ABSTRACTS OF REPORTS FROM THE 45th 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
45th Annual Western Cooperative Spray Project

TABLE OF CONTENTS

LEPIDOPTEROUS INSECTS -- Section I

Codling Moth - Pears 1
Codling Moth - Walnut 1
Codling Moth - Apples and Walnuts 1
Codling Moth - Apples . . . . . 1 - 2
Fruit tree Leafroller - Apples 2
Peach Twig Borer - Almonds 2
- Peaches 2
- Almonds, Prunes and Peaches 2
Oriental Fruit Moth - Peaches 3

ORCHARD MITES -- Section II

Phytophagous Mites . . . . . 4 - 6
Predator Mites. 6
Integrated Control 7

OTHER INSECT PESTS -- Section III

Thrips 8
Pear Psylla. 8
San Jose Scale 9
Campylomma verbasci. 10
Cherry Fruit Fly. 10
Aphids. 10
Lygus Bugs 11
Pacific Flatheaded Borer 11

SPRAY RESIDUES, COMPATIBILITY, PHYTOXICITY, BEE POISONING &
POLLINATION, CONCENTRATE SPRAYING AND OCCUPATIONAL EXPOSURE -- Section IV. 12

DISEASES OF STONE FRUITS -- Section V. 14

DISEASES OF POME FRUITS -- Section VI. 19

CONTRIBUTORS TO ABOVE ABSTRACTS 23

SECTION I

LEPIDOPTEROUS INSECTS

CODLING MOTH

L. G. Schoenleber:

A mechanical dispenser enclosed in a temperature controlled box was developed for metering sterile adult codling moths continuously in the airstream from an aircraft. It was used on a fixed wing and rotary aircraft. The dispenser will hold approximately 70,000 adult codling moths. Adjustments are provided to meter the insects at rates of 1,000 to 17,000 per minute.

CODLING MOTH -- PEARS

W. C. Batiste:

Live female sex traps were used for improved timing of spray applications. Dosage of Guthion (50% W.P.) was varied for each cover spray in a schedule ranging from three highs (4 oz AI/100) to three lows (2 oz AI/100). A similar dosage schedule was repeated for Guthion used in combination with oil (1% Volck Supreme). Oil reduced the effectiveness of Guthion against codling moth, however control was adequate where dosage was reduced in up to two applications. No added benefit was provided by the higher dosage where oil was not included. Lower dosages of Guthion resulted in less-severe infestations of two-spotted spider mite, European red mite and pear psylla. Addition of oil increased the degree of control of mites and pear psylla.

Methods were developed to rear codling moths on an artificial diet under limited insectary facilities. Compressed air with regulated constant humidity was used to provide a suitable environment for individual trays of media within plastic bags. Production was about 300 moths per 9 x 12 inch tray. Six trays of media were prepared each week.

P. H. Westigard

Three applications of Phosvel at 1.0 lb AI/100 or of Zolone E.C. at .5 lb AI/100 produced fruit with no wormy fruit at harvest. Zolone W.P. applied at the same rate as the E.C. formulation resulted in nearly 2.0% wormy fruit.

CODLING MOTH -- WALNUTS

M. M. Barnes, C. S. Davis and G. S. Sibbett:

Galecron provided very good control of codling moth and two-spotted mite on walnuts. There were indications of selective action favoring the walnut aphid parasite, but confirmation is needed. Cryolite was inadequate for codling moth control.

CODLING MOTH -- APPLES AND WALNUTS

F. Cisneros and M. M. Barnes:

Comparisons between apple and walnut "strains" of codling moth are being conducted. Comparisons being made include photoperiodic responses, oviposition preference on leaves and fruit, sex ratio, longevity and oviposition capacity.

CODLING MOTH -- APPLES

M. D. Proverbs:

Release of gamma irradiated codling moth adults was continued for the second year on 110 acres. Harvested fruit samples showed 0.02% infested apples in the release orchard. Approximately 3.5 million moths were produced on an artificial diet during a 5-month period. Moths were released from a helicopter by feeding them into a discharge tube via a rapidly vibrating trough.

CODLING MOTH -- APPLES (Cont'd.)

H. F. Madsen:

Gardona, Zolone and Galecron gave satisfactory control of the codling moth in a heavily infested orchard. Phosvel did not provide commercially acceptable control. Trees treated with Gardona had very high populations of European red mite and McDaniel spider mite. Mite populations were not significantly different from the nonsprayed checks on trees treated with Zolone or Phosvel. Galecron sprayed trees had few mites, either phytophagous or predators.

FRUIT TREE LEAF ROLLER -- APPLES

H. F. Madsen:

A full pink bud spray of diazinon gave good control of the fruit tree leaf roller and a green fruit worm on apples. Galecron was less effective but provided acceptable control. Zolone and Imidan did not give commercial control. Trees treated with diazinon, Zolone or Imidan did not have mite populations during the season which differed from the nonsprayed checks. Galecron sprayed trees had low populations of European red mites and predacious mites, but McDaniel mite increased 60 damaging numbers in August.

PEACH TWIG BORER -- ALMONDS

R. E. Rice and F. M. Summers:

Nine chemicals were field tested on 3-year old almonds for control of peach twig borer. Trees at popcorn stage were sprayed to run-off with a handgun at 400 psi. Supracide gave outstanding control, while Zolone, Gardona and Galecron/Fundal were somewhat less effective. TH-367, Azodrin, Plictran, Acarol and Carzol did not give satisfactory control in this test.

PEACH TWIG BORER -- PEACHES

E. W. Anthon:

The rearing of peach twig borer on artificial diet was continued this year with considerable more success in the numbers of larvae reared to maturity. Past trials have shown that neonatal larvae will not mature unless they are taken from the eggs and placed in total darkness for two weeks under controlled atmospheric conditions. They are then gradually brought out into a completely lighted room. Under these conditions they have been reared through two generations on artificial diet. However, when they reach the third generation the moths are smaller, the wings distorted and they are not able to fly. Experiments are planned in the future to vary the articifical diet in various ways to see if this condition can be corrected.

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

Peach twig borer trunk sprays applied July 1 and August 3 with the following materials gave good control: Gardona, Dursban, Furadan and Thiodan.

PEACH TWIG BORER -- ALMONDS, PRUNES AND PEACHES

J. E. Dibble and G. R. Post:

Using average number of twig strikes per tree as the evaluation method Zolone and Sevin gave perfect borer control. These May applications and June counts showed Galecron/Fundal S.P. to be somewhat inferior to the E.C. formulation. Both were less effective in almonds than Zolone and Sevin. Treatments on prunes also showed the S.P. formulation treated trees infested (though borer population was extremely light) and the E.C. formulation, Zolone and Sevin trees clean.

J. E. Dibble and G. R. Post: (Cont'd.)

In a very heavy infestation of twig borer in peaches, Sevin and Zolone gave excellent control. Both the E.C. and S.P. formulations of Galecron/Fundal also looked very good when compared to the high shoot strike incidence in the check.

OTHER LEPIDOPTEROUS PESTS

ORIENTAL FRUIT MOTH -- PEACHES

J. E. Dibble and G. R. Post;

Sevin and Galecron/Fundal S.P. gave good seasonal OFM control when applied in May and July. Shoot strike counts in June showed the above treatments, Zolone and Galecron/Fundal E.C. all equal in control, however, in the July counts the latter two were inferior.

S E C T I O N II

ORCHARD MITES

PHYTOPHAGOUS MITES

J. E. Dibble and G. R. Post:

For control of the brown almond mite, Zolone with and without oil, Galecron/Fundal (S.P. & E.C.), Carzol, Trithion and Volck Supreme showed excellent BAM control on both almonds and prunes up to a month after treatment. Due to extremely heavy mite populations in the rough bark of the almond spurs, the seven day reduction was not as apparent as the same count on prune leaves.

R. W. Zwick:

Plictran at reduced rates gave good mite control and allowed *Typhlodromus* to survive. NC 7333, a Lovozal analogue, appears promising as does GS-19851 against highly Kelthane-resistant mites. Possible 2-spot resistance to Omite following two cover applications was noted. Chlorphenamidine was excellent on European red mite, but gave erratic results against 2-spotted mite. Morestan gave excellent control of 2-spotted mites on cherry.

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

Two-spotted mites were controlled in a walnut orchard in Hanford by forcing predators into trees from an alfalfa cover crop by cutting the alfalfa. The predators controlling mites in the trees were six-spotted thrips, Stethorus lady beetles, minute pirate bug and *Metaseilulus occidentalis*. No chemical treatments for any walnut pests were applied in this orchard. In a walnut orchard in Porterville which was sprayed with Guthion for codling moth in June, cutting the alfalfa cover crop did not control mites. There were no predators in the alfalfa. The mites were controlled by an application of oil.

R. E. Rice, J. E. Dibble and F. M. Summers:

Carzol, Plictran, Acarol and Omite in that order gave good to acceptable control of Pacific mite on almonds over a 26 day post-treatment period. Supracide provided effective suppression for 12 days, while Gardona was ineffective.

J. E. Dibble and J. H. LaRue:

Certain superior narrow range spray oils were evaluated along with the highly refined supreme Volck oil on the Pacific mite. Due to a heavy spider mite population, the true control performance did not shake out until after one week in a four week test. Orchex 796 showed some superiority at first with Volck and PGSO-2 performing slightly behind and equal to each other. Spraytex with 0.75% emulsifier would appear to be that oils best formulation and also gave results equal to the above treatments.

J. E. Dibble, R. E. Rice and J. H. LaRue:

In a plum orchard averaging 10 mites per leaf, Supracide, Acarol, Omite, Plictran, Carzol, Zolone and Tedion + oil gave excellent results through two weeks. Carzol continued to hold the population down to less than one mite per leaf for over a month. Acarol, Omite and Plictran looked good for three to four weeks.

J. E. Dibble, R. E. Rice and T. L. Brown:

Galecron/Fundal by itself, Zolone and Trithion plus oil (PGSO-2) and oil alone at 1.5 gpa gave very good control on a heavily webbed mite population in almonds. This control was economic, however, for only 12 to 14 days. Of interest was the use of surfactants applied at high rates and without any miticide. Though not as effective in mite reduction by comparison to logical treatments a 70% reduction over the check was obtained with one treatment and approximately 50% with the others on the four day count.

Other tests compared different spray oils and miticides. Trithion plus oil gave a very good four day control, however, at 11 days after treatment Kelthane alone and with oil, Chlorobenzilate and Volck Supreme looked superior to the other treatments.

PHYTOPHAGOUS MITES (Cont'd.)

J. E. Dibble and J. H. LaRue:

Various miticides with and without spray oils and spray oils alone were tested on an extremely heavy population of Pacific mites on plums (41.6/leaf ave. pre-treatment). Kelthane, Kelthane plus oil, Omite, Zolone, Galecron/Fundal and Carzol all looked very good at one, two and three week counts. A lesser amount of Zolone (1.5 lbs vs. 2 lbs AIA) than the above but plus oil looked good at two weeks as did Tedion plus oil and PGSO-2 at 1.5 gals per acre. High predatory mite population in the Spraytex 1.5 gpa affected control favorably in this treatment. The lower rate of Spraytex as well as the check had to be treated out due to a high Pacific mite population.

P. H. Westigard: Pre-bloom

TH 367-I (Mytrol) applied at either the delayed dormant or pink stage of development gave excellent control of the European red mite. In other tests the pink bud timing was more effective.

P. H. Westigard: Summer application

Three applications of Zolone applied for codling moth control gave excellent control of this pest and in addition produced economic suppression of spider mites. A buildup in spider mites was evident near harvest time and resulted in non-economic but noticeable leaf injury by harvest time. Application of Carzol or Fundal or Galecron resulted in excellent control of the European red mite on pears.

R. S. Downing:

Plictran and SD-14114 gave good control of the European red mite on apples and were only slightly toxic to predatory mites. Fundal was equally toxic to both European red mite and predatory mites. Gardona was ineffective against European red mite and toxic to predatory mites. In July, a heavy infestation of European red mite was controlled by a single application of Plictran, SD-14114, or GS-19851.

Everett C. Burts:

Late season aerial application of dust and spray to suppress McDaniel and European red mite populations was evaluated on both pear and apple. Galecron and Fundal in eight gallon per acre sprays were effective in several tests but failed in one. Morestan as a dust or spray did not provide satisfactory control in most cases. Sprays were as good or better than dusts in all comparisons.

Donald W. Davis:

Eight materials were tested in replicated orchard plots on delicious apples at North Sale Lake City, Utah. McDaniel mites were the primary injurious species, with some 2-spotted mites. The predatory mite, *Typhlodromus occidentalis* did not appear in substantial numbers until late August. Acaralate, and to a lesser extent, Galecron and Zolone reduced the number of predators. Omite and Lovozal appeared to have the least effect on the predators.

The three most effective acaricides were Plictran, Carzol and Lovozal. They kept the mites under acceptable control from June 30th to the middle of August. The initial control by Plictran and Lovozal was somewhat better than by Carzol. When the materials began to fail in mid-August, Carzol seemed to have some suppressing effect until the end of the season, while Plictran and Lovozal did not. Galecron gave an effective control until about August 10th, and Omite and Acaralate until about August 5th. Torak and Zolone were ineffective.

E. W. Anthon:

For the control of McDaniel mites on peach seedlings the following materials gave good results under greenhouse conditions: Plictran, Shell 14114, Stauffer R10044, Pennwalt 1615 and Kelthane.

PHYTOPHAGOUS MITES (Cont'd.)

E. W. Anthon:

The following acaricides gave good control of the McDaniel mite on peaches in the field: Stauffer R10044, S.D. 14114, 14328, Plictran, Galecron, Carzol, Lovozal, Omite and TH 367I.

E. W. Anthon:

The following acaricides gave good control of McDaniel mites on cherries in the field: Stauffer R10044, S.D. 14328, 14114, Plictran, Galecron, Carzol, Azodrin, Lovozal, Omite and TH 367I.

PREDATOR MITES

B. A. Croft and M. M. Barnes:

In 1969, two azinphosmethyl-resistant strains of *Typhlodromus occidentalis* from Washington and Utah and a native susceptible strain from Oak Glen, California, were released into single tree plots (5 replications) in a sprayed apple orchard in southern California. During the first summer following these releases, the resistant strains persisted in the release area and demonstrated a greatly enhanced ability to regulate populations of *Tetranychus mcdanieli* at lower levels and earlier in the season when compared to the native susceptible strain which numerically responded after insecticide residues had dissipated.

Although the potential role of this resistant predator was demonstrated on a mass-release basis, the possibilities of long-term establishment were of equal or greater importance. In 1970, studies were conducted to determine if the resistant genes would be lost (a) if excessive winter mortality had occurred and the northern populations had not established, or (b) would persist if the northern resistant strains were well adapted to the climate in southern California and could be maintained by applying azinphosmethyl treatments each year, or (c) would persist if the resistant genes would be transferred through hybridization into the genome of the native strain, this strain being most adapted to the environmental conditions in the release area.

In 1970, dispersal rates of predators were monitored by measuring numerical changes in host and predator populations in zones extending away from the original release sites. Predators migrated up to nine orchard rows away from the release trees during 1969 and 1970. Toxicological responses (to a 0.5 mg/ml dosage of azinphosmethyl) of mites collected immediately after two azinphosmethyl applications in 1970 evidenced that resistant mites had persisted for two complete seasons in the release area. Measurement comparisons between the three strains of certain morphological features had shown the resistant strains from Washington and Utah to be larger mites with a significantly larger dorsal shield (ca 200 μ length), whereas the native susceptible strain from Oak Glen had a smaller measurement for this character (177 μ length). Measurement data of dorsal shield characters for the resistant mites which were collected in 1970 from the field indicated that predators in certain trees had smaller dorsal shields which were indicative of the native strain which previously had been susceptible. These data suggested that hybridization and a gene transfer of resistance had occurred into the native strain and indicated that this genetic control method of inducing resistant genes into native natural enemy populations by hybridization may be a useful tactic in pest management schemes where chemical methods are necessary.

R. W. Zwick:

On pome fruit, Ethion, phosalone, Omite and low rates of Plictran permitted good *Typhlodromus* survival. Kelthane was not immediately lethal, but eventually reduced phytoseiid mites.

R. W. Zwick:

Diazinon as a pre-bloom, fruit-fly and post harvest material on sweet cherries was innocuous to phytoseiids as were malathion ULV applications.

INTEGRATED CONTROL

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

The effect of certain chemicals on the European red and two-spotted species and the consequential influence on predaceous forms is of sound field interest. Carzol and Morocide performed well on both the ERM and 2-spot, Kelthane, Trithion, Galecron/Fundal and Zolone were generally to appreciably more effective on the ERM. Kelthane, Trithion and Zolone were the least injurious to *T. occidentalis*, but counts in all treatments, except Carzol, showed a slight to high return build-up after two weeks. Over-all, Carzol and Morocide appear to be the most harmful of the above materials.

J. E. Dibble and G. R. Post:

On the European red and two-spotted mite in almonds and prunes, Galecron/Fundal, Trithion, Carzol and Zolone all performed very well on ERM up to two weeks after application. Galecron/Fundal gave good control throughout the plot evaluation period of almost six weeks. All materials controlled 2-spot to the end of the test with the check population giving way to ERM and predatory mite pressure.

E. W. Anthon:

The last four years commercial control of mites on prunes has been obtained with the use of a delayed dormant spray of oil plus Ethion. Thiodan has been applied the last of June or early July for rust mite control. In some plots leafhoppers have caused more damage than the mites.

R. W. Zwick:

Predator-prey mite populations on apple continue to be cyclical in the absence of rust mites as an alternate host. Good over-wintering phytoseiid populations control 2-spot and McDaniel mites in April and disappear until August when their numbers are too low to exert much control of phytophagous mite increases. Following a selective acaricide application which reduces the spider mites phytoseiids exert effective control during mid to late September.

Of six cherry orchards followed this year, predator mites had controlled spider mites in four by mid-August. One orchard required a Morestan application to reduce 2-spotted mite and one orchard suffered severe foliage damage before an exceptionally high predator population eventually controlled McDaniel mites in early September.

S E C T I O N III

OTHER INSECT PESTS

THRIPS

J. H. LaRue and J. E. Dibble:

Twenty-one different materials were tested on flower thrips infesting nectarine shoot terminals. Counts made of individual terminals, however, concluded slightly different results than those made with standard thrips counters. Of the newer materials Cygon, Carzol, Gardona and Biothion looked very good. Parathion, Ethion, Delnav and a high rate of TEPP proved best of the old chemicals used. Zolone, Imidan, Guthion and Trithion are placed in questionable ranking as they appeared to perform well in one method of counting and poor in the other. Individual terminal counts are probably more accurate for performance evaluations.

PEAR PSYLLA -- PEARS

P. H. Westigard: Pre-Bloom

Delayed dormant application of Mytrol and of Galecron plus oil gave good psylla control. Morestan or Mytrol at the pink stage also resulted in excellent control.

Summer

Of the 16 materials tested for summer control of the pear psylla Thiodan, Fundal (Galecron), Fundal plus oil, Phosvel plus oil and relatively high rates of Guthion or Imidan (2 lbs/100) showed reduced nymph densities three weeks after treatment.

Post-Harvest

Application of Mytrol or Perthane or Perthane plus parathion gave excellent control of adult psylla.

F. W. Peifer:

Dormant applications of Perthane and oil were not as effective in reducing the adult psylla populations as in previous years. Dormant treatments which included oil were effective in delaying early oviposition. The following treatments or treatment combinations provided good early season control: 1) Dormant-oil + delayed dormant-Thiodan + oil and petal fall-Fundal; 2) Dormant-oil + pink-Galecron; 3) Pink-Thiodan + NF-17; 4) Pink-Morestan.

As cover sprays, several Thiodan formulations, Perthane, and SD 17250 gave good nymph control for three weeks. Fundal gave good initial control but nymphs started building up after three weeks. In many instances Perthane did not perform well during the cover spray period. In most tests Thiodan, Galecron-Fundal and TH 367-I were superior to Perthane as a cover spray. In a commercial pear block five Imidan applications were more effective than six Perthanes and one Imidan in keeping the psylla under control during the cover spray period.

Gary J. Fields:

Research was conducted during 1969 to determine if the European anthocorid bug *Anthocoris nemoralis* was displacing one of the native species from orchards near its introduction site at Summerland, British Columbia. The populations of three species of *Anthocoris* from six pear orchards were analyzed for similarities and differences and 30 different types of non-pear vegetation were examined for indications of anthocorid migrations away from pears. The disappearance of the native species, *A. melanocerus* was caused by its migration to a different host outside the orchard when *Psylla pyricola* prey density reached a low of one per leaf. *Anthocoris nemoralis* is evaluated as an excellent predator of pear psylla showing a high degree of prey preference for the pest, a preference for a tree habitat and a good response to increases in psyllid density. The importance of non-crop vegetation as a reservoir for natural enemies of pear psylla was made clear by this research.

PEAR PSYLLA -- PEARS (Cont'd.)

Everett C. Burts:

Galecron and Fundal, which had previously provided good control of overwintered adult pear psylla, were quite erratic in action against this insect this spring. Oil included with these materials in both ground and aerial sprays improved the kill. TH 3671 (Mytrol), the most promising new chemical for psylla control the past few years, was further evaluated in ground and aerial sprays with and without oil. Control in all plots was as good or better than that provided by the currently recommended insecticides. TH 3671 oil combinations were slightly more effective than TH 3671 alone.

The organophosphorous compounds, Zolone, Imidan and Gardona, were ineffective against overwintered adult pear psylla when applied as aerial sprays. Lannate in handgun sprays was also ineffective against this insect.

The dithio-carbamates, Manzate 200, Dithane M45 and Trimanzone, were evaluated in summer sprays to find the most effective way to use them against pear psylla. A single spray of any of these materials was not effective in bringing a heavy population under control. These materials were most useful against low populations or when used in a program of two or more sprays at 10 to 20 day intervals. They are most active against young nymphs but their residual activity prevented successful egg hatch for 14 or more days after application. New growth is not protected and reproduction of psylla can continue on actively growing trees.

In a limited screening test TD8550 was active against both adults and nymphs of pear psylla. Lannate was not effective in a similar test.

A summer spray program of three Thiodan sprays provided commercial control of pear psylla. Although low populations were present all season they did not build up to damaging numbers. The emulsifiable formulations were more effective than the wettable powder. The cottonseed oil and Pyrenone-Thiodan formulations had no greater effect than the standard E.C. The E.C. forms caused no injury to Bartlett fruit or foliage.

R. D. McMullen:

Studies on pear psylla egg and nymph mortality showed that predators were the major mortality factor early in the season and that temperature plays an important role later in the season. Dithane M-45 (Manzate-300) and Galecron gave good control of the pear psylla in summer sprays. Dithane M-45 provides residual toxicity against nymphs, but is not effective against adults and eggs. Galecron controls European red mite and pear rust mite in addition to pear psylla.

SAN JOSE SCALE -- APPLES

R. W. Zwick:

Fall applications of effective materials are as good or better than dormants. Oil plus either diazinon or lime sulphur was slightly better than oil alone at a higher rate or oil plus parathion or phosalone. Oil-ethion was one of the poorer combinations and Orchex 70 vis oil was definitely inferior to Volck oil. Although lime sulphur alone gave low mortality by the April count, delayed toxicity apparently resulted in effective control by harvest time as no scales were observed on the fruit.

C. V. G. Morgan:

In laboratory experiments, 0.08 lb actual parathion per 100 gal killed 50% of the dormant black caps. Diazinon was three times less effective, ethion five times, Zolone six times and Imidan 25 times. A low volume sprayer (25 gal per acre) was compared with a standard low volume sprayer set to deliver 200 gal per acre for San Jose scale control. A dormant spray of oil + parathion and two summer sprays of diazinon were applied. At harvest, the per cent scale infested apples were 2.3 for the 200 gal rate, 12.5 on the 25 gal and 97.2 on the nonsprayed check.

CAMPYLOMMA VERBASCI -- APPLES

R. D. McMullen:

Campylomma verbasci, a predator of the pear psylla, severely injured Red and Golden Delicious apples in two orchards, one in the Okanagan Valley and the other in the Kootenay Valley. Fruit of McIntosh, Spartan and Newtown trees in the same orchards were not affected. On apples, feeding punctures develop into raised corky pustules, and the fruits are misshapen. The abundance of *C. verbasci* in the affected orchards was 25 to 30 times greater than observed in previous years.

CHERRY FRUIT FLY -- CHERRY

F. L. Banham:

The peak emergence of western cherry fruit fly in the Okanagan Valley was from June 15 to July 20. A modified hydrolysate of corn protein incorporated with Stikem on yellow sticky boards was the best lure for the flies. One, two or three applications of dimethoate prevented maggot damage to Bing cherries and were equal to three applications of diazinon and superior to two applications.

Don R. Merkley:

Three chemical compounds were evaluated for their effectiveness in controlling cherry fruit flies during 1970. Carbofuran, at 1/4 lb, Imidan at 1/2 lb, and Zolone at one pint per 100 gals of water were applied at weekly intervals from June 24th for three applications. A pre-harvest Perthane (1 qt/100) application was made to all plots. All treatments gave effective control. Zolone was phytotoxic in the last application, apparently due to high temperature during application period. Following varieties in order of injury were: Sam, Bing, Chinook and Lambert.

APHIDS

M. M. Barnes, G. S. Sibbett and C. S. Davis: Payne walnuts

A second year of study on influence of walnut aphid on yield and quality (on the same trees) showed a depression of 730 lbs per acre resulting from aphid infestation as compared with controls. In addition, there were significant effects on quality resulting from aphid infestation e.g. decreased % Diamonds and increased % off grade. In a second experiment, the relationship between aphid infestation and the so-called "sunburn" problem was clearly demonstrated. It is clear that aphid populations in San Joaquin Valley Payne orchards must be maintained at a relatively low level, tentatively below 5-10 per leaf.

M. M. Barnes and M. J. Wargo: Walnuts

In trials on chemical control of the walnut aphid, Zolone at 4 oz actual per 100 gallons provided outstanding performance equivalent to that provided by Morestan at 2 oz. Next in order of effectiveness at the 4 oz dosage was Supracide. Fundal at 8 oz suppressed aphid populations.

E. W. Anthon:

The materials that showed promise for control of the green peach aphid in the greenhouse were: Ortho, 11775, TH 367I, 459I, American Cy 72613 and Thiodan plus Pinolene.

In the field trials: Furadan, Carzol, Ortho, 11775 and TH 459I, and 367I gave good control.

E. W. Anthon:

The leaf curling plum aphid on prunes was controlled in the field with the following materials: Azodrin, Furadan, Thiodan, TH 367I and parathion.

LYGUS BUGS

E. W. Anthon:

The following materials gave good control of this insect caged on peaches: Gardona, Azodrin, Dylox, parathion and Zolone.

Preliminary testing of Thiodan against lygus bugs from the Richland area gave only fair results.

PACIFIC FLATHEADED BORER

C. S. Davis, D. H. Chaney and L. B. Fitch:

An acrylic paint, white B42 W101 manufactured by Sherwin-Williams was applied to two varieties of peaches by a commercial type paint sprayer at full strength and at half strength prevented infestations of Pacific flatheaded borer. The white paint also prevented sunburning of the limbs treated. All infestations of borers were in the Dixon varieties; none occurred in the Paloras.

S E C T I O N IV

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

D. H. Chaney, J. E. Dibble and G. R. Post:

Three dormant oil sprays and two different forms of copper were applied at 15 - 400 gallons per acre by ground and at 20 gpa by air on the peaches. The results, as obtained in ppm or micrograms per square inch of copper, show a great variation does exist between commercial recommendations involving different oil/copper rates and application techniques.

M. H. Gerdts and J. E. Dibble: May Oil Sprays -- Plums

Fruit bloom removal occurred to a much greater degree with dilute SJS application than with concentrate.

M. H. Gerdts and J. E. Dibble:

Dormant oil emulsion sprays applied early in January to dry (no winter rains) peach trees caused no twig or wood injury at 1 gpa. Slight injury occurred with 2 gpa and heavy necrosis and twig kill followed the 3 gpa application. With Volck Supreme the same order of injury occurred at 1 gpa, 1.5 gpa and 2 gpa. The above symptoms could not be picked after rains in late January sprays.

Everett C. Burts:

Manzate 200 and Dithane M45 seem to be safe as summer sprays on both Bartlett and D'Anjou varieties. They may cause some injury when applied with oil or when oil is applied over their residues. Trimanzone caused injury to both fruit and foliage and this injury was increased by the addition of oil to the spray.

Plictran caused dark russet spots on D'Anjou fruit when applied over oil residues in tests last year. Attempts to duplicate this injury this year by applying oil over Plictran or Plictran over oil residues were unsuccessful. The question of oil-Plictran compatibility remains unanswered.

F. W. Peifer:

The following materials caused some degree of leaf damage (spotting, yellowing, defoliation, etc.) NC 7333 when followed in one week by oil, Volck oil, Morestan w/wo NF-17, NC 9369, Zolone W.P. + Omite.

Pears: Morestan alone and in combination with Cyprex and NF-17 caused varying degrees of petal burn on D'Anjou blossoms. Lovozal and its analogs NC 7779, NC 9369 and NC 7333 caused some degree of leaf and/or fruit marking when applied alone or when followed in one week by oil. Oil alone and Guthion + oil caused a slight amount of leaf spotting. Omite and Omite + Imidan caused a characteristic bronzing of the lower leaf surface of D'Anjou and Bartlett pear. Omite, applied two weeks following a Volck oil application also caused brown blisters on the fruit. A Zolone E.C. application resulted in typical "E.C. ringing" of D'Anjou fruit when followed the next day by Karathane and Cyprex W.P.'s.

R. W. Zwick:

Overhead application of acaricides resulted in poor control of spider mites but allowed phytoseiids to survive and control two-spotted mites.

C. S. Davis and R. R. Sanborn:

Application of chlorobenzilate, chlorobenzilate and 1% Volck Supreme oil caused severe leaf drop to Tilton and Blenheim varieties of apricots. Kelthane and 1% Volck Supreme oil caused slight leaf drop to these varieties. No phytotoxicity was noticed by applications of Aramite, Kelthane, Omite, Zolone, Trithion, ethion, or Volck Supreme oil when used alone. Combinations of Aramite plus Dibrom, Trithion plus 1% Volck Supreme, ethion plus 1% Volck Supreme also caused no apparent leaf drop.

J. E. Dibble, J. H. LaRue and M. H. Gerdts: Thrips materials - Nectarines

A shot hole effect was somewhat common on leaves sprayed with Cygon 267 at 1.5 pts per 100 and Gardona 75 W.P. at 12 oz. Parathion 4 F and PGSO-2 alone and in combination with Trithion caused a lesser degree of injury. TEPP at a standard rate of 1 pt/acre caused no phytotoxicity, however severe injury occurred at twice this rate.

J. E. Dibble: PTO operated sprayers - Noncrop, almond, plum and olive targets

Non-obstructed targets were placed at 1', 3' and 6' above the ground and at 5', 10' and 15' away from the nozzle and air discharge outlets of each sprayer. Adjusted for a 20' x 20' planting and operating at 50 gpa and 2 mph the dye coverage pattern was observed. A coverage gap was found in the RSM at 15' with the Victair on the 1' target card at all three stations. The Turbomist, Kinkelder and Windmill gave very satisfactory coverage.

These same sprayers operated in almonds, plums and olives (tree progressively more dense) were evaluated by target card coverage at 2' to 18'. The small Turbomist not designed for this use proved as suspected unsatisfactory. The Windmill obtained the best coverage on almonds and plums followed by the equally ranked RSM and Kinkelder. The Victair was equal to the Kinkelder in almonds but not as effective on plums. None of the units were satisfactory in olives.

Carl Johansen and Jack Eves:

Small-scale test of Morestan plus Nu-Film-17 on cherry showed that Nu-Film did not increase the hazard to honey bees. A test of SD 14114 and SD 14328 on cherry showed that these materials are non-hazardous to honey bees. The residual hazard to honey bees of several materials was as follows: Imidan, very high through one day; De-Fend and Cygon, very high through eight hrs; HCS 3260, moderate to very high for three hrs; Chlordane, N-2596 and Phosvel, only very high by direct application; Tedion and Omite, non-hazardous to honey bees.

Carl Johansen and Jack Eves:

A field test showed that Furadan + Sorba-Spray Mg (acidifier) was definitely superior to Furadan alone (in an alkaline spray water) against lygus bugs and aphids. Furadan outperformed Baygon + Di-Syston, Bidrin, Imidan, Lannate and Cygon in this test. A buffer, Sorba-Spray Mg, did not increase the hazard of Dylox, Dibrom and Systox combinations to honey bees at 1 pt/100 gal. However, all dilutions of Sorba-Spray Mg from 1 pt to 1 gal/100 gal with Dylox alone were increasingly hazardous to honey bees with the 2-hr residues. A commercial application of such a mixture on carrot seed apparently caused a heavy kill of honey bees. Buffers of several types did not change the very high hazard of Furadan to honey bees through one day. Dylox 80% SP, Dylox 95% SP, and Dylox 4 lb LS all gave a low mortality of honey bees with the 3-hr residues; as did Lannate 25% WP and Lannate 90% SP, at ½lb/acre. Combination of Cygon + 2, 4-DB did not reduce the effectiveness against lygus bugs or China lettuce and apparently 2, 4-DB reduced the hazard of Cygon to honey bees. A mixture of Furadan 4 lb F and 2, 4-DB 2 lb EC presented a foam problem. Kerb (herbicide) was not hazardous to honey bees. A laboratory test showed that Dibrom was much more hazardous to big-eyed bugs and damsel bugs than Biothion and Dylox.

S E C T I O N V

DISEASES OF STONE FRUITS

L. E. Lopatecki:

Tecto-60, NF-35 and Benlate reduced brown rot of artificially inoculated peaches 27, 46 and 50 percent respectively. Botran applied alone as a post harvest dip was not effective, but in combination with other fungicides generally increased rot control considerably. Best control resulted from mixtures of Botran and Benlate, or Botran and NF-35. By comparison, activity of Botran-captan mixtures was poor.

J. M. Ogawa, B. T. Manji, D. C. Ramsdell and D. J. Ravetto:

California's stone fruit crop acreage approaches the half million mark. Considering that at least one fungicide spray is applied to control the brown rot disease, costs are calculated at a minimum of five million dollars. In addition, one percent loss of the estimated production value of 280 million dollars would add another 2.8 million dollars. Therefore, our research program is directed to reduce the cost for control as well as attempt to obtain better disease control.

Current control programs recommend sprays to eradicate or suppress sporodochia during the winter, to protect blossoms from infections during the presence of susceptible parts, to protect the ripening fruits during the last three weeks of harvest with sprays or dust, and to dip or spray fruits with Botran after harvest. Considerable difficulties are encountered in making these spray applications because of inclement weather and cultural practices. Normally both high volume and semi-concentrate sprays are used with a few growers forced to use aircraft applications. Improvements to the current spray recommendation can be achieved through the following: 1) control programs directed for use during the winter in conjunction with other pesticides, 2) extension of the critical period for timing of sprays, 3) reduction in the number of sprays required for disease control, 4) control of post-harvest brown rot from pre-harvest treatments, 5) ability to mix sprays to control both brown rot and pests such as mites and oriental fruit moths.

Current recommendations are:

1. Dormant sprays are available only for apricot, almond and prune and these sprays must be applied with due consideration of pruning, leaf fall, and use of other pesticides such as dormant oils. The materials used are monocalcium arsenite (22%) and sodium pentachlorophenate (37%) at the rates of two and eight pounds per 100 gals., respectively.

2. Blossom sprays require specific timing, such as green tip, red bud, pink bud, popcorn, or even as critical as 5% bloom for the initial spray followed by another at full bloom. Extreme difficulties are encountered in spraying at this period because of large acreages to cover, the nonuniformity of blossoming, presence of bees for pollination, and the uncertainties in the weather. In general, aircraft applications have not been successful.

3. Preharvest sprays or dusts are mandatory in sprinkler-irrigated orchards. During years of unseasonal rains, coverage before the rain is needed to protect from brown rot. After infections have established, liquid lime sulfur, applied immediately after a rain or within 36 hours from the time of initial rainfall, offers good control. This treatment is most difficult because of wet ground and use of props to prevent branches from breaking.

4. Postharvest treatments are needed on fruits for fresh market or ripened for processing. Both sprays and dips with Botran have yielded excellent results. The key to control is the deposit of the proper amount of chemical on the fruit. On smooth-skinned fruits such as cherries and plums, sufficient deposit was obtained only through combinations of Botran with captan or wax. Botran residues of near 10 to 15 ppm are required.

Since 1967, research with benomyl (Benlate), Mertect and EL 273 has offered a new outlook on uses of fungicides for control of brown rot on stone fruits. Significant changes in both timing and methods of application are anticipated. The main reasons are: 1) these chemicals will inhibit growth of *Monilinia fructicola* and *Monilinia laxa*, the two brown rot fungi in California at extremely low dosages, 2) longer residual effect, 3) compatibility with oils or insecticides, 4) less phytotoxicity, and 5) possible systemic action. The research progress presented here is only with benomyl.

DISEASES OF STONE FRUITS (Cont'd.)

J. M. Ogawa, et al.

Dormant application of benomyl at 8 oz active material per 100 gallons significantly reduced *Monilinia laxa* sporodochial development on almonds, apricots and prunes. When mixed with supreme oil, the active material needed was only 4 oz. This mixture was safely applied without the need for consideration of pruning or application of other pesticides. Thus, for the first time, a dormant spray is possible on other stone fruit crops such as cherry, peach, nectarine and plum. The effectiveness of a dormant spray to control *Monilinia fructicola* has not been determined.

Benomyl does not control *Coryneum beijerinckii* or *Taphrina deformans* and, therefore, research on mixtures of benomyl with heavy metals such as copper is being undertaken.

Blossom sprays with the 4 oz active material per 100 gals provided better control of blossom blight than currently recommended chemical protectants, when applied at the critical blossom stages, except on apricots. Considering these facts, only minute amounts of chemical are needed and residual activity is longer than that of other protectants, applications were made at the bud-swell stage of bloom or delayed dormant. This treatment provided effective control of blossom blight on peaches, almonds and prunes. This is the first real evidence to show that fungicides applied before the presence of susceptible parts can be effective. This result suggests the possibility of aircraft applications. Based on recent data, a properly rigged helicopter was shown to deposit fungicide on each anther of the opening blossoms. Explanation for the disease control obtained from spraying at bud-swell stage of bloom is being investigated. The mixture of benomyl and supreme oil has not caused any phytotoxicity when applied at the bud-swell stage or during early bloom.

The lack of effectiveness of benomyl to *C. beijerinckii* and *Hendersonia rubi* must be considered in the use of benomyl, but other fungicides can be applied at petal or shuck-fall to control these diseases.

The most significant benefit derived from better blossom blight control may be the reduction of incipient infections of *Monilinia* on green fruits. Incipient infection is thought to occur at shuck fall, at which time the fungus grows from the infected shuck into the green fruit.

Blossoms sprayed with benomyl retained their petal color longer in the field and in the laboratory. but this mechanism has not yet been explained.

Preharvest protection of fruit was shown by various timings of benomyl sprays at 4 oz active chemical per 100 gallons. The amount of chemical required per unit surface area of the fruit was determined; calculated on the basis of fruit weight resulted in the need for 0.3 ppm. This was confirmed with the residue data obtained on fruit sprayed in the field and incubated to observe disease development. Residual activity of benomyl from a single spray during the last month before harvest affords disease control for 21 days on peach, 14 days on nectarine and 10 days on cherries, prunes and plums. On smooth-skinned fruits, it is more difficult to obtain initial deposits of the chemical. The addition of 8 oz of B1956 was necessary to deposit benomyl on French prunes. Supreme oil was added to benomyl in an attempt to enhance coverage and residual life.

Fruits already infected with *Monilinia fructicola* in the field were sprayed with benomyl. Only slight suppression was obtained and benomyl was not as effective as liquid lime sulfur -- wettable sulfur combination.

There is strong evidence that fruits sprayed with benomyl are slightly greener at harvest, but tests of soluble solids and color comparisons have not yet been completed.

Postharvest decay control of fruit for fresh market was possible with two preharvest sprays of benomyl, the first applied about three weeks and the second one day before harvest. Such field-sprayed fruit retained benomyl residues required for decay control even after wet or dry defuzzing procedures commonly used by the packers in California. In these treatments, postharvest Botran spray was used to control the *Rhizopus* rot. Only in the dry defuzzing process was it possible to retain the residues of field-applied Botran required for *Rhizopus* control.

Only dip applications of Botran and benomyl gave satisfactory decay control of fruits severely damaged by mechanical harvesting.

J. M. Ogawa, et al. Conclusions

Four new lines of approach in uses of benomyl for control of brown rot on stone fruits are proposed: 1) Use of benomyl as a dormant spray to suppress sporodochial development. The mixture could be four oz active benomyl, 1½ gallons of supreme oil and insecticide/100 gals. spray. 2) The application of 4 oz active benomyl with 1½ gallons of supreme oil between bud-swell and the critical stage of bloom such as green tip for prune, red bud for apricot, pink bud for almond and 5% bloom for peach. 3) Protection of fruits from brown rot infection during the last month before harvest with benomyl and oil used at the same concentrations as during blossoming. A single application three weeks before harvest on peaches could protect the fruits even in the event of unseasonal rain. 4) For postharvest decay control, a field spray one day before harvest.

Further studies are being undertaken to explain the following: 1) delayed blossoming of apricots from dormant applications of benomyl, 2) lack of effective blossom blight control on apricots, 3) effectiveness of -swell spray application, 4) extended activity of fruit spray applications even after a water wash, 5) lack of full color on nectarines and peaches at harvest, 6) benefits of benomyl and supreme oil mixtures, 7) possible chelation of the decomposition product (BCM) with other fungicides and minor element corrective sprays.

This is a research progress report and does not imply recommendations. Benomyl is not registered for use on stone fruits.

R. R. Sanborn, B. T. Manji and J. M. Ogawa:

In recent years semi-concentrate (100 gals/acre) applications of protectant fungicides have given satisfactory control of most stone fruit diseases in California. The current study was undertaken to compare the efficiency of dormant eradicant fungicides applied semi-concentrate and dilute.

A mature Blenheim apricot orchard with a history of brown rot (*Monilinia laxa*) in Brentwood, California, was selected for this study. Monocalcium arsenite and sodium pentachlorophenate were used because both are currently being applied as eradicants on apricots.

A block of 60 trees was used for each treatment, including control, and replicated three times. The sprays were applied with an Air-o-fan airblast sprayer on January 2, 1970.

Blighted twigs from the previous year were collected from the control and treatments. The sporodochia development on these twigs was counted. Also, shoot strikes were counted on April 9, 1970. The following table shows the data.

Treatment [b]	Rate/acre	FIRST SAMPLE [a] Sporodochia Total	Avg/twig	SECOND SAMPLE Sporodochia Total	Avg/twig	Blossom and Twig Blight Avg strikes/tree
Control		310 [c]	6.89	253	5.62	34.7 [d]
MCA (semi-conc)	9.6# 22%	15	0.33	9	0.20	3.8
SPCP (semi-conc)	12 # 79%	10	0.22	8	0.18	0.9
SPCP (dilute)	9.6# 22%	3	0.07	3	0.07	0.7
MCA (dilute)	12 # 79%	0	0	0	0	1.0

a/ First sample collected on January 30, 1970
Second sample collected on February 12, 1970

b/ semi-conc = 100 gallons/acre
dilute = 400 gallons/acre

c/ Total number of sporodochia from 45 4" twigs

d/ Average number of strikes on 6 trees replicated 3 times

Semi-concentrate applciations of eradicant fungicides are just as effective as dilute in reducing sporodochia development. Semi-concentrate dormant eradicant sprays gave satisfactory control of blossom and twig blight of apricots.

DISEASES OF STONE FRUITS (Cont'd.)

W. J. Moller and M. V. Carter:

Apricot dieback, caused by the wound-invading vascular pathogen, *Eutypa armeniacae* (imperfect state *Cytosporina* sp.), is the most serious disease affecting apricots in South Australia and California. Experiments in Australia during 1968 and 1969 showed that a single post-pruning, high-volume application of 0.025% (active ingredient) benomyl during tree dormancy significantly reduced infection of inoculated wounds.

Eleven other chemicals applied to comparable sites on apricot trees afforded little or no protection. This is the first success obtained in control of *Cytosporina* dieback by chemicals in some 40 years of research on the disease.

Iain C. MacSwan:

Sprays were applied by handgun sprayer to single tree plots, replicated four times, of mature Early Italian prune trees at popcorn, full bloom and late petal fall.

No brown rot blossom blight occurred in the plots. Although the fruit yield per tree was very low, normally we can expect a yield of 300-400 lbs per tree, the significant yield increase in the Dithane M-22 plots indicates an effect on yield that cannot be correlated with disease control. Yield increases from the application of a maneb fungicide and some others applied for blossom blight control during seasons when there is no blossom blight occur commonly in some prune growing areas in Oregon and as yet the cause has not been determined.

Treatment and rate per 100 gallons	% Brown Rot Blossom Blight	Yield (Ave. lbs. per tree)
Benlate 8 oz.	Nil	36.3
Benlate 1 lb.	Nil	27.5
TH 439 1 lb.	Nil	38.6
Dithane M 22, 80 WP, 2 lb + 2 oz. B-1956	Nil	63.0
Thynon 75 WP, 1 lb + 2 oz. B-1956	Nil	26.6
Liquid lime sulfur 1 gal.	Nil	19.7
Check	Nil	28.0

Iain C. MacSwan:

Preharvest sprays were applied by hand sprayer to single tree plots of mature Early Italian prunes replicated four times, at fourteen days before harvest and three days before harvest. The night previous to the applications the trees were overhead irrigated for five hours to induce fruit rot and allowed to dry before being sprayed. Approximately two orchard lugs of fruit were harvested from each replicate and placed in common storage. At eight and fourteen days after harvest fruit affected by *Monilinia fructicola* was counted and removed from the lugs.

None of the fungicides under the conditions of this test provided control of brown rot fruit rot.

Treatment and rate per 100 gallons	% Fruit Rotted by Brown Rot	
	after 8 days common storage	after 14 days common storage
Benlate 8 oz.	65.3	92.6
TH 439 1 lb + 2 oz B-1956	64.3	90.5
Dithane M 22, 80 WP, 2 lb + 2 oz B-1956.	68.5	95.6
Thynon 75 WP, 1 lb + 2 oz B-1956	66.7	92.9
Liquid lime sulfur 1 gal.	57.1	86.7
Check	59.4	84.7

DISEASES OF STONE FRUITS (Cont'd.)

Iain C. MacSwan:

Sprays were applied to single tree plots of thirteen year old Improved Elberta trees replicated eight times. Sprays were applied by handgun sprayer on January 20, 1970. One hundred leaves per tree were rated as diseased or healthy on May 15, 1970.

Difolatan and Elgetol provided excellent control of leaf curl.

Treatment and rate per 100 gallons	Percent Leaf Curl
Difolatan 4F, 3 qts.	3.5
Elgetol 2 qts.	7.5
Puratized 10 Spray 1½ pt plus B-1956 2 oz.	16.0
Cyprex 65 W, 2 lb plus 4 oz B-1956.	23.25
Kocide 101, 5 lb plus Volck Supreme Oil 4 oz.	26.25
Benlate 2 lb plus Volck Supreme Oil 1 qt.	38.37

Iain C. MacSwan:

Sprays were applied to single tree plots of mature Improved Elberta peach trees replicated five times by handgun sprayer at popcorn, full bloom and petal fall. Triton B-1956 at rate of 2 oz per 100 gallons of spray was added to all treatments except Benlate.

Benlate and Mertect provided excellent control of brown rot blossom blight.

Treatment and rate per 100 gallons	Percent Brown Rot Blossom Blight
Benlate 8 oz.	0.0
Mertect 8 oz + 2 oz B-1956..	3.2
Dithane, M 22, 80 WP 2 lb + 2 oz B-1956.	7.8
Fermate 76 WP 1½ lb + 2 oz B-1956.	13.2
Puratized 10 Spray 1/2 pt + 2 oz B-1956.	17.2
Zerlate 65 WP 1½ lb + 2 oz B-1956.	17.6
TH 439 1 lb + 2 oz B-1956.	19.4
Orthocide 50 WP 2 lb + 2 oz B-1956.	19.4
Difolatan 4 F, 1½ pt + 2 oz B-1956.	21.8
Cyprex 65 W, 3/4 lb + 2 oz B-1956.	24.6
Thynon 75 WP 1 lb + 2 oz B-1956.	32.6
Kolo 100 3½ lb + 2 oz B-1956.	33.0
Phygon XL 50 WP 1/2 lb + 2 oz B-1956.	35.2
Check.	61.2

Iain C. MacSwan:

Sprays were applied to single tree plots of seven year old Montmorency sour cherry trees, replicated six times, at late popcorn and late petal fall. Rainy weather prevented an application at full bloom stage and delayed the other sprays.

All of the fungicides, recommended in Oregon for control of brown rot blossom blight, provided acceptable control of the disease.

Treatment and rate per 100 gallons	Percent Brown Rot Blossom Blight
Dithane M 22, 80 WP 2 lb + B-1956 2 oz.	3.8
Puratized 10 Spray, 1/2 pt + B-1956 2 oz..	4.3
Orthocide 50 WP 2 lb + B-1956 2 oz.	6.4
Fermate 76 WP 1½ lb + B-1956 2 oz..	7.0
Phygon XL 50 WP 1/2 lb + B-1956 2 oz.	7.8
Zerlate 65 WP 1½ lb + B-1956 2 oz.	8.6
Kolo 100 3½ lb + B-1956 2 oz.	9.3
Cyprex 65 W 3/4 lb + B-1956 2 oz.	9.8
Check.	21.2

SECTION VI

DISEASES OF POME FRUITS

Duane L. Coyier and Scott B. Kelly:

Fruit harvested August 27th, was treated with 1 lb/100 gal of benomyl (Benlate), 50% W.P. on August 29, 1969. Separate samples were treated weekly thereafter for six weeks to determine the effect of delayed treatment on decay control of D'Anjou pears.

Inspection of the fruit in mid-February, 1970 showed that treatment up to three weeks following harvest prevented decay. Fruit treated four, five or six weeks after harvest developed only minor amounts of decay while over 4% of the untreated fruit was infected.

Delayed Post-harvest Benomyl Treatment of D'Anjou Pears for Control of Storage Decay:

Delay (Weeks)	Date Treated	Total Fruit	Percent Decay
0	8-29	388	.00
1	9-5	422	.00
2	9-12	429	.00
3	9-19	398	.00
4	9-26	407	.49
5	10-3	416	.72
6	10-10	383	.71
Check	(Untreated)	248	4.03

In another test, we treated D'Anjou pears with Thiobendazole (TBZ) and benomyl for control of "Bulls-eye" rot caused by *Cryptosporiopsis perennans* (Zeller & Childs) Wr. Treatments were applied with commercial equipment on December 31, 1969. We inspected 1000 fruit per treatment on February 11th, and on March 12, 1970 and accumulated the data which is presented in the following table:

Bulls-eye Rot Control on D'Anjou Pears Treated with TBZ and Benomyl:

Treatment (Fungicide and dosage/100 gal)	Percent Disease Control
Benomyl, 50% WP, 2 lb	100
Benomyl, 50% WP, 1 lb	100
Benomyl, 50% WP, ½ lb	100
TBZ, 60% WP, 3 lb	95
TBZ, 60% WP, 1½ lb	90
TBZ, 60% WP, 3/4 lb	80
Check (No fungicide)	0

Benomyl treatment completely eliminated bulls-eye rot on the fruit in this test, in spite of the long delay before treatment. Other tests, over a three year period, have indicated that benomyl is extremely effective against most decay organisms with the exceptions of *Alternaria tenuis* and *Rhizopus* sp. We believe that bulls-eye rot can be prevented if benomyl is applied at any time prior to visible symptom development.

TBZ provides good control of the bulls-eye rot disease and has been effective for the control of other organisms in the storage rot complex. However, it has not consistently controlled storage diseases as well as benomyl.

L. E. Lopatecki:

Of a number of post-harvest fungicidal treatments of apple, two gave outstanding control of bull's eye rot in the Newtown variety. Benlate at 1/4 lb/100 gal reduced rot from 93% in checks to 7.5%, and Tecto-60 at 1½ lb/100 gal to 9.0%. Both the above materials produced good results with McIntosh, but were somewhat less effective.

Perennial canker paints were prepared from dithiocarbamate fungicides, maneb, ferbam and ziram, plus the corresponding metallic oxide (manganese, iron and zinc) and linseed oil. These paints possessed excellent weathering properties, retained fungicidal properties for long periods, and repelled woolly aphids. Highest fungicidal activity after four months exposure was retained by the ziram-zinc oxide mixture.

Duane L. Coyier and Scott B. Kelly:

Apple seedlings were grown in one gallon cans and treated with dilute fungicide sprays to evaluate them for control of powdery mildew (*Podosphaera leucotricha* Ell. & Ev.). Four sprays were applied at weekly intervals beginning May 20, 1970. The plants were grown in a shaded area and removed for spraying to eliminate the possibility of cross-contamination due to spray drift. We applied the treatments with a handgun sprayer operated at 250 psi and sprayed each plant to the "drip" stage. The position of each of 10 single tree replicates per treatment was re-randomized following each treatment to reduce position effect. Heavily mildewed apple seedlings were placed adjacent to each treated plant and the conidia were discharged daily with a compressed air jet nozzle to provide thorough inoculation of the test plants. We rated powdery mildew 0-50 according to severity and converted the rating to percent disease control.

Morestan has provided good disease control during past seasons, both in our controlled tests and in the field. However, it has often been accompanied by phytotoxicity to fruit and foliage. This year we mixed it with a special surfactant (Nu-Film-17) to reduce phytotoxicity. The mixture provided excellent disease control but failed to alleviate the problem of plant injury. EL-273 provided good control of powdery mildew and has been notably non-phytotoxic to apples and pears in all our tests, including combinations with various insecticides. Benomyl (Benlate) and Thiobendazole (TBZ) did not perform well this season in contract with past performances. Dikar and Karathane treatments achieved excellent disease control but both were accompanied by slight phytotoxicity.

We would rate Elanco's EL-273 among the best of those fungicides we have tested for control of powdery mildew on apples and pears. It has given consistently good control, been free of phytotoxicity and compatible with commonly used insecticides.

Treatment and rate per 100 gallons	Phytotoxicity	PDC*
Morestan, 25% WP, 4 oz + Nu-film-17, 6 oz.	Moderate	100
Karathane, 25% WP, 3/4 lb.	Slight	98
Dikar, 80% WP, 2 lb.	Slight	98
EL-273, 10% WP, 1 lb.	None	91
R-10044, 65W, 2 lb.	Moderate	88
Benomyl (Benlate) 50% WP, 1 lb	None	87
EL-273, 10% WP, ½ lb.	None	82
Thiophanate-methyl (TD-1771)	Slight	80
BAY 79770, 50% WP, 1 lb.	Slight	77
Thiobendazole (Mertect) 60% WP, 1½ lb.	None	61
Check (Water Sprayed)	None	40
Check (Unsprayed).	None	0
LSD .05		17

*Percent disease control.

DISEASES OF POME FRUITS (Cont'd.)

Iain C. MacSwan:

Sprays, with exception of Polyram, were applied by handgun sprayer to single tree plots of mature Rome trees replicated four times at pink, late pink, late calyx and first cover. Triton B-1956 2 oz per 100 gallons was added to Dikar, Cyprex and Thynon sprays. Polyram was applied in a single application treatment (SAT) formerly referred to as 'massive dose treatment' at green tip only.

Fruit scab: Excellent control was obtained by sprays of EL 273 (80 ppm) and TD 1771. EL 273 (40 ppm), Dikar and Thynon gave good control -- equal to the standard Cyprex treatment. The SAT treatment of Polyram gave poor control.

Powdery mildew: All fungicides, including the Polyram SAT treatment but with the exception of Thynon, provided acceptable control of powdery mildew.

Fruit russet: Polyram reduced fruit russet when compared to the check treatment and was approximately 50 percent of that of the standard, Cyprex-Karathane treatment. EL 273 (30, 40 and 80 ppm), Dikar and Thynon produced russet in excess of that of the check treatment but equal to that of the standard Cyprex-Karathane treatment. Spray burn on fruit from TD 1771 produced an unacceptable amount of russet.

Treatment and rate per 100 gallons	% Fruit Scab	% Leaf Scab	% Powdery Mildew	% Fruit Russet
EL 273 30 ppm.	14.3	12.75	10.75	19.0
EL 273 40 ppm.	5.9	8.0	11.25	24.9
EL 273 80 ppm.	2.6	6.25	13.75	20.0
TD 1771 70 WP 3/4 lb.	1.6	12.0	9.5	45.4
Dikar 2 lb + 2 oz B-1956	8.2	16.25	11.0	24.2
Cyprex 65 W 3/4 lb + Karathane 25 WP 3/4 lb + 2 oz B-1956.	9.9	12.75	11.0	24.8
Thynon 75 WP 1 lb + 2 oz B-1956.	7.6	16.5	20.5	24.7
Polyram 80 W, 10 lbs + 2½ gal superior-type oil (SAT test).	56.8	53.0	15.0	12.8
Check.	83.4	40.5	28.25	19.6

Iain C. MacSwan:

Nine weekly handgun applications (March 30th through June 12th) of EL 273 (40 ppm), Benlate (8 oz) and Karathane (3/4 lb plus 2 oz Triton B-1956), in 100 gals water provided good control of mildew. Karathane (3/4 lb plus 2 oz Triton B-1956) applied on regular shcedule (pre-pink, pink calyx, first cover) and Dikar (2 lb. plus 2 oz. Triton B-1956) per 100 gal water applied weekly provided acceptable control of powdery mildew.

Treatment and rate per 100 gallons	% Mildew (terminals)	% Fruit Russet
EL 273 40 ppm	3.5	11.25
Benlate 8 oz.	6.0	35.8
Karathane 3/4 lb + Triton B-1956 2 oz.	7.5	16.2
Dikar 2 lb + Triton B-1956 2 oz.	10.0	17.78
Karathane 3/4 lb + Triton B-1956 2 oz (regular schedule)	12.25	15.93
Check	30.1	53.17

DISEASES OF POME FRUITS (Cont'd.)

Iain C. MacSwan:

Benlate T sprays were applied by handgun sprayer to single tree plots of seven year old Rome trees replicated four times. Four check trees were unsprayed. The remainder of the orchard was sprayed with Cyprex and Karathane by air blast sprayer at rate of 200 gallons of spray per acre. All sprays were applied at pink, full bloom, calyx and first cover.

Benlate T provided excellent control of apple scab. Cyprex continues to provide excellent control of scab.

Treatment and rate per 100 gallons	% Fruit Scab	% Fruit Russet
Benlate T 16 oz (handgun)	.5	29.9
Cyprex 65 W, 3/4 plus Karathane 25 W 3/4 lb + 2 oz B-1956 (air blast).	3.6	26.3
Check.	23.8	20.0

Iain C. MacSwan:

The test was designed to compare Polyram, Difolatan, Cyprex and Thynon when applied as single application treatments (SAT), formerly referred to as 'massive dose' treatments and with a regular spray program of Cyprex. The SAT were applied at green tip (March 12). The Cyprex regular program sprays were applied at prepink (April 3), pink (April 14), late calyx (May 5) and first cover (June 1).

Thynon provided best control of scab of the single application treatments (SAT). Polyram, Difolatan and Cyprex gave poor scab control. Difolatan resulted in severe fruit russeting. The regular spray program with Cyprex (4 sprays) provided excellent control of scab and continues, in Oregon, to be the standard fungicide for scab control.

Treatment and rate per 100 gallons	% Fruit Scab	% Leaf Scab	% Fruit Russet
Polyram 80 W 6.25 lb plus 2½ gal superior-type oil	61.3	55.25	15.5
Difolatan 4 F 6.5 qts plus 2½ gal superior-type oil	16.1	14.0	46.9
Cyprex 65 W 3 lb plus 2½ gal superior-type oil	75.4	36.8	14.6
Cyprex 65 W 3/4 lb (regular schedule)	3.1	2.2	15.7
Thynon 75 WP 3 lb plus 2½ gal superior-type oil	8.3	6.75	9.6
Check	77.2	59.0	13.4

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