ABSTRACTS OF REPORTS FROM THE 51st WESTERN ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE

Imperial Hotel, Portland, Oregon

January 12-13-14, 1977

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

Abstracts of Reports from the
51th Annual Western Orchard Pest and Disease Management Conference

TABLE OF CONTENTS

S E C T I O N I

LEPIDOPTEROUS INSECTS

Discussion Leader -- John Quist

CODLING MOTH -- APPLES

S. C. Hoyt:

Dimilin at 4 or 8 ounces per 100 gallons of water in 2 applications, or Dimilin at 2 ounces in 3 applications provided control equivalent to 3 applications of Guthion at 3 ounces per 100. Mobil 9087 also provided control of codling moth, but its use resulted in higher mite populations than other treatments and in a prolonged woolly apple aphid problem.

Attempts to determine when first eggs were laid were unsuccessful. This may have been due to the cool weather and delayed activity of codling moth. Examinations for eggs were discontinued in early June, and first entries were not observed until June 14, about 20 days later than normal.

M. D. Proverbs:

Radiation sterilized male and female codling moths were released in about 800 acres of apples and pears (70 orchards) in the Similkameen Valley. Each orchard received sterile moths 2 or 3 times weekly and release was from dune buggies. About 9.8 million moths were produced on artificial diet, 80% sterilized and released, 15% used for colony maintenance and 5% used for experiments. At harvest, codling moth injury in the release area was appreciably less than in 1975 when sprays were used.

H. F. Madsen:

Male removal gave successful control for the 4th consecutive year in an isolated high density apple orchard. Traps at a density of 10 per hectare caught a total of 24 male moths and harvest infestation was less than 0.1%. In a 1 hectare apple orchard with a high infestation, 36 traps (1 per 4 trees) caught 992 male moths during the season and reduced the percent injured fruit from 42 in 1975 to 10.4.

Penncap E, NRDC and Dylox gave good control of the codling moth in 2 locations.

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

The IGR Dimilin was as effective in 3 early cover sprays as azinphosmethyl and methyl parathion in 4 covers under low infestation rates. Two covers of Dimilin were less effective but gave considerable protection. SD43775 was as effective as standard materials. In a mixed variety planting codling moth attack was: Bartlett Red Delicious Newtown d'Anjou. In an unsprayed portion of an adjacent sprayed apple block a pheromone trap averaged 1.4 males/day seasonally with 11.5% stings and entries in Golden Delicious at harvest.

Philip S. McNally:

The codling moth model developed by researchers at UC Berkeley was evaluated using two unsprayed apple orchards in Oak Glen, California. To monitor adult flight, three pheromone traps were placed in one orchard (6 ha.) and two traps in the other orchard (1 ha.). Larval abundance was monitored by random fruit sampling (400 weekly from the larger orchard and 100 weekly from the smaller orchard) and by tree banding (10 in each orchard). Pupae were also monitored by banding trees. Early in the season, the sampling procedures were not adequate to detect any stages but the adult stage. Maximum-minimum thermometers and hygrothermographs were placed in various positions in the two orchards and their respective day-degrees were claculated. A hygrothermograph that was placed in a shelter in the open accumulated significantly more day-degrees than any of the thermometers placed in trees, while a hygrothermograph placed in the shade of a tree accumulated significantly fewer day-degrees than any of the thermometers placed in trees. Of the thermometers placed in the trees, those placed near the ground accumulated significantly more day-degrees than thermometers placed six feet above the ground. At present it seems that day-degree accumulations using an average of thermometers near ground level and at a height of 6 feet within trees best reflects codling moth development.

A regression analysis was performed with the temperature at civil twilight on the daily maximum temperature required to yield a corresponding civil twilight temperature of 60°F (the adult flight threshold) was estimated at 76°F. A correlation between adult flight and infested fruit was detected this year and will be studied in more detail next year.

M. T. AliNiazee:

The codling moth populations were monitored using Zoecon's pheromone traps baited with Codlemone®. In the Willamette Valley, Oregon, the first moths appeared on May 4, 1976, and peak emergence occurred in the second week of May. Later moth flights were overlapping with a rather sharp peak towards the end of August, indicating the emergence of second generation adults. Various experimental compounds were tested against the codling moth. Among the tested compounds, Guthion at 1.5 lb. AI/acre rate, and SD 43775 at a rate of 18 oz. actual/acre reduced the infestation level from a 26% in untreated control to about 1% in treated blocks. Guthion, at a much reduced rate, 0.3 lb. AI/acre, Imidan and Zolone, at 1.5 lb. AI/acre, obtained moderately effective control.

CODLING MOTH -- APPLES AND PEARS

D. O. Hathaway, L. M. McDonough, and D. A. George:

In laboratory tests it has been found that the evaporation rate of one mg of acetate of 8,10 dodecadienol from rubber septa gave a half-life of 46 days. The rate constant for this half-life is 6.3×10^{-4}/hr.

Several separate field tests were conducted to determine the number of males trapped as a function of concentration. Sector I® traps were placed in the center of young apple trees upon which were attached approximately 25 no. 1 red rubber sleeve stoppers. At a concentration of 2.65 mg/septa the acetate of 8,10 dodecadenol inhibited the response of males to traps over a 7-week period at the following percent inhibition from 1, 5, 8, 12, 15, 23, 29, 33, 39, 43, and 50 days was 94, 96, 91, 90, 90, 92, 93, 94, 93, 92, and 90 percent, respectively. In another test the septa were treated with 0.582 mg of the acetate. The percent inhibition from 3, 6, 7, 12, and 14 days was 71, 82, 85, 86, and 86 percent respectively.

H. R. Moffitt, L. M. McDonough, and D. O. Hathaway:

Two formulations of the sex pheromone, (E,E)-8,10 dodecadien-1-ol, were evaluated in the field in 1976 as means of disrupting communication between the sexes of the codling moth. These were the Hercon® polymeric dispenser and the Conrel® hollow fiber system. Prior to 1976, a number of formulations of microencapsulated (NCR) pheromone had been evaluated. These formulations differed in treatment of the capsule, concentration of pheromone, solvent system, and/or addition of stickers. The duration of effectiveness of the better formulations approached 20 days as measured by the response of marked released males to females or pheromone-baited traps.

The Hercon® sheets were cut into selected sizes of pieces based upon the amount of pheromone per cm^2 of the sheet and the rate of emission of the pheromone from the piece. Two concentrations of pheromone and two densities of dispensers were tested. The dispensers were hung in the upper part of each of nine adjacent apple trees in each replication; one per tree and three per tree for each concentration of pheromone. Even though the total numbers of males responding in this test was low, it appears that both the high and low concentrations at one per tree failed relatively quickly, i.e., 7 to 10 days, while both at three per tree displayed a period of effectiveness approaching 21 days.

The Conrel® fibers containing the sex pheromone were distributed by helicopter, using a spinning dispenser developed by Conrel, to replicated one-acre blocks of pear trees in one test and to apple trees in the second test. Evaluation was based upon the response of both released laboratory-reared and native codling moths to female-baited traps. In the first test, the formulation was applied to yield a pheromone emission rate of about 25 and 125 mg per acre per day. In the second

test, only the 125 mg treatment was applied. In both tests, the 125 mg per acre per day treatment was applied. In both tests, the 125 mg per acre per day treatment had a period of effectiveness, i.e., 90% or greater reduction in response to traps, of more than 20 days. Throughout the 57-day test period of the first test the reduction in response in the 125 mg treatment never fell below 80%. The effectiveness of the 25 mg treatment fell below 90% after six days and below 80% after 16 days.

Jack Eves:

Three applications of Mobil 9087 at 1/8, 1/4, and 1/2 lb. a.i. per 100 resulted in fair control of codling moth on apples, but not as good as Guthion at 1/4 lb. a.i. per 100. Mobil 9087 did not appear to adversely effect predator mites or rust mites.

Three applications of Mobil 9087 at 1/4 and 1/2 lb. a.i. per 100 provided moderate control of codling moth on pears, but was less effective than Guthion at 1/4 lb. a.i. per 100.

CODLING MOTH -- PEARS

Everett Burts:

Dimilin, Ambush and SD43775 provided good control of codling moth on pears when applied in 3 sprays at 21 day intervals against first brood and 1 spray at the beginning of second brood larval infestations.

P. H. Westigard:

Summer evaluation of compounds for codling moth control. - The synthetic pyrethriods PP557 and SD43775 gave excellent control of the codling moth. These compounds also reduced psylla predators and increased spidermite levels. In another test, Mobil 9087 gave excellent worm control, Dimilin fair control and BAAM poor control. A third test, indicated that Ryannia used in just the first, or in the first and second cover sprays, resulted in economic codling moth control when followed in the third or second and third covers with Azinphosmethyl. Season-long (3 covers) sprays of Ryannia did not give commercial control.

PEACH TREE BORER -- PEACHES

F. L. Banham:

Traps baited with the peach tree borer pheromone effectively monitored emergence of males in peaches, prunes, and nectarines. The lure was effective for a period of 6 weeks.

PEACH TWIG BORER -- PEACHES

F. L. Banham:

Pherocon IC traps baited with the sex pheromone of the peach twig borer effectively monitored emergence of the moths in peaches and apricots and showed promise as a means of monitoring population levels. Guthion, timed by pheromone traps to the emergence of first generation moths, reduced larval damage in peaches from 15.9 to 1.2%.

R. E. Rice, R. A. Jones:

Hand gun sprays were applied at 400 gpa to peaches on May 11, 1976, for control of peach twig borer. Strike counts made on May 27 showed complete control with PP 557 at 1.0 and 2.0 oz. a.i./100 gallons; SD 43775 at 1.6 and 3.2 oz. a.i./100 gallons; and Sumithion at 32 oz. a.i./100 gallons. Sumithion at 8.0 and 16.0 oz., M-9087 at 4.0 oz., S-2957 at 6.0 and 8.0 oz., Lorsban at 4.0 and 8.0 oz., and Imidan at 8.0 and 12.0 oz. a.i./100 gallons gave somewhat less, but still acceptable, control. Severe phytotoxicity was observed with Sumithion at all rates, and slight phytotoxicity was seen on newer leaves with S-2957 at 8.0 oz. a.i./100 gallons.

NAVEL ORANGEWORM -- ALMONDS AND PISTACHIOS

R. E. Rice, L. L. Sadler, and R. A. Jones:

Guthion 50 W was applied at 2.0 lbs. a.i. and 100 gpa to 40 acre blocks of mature almonds that had been culturally cleaned during midwinter. Applications made on May 10 and July 1 gave 68.2% and 83.5% reduction, respectively, of combined NOW and PTB damage to Nonpareil nut meats. A rain-caused delay in harvesting from September 15 (normal) until October 22 resulted in six-fold increases in worm damage in the Guthion treated blocks.

Treatments were applied to young, bearing pistachio trees in Kern County on September 8, 1976, with hull split at ca. 7%. Guthion 50 W at 1.5 lbs. a.i./acre and Sevin 80 SP at 6.0 lbs. a.i./acre gave 37% and 36% control respectively when compared to an untreated check. Orthene 75 S at 1.5 lbs. a.i./ acre and Diazinon at 1.5 lbs. a.i./acre resulted in infestations higher than the check, +22.8% and +45.7% respectively. A heavy rain two days after application, plus perhaps poor timing, may have contributed to the unsatisfactory results of this test.

NAVEL ORANGEWORM -- ALMONDS

M. M. Barnes:

Large plot treatments against navel orangeworm directed at suppression of the first generation were applied beginning in May at onset of egg hatch. One vs. two treatments were included as were varied timings of acaricides to provide information on their optimum use against twospotted mites in navel orangeworm programs. Also included were post-hullcrack treatments, including 4 aerial applications of TEPP. Data from 3 check areas in the orchard each averaged 28% infested nutmeats. The optimum chemical program, resulting in a 5% infestation, was a single application of Guthion WP at 2 lb. a.i./acre timed at onset of egg hatch in May. This treatment also suppressed peach twig borer damage from 2.6% (untreated) to 0.6%. Two applications did not improve results, nor was there benefit from including an acaracide in preventive use in spring treatments. The best timing for mite control was a special acaricide treatment at the time of appearance of significant mite populations, which was in mid-July in the orchard used. Preventive use of acaricides with early NOW sprays delayed, but did not avoid the need for later treatments.

Early season use of Sevin gave comparable results to Guthion in navel orangeworm control but mites were much more difficult to control in these programs and they are not suggested for further trial. Use of Sevin at hullcrack plus an acaricide was acceptable, as mites were adequately controlled by this timing. Four post-hullcrack aerial treatments with TEPP at 1 qt. in 10 gal./acre gave an apparent reduction of 50% of the NOW infestation and controlled mites satisfactorily.

A comparison of new materials for navel orangeworm when applied at hullcrack showed best results with the Shell Development pyrethroid and this material did not increase the twospotted mite problem.

Keith L. Andrews:

Studies on dispersal of female moths based on release of moths laying dye-labelled eggs demonstrated that under normal summer temperature conditions, there was 1) no egg laying during first 24 hours, 2) heavy deposition the second night followed by virtual cessation, 3) oviposition activity through the night but predominantly before 2 a.m., 4) most dispersal upwind, and 5) observed movement of at least 1000 feet within 48 hours of release. Under cool and wet conditions of early fall, 1) oviposition again began the second night and continued for at least a week, 2) oviposition activity was restricted to 1 hour after sunset, 3) flight activity diminished at ca. 60^{o}F. Based on examination of infestation of a large previously uninfested pistachio orchard (coming into bearing following a complete freeze) adjacent to infested almond orchards, infestation declined logarithmically and fell to 1/10th at one mile as compared to immediately adjacent to the source.

Presence of a volatile attractant resulted in more egg laying on egg traps baited with uninfested. The unidentified volatile(s) is definitely present in the larval frass. Studies were made with solvent extracts of various substrates and will be discussed.

FRUITTREE LEAFROLLER -- APPLES

H. F. Madsen:

The sex pheromone of the fruittree leafroller showed promise as a means of monitoring populations. The sex pheromone of the European leafroller attracted male moths, but numbers did not correlate with other population estimates.

Guthion, Penncap E and Dylox gave good control of a leafroller strain on cherries resistant to diazinon.

LEPIDOPTERAN POPULATIONS -- NORTHERN COLORADO EASTERN SLOPE

J. Ward, M. Rehner, J. A. Quist:

Data from cherry orchard, April-September 1976, at Ft. Collins. Weekly average for fruittree leafroller - 10.6, oblique-banded leafroller - 7.09, codling moth - 14.5, lesser apple worm - 14.0, and red-banded leafroller - 57.6.

Data from apple orchard, June-September 1975, at Ft. Collins and Boulder. Weekly average for fruittree leafroller - Ft. Collins - 15, Boulder - 16, oblique-banded leafroller - Ft. Collins - 7, Boulder - 9, codling moth - Ft. Collins - 30, Boulder - 44, lesser apple worm - Ft. Collins - 2, Boulder - 8, red-banded leafroller - Ft. Collins - 21, Boulder - no data.

PANDEMIS PYRUSANA -- APPLES

S. C. Hoyt:

The seasonal development of this species was observed at several locations in the Wenatchee area. First activity of overwintered larvae was observed just after petal fall. Two generations occurred with very high numbers of moths caught in pheromone traps in September. Two samples of first generation larvae had a combined average parasitism of 46%.

In spite of the relatively high populations of P. pyrusana, little fruit damage was observed in orchards treated with Guthion in late August.

PEST MANAGEMENT -- APPLE

H. F. Madsen:

In cooperation with the B.C. Department of Agriculture, 10 orchards were pest managed in 1976. The average number of sprays applied per orchard was 3, compared to 7 in a calendar based spray program. Insect and mite injury was below economic levels in all the orchards except for one where aphids were not detected and in a second where Vendex failed to control European red mite.

BIOLOGY OF THE FILBERT LEAFROLLER

M. T. AliNiazee

Biology of the filbert leafroller was studied during a four year period. Data indicates that eggs hatch in early spring and larvae pass through five larval instars, completing their development in about 6 to 8 weeks. Pupation occurs within the rolled leaved and adults emerge mostly in June and July. Adults live for 1 to 2 weeks and females deposit about 150 eggs. Eggs are laid in batches, which overwinter and hatch in the following spring. Reduced egg hatch (50%) under field conditions and high incidence of larval-pupal parasites were the two major mortality factors in untreated orchards. The major natural enemies of A. rosanus in the Willamette Valley include two tachinids, one pteromalid, one chalcid, three braconid, and two ichneumonid species.

CHEMICAL CONTROL OF THE FILBERTWORM

M. T. AliNiazee

Six different chemicals were tested for the control of filbertworm. Sprays were applied July 13 and August 30, 1976, based on light trap data. Among the tested chemicals, SD 43775 obtained exceptionally good control. Other effective chemicals include Furadan, Guthion, Sevin, and Pencap M. Zolone was relatively ineffective.

S E C T I O N II

ORCHARD MITES

Discussion Leader -- Harold Madsen

EUROPEAN RED MITE -- APPLES

R. S. Downing:

PP199 gave excellent and residual control of European red mite and deposits resisted the washing effect of rain. Zardex was effective against eggs and immature stages, but the initial application was washed off by rain. Deposits of Plictran and Vendex were adversely affected by rain and failed to control the mites.

ORCHARD MITES -- APPLES

S. C. Hoyt:

UBI R677 and Malonoben showed some miticidal activity, but were too toxic to Metaseiulus occidentalis for use in an integrated program. RE 20996 was ineffective against mites, toxic to predators and exhibited some phytotoxicity. Though PP 557 and SD43775 showed toxicity to mites at high dosages (10 cc. per 100 gals. for SD43775), and their use frequently resulted in a buildup of mite populations. Lannate, Mobil 9087 and Lorsban exhibited little or no miticidal activity, but all were toxic to predators.

Zardex was effective against European red mite, but provided marginal or ineffective control of McDaniel and twospotted spider mites. DPX 3792 gave effective control of the 3 tetranychid species, was low or moderate in toxicity to predators, and caused only a knockdown with rapid resurgence of apple rust mites.

SPIDER AND RUST MITES -- APPLES AND PEARS

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

Promising acaricides for European red mite control were: Malonoben, Zardex, RH-0308, and UBI-R677. PP-557, SD43775, and R-8394 resulted in ERM resurgences. BAAM controlled European red and pear rust mites, but was poor against two-spotted and McDaniel species on pear. Phosalone cover sprays led to ERM resurgences on Golden Delicious while unsprayed trees generally had higher McDaniel and lower ERM densities. Spider and rust mite densities were lower on Newtown trees sprayed with phosalone than on GD.

MITE SPECIES -- ALMONDS

Keith L. Andrews:

Three pest species of mites are commonly found on almonds in the southern San Joaquin Valley,--citrus red mite predominating in spring, followed by the species of major concern,--twospotted spider mite and Pacific spider mite in summer. Sixspotted thrips appears to be the only significant predator on the latter two species, although its appearance in time to prevent damage is sporadic. Trials with acaricides showed that Zardex 40W (cycloprate) and GCP 5126 (malonoben) gave promising results as compared with Omite and Plictran. Results will be presented of the second year of a study on effects of mites on almond tree productivity.

TWO-SPOTTED MITE -- ALMONDS

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

Morestan 25 W at 4.0 oz.; Malonoben 50 W at 4.0 oz.; and PP 199 4.0 col. at 1.0 and 2.0 oz. a.i./100 gal. were applied to almonds on August 10, 1976. All treatments gave good control of the two-spotted mite, T. urticae, but were also severe in their effects on Phytoseiid mites and six-spotted thrips.

TWO-SPOTTED MITE AND PREDATORS -- PEACHES

R. E. Rice, R. A. Jones, and L. L. Sadler:

Mature Fay Elberta peaches were sprayed to run-off by handgun in July, 1976, for control of Tetranychus urticae and effect on the Phytoseiidae and six-spotted thrips predators. Materials applied and a.i./100 gals. were: Omite 30 W at 7.2 oz.; PP 199 4.0 col. at 1.0 and 2.0 oz.; Malonoben 50 W at 4.0 oz.; Mesurol 75 W at 12.0 oz.; Morestan 25 W at 4.0 oz.; DPX-3792 2 E at 2.0 and 4.0 oz.; and Diocofol 18.5 W at 6.0 oz. Zardex 40 W at 2.0 and 2.5 lbs./acre was applied in 50 gpa concentrate. All treatments except Mesurol gave satisfactory reductions of T. urticae through 28 days post-treatment. Mesurol had the most severe effect on Phytoseiid mites, reducing a 95 mites/100 leaves pre-treatment count to zero through 42 days. The order of decreasing effect to Phytoseiids by the other materials was Morestan, PP 199, Malonoben, Kelthane and Omite, and DPX-3792 and Zardex. The same relative effects were observed by these materials on six-spotted thrips, i.e., Mesurol was the most severe, and Kelthane, Omite, Zardex and DPX-3792 the least toxic.

MCDANIEL MITE -- APPLES

Lynell Tanigoshi:

Scanning and transmission microscopy has revealed that cytological changes resulting from foliage feeding by Tetranychus mcdanieli on 'Red Delicious' apply resembled those reported for both natural senescence and induced changes consequent upon fungal and viral infections, cold injury, chemical treatments and mineral deficiencies for the Angiospermae.

Injured mesophyll tissues possessed some cells with coagulated protoplasts, some devoid of any visible content, and many with collapsed walls. Electron micrographs of adjacent mesophyll cells, which contained readily discernible organelles, showed conspicuous fine structural changes occurring within the chloroplasts. These changes were manifested as a marked swelling of the organelle with the granal and stromal thylakoids becoming cup-shaped and the stroma filling the cup; in sectional view these chloroplasts had a characteristic C-shaped silhouette.

Jack Eves:

A single application of Zardex at ½ lb. a.i. per 100 applied on a 10 acre block in late July controlled McDaniel mites for the remainder of the season. Mite counts at the time of application were 4-5 per leaf. Mites in an adjoining one acre check block rose to 50+ per leaf by mid-August. The block was sprayed with ¼ lb. a.i. Plictran per 100, but poor control resulted.

PREDATORY MITES -- APPLES

T. pyri was the most common phytoseiid encountered in the orchards studied this year and may have been gradually displacing M. occidentalis the past several years. T. pyri generally did not build up to high levels without apple rust mite. Both species coexisted in several orchards. T. pyri appeared to survive carbaryl sprays well, also methyl parathion, azinphosmethyl and Imidan + endosulfan. SD43775, PP-557 and M09087 were highly destructive. Malonoben allowed some, and Zardex and phosalone more, survival of phytoseiids. M. occidentalis in The Dalles on apples cycled with spider and rust mites much more effectively than in Hood River.

S E C T I O N III

OTHER INSECT PESTS

Discussion Leader -- Don Merkley

WESTERN BOXELDER BUG -- PEARS

J. L. Joos, B. E. Bearden, C. S. Davis, and A. Berlowitz:

Researchers have recognized for years the potential of several Hemiptera for feeding on and causing damage to pear fruit, especially Pentatomidae (stink bug), Coreidae (squach bug), and Lygaeidae (chinch bug, plant bug). The western boxelder bug, Leptocoris rubrolineatus Barber, studied in this test has been known to feed on developing fruit of apples, cherries, grapes, peaches, and plums. Boxelder bugs are normally host specific to boxelder (Acer negundo L.) and infrequently to maple and ash.

A replication of 47 sleeves with introduction of seasonal nymphs and adults at different pear fruit growth stages gave us an excellent indication of positive economic damage that can develop from western boxelder bug in the north coast counties of California.

PEAR PSYLLA -- PEARS

D. W. Davis:

The pear psylla has now spread over all of Utah except the southwestern corner. Field recovery of newly introduced predators and parasites is still negative. Native predators are very active in orchards which use carefully selected insecticides, or are unsprayed, with the psylla usually scarce by late June. One series of replicated applications was made on July 2, using BAAM, Galecron SP, Imidan, and Guthion all at 8 oz. AI/100 gallons. Adults, nymphs and eggs were counted. All materials reduced the adults. Imidan failed to show reduction on July 28, Guthion on August 4, BAAM and Galecron on August 11. On July 13, all treatments showed nearly 100% control of nymphs, but by July 20 Imidan and Guthion failed to show reduction. Some nymphal reduction was evident in the BAAM and Galecron treatments when the experiment was terminated on August 11. Egg reduction was erratic and impossible to interpret. Galecron and BAAM performed better than Imidan or Guthion, but in no cases were the Galecron and BAAM results significantly different from each other.

J. R. Leeper:

Three coccinellids (Harmonia conformis, Harmonia dimidiata, Diomus pumilio) and an encyrtid (Trechnites sp.) were released in pear orchards in attempts to establish them for pear psylla control. Establishment of all species is still uncertain.

Tree washing studies to reduce honeydew russet on fruit were inconclusive due to the mild summer and late or no psylla population build-ups in test orchards.

R. D. McMullen:

The synthetic pyrethroid NRDC-143 gave excellent control of overwintered adult pear psylla when applied at the delayed dormant stage at 0.1, 0.05, and 0.025 lb. a.i. per acre. The material gave good control of adults in July, but was less effective against nymphs.

W. W. Barnett, G. Morehead, C. S. Davis:

Dormant applications were made for control of pear psylla. Perthane provided the best control of adult psylla. BAAM + oil provided slightly better control than oil five days after treatment. However, ten days after treatment, 20 gallons of oil in 800 gallons of water per acre was comparable to the BAAM + oil. At the end of three weeks all the oil treatments alone were as effective as the BAAM + oil with Perthane still providing the best control. Dithane + oil, Thiodan and Galecron were somewhat less effective.

A harvest fruit sample showed oil alone and BAAM + oil significantly reduced rust mite injury. In the Perthane treatment there was 3.5 times as much rust mite damage as in the check.

Everett Burts:

Aerial dormant sprays of BAAM + oil provided as good as or better control of overwintered adult pear psylla than chlordimeform + oil. Pyrenone did not increase kill of adults when added to Thiodan sprays nor did it produce significant kills when combined with oil. SD43775 + oil provided excellent control of overwintered adults in sprays applied either by aircraft or ground equipment.

In summer sprays SD43775 gave good control of mixed populations of psylla nymphs and adults. Ambush was not very effective in these tests.

P. H. Westigard:

Petroleum oil sprays applied prior to egg laying by overwintering females delayed oviposition for up to five weeks. A direct relationship was found between oil rate used and ovipositional delay. Ground applications were more effective than fixed-wing aerial treatments. No adverse effect was noted to pears following these dormant oil treatments.

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

Preseason lab tests showed SD43775 EC and PP-557 EC to be effective adulticides; Pyrenone + oil was only slightly inferior to Perthane + endosulfan. Field use of PP-557 and SD43775 gave excellent control with one spray prior to or at petal fall and one cover spray; no increase in soluble solids or early maturity in Bartlett pears was noted. Field use of Pyrenone + oil was an effective prebloom adulticide only if temperatures were above 53° F. Seasonal use of BAAM EC gave good commercial control for the second year, however, up to 35% spray injury on d'Anjous was sustained from a late June application. BAAM WP was slightly less effective as an adulticide compared to the EC, but equally effective against immature psylla. MO-9087 gave no commercial control, nor did any other numbered compound other than the pyrethroids.

The use of a dormant oil spray followed by a second oil + adulticide spray at the delayed dormant stage gave about 40% control of adults and delayed normal oviposition for about five weeks. In some blocks only one cover spray followed this early season program with excellent results.

Jack Eves:

Three applications of Mobil 9087 at ¼ and ½ lb. a.i. per 100 resulted in moderate control of pear psylla, but not as good as ¼ lb. a.i. Fundal. Mobil 9087 did not control pear rust mite.

PEST MANAGEMENT -- PEARS

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

Integrated control was again observed in one upper valley orchard where no cover sprays were needed following a prebloom spray program. Overall, populations of pear psylla, predators, and parasites were lower than in 1975. A predaceous thrips (Aeolothrips) and spiders were the most numerous predators this year.

WESTERN FLOWER THRIPS -- APPLES

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

Formetante applied at bloom was again the most effective material tested for control of marking on Golden Delicious and Newtown apples.

SAN JOSE SCALE -- APPLES

R. S. Downing:

Diazinon, Penncap E, Thiodan, and Guthion effectively controlled male scales when applied at the petal fall stage. Diazinon killed the males before they

emerged from their shells. The petal fall spray against males gave control equivalent to three summer sprays timed against scale crawlers.

S. C. Hoyt:

Delayed dormant treatments of Parathion plus oil, Supracide alone or with oil, were superior to all other treatments in protecting fruit or new growth from infestation by San Jose scale. Summer treatments of Lorsban, Penncap M or parathion did give fairly good fruit protection. A 2-spray program (tight cluster and first cover) of RO 10-3108 was also effective. Late June sprays provided the most effective summer control due to the delayed emergence of crawlers.

SAN JOSE SCALE -- NECTARINES AND PLUMS

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

Several varieties of nectarines and plums were sprayed by handgun at 400 gpa on May 13, 1976. Treatments were evaluated on July 14, 1976, by counting the percent of infested fruit in each of 4 reps/treatment. Lorsban 50 W at 8.0 oz. and 4.0 oz. a.i./100 gal. gave 78% and 59% control respectively, followed closely by parathion and S-2957 with 57% and 56% respectively. Diazinon, Sumithion, S-197, Mobil 9087, Imidan, Malonoben, and Dylox did not give satisfactory results in this test.

SAN JOSE SCALE -- PHEROMONE MONITORING

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

Trapping of male San Jose scale in 1976, using virgin female scale in sticky traps, confirmed the sudden early-season onset of male flight previously observed in 1974. The March flight (overwintering males) was followed by three more distinct flights in June, August, and October. These data suggest that monitoring of male scale flights may have potential in optimum timing of spray programs in the future.

CHERRY FRUIT FLY

M. T. AliNiazee:

Four different chemicals were tested for the control of the western cherry fruit fly. All sprays were applied three times during the summer of 1976. Data indicates that all tested chemicals, Mesural 75 WP, Penncap M, SD 43775, and Cygon obtained excellent control of the cherry fruit fly. Mesural is a very promising compound because of its bird repellent effects.

M. T. AliNiazee:

During the past four years, a management program employing Pherocon®--AM standard traps at a rate of 2-4 traps/acre was tested. Data indicates that these traps can effectively predict the fly population levels and are helpful in determining the necessity and proper timing of chemical treatment. During this study period, one of the study orchards was not treated for four years, saving about $52/acre/year, based on an economic threshold level of two fly/traps/week. An area-wide management program involving over 15 growers is planned for the coming year.

F. L. Banham:

The western cherry fruit fly was effectively controlled by one application of oxydemeton-methyl or diazinon plus Keltose gelling agent applied eight days after the first fly emerged. Control was equivalent to three diazinon sprays or two dimethoate sprays.

D. R. Merkley:

Mesurol, a carbamate insecticide, was applied three times at seven to ten day intervals to test its effectiveness as a bird repellant, as well as a control for Rhagoletis indifferens. Rate of application was 1 lb. a.i. per 100 gallons of water.

This compound, applied to 12 varieties, gave excellent control of fruit flies and there was no indication of any phytotoxicity. The bird population was extremely high throughout the orchard with starling causing the most damage. Based on a standard of 10, as no damage, over-all evaluation of bird control was given a rating of six.

R. D. Brown and M. T. AliNiazee:

Gamma irradiation of the western cherry fruit fly was conducted using a cobalt-60 source. Data indicates that male flies can be sterilized at a rate of 6-8 Krads without any noticeable effects on competitiveness. A similar response was obtained using female flies under laboratory conditions; a sterile to normal male ratio of 4:1 caused a substantial reduction in egg fertility. Under field conditions, a 20:1 sterile to normal ratio reduced the infestation of maggots from 97% in check trees to less than 1% in the treatment trees.

M. T. AliNiazee:

Based on a four year study of the western cherry fruit fly emergence in the Willamette Valley, Oregon, a phenological predictive model is proposed. The model suggests that the fly emergence commences at the accumulation of 468 Thermal Units above a base of 5^{o} C using air temperature data. When soil

temperatures are measured, the emergence of the first fly starts at the accumulation of 720 and 657 TU respectively for the temperatures taken at 2" and 4" below ground surface. The last fly emerges at the accumulation of 975, 1130, and 1056 TU, respectively, for the temperatures taken in air, 2" below, and 4" below ground surfaces. A positive relationship was observed between the accumulation of a certain number of thermal units and various biological activities, like emergence of different population levels, 10%, 50%, 90%, etc., oviposition, and fruit infestation.

CUTWORMS -- TREE FRUITS

J. F. Howell:

Economic damage was experienced in some apple and pear orchards prebloom in the Yakima area. In June, redbacked cutworm was damaging isolated orchards. In July, in weedy orchards, nectarines were severely damaged by spotted cutworms, one small orchard was 100% damaged; pears were damaged by both spotted cutworms and bertha armyworm. In October, bertha armyworm was damaging ripe apples in the Cowiche area. Sugarbeets were heavily infested, more so than in 1975, particularly by bertha armyworm, but also by spotted cutworm. Potatoes were damaged in some areas by the variegated cutworm. Hops were damaged by the bertha armyworm. In general, cutworms were more abundant this year than any year of record (since 1973).

Tests using the nematode Neoaplectana to control Spodoptera praefica in mint were repeated in 1976. Acceptable control was obtained; 81.5% leaf damage in the untreated and 25.0% in the treated plot. Results were not uniform and additional testing is needed. Neoaplectana was tested in the lab against two additional species, Amathes c-nigrum and Heliothis zea. Both were susceptible bringing the total tested and susceptible to six species. Problems in rearing and storing the nematode were partially resolved, particularly storage.

Roelof reported cis-7-TDA as the pheromone for the spotted cutworm, Amathes c-nigrum. Tests in Yakima in 1974, 1975, and 1976 with cis-, trans-, and cis-trans isomers combined demonstrated negligible attraction. Live trapped females were quite attractive. Abdominal tips excised from live trapped females were steeped in methylene chloride, and the extract evaporated on filter paper. Pheromone thus obtained was weakly attractive for a few hours but more attractive than cis-7-TDA. It was apparent that the tips were not collected at the appropriate age or time of day.

The following materials were tested for control of the bertha armyworm and spotted cutworm: Lannate®, Lorsban®, Mobil 9087, Thiodan®, and toxaphene. Good control was obtained with Lorsban > Thiodan ≥ Mobil 9087 > Lannate. Dipel® applied at harvest was ineffective against bertha armyworm. Grower applied Sevin® was also ineffective.

For controlling climbing cutworms (armyworms) in tree, cane, or vine crops, sprays need to be applied to the soil surface or cover crop rather than to the aerial parts of the crop plants (trees). Hops would be an exception.

From data available it may now be possible to forecast damaging populations of bertha armyworm.

S E C T I O N IV

CONCENTRATE SPRAYING RESIDUES AND PHYTOTOXICITY

Discussion Leader -- Dale Johnson

A. P. Gaunce: Insecticide Persistence -- Apples

Keltose, a gelling agent, increased the initial deposit of diazinon and extended the persistence of diazinon, phosalone, malathion, and dimethoate. Keltose improved leafroller control and appeared to reduce thrips injury when combined with diazinon at the petal fall stage.

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

BAAM EC produced an EC type ring on 20-30% of Anjou fruit during seasonal use. Zardex in combination with parathion + Solubor caused severe necrotic areas on Anjou fruit, dark circles on Newtowns and dark blotches on Red Delicious fruit. However, Zardex alone produced no phytotoxicity. RH-0308 EC caused EC rings on Anjou and Bartlett fruit. Morestan when combined with Solubor + Pyrenone + Cyprex and applied at pink caused severe burning of sepals and fruit. Morestan + Pyrenone caused more sepal burn than Morestan alone.

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

Concentrate application of BAAM EC was as effective as comparable rate dilute sprays. Dormant oil sprays to delay psylla oviposition were equally effective as concentrate (55-70 GPA) or dilute (400 GPA).

R. E. Rice and R. A. Jones: Sumithion -- Stone Fruits

Sumithion was applied to non-bearing Flamecrest peaches at 0.5, 1.0, and 2.0 lbs. a.i./100 gal., and to bearing French and Early French prunes and Nonpareil and Merced almonds at 1.0 and 2.0 lbs. a.i./100 gal. On peaches, all three rates caused shot-holing on leaves of all ages with damage most severe on younger leaves and at the higher rates. On prunes, similar shot-hole injury was observed on leaves, along with some early leaf senescence and ca. 25% fruit drop four weeks after application. There were no observable phytotoxic effects by this chemical on almonds at the rates used. European red mite and two-spotted mite populations were increased in all Sumithion treatments compared to untreated checks, apparently due to severe reduction of Phytoseiid predators.

S E C T I O N V

PHEROMONES

M. Mumtaz and M. T. AliNiazee: An Oviposition Deterrent Pheromone in the Western Cherry Fruit Fly

Laboratory and field data indicate the presence of a fruit marking pheromone, which deters repeated oviposition in a cherry. The pheromone is soluble in water and methonal, and is very stable. Both the water and alcohol washings are effective. Preliminary field studies indicate that cherries coated with water washings received about 70-80% less oviposition compared to check cherries.

J. Ward, M. Rehner, J. A. Quist: Olfactometer Responses of Macrocentrus to Lepidopteran Pheromones

Macrocentrus ancylivorus is used in biological control, particularly of the oriental fruit moth Grapolitha molesta. Tests using a "T" type olfactometer provided a positive reaction by female Macrocentrus to the synthetic sex pheromones of different Lepidoptera, with the highest reaction occurring toward the OFM pheromone.

A field test of wasp reaction to the pheromones has not corroborated the olfactometer results. Improved field testing may provide better understanding of use of pheromones by parasitic insects.

G. C. Fisher and T. R. Wilmot: Strawberry Crown Moth

A continuation of a study initiated in 1975 by Ron Collins, consultant, Hillsboro, Oregon, to identify a suitable synthetic pheromone for the attraction and capture of males of the Strawberry Crown Moth, Synanthedon bibioipennis was conducted in Washington County, Oregon. Zoecon's Pherocon IC traps were equipped with four different combinations of the EZ and ZZ isomers of 3, 13 - octadecadien - 1 - ol acetate supplied by Dave Nielsen of the Ohio Agricultural Research and Development Center, Wooster, Ohio 44691.

Rubber septa containing the attractants were placed in the center of the traps. The four mixtures were randomized and replicated three times in two different locations. The traps were supported by metal wire frames and placed approximately one foot above the soil surface. The traps were inspected once a week for six weeks with the numbers of male crown moths recorded each time. Tom Eichlin, Systematic Entomologist, California State Department of Agriculture identified the adults captured.

One combination was attracted significantly more males than the other three, and will be used during the 1977 season to monitor flight periods in different areas of the strawberry producing region of Oregon.

S E C T I O N VI

DECIDUOUS ORCHARD DISEASES

Discussion Leader -- Bill Manji

DISEASES OF POME FRUITS

J. D. Eves: Powdery Mildew -- Jonathan Apples

Green tip, pink, and petal fall applications of Afugan were applied at three and eight oz. per 100. The higher rate of Afugan was superior to Karathane and almost as effective as Benlate plus oil.

N. S. Luepschen: Powdery Mildew -- Apples

Five fungicides were evaluated at different concentrations in field efficacy trials against powdery mildew on two varieties of apples. The first applications were made in late April at full pink, and sprays were repeated at 10-20 day intervals, ending on July 19. In the Jonathan test a total of seven applications were made, while in the Rome test only six applications were used.

Mildew incidence in 1976 was moderately high. In the Jonathan test, Chevron's RE 20996 performed poorly with less than 20% control. The Benlate and oil combination again gave the highest control of foliar infection, 80%, while Karathane provided 60% control. In the Rome test, That Flowable Sulfur provided the best control, 80%, while Topsin M provided 50% control. On this variety the performance of Karathane and Benlate/oil was about equal.

Treatment	Rate/100 gals.	% Leaves Infected
'Jonathan' test		
Unsprayed check		78 a
Benlate	6 ozs.	18 d
Benlate + oil	2 ozs. + 1 qt.	16 d
Karathane	8 ozs.	32 c
Chevron RE 20996	8 ozs.	64 b
Chevron RE 20996	16 ozs.	64 b
'Rome' test		
Unsprayed check		71 a
Benlate + oil	2 ozs. + 1 qt.	27 bc
Karathane	8 ozs.	26 bc
Topsin M	6 ozs.	36 b
That Flowable Sulfur	3 pts.	14 c

D. L. McIntosh: Crown rot -- Apples

Numbers of germinable propagules of Phytophthora cactorum/g orchard soil were determined using soil dilution plates. Green pear fruits also were used as traps for P. cactorum to check the sensitivity of the plates. Three to 20 germinable propagules/g were present in soil in contact with diseased apple trunks. There were few to none in soil samples taken 15 cm to 60 cm from diseased trunks, or from under apparently healthy trees. Soil dilution plates were preferable to green pear fruits used as baits, in determining propagule density levels.

M. Sanders, J. Yorston, and H. O'Reilly: Apple Scab

An apple scab control experiment was conducted on young, bearing McIntosh trees in Creston, B. C. An erradicant control spray program using Benlate at six and nine days after an infection period was compared to the normal application times for Cyprex.

Treatment (rates per 100 gal.)	Average No. of fruit with scab lesions per 200 fruit
1. Benlate 50 W (8 oz.) - 6 day delay	20.3 a
2. Benlate 50 W (8 oz.) - 9 day delay	9.8 a
3. Cyprex 65 W (12 oz.) - regular schedule	17.8 a
4. Benlate 50 W (4 oz.) + oil (1 qt.) - 6 day delay	61.5 a
5. Check - no scab sprays	168.0 b

All chemical treatments gave significant control of fruit scab. There were no significant differences between chemical controls. It is difficult to evaluate the effectiveness of the delayed applications of Benlate as they also act as a protectant for up to 10 days after their application date. In the case of treatment 2, the first Benlate spray was applied nine days after an infection period with no additional infection period occurring during that period or for 13 days following the spray. However, with the second Benlate spray, two additional infection periods occurred, one, two days before the nine day delay spray was applied and the other, three days after the application date. In this case, the nine day delay spray was also an erradicant spray for the infection period occurring two days before the spray and the protectant spray for the infection period occurring three days after the spray application. Similar situations occurred in the six day delay treatments. Evidence for the past three years is sufficiently encouraging to warrant continuation of trials on delayed application of Benlate for scab control.

R. S. Bethell, J. M. Ogawa, W. H. English,
R. R. Hansen, B. T. Manji, and F. J. Schick: Bacterial Blossom Blast -- Pears

Blasting of flowers is an occasional problem in California pear orchards. Three common causes for blasted blossoms are: boron deficiency, lack of winter chilling, and bacterial infection caused by Pseudomonas syringae. Bacterial blast is the most damaging and can reduce crops so severely they become unprofitable to harvest. Recommendations based on experimental data have not been established for control of bacterial blast in California or other parts of the world. Judging from conversation with Dr. D. L. Coyier, some Oregon pear growers apply fall and/or winter copper sprays and streptomycin during bloom to reduce the incidence of fireblight and blast. The experiment reported here was made to obtain experimental data on control of bacterial blast. Two chemicals reported to be effective in controlling diseases caused by P. syringae were selected for the 1976 trial in the Bodhaine pear orchard near Camino, El Dorado County, California. A 50% copper material, COCS, was applied at the rate of five pounds per 100 gallons of water, 17.5% streptomycin was applied at the rate of eight oz. per 100 gallons of water. Treatments were applied with handgun equipment at green tip (February 13) and at 1% bloom (March 26). Single trees were selected randomly and replicated eight times. A cold rain fell during April 5-6, 8, and 10 followed by temperatures to 31, 27, and 31° F, respectively. One hundred blossom clusters were examined in each tree on April 19 to establish percent infected clusters. Table 1 shows that copper applied at the green tip stage followed by streptomycin at 1% bloom had only 1% infection, compared to 10.4% for the check. Statistical analysis of the data shows copper followed by streptomycin and copper followed by copper to be significantly different from the check. The copper spray applied at 1% bloom caused some phytotoxicity to foliage and flowers. All the chemical spray treatments were significantly better than the check at the 5% level.

Table 1. Results of copper and streptomycin sprays on control of bacterial blossom blast in Bartlett pears.

Treatment[a]		Percent blossom blast[b]		
Green tip (Feb. 13)	1% bloom (March 26)			
None	None	10.4**	a	a*
None	Streptomycin	5.0	ab	b
Copper	None	4.1	ab	b
Copper	Copper	3.1	b	b
Copper	Streptomycin	1.0	b	b

[a]Sprayed with handgun equipment.

[b]Stat. sign at 1% level (**) and 5% level (*). Treatments with same letters are not significantly different.

B. G. Zoller: Fireblight -- Pears

Resistance of Erwinia amylovora to streptomycin was monitored in approximately 29 commercial Bertlett pear orchards located in two districts in California from 1972 through 1976. Blossom samples (100 - 300 blossoms, collected randomly, comprised a sample) were processed 2X weekly during the blight season by washing and plating the washate on selective media with and without 100 ppm streptomycin sulfate incorporated. The prevalence of streptomycin resistant strains of E. amylovora decreased after 1973 in both districts. The use of streptomycin as a blight treatment in monitored orchards of both districts ceased after 1972, but was used as approximately 1/5 of treatments in monitored orchards of one district (Delta) in 1976.

District	Year	Number of Samples with E. amylovora	% of Positive Samples with Streptomycin Resistant E. amylovora
Delta	1972	2	0
	1973	76	29
	1974	154	8
	1975	41	2
	1976	62	0
Yuba-Sutter	1972	27	37
	1973	112	66
	1974	32	53
	1975	44	45
	1976	14	29

W. O. Reil and J. A. Beutel: Fireblight -- Pears

Twenty-seven growers applied Terramycin to 10 acre pear blocks in the major pear growing districts of California during the spring blight season of 1976. In all commercial orchards sprayed by air blast sprayers, eight ounces of formulated Terramycin per acre gave fireblight control equal to one pound of 50% copper or eight ounces of formulated Streptomycin per acre. On one block where applications were made by hand using 400 gallons dilute spray after high populations of Erwinia amylovora bacteria were detected in the blossoms, control was less effective than an extra heavy dosage of copper (two pounds actual per acre).

Lenticel russet of Bartlett pears did not develop as severly during April and May of 1976 (fireblight treatment time) as in past seasons. As a result, differences in fruit russet between copper and Terramycin treated orchards was not as great as found in 1973, 1974, or 1975. Even though 1976 was not a bad year for pear russet, over one-third of the treated orchards showed considerably less russet in the Terramycin block than in the copper block and the overall average russet (32% to 23%) favored Terramycin.

Based on these and previous tests, we are hoping that Terramycin will be registered for use by growers in 1977. Recommended intervals between applications should be two to five days, depending on temperature, rain, amount of bloom and bacterial pressure. Effective control was obtained with eight ounces of formulated Terramycin in 15 to 200 gallons of water per acre.

FIREBLIGHT CONTROL IN COMMERCIAL BARTLETT PEAR ORCHARDS IN 1976 IN CALIFORNIA USING TERRAMYCIN^{R}, COPPER AND STREPTOMYCIN SPRAYS

County	No. of Applications	Treatment Period	Fireblight Strikes Per Tree				Russet %		
			Terramycin	Copper	Strepto-mycin	Unsprayed Check	Terramycin	Copper	Check
Sacramento	11	4-1/5-28	.03	.02		0	6%	9%	--
	5	4-23/6-4	.01	.05		1.1	9%	18%	8%
	7	4-12/??	14.4*	15.2*		59.8	25%	28%	25%
	7	4-5/5-12	0	.1		.14	21%	34%	--
	8	4-5/5-26	.06	--		.12	11%	24%	11%
	8	4-4/5-20	.01	.01		0	11%	24%	11%
Yuba	10	4-1/5-25	2	3		.58	12%	27%	10%
	10	3-31/5-20	.05	5		0	6%	12%	6%
Yolo	9	4-6/5-24	.7			33			
Solano	7	4-2/5-4	8.2**	1.1		22.8			
Stanislaus	7	4-5/5-8	.5		.9	4.0			
El Dorado	8	4-23/5-28	.05	.04		.20	4%	22%	5%
	5	4-2/5-16	.02			.07	23%	--	23%
Mendocino	6	4-5/5-25	.02			.30	50%	64%	--
	16	4-23/5-28	0	0		.88	19%	36%	--
	12	4-5/??	.08	.40		.42	46%	62%	42%
	5	5-3/5-24	.05			.08	40%	43%	37%
	6	4-29/5-22	.35	.35		1.15	35%	46%	31%
	6	4-30/5-24	.15	.20		.07	40%	41%	31%
Lake	4	4-22/6-3	.41		.36	--	No differences in russet could be determined between Copper, Terramycin or untreated checks in Lake County. Russet rating between 20-30%.		
	13	4-19/6-8	.37	.34		.65			
	9	5-7/6-9	1.02	.80		1.33			
	10	4-6/6-5	.43	.46		1.33			
	10	4-30/6-11	1.21	2.18		.68			
	11	4-21/5-30	1.07	1.11		--			
	4	5-11/6-7	.12	.11		.29			

* First application applied approximately 1 week after high populations of E. amylovora were detected in blossoms.

** First application applied 1 week after high populations of E. amylovora were detected in blossoms. Trees were sprayed by hand with 8 ounces of Terramycin in 400 gal. water and copper used at rate of 2 lbs. per 400 gal.

J. A. Beutel, W. J. Moller, and W. O. Reil: Fireblight -- Pears

A California statewide pest management program on fireblight developed over the past four years following the disastrous fireblight epidemics of the early 1970's. The program coordinated information on climate, bacterial populations, and host conditions into a forecasting service, together with specific recommendations for individual growers. Over half the state pear acreage used some type of pest management approach for blight control in 1976 with an estimated savings to growers of $400,000-500,000.

The use of weather data and blossom monitoring has enabled some growers to eliminate many blight sprays each season and still maintain good blight control. At the same time, fruit finish has been improved appreciably due to less lenticel russet.

With an increased confidence level in predicting and forecasting fireblight, better control plus reduced applications of bactericides is a reality with many growers.

A weekly fireblight disease bulletin has been mailed to about 350 growers and industry people to inform them about disease occurrence within the state. Growers with orchards being monitored are personally contacted when bacteria are first detected. Monitoring bacterial populations within each individual orchard is still the best way to maximize reduced spray application and improve control, however, monitoring typical orchards within an area, correlating the data with climatic conditions, and reporting on an area basis has given some savings to growers. Orchards with considerable holdover cankers generally have an E. amylovora population buildup in the blossoms earlier than in clean orchards with usually a much higher population detectable throughout the season. Monitoring blossoms within an individual orchard helps detect localized problems.

With the termination of federally funded grants to offset costs of personnel and supplies, the University's role in blight forecasting will continue to decrease. More emphasis will be on pest management specialists to make recommendations to individual growers. The University of California will stress continued research into disease-host-climate relationships to improve techniques for management specialists in the field.

GROWERS UNDER FIREBLIGHT PEST MANAGEMENT

County	Number of Sprays				Average Yearly $ Savings Per Acre
	Prior to 1974	1974	1975	1976	
Glenn	9	4	7	3	$22
Sacramento	7	1	1	2	28
Solano	7	-	4	1	22
El Dorado	6	-	3	2	18
Mendocino	11	-	5	6	28
Santa Clara	12	2	10	11	22

I. C. MacSwan: Apple Scab and Powdery Mildew -- Rome Apples

All fungicides or fungicide combinations provided good control of scab and powdery mildew. Sprays were applied by handgun to mature Rome trees at prepink, pink, calyx, first, second, and third covers with the exception of Afugan 30 EC which was not applied in the cover sprays. Fungicides tested (rate per 100 gallons)--Benlate 50 WP 3 oz. + 12 Manzate 200 + 1 quart Volck supreme oil, Afugan 30 EC 2 oz. + 12 oz. Cyprex 65 WP, and Afugan 30 EC 3 oz. + 12 oz. Cyprex 65 WP. Fruit russet in all plots was insignificant.

I. C. MacSwan: Apple Scab -- Red Delicious Apples

All fungicides or combinations of fungicides provided good control of scab. Sprays were applied by handgun to mature Red Delicious trees at prepink, pink, calyx, first, second, and third covers. Fungicides tested (rate per 100 gallons)--Cyprex 65 WP 0.75 lb., Cyprex 65 WP 4 oz. + 1 quart Volck supreme oil, Captan 50 WP 2 lbs., Captan 50 WP 8 oz. + 1 quart Volck supreme oil, Ziram 76 WP 1.5 lbs. Fruit russet in all plots was insignificant.

I. C. MacSwan: Apple Scab and Powdery Mildew -- Rome Apples

All test fungicide combinations provided good control of scab and mildew, except PP588 used alone was ineffective against scab. Sprays were applied by handgun to mature Rome trees at prepink, pink, calyx, first and second covers except for Afugan 30 EC, which was not applied in the cover sprays. Fungicides tested (rate per 100 gallons)--PP588 25 EC 8 oz., Cyprex 65 WP 12 oz. + 12 oz. Karathane WD, Cyprex 65 WP 12 oz. + Adhere 6 oz. + 12 oz. Karathane WD, Benlate 50 WP 3 oz. + 12 oz. Manzate 200 + 1 quart Volck supreme oil, Afugan 30 EC 8 oz. + 12 oz. Cyprex 65 WP, and Afugan 30 EC 4 oz. + 12 oz. Cyprex 65 WP. Fruit russet was insignificant in all plots.

Iain C. MacSwan: Scab - Pear

All fungicides provided good control of scab. Sprays were applied by handgun to mature Bartlett trees at prepink, pink, calyx, first and second covers. Fungicides tested (rate per 100 gallons)--Cyprex 65 WP 0.75 lb., Cyprex 65 WP 4 oz. + 1 quart Volck supreme oil, Ziram 76 WP 0.75 lb. + 1 quart Volck supreme oil, Ziram 76 WP 1.5 lbs., Captan 50 WP 2 lbs., and Captan 50 WP 8 oz. + 1 quart Volck supreme oil.

Iain C. MacSwan: Scab - Pear

All fungicides provided good control of scab. Sprays were applied by handgun to mature Bartlett trees at prepink, pink, calyx, and first cover. Fungicides tested (rate per 100 gallons)--Supersul 80 WP 4 lbs., Benlate 50 WP 3 oz. + 6 oz. Adhere, Benlate 50 WP 3 oz. + 1 quart Volck supreme oil, Benlate 50 WP 3 oz. + 12 oz. Manzate 200 + 1 quart Volck supreme oil, Cyprex 65 WP 12 oz., and PP588 25 EC 8 oz.

DISEASES OF STONE FRUITS

B. T. Manji, J. M. Ogawa, and W. R. Schreader: Evaluation of Fungicides for Control of Sweet Cherry Powdery Mildew

New promising fungicides for powdery mildew control have been developed. This small field study was conducted to evaluate these new compounds for control of powdery mildew (Podosphaera oxyacanthae syn Podosphaera clandestina) on sweet cherry. Cherry trees were sprayed approximately two weeks before harvest. Some fruit were already infected and sporulating when the fungicides were applied. Disease evaluation was made using two categories: 1) fruits with one small depressed area (small lesion), 2) fruits with more than one small depressed area or one large depressed area (large lesion). Data presented in Table 1 indicates suppression of disease development.

Table 1

EFFICACY OF A PREHARVEST FUNGICIDE SPRAY IN REDUCING POWDERY MILDEW OF BING CHERRY FRUIT

Treatment[1/]	Conc/100 gal	% Healthy	% Diseased[2/] Small lesion	Large lesion
EL 222 12.5% E.C.	200 ml	78.0 a	21.3 NS	0.7 a
EL 228 9.46% E.C.	300 ml	74.3 a	24.7 NS	1.0 a
BAY MEB 6447 25W	8 oz	79.0 a	20.0 NS	1.0 a
CONTROL	--	55.0 b	22.7 NS	22.3 b

1/ Four large branches on a single tree were sprayed with each fungicide. Four branches left unsprayed were the control. Fungicide applied with a small home and garden hand sprayer on 5/3/76.

2/ Fruit were harvested 5/17/76 and evaluated.
Small lesion = A single mildew spot. Fruit considered marketable.
Large lesion = Numerous large mildew spots. Fruit unmarketable.

I. C. MacSwan: Brown Rot Blossom Blight -- Cherry

All test fungicides provided good control. Sprays were applied by handgun at popcorn, full bloom, and petal fall, except DPX 115 B and Benlate 50 WP which were applied at popcorn and full bloom only. Fungicides tested (rate per 100 gallons)--Topsin M 70 3 oz. + 1 quart Volck supreme oil, Topsin M 70 6 oz., Cyprex 65 WP 0.50 lb., Triforine 20 EC 12 fl. oz., Bravo 6F 0.75 and 1.5 lbs., DPX 115 B 1.5 lbs., Benlate 50 WP 4 oz., Captan 50 WP 2 lbs., Kocide 101 86 WP 1 and 1.5 lbs., and COCS 3 lbs. Test trees were Montmorency (sour cherry).

I. C. MacSwan: Brown Rot Blossom Blight -- Peach

(Results of two tests--one in each of two orchards.)
All test fungicides except Bravo 6F provided good control. Sprays were applied by handgun at popcorn, full bloom, and petal fall, except Benlate 50 WP and DPX 115 B, which were applied at popcorn and full bloom only. Fungicides tested (rate per 100 gallons)--RP26019 50 WP at 0.25 lb., and 0.50 lb., 1 lb., and 2 lbs., RP26019 50 WP 0.25 lb. with surfactant and 0.50 lb. with surfactant, Topsin M 70 6 oz. and 3 oz. + 1 quart Volck supreme oil, Benlate 50 WP 4 oz., DPX 115 B 1.5 lbs., Triforine 20 EC 12 fl. oz., and Bravo 6F 1 pt. and 1.5 pts. Test trees were Improved Elberta.

I. C. MacSwan: Leaf Curl -- Peach

All test fungicides except PQ-50(2) provided control equal to that of Bordeaux, the standard. The addition of a surfactant, Biofilm, did not increase the efficacy of test fungicides. Sprays were applied by handgun on January 15 and 19. Fungicides tested (rate per 100 gallons)--Ziram 76 WP 3 lbs., Ferbam 76 WP 3 lbs., Ferbam 76 WP 3 lbs. + 2 oz. Biofilm, Bordeaux 12-12-100, Bravo 6F 24 oz. + 2 oz. Biofilm, Ziram 76 WP 3 lbs. + 2 oz. Biofilm, Cyprex 65 WP 3 lbs., Cyprex 65 WP 3 lbs. + 2 oz. Biofilm, Bravo 6F 24 oz., PQ-50(2) 2 pts. and 4 pts. Test trees were mature Improved Elberta.

I. C. MacSwan: Brown Rot Blossom Blight -- Cherry

Two sprays of Benlate 50 WP 4 oz. (popcorn and full bloom) gave as good control as did three sprays of other fungicides tested. All fungicides provided significant control. Fungicides tested (rate per 100 gallons)--Topsin M 70 3 oz. + 1 quart Volck supreme oil, Bravo 6F 0.75 and 1.5 pts., Topsin M 70 6 oz., and Triforine 20 EC 12 fl. oz. Test trees were Royal Anne. Sprays were applied by handgun.

I. C. MacSwan: Brown Rot Fruit Rot

The test was designed to investigate if the addition of oil (Volck supreme) or surfactant (Biofilm) to preharvest Benlate sprays would improve control of post harvest fruit rot. For each fungicide treatment, two mature Early Italian prune trees were sprayed by handgun September 15, 1976. Two unsprayed trees were left as checks. A trace of brown rot fruit rot was present in the trees at time of spraying. Two days later, two orchard lugs of fruit per treatment were randomly selected and harvested from each plot, placed one layer deep, on a wooden grading table in common storage and covered with poly sheeting to prevent loss of fruit moisture. Rotted fruit, principally to brown rot, was removed and counted one to three days (total 6 counts) between September 20 to September 30.

Some control of post harvest brown rot was provided by a spray of Benlate 50 WP 2 oz. + 2 oz. Biofilm per 100 gallons of water. There was no control from a spray of either Benlate 50 WP 2 oz. + 1 quart Volck supreme oil or a spray of Benlate 50 WP 4 oz. per 100 gallons of water.

I. C. MacSwan: Brown Rot Blossom Blight -- Cherry

All fungicides tested provided good control. Sprays were applied by handgun at popcorn, full bloom, and petal fall, except DPX 115 B and Benlate 50 WP, which were applied at popcorn and full bloom only. Fungicides tested (rate per 100 gallons)--RP26019 50 WP 0.25 lb., RP26019 50 WP 0.25 lb. with surfactant, RP26019 50 WP 0.50 lb., RP26019 50 WP 0.50 lb. with surfactant, RP26019 50 WP 1 lb. and 2 lbs., DPX 115 B 1.5 lbs., Benlate 50 WP 4 oz., Bravo 6F 0.75 and 1.5 pts., Topsin M 70 6 oz., Topsin M 70 3 oz. + 1 quart Volck supreme oil, and Triforine 20 EC 12 fl. oz. Test trees were Black Republicans.

DISEASES OF NUTS

D. J. Ravetto: Blight -- Walnut

Spray tests were applied to 12 year old English walnuts, Ashley variety using a high pressure dilute (400 GPA, 12 gallons/tree) handgun sprayer. Sprays were applied at 10% catkin elongation and early, mid and full pistillate bloom. Plots consisted of four single tree replicates in a completely randomized design. Copper materials tested (1975) included Cop-oil (Kocide Chemical Co. - 4 gal/A), K1201X (8 lb./A), Kocide 101 (8 lb./A), Bordeaux (3-2-100), and Copper Count-N (2 gal./A). All materials tested reduced the incidence of walnut blight with Cop-oil being the least effective.

Tests conducted in 1976 were directed toward determining the best timing of copper sprays. Kocide 101 (new formulation, 8 lbs./400 GPA) was applied to 10 year old English walnuts, Ashley variety, at bud swell, bud swell plus 50% catkin elongation, and bud swell plus 50% catkin elongation plus 30% pistillate bloom. Two catkin sprays reduced the incidence of blighted nuts by 92.1% while two catkin and one pistillate sprays reduced blight incidence 96.9%. A single, early catkin spray reduced blight only 37.1%. Early catkin sprays to protect them prior to or early on in their elongation appear to be as effective, or more so, than one catkin spray followed by several pistillate bloom sprays.

D. J. Ravetto, B. Thompson, and W. Haddox: Blast -- Almond

Dormant applications (handgun sprayer, 400 GPA) of certain copper compounds effectively controlled blast on almonds in tests conducted in 1975 and 1976. Basic copper sulfate (20 lbs./A), Kocide 101 (old and new formulation, 12 and 16 lbs./A), and Bordeaux (10-10-100) all resulted in substantially reduced numbers of blast lesions on leaves when evaluated the following spring. In one test conducted in 1976, several copper materials at different rates/A were applied during the dormant season followed by one or more sprays from petal fall through May 1st. Repeated applications of Kocide 101 (new formulation), basic copper sulfate, and Bordeaux, at certain rates and timings, all effectively reduced the number of blast lesions on leaves. Repeated applications of copper materials at low rates per acre may afford adequate blast control on almonds during years favorable for blast development.

D. Rough, J. M. Ogawa, and B. T. Manji: Field Evaluation of Chemicals to Control Coryneum Blight, Bacterial Blast and Blossom Brown Rot of Almond

The study was conducted to evaluate, 1) chemical combinations applied at early petal stage of bloom to control both blossom brown rot (*Monilinia laxa*) and bacterial blast (*Pseudomonas syringae*) and its effect on Coryneum blight (*Coryneum beijerinckii*), 2) new fungicides for control of blossom brown rot. Because of a very dry and mild fall and winter no bacterial blast or Coryneum blight developed in the test plot. Blossom brown rot was evaluated and data presented in Table 1. A combination spray of Benlate 50W, four ounces with copper sulfate provided equivalent brown rot control as Benlate 50W, eight ounces.

Table 1

FUNGICIDE EVALUATION FOR BROWN ROT (*MONILINIA LAXA*) BLOSSOM BLIGHT CONTROL OF MISSION ALMOND

Treatment[2]	Conc/100 gal	Number of blighted blossoms/ 400 spurs[1]/tree									Total	Avg.
		1	2	3	4	5	6	7	8	9		
Benlate 50W + Copper sulfate 53%	4 oz. 4 lb.	7	18	23	11	1	3	14	13	9	99	11.0a
Benlate 50W	8 oz.	7	32	5	8	14	10	20	26	14	136	15.1ab
Rp 26019 50W	1 lb.	14	26	14	3	7	9	13	27	48	161	17.9abc
Benlate 50W + Captan 50W	4 oz. 1 lb.	24	30	11	11	19	23	19	18	13	168	18.7abc
Bravo 6F	1 ½ pt.	26	15	4	14	11	24	43	24	41	202	22.4abc
Topsin M 70W	6 oz.	22	23	11	15	18	38	71	31	28	267	29.7abc
Copper sulfate 53%	4 lb.	22	27	42	26	9	16	35	90	51	318	35.3 bcd
Rp26019 50W	8 oz.	80	59	33	20	22	10	21	45	64	354	39.3 cd
Benlate 50W	4 oz.	15	52	20	32	10	70	58	63	44	364	40.4 cd
Captan 50W	1 lb.	36	48	15	74	14	52	79	109	71	498	55.3 de
Rp26019 50W	4 oz.	23	48	62	47	59	91	84	54	142	610	67.8 ef
Cela 20% E.C.	12 fl. oz.	88	180	95	38	42	60	118	54	91	766	85.1 fg
Control	--	95	129	60	51	125	90	99	78	122	849	94.3 g

1/ Only spurs with fruit or blighted blossoms counted (3/30/76).

2/ One blossom spray applied with handgun sprayer, 7 gal./tree at early petal stage of bloom (2/23/76).