	99.5[a]
Buckman HPMTS liquid .5 gal. + 1/3 gal. WSCP	103.5[a]
Bordeaux 12-12-100	105.6[a]
Buckman HPMTS 50W 8 lb. + 1/3 gal. WSCP	130.0[b]
Citcop 4E .5 gal.	133.8[b]
Unsprayed control	141.1[b]

[a,b]Small letters indicate Duncan's multiple range groups of treatments which do not differ significantly at the 5% level.

Kocide 101: Cupric hydroxide (56%) WP
Kennecot Copper Corporation, Special Products Division
P. O. Box 45539, Houston Texas 77045

HPMTS: 2-hydroxypropyl methanethiolsolfonate (80%)
Buckman Laboratories Inc.
1256 North McLean Boulevard Memphis, Tennessee 38108

WSCP: spreader-sticker
Buckman Laboratories Inc.
1256 North McLean Boulevard Memphis, Tennessee 38108

Citcop 4E Copper salt of fatty and rosin acids (4% copper)
City Services Co. Chemicals and Minerals Research and Development
P. O. Drawer 8 Cranbury, New Jersey 08512

A. W. Helton:

Infection of prune and peach trees with Cytospora, Agrobacterium, or Prunus ringspot virus has been found to induce a systemic resistance reaction to Cytospora. Once induced, this resistance seems to remain indefinitely but is additive in that infection with a second inducing organism results in a stronger resistance reaction. Laboratory analyses indicate that isolable moities are present in bark from infected prune trees that are not present in uninfected trees. Attempts are being made to identify these moities/compounds with a view to synthesizing them and inducing the resistance via spray applications.

B. T. Manji and J. M. Ogawa:

Inoculation studies with apple powdery mildew on Rio Oso Gem peaches for two years resulted in development of similar symptoms observed on Rio Oso Gem peaches located near or interplanted within Jonathan apple orchards. In commercial peach orchards distant from apple orchards symptoms of rusty spot were found indicating that further studies on speciation of powdery mildew in peach orchards are needed.

J. M. Ogawa, B. T. Manji, W. J. Moller, R. R. Sanborn, and L. Hendricks:

Presporodochial application of Benlate 50W with supreme oil in December suppressed development of sporodochia for the duration of the winter and bloom period in two large field experiments. This treatment gave suppression equivalent to those treated with sodium pentachlorophenate. The impact of this is that an alternate treatment besides monocalcium arsenate and sodium pentachlorophenate is available although the cost is higher. The advantage of Benlate is that it can be used before the rainy period and is compatible with dormant oils.

J. M. Ogawa, W. E. Yates, B. T. Manji and R. E. Cowden:

A single application of Topsin M applied at early petal stage of bloom controlled both Monilinia fructicola and Monilinia laxa blossom blight on stone fruits. A single aircraft application of Topsin M using only 10 gallons per acre controlled Monilinia laxa blossom blight on apricots. The disease control obtained was not significantly different from ground sprays of Topsin M or Benlate 50W applied at the rate of 100 gallons/acre.

D. E. Ravetto and J. M. Ogawa:

Preharvest spray applications or postharvest sprays or dips using Botran or benomyl resulted in penetration of these chemicals into fruit tissue. Penetration was determined by bioassays of tissue, injection of treated fruit with fungus pathogens, and chemical analyses of the fruit mesocarp tissues. Washing of the treated fruit reduced the amount of active chemical in the mesocarp and the penetration of the chemical increased with storage time.

B. Zoller:

The seasonal fire blight bacteria population in the middle Sacramento Valley in California pear orchards was studied. Random blossom samples (100 per sample) were collected from seven orchards (30-50 acres each) in the Yuba City area at weekly intervals from 1% bloom in early March through June 1972. Each orchard received approximately 5-day streptomycin or copper sprays during the first three months of this period. The average number of fire blight bacteria per blossom in each sample was determined by washing the blossoms in 0.1 M Phosphate buffer (pH 7.2) and plating portions of the wash fluid on Miller and Schroth's selective medium (with mannitol) for Erwinia species, and on the same medium containing 100 ppm streptomycin. All colony types were cross-checked for pathogenicity to green pear fruits.

In orchard I, which began the season under a streptomycin program, up to 4000 streptomycin-resistant fire blight bacteria per blossom were detected for four weeks beginning in mid-March. After the second week of detection, the orchard was brought under a copper control program. Although the population fell to 0 within three weeks, epidemic numbers of blight infections occurred in early April.

Orchard II received copper treatments through early April, followed by two streptomycin applications. Beginning at the time of these latter sprays, up to 2000 streptomycin resistant bacteria per blossom were detected. The population persisted even after copper applications were reinstituted. Epidemic numbers of infections occurred in this orchard in mid-April and again in early May.

Data collected from the remaining orchards showed lower bacterial populations of shorter duration. Only a few scattered infections occurred in these orchards during the entire season.

B. G. Zoller and J. Sisevich:

The seasonal fire blight bacteria population in an Upper Lake, California pear orchard was studied in an attempt to implement a spray program based on population and weather. Random blossom samples (300 per sample) from three five acre blocks were collected at weekly and sometimes daily intervals from 1% bloom in mid-March through June 1972. The average number of fire blight bacteria per blossom in each sample was determined by washing the blossoms in water and plating portions of the wash fluid on Miller and Schroth's selective medium (with mannitol) for Erwinia species. All colony types were cross-checked for pathogenicity to green pear fruits. Rainfall and temperature data for the city of Lake Port (eight miles south) were obtained from publications of the U. S. Department of Commerce. No blight control sprays (streptomycin) were instituted until first detection of the pathogen.

Although 6 bacteria per blossom were detected on April 24 in block I, first detection in block II was in epidemic numbers over 5000 per blossom (May 3) and did not occur until after the last frost of the season (April 29) or until the high temperature had risen above 80°F (May 1-3) or the average temperature had risen above 61°F (May 1-4) for the first time in the season. Bacteria were detected in block III on May 9 and 16 only. Although eight rainstorms occurred during the assay period, only two (May 8 and 16) fell during times when bacteria were present in the orchard and apparently resulted in blight infections. Eight blight infections were found in lock II, only, on May 17 and 29. Four sprays were given blocks I and III and five sprays given block II all during the period May 1 through May 22. No bacteria were detected from May 17 to the last assay on June 25. A third minor infection period occurred during a July rainstorm after cessation of the experiment.

Iain C. MacSwan:

Two rates (4 oz. and 8 oz.) of Benlate were tested in a one, two or three spray schedule to determine if all three regularly recommended bloom sprays are necessary to obtain acceptable control. Topsin M plus oil, captan, captan plus oil, Cela W524 (200 ppm and 250 ppm), and Bravo were tested under the regular three-spray schedule. Sprays were applied by handgun to single tree plots, replicated four times, in a mature Royal Anne-Corum sweet cherry orchard. Popcorn occurred on March 30, full bloom on April 10 and petal fall on April 18. One hundred blossoms per tree were rated as diseased or healthy on May 1, 1972.

All sprays and spray schedules produced significant reduction of brown rot blossom blight. Best control was obtained from three sprays of Benlate 8 oz/100 gal. Topsin M 3 oz. plus .5 gal. superior type oil/100 gal. applied at popcorn, full bloom and petal fall also provided excellent control. Two sprays of Benlate 4 oz/100 gal. provided slightly better control than three sprays. Two sprays of Benlate 8 oz/100 gal. resulted in control identical to that from three sprays of Benlate 4 oz/100 gal. Tests of Benlate at 4 oz. and 8 oz/100 gal. under the one, two or three bloom spray program warrants testing in 1973 in the hope that a reduction can be made in the number of bloom sprays recommended to growers. All other test fungicides - Topsin M, Captan plus oil, Cela W524 and Bravo W75 warrant further testing.

Treatment and rate per 100 gallons	Percent brown rot blossom blight
Benlate 50 wp, 8 oz. (popcorn, full bloom, petal fall).	3.0
Topsin M 70 wp, 3 oz. + .5 gal. superior type oil (popcorn, full bloom, petal fall)	4.2
Benlate 50 wp, 4 oz. (popcorn, full bloom).	5.0
Benlate 50 wp, 8 oz. (popcorn, full bloom).	5.2
Benlate 50 wp, 4 oz. (popcorn, full bloom, petal fall).	5.2
Benlate 50 wp, 8 oz. (popcorn).	6.5
Captan 50 wp, 2 lbs. + 2 oz. Biofilm (popcorn, full bloom, petal fall). . . .	6.7
Captan 50 wp, 8 oz. + .5 gal. superior type oil (popcorn, full bloom, petal fall).	7.5
Cela W524 20% EC, 16 fl. oz. (250 ppm) (popcorn, full bloom, petal fall). . .	7.7
Bravo 6F 54% EC, 1.5 pt. (popcorn, full bloom, petal fall).	7.7
Bravo W75 75 wp, 1.5 lbs. + 2 oz. Biofilm (popcorn, full bloom, petal fall) .	8.0
Benlate 50 wp, 4 oz. (popcorn).	8.5
Cela W524 20% EC, 12 fl. oz. (200 ppm) (popcorn, full bloom, petal fall). . .	9.2
Check	22.5
LSD .05	6.00

Iain C. MacSwan:

The test was designed to evaluate the effect of some of the commonly available (in Oregon) surfactants when added to one of the recommended fungicides, captan, for control of brown rot blossom blight. Each surfactant was used at two rates, the commonly recommended rate and four times that rate, e.g., if the surfactant is recommended at the rate of 2 oz. per 100 gal., it was used at 2 oz. and 8 oz. per 100 gallons. Sprays were applied by handgun to single tree plots, replicated four times, on mature Black Republican Sweet Cherry trees. The sprays were applied at 60% bloom (March 27), full bloom (April 3) and petal fall (April 13). One hundred blossoms per tree were rated as diseased or healthy on May 1, 1972.

Sprays of captan 50 wp at the rate of 2 lbs. per 100 gal. provided good control of brown rot blossom blight. Neither the low nor high rate of any of the test surfactants when used with captan 50 wp increased significantly the effectiveness of captan alone for control of brown rot blossom blight.

Treatment and rate per 100 gallons	Percent brown rot blossom blight
Captan 50 wp, 2 lbs. + 8 oz. Triton B 1956.	3.0
Captan 50 wp, 2 lbs. + 8 oz. Plyac.	3.7
Captan 50 wp, 2 lbs. + 2 oz. Multifilm X77.	3.7
Captan 50 wp, 2 lbs. + 8 oz. Miltifilm X77.	3.7
Captan 50 wp, 2 lbs. + 2 pts. Regulaid.	4.0
Captan 50 wp, 2 lbs. + 2 oz. Plyac.	4.0
Captan 50 wp, 2 lbs. + 1 pt. Nufilm 17.	4.2
Captan 50 wp, 2 lbs. + 1 gal. Regulaid.	4.7
Captan 50 wp, 2 lbs. + 8 oz. Biofilm.	5.0
Captan 50 wp, 2 lbs. + 2 oz. Biofilm.	5.2
Captan 50 wp, 2 lbs. + 4 pt. Nufilm 17.	5.2
Captan 50 wp, 2 lbs. + 2 oz. Triton B 1956.	5.2
Captan 50 wp, 2 lbs.	5.2
Check	25.7
LSD .05	3.76

Iain C. MacSwan:

Sprays were applied by handgun to two-row plots of eleven year old Black Republican trees on November 23, 1971, and February 7, 1972. Each plot contained eighteen trees. Assessment of disease was made on three trees in each plot selected at random on June 14, 1972, by rating 100 buds produced in 1971 as diseased or healthy.

The very cool, wet spring resulted in heavy infections in most trees. Under these conditions the two sprays of the bactericides were not sufficient protection. A third spray in March probably would have provided additional protection. Bordeaux, Buckman HPMTS plus WSCP and Kocide 101 plus oil apparently provide equal control of dead bud.

Treatment and rate per 100 gallons	Percent buds with dead bud
Bordeaux 12-12-100.	37.5
Buckman HPMTS 50 wp, .5 gal. + .33 gal. WSCP.	44.3
Kocide 101 86 wp, 6 lbs. + 1 pt. oil.	45.6
Citcop 4 EC, 6 qts.	53.3
Check	53.6
LSD .05	12.31

Iain C. MacSwan:

In 1971, the application of Difolatan Flowable at the rate of 3 qts. per 100 gal. of water applied in early November provided a significant decrease in Coryneum fruit spot even though the regular shuck fall spray was not applied. The 1972 test was designed to test the efficacy of the commonly available copper fungicides, when applied only in the fall for Coryneum fruit spot control. Sprays were applied by handgun sprayer at the rate of 400 gallons per acre to four blocks of nineteen year old Improved Elberta trees on October 29, 1971. Each block contained twenty trees, with one block of ten serving as check. A wet, cold bloom period and subsequent low numbers of fruit produced in each block allowed us to assess on September 2, 1972,

only 100 fruits from each block as diseased or healthy. The whole orchard received leaf curl sprays of Bordeaux 12-12-100 on December 22, 1971, and January 14, 1972.

None of the fungicides applied in the fall (October 29) were able to reduce Coryneum fruit spot to an acceptable level.

Treatment and rate per 100 gallons	Percent fruit with blight
Kocide 86 wp, 5 lbs. + 1 gal.superior type oil.	51.0
Bordeaux 8-8-100.	54.0
Citcop, 4 EC, 6 qts	64.0
Tribasic 50% wp, 5 lbs. + 1 gal. superior type oil.	82.0
Check	81.0

Iain C. MacSwan:

The test was designed to evaluate the effect of some of the commonly available (in Oregon) surfactants when added to one of the recommended fungicides, Cyprex, for control of brown rot blossom blight. Each surfactant was used at two rates, the commonly recommended rate and four times that rate, e.g., if the surfactant is recommended at the rate of 2 oz. per 100 gal., it was used at 2 oz. and 8 oz. per 100 gal. Sprays were applied by handgun to single tree plots, replicated four times, of nine year old Improved Elberta trees at popcorn (March 16), full bloom (March 21) and petal fall (March 28). One hundred blossom remnants per tree were rated as diseased or healthy on April 27, 1972. Wettable Bravo and Flowable Bravo were applied at full bloom and petal fall only.

NuFilm at 2 oz. and 8 oz. with Cyprex and at 8 oz. with Ortho Spreader Sticker caused the mixtures to coagulate and deposit large globs of the fungicides at the bottom of the spray tank. As a result, the amount of these fungicides applied in each spray is unknown. Although Multifilm X77 at 8 oz., Biofilm at 2 oz. and Regulaid at 2 pts. per 100 gal. when added to Cyprex 65 wp show promise of increasing efficacy of Cyprex, none of the surfactants at either the low or high rate significantly increased control.

Treatment and rate per 100 gallons	percent brown rot blossom blight
Cyprex 65 wp, .5 lb. + 8 oz. Multifilm X77.	6.7
Cyprex 65 wp, .5 lb. + 2 oz. Biofilm.	8.0
Cyprex 65 wp, .5 lb. + 2 pts. Regulaid.	8.0
Cyprex 65 wp, .5 lb. + 8 oz. Biofilm.	11.5
Cyprex 65 wp, .5 lb. + 2 oz. Multifilm X77.	16.0
Cyprex 65 wp, .5 lb. + 1 gal. Regulaid.	16.6
Cyprex 65 wp, .5 lb. + 4 pts. Nufilm 17	21.2
Cyprex 65 wp, .5 lb..	25.7
Cyprex 65 wp, .5 lb. + 2 oz. Plyac.	29.7
Cyprex 65 wp, .5 lb. + 1 pt. Nufilm 17.	31.5
Cyprex 65 wp, .5 lb. + 8 oz. Plyac.	31.7
Cyprex 65 wp, .5 lb. + 8 oz. Ortho Spreader-Sticker	32.6
Cyprex 65 wp, .5 lb. + 2 oz. Ortho Spreader-Sticker	34.0
Wettable Bravo 75 wp, 1.5 lbs. + 2 oz. Biofilm (full bloom, petal fall sprays only.	38.2
Captan 50 wp, 2 lbs. + 2 oz. Biofilm (popcorn and full bloom sprays only - applied by air blast sprayer)	39.6
Flowable Bravo, 54% EC, 1.5 lbs. (full bloom and petal fall sprays only)	41.0
LSD .05	20.40

Iain C. MacSwan

Two sprays were applied by handgun to 20 tree plots of mature Elberta peach trees. Lime sulfur, 10 gal/100, Bordeaux 12-12-100 and Cela W524 20% EC, 250 ppm, were applied December 17, 1971, and January 13, 1972. Because of heavy rains, the first spray of the other test materials, Kocide 101, 5 lbs. plus 1 gal. superior type oil, Tribasic, 5 lbs. plus 1 gal. superior type oil, Cyprex, 2 lbs. plus 12 oz. Biofilm and Ferbam 3 lbs. plus 12 oz. Biofilm were not applied until December 27. The second spray on these plots was applied January 14, 1972. Cyprex and Ferbam plots consisted of five trees each; check plot had 7 trees. Bordeaux 8-8-100 was applied by airblast sprayer to all trees for Coryneum control on November 3, 1971. One hundred leaves, selected at random, were assessed as diseased or healthy on each of three trees in each block on June 1, 1972.

All test fungicides provided significant reduction of leaf curl over that of the check trees, but acceptable control was obtained only in blocks sprayed with Ferbam 76 wp, 3 lbs. plus 12 oz. Biofilm or Cyprex 65 wp, 2 lbs. plus 12 oz. Biofilm.

Treatment and rate per 100 gallons	Percent leaf curl
Ferbam 76 wp, 3 lbs. + 12 oz. Biofilm.	6.3
Cyprex 65 wp, 2 lbs. + 12 oz. Biofilm.	7.3
Lime Sulfur, 10 gal.	13.0
Kocide 101 86 wp, 5 lbs. + 1 gal. superior type oil.	16.6
Bordeaux 12-12-100	19.0
Tribasic 50 wp, 5 lbs. + 1 gal. superior type oil.	20.0
Cela W524 20% EC 250 ppm (475 ml/100).	35.6
Check.	66.0
LSD .05	8.61

Iain C. MacSwan:

Sprays were applied by handgun to single tree plots replicated four times of fourteen year old Improved Elberta trees. The test was designed to test two rates of Cela W524 20% EC, two rates of Benlate 50 wp and the optimum time for the application of Benlate 50 wp - popcorn only or popcorn plus full bloom or popcorn, full bloom and petal fall sprays. Spray dates: popcorn (March 16) full bloom (March 20) and petal fall (March 28). One hundred blossom remnants per tree were rated as diseased or healthy on April 27, 1972.

All treatments, including the one spray or two sprays of Benlate, provided excellent control of brown rot blossom blight.

Treatment and rate per 100 gallons	Percent brown rot blossom blight
Benlate 50 wp, 1 lb. (popcorn and full bloom).	.31
Benlate 50 wp, 2 lbs. (popcorn and full bloom)	.45
Benlate 50 wp, 2 lbs. (popcorn, full bloom, petal fall).	.65
Benlate 50 wp, 2 lbs. (popcorn only)	.72
Benlate 50 wp, 1 lb. (popcorn, full bloom, petal fall)	.81
Benlate 50 wp, 1 lb. (popcorn only)	1.10
Cela W524 20% EC, 150 ppm.	1.50
Cela W524 20% EC, 200 ppm.	2.60
Check.	31.20
LSD .05	11.70

S E C T I O N V I

DISEASES OF POME FRUITS

R. P. Covey:

The control of apple powdery mildew on foliage achieved by sprays of Topsin E, Topsin M, Celia 70203, and Afugan was not significantly different from the standard Karathane spray program. These materials reduced mildew russet on the fruit when compared to the check, but all treatments except Celia 70203 had significantly more mildew russet than Karathane.

D. L. Coyier and S. B. Kelly:

Apple seedlings were treated with dilute fungicide sprays and evaluated for control of powdery mildew. Four sprays were applied at weekly intervals in each of two tests. Spraying commenced on May 10, 1972 for the first test and June 14, 1972 for the second. The plants were grown in 1-gallon cans and removed from the growing area during the spray operation to eliminate cross contamination of fungicides due to spray drift. The treatments were applied with a handgun sprayer at 250 psi and sprayed to the "drip" stage. The position of each of 10 single-tree replicates per treatment was rerandomized following each treatment to reduce position effect. Heavily mildewed apple seedlings were placed adjacent to each group of treated plants and the conidia were discharged daily with a compressed air jet nozzle. The plants were grown under heavy shade to increase the incidence of powdery mildew. Powdery mildew was rated 0-50 according to severity and converted to percentage disease control. The disease ratings were made on June 8 and July 12, 1972 for tests 1 and 2, respectively.

Three recently introduced fungicides provided excellent control of powdery mildew in these tests. Afugan controlled the disease at rates of 4, 8, and 16 oz. per 100 gal. but its effectiveness was significantly reduced when the dosage was lowered to 2 oz. per 100 gal. Cela W524 provided near complete control of the disease at 16 oz. per 100 gal. BAY DAM 18654 and the lower rates of Karathane and Morestan resulted in marginal disease control. None of the compounds used in the first test caused visible plant damage. A rating of 85-100 percent disease control is considered satisfactory performance in these tests.

A second test was conducted to include a compound not available previously and to re-examine Afugan and Cela W524. Conditions were essentially identical for both tests. Average minimum and maximum temperatures during the second test were 11.8°C and 25.6°C, respectively, compared with 11.4°C and 26.4°C in the first test. During each test period the temperature exceeded 32°C on only two days.

RP-23060 provided 100 percent disease control at both rates tested but plants sprayed with this chemical developed smaller leaves and were generally more chlorotic than unsprayed plants. A rate lower than 1 pt./100 gal. would be appropriate for future tests on apples. The difference in disease control between Afugan (4 oz./100 gal.) and Cela W524 (16 oz./100 gal.) was significant in the second test but not in the first.

In addition to the efficacy test, an Afugan phytotoxicity test was conducted on mature, bearing apple and pear trees. Pear cultivars d'Anjou and Bartlett and apple cultivars Red Delicious, Golden Delicious and Newtown were sprayed with 7 oz. per 100 gal. of Afugan, 30% EC. The pears were sprayed at prebloom, immediately postbloom and twice during early fruit development. The apples were sprayed on the same schedule as pears with the exception of the final spray, which was omitted. No damage to fruit or foliage of these cultivars was observed following treatment with Afugan.

D. L. Coyier and S. B. Kelly: (continued)

Test No. 1
(May 10-June 8, 1972)

Treatment and rate per 100 gallons	Powdery mildew rating (Total of 10 reps)	% Disease control
Cela W524, 20 EC, 16 oz.	2	99
Afugan, 30 EC, 16 oz.	15	96
Afugan, 30 EC, 8 oz.	28	92
Afugan, 30 EC, 4 oz.	37	90
Karathane, 25 W, 8 oz.	40	89
Morestan, 25 W, 4 oz.	47	87
Karathane, 37 EC, 4 oz.	63	83
BAY DAM 18654, 50 W, 16 oz.	124	66
Morestan, 25 W, 2 oz.	128	65
Afugan, 30 EC, 2 oz.	139	61
BAY DAM 18654, 50 W, 8 oz.	143	60
Check (Water sprayed)	264	27
Check (Unsprayed)	360	--
LSD .05	58	16

Test No. 2
(June 14-July 12, 1972)

Treatments and rate per 100 gallons	Powdery mildew rating (Total of 10 reps)	% Disease control
RP-23060, EC, 3 pt.	0	100
RP-23060, EC, 1 pt.	0	100
Afugan, 30 EC, 4 oz.	0	100
W524, 20 EC, 16 oz.	53	88
Check (Water sprayed)	350	20
Check (Unsprayed)	435	--
LSD .05	27	6

D. L. Coyier and S. B. Kelly:

Two tests were conducted to evaluate bactericides for control of fireblight on pears. Ten Bartlett pear trees were selected for each of four treatment groups. The plants were grown in one-gallon cans under Saran^{R} shade and removed from the growing area for treatment. An intermittent mist system was installed to enhance disease development. Inoculation was accomplished by injection of the bacteria (Erwinia amylovora - 10^5 cells/ml) into shoot tips with a hypodermic syringe.

Plants in the first test were treated on May 31, June 2, 6 and 9, 1972 with the concentration of bactericide shown in the following table. They were inoculated on May 12, 1972 and the intermittent mist system was activated for the ensuing 48 hrs. On July 12, 1972 an evaluation

D. L. Coyier and S. B. Kelly: (continued)

of fireblight infection was made to compare efficacy of the various treatments. The length of stem tissue invaded by the bacterium was measured and recorded. The amount of tissue invaded varied widely from plant to plant within treatments and only those plants treated with streptomycin had statistically less blight infection than did untreated plants. However, all untreated plants developed blight while the disease appeared on 8 of 10 plants treated with MBR-10995 and HPMTS. Only 6 of 10 plants treated with streptomycin developed fireblight symptoms. The results are shown in the following table:

Treatment and dosage (A. I.)	Total tissue infected (inches)	Range[1/] (inches)	No. plants Infected	No. plants Healthy
Streptomycin, 21 W, 100 ppm	32.50	12.0	6	4
HPMTS, 50 W, 600 ppm	52.00	8.8	8	2
MBR-10995, 25 W, 600 ppm	68.75	14.0	8	2
Check (No treatment)	74.75	9.0	10	0
LSD .05	42.90	---	--	-

[1/] Greatest difference observed in extent of fireblight infection within a given treatment.

A second test was conducted in a manner similar to the first with the exception that two additional sprays were applied after inoculation. In addition, ABG-1000 was substituted for HPMTS. Plants treated with HPMTS developed considerable phytotoxicity in the first test. Treatments were applied July 18, 21, 24, and 27 and were inoculated July 28. Intermittent mist was applied for 48 hours following inoculation and further treatments were applied on July 31 and August 3, 1972. An evalution of blight development was made August 22, 1972.

No fireblight developed in plants treated with MBR-10995 and only one plant treated with streptomycin was infected. ABG-1000 did not provide significant fireblight control under conditions described in this test. Post-inoculation treatment enhanced control compared with results shown in the earlier test. Further studies should be conducted to compare pre- and post-inoculations. The results of this test are given in the following table:

Treatment and Dosage (A. I.)	Total tissue infected (inches)	Range[1/] (inches)	No. plants Infected	No. plants Healthy
MBR-10995, 25 W, 600 ppm	0.0	0.0	0	10
Streptomycin, 21 W, 100 ppm	9.5	9.5	1	9
ABG-1000, 25 ppm	49.0	12.0	6	4
Check (Untreated)	51.5	12.0	9	1
LSD .05	32.8	--	--	--

[1/] Greatest difference observed in extent of fireblight infection within a given treatment.

These results indicate that ABG-1000 does not act as a systemic bactericide. However, it may control fireblight under normal field conditions. Streptomycin and MBR-10995 appear to have systemic activity. No phytotoxicity was observed on the foliage of plants treated with ABG-1000 although chlorosis of the leaves has been reported previously when the cumulative dosage exceeds 100 ppm.

List of Chemicals Used and Suppliers:

ABG-1000 - Chemistry unavailable, antibiotic; Abbott Laboratories.

AFUGAN - (HOE-2873) 2-(o,o-Diethyl thionophosphoryl) - 5-methyl-6-carbethoxy-pyraxolo [1,5-a] pyrimidine, 30% EC. American Hoechst Corporation.

BAY DAM 18654 - Methyl [1- [[(5-cyanpentyl) amino] carbonyl] -1H-benzimidazol-2yl] carbamate, 50W. Chemagro Corporation.

CELA W524 - (CA-70,203, triforine). Piperazin-1, 4-diyl-bis [1-(2,2,2-trichloroethyl) formamide] , 20% EC. Cela Landwirtschaftliche Chemikalien Gesellschaft MBH.

HPMTS - 2-hydroxypropyl methanethiolsulfonate, 50 W; Buckman Laboratories, Incorporated.

KARATHANE - dinocap; Rohm and Haas Co.

MBR-10995 - Chemistry unavailable, 25 W; Minnesota Mining and Manufacturing Company.

MORESTAN - 6-Methyl -2,3-quinoxalinedithiol cyclic S,S-dithiocarbamate, 25 W; Chemagro Corp.

RP-23060 - 1 Methyl-5 carbamic acid butyl ester-11-dihydro-(10f, 11b) dibenzo azepinc, 1.67 lb/gal. Rhodia Inc., Chipman Division.

STREPTOMYCIN - Streptomycin sulfate, 21.2%, antibiotic; Merck and Co.

Iain C. MacSwan:

Sprays were applied by handgun to single tree plots, replicated three times of mature Red Delicious trees at pre-pink (April 14), first bloom (April 26), calyx (May 4) and first cover (June 17). Approximately one hundred leaves per tree were rated as diseased or healthy on September 19, 1972. Exceptionally wet and cold weather during bloom resulted in a very small crop. Apples were too few for assessment of fruit scab. Insecticides, applied to all trees by airblast spayer: liquid lime sulfur, 3 gal. plus 2 gal. dormant oil per 100 gal. of spray applied March 15; Guthion .75 lb. plus 2 oz. Biofilm per 100 gal. of spray applied June 12 and July 10.

Weather conditions resulted in relatively long periods between spray applications. Under the conditions of this test all trees had an unacceptable amount of leaf scab. The following fungicides provided better control than the 'standards'; Cyprex or ferbam; Topsin M 70 wp at .75 lb., Cela W524 20% EC at 250 ppm, BAS 3460F 50 wp at 8 oz. and Cela W524 20% EC at 200 ppm. All warrant further testing.

Treatment and rate per 100 gallons	Percent leaf scab
Topsin M 70 wp, .75 lb.	11.0
Cela W524 20% EC, 16 fl. oz. (250 ppm)	13.0
BAS 3460F 50 wp, 8 oz	16.6
Cela W524 20% EC 12 fl. oz. (200 ppm)	17.3
Topsin M 70 wp, 3 oz. + .5 gal. superior type oil	23.3
Ferbam 76 wp, 1.5 lbs. + 2 oz. Biofilm.	36.0
Cyprex 65 wp, .75 lb. + 2 oz. Biofilm	37.0
Check	44.6
LSD .05	15.64

Iain C. MacSwan

Sprays of BAS 3460 F 50 wp, Benlate 50 wp and Karathane 25WD were applied by handgun to single tree plots, replicated three times of mature Jonathan trees at prepink (April 3), pink (April 13), calyx (May 1) and first cover (May 30). Sprays of Afugan 30% EC were applied approximately every fourteen days - April 3, 17, May 1, 18, June 1, 15, 20, July 13 and August 3. Benlate 50 wp plus NuFilm 17 was applied only twice - April 3 and 13. On both dates the mixture coagulated and large globs were deposited on the bottom of the tank. Readings of terminals (100 per tree in each of three replicates) were made on September 19 and of fruit for russet on September 22 (Harvest).

Powdery mildew: All treatments including the Benlate plus NuFilm 17 mix which coagulated, provided control equal to that of the 'standard' Karathane. Fruit russet: none of the treatments significantly affected the incidence of fruit russet.

Treatment and rate per 100 gallons	percent mildew	percent fruit russet
BAS 3460F 50 wp, 8 oz. (4 sprays).	8.3	35.2
Afugan 30% EC, 6.7 fl. oz. (9 sprays) approximately every 14 days	9.0	58.1
Benlate 50 wp, 8 oz. + pt. NuFilm 17 (2 sprays).	9.3	50.9
Afugan 30% EC, 13 fl. oz. 1st spray then 6.7 fl. oz. approx. every 14 days (9 sprays)	9.6	40.4
Benlate 50 wp, 8 oz. + 2 oz. Biofilm (4 sprays).	11.0	33.3
Karathane 25 WD, .75 lb. + 2 oz. B 1956 (4 sprays)	11.6	44.0
Check.	23.0	54.6
LSD .05	7.46	21.14

Iain C. MacSwan:

Sprays were applied by handgun to single tree plots replicated three times of mature Rome trees at pink (April 25), full bloom (May 2), calyx (May 12) and first cover (June 15). Afugan sprays were also applied at 2nd cover (June 29), 3rd cover (July 13) and August 8. Dates of disease readings: powdery mildew (100 terminals per tree), September 18, 1972; leaf scab (100 leaves per tree), September 19, 1972; fruit scab and russet (200 fruits per tree) on November 2, 1972. (Harvest).

Fruit Scab: The long period between application of the calyx spray (May 12) and first cover (June 15), because of rainfall, resulted in unacceptable fruit scab control by any of the treatments. Best control was obtained from sprays of three Benlate 50 wp plus superior type oil combinations, Topsin M 70 wp .75 lb/100 gal. and Cyprex 65 wp .75 lb. plus Karathane 25 WD .75 lb/100 gal. Leaf Scab: Lowest incidence of leaf scab occurred in plots sprayed with three Benlate 50 wp plus superior type oil combinations, Cyprex 65 wp .75 lb. plus .75 lb. Karathane 25 WD/100 gal., Topsin M 70 wp .75 lb/100 gal. and Cela W524 20% EC at 250 ppm. Powdery mildew: best control was provided by Karathane plus Cyprex, Afugan 30% EC 13 fl. oz/100 applied at delayed dormant then 6.7 fl. oz. every fourteen days, Topsin M 70 wp .75 lb/100 gal., Cela W524 20% EC at 200 ppm and 250 ppm, and Benlate 50 wp at 4 oz. plus 1.5 gal. superior type oil. Fruit russet: sprays of Cyprex plus Karathane, Polyram or Benlate 50 wp 4 oz. plus 1.5 gal. superior type oil reduced fruit russet.

Treatment and rate per 100 gallons	Percent Fruit Scab	Percent Leaf Scab	Percent Powdery Mildew	Percent Fruit Russet
Benlate 50 wp. . . . . Delayed Dormant, 4 oz. + 1.5 gal. superior type oil. . . . . Pink, 4 oz. + 1.5 gal. oil . . . . . Petal fall, 4 oz. + 1.5 gal. oil . . . . 1st cover, 4 oz. + 1.5 gal. oil.	9.9	17.3	4.6	5.5
Benlate 50 wp. . . . . Delayed Dormant, 4 oz. + 1.5 gal. superior type oil. . . . . Pink, 4 oz. + .5 gal. oil. . . . . Petal fall, 4 oz. + .5 gal. oil. . . . . 1st cover, 4 oz. + .5 gal. oil	11.3	18.3	5.3	7.2
Topsin M 70 wp .75 lb	19.4	20.3	3.3	13.6
Benlate 50 wp. . . . . Delayed Dormant, 2 oz. + 1.5 gal. superior type oil. . . . . Pink, 4 oz. + .5 gal. oil. . . . . Petal fall, 4 oz. + .5 gal. oil. . . . . 1st cover, 2 oz. + .5 gal. oil	22.2	16.0	5.6	7.2
Cyprex 65 wp .75 lb. + Karathane 25 WD .75 lb. + 2 oz. Biofilm.	23.4	12.3	3.6	4.0
Cela W524 20% EC 16 fl. oz. (250 ppm). . .	33.6	21.6	4.0	14.7
Benlate 50 wp, 8 oz. + 1 pt. NuFilm 17 . .	40.9	31.0	6.0	11.4
Benlate 50 wp, 8 oz. + 2 oz. Biofilm . . .	47.4	25.0	6.3	10.4
Cela W524 20% EC 12 fl. oz. (200 ppm). . .	52.3	27.0	4.0	7.9

Treatment and rate per 100 gallons	Percent Fruit Scab	Percent Leaf Scab	Percent Powdery Mildew	Percent Fruit Russet
Polyram, 2 lbs. 80 wp at green tip, prepink, pink, calyx, and 1.5 lbs. 80 wp at 1st, 2nd and 3rd covers.	54.5	25.3	---	6.3
Topsin M 70 wp, 3 oz. + .5 gal. oil	79.0	27.6	6.0	9.8
Afugan 30% EC 13 fl. oz. for first spray then 6.7 fl. oz. every 14 days. . . .	92.2	30.3	3.6	12.2
Afugan 30% EC 6.7 fl. oz. every 14 days . . .	96.7	28.3	9.3	10.6
Check	94.4	35.5	9.9	16.4
LSD .05	16.60	11.67	4.45	9.33

CONTRIBUTORS TO ABSTRACTS OF THE
47th ANNUAL WESTERN COOPERATIVE SPRAY PROJECT

Anthon, Edward W., Tree Fruit Experiment Station, Washington State University, Wenatchee, Washington 98801
Baird, Craig, Department of Entomology, Washington State University, Pullman, Washington 99163
Banham, F. L., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
Barnes, M. M., Department of Entomology, University of California, Riverside, California 92507
Beroza, M., USDA-ARS Yakima, Washington 98902
Batiste, William C., Department of Entomology, University of California, Berkeley, California 94720
Barnett, W. W., Box 592 Yuba City, California 95991
Booher, L. J., University of California, Berkeley, California 94720
Bruce, D., Department of Entomology, University of California, Riverside, California 92507
Burts, Everett, Tree Fruit Experiment Station, Washington State University, Wenatchee, Washington 98801
Butt, B. A., USDA, ARS, Entomology Research Division, Yakima, Washington 98902
Cameron, H. R., Department of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon
Chaney, D. H., Box 592 Yuba City, California 95991
Coyier, Duane L., USDA, ARS, Hood River, Oregon 97031
Covey, Ronald P., Tree Fruit Research Center, Wenatchee, Washington 98801
Cowden, R. E., Department of Plant Pathology, University of California, Davis, California 95616
Culver, D., Department of Entomology, University of California, Riverside, California 92507
Davis, C. S., Extension Entomologist, University of California, Berkeley, California 94720
Davis, Donald W., Utah State University, Logan, Utah 84321
Dibble, J.E., University of California, Berkeley, California 94720
Downing, R. S., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
Eves, Jack, Irrigated Agricultural Research and Extension Center, Washington State University, Prosser, Washington 99350
Fields, Gary J., Mid-Columbia Branch Experiment Station, Hood River, Oregon 97031
Gaunce, A. P., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
Hathaway, D. O., USDA, ARS, Entomology Research Division, Yakima, Washington 98902
Helton, A. W., Department of Plant and Soil Science, University of Idaho, Moscow, Idaho 83843
Hendricks, L., Department of Plant Pathology, University of California, Davis, California 95616
Hoyt, Stanley C., Washington State University, Wenatchee, Washington 98801
Hutt, R. B., USDA, ARS, Entomology Research Division, Yakima, Washington 98902
Johansen, Carl, Department of Entomology, Washington State University, Pullman, Washington 99163
Jones, R. A., University of California, Research and Extension Center, Parlier, California 93648
Joos, John S., University of California Extension, Santa Rosa, California 95401
Keenan, L. C., USDA, Irrigated Agricultural Research and Extension Center, Prosser, Washington 99350
Kelly, Scott B., USDA, ARS, Hood River, Oregon 97031
LaRue, J. H., University of California, Berkeley, California 94720
MacSwan, Iain C., Plant Pathologist, Oregon State University, Corvallis, Oregon 97331
McDonough, L. M., USDA, ARS, Yakima, Washington 98902
McMechan, A. D., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
McMullen, R. D., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
Madsen, Harold F., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
Manji, Billy T., Department of Plant Pathology, University of California, Davis, California 95616
Mayer, D. F., Department of Biological Sciences, Simon Fraser University, Burnaby 2, B. C.
Moffitt, H. R., USDA, ARS, Entomology Research Division, Yakima, Washington 98902
Moller, W. J., University of California, Davis, California 95616
Morgan, C. V. G., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
Ogawa, J. M., Department of Plant Pathology, University of California, Davis, California 95616
Phillips, P., Department of Entomology, University of California, Riverside, California 92507
Post, G. R., Box 592, Yuba City, California 95991
Proverbs, M. D., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
Ravetto, D. E., Department of Plant Pathology, University of California, Davis, California 95616
Rice, R. E., University of California, Research and Extension Center, Parlier, California 93648
Sanborn, R. R., Department of Plant Pathology, University of California, Davis, California 95616.
Twilleager, D., University of California, Berkeley, California 94720
Vakenti, J., Entomology Laboratory, Canada Department of Agriculture, Summerland, B. C.
White, L. D., USDA, ARS, Entomology Research Division, Yakima, Washington 98902.
Yates, W. E., Department of Plant Pathology, University of California, Davis, California 95616.
Zoller, Broc, P. O. Box 952, Yuba City, California 95991.
Zwick, R. W., Mid-Columbia Branch Experiment Station, Hood River, Oregon 97031.