ABSTRACTS OF REPORTS FROM THE 43rd ANNUAL WESTERN COOPERATIVE SPRAY PROJECT

Imperial Hotel, Portland, Oregon

January 15-17, 1969

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

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

Abstracts of Reports from the
43rd Annual Western Cooperative Spray Project

T A B L E O F C O N T E N T S

LEPIDOPTEROUS INSECTS -- Section I
Codling Moth - Apple 1
Codling Moth - Apple and Pear 3
Codling Moth - Pear 4
Codling Moth - Walnut 4
Peach Twig Borer 4
Fruit Tree Leafroller - Apple 5
Fruit Tree Leafroller - Cherry 5

ORCHARD MITES - Section II
Phytophagous Mites 6
Predator Mites 12

OTHER INSECT PESTS - Section III
Pear Psylla 14
Aphids 16
Cherry Fruit Fly 18
Scale Insects 18
Boxelder Bug 19
Pacific Flathead Borer 19

SPRAY RESIDUES, COMPATIBILITY, PHYTOTOXICITY, BEE POISONING &
POLLINATION, CONCENTRATE SPRAYING & OCCUPATIONAL EXPOSURE -- Section IV 20

DISEASES OF STONE FRUITS -- Section V 23

DISEASES OF POME FRUITS -- Section VI 27

DISEASES OF NUT CROPS -- Section VII 32

LEPIDOPTEROUS INSECTS
Codling Moth 33

CONTRIBUTORS TO ABOVE ABSTRACTS 34

S E C T I O N I

LEPIDOPTEROUS INSECTS

CODLING MOTH - APPLE

Don R. Merkley:

Guthion, E.C. applied at 1/2# ai/100 gallons of water; Gardona, 50% W.P. at 3/4# ai/100 gallons of water and 1/2# ai/VCS-506, 50% W.P. per 100 gallons of water, were made as follows: June 18, 1968, July 3, 1968, and July 19, 1968. Apples harvested from Gardona and VCS-506 plots indicated 25% to 50% wormy fruit.

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

Granulosis virus of codling moth was collected from 90,000 larvae reared at an estimated cost for artificial medium and containers of 0.3 cents per larva. Twelve spray applications of virus were made in a 1-acre experimental apple orchard (Golden Delicious variety) located near Placerville, California. The first 8 treatments were applied at weekly intervals during the period of moth emergence by the overwintered population (April 29 to June 17). The subsequent 4 applications were made at 2 to 3 week intervals from July 8 to August 26. The dosage used was about 8 larval equivalents per gallon (9.5×10^9 capsules) or 13 times less material than in 1967.

At harvest, 2.3% of 2400 fruit examined were wormy or vacated. One bin of fruit (ca. 800 lbs.) picked at random was graded by the Placerville Fruit Growers Association with a turnout of 55% fancy grade, 18% C grade, 18% canning grade, 5% cider grade and 5% culls.

During the season an average of 3.5 larvae per trap band was found between June 5 and September 24. In November, overwintered larvae per trap band (20 trees) also averaged 3.5. By contrast, in November, 1967, there was an average of 86.7 overwintered larvae per trap band (12 trees) in an untreated area of the orchard.

The virus was the only control agent applied during the season. Other damaging species observed were spider mites, woolly apple aphid, rosy apple aphid, climbing cutworm, cankerworm and fruit tree leaf roller. However, all species remained below damaging levels, apparently held in check by an abundance of parasites and predators.

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

Codling moths were taken in 23 commercial orchards using female pheromone traps.

Zolone WP gave the best protection followed by Gardona, Furadan, Guthion (0.5#) and Diazinon in a 4-cover program. Three covers of Guthion (1.0#) were more effective than 1 Guthion followed by 3 Diazinon covers.

M. D. Proverbs:

Release of sterilized moths was continued for the third year in a 10-acre commercial orchard. One release of sub-sterile moths was inadvertently made in July, which made it necessary to spray two-thirds of the orchard with Guthion. Releases were continued in the remainder of the orchard, and adequate control was obtained. The total fruit injury in the release section at harvest due to codling moth averaged 0.71%. Of this percentage, 0.17% was due to second brood larvae and the remainder was caused by larval progeny of the sub-sterile moths released in July.

H. F. Madsen:

Zolone and Gardona gave commercial control of the codling moth in a heavily infested area where the unsprayed trees averaged 77% damaged fruit. Diazinon alone and Diazinon combined with oil did not provide commercial control. Most of the damaged fruit in Diazinon treated plots was due to stings rather than entries. Gardona treated trees showed high populations of European red mite and McDaniel mite and low numbers of predacious phytoseiid mites.

F. P. Dean:

In orchard spray tests against codling moth, Zolone (ENT-27163) 25% WP at 2 lb/100 gal was effective for four weeks after the application. Hercules-14503 (ENT-27320) 6-1/2 lb/gal EC used at 20 oz/100 gal gave good control for six weeks.

L. D. White:

The routine use of Eosin Y as a marker in our sterile codling moth release studies significantly reduced male longevity, number of matings, number of eggs per female, and percent hatch of eggs. The addition of CO_2 or cooling as a necessary immobilizing agent during treatment indicates cooling to be superior.

H. R. Moffitt:

Adult codling moths were irradiated at 0, 25 and 40 krads and then tested to determine what effects, if any, irradiation had upon the susceptibility of these insects to azinphosmethyl (ENT-23233), carbaryl (ENT-23969), and DDT (ENT-1506). These data are now being statistically analyzed and the results will be presented at the meeting.

On the basis of the raw data, it would appear that the effects of irradiation upon insecticide susceptibility in the adult codling moth are very slight. It would appear that susceptibility increases as irradiation level increases.

Stan Hoyt:

Aerial application of Guthion (4 lbs. of 50% WP per acre) gave very good control of the codling moth.

D. O. Hathaway:

The flight habits of sterile male codling moths were studied by attracting the males to cages of virgin female moths. Once inside, the sterile male is caught in a sticky substance applied to the trap.

Over 4 million sexually-sterilized codling moths have been released in apple orchards near Yakima, Washington. Almost 15,000 sterile males were trapped outside the release orchards. Although the primary goal of the releases was to determine the effectiveness of sterile insects in controlling natural codling moth populations, the movement of sterile males outside the release area provided valuable information.

The flight range of the codling moth has not been fully determined. Flights of 1 mile have previously been reported. However, we captured sterile males released 3 miles from the traps.

Traps were placed at various distances north, east, south, and west, from the release orchard. Sterile males were caught in all directions.

The farther the traps were placed from the release orchard, the less sterile males were captured. However, when a barren area lay between the release orchard and another apple orchard, the catch would increase where the trap line enters the non-release orchard. The increase in catch may be caused by an attraction of favorable host trees, also moths may continue to fly when in non-host areas but congregate upon reaching a host area.

S. C. Jones:

Excellent control of the codling moth was obtained with Gardona 75% WP 1#/100 and Guthion 25% WP 1 1/2#/100. The cover sprays were applied on June 5, June 27 and July 29. These plots were heavily infested in 1967 where lower dosages were used and the temperatures were much higher than in 1968.

CODLING MOTH - APPLE AND PEARS

B. A. Butt:

Several materials synthesized at Yakima evoked a strong sexual response from male codling moth in the laboratory at rates as low as 10^{-16} g/ml. Mating was not reduced when large amounts of one of these materials were placed in paper bags containing 5 pair of moths each.

A confusion test in a 3-acre orchard also failed.

In experiments with live female traps, the 1-gallon paper-can trap was more effective than a trap in which live females were hung over a 6-pint pan of water.

CODLING MOTH - PEARS

P. H. Westigard:

Commercial control of the codling moth was obtained in experimental plots with 3 cover sprays of Guthion, Gardona, GS 13005, Zolone, Galecron and UC 34096. Mite populations were expecially high on trees treated with Gardona.

W. C. Batiste:

Experimental materials were evaluated a second year for control of codling moth and for effects on pear psylla, mites, and beneficials. Sprays were applied three times and were timed on the basis of light trap and pheromone trap catches. Terpinyl acetate bait pans were not sensitive enough to be useful. Determined population trends were similar for both light trap and pheromone trap methods, and timing of sprays would have been similar with either method alone. Timing for codling moth was good based on the following results of infested fruit at harvest: Imidan, 0.0%; guthion plus Volck Supreme, 0.0%; Furadan, 0.0%; GS 13005, 0.7%; Gardona, 0.8%; EP-333, 0.8%; Check, 26.3%.

CODLING MOTH - WALNUTS

W. C. Batiste:

The pheromone attraction principle was used in conjunction with a time-sequence device to determine the time of day that male moths are attracted to pheromone traps (live females). This study was conducted from April 29 to September 22 which included all but the very early season flight period. For the first few weeks catches were mainly before sunset; gradually they shifted to later in the evening. This shift appeared to exceed the shift in day length, but no measurements of light intensity were made. The termination of daily catch appeared to be correlated with temperature. The mean temperature for the last moth catch of the day was 61 degrees F.

PEACH TWIG BORER

E. W. Anthon:

Under field conditions Azodrin, Thiodan, Gardona and Furadan applied in pre-pink stages to young peach trees gave commercial control of the peach twig borer.

Peach twig borer larvae were gathered from the field and sucessfully reared on artifical diet to the adult stage. Moths mated and layed eggs under greenhouse conditions. The eggs hatched, but the newly hatched larvae would not accept the artificial food media. Moths were found to mate during the night and early morning hours. They layed eggs on nylon organdy placed

over battery jars that were kept on a slant or on the organdy placed over old fashioned chimney type rearing cages.

FRUIT TREE LEAF ROLLER - APPLES

H. F. Madsen:

Pre-pink sprays of Guthion, parathion and Diazinon and a petal fall spray of DDT gave good control of the fruit-tree leaf roller. Oil-ethion at the 1/2 inch green stage and Thiodan at the petal fall stage reduced leaf roller, but did not give commercial control. Temik at the petal fall stage was ineffective. Of the above materials, the petal fall sprays of DDT and Thiodan were the only ones that gave acceptable control of the white apple leafhopper.

FRUIT TREE LEAF ROLLER - CHERRY

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

A complete 3-spray program gave the most effective control of leaf roller damage. Delayed dormants followed by petal-falls were more effective than when followed by popcorn applications. Petal-fall sprays were more effective than popcorn sprays of the same materials. Guthion, TDE, GS-13005, and Zolone were the most effective materials as single applications.

S E C T I O N II

ORCHARD MITES

PHYTOPHAGOUS MITES

S. C. Jones:

Both the European red and Carpini mites were controlled in the Gardona plots sprayed for codling moth control and combined with Azodrin 1#/100. These same mites were also controlled in plots sprayed with Guthion 25% WP 1½#/100 combined with Galecron EC., 1 pt./100.

F. P. Dean:

In orchard plot tests of experimental acaricides, excellent control of McDaniel mites was obtained with Galecron (ENT-27335) 4 lb/gal EC at 1 pt/100 gal, Plictran (ENT-27395) 50% WP at 1/4 and 1/2 lb., Lovozol (ENT-27438) 20% WP at 1-1/2 lb., TH-367-I (ENT-27477) 1 lb/gal EC at 1 qt. and Zolone (ENT-27163) 25% WP at 2 lb/100 gal. Good control, but with shorter residual activity, was obtained with Hercules-14503 (ENT-27320) 6-1/2 lb/gal EC at 10 and 20 oz/100 gal and Acaralate (ENT-26999) 2 lb/gal EC at 1 qt/100 gal.

Azodrin (ENT-27129) has been tested for several seasons as EC and WP formulations at 1/2 lb actual/100 gal with excellent results. In 1968, Azodrin 25% WP at 1/4 lb actual/100 gal gave poor control in one test on young Red Delicious trees but very good control in two plots of mature Winesap trees. VCS-506 (ENT-27378) 50% WP at 1 lb/100 gal used primarily as an insecticide showed promise as an acaricide. Unsatisfactory results were obtained with EP-332 (ENT-27566), UC-34096 (ENT-27473), DP-1991, TX-1219, and PCS-1301 (ENT-27545).

A fair number of Typhlodromid predators survived the sprays of Zolone, Hercules-14503 and VCS-506.

Stan Hoyt:

Plictran (4 ozs./100), Galecron (3/8 lb/100) and Lovozal gave excellent control of the McDaniel spider mite. Azodrin (1/2 lb./100), Omite, and Galecron (1/4 lb./100) gave fair to good control but a slow reduction of the population of this species. du Pont 1991 was ineffective and Dessin was inconsistent in the control provided. Plictran gave good control of McDaniel spider mite at 2 ounces per 100 gallons when Typhlodromus occidentalis was present. Omite also allowed sufficient survival of predators to prevent a resurgence of mites following application.

Stan Hoyt:

Prepink sprays of Galecron, Lovozal, Plictran and du Pont 1991 failed to control the European red mite. Summer sprays of Azodrin, Omite, Galecron, Lovozal

and Plictran gave good control of this species. Dessin provided control for a short period of time while du Pont 1991 was ineffective.

E. W. Anthon:

The following materials gave good control of this mite under greenhouse conditions: Bay 68138, 16448, 89504, 89502, and 16448; Stauffer R15552-A, R-11853-A; Niagara 16277; CIBA 14704; Dow M-3180; Thompson-Hayward 367-1 and 427-1; Mobil-Mc 9-147; Shell 16898 and Chemagro 45432.

E. W. Anthon:

The following acaricides gave good control of McDaniel resistant mites on cherries in the field: Plictran, Lovozal, Omite, Azodrin, Galecron, Fundal and Morestan. Most of the materials above plus UC34096, TH427-1, Humble and PGS02 oils gave good control of this mite on prunes. Lovozal and Morestan caused injury to cherry leaves.

E. W. Anthon:

In the field the following acaricides gave good control of this mite on peaches: Plictran, Lovozal, Omite, Azodrin, Galecron, TH427-1, Humble and PGS02 oils, Morestan, Kelthane, Fundal and Morocide.

The first seven materials in the above acaricide list plus UC34096 gave good control of this mite on young prunes.

E. W. Anthon:

Field experimental trials this season have shown the following materials to give excellent control of the peach silver mite: Plictran, Lovozal, Omite, Azodrin, Galecron, TH427-1, Furadan, Fundal, Gardona, Morestan, Kelthane, Ethion, UC34096, Humble and PGS02 oils. The following materials caused injury to peach leaves: Lovozal, Fundal, Morestan and Gardona.

Everett Burts:

In laboratory screening tests, spurs with large numbers of overwintered European red mite eggs were collected from orchard trees. The eggs were counted and the spurs trimmed until 100 eggs remained. The infected spurs were dipped 5 seconds in water dilutions of candidate ovicides and laid on a towel to dry. The treated spurs were then taped to 3 X 5 file cards ringed with vaseline and were placed in a growth room. Hatched mites were counted 7 days after treatment.

Of the materials tested, Morestan was the most active; Dow 213, UC34096 and TH3671 2% in oil also prevented egg hatch at the highest dosages tried.

R. S. Downing:

Handgun applications of Lovozal and GS19851 gave excellent initial and residual control of both European red and McDaniel spider mites, whereas Galecron and Plictran provided good control. DuPont 1991 gave poor control of European red mite but was more effective against the McDaniel spider mite. GS19851 caused a ring-type injury to the fruit of McIntosh and Staymen apple trees.

Low-volume pink bud applications of Plictran gave excellent control of European red mite and apple rust mite whereas Morestan applied at the "pink" or Shell Neutrol oil with or without ethion applied at the 1/2-inch green bud stage gave good control of European red mite. Morestan also gave good control of the apple rust mite whereas the oil or oil plus ethion were practically ineffective against that mite.

R. S. Downing:

Applications of Morestan to Bartlett pears at the white bud, calyx or white bud plus calyx were more effective in controlling russeting by pear rust mite than an early June spray of Morestan because considerable russeting of the calyx end of the pear fruits had already occurred by early June. Applications of Morestan, Kelthane or ethion in early June gave equally good control of the pear rust mite.

W. C. Batiste:

Experimental materials applied for control of codling moth were evaluated for effects on mites. Three applications of EP-333 resulted in very good suppression of European red and two-spotted mites. Guthion plus Volck Supreme was also effective but a post-harvest increase in two-spot occurred. Two-spot remained at low levels in the GS 13005 and Imidan treatments, but European red increased to levels exceeding the check. The reverse situation resulted in Furadan and Gardona plots where European red levels remained low while two-spot populations greatly exceeded the check levels.

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

EP 332, UC 34096, NC 5016, Morestan, Galecron WS, and Plictran were excellent in one or more cover evaluations. Omite was fair to good and Acaralate and DuPont 1991 poor.

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

UC 34096, EP 332, Azodrin, and Morestan were the most effective and consistent against varying populations of two-spotted mite. NC 5016 was effective in some tests, but the residual control was short and control of this species was not equal to control of red mite. Galecron was also much less effective against two-spotted mite.

P. H. Westigard:

A prebloom application of Morestan at 1.0 and 0.5 lbs. per 100 resulted in economic control of the 2-spotted mite until early July. In summer trials Plictran, Galecron, Carzol and GS 19851 provided excellent control.

P. H. Westigard:

Chloropropylate and Chlorobenzilate provided good control when applied at petal fall. Ethion, which had been recommended during 1967 failed to give control. Experimental materials which gave control of the yellow mite included: Plictran, Galecron, GS 19851, Zolone, UC 34096, Carzol, Bay 37344, Bay 58773 and NC 5016. With the exception of PGSO-2 with 1% emulsifier all oils tested with various amounts of emulsifiers gave good control. These included Volck Supreme, Orchex 796 and PGSO-2 with 1/2 and 2% emulsifiers.

M. M. Barnes:

In an area where the mcdaniel spider mite is the major residual pest of apples using conventional spray schedules for other pests. Typhlodromus occidentalis is not found within sprayed orchards, although it occurs adjacently. Studies by B. A. Croft (see accompanying abstract), are designed to characterize various T. occidentalis strains with a view toward possible introduction of a strain which may maintain itself in sprayed orchards. Such introduction infers maintenance of low populations of mcdanieli by proper dosages of selective acaricides especially for use in intervention during periods of rapid assurgency of mcdanieli populations. The following materials and dosages applied when high populations of mcdaniel mite was present in the center of the trees provided sharp restriction of mcdanieli populations equivalent to excellent commercial control, while permitting persistence of populations in the thoroughly sprayed tree interior: Fundal S.P. (EP-333) 4 oz.; Omite 30W 1 lb.; Zolone 3E 1 pt., and Plictran 4 oz. Morestan at 10 oz. provided excellent commercial control and similar significant persistence of mcdanieli in the tree interior. Check tree populations rose from 37 to 77 mites per leaf, spread throughout the tree, and caused severe discoloration and leaf drop during the five week post-treatment observation period.

Brian A. Croft:

Recent studies have been initiated at Riverside, California, in which 4 strains of Typhlodromus occidentalis, one each from Wenatchee, Washington; Provo, Utah; Yucaipa, California and Riverside, California are being tested in the laboratory and field. Comparative studies on biology, mating crosses, and toxicology of these strains are being tested.

Preliminary tests have indicated that crossmatings and oviposition occur between all cross combinations, but complications in egg production and development are evident in certain crosses. Biology in terms of developmental are evident in certain crosses. Biology in terms of developmental rates, egg production and behavioral characteristics are similar between strains, but distinct biological and morphological differences have been noted. The fact that this species is able to exist in relatively large numbers in sprayed

orchards in some areas is attributed to its resistance to phosphate pesticides which is unique among phytoseiid species. Strain comparisons have demonstrated differential susceptibility to several pesticides tested including Guthion, parathion, ethion and Kelthane. These characteristics extend the possible manipulation and integration of this species into present control programs.

M. M. Barnes and W. J. Wargo:

The following materials at the indicated rates provided good commercial control of European red mite equivalent to that provided by the standard treatments of Kelthane 35W at 1 lb. or Morestan 25W at 8 oz.: Omite 30W, 1½ lbs.; Omite 57E, 12 fl. oz.; Zolone 3E, 1 1/3 pts.; Plictran 50W, 4 oz.; Fundal S.P. (EP 333) 8 oz.; Carzol S.P. (EP 332) 8 oz.; and Azodrin 25W, 1 lb. No phytotoxicity was observed when these materials were applied either with or without 1¼ lbs. of 80% Sevin W.P.

C. M. Hemstreet and C. S. Davis:

Mid October treatments of Volck Supreme oil plus either Thiodan or diazinon or Orthorix gave satisfactory control. Two treatments of these materials applied in mid October and mid February were no better than one treatment applied in mid October. One mid February treatment of these materials was not satisfactory in controlling this mite.

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

Kelthane, Tedion, Trithion and Orchex 796 were applied alone and the three wettable powders also in combination with 796. Mite evaluations were made on both French and Imperial varieties. Tedion alone was of little value but combined with oil proved effective. The performance of both Kelthane and Trithion was also enhanced considerably with the addition of oil. Three-quarter gallon of oil/100, though effective in combination, was not so alone. One and one-half-2 gal./100 performed well on both mite species.

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

Orchex 796 and PGSO-2 were applied at 1.5 gallons per 100. The lighter oil gave its best initial mite control at the 0.5% emulsion level followed by 1, 2, and 0.25% emulsifier. PGSO-2 controlled and apparently deposited best at the two lower emulsifier rates.

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

Applications of 6 miticides, 2 oils and 3 miticide-oil combinations showed Galacron to be the most effective. Dibrom plus oil and Aramite alone were next best followed by Orchex 796, Omite, Trithion, Dibrom and Kelthane plus oil as a group. Kelthane alone was the poorest treatment.

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

Kelthane, Trithion and Tedion wettable powders were applied alone and in combination with Orchex 796 at 3/4 gal./100. These were compared with PGSO-2, Volck Supreme and Orchex 796 at 1 1/2 gal./100. All treatments performed well on the 3 species of mites except Kelthane and Trithion alone and the combination of Tedion and oil. The latter was better than the two wettable powders though slow in performance.

J. E. Dibble and C. M. Hemstreet:

A series of spray oil rates and timings were compared against miticide and miticide-oil combinations. Oils applied at 2,4 and 6 gpa alone and with Kelthane, Ethion, Chlorobenzilate and Acarolate all gave good to excellent mite control. The poorest was Ethion/oil at the 2 gallon rate. Acarolate was the best miticide with Ethion the poorest when applied alone without oil. The high rates of oil alone and Acarolate were better than Kelthane or Chlorobenzilate alone. Oil at 2 gpa was not as effective as 4 or 6 gpa.

J. E. Dibble and C. M. Hemstreet:

Three spray oils, Orchex 796, PGSO-2 and Volck Supreme, were each applied 3 times at 2 gpa and 3 times at 6, 4 and 2 gpa respectively over a 6 week period. They were also applied twice at 6 gpa 10 days apart and compared with oil plus Kelthane applied as needed. Treatments were started at 8 weeks prior to harvest. All gave very acceptable control of a moderate 2-spot and light European red mite population.

J. E. Dibble and G. W. Morehead:

Comparison of 3 plant spray oils applied at 2 and 6 gpa alone and one in combination with Kelthane were evaluated against single applications of oil and the miticides alone and certain combinations. Triple applications at 2 week intervals were compared with single treatments. All sprays were applied with a RSM sprayer at 75 gpa. The repeated high rates of oil were only slightly more effective than the low rates. The single application of the oil plus Kelthane, Chlorobenzilate or Ethion were better than the repeated heavy rates of oil alone. Emulsifiable miticides were more effective than wettable powders; however, Kelthane and chlorobenzilate caused some fruit injury.

PREDATOR MITES

James Schafer and L. C. Terriere:

T. occidentalis, collected from commercial orchards in Milton-Freewater, Hood River, The Dalles, and Medford, were screened for susceptibility to several commercial and experimental insecticides and acaricides. The predacious mites and T. telarius were exposed to the toxicants on bean leaf discs treated with W.P. or E.C. formulations in a Potter Spray Tower. Mortality counts were made at 48 hours. Deposits of Kelthane, Chlorobenzilate and Morestan were more selective for T. telarius than Gardona, Guthion, Acaralate, and Morocide. Trithion, Zolone and Thiodan were relatively non-toxic to both species. There was no significant difference in the response to the test compounds among the strains collected from the four locations.

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

A project to develop integrated control of orchard mites in 10 commercial orchards extending from the Okanagan to the Similkameen was started in 1967 and continued in 1968. Sprays were applied only when necessary and, in general, consisted of one pre-bloom spray to control aphids, European red mite and San Jose scale and two or three Guthion or Diazinon summer sprays for codling moth control. Predaceous phytoseiid mites and apple rust mites were present in all orchards and the McDaniel spider mite was virtually absent from all orchards. The average cost of chemicals for insect and mite control over the 10 orchards was $26.50 per acre.

E. W. Anthon:

Typhlodromus occidentalis and Zetzellia mali the last two years have been the contributing factor in controlling McDaniel mite in three prune integrated plots. Ethion and oil, plus DDT applied in the early part of the year have held down European red mite and peach twig borer. Thiodan applied in mid-season has assisted by reducing the prune rust mite population.

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

Only on unsprayed apple were Typhlodromus and Zetzellia able to control phytophagous mites in Hood River. Pre-bloom sprays and lack of apple rust mite are probably important factors in delaying development of effective predator mite populations until late summer or early fall. Four-cover plots of Diazinon, Guthion, Gardona, Zolone, and Furadan all had high red and/or 2-spot populations which predators did not control. Zetzellia survives most materials better than Typhlodromus.

Effective biological control of McDaniel mite by Typhlodromus was observed in The Dalles. Here predators were sustained by cherry rust mite and populations expanded rapidly to control McDaniel mite increases.

Typhlodromus mites survived Karathane, Morestan, Guthion (0.5#), parathion, NC 5016, Omite, Zolone, Azodrin, Plictran, and several cherry fruit fly insecticides in one or more of the counties observed.

Donald W. Davis:

1. The acaricidal plots were at North Salt Lake City on McIntosh apples. The dominant mite species was the McDaniel mite, with some two-spotted mites scattered throughout. Morton EP 332, followed closely by Azodrin and Plictran, gave the best control. EP 332 was effective for the entire season with one application while Azodrin and Plictran allowed some late season mite build-up. Lovozal and Omite were effective for 5-6 weeks. Galecron and Trithion were effective for 4-5 weeks. Thompson-Hayward 367-I was highly effective in 3 of the 4 replicates, but in the one replicate located in the center of a heavily infested area, it failed to control the mites. Tedion was ineffective.

2. Six orchards were followed closely in the integrated program and several others checked occasionally. Three of the six orchards had excellent control of Tetranychus mites while three had only partial control. Two of the six orchards had some difficulty with the European red mite while achieving excellent control of the Tetranychus mites. The relative scarcity of the apple rust mite with no other alternate food for the Typhlodromus predators, is undoubtedly causing difficulties in Utah. Even in orchards with the best results, some selective acaricidal use was needed. Karathane and Morestan were used most commonly for selective mite control. Imidan seemed to fit better in Utah integrated control programs than Guthion.

SECTION III

OTHER INSECT PESTS

PEAR PSYLLA

Everett Burts:

In laboratory screening tests using topical sprays of candidate insecticides on overwintered adult psyllas, the following materials were found to be active; Zolone, UC34096, SD16898, AC18526, AC17413, AC18164 and AC14503.

Further evaulations of Lethane for dormant season control of adult pear psylla demonstrated the effectiveness of Lethane 384 in combination with oil as a ground spray. However, aerial applications of this combination were less effective. Since aerial applications are essential to the dormant psylla control program, this material is of little value.

TH371I was found very effective against pear psylla adults as dormant sprays applied both from the ground and by aircraft.

In summer screening trials on orchard trees, Galecron and TH367I were the most effective materials tested. Galecron tech. in two summer sprays provided good control of pear psylla and codling moth.

F. P. Dean:

In orchard spray tests against pear psylla, Zolone (ENT-27163) 3 lb/gal EC at 1 qt/100 gal and Galecron (ENT-27335) 95% sol. at 0.5 lb/100 gal were very effective. Nearly as effective were EP-332 (ENT-27566) 98% sol. at .5 lb/100 gal and Hercules-14503 (ENT-27320) 4 lb/gal EC used at 1 qt/100 gal. Pear psylla infestation was generally much higher during 1968 in the Yakima Valley than it has been for several years. Populations were especially high in September and October even when they were held to small numbers by control measures during most of the growing season.

P. H. Westigard:

The area wide dormant Perthane program provided excellent control and many growers did not apply subsequent materials. In a summer trial only TH-367I provided effective control.

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

Dormant applications of Perthane EC by aircraft did not result in the early adult psylla knockdown obtained from speedsprayer applications. Slightly better control was realized by adding 2.0 gal of Volck oil to the 1.0 gal of Perthane EC/100 gal as a dormant spray.

Summer sprays of TH 367-I, Perthane EC & WP, Volck Supreme Oil, Morestan and combinations of Guthion-Perthane, Guthion-Volck Supreme, Ethion-Perthane,

Morestan-Perthane, Dilan WP + oil, and Perthane WP + oil gave the best control for a 3-5 week period.

H. F. Madsen and K. Williams:

Orchex 796 and Volck Supreme oil at two rates, 2½ and 5 gal. per acre were compared for pear psylla control on Anjou pears. The 5 gal. rate was better than 2½ gal., but both rates gave commercial control. There was no difference in control between the two oils. Both oils at 5 gal. caused leaf spotting and fruit russet on Anjou pears. At the 2½ gal. rate there was slight leaf spotting, but no fruit injury.

R. D. McMullen:

M2060 as a dormant spray reduced adult pear psylla 94-96% on Bartlett and d'Anjou pears. Egg mortality on treated trees was 97-99% compared to 33-37% on untreated trees. Galecron applied in July gave excellent kill of pear psylla eggs and nymphs. Mortality of adults was good, but significantly poorer than in plots treated with Perthane. Galecron also gave excellent control of the European red mite and the McDaniel mite.

W. C. Batiste:

Experimental materials applied for control of codling moth were evaluated for effects on pear psylla. Three spray applications were made and psylla populations remained at relatively low levels in the spray plots up to the third application. However, populations were starting to increase by that time in the Furadan, GS 13005, and Gardona treatments, and psylla continued to increase in those treatments following the third application, reaching or exceeding check levels within 1 to 3 weeks. Imidan, EP-333, and guthion plus Volck Supreme treatments provided better suppression of psylla, but would require additional applications about 5 weeks after the third application.

J. E. Dibble and C. M. Hemstreet:

Three spray oils Orchex 796, PGSO-2 and Volck Supreme were applied 3 times during the summer at 2 and at 6, 4 and 2 gpa in 100 gpa spray applications. The higher gpa rate was not appreciably better than the 2 gpa rate as all gave good psylla control.

APHIDS

E. W. Anthon:

Under field control trials Fundal, Azodrin, Humble Oil, Parathion and Thiodan gave excellent control of this aphid.

E. W. Anthon:

Laboratory control experiments using Bay 16448, 78389, Stauffer R15552-A and Union Carbide 34096 have given good control of the green peach aphid. Furadan, Baygon and Thiodan looked the best in the field trials.

H. R. Moffitt:

A study of the biological control agents affecting the various apple aphids was initiated this past season. The various predators observed were coccinellids, primarily Hippodamia convergens; syrphid flies; green lace wings; and Deraeocoris, a mirid.

From the apple grain aphid, both a primary parasite, Praon sp. (Braconidae) and a hyperparasite, Charips sp. (Cynipidae) have been reared. Parasitism on the apple grain aphid is common in the Wenatchee area in the early season.

A disease of the apple aphid has been common at various times during the past several seasons. Preliminary efforts to identify the organism have not been successful.

The toxicity of a number of commonly used orchard pesticides to Hippodamia convergens was evaluated in the laboratory. Dosage-mortality curves for diapausing adults were established by a topical application technique. Toxicities were azinphosmethyl (ENT-23233) > parathion (ENT-15108) > carbaryl (ENT-23664) > diazinon (ENT-19507) > DDT (ENT-1506) > endosulfan (ENT-23979) > binapacryl (ENT-25793). Non-diapausing adults were exposed to residues of the same pesticides applied at half the normal field level and at normal field level. Residues from both one-half and full field dosage resulted in very high mortalities. At 24 hrs., only binapacryl allowed some survival, 24% at half level and 2.5% at full level. At both levels, survival was 2% at 48 hours.

The effects of direct spraying at both levels upon non-diapausing adults was also assessed. At both levels of application, azinphosmethyl, carbaryl, diazinon and parathion were quite toxic with 100% mortality resulting 6 hours after application. Binapacryl, endosulfan and Morestan (ENT-25606) applications resulted in 50% or less mortality at 48 hours while DDT resulted in 75-80% mortality at the same time interval.

On the basis of the data obtained, a number of adults of H. convergens would survive applications of binapacryl, DDT, endosulfan and Morestan initially but the residues would prove toxic within 24-48 hours after application. The effects of aged residues and the effects of these pesticides upon the larvae remain to be assessed.

S. C. Jones:

Meta-Systox R technical was used as a paint on trunks of filbert trees for the control of the filbert aphid and bud mite control. The amount of the material used per tree was determined by the diameter of the trees. All the Daviana and Royal filbert trees in the plots, except the check trees, received the first application on April 29. One-half of these trees were given a second application on June 20. The second application was applied primarily for the bud mite control.

The aphids were controlled by the April 29 application. However, the two applications did not control the filbert bud mite.

D. E. Ramos and C. S. Davis:

Treatments to control walnut aphid were applied on May 16th. Guthion plus PGSO-2 gave excellent control for 14 weeks. Phosphamidon, Trithion, PGSO-2, PGSO-2 plus either eithion or trithion or diazinon or parathion gave economic control for 12 weeks. All treatments were above economic levels in 16 weeks.

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

Morestan 25W at ¼ lb. plus 3.5 oz. of Pinolene 1912 per 100 gallons provided excellent control of the walnut aphid for periods exceeding 30 days. This control was clearly superior to that provided by Morestan 25W at ½ or 3/4 lb. alone.

Sevin 80 W.P. at the rate of 1¼ lbs. provided control of the walnut aphid for approximately 30 days.

The following materials applied for European red mite control also provided very good control of the walnut aphid: Zolone 3E, 1 1/3 pts.; Azodrin 25W, 1 lb.; Morestan 25W, ½ lb.; Fundal S.P. (EP 333) ½ lb.; Plictran 50W ¼ lb.; and Carzol S.P. (EP 332) ½ lb.

J. E. Dibble, C. S. Davis and D. E. Ramos:

Orchex 796, PGSO-2 and Volck Supreme applied by handgun at 1.5 gal./100 and PGSO-2 and Diazinon at 1 lb./100 reduced the pretreatment aphid population by 75-80%. The combination treatment gave the best initial knockdown but by 3 weeks was comparable to the oils alone. Oil kill at 3 weeks was directly related to oil "heaviness," Volck showing the lowest number of aphids. High temperatures discontinued these tests.

CHERRY FRUIT FLIES

S. C. Jones:

The initial emergence of the cherry fruit fly in cages under cherry trees in the Willamette Valley was on June 2. Seasonal emergence was the heaviest in cages between June 9 and June 23. Cherry fruit fly infestations in the Willamette Valley increased over 1967. This was probably due to the light crop of cherries and the decreased amount of spraying. Very few large commercial growers experienced difficulty in controlling the fly.

Gardona 75% W.P. and Zolone E.C., was tested against the cherry fruit fly in a heavily infested orchard near Eugene, Oregon. Although a few larvae were found in samples examined in all the plots the number of maggots were few compared with the unsprayed plots. The plots were sprayed on June 7; June 17; and June 25. The samples were picked on July 16, 21 days after the final application.

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

Malathion technical as an aerial-applied ULV gave protection from a low infestation of fruit fly, but further tests are needed before the method can be relied upon for fruit fly protection.

Don R. Merkley:

Three chemicals were screened for fruit fly control during 1968. VCS-506 E.C. was applied at 1# ai/100 gallons of water. Gardona, 50% WP was applied at the rate of 1# ai/100 gallons of water, and Diazinon, 25% WP applied at the rate of 1/4# ai/100 gallons of water in three applications on the following dates: June 20th, July 1st, and July 9th. Perthane was applied as a pre-harvest spray. Four percent wormy cherries were found in the VCS-506 block as compared to no wormy cherries in either of the other two plots sprayed with Gardona or Diazinon.

SCALE INSECTS

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

Addition of an OP (Diazinon) to a dormant oil resulted in effective control of overwintering San Jose scale and was better than a slightly higher rate of oil alone.

G. S. Sibbett and C. S. Davis:

Orchex-796 plus either diazinon or parathion gave the best control of walnut scale. Phosphamidon alone, Orchex-796 alone and Orchex-796 plus either

Trithion or ethion or Guthion gave a little better control than the check, but not satisfactory treatments in reducing the scale population.

L. C. Hendricks and C. S. Davis:

One and two percent treatments of Volck Supreme, Orchex-796 and PGSO-2 applied in February gave satisfactory control of frosted scale. Two percent dormant oil emulsion also gave satisfactory control but one percent did not. All treatments were much better than the check.

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

Orchex 696 and 796, PGSO-2 and Volck Supreme were applied in the dormant period along with Orchex 796 and D.O.E. plus Diazinon 50 WP. Applications were made in 60 gpa with an RSM sprayer. Spring evaluation showed all treatments (except the 0-696 at 6 gpa and 0-796 at 4 gpa) had lowered the fairly heavy scale population substantially. The 6 gpa rate of 0-796, PGSO-2 and Volck were comparable to the 2 combination treatments. No phytotoxicity was observed.

J. E. Dibble, C. S. Davis, and D. E. Ramos:

Orchex 796, PGSO-2 and Volck Supreme at 1 gal./100 and at 1.5 gal./100 were compared with D.O.E. at 2 and 3 gal/100. All treatments included Diazinon at 1 lb./100. The treatments all gave excellent control of scale when evaluated in the spring.

BOXELDER BUG

R. W. Zwick & F. W. Peifer:

Diazinon, pyrethrins, parathion and Thiodan gave the best control as contact or residual applications against adults in laboratory evaluations.

PACIFIC FLATHEAD BORER

C. S. Davis:

Latex paint applied by brush to young prune trees on May 1 prevented sunburn and infestation of Pacific flathead borer. This treatment was as good as latex paint plus either Sevin or ethion or dieldrin or diazinon. Dieldrin spray also prevented infestation of this pest but did not prevent sunburn. Neither diazinon, Sevin nor ethion sprays prevented infestation and sunburn.

SECTION IV

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

Loyd L. Stitt and Ben R. Payne:

Analyses made of cured alfalfa samples collected from fields treated commercially at the recommended rate of methyl parathion indicated residues well below the established tolerance. Samples were obtained from the three main alfalfa hay areas (Fallon, Lovelock, and Yerington). The analyses were made on cured alfalfa from both one and two application treatments to the first alfalfa crop. Preliminary studies in comparing rehydration with non-rehydration methods for residues in cured alfalfa showed higher residues from rehydration. Residues from both methods for samples from commercially treated fields were all below the tolerance. In 20 test samples, the residues recovered by the non-hydration method ranged from $<$ 0.01 to 0.1 ppm; by rehydration $<$ 0.01 to 0.9 ppm. Many of the samples rehydrated showed a residue 0.2 to 0.4 ppm compared to 0.1 ppm in the non-rehydrated.

In an alfalfa seed area, residue investigations were initiated to study possible drift from applications of insecticides to alfalfa seed fields. Indications were that drift occurred from the seed field treatments to the hay fields.

H. F. Madsen and K. Williams:

Several pesticides, alone and in combination with oil, were applied to 8 apple varieties. Phytotoxic effects were as follows: No injury-Guthion, iron chelate, manganese sulfate plus oil. Slight fruit injury on McIntosh and Spartan - Lovozal. Leaf injury, necrotic spots followed by yellowing and leaf drop on Spartan, Newtown, Rome, McIntosh, Golden Delicious - Guthion plus oil, oil followed in 24 hours by Guthion, Guthion followed in 24 hours by oil. Leaf injury, spotting and marginal burn followed by yellowing and leaf drop on Spartan, Golden Delicious, Red Delicious, Newtown, Rome, McIntosh - iron chelate followed in 1 week by oil, oil followed in 1 week by iron chelate.

J. H. Black and C. S. Davis:

Two treatments of PGSO-2 plus Kelthane gave excellent control of Pacific mite but caused serious fruit injury. Volck Supreme, Orchex 796 and PGSO-2 applied twice at 19 day intervals caused some fruit injury and did not give good mite control. Omite and Lovozol gave good mite control and did not injure the fruit.

Stan Hoyt:

In one test Azodrin caused severe injury to approximately 10% of the fruit on Red Delicious. Dessin and Lovozal caused moderate foliage burn on Red Delicious in one test each. Handgun applications of Morestan caused severe fruit injury on Red and Golden Delicious and Winesap.

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

Leaf damage and/or defoliation resulted when the following materials and combinations were applied: Cygon-EC and WP, Morestan + DDT; Cyprex + Karathane + Diazinon; Volck Supreme followed in from 2-28 days by NC 5016 (the reciprocal combination being somewhat less damaging); Gardona + Kelthane followed in one week by Guthion + oil. Fruit spotting resulted from oil followed by NC 5016, NC 5016 followed by oil and from a NC 5016 + Guthion combination.

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

Several pre-bloom applications of Morestan + DDT + Cyprex resulted in a combination of bud blasting (similar to boron deficiency symptoms), leaf stunting and curling. The phytotoxic symptoms seemed to be aggravated by other stress conditions such as previous oil applications or cold pockets within the orchard. Leaf damage also resulted from summer applications of Azodrin and by Karathane LC followed in one week by Volck Supreme oil, (apparent only on Anjou).

Carl Johansen:

Small-scale honey bee poisoning tests on cherry or apple gave the following results:

1. Can be applied any time on blooming crops -- Acarol, Bacticin, DuPont 1991, Fundal, Lethane 384, Plictran.

2. Can be applied whenever bees are not foraging -- Carzol, Lethane 384 special, Lovozal, Thanite.

3. Cannot be safety applied on blooming crops -- BAY 78182, Cygon WP, Folimat.

Another small-scale test on apple compared the safety to bees of Pennsalt and Ortho superior spray oils, combinations of the oils and Perthane EC or Ethion WP, Perthane, and Ethion. Results indicated that the superior oils "safened" both of the insecticides to honey bees.

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

Concentrate applications at 93 GPA were evaluated against dilute sprays at 700 GPA for summer control of pear psylla and phytophagous mites on a mature pear planting. At comparable per acre rates superior control was achieved with full dilute applications.

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

The highly refined plant spray oils (applied to runoff by handgun) alone or in combination with Kelthane or Trithion caused a light leaf spotting and leaf drop on slightly stressed peach trees. The same treatments in 13.5, 18, 21, 48, 65, 100 and 400 gpa applications did not cause any foliage injury.

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

More than a dozen self powered and P.T.O. driven sprayers were evaluated in approximately 65 separate spray runs. Water or oil soluble dyes were sprayed at target cards placed in trees or in open ground towers. Unobstructed some of the lower gallonages showed misses and a shorter droplet carry limit. Using plastic overlays with 25-100 holes drilled in them the spray coverage on the cards was rated under a binocular scope. Most units correctly calibrated proved satisfactory.

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

Six applications of 18 to 400 gpa were made in an extremely heavy 2-spotted mite population. Thick webbing and the use of spray oil necessitated penetrating coverage. Eighteen gpa with the smallest droplet size was as good as 400. Aramite and Armite plus oil at 13.5 and 18 gpa was substantially better than oil alone.

J. E. Dibble:

Orchex spray oil with 0.25, 0.5, 1 and 2 per cent emulsifier was applied to peaches, prunes, almonds, and walnuts. Initial deposits were taken immediately after application. The 0.5 and 1 per cent deposited heavier than the low and high emulsifier rate.

J. E. Dibble and C. M. Hemstreet:

PGSO-1 and PGSO-2 were applied in the summer two times at a 10 day interval on pears. Residues were taken from leaves at 2,7 and 14 days after the second application. Six gallons of each oil were sprayed at 9, 90 and 360 gpa in an effort to relate oil deposit and degradation with spray gallonage. Generally the heaviest deposit was obtained in the 90 gpa application followed by 360 gpa and with 9 gpa the lowest. PGSO-2 deposited heavier than PGSO-1 and retained this attitude. There were substantially greater differences in the oil recoveries from 90 and 360 gpa than from 9 gpa. Evaluations of Orchex 796 and Volck Supreme oils showed basically the same pattern.

SECTION V

DISEASES OF STONE FRUITS

Iain C. MacSwan:

Sprays were applied to single tree plots of mature Improved Elberta peach trees, replicated six times, by handgun sprayer. Two sprays (December 11, 1967 and January 18, 1968) were applied to all plots except the Difolatan plot which received only one spray (November 1, 1967). Three hundred plus leaves per tree were rated as diseased or healthy on May 7, 1968.

Leaf curl infection of unsprayed trees in this and other orchards was virtually 100 percent and severe defoliation - often denuding the trees - occurred. One spray of Difolatan, applied in the fall, gave outstanding control - considerably better than the recommended fungicides Bordeaux and Puratized Agricultural Spray. Benlate was ineffective against leaf curl.

Fungicide rate/100 gal.	Percent Leaf Curl
1. Difolatan 80 W 4 lb.	17.2
2. Bordeaux 8-8-100 (tank mix)	38.7
3. Bordeaux 8-8-100 (pre soak)	38.8
4. Puratized Agricultural Spray 3 pt. plus Colloidal Spray Modifier 2 oz.	57.3
5. Kocide 101 5 lb. plus Volck Supreme Oil 4 oz.	63.2
6. F-BCAS 1 gal.	78.7
7. Benlate 50 wp 8 oz. plus Surfactant F 4 oz.	96.4
8. Check	97.0
LSD - 5%	15.4
LSD - 1%	25.6

Iain C. MacSwan:

Sprays were applied to 4 year old Elberta trees in single tree plots replicated four times to test efficacy of fungicides when applied "late" - just before buds started to open - for control of leaf curl. Sprays were applied by handgun sprayer on February 6. Three hundred leaves per tree were rated as diseased or healthy on May 7, 1968. Colloidal Sprayer Modifier at 2 oz/100 gals. was added to each spray.

Brestan 60 reduced leaf curl to some extent but none of the fungicides provided acceptable control when applied "late" - just before buds started to open.

Fungicide rate/100 gal.	% leaf curl
1. Brestan 60 1%	65
2. TAG 1½ pints	71
3. Dithianon W-75 1 lb.	75.7
4. Check	98

Iain C. MacSwan:

Sprays were applied to single tree plots of mature Improved Elberta peach trees, replicated six times, by handgun sprayer. Sprays were applied at popcorn (March 2), full bloom (March 6) and petal fall (March 19). One hundred plus blossoms per tree were rated as diseased or healthy on April 18, 1968.

Benlate provided outstanding control of brown rot blossom blight.

Fungicide rate/100 gal.	Percent Brown rot blossom blight
1. Benlate 50 wp 8 oz. plus Surfactant F 4 oz.	.167
2. TAG 1/2 pt. plus Colloidal Spray Modifier 2 oz.	10.5
3. Kolo 100 3 1/2 lb. plus Colloidal Spray Modifier 2 oz.	13.1
4. Maneb 80 W 2 lb. plus Colloidal Spray Modifier 2 oz.	14.3
5. Cyprex 65 W 1/2 lb. plus Colloidal Spray Modifier 2 oz.	14.3
6. Puratized 10 Spray 1/2 pt. plus Colloidal Spray Modifier 2 oz.	16.3
7. Dithianon W-75 3/4 lb. plus Colloidal Spray Modifier 2 oz.	20.6
8. Check	22.1
LSD - 5%	9.4
LSD - 1%	12.6

Iain C. MacSwan:

Sprays were applied to mature Black Republican (sweet cherry) trees in single tree plots replicated five times. Sprays were applied by handgun sprayer at popcorn (March 20) and full bloom (April 3). One hundred blossoms per tree were rated for disease on April 17. Surfactants: Surfactant F at 4 oz./100 gal. was added to Benlate sprays, all others received Colloidal Spray Modifier at 2 oz./100 gals.

Of the new fungicides, Benlate, at both rates, and Dithianon provided control of brown rot blossom blight equal to the recommended fungicides Puratized 10 Spray and TAG.

Fungicide rate/100 gal.	% brown rot blossom blight
1. Benlate 50 wp 8 oz.	10.4
2. Puratized 10 Spray 1/2 pint	12.2
3. Dithianon W-75 3/4 lb.	14.0
4. TAG 1/2 pint	15.0
5. Benlate 50 wp 4 oz.	15.8
6. Kocide 101 2 lbs.	21.4
7. Check	28.6
LSD - 5%	6.0
LSD - 1%	8.2

Norman S. Luepschen:

Preharvest sprays were applied to Hale peaches to check method of application, Botran formulations, the effect of post harvest brushing, and Bay 33172. Peaches were harvested and inoculated with Rhizopus spores 48 hours after spraying. The peaches were then incubated for 4 days. Decay data are shown in table (A).

Post harvest dips with Botran wettable powder and liquid formulation were compared for effectiveness at equal active concentrations, together with the effect of dry brushing. All peaches were inoculated 24 hours later. Decay data are presented in table (B).

(A)

Chemical	Appl. Method	Rate/100 gals.	Post-harvest Brush	Mean % decay	
check		———	———	72	c
Botran 75W	hand gun	1¼ lb.	———	12	a
" "	" "	"	dry	15	ab
" "	" "	"	wet	8	a
Botran 4L	" "	1 qt.	———	19	ab
Botran 75W	Turbomist	6¼ lb. (conc.)	———	25	b
" "	" "	1¼ lb. (dilute)	———	26	b
Bay 33172	hand gun	1 lb.	———	74	c

(B)

Botran Formulation	Rate/100 gals.	Brushed	Mean % Decay	
75W	1¼ lb.	-	21	a
75W	1¼ lb.	+	29	a
4L	1 qt.	-	34	a
4L	1 qt.	+	49	b
check	———	-	100	c

Duane L. Coyier and Scott B. Kelly:

Several chemical treatments were applied to Lambert sweet cherries as a post-harvest dip to test their effect on control of storage diseases. Six hundred cherries per treatment were dipped in the following solutions shortly after harvest.

1. Benlate (Dupont 1991), 50% W.P., 2 lb/100 gal + 4 oz surfactant "F".
2. Captan, 50% W.P., 2 lb + Botran, 75% W.P., 1 lb/100 gal.
3. Benlate, 50% W.P., 1 lb + Botran, 75% W.P., 1 lb + 4 oz. surfactant "F".
4. Check (Water only).

The fruit was stored at 35 degrees F following treatment and inspected periodically after a 3-week storage interval. Severe damage occurred on cherries treated with Benlate plus Botran. The injury first appeared as dark, sunken spots which were later infected with fungi. Nearly complete deterioration of the fruit in this lot occurred by the termination of the test.

No injury to the fruit was apparent in the lot treated with Benalte alone or in the lot treated with Botran plus Captan. Cherries treated with Benlate alone displayed less stem deterioration and had more marketable cherries at the end of the test period than did other treatments. Alternaria sp. was the principal fungus involved in the decay of Benlate-treated fruit.

SECTION VI

DISEASES OF POME FRUITS

Iain C. MacSwan:

Sprays were applied by handgun sprayer to single tree plots of mature Rome trees replicated six times. Sprays applied once at silver tip to green tip stage only (March 21): (1) Cyprex 6 lb. plus Volck Supreme Oil 2½ gal. plus Difolatan 6¼ lb plus Volck Supreme Oil 2½ gal. per 100 gals. (2) Cyprex 6 lb plus Volck Supreme Oil 2½ gal/100 gal. (3) Difolatan 4 lb. plus Volck Supreme Oil 2½ gal/100 gal (4) Difolatan 6¼ lbs. plus Volck Supreme Oil 2½ gal/100 gal. Sprays applied in full program - at prepink (April 9, pink (April 23), calyx (May 15), 1st cover (June 18), 2nd cover (July 12): (1) Benlate at both 4 oz. and 8 oz. rates plus Surfactant F 4 oz/100 gal (2) Dithianon 1 lb. (3) HOE 2873 .05% (4) Cypres 3/4 lb plus Karathane 3/4 lb/100 gal (5) Bayer 33172 1 lb/100 gal. Surfactant Triton B 1956 at the rate of 2 oz. per 100 gal. of spray was added to Dithianon, HOE 2873, Cyprex plus Karathane and Bayer 33172. Dates of disease readings: powdery mildew - September 27; scab and russet October 29 to November 1.

Benlate (two rates), Dithianon, Difolatan (2 rates of "massive dose" of Cyprex plus Volck provided good control of scab. "Massive dose" rates of Difolatan plus Volck oil applied only at silver tip to green tip stage provided scab control similar to that of the 1967 trials. This is the first year of testing Cyprex at the "massive dose" rate plus Volck Oil. The results indicate that the trial warrants repeating in 1969. Benlate, Difolatan and Dithianon provided good control of powdery mildew when compared with the standard Karathane (plus Cyprex) sprays.

ROME

Fungicide rate/100 gal.	%Fruit Scab	%Powdery Mildew	%Fruit with Russet
1. Benlate 50 wp 8 oz.	.21	14	6.0
2. Dithianon W-75 1 lb.	1.1	23.1	7.0
3. (1)Cyprex 65W 6 lb. plus Volck Supreme Oil 2½ gal.	1.2	37.5	6.4
4. (1)Difolatan 80W 4 lb. plus Volck Supreme Oil 2½ gal.	1.3	22.5	6.8
5. Cyprex 65W 3/4 lb. plus Karathane WD 3/4 lb.	2.1	19.8	7.9
*6. (1)Cyprex 65W 6 lbs. plus Difolatan 80W 6¼ lb plus Volck Supreme Oil 5 gal.	2.4	25.0	9.7
7. Benlate 50 wp 4 oz.	2.9	14.2	13.6
8. (1)Difolatan 80W 6.25 lb. plus Volck Supreme Oil 2½ gal.	4.1	31.8	8.5
9. HOE 2873 .05%	13.4	29.0	5.7
10. Bayer 33172 1 lb.	16.0	27.3	6.4
11. Check	19.4	34.5	9.3
LSD 5%		9.5	
LSD 1%		12.7	

*This spray reslted from an inadvertent mixing of two tanks - one containing Difolatan 6.25 lb. plus Volck Supreme Oil 2½ gal./100 gals and one containing

Cyprex 6 lb. plus Volck Supreme Oil 2½ gal/100 gals. Two trees only were sprayed with the mix.

(1) Spray was applied only once - on March 21, between silver tip and green tip.

Iain C. MacSwan:

Sprays were applied by handgun sprayer to single tree plots of mature Jonathan trees replicated four times. Applications were made at pre pink (March 20), pine (April 2), calyx (April 26), 1st cover (June 5) and 2nd cover (July 16). Fruit was picked September 23, russet readings made on September 24 and terminals assessed for powdery mildew on September 25.

Benlate at the 8 oz. per 100 gal. rate is an effective midewcide.

Fungicide rate/100 gal.	Percent Powdery Mildew	Percent Fruit with Russet
1. Benlate 50 wp 8 oz. plus Surfactant F 4 oz.	30.2	16.2
2. Karathane WD 3/4 lb. plus Triton B 1956 2 oz.	36.0	22.5
3. Benlate 50 wp 4 oz. plus Surfactant F 4 oz.	42.0	27.0
*4. Bayer 33172 1 lb. plus Triton B 1956 2 oz.	46.0	42.1
5. HOE 2873 .05% active plus Triton B 1956 2 oz.	47.5	26.7
6. Dithianon W-75 1 lb. plus Triton B 1956 2 oz.	56.2	49.4
7. Check	63.0	76.9
LSD-5%	11.4	
LSD-1%	15.6	

*Missed pre pink application because of late arrival.

Iain C. MacSwan:

Thirty-five 5 year old Rome apple trees were sprayed with one fungicide (Dikar), twenty-eight trees were unsprayed. Dikar was applied at the rate of 2 lbs. plus 2 oz. Triton B 1956 per 100 gals. water by air blast sprayer at late pre pink (April 17), pink (April 26), 1st cover (May 24) and 2nd cover (June 12). Leaf scab - 100 leaves on each of five random trees were assessed as diseased or healthy on September 20. Fruit scab - 160 random picked apples from the check trees and 224 from the sprayed trees were rated as diseased or healthy on October 24. Russet - ratings were made on October 24 on apples examined for scab. Powdery mildew - 50 terminals on each of five random selected trees in both sprayed and unsprayed blocks were assessed for powdery mildew on September 20.

Dikar is a promising fungicide for control of both scab and powdery mildew and warrants further trials.

Fungicide rate/100 gal.	Percent fruit scab	ROME Percent leaf scab	Percent powdery mildew	Percent fruit with russet
1. Dikar 2 lb. + Triton B 1956 2 oz.	4.4	50.6	11.6	10.7
2. Check	61.2	85.8	37.2	6.8
LSD - 5%		28.3	8.3	
LSD - 1%		46.9	13.7	

Dikar* -

ACTIVE INGREDIENT

Coordination product of zinc ion and manganese ethylene bisdithiocarbamate	74.00%
Dinitro (1-methyl heptyl) phenylcrontonate	4.68%
Other dinitro phenols and derivatives, chiefly dinitro (1-methyl heptyl) phenol	1.32%
INERT INGREDIENTS	20.00%
TOTAL	100.00%

* Patent Pending
By Rohm and Haas Company

Iain C. MacSwan:

Test to determine if "massive doses" of Difolatan in combination with heavy rate of Volck Supreme Oil when applied once - at the silver tip to green tip stage of mature Richared Delicious trees - would provide scab control for the season as did the 1967 tests. In addition, to rate Dithianon and Benlate as scab fungicides against the standard material Cyprex when applied in a full program (prepink, pink, calyx, two covers).

Sprays were applied by handgun sprayer to single tree plots replicated four times. Difolatan sprays were applied once - February 29. Cyprex, Dithianon and Benlate sprays were applied March 21, April 8, May 8, June 7 and June 12. One hundred leaves per tree were assessed as diseased or healthy on September 25. From 70 to 200 fruits per tree were rated for scab and russet October 1 to October 3. Surfactants: Triton B 1956 at rate of 2 ounces/100 gallons was added to Dithianon and Cyprex sprays. Surfactant F at rate of 4 ounces/100 gallons was added to Benlate sprays.

Benlate, Dithianon, Cyprex and Difolatan (at the higher rate) plus Volck Supreme Oil provided good control of scab. Of high interest is the ability of Difolatan plus Volck Oil when applied once at silver tip to green tip stage to provide scab control.

	Richared Delicious		
Fungicide rate/100 gal.	%Fruit Scab	%Leaf Scab	%Fruit with Russet
1. Benlate 50wp 8 oz.	.25	1.2	44.1
2. Dithianon W-75 1 lb.	1.4	5.7	30.0
3. Cyprex 65W 3/4 lb.	3.4	9.0	43.2
4. Difolatan 80W 6.25 lb. plus Volck Supreme Oil 2½ gal. (applied once at silver tip to green tip stage)	9.0	11.0	22.0
5. Difolatan 80W 4 lb. plus Volck Supreme Oil 2½ gal. (applied once at silver tip to green tip stage)	12.5	10.2	26.4
6. Check	36.3	29.7	53.1
LSD 5%	11.4	7.4	17.4
LSD 1%	15.7	10.2	24.0

Scott B. Kelly and Duane L. Coyier:

Powdery mildew fungicide screening tests were conducted during the cool weather of late April through early May and again in the warmer period of June and July. Seedling apple trees grown in 1-gallon cans under moderate shade were used as host plants. Sprays were applied weekly and the plants were rated for incidence of powdery mildew one week following the final spray. Four applications were made during the first test and six were applied in the second.

Benlate (Dupont 1991) used at 1/2 lb/100 gal provided good powdery mildew control with no apparent phytotoxic effects in either test. Karathane (1/2 lb., 25% w.p.) controlled mildew nearly as well as Benlate but minor phytotoxicity was observed in each test. Dikar (80% w.p., 2 lb) and Karathane provided comparable powdery mildew control and caused similar injury to apple leaves.

Three Penn Salt Co. chemicals were tested with fair to excellent results. TD-8537 (25% w.p., 1/2 lb) provided 100% control with no injury in the mid-summer test. During cool weather it provided only 84% disease control and caused minor injury to the foliage. TD 8553 (25% w.p., 1/2 lb) was 89% effective and caused no injury in the first test and was 98% effective with slight phytotoxicity in the second. Brandol caused no injury in either test but was less effective than either of the other two compounds.

Hoechst 2873 (30% E.C., 1/2 gal) provided excellent control but caused moderate to severe phytotoxicity to the foliage of test plants. Other compounds which showed promise for powdery mildew control without excessive phytotoxicity included GS-16, 306 (Geigy), EL-241 (Elanco), BAY 49854 (Chemagro), Cosanil and SuperKosan (both Occidental Chem. Co.).

Duane L. Coyier and Scott B. Kelly:

D'Anjou pears were treated pre-and post-harvest to investigate potential new methods for decay control. Seven growers were instructed to apply up to 3 ziram (1-1/2 lb/100 gal) sprays on selected field plots. All used conventional air-blast equipment and applied the sprays at full volume. Random fruit samples were collected at harvest time and stored at 32 degrees F core temperature until inspection 5 months later. Half the samples were given post-harvest treatment before storage and the balance were stored without further treatment. Post-harvest treatment consisted of immersion in S.O.P.P., followed by a detergent wash, fresh water rinse and wax.

Observation of nearly 2000 "field-run" fruit per lot showed little correlation between the number of ziram sprays and incidence of decay. Average decay for "field-run" fruit was 8.0 percent. However, the decay rate declined proportionately as the number of ziram sprays increased, when the fruit was treated post-harvest. Average decay for all lots treated post-harvest was 4.1 percent.

Another experiment was designed to compare decay control of four post-harvest treatments on D'Anjou pears. Benlate (Dupont 1991) used at 500 ppm (a.i.) provided best decay control with only 3.9 percent of the fruit showing evidence of fungus infection following a 5-month storage period. A Bromodine-wax combination (one part wax--two parts Bromodine), used at 1 oz/gal., resulted in 9.9 percent decay while Bromodine used alone at 1000 ppm (formulated) yielded 13.9 percent decay. Fruit treated with Stop-Mold followed by a fresh water rinse had 32.5 percent decay.

Bromodine-treated fruit displayed pin-point lenticel injury at the time inspection was made in February, 1968. The injury was accentuated by the addition of wax to Bromodine.

Norman S. Luepschen:

Bloom and post-bloom sprays (8 applications) were made April 24-June 3, using fixed copper @ ½ lb./100 gals., streptomycin @ 100 ppm, Bacticin @ 1 and 2 qts./100 gals., Cosanil @ 4 lbs/100 gals., Zineb @ 2 lbs./100 gals., and Zinc Coposil @ 1½ lbs./100 gals. No natural infection occurred due to cool weather. No phytotoxicity.

A foliar spray of Bacticin @ 2 qts./100 gals. was applied July 11; terminal shoots were harvested July 12, brought into the lab, inoculated with E. amylovora, and blight measurements made July 19. In comparison with the check terminals, the Bacticin spray treatment resulted in 34% control, statistically not significant at 5% level.

L. E. Lopatecki:

In field tests, Lysol gave more consistant disinfection of cutting tools than did mercuric chloride, Torsite, Nurelle, or Roccal. The most critical factors limiting bactericidal efficiency appeared to be inactivation by organic matter, and the rapid fall in activity of some compounds when contact periods were reduced to 5-15 secs. Lysol and phenols generally were inactivated less by organic matter than mercury of chlorine, yet retained relatively high activity at short contact periods. For field use, a concentration of around 5% Lysol is recommended.

SECTION VII

DISEASES OF NUT CROPS

Iain C. MacSwan:

Test No. 1 - One application of the indicated spray materials was made (May 8) on the variety Franquette before bloom. The spray was applied with an air blast sprayer at the rate of 100 gallons per acre. Each plot was approximately one acre. From 100 to 200 nuts from each of ten trees per plot were assessed as diseased or healthy.

	Disease Control			
Fungicide and rate of usage/A	Percent of nuts infected	Rating	Safety to host	Recommended for grower use
Kocide 101, 8 lbs. + Volck Oil 1 qt.	0.4	1	1	yes
Bordeaux 12-6-100 + Triton B 1956 2 oz.	0.9	1	2	yes
Kocide 101, 8 lbs. + Sun oil 1 qt.	3.5	2	1	yes
Orthocop 53, 12 lbs. + Volck Oil, 2 oz.	4.4	3	1	yes
Check	4.7			

Test No. 2 - Two applications of the indicated spray materials were made on the variety Franquette, one at the late prebloom stage (May 22) and one at the early post bloom stage (June 1). Applications were made with an air blast sprayer at 125 gallons per acre. Each plot was approximately one acre. From 100 to 200 nuts from each of ten trees per plot were assessed as diseased or healthy.

	Disease Control			
Fungicide and rate of usage/A	Percent of nuts infected	Rating	Safety to host	Recommended for grower use
Kocide 101, 8 lbs. + Sun Oil, 1 pt.	0.1	1	1	yes
Kocide 101, 8 lbs. + Sun Oil, 1 pt.	0.6	1	1	yes
Millers Microcop 8 lbs. + Sun Oil 1 pt.	1.8	2	1	yes
Check	11.3			

CODLING MOTH

J. Franklin Howell:

A pilot plant for mass rearing colding moths on an artificial medium was placed into operation in April, 1968. Approximately one-half million insects were produced. However, production was far below that expected. Fungi and disease were partly responsible; however, mortality of neonate and 2nd instar larvae resulting in a poor larval density per tray was the prime reason. The environment of the rearing rooms was favorable for fungal development and can be corrected with proper equipment. Sanitation must be improved to maintain virus-free conditions. The virus probably was the result of stress applied by poor rearing conditions (high RH, fluctuating temperatures, fungi, and secondary vectors). Dosophila, once started, contaminated every tray spreading a micro-organism (yeast or bacteria) that expresses itself as a mucous-like film on the surface of the diet. These flies could mechanically transfer the virus also. Techniques for mass culturing codling moth on an artificial medium need further development.

CONTRIBUTORS TO ABSTRACTS OF THE
43rd ANNUAL WESTERN COOPERATIVE SPRAY PROJECT

Anthon, Edward W., Tree Fruit Experiment Station, Washington State University, Wenatcheee, Washington 98801.
Arrand, J. C., Vernon, British Columbia, Canada.
Barnes, Martin M., Department of Entomology, University of California, Riverside, California 92507.
Batiste, William C., Department of Entomology, University of California, Berkeley, California 94720.
Bethel, R. S., Agricultural Extension Service, Placerville, California.
Black, J. H., University of California, Berkeley, California.
Burts, Everett, Tree Fruit Experiment Station, Washington State University, Wenatchee, Washington 98801.
Butt, B. A., USDA, ARS, Entomology Research Division, Yakima, Washington 98901.
Croft, Brian A., University of California, Riverside, California 92502.
Coyier, Duane L., Hood River, Oregon.
Davis, C. S., Extension Entomologist, University of California, Berkeley, California 94720.
Davis, Donald W., Utah State University.
Dean, Fred, USDA, ARS, Entomology Research Division, Yakima, Washington 98901.
Dibble, J. E., Extension Service, University of California, Berkeley, California 94720.
Downing, R. S., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
Etzel, L. K., Division of Entomology, University of California, Berkeley, California 94720.
Falcon, L. A., Division of Entomology, University of California, Berkeley, California 94720.
Hathaway, Darrell O., USDA, ARS, Entomology Research Division, Yakima, Washington 98901.
Hemstreet, C. L., University of California, Berkeley, California 94720.
Hendricks, L. C., University of California, Berkeley, California 94720.
Howell, J. Franklin, USDA, ARS, Entomology Research Division, Yakima, Washington 98901.
Hoyt, Stanley C., Tree Fruit Experiment Station, Washington State University, Wenatchee, Washington 98801.
Johanson, Carl, Washington State University, Pullman, Washington 99163.
Jones, S. C., Department of Entomology, Oregon State University, Corvallis, Oregon 97331.
Kelley, Scott, Hood River, Oregon.
Lopatecki, L. E., Summerland Research Station, Canada.
Luepschen, Norman S., Colorado State University, Branch Experiment Station, Grand Junction, Colorado.
MacSwan, Iain C., Plant Pathologist, Oregon State University, Corvallis, Oregon 97331.
Madsen, Harold F., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
McMullen, R. D., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
Merkley, Don R., West Montana Branch Station, Corvallis, Montana 59828.
Moffitt, H. R., USDA, ARS, Entomology Research Division, Yakima, Washington 98901.

Morehead, G. W., University of California, Berkeley, California.
Payne, Ben R., University of Nevada, Reno, Nevada 89507.
Peifer, Forest W., Mid-Columbia Branch Experiment Station, Hood River, Oregon 97031.
Post, G. R., University of California, Berkeley, California.
Proverbs, M. D., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
Ramos, D. E., University of California, Berkeley, California.
Schafer, Jim, Department of Entomology, Oregon State University, Corvallis, Oregon 97331.
Sibbett, G. S., University of California, University Hall, Berkeley, California 94720.
Stitt, Loyd L., University of Nevada, Reno, Nevada 89507.
Terriere, L. C., Department of Agricultural Chemistry, Oregon State University, Corvallis, Oregon 97331.
Wargo, M. J., University of California, Riverside, California 92502.
Westigard, P. H., Southern Oregon Branch Experiment Station, 569 Hanley Road, Medford, Oregon 97502.
White, L. D., USDA, ARS, Entomology Research Division, Yakima, Washington 98901.
Williams, K., Entomology Laboratory, Canada Department of Agriculture, Summerland, B.C.
Zwick, R. W., Mid-Columbia Branch Experiment Station, Hood River, Oregon 97031.