ABSTRACTS OF REPORTS FROM THE 44th ANNUAL WESTERN COOPERATIVE SPRAY PROJECT

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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.

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Abstracts of Reports from the
44th Annual Western Cooperative Spray Project

TABLE OF CONTENTS

SECTION I

LEPIDOPTEROUS INSECTS

CODLING MOTH -- APPLE

M. D. Proverbs:

Codling moths, sterilized as adults by exposure to 50 krad in a CO_2 atmosphere, was released three times per week from late April to mid-September in a 120-acre orchard. The moths, 90% produced from an artificial diet, were released in boxes from a helicopter at the rate of five boxes per acre. At harvest, approximately 0.05% of the fruit had been injured by codling moth. This is better control than in most chemically sprayed orchards in the district.

H. F. Madsen:

Zolone and Gardona gave good control of the codling moth in an orchard where the nonsprayed trees had 95% injured fruit. Lannate gave relatively poor control, and indications were that Lannate was not persistent enough when sprays were applied a month apart. Heavy infestations of European red mite, McDaniel spider mite and apple rust mite developed on trees sprayed with Gardona. Zolone and Lannate sprayed trees did not develop injurious mite populations.

R. W. Zwick and F. W. Peifer:

Imidan and Diazinon gave excellent control of codling moth in a commercial orchard where small numbers of moths were constantly infiltrating from several unsprayed trees during the season. Peak moth numbers were caught in pheromone traps 25 July and 11 August and their presence did not signify apple infestation by worms in the sprayed orchard.

Stan Hoyt:

Aerial application of Guthion at three pounds per acre gave very good control of the codling moth. However, in one area where coverage was difficult to obtain, fixed wing aircraft application gave poor control.

Dale E. Johnson:

A standard BAB pheromone trap was compared with a modified pheromone trap in a commercial apple orchard from April 15 through September 15. The first male moths were caught on May 4 in the standard trap and on May 6 in the modified trap. During the first brood flight period the standard trap caught a ratio of 4.8 male moths to each male moth caught in the modified trap. During the second and third brood flight periods the standard trap caught a ratio of 1.3 moths to each moth caught in the modified trap. The last male moths were caught on September 8 in the standard trap and on August 24 in the modified trap.

L. G. Schoenleber:

A battery powered trap was developed and used for trapping codling moths. The equipment utilizes a continuous, sticky covered belt which exposes a new belt area each clock hour to trap insects. The trap will recycle each day. Live female moths placed in a wire container inside a hood above the exposed belt are used to attract male moths. Use of the trap in an abandoned orchard during the 4½ months in the summer of 1969 showed the largest catch occurred around sunset and many were caught up until midnight. A few insects were caught at most of the other clock hours.

L. A. Falcon, L. K. Etzel and R. S. Bethell:

Field tests to evaluate the impact of spray applications of a granulosis virus (applied with hand-guns at 150-300 psi) on field populations of codling moth have been conducted each year since 1966. Effectiveness and persistence (i.e. virus efficiency) of virus spray deposits have been continually monitored by laboratory bioassay.

Some of the information developed is as follows: (1) Dosages of 3.4×10^{11} (1966), 1.2×10^{11} (1967) and 9.5×10^{9} (1968) virus capsules per gallon were similarly effective at 0 days after application with the higher dosages providing longer residual effectiveness. (2) Virus applications were more effective during the 1st half of the fruit growth period than during the second half. (3) The use of repeated spray applications containing 9.5×10^{9} capsules (8 larval equivalents) per gallon at 7-day intervals (1968) provided the highest degree of virus efficiency for the lowest cost. (4) The addition of 0.03% Bio-film(R) (Colloidal Products) to virus sprays (1968) further improved virus efficiency. (5) A combination of 0.03% Bio-film, 2.0% v/v crude molasses and 0.5% w/v skim milk powder added to virus sprays (1969) gave the greatest improvement in virus efficiency thus far obtained. The unsightly spray deposit was readily removed from harvested fruit by standard wash operations at a fruit packing shed.

The results demonstrated that the virus must be applied at close time intervals throughout the growing season for maximum effectiveness and that its efficiency can be improved with the use of certain adjuvants. It now appears that by following an intensive treatment schedule as used with the sterile moth program, but replacing irradiated moths with larval equivalents of virus, that similar results could be achieved. To employ the virus in this manner, inexpensive, simple, efficient methods of dissemination must be developed.

L. A. Falcon, L. K. Etzel, R. S. Bethell and E. Delfino:

During 1969, codling moth pheromone traps were located in six apple orchards which had also been used the previous year. Three traps were assigned to each orchard in contrast to one for 1968. Five virgin females were used per trap and replaced at about weekly intervals. In all locations collections of wild male moths began in late April and early May, about 2 to 3 weeks later than for 1968. For five locations total moth catch per orchard lagged 1968 collections as follows: July 7 -- 50%; Aug. 4 -- 25%; and Sept. 1 -- 5%. By Sept. 23, the differences were less than 3% and about as many moths had been captured per orchard as in 1968. In the 6th orchard a greater number of moths were captured than in 1968. This was apparently related to the importation of codling moth infested cull apples for pig food in the fall of 1968.

R. S. Bethell, L. A. Falcon and W. C. Batiste:

Six pear growers and five apple growers cooperated in a season-long program to investigate the use of sex lures (a) to assess codling moth density in sprayed and unsprayed orchards and (b) time chemical spray applications for codling moth control. In each orchard three traps per 10 acres were used. Five newly emerged females per trap were provided at about weekly intervals and the number of male moths trapped was determined daily. By timing spray applications to codling moth flight activity, one pear grower eliminated two sprays, three pear growers and four apple growers each eliminated one spray from their spray programs. The savings in spray costs was considerable and easily offset estimated costs for trap operation. In addition, by reducing chemical sprays for codling moth, beneficial side-effects accrued which reduced the need for control of other pests, especially mites.

CODLING MOTH -- PEARS

J. E. Dibble, W. W. Barnett and C. S. Davis:

Gardona 75 WP at 1 and 2 lbs. per 100 and Galecron 4 EC at 1 pt. applied twice at seven and four weeks prior to harvest were as effective (98 - 100% control) as was Guthion 50 WP at 1 lb/100.

W. C. Batiste:

Handgun applications were made with Guthion (50% WP) at 1, 2, and 4 oz. AI/100 gallons and Gardona (75% WP) at 8 oz. AI/100 both with and without oil (1 gallon Volck Supreme). Fundal (95% SP) was used at the rate of 8 oz. AI/100 without oil. Three cover sprays were timed on the basis of catches in 4 sex traps. The addition of oil reduced the effectiveness of Guthion and Gardona somewhat, but this was not serious with properly timed sprays. Survival increased with decrease in dosage of Guthion, but control was relatively good even at the lowest rates. Gardona was slightly less effective than the high rate of Guthion and Fundal was considerably less effective. The oil aided in the control of pear psylla, European red mite, two-spotted spider mite, and pear leaf rust mite. Fundal was highly active as an acaricide.

CODLING MOTH -- APPLES, PEARS AND WALNUTS

W. C. Batiste:

A total of 61 sex traps weresupplied to growers in five counties of northern California in a cooperative study involving the Western States Codling Moth Committee, the U.S.D.A., Extension Service, and growers. Larvae and pupae reared by the U.S.D.A. were sent weekly through the mail from Yakima to Berkeley where the moths were reared out, sexed, and packaged for transportation to cooperating Farm Advisors. This method of handling the insects proved to be very practical. Grower reaction to the traps was good and in several cases one or more sprays were deleted as a result of surveillance and proper timing of sprays. Data obtained on the flight activity in the various areas are being compared to determine temporal differences in moth flight in relation to area, crop and local conditions. Studies were continued with the timing sex trap in an effort to correlate daily and seasonal catches with environmental conditions. Early season catches occurred from midday to about sunset at which time low temperatures terminated the flights. The timing sex traps caught more moths than the ultraviolet light traps in the early season while the light trap was somewhat more effective than the sex trap at mid-season.

PEACH TWIG BORER

E. W. Anthon:

The past few years investigations have been underway to try and rear peach twig borer in the laboratory using artificial media as a diet food.

Recently we have been successful in getting the moths to mate and lay fertile eggs, but could not induce the newly hatched larva to feed on the artificial food media. This year with the use of different feeding and rearing techniques and the addition of wheast to the diet we have induced the newly hatched larva to feed on the artificial diet and by early November we were into our third generation of twig borer under laboratory conditions.

The following materials gave excellent control of peach twig borer when applied as a pre-pink spray: Gardona, Furadan, Azodrin, Zolone and Thiodan.

Trunk spray applications of the following materials applied July 2, and August 6, gave good control of peach tree borer: Furadan, Gardona, Dursban, Thiodan, Guthion, Azodrin, Zolone and Shell 17250.

J. E. Dibble and W. W. Barnett:

Excellent control was obtained on this pest with Gardona 75 WP at both 1 and 2 lbs/100 and Diazinon 50 WP and Thiodan 50 WP both at 1 lb/100. Galecron 4 EC at 1 pt/100 was only slightly less effective.

FRUIT TREE LEAF ROLLER -- APPLES

H. F. Madsen:

Diazinon alone and in combination with oil, Guthion alone and in combination with oil and Gardona gave good control of the fruit-tree leaf roller following a spray at the pink bud stage. Zolone did not provide acceptable control although fruit damage was less than in the nonsprayed check. The treatments did not affect phytophagous or predaceous mites with the exception of Gardona. Trees sprayed with this material had damaging populations of McDaniel spider mite. Both Diazinon and Guthion combined with oil caused yellowing and defoliation of primary leaves on the McIntosh and Spartan apple varieties.

ORIENTAL FRUIT MOTH -- PEACHES

J. E. Dibble and W. W. Barnett:

Gardona 75 WP at 2 lbs/100 provided excellent control of OFM. Diazinon 50 WP and Galecron 4 EC were only slightly less effective than the above, but were slightly more effective than Sevin WP and Gardona 75 WP at 1 lb/100.

RED-HUMPED CATERPILLAR -- WALNUTS

J. E. Dibble, C. S. Davis and G. S. Sibbett:

The following materials were applied to walnuts in search of a DDT substitute: Malathion, Diazinon, Parathion, Guthion, Sevin, Imidan, Thiodan, Galecron, Gardona, Trithion, Standard lead arsenate, Thuricide and Biotrol. All materials were effective however the latter four were slow in action.

S E C T I O N II

ORCHARD MITES

PHYTOPHAGOUS MITES

J. E. Dibble:

For prunes and peaches Lovozal 20 and 40 WP showed perfect to near perfect control when applied once on an existing population or repeatedly for seasonal control. Galecron 4 EC also provided very good control on the two-spotted mite.

J. E. Dibble and C. S. Davis:

Lovozal and Galecron proved to be the best materials in a general test program on pears. The addition of Orchex 796 to other insecticides aimed at pests other than mites held down the mite population to a very low number.

The spray oils Orchex 796, PGSO-2, PG-435 and Volck gave good to excellent results on control of the two-spotted and European red mites. Alone @ 4-6 gpa or in combination (at a lesser rate) with relatively non-effective miticides the value of the highly refined oils is well confirmed.

Donald W. Davis:

The plots were located at North Salt Lake City on McIntosh apples. About 75% of the phytophagous mites were two-spotted and 25% McDaniel. For the past three years the two-spotted mite has tended to replace the McDaniel mite in many northern Utah orchards. One application of Plictran gave excellent seasonal control. Omite and Carzol followed in effectiveness. These three materials were aided by many *T. occidentalis*. Acaralate and TH 3671 gave a faster knock-down but less residual control. Azodrin, Morestan and Lovozol were effective for about four weeks and required two applications for seasonal control. Galecron, of the materials tested, was least effective.

E. W. Anthon:

The following materials gave good results of the McDaniel mite under greenhouse screening tests on peach seedlings: Hoechst 2960, Pennsalt 1615, Shell 17250, and Bay 80530 gave fair results.

E. W. Anthon:

Most of the materials applied to cherries for the control of McDaniel mites gave good control of this mite. However, those that were slightly better were Thom. Hay. 427-1, Azodrin, Omite, Plictran, Humble Oil and Collier Oil PGSO2 combined with ¼ lb. of Omite, UC 34906, Lovozol, Carzol, Fundal and Hercules 17413.

A helicopter application gave good control of a heavy infestation of McDaniel mite on cherries, along with the help of mite predators.

Stan Hoyt:

McDaniel spider mite -- Apples. Predators were so numerous in several plots in 1969 that it was difficult to evaluate the effects of the chemicals. However, mite populations developed where Gardona was used.

Stan Hoyt:

Populations of the McDaniel spider mite, apple rust mite and *T. occidentalis* were similar on trees with overhead or with undertree sprinklers.

M. M. Barnes:

Applications made in early August after development of populations of the McDaniel mite in the interior of the apple tree were successful in preventing spread to the periphery of the tree with the following: Morestan and Plictran at 2 oz. act./100 gal; Carzol and Fundal at 4 oz. and Omite at 4.8 oz.

William B. Hudson:

Overtree sprinkling was tested as a physical control against the McDaniel spider mite and the European red mite on apples. Low populations of McDaniel spider mites were controlled by repeated sprinklings, but high populations were not controlled. Sprinkling gave only temporary control of European red mites. The rate of increase of European red mites over a five-week period was no different on sprinkled and non-sprinkled trees. Predaceous phytoseiid mites were not adversely affected by overtree sprinkling. Phytoseiid mites were more important than overtree sprinkling in regulating the population density of the McDaniel spider mite.

E. W. Anthon:

The majority of insecticides tested in the field gave good control of the European red mite on peaches in the field. The materials which were slightly better were T. H. 467-I, Shell 17578, Plictran, Shell 16898, Humble and Collier Oil combined with ¼ lb. of Omite.

Stan Hoyt:

Winter kill of European red mite eggs approached 100% in an apple orchard where temperatures were -30°F and below.

Plictran, Fundal (Galecron), Omite and Lovozal gave good control of summer populations of European red mite.

M. M. Barnes:

Application of the following in a developed infestation in July, resulted in seasonal control of the European red mite on walnuts: Morestan at 2 oz. act./100 gal; Plictran, Torak and Azodrin at 4 oz., and Fundal and TH 427 at 8 oz.

R. W. Zwick and F. W. Peifer:

TH 367-I and oil were the only effective delayed dormant materials against European red mite eggs on apples. Foliage applications of Fundal, Plictran, Lovozal, UC 34096, Omite, and R-10044 were all effective against mites. Binapacryl was effective in an experimental block where dinitros have not been applied for years. Kelthane with oil was more effective than used alone but was phytotoxic to Newtown apple. Omite and Lovozal were more effective at full recommended rates than at reduced rates. GS-19851 at ½ lb. active/100 gal. gave very good control of red and two-spotted mites. Carbophenothion, TH 427-I, phosalone, Kelthane alone, Acarathane, and Carzol did not give consistently good control.

E. W. Anthon:

The following material looked the best for control of the peach silver mite on field peaches: T. H. 427-I, Hoe 2960, Plictran and Fundal, however, most of the material tested gave satisfactory control.

J. E. Dibble, W. W. Barnett and C. S. Davis:

May and June applications of Gardona, Galecron and Guthion were superior to single May sprays on the pear rust mite. Single June applications showed all of the above materials plus oil as well as Diazinon and Thiodan plus oil to give satisfactory control.

Donald W. Davis:

Omite was supplied by the manufacturer for use in six selected orchards. In five orchards, where *Tetranychus* mites predominated, the results were good to excellent. In one orchard where the European red mites were numerous, results were marginal.

BAY 37344 (Mesurol) was used as a combination acaricide-insecticide. With the exception of sulfur added to the first application, it was the only pesticide used. The late apple varieties had four sprays and the earlier varieties either two or three. Codling moth control was very good. Mite control with four applications was excellent, but with two or three there was a substantial build-up of McDaniel mites late in the season. Wooly apple aphid damage was severe, indicating the destruction of natural enemies without significant kill of the aphids.

PREDATOR MITES

Stan Hoyt:

Good survival of this predator was obtained where Hercules 14503, Abar and Zolone were used in ground applications. Aerial applications of Sevin or Guthion (3# of 50% WP per acre) allowed sufficient survival of predators to maintain good mite control. Populations of *Typhlodromus occidentalis* were lower where Sevin was applied, but this was mostly due to its effect on apple rust mite.

B. A. Croft:

Four strains of *T. occidentalis* from Wenatchee, Washington; Provo, Utah; Yucaipa, California; and Riverside, California, have recently been studied in the laboratory at the University of California and in the field at Oak Glen, near Yucaipa, California. Comparative biosystematic, life history, toxicological and natural enemy introduction studies have been considered.

Biosystematic studies have shown the above predator strains to be subpopulations of a single species although partial sterility factors have been noted. The general life history between these populations did not differ appreciably. Toxicological comparisons have identified a differential susceptibility to several insecticides and acaricides which are common to the control of apple pests. Resistance to azinphosmethyl and Gardona was present in populations from Washington and Utah, whereas strains from California were still susceptible. An introduction and evaluation program of releases of resistant strains into a sprayed orchard ecosystem, where a native susceptible strain failed to persist, was accomplished in 1969. Resistant predators persisted in the sprayed orchard and demonstrated an enhanced ability to regulate *T. mcdanieli* populations when compared to a similar ability in a susceptible native population.

INTEGRATED CONTROL

R. S. Downing and J. C. Arrand:

A project to develop integrated control of orchard mites in 10 commercial apple orchards was conducted from 1967 through 1969. The program was a success, and the project was scheduled to be discontinued in 1969, but the extremely cold winter of 1968-69 caused such high mortality to predaceous phytoseiids that the project was continued in six of the orchards. Although there was almost complete mortality of the phytoseiids in the aerial parts of the tree, the predators increased in all but one orchard and controlled both the European red and McDaniel spider mites. There was evidence that those phytoseiids which overwintered with the McDaniel mite on tree trunks survived the cold winter and temperature of -27° F.

R. S. Downing:

Shell Neutrol oil (220 S.S.U.) at the half-inch green stage gave good control of the European red mite, poor control of apple rust mite and allowed the highest survival of predaceous phytoseiids. Plictran controlled both the European red mite and the apple rust mite. Morestan and Lovozal gave poor control of European red mite, good control of the apple rust mite and were highly toxic to phytoseiid mites. Micasin, Milbex, and Tedion failed to control the European red mite.

R. S. Downing:

On summer mite control Omite, Lovozal, and GS 19851 gave excellent control of the European red mite but were toxic to predaceous phytoseiids. Galecron was less effective against European red mite and was toxic to phytoseiids. Plictran gave good control of the European red mite and was not toxic to phytoseiid mites.

R. W. Zwick and F. W. Peifer:

Omite and Morestan (2.0 & 4.0 oz) were used to reduce McDaniel and two-spotted mites and allowed *Typhlodromus* to survive, build up, and control the phytophagous species late in two orchards. Kelthane did not eliminate Typhs but predators failed to increase after its application and a high McDaniel population resulted. Lack of prey such as rust or McDaniel mite during May-June may be preventing early *Typhlodromus* establishment and a capacity for rapid increase to effect phytophagous mite control during July-August. At least one acaricide application tolerated by Typhs may be needed in most apple orchards if a measure of integrated mite control is to be established.

E. W. Anthon:

The last three years good control of mites has been obtained with the use of a delayed dormant spray of oil plus ethion on prunes and peaches. Occasionally Thiodan or Dieldrin were added for peach twig borer control. In some plots Thiodan at a reduced rate is added in mid-season for rust mite control.

The integrated mite studies on peaches have not been as profitable as on prunes because of the erratic mite infestations.

Donald W. Davis:

Six orchards in northern Utah were supervised for the third season, and frequent counts made of both predatory and phytophagous mites. In one orchard it has required three seasons for *T. occidentalis* to build up to substantial numbers. Two orchards had low populations of European red mites which were not adequately controlled by the predators, but in five out of the six orchards the *Tetranychus* mites were kept under control. Only one orchard had poor results, and in this case the early spray applications were made by a contract operator who did not follow all instructions. As a result there were problems with mites, codling moth, and powdery mildew.

S E C T I O N III

OTHER INSECT PESTS

PEAR PSYLLA

H. F. Madsen:

Orchex 796 oil was tested at 2, 4, and 6 gallons per acre on Bartlett and Anjou pears for pear psylla control. The 4- and 6-gallon rates gave good control, but 2 gallons was less effective. None of the rates of oil were injurious to Bartlett pears, but 4 and 6 gallons per acre caused foliage and fruit injury to the Anjou variety.

R. D. McMullen:

Dikar at 8 lb. per acre gave excellent control of the pear psylla following one or two sprays per season. In June, when there was new foliage growth, two sprays applied two weeks apart were better than a single spray. In mid-July, when growth had ceased, a single spray was as effective as two treatments. Dikar has little toxicity to adults or eggs of the pear psylla, but has a long residual action against newly hatched nymphs. The material shows little toxicity to the principal predators of the pear psylla.

R. D. McMullen:

The record cold winter of 1968-69 caused a high mortality of pear psylla adults and its predators. Mortalities were 90-95% following minimum temperatures of -21° and -17° F and the insect was almost eliminated at temperatures of -36° to -42° F. Of the pear psylla predators, *Anthocoris antevolens* was the species most severely affected by the winter cold. Other species were reduced as well, but populations returned to normal by mid-summer.

Everett C. Burts:

Three compounds from Pennsalt Chemical Corp., TD 8550, TD 8546 and TD 1617, and three surfactants, A88, RP11, and X77, were found to have considerable toxicity to adult pear psylla's when applied at topical sprays. Several other compounds tested were not very effective.

Dormant sprays of TH 367I and Galecron from both ground equipment and aircraft provided good kills of overwintered adult pear psylla. Neither compound was phytotoxic when combined with oil in these sprays. A delayed dormant application of TH 367 Iwas more effective than Galecron where heavy deposits of eggs were present when the sprays were applied.

A dormant spray of Galecron followed by two summer cover sprays of Fundal provided good seasonal control of pear psylla. No codling moth infested fruit was found and spider mite control was excellent. In a similar program three summer covers of Zolone failed to provide adequate psylla control.

Zolone and Furadan combined with oil in summer sprays provided psylla control comparable with Guthion and oil combinations.

In summer screening plots Herc. 17413 and TD 8550 provided good control of a heavy population of pear psylla. Herc. 18164, SD 17250 and Dyfonate were less effective but provided some kill of this insect. The test population was resistant to Guthion and most other organophosphorous compounds.

In post harvest applications for the control of pear psylla, TH 367 was the outstanding material. Also relatively large populations of *Deraeocoris brevis* survived sprays of this insecticide. Triamanzone and Dithane M45, two fungicides containing manganese bis-dithiocarbamate provided good kills of psylla nymphs. When Perthane was added to Trimanzone adult kill was better.

F. W. Peifer and R. W. Zwick:

Dormant applications of Perthane EC or Perthane EC plus oil were more effective against the adult psylla when applied by air carrier sprayer as opposed to aerial applications. Most aerial applications were not as effective as expected.

Laboratory dip tests to destroy pear psylla eggs attached to pear twigs were only moderately effective. DNOC plus oil gave the best control.

Perthane EC with and without Volck oil gave much better control of overwintering psylla than TH 367-I or Galecron when applied in the dormant or delayed dormant. Concentrate applications (112 GPA) of Perthane or Perthane plus oil effectively controlled adult psylla during the dormant period.

Cover sprays of Imidan WP and flowable, phosalone EC, Galecron, Dilan EC, Perthane EC plus Volck oil, and Fundal all gave good to excellent control of pear psylla nymphs for 3-5 weeks.

J. E. Dibble, W. W. Barnett and C. S. Davis:

A May and June application of Gardona 75 WP, Galecron 4 EC and Guthion 50 WP proved to give near perfect control of psylla immatures when compared to the check and a single Diazinon treatment. A single June Thiodan 50 WP application also looked very good.

APHIDS

E. W. Anthon:

A few materials gave good control of the green peach aphid in greenhouse and field testing. They were Pennsalt 8550, Fundal, American Cy. 72613, Stauffer R 15552, and 15792.

In the field trials, Furdan, Baygon, Carzol and American Cy. 72613 gave excellent control of this aphid.

E. W. Anthon:

The leaf-curling plum aphid was controlled on prunes in the field with the following materials: Azodrin, Gardona, Furdan, Baygon, Carzol, Parathion and American Cy.

M. M. Barnes:

The effect of walnut aphid infestation, during a single season, on walnut production, was measured on 24 replications of single Payne walnut trees at Visalia, California. The infestation lasted from May 7 to June 25 (seven aphid-weeks) and averaged 37 aphids per leaflet, during a period when growth of walnuts was rapid. This resulted in a reduction in yield of 9.9% (9.3 lbs. per tree) (325 lbs. per acre) and this difference was significant at odds of 40:1. Data on effects on quality are not yet available. Chemical control studies showed effective performance by Morestan at 2 oz./100 gal. (unusually effective against this species), TH 367, Torak, and Azodrin at 4 oz., and Gardona and TH 427 at 8 oz.

R. W. Zwick and F. W. Peifer:

Carbofuran, phosalone, Diazinon, and dimethoate (1.5#) gave excellent aphid control of apples. Plictran, Guthion, Fundal, Morestan, carbaryl, Gardona, Imidan, and Carzol were ineffective.

Stan Hoyt:

Zolone gave good control of wooly apple aphid, but relatively poor control of the apple aphid on young, rapidly-growing trees.

WESTERN CHERRY FRUIT FLY

H. F. Madsen:

The western cherry fruit fly was first recorded in the Okanagan in 1968 at two localities. Surveys in 1969 showed the fly to be present in most of the cherry growing area of the Okanagan Valley. The majority of the flies were trapped in neglected orchards, pollinator trees, and seedlings, and no infestations were found in commercial orchards. The first fly was taken on June 4 and the last on July 30. The peak emergence was from June 10 to mid-July. Five other *Rhagoletis* species were trapped on the yellow sticky boards used in the survey.

R. W. Zwick and F. W. Peifer:

Malathion LVC applications at 8 oz. gave commercial control of cherry fruit fly and residues resulting from five applications at 16 oz/acre were far under the present tolerance one day after application.

Don R. Merkley:

Effort was made during 1969 season to concentrate on one chemical for cherry fruit fly control. Two plots containing approximately 100 trees each sprayed on July 1, July 14, and July 22 with 3/4 lb. and 1 lb. of 75% Gardona, WP. These application rates were a.i./100 gallons of water. Results indicated excellent control in both plots, with only one wormy cherry found at harvest time. Adjacent plots were sprayed with Diazinon, Guthion, and Perthane -- all of which were effective.

SCALE INSECTS

C. V. G. Morgan:

Mortality of the San Jose scale following minimum winter temperatures of -30° C was only 56% which is little different from mortality during mild winters. The European fruit scale showed only 62% mortality after temperatures which reached -40° C. These results indicate that both of these scales will survive wherever apple trees can be grown commercially. It is of interest to note that most of the parasites of the San Jose scale were killed at these low temperatures.

R. W. Zwick and F. W. Peifer:

Oil alone (2 Gal) was the most effective delayed dormant followed by oil carbophenothion or Diazinon. Oil-ethion, parathion, Galecron, and TH 367-I could not be recommended for commercial control.

THRIPS

R. W. Zwick and F. W. Peifer:

The most effective materials were DDT toxaphene> DDT parathion > endosulfan> dimethoate. Petal fall sprays were slightly more effective than pink applications.

Stan Hoyt:

Petal fall applications of DDT, Thiodan and Guthion provided control of thrips but did not prevent damage from occurring.

J. H. LaRue, J. E. Dibble and C. S. Davis

Late seasonal infestation of flower thrips were effectively controlled with Guthion applications. Timing was very important. Three applications applied during April and May or two applications during May gave the best control.

S E C T I O N IV

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

F. W. Peifer and R. W. Zwick:

Lovozal in combination with Cyprex, diazinon, and Karathane; Lovozal plus Diazinon; Lovozal, Cyprex, and endosulfan resulted in several types of injury depending upon the combination, apple variety, and time of application. Omite plus diazinon caused leaf yellowing, marginal burning and some defoliation to Red Delicious and Golden Delicious. C-2307 caused severe leaf burning, curling, and defoliation to Newtown as a first cover. U-27,415 caused a yellowing of older leaves and subsequent heavy defoliation of Newtown variety. R-10044 resulted in fruit spotting, foliage burn, and severe defoliation to Newtown.

H. F. Madsen and K. Williams:

The following sprays and combinations caused both foliage and fruit injury to several apple varieties: Zolone + oil, leaf injury to Rome, Spartan, McIntosh, Newtown, Golden Delicious, Winesap, and Jonathan, fruit injury to Golden Delicious, Newtown, Spartan, and Jonathan; Gardona + oil, leaf injury to Spartan, McIntosh, Rome, Jonathan, Newtown, Red Delicious, and Golden Delicious, fruit injury to Golden Delicious, Newtown, Rome, and McIntosh; Guthion + oil, leaf injury to Rome, Newtown, and Spartan, fruit injury to Golden Delicious, and Newtown; oil alone, leaf injury to Newtown, fruit injury to Golden Delicious, and Newtown; Gardona alone, fruit injury to Golden Delicious, Rome, and McIntosh. All Gardona sprayed trees had high mite populations and leaf bronzing.

Everett C. Burts:

Summer sprays of Lovozal were phytotoxic to D'Anjou pear. First cover applications at double the standard dosage of the 20% WP formulations produced quite a lot of chloratic spotting of the foliage. Second cover sprays of this formulation produced severe necrotic spotting of foliage and fruit russetting under the deposit spots. The 40% WP formulation was less phytotoxic. Bartlett pears were less susceptible to this injury.

Plictran produced necrotic spotting of foliage and light russett spotting of fruit on D'Anjou and Bartlett when applied one week after, in combination with or two weeks before superior oil. Fundal in combination with superior oil as a summer spray did not injure Bartlett or D'Anjou. Summer sprays of Imidan were not injurious to either fruit or foliage of these two varieties.

F. W. Peifer and R. W. Zwick:

Lovozal in combination with Diazinon resulted in severe leaf and fruit spotting under the spray deposits. Less damage occurred with the 40% Lovozal formulation. No damage was apparent on the same pear varieties when Lovozal and Imidan or guthion were applied in combination. The combination of Omite and Perthane caused severe bronzing, heavy defoliation, and some fruit drop on Anjou pear when applied by air carrier sprayer during the 1st cover period. Additional phytotoxicity information is given in the report.

J. Kenneth Kinney:

During FY 1969 the Food and Drug Administration collected and examined food or feed commodities as follows:

Domestic	All FDA	Seattle District (Wash. & Oregon)
Total Examined	10519	377
Total with no Residues	4461	164
Total with Residues	6058	213
Imports		
Examined	1879	47
No Residues	538	26
Residues	1341	21
Grand Totals		
Examined	12398	424
No Residues	4999	190
Residues	7399	234

FDA laboratories found a trace or higher residue in a total of 53 samples of large and small fruits in FY'69 and the first quarter of FY'70. All of these were grown in Washington or Oregon. No regulatory action was taken on any of these samples. These commodities involved 12 samples of apples, two peaches, 11 pears, one apricot, two cherries, one prune, 12 strawberries and 12 cranberries. The highest residues found on any one of these samples were as follows:

Aldrin-T	Methoxychlor - 2.30
Dieldrin - .01	Ovex - .06
DDT - .56	Carbaryl - .40
DDE - .18	Diazinon - .02
TDE - .06	Ethion - .96
Endosulfan - .04	Parathion - .12
Kelthane - .31	PCNB - .01
Lindane - .01	HCB - .03

On July 1, 1969, we initiated a new pesticide sampling program. This program is directed by each of the individual 17 field districts, utilizing their past experience and knowledge of their own local crops and growing areas. It is a statistically based program that will zero in on local problem areas, focusing on particular commodities and geographic areas. Sampling is being done at shipping points and at growers' fields in some instances.

J. E. Dibble, W. W. Barnett and D. H. Chaney:

The combination of spray oils, with copper compounds has a beneficial effect in dormant application. More copper was present up to 76 days after application when combined with oil. The type of oil shows some difference in deposit residue as does the percent of emulsifier. Concentrate applications gave a copper residue 2-3 times that of dilute @ 1 and 2 months after application.

J. E. Dibble:

The velocity of air discharged from a orchard sprayer drops off surprisingly fast. This deceleration is in relation to distance and height and shows spray pattern and coverage characteristics.

L. W. Getzin:

The persistence and degradation of carbofuran in soils are being investigated in the laboratory with the aid of ^{14}C-labeled insecticide. Data indicate that soil type and soil pH influence the persistence of this insecticide to a great extent. The time required for 50% degradation of carbofuran was eight weeks in a clay loam and greater than 24 weeks in a silt loam and organic soil. Only small amounts of ^{14}C from radio-labeled insecticide were expired as $^{14}CO_2$ which suggests that microbial decomposition may not be an important degradative pathway for this insecticide.

Carbofuran degrades faster in alkaline soil than in acid soil. After eight weeks of incubation at 25°C the amount of carbofuran recovered from soil with pH levels of 4.3, 5.5, 7.0 and 8.3 was 84, 84, 48 and 9% respectively. It is evident from these data that carbofuran will be more effective as a soil applied systemic or as a soil treatment for subterranean pests in acid soils.

J. E. Dibble:

Lovozal applied for mite control on prunes proved to be substantially phytotoxic. Some injury was also noted on cling peaches. Gardona showed some injury to peach leaves.

Carl A. Johansen:

The following results were obtained in honey bee poisoning tests on apple or alfalfa:

Material	hazard by direct application	residual hazard
EL-273 (Elanco fungicide)	nil	nil (2 hr.)
SD 17250 S (Shell)	---	moderate (3 hr.)
AC 17413 EC (Hercules)	---	very high (1 day)
BAY 93820 EC (Chemagro)	very high	very high (1 day)
C-9491 EC (CIBA)	very high	moderate (1 day)
C-9491 D (CIBA)	very high	low (1 day)
Galecron D (CIBA)	low-moderate	low (3 hr.)
Torak EC (Hercules)	high	low (3 hr.)
U 27,415 WP (Upjohn)	high	moderate (3 hr.)
Dikar WP (Rohm & Haas miticide-fungicide)	low	nil (3 hr.)
Lannate WP (DuPont) (1/2 lb/acre)	---	low (4 hr.)
Lannate WP (DuPont) (1 lb/acre)	---	low (8 hr.)

Superior oil did not act as a "safener" to bees when mixed with Parathion in alfalfa applications (oils did "Safen" Ethion or Perthane on apple in 1968 tests). Possibly the difference in waxy surfaces on foliage of the two crops help explain this.

S E C T I O N V

DISEASES OF STONE FRUITS

Iain C. MacSwan:

Sprays were applied to single tree plots of mature Improved Elberta peach trees, replicated five times, by hand gun sprayer. One spray (February 12), was applied to all plots. Unusually heavy snowfall in January delayed the time of application of these sprays approximately one month. Approximately one hundred leaves per tree were rated as diseased or healthy on June 9, 1969. Difolatan provided excellent control, Puratized 10 spray good control and Kocide 101 and Brestan commercially acceptable control of leaf curl.

Treatment and rate per 100 gallons	Percent leaf curl
Thynon 3/4 lb. + Triton B1956 4 oz.	25.6
Thynon 1 lb. + Triton B1956 4 oz.	23.2
Difolatan 2 lb. + Triton B1956 4 oz.	1.6
Bordeaux 8-8-100 (Pre Soak)	19.4
Bordeaux 8-8-100 (tank mix)	25.6
Puratized 10 spray + Triton B1956 4 oz.	8.4
Brestan 1% by weight + Triton B1956 4 oz.	11.6
Kocide 101 5 lb. + Volck 4 oz.	13.6

Iain C. MacSwan:

Sprays were applied to five year old Improved Elberta trees in single tree plots replicated three times to compare efficacy of Cyprex and Benlate when used at rates higher than normal with the 'standard' TAG for control of leaf curl. Sprays were applied by hand gun sprayer on February 13, 1969. Approximately one hundred leaves per tree were rated as diseased or healthy on June 9, 1969.

Neither the Cyprex nor Benlate treatments provided acceptable control of leaf curl.

Treatment and rate per 100 gallons	Percent leaf curl
Cyprex 2 lb.	18.0
TAG 1½ pts.	5.0
Benlate 2 lb.	35.4

Iain C. MacSwan:

Sprays were applied to single tree plots of mature Improved Elberta peach trees, replicated six times, by hand gun sprayer at popcorn (March 28), full bloom (April 7), and petal-fall (April 15). Triton B1956 2 oz. per 100 gallons was added to all sprays. One of the planned candidate fungicides did not arrive and as a result two sets of control plots were in the test. One hundred plus blossoms per tree were rated as diseased or healthy on May 5.

Both rates of Benlate and Thynon (1 lb. rate) gave excellent control of blossom blight. Cyprex, Daconil 2787 and Thynon (3/4 lb. rate) were slightly less effective.

Treatment and rate per 100 gallons	Percent brown rot blossom blight
Daconil 2787 1 lb.	6.67
Benlate 4 oz. active	.67
Benlate 8 oz. active	1.00
Thynon 3/4 lb.	7.95
Thynon 1 lb.	2.33
Dithane M 45 80W 1½ lb.	9.45
Control	27.03
Cyprex ½ lb.	6.27
Control	25.70
LSD .05	2.92
LSD .01	3.46

S E C T I O N VI

DISEASES OF POME FRUITS

N. S. Luepschen:

Two experiments were conducted in separate blocks of 'Bartlett' pear to test two new materials and to improve streptomycin penetration with the use of surfactants and humectants. Test 1 was conducted in late May with 6-year-old trees; Test 2 was conducted in early June with 8-year-old trees. Sprays were applied during daylight hours with a hand gun at 400 lbs. psi., wetting the foliage to the point of run-off. Treatments were randomized throughout the blocks, with 7 single tree reps for Test 1, 6 reps for Test 2. Twenty-four hours after spraying, ten terminal shoots were harvested from each tree, brought into the lab, placed into jars of water and held at 75°F. Terminals were inoculated with water suspensions of *E. amylovora* by means of hypodermic needle. Blight and terminal growth measurements were made in cm 7 days after inoculation, and calculated as percent of each terminal blighted.

The rather non-succulent stage of terminal growth at the time of the tests limited the amount of blight development, as noted in the low percentage of terminal growth blighted. LMA-B 100 exhibited excellent blight control (87 and 90%), while the surfactant and humectant combinations with streptomycin were disappointing. Streptomycin with Atlox 210 resulted in 73% control in Test 2. Uniroyal F 454 was equal to or slightly better than streptomycin in Test 1. LMA-B 100 was phytotoxic to the extent that a persistent chlorotic margin developed on the leaves of sprayed trees in each of the tests.

Test 1.

Treatment and rate	% blighted terminal growth
Check	5.5
Uniroyal F 454 50% E.C. @ 2000 ppm + S-77 @ 8 oz/100 gal	3.7
Amdal LMA-B 100 @ 250 ppm + X-77 @ 8 oz.	0.7*
Agri Strep @ 100 ppm + Tween 20 @ 8 oz.	5.8
Agri Strep @ 100 ppm + Glycerol @ 2 qts.	5.2
Agri Strep @ 100 ppm + X-77 @ 8 oz.	3.8
Agri Strep @ 100 ppm + X-77 @ 8 oz.	4.8
L.S.D. 5%	3.7

Test 2.

Treatment and rate	% blighted terminal growth
Check	6.0
Agri Mycin 17 @ 100 ppm + X-77 @ 4 oz/100 gals	5.8
" " " @ 200 ppm + X-77 @ 4 oz.	4.9
" " " @ 100 ppm + 2 qts. glycerol	4.2
Amdal LMA-B 100 @ 250 ppm + X-77 @ 4 oz.	0.6*
Agri Mycin 17 @ 100 ppm + Tween 20 @ 4 oz.	3.2
" " " " " " + Nu Film-P @ 4 oz.	3.8
" " " " " " + Nu Film-17 @ 4 oz.	2.5
" " " " " " + PM-4879 @ 4 oz.	5.8
" " " " " " + Riedel's 1814 @ 4 oz.	3.2
" " " " " " + Biofilm @ 4 oz.	3.5
" " " " " " + Buffer X @ 4 oz.	2.9
" " " " " " + Sutro 170 @ 2 qts.	4.7
" " " " " " + Span 20 @ 4 oz.	6.7
" " " " " " + Atlox 1087 @ 4 oz.	2.9
" " " " " " + Atlox 209 @ 8 oz.	4.4
" " " " " " + Atlox 210 @ 8 oz.	1.6*
" " " " " " + Amway L.O.C. @ 4 oz.	3.9
" " " " " " + Triton X-100 @ 4 oz.	3.7
L.S.D. 5%	4.1

Duane L. Coyier and Scott B. Kelly:

Two locations were selected for field trials and identical fungicide treatment was applied at each location. One pear orchard was located in the Odell area at 1100 feet above sea level and the other was located south of Parkdale at approximately 2100 feet. Two pre-harvest fungicide treatments were applied with a hand-gun sprayer operated at 450 psi. Measurable rainfall occurred the day following each application. The following list shows the fungicide, formulation and dosage applied at each spray date:

1. Benomyl, 50% w.p., 1 lb/100 gal(1)
2. Benomyl, 50% w.p., 1 lb + Dithane M-45, 80% w.p., 1 lb
3. Benomyl, 50% w.p., 1 lb + Dithane M-45, 80% w.p., 1 lb + Botran, 75% w.p., 1 lb/100 gal.
4. Ziram, 76% w.p., 1½ lb/100 gal.
5. Check (water only -- no fungicide).

The above treatments were applied to each of six single tree replicates per treatment at each location. The Odell orchard was sprayed on August 13 and 30, 1968. Fruit from this orchard was harvested on September 9 and 10, 1968. Treatments were applied at the Parkdale orchard on August 29 and September 12, 1968. The fruit was harvested from this orchard on September 23 and 24, 1968. Fruit from each location was hand-graded the day following harvest to eliminate damaged pears and other culls including extremely large and small sizes.

Four boxes of fruit from each of the six single tree replicates were packed in cardboard boxes lined with polyethylene bags. Each box contained 90 fruit (18 on each of five layers, separated by molded fiberboard trays). The fruit was placed in common cold storage immediately after packing, and the core temperature was held at 31° F where it remained until mid-March, 1969, at which time it was examined for incidence of decay. Following this examination, the fruit was returned to cold storage where it remained until the final inspection in early May. After the final examination, samples were selected from each treatment and ripened at 70° F, 85% R.H. for eight days. Following the ripening period, random samples were pressure tested and analyzed for total acids and soluble solids. Decay control by the various treatments is given in the following table:

Decay control in stored D'Anjou pear fruit by various pre-harvest fungicide treatments.

Fungicide, formulation and dosage/100 gal	Percent Decay March	May	Total	
Odell Plot				
Benomyl[1], 50% w.p., 1 lb	.12	1.48	1.60	a
Benomyl, 50% w.p., 1 lb + Dithane M-45[2], 80% w.p., 1 lb	.00	1.30	1.30	a
Benomyl, 50% w.p., 1 lb + Dithane M-45, 80% w.p., 1 lb + Botran[3], 75% w.p., 1 lb	.09	.60	.69	a
Ziram, 76% w.p., 1½ lb	.51	3.66	4.17	b
Check (water only, no fungicide)	2.30	12.96	15.26	c
Parkdale Plot				
Benomyl, 50% w.p., 1 lb	.00	.42	.42	a
Benomyl, 50% w.p., 1 lb + Dithane M-45, 80% w.p., 1 lb	.00	.23	.23	a
Benomyl, 50% w.p., 1 lb + Dithane M-45, 80% w.p., 1 lb + Botran, 75% w.p., 1 lb	.00	.19	.19	a
Ziram, 76% w.p., 1½ lb	.32	1.53	1.85	b
Check (water only, no fungicide)	2.04	13.52	15.56	c

(1) All benomyl treatments also included 4 oz/100 gal of surfactant "F" as recommended by the manufacturer.

1 Product of E. I. duPont de Nemours Co. Registered trade mark name is Benlate and was originally tested as duPont 1991.

2 Product of Rohm & Haas Co. A coordination product of zinc ion and manganese ethylene bisdithiocarbamate. Registered trade mark name.

3 Product of Upjohn Co. Registered trademark name.

Control of decay in storage by pre-harvest benomyl treatment was excellent. The addition of Dithane M-45 or Dithane M-45 plus Botran to benomyl did not significantly lower the incidence of decay. Most of the decay found in this fruit was caused by *Botrytis cinerea* Pers. although other fungi we observed included *Penicillium expansum* Lk., *Gloeosporium perennans* Zeller & Childs and several others not identified. It was noted at the final inspection that decay due to *G. perennans* was completely absent in fruit lots treated with benomyl while ziram treated and check lots had a relatively high incidence of decay caused by this organism.

No significant difference in total acids or soluble solids was observed among the treatments in this test. In only one case did a significant difference in average pressure occur and this did not appear in fruit from both orchards. We concluded that the fruit quality was not materially influenced by pre-harvest application of these treatments.

Iain C. MacSwan:

Sprays were applied by handgun sprayer to single tree plots of mature Jonathan trees replicated three times. One treatment (NC 5630) was tried as a 'massive dose' and applied only once (March 19-silver tip to green tip). The other plots received a full season schedule: pre-pink (April 8), except NC 5334 which received the pre-pink spray on April 10; pink (April 16); calyx (April 30); first cover (May 28) and second cover (June 30). (NC 5334 did not receive the second cover spray).

Triton B1956 at rate of 2 oz. per 100 gallons of spray was added to Karathane, Lovozal and NC 5334. Guthion 50 wp at 3/4 lb. per 100 gallons of spray was applied to all plots on May 15 and June 20 for control of codling moth.

Terminals (100 per tree) were assessed for mildew and fruit russet readings (300 apples per tree) on September 26. EL 273 and Lovozal provided mildew control equal to that of the 'standard' Karathane treatment.

Treatment and rate per 100 gallons	Percent Powdery mildew	Percent fruit with russet
Karathane 3/4 lb.	68.33	16.13
EL 273 30 ppm	58.00	15.33
Check	90.00	60.93
EL 273 40 ppm	72.33	5.03
EL 273 80 ppm	52.00	8.30
Lovozal 40 W	68.00	19.90
NC 5630	86.33	31.20
NC 5334	82.33	16.53
LSD .05	10.35	6.40
LSD .01	12.98	8.07

Iain C. MacSwan:

Sprays were applied by handgun sprayer to single tree plots of mature Rome trees replicated five times. Plots were sprayed at: pink (April 21), calyx (April 30), first cover (May 12), and second cover (June 17).

Guthion 50 wp at 3/4 lb. per 100 gallons of water was applied May 15 and June 20 for control of codling moth. Triton B1956 at rate of 2 oz. per 100 gallons of spray was added to all sprays except Benlate and EL 273 (three rates).

Dates of disease readings: Leaf scab (approximately 100 leaves per tree) October 23; fruit scab and fruit russet (100-200 apples per tree) at harvest, October 30; powdery mildew (approximately 100 terminals per tree) on November 5.

Fruit scab: Good control was obtained by Cyprex, Benlate, Dikar, Thynon (two rates) and EL 273 (80 ppm). Leaf scab: Benlate, (8 oz. active) EL 273 (80 ppm) and Thynon (4 oz.) gave control equal to the 'standard' Cyprex treatment. Powdery mildew: Benlate (8 oz. active), EL 273 (80 ppm) and NC 5334 provided control equal to that of the 'standard' Karathane treatment.

Treatment and rate per 100 gallons	Percent fruit scab	Percent leaf scab	Percent Powdery mildew	Percent russet
NC 5016 3/4 lb.	36.68	42.20	24.00	8.34
NC 5630 1 pt. 10 oz.	14.70	22.20	24.80	17.14
EL 273 30 ppm	8.36	12.40	20.60	6.86
EL 273 40 ppm	7.48	15.40	22.20	6.94
EL 273 80 ppm	1.40	7.00	16.40	5.82
Benlate 8 oz. active	.88	3.80	17.00	10.74
Karathane 3/4 lb. + Cyprex 3/4 lb.	1.52	6.00	14.40	5.70
Dikar 2 lb.	2.40	15.20	20.80	7.18
Thynon 8 oz.	1.74	11.40	34.00	7.52
Thynon 4 oz.	.32	7.40	27.80	6.84
NC 5334 2 lb.	7.48	18.20	16.60	8.82
Check	91.94	62.00	39.40	2.86
LSD .05	5.88	4.94	5.32	2.08
LSD .01	6.92	5.81	6.26	2.45

Iain C. MacSwan:

Two rates of Difolatan 4 Flowable and one rate of Cyprex were tested as 'massive dose' applications and compared with two rates of Thynon applied in a regular spray schedule to single tree plots of mature Richared Delicious trees replicated four times. Difolatan and Cyprex treatments were applied on March 25 (silver tip to green tip stage). The Thynon treatments were applied at: pre-pink (April 14); pink (April 22); calyx (May 2); first cover (May 22) and second cover (June 30). Triton B1956 at the rate of 2 oz. per 100 gallons was added to the Thynon sprays.

Guthion 50 wp at the rate of 3/4 lb. per 100 gallons of water was applied to all plots on May 15 and June 20, for control of codling moth.

'Massive dose' sprays of Difolatan in previous years (1967, 1968) and of Cyprex in 1968 provided good control of scab, but were inadequate in 1969. Exceptionally heavy rainfall in June, (2 inches of rainfall occurred June 21-29) is believed to be responsible for the lack of control by the massive dose applications. Under these conditions a 'booster' application of the fungicides is probably required.

Thynon (4 oz. rate) looks very promising for scab control.

Treatment and rate per 100 gallons	Percent fruit scab	Percent leaf scab	Percent russet
Difolatan 6.25 lb. + 2½ gal. Volck	75.90	31.25	.35
Difolatan 4 lb. + 2½ gal. Volck	92.85	44.75	.40
Thynon 8 oz.	26.50	3.75	1.23
Thynon 4 oz.	4.15	7.50	1.43
Cyprex 3 lb. + 2½ gal. Volck	76.43	33.75	0
Control	98.98	54.50	0
LSD .05	23.41	10.03	1.95
LSD .01	29.58	12.67	2.80

Iain C. MacSwan:

Sprays were applied by hand gun sprayer to single tree plots of six year old Rome trees replicated six times. One treatment (Benlate 8 oz. active plus 4 oz. Triton B1956) was applied only once -- November 1, 1968. The remainder of the treatments were applied at pre-pink (April 21), calyx (May 1), first cover (may 12), and second cover (June 19). Triton B1956 at the rate of 2 oz. per 100 gallons of water was added to all treatments except those of Benlate.

Guthion 50 wp at the rate of 3/4 lb. per 100 gallons of water was applied to all plots on May 15 and June 20. Fruit scab and fruit russet readings were made at harvest on October 22; leaf scab readings were taken on October 9.

All of the treatments with the exception of the November 1, 1968 application of Benlate provided good control of fruit scab.

Benlate at both 4 oz. and 8 oz. active, Dikar, Karathane (plus Cyprex) and lime sulfur -- wettable sulfur treatments provided good control of powdery mildew.

Treatment and rate per 100 gallons	Percent mildew	Percent russet	Percent fruit scab	Percent leaf scab
Benlate 1 lb. + 4 oz. B1956 (Nov. 1, 1968)	22.67	11.88	54.50	55.83
Benlate 4 oz. active	7.33	25.30	.73	3.17
Karathane 3/4 lb. + Cyprex 3/4 lb.	7.20	15.68	.53	4.57
Benlate 8 oz. active	7.33	24.67	.57	3.00
Dikar 2 lb.	4.33	27.20	1.88	14.33
Lime sulphur 2½ gal. early bloom and calyx-- 6 lbs. wettable sulfur for covers	9.67	21.82	2.21	3.83
Check	16.67	19.23	67.17	53.83
TD 5056 - 50 wp 1½ lb.	12.67	24.47	1.32	3.71
TD 1604 - 50 wp 2 lb.	10.67	18.27	.43	4.57
TH 439 50 wp 1 lb.	16.03	26.82	.58	2.67
LSD .05	6.12	8.52	6.42	3.32
LSD .01	7.24	10.06	7.58	3.92

Duane L. Coyier and Scott B. Kelly:

Fungicide screening trials were conducted under shade house conditions to evaluate new chemicals for control of powdery mildew on apple seedlings. Our tests this season were similar to those of previous years except that the light intensity of the plant growing area was increased. In previous years we provided shade with burlap, but this year a plastic shade screen was substituted. The new material was designed to provide 55% shade.

We applied the fungicides, with a handgun sprayer, weekly for four applications and rated the plants one week following the final spray. Unsprayed plants had an average powdery mildew rating of 40 on a rating scale of 0-50; where 0 is complete absence of mildew and 50 is over 50% of the leaf surface covered by the fungus. The powdery mildew rating was converted to percent disease control based on mildew rating of unsprayed check plants and the data are presented in the following table.

Shade-house fungicide test for control of powdery mildew on seedling apple plants.

Treatment, Formulation and Dosage/100 gal	Percent Disease Control[3]
1. EL-273, 4.5% EC, 1 pt	100 a
2. Karathane, 25% w.p., ½ lb	99 a
3. Dikar, 80% w.p., 2 lb	99 a
4. EL-273, 10% w.p., .43 lb	97 a
5. BAY 66109, 15% EC, 1 pt	85 b
6. R-10044, 65% w.p., 2 lb[1]	75 c
7. Benlate, 50% w.p., ½ lb	72 c
8. DS-11385, 25% w.p., 3/4 lb	71 c
9. NC-5334, 40% w.p., 2 lb	67 c
10. Check (water sprayed)	-- d
11. Check (unsprayed)	-- d
12. R-10044, 1E, 10.6%, 1½ gal[2]	-- d

Sprays were applied 6-17, 6-24, 7-1 and 7-8-69 and powdery mildew evaluation was made 7-15-69.

[1] Dosage reduced to 1 lb/100 gal following first application (due to phytotoxicity).

[2] Treatment discontinued following first application due to extreme phytotoxicity.

[3] Numbers followed by the same letter are not significantly different at 0.05.

CODLING MOTH

H. R. Moffitt:

Field studies on the effects of trap density upon the trapping efficiency of the BAB trap have shown that the recovery rate of released laboratory-reared male codling moths increases only up to a point as the numbers of traps/acre increase. The trap densities employed were 1.5, 4.5, 10, 19, 39 and 79 traps/acre. The highest recovery rate (58%) was achieved at 10 traps/acre. At 19, 39 and 79 traps/acre, the recovery rate ranged from 40-48%. At 1.5 and 4.5 traps/acre, the recovery rate was 15% and 37%, respectively.

As only males were released, these data indicate the degree of recapture with the BAB trap when no or little competition from free females is present. Studies will be conducted on recapture success with the BAB trap in a mixed-sex population.

F. P. Dean:

The experimental insecticides phosalone, VCS-506, and Torak® gave good control of codling moth. These tests were made by taking samples of fruit and twigs with leaves at weekly intervals from sprayed trees and exposing them to young larvae and adults in the laboratory. The experimental insecticides were slightly less effective than the standard treatment of Guthion.®

FILBERTWORM

S. C. Jones:

Gardona 75% w.p., 1 lb/100 was evaluated for filbertworm control in the Entomology filbert orchard. The plots were sprayed on July 15 and August 15 with a power sprayer using hand guns. One thousand filbert nuts were cracked and examined from the sprayed plot and one thousand nuts examined from the check plot. No worms were found in the nuts from the sprayed plot and seven from the unsprayed plot.

McDANIEL MITES

F. P. Dean:

In orchard plot tests with experimental acaricides, excellent control of McDaniel mites was obtained with Lovozal, Omite, Plictran, TH-367-I, SD-16898, SD-17250, and SD-17578. Fundal EC also gave excellent control but the soluble powder was less effective. Formetanate, TH-367-I, Torak and Hercules-17413 gave only fair control and phosalone was ineffective. Predation by Typhlodromid mites was not a factor in the above tests. In another test orchard where predators were present, they survived three applications of phosalone, VCS-506, and Torak in fair numbers and held the McDaniel mites to small numbers.

WESTERN CHERRY FRUIT FLIES

S. C. Jones:

The first cherry fruit fly emerged in ground cages in a cherry orchard east of Salem on May 25, 1969. The flies were most abundant in cages between June 3 and June 7. The infestation in the Willamette Valley was generally light and growers had little difficulty controlling the fly.

Ultra Low Volume aerial applications of 95% technical malathion was conducted in an abandoned five acre orchard near Eugene, Oregon. A helicopter was used to apply the sprays. Five weekly applications were made at seven day intervals except the fifth spray which was delayed six days on account of rain. Cherry samples were examined for worms on July 8 and July 17. The dosages used were ½ pint and one pint per acre. No worms were found in the sprayed plots on July 8 but seven were found in the check sample. The samples taken on July 17, showed 10 worms in the plot sprayed with ½ pint/ Acre and no worms in the plot sprayed with one pint per acre. There were 87 worms in the check sample on July 17. The sample size was 865 cherries. Other samples examined ranged in size from 1,105 to 1,643 cherries.

Other plots were sprayed with a power sprayer using hand guns in the Entomology cherry orchard in Corvallis. Gardona, Furadan, and Zolone were evaluated for cherry fruit fly control. Three sprays were applied at approximately 10 day intervals. Flies were released in the orchard almost daily. Samples of cherries were taken from the plots on July 2, 3, and 14 and examined for worms. A total of 14,066 cherries were examined from these plots and only one worm was found.

PACIFIC MITE

J. H. Black, K. E. Hench and C. S. Davis:

Petal fall applications of Volck Supreme and Premerge delayed mite infestations for two weeks when applied to the trunk and surrounding soil. Prebloom sprays did not delay mite infestation.

PREDATORY MITE

W. W. Barnett, D. H. Chaney and C. S. Davis:

Applications of Volck Supreme were not detrimental to *Neoseilulus caudiglans* and *Metaseilulus occidentalis*. Thiodan was not as detrimental to populations of these two mites as were Sevin and Guthion. Guthion and Sevin were the least detrimental to *Zetzellia mali*.

WALNUT APHIDS

G. S. Sibbett, L. C. Brown and C. S. Davis:

Alfalfa interplanted in two walnut orchards to breed ladybird beetles and green lacewings controlled walnut aphid in trees after the alfalfa was strip cut. Ladybird beetles and green lacewings were kept in the orchard during the entire summer.

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