ABSTRACTS OF REPORTS FROM THE 38th 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 in the states of California, Colorado, Idaho, Montana, Oregon, Utah, and Washington, and the Province of British Columbia, are not intended in any way to constitute recommendations of the project. Official recommendations can only be made by public service investigators from their respective areas.

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Abstracts of Reports from the
38th Annual Western Cooperative Spray Project

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S E C T I O N I

INSECT AND MITE PESTS OF POME FRUITS

APPLE INSECTS AND MITES

Codling Moth

Donald W. Davis:

One series of replicated treatments for the control of codling moth on mixed apple varieties (Red Delicious, Jonathan and Rome) was conducted at North Ogden, Utah. Guthion, Guthion M-E (methy-ethyl), and Sevin all gave results indistinguishable from each other by statistical analysis. In general, the control was better than with the other chemicals used. Anti-resistant DDT continued to give better control than expected from DDT, but the results were inferior to either Guthion or Sevin. Results with Bayer 37344 and Bayer 39007 were hard to evaluate. The percentage stings was low with both of these materials, but the amount of wormy fruit was somewhat high. Bayer 39007 had significantly higher numbers of wormy fruit among windfalls than any treatments except the anti-resistant DDT. Bayer 37344 had significantly more wormy fruit picked from the trees than any of the other sprays.

The bioassay tests of DDT on five populations of codling moths was completed. The differences in degree of resistance were striking. About half of the individuals from Roy and Orem populations were almost immune to DDT. The other half were killed rather easily. All of the populations tested showed some resistance, but the Honeyville larvae were still quite susceptible.

F. W. Peifer:

Two cover sprays of DDT 50% WP and Malathion 25% WP - 2 lbs./100 and a third cover of Guthion 25% WP 1.25 lbs./100 and Ethion 25% WP - 1.5 lbs./100 provided excellent control of codling moth on Red Delicious and Newtown apples. The different materials used in the third cover were only substituted to provide better E. red mite control.

Stanley C. Hoyt:

The following materials gave good control of the codling moth: Sevin + Dimethoate, SD 8448, Bayer 37344, Imidan, Niagara 9203, Niagara 9227, Niagara 9239, Niagara 9241, and Guthion. SD 7438 was slightly less effective. Of these materials, Niagara 9203 and 9239 caused injury. Trees sprayed with Niagara 9227 and SD 8448 had very high population of mites.

F. H. Harries:

Egg laying and mortality of the codling moth are influenced by some antibiotics. Females one to three days after emergence were treated with

one droplet of solution on the ventral abdomen with a micro-applicator. Treated moths were confined in pairs in individual cages or in groups of five females and two males. Two of the antibiotics, venturicidin at 1200 ppm. and phytoactin at 2000 ppm., were definitely toxic, producing 40 and 60 percent mortality, respectively, in 10 replicates of 5 females in each test. Pleomycin, ristocetin, acti-dione, cytovirin, viridogrisein, candicidin, actinobolin, U-14713, and the anti-tumor drug, azauracil, did not have any marked effects on either egg laying or mortality of the moths. In other tests it was found that acti-dione and cytovirin caused a marked reduction in egg laying if applied soon after emergence of the moths or before mature eggs had been formed. In other tests of 40 pairs in each treatment group, it was found that acti-dione and cytovirin reduced egg laying appreciably in a 3-day observation, but that much more effect of the antibiotics was shown in 7 days or after deposition of the first eggs, presumably those formed before the moths were treated.

A. J. Howitt:

The following materials applied at listed rates per 100 gal. at petal fall and in 6 cover sprays at Saugatuck gave excellent control of codling moth and plum curculio: Bidrin 7.5 EC - 200 ml, GC3707 25 WP - 1#, 4072-25 WP - 1#, CP40273-25 WP - 4#, Colep 25 WP - 4#, SD8448-50 WP - 1#, SD8447-75WP - .6#, Imidan 50 WP - 1#, B37344 0 50WP - 1#, B41831 - 25WP - 1#, and Nia 9239-25WP - 2#. UJ12927 - 75 WP (Upjohn carbamate) gave control at 2.6# but not at 1.3#. Dimetilan 50 WP - 2#, B44646 - 50WP - 1#, and Nia 9203 - 25WP -2# did not give commercial control. Sevin, Guthion, Diazinon, and half dosages of Sevin-Guthion were used as standards in orchards where this work was conducted.

M. M. Barnes:

Four types of low intensity ultra-violet light traps were tested for detection of codling moth flight. Trap design and lamp selection is aimed at minimizing extraneous catch but maintaining a sensitive, dependable index of codling moth activity.

Darrell O. Hathaway:

Topical application of 30 micrograms of tepa to adult moths resulted in 99% egg sterility without any reduction in longevity or mating. Mature larvae treated with 30 micrograms of tepa per insect induced a high mortality, caused larvae to hibernate, and moths that did develop from the treated larvae were in many cases deformed.

Results of tests with 4-day old eggs dipped for 1 minute in a 5% solution of tepa was an 87% egg mortality. No sterilization effect has been noted when pupae were dipped in a 5% solution of tepa for 1 minute.

Darrell O. Hathaway:

In laboratory tests codling moth males 0 to 24 hours old were anesthetized with CO_2 and exposed to gamma radiation in a cobalt 60 irradiator at dosages of 20, 30, 40, and 50 Kiloroentgens (Kr). The average egg hatches from crosses of treated male moths and untreated female

moths were: 22.3%, 15.3%, 3.6% and 0.4%, respectively. Fully developed pupae exposed to dosages of 15, 20, 25, 30, and 40 Kr produced egg hatches of 60%, 25.3%, 18%, 14%, and 3.5%, when treated male moths were crossed with untreated female moths. Female moths irradiated as adults or fully developed pupae at 20 Kr produced no viable eggs.

High mortality of pupae occurred after exposure of 4-day old eggs to gamma radiation doses of 5 Kr. A small percentage of the mature larvae exposed to 10 Kr completed the pupal stage and emerged as adults.

Field-cage testing resulted in a reduction of 83.6% of the F_1 generation when a ratio of 20 treated male moths irradiated at 40 Kr were released for every untreated male and female moth. An average of the control cages represented a 6-fold increase per generation.

John A. Quist:

Three experimental insecticides were subjected to field trials upon a block of Red Delicious apple trees that had been unsprayed for several years. Duplicate tests were run on Bartlett pears. Five applications at about three week intervals proved very effective whereas untreated check trees were completely wormy. Bayer 37344 gave best control and complete mite control. The woolly aphid population was excessive at harvest, and no control of the rosy apple aphid was noted. Stauffers' R-5092 gave good codling moth and mite control but no aphid control except that there was no woolly aphid buildup. Imidan gave good codling moth control and moderate mite control. Rosy aphid was not controlled and no woolly aphid buildup was noted.

Ten commercial orchardists cooperated in demonstrational trials to minimize the number of codling moth sprays applied for the season. Such spraying has been conveniently termed "calculated risk spraying" since a low percentage of fruit stings are permitted in order that the number of cover sprays may be reduced. The results have shown that sprays can probably be uniformly reduced to two or three for the season, provided that either removal or spraying of abandoned trees is associated with these practices. These trials have focused the growers' attention and interest upon a program of sanitation through the establishment of a pest control district for codling moth and some other insects. The legal procedures for the establishment of a pest district have been initiated.

Apple Maggot in Michigan

A. J. Howitt:

Since gravid females may rest on untreated trees then fly to treated trees and oviposit before expiring, commercial control can be obtained only when no check trees are left. To test a candidate maggot material a small isolated orchard is treated with no checks. An isolated orchard of 50 trees treated in 4 cover sprays with Colep 25 WP at 1# was 30.2% infested with maggot.

Orchard Mites

Harold F. Madsen:

On a strain of European red mite resistant to Tedion, early season treatments of Tedion wettable, emulsion concentrate, and emulsion concentrate plus a synergist all failed to give control. Morocide and Bayer 37344 gave an initial reduction of mites but failed to provide adequate control. Morestan gave excellent control and a single treatment in April held mites in check until August. A series of oils of varying viscosities were also tested, and oils ranging from 70 to 991 seconds Saybolt gave good control when two sprays timed two to three weeks apart were applied. A 60 viscosity oil did not give as good control as the heavier oils indicating that oils with too low viscosity may not be effective for mite control. A single early season spray of Penn. Salt superior oil gave excellent control, and may indicate that timing of oil sprays is more important than previously thought. An oil of low U.R. (77.0) was effective, but phytotoxic, causing marginal leaf burn and yellow spotting of the fruit.

Donald W. Davis:

Two series of replicated experiments were conducted during 1963 for the control of the McDaniel mites. One of the experiments was at Midvale and the other at Bountiful, (both areas are near Salt Lake City and have mite populations with a long history of resistance to various acaricides). Animert 20% 1#/100 gallon (related to tedion) was used in one experiment.

The mite control was excellent for a period of five weeks. There was no tedion used in direct comparison with Animert, but the results, population pattern, etc. were typical of tedion in other orchards.

Bayer 37344 50% 1½#/10 gallon showed excellent results, but was not checked for length of residual control. The foliage and fruit appearance was better than that of some of the other treatments, especially compared to Morocide.

Bomyl (General Chemical 3707) 20% 2#/100 gallon gave very good control in the one orchard where it was used. It controlled the mites for a period of nearly five weeks. It was surpassed slightly by Morestan and Animert.

Cellosize QP 4400 2#/100 gallon gave poor mite control and caused the foliage to be brittle.

Ethion 25% 2#/100 gallon did not give a satisfactory control during 1963. The orchard had a history of phosphate resistant mites, but in spite of this, Trithion still worked well in the current comparisons.

Morocide 50% 1#/100 gallon was used in both of the orchards with very good results for nearly five weeks. There was some foliage burn and a poor color to the foliage in general, but there was no economic loss. The dosage used was higher than usually recommended.

Morestan (Bayer 36205) 25% 1#/100 gallon gave excellent results for about five weeks. It was clearly one of the better miticides used for 1963.

NIA 9203 25% 2#/100 gallon gave a quick knock-down of the mite populations, but required retreatment in about three weeks.

Tedion 25% 1#/100 gallon plus Kelthane 18½% 2#/100 gallon (both at full recommended strength) was used in one of the orchards. Both materials used alone failed repeatedly in 1961 and 1962. The results with the mixture were very good but expensive.

Trithion 25% 2#/100 gallon still gave excellent control in one of the orchards. It is the only phosphate known to work in this orchard at Midvale.

F. W. Peifer:

A series of registered and non-registered materials were applied as pre-bloom and cover sprays to control E. red mites. The promising pre-bloom treatments included: Karathane 22.5% WP - 0.75 lbs./100, Karathane 37% EC - 6 oz./100, Morocide 50% WP - 0.5 lbs./100, Morocide 4E - 1 pt./100, and UC 19786 50% WP - 1.0 lb./100. Cover sprays that demonstrated good to excellent acaracidal properties included: All of the above materials for a limited period of time -- 3 weeks or less, Hoechst 2813 50% WP - 1.0 -1.5 lbs./100, Hoechst 2836 37.5%WP - 1.5 - 2.0 lbs./100, Karathane 22.5% WP - 0.75 lbs./100 plus Tedion 25% WP - 1.0 lb./100, Kelthane AP 18.5% WP - 2.0 lbs./100, Ethion 25% WP 2.0 lbs./100 and Chlorobenzilate 25% WP - 2.0 lbs./100 (not recommended for commercial use on apples in this area).

Stanley C. Hoyt:

For control of apple rust mites on apples delayed dormant sprays of sulfur were more effective than prepink sprays, and sulfur paste was more effective than wettable sulfur. Prepink sprays of Morestan or Thiodan were also highly effective.

Summer sprays of UC 20047, UC 21149, HRS 1654, Bayer 37344, Morocide and Morestan gave good control while UC 19786 was slightly less effective.

Stanley C. Hoyt:

For control of red mites on apples a pink spray of Morestan gave excellent control, and prepink sprays were generally good. HRS 16A was ineffective. Summer sprays providing good control were Morestan, UC 20047, HOE 2813 and HOE 2836. Bayer 37344, UC 19786, and Morocide WP provided good control in some tests, but were less effective in other trials. Several additional materials which did not provide adequate control were HRS 1654, UC 21149, American Cyanamid 38906, Bayer 50282, Bayer 42696, CP 40273, Kelthane, Chlorobenzilate, and Morocide EC.

Stanley C. Hoyt:

For control of McDaniel spider mites Morestan is the only material tested which provided a good reduction of populations following prebloom

applications. Materials which were effective as summer sprays were Morestan, Morocide, HRS 1654, SD 7438 EC, Bayer 37344, UC 20047, UC 19786, HOE 2813 and HOE 2836. Fair to poor control was provided by Morocide EC, Morestan at a reduced rate, UC 21149, CP 40273, American Cyanamid 38906, Bayer 42696, Bayer 50282, Chlorobenzilate and SD 7438 WP.

Stanley C. Hoyt:

An application of Guthion at 1-1½ pounds per 100 gallons of water practically eliminated the predator Typhlodromus occidentalis for six weeks. Guthion at 3/4 pound and Imidan caused 50 per cent reduction in predator populations for two weeks.

Entomology Laboratory, Summerland, B. C.:

(1) Pink bud sprays for orchard mite control.

Where Morestan, 25 per cent wettable powder, was applied by a concentrate sprayer at 3 pounds per acre at the pink bud stage of apple, the control of the European red mite was excellent. Where only 2 pounds were used, the European red mite started to increase about the end of July. The addition of 8 gallons of lime sulphur to 4 pounds of Morestan per acre did not influence the effectiveness of Morestan against mites nor did it affect the initial deposition or the persistence of the actual chemical on the foliage:

Pink bud sprays of 2 or 4 pounds of Morestan alone or with the addition of 8 gallons of lime sulphur per acre gave excellent control of the apple rust mite until the end of July. These sprays also gave control of the McDaniel spider mite that was present on the trees at the time of spraying but did not prevent a later reinfestation by this mite.

(2) Summer sprays for orchard mite control.

(a) Morestan. As a summer spray, a 25 per cent wettable powder of Morestan applied at 0.5 pounds per 100 gallons by hand gun sprayer, gave excellent control of the European red mite and the McDaniel spider mite for 6 weeks. Similar control was given by a flowable concentrate formulation at a similar rate of active ingredient. When the concentration of wettable powder was reduced to 0.25 pounds, control of both mites was satisfactory, but only for 3 weeks. Morestan wettable powder, applied by concentrate sprayer at 2, 3, or 4 pounds per acre, gave excellent control of the apple rust mite and of a predaceous typhlodromid mite. Morestan applied by hand gun sprayer at 0.5 pounds caused dark red areas, 0.25 to 0.5 inches in diameter, on McIntosh apples. This did not appear on Delicious or Winesap.

(b) Binapacryl (Morocide). A 50 per cent wettable powder applied by concentrate sprayer at 3 or 4 pounds per acre gave excellent control of the McDaniel spider mite for at least 6 weeks. Where it was applied at 2 pounds per acre, the control lasted 4 weeks. Three hand gun applications, one at 1 pound and two at 2 pounds per 100 gallons, failed to control the European red mite, although there was some decrease in the numbers of mites after the second application. The McDaniel spider mite was virtually eliminated in these plots. In another orchard, concentrate

applications of this 50 per cent dinitro miticide at 2, 3, or 4 pounds per acre, gave excellent control of the apple rust mite and of a predaceous typhlodromid mite. The hand gun applications produced bleached areas on McIntosh apples.

(c) Pennsalt Superior Oil. Where this was used at the rate of 1 gallon per 100 gallons in a hand gun sprayer the control of the European red mite was excellent. This amount did not control the McDaniel spider mite but where the rate was increased to 1.5 gallons, the control was fairly good. The latter application, however, caused a "buckskin" appearance of McIntosh apple.

(d) HRS 1654. This new chlorinated pentadiene compound can be classified as a fairly effective miticide. A 50 per cent wettable powder used in a hand gun sprayer at 2 pounds per 100 gallons gave good control of the McDaniel spider mite for about 5 weeks. The same concentration gave control of the European red mite for 3 weeks in one orchard and no control in another.

F. H. Harries:

In screening tests of new compounds, excellent results were obtained in controlling European red mites with Bayer 36205, 29492, 34735, 41522, Stauffer B-10095, N-4446, R-6482, B-9381, B-9564, N-4539, B-10038, N-4543, N-3336, N-2793, N-4168 and R-6395. The materials were equal to or better than Kelthane against non-Kelthane resisting mites.

A. J. Howitt:

In preventative schedules when applied at pink or first cover, Morestan 25 WP at .5 pounds gave outstanding control. Genite, Chlorobenzilate, 60 and 70 sec oil gave control until mid July when applied at pink. Chloropropylate, Animert, Morocide, B39007, G3707, Delnav oil and Polybutenes did not give control in early July when applied in pink. In eradicative schedules, applied in summer when the mites had build up all materials except GS15638 (analog of chlorobenzilate) and summer oils failed to achieve control whether applied in single or double applications. These materials included Morestan, Animert, Morocide, Chlorobenzilate, Chloropropylate, Aqua Delnav, Kelthane, CL47031, CL38906, CL47470, Tedion, UC19786, Bidrin, Cygon, Phosphamidon, tepp, and UC2007. Imidazole alone or with 2-Aminopyridine did not enhance the miticidal value of summer oil with a hydrophylic surfactant, Igepal CO-210. Polybutenes alone and in combination with oil were severely phytotoxic to Red Delicious. Mites show a high level of phosphate resistance. Kelthane and Tedion show reduced efficiency.

M. M. Barnes:

In a heavy infestation of Kelthane resistant European red mite, Morocide and Morestan gave the best initial control, but neither provided satisfactory residual effects. Upjohn 12927 and UC 21427 did not provide satisfactory initial control.

F. P. Dean:

In orchard plot tests of acaricides for control of the McDaniel mite,

excellent control for the season was obtained with two applications of Union Carbide compounds 19786 and 20047 and with Morocide. Morestan also gave excellent control but caused severe spotting of the fruit. Kelthane was used as a standard in this series of tests and resulted in satisfactory control but was less effective than the above named compounds. Control with Bayer-47043 was equal to Kelthane. Shell-7438 50% WP at 2.0 pounds and Bayer-37344 50% WP at 2.0 pounds per 100 gallons were very effective but at lesser concentrations were not satisfactory. Two applications, eleven days apart, of Karathane 4 pounds per gallon liquid concentrate gave excellent control of a high mite population. Poor control was obtained with Tedion, Chlorobenzilate, Bayer compounds 47185, 37289, 44646 and Meta-systox-R.

John A. Quist:

Two-spotted mite control studies using Meta - Systox - R were conducted with waters of differing salinity and pH levels. Thirty days following application, three times fewer mites were recorded for acidic, low-salt water than for alkaline, high-salt water. Spray surfactants and spreaders, combined with the alkaline water typical of western Colorado, enhance acaricidal action and provide more uniform control. Combinations of Meta-Systox, Volck oil, and either Buffer X, X-77 or Triton B-1956 appear to provide the best results.

San Jose Scale

Entomology Laboratory:

(1) San Jose scale control by concentrate sprayers.

Tests in 1963 demonstrated that spray coverage is the most critical factor in the control of the San Jose scale and that the low-volume, air-blast spraying of trees from 2 sides, the usual procedure practised in the past, is not satisfactory. To obtain coverage for commercial control, trees must be sprayed from 4 sides, that is, a machine with one 'fish-tail' must be run up and down the rows and back and forth across the rows. Where trees are sprayed from 4 sides the same speed of travel and the same nozzle arrangement are used as where trees are sprayed from 2 sides, but only half the concentration of insecticide is put in the tank. In other words, the trees sprayed from 4 sides receive the same amount of insecticide per acre but twice as much water. Spraying trees from 4 sides with a dormant spray mixture of 12 gallons of lime sulphur and 6 gallons of oil per acre will give outstanding control of this pest.

In desperation, summer sprays for the control of the San Jose scale were recommended in 1962 and 1963, for the first time in the history of the scale in the Okanagan Valley. These sprays are absolutely unnecessary if the dormant spray has been properly applied; they should be used only in an emergency. Summer sprays are not as effective as dormant sprays because, as indicated by biological studies, the young scales emerge over a long period and it is difficult to time one or even two sprays to kill all the crawlers with contact insecticides.

(2) Fate of the San Jose scale on fruit in storage.

After harvest, apples are subjected to a number of storage conditions including dipping in anti-scald inhibitors, a flotation segregation bath for the separation of water-cored apples, standard cold storage, controlled atmosphere storage, etc. An investigation of these various storage procedures on the fate of the San Jose scale was initiated in the storage season of 1962-63 with most promising results. For example, in standard cold storage (30-32°F.) all the scale is killed within 34 days on prunes harvested the first week of September and within 3 months on Winesap apples harvested in mid-September.

Apple Aphid

P. H. Westigard:

Severe rosy apple aphid infestations were completely eliminated by spring application of Bayer 39007, Cygon, G. C. 3707 and Phosphamidon. Bayer 37344 and Thiodan were only slightly less effective.

Stanley C. Hoyt:

HOE 2813 gave excellent aphid control, while fair control was provided by CP 40273 and Guthion. SD 7438 was relatively ineffective. A soil drench of Dimethoate gave poor initial control, but brought about a gradual reduction of the population over a period of one month.

Stanley C. Hoyt:

For use on woolly apple aphid Thiodan and CP 40273 gave excellent control, Imidan provided fair control, and UC 20047, SD 7438 and HOE 2813 were ineffective.

F. H. Harries:

Trunk injections of dimethoateemulsions and some water solutions of some other compounds gave good control of the apple aphid on the terminal twigs of bearing apple trees. Some control of the woolly apple aphid was also obtained by this method. Insecticides effective against aphids. In tests of new materials in 10 replicates of 10 adult apple aphids on leaf disks from sprayed plants, Stauffer B-9564, B-9381, B-9627 and Bayer 47940 were effective and equal to or better than Parathion.

Red Banded Leaf Roller in Michigan

A. J. Howitt:

To test the effectiveness of insecticides in reducing egg laying by killing adult red-banded leaf rollers before oviposition, materials were applied in pink to blocks of apples ranging from 1.5 to 5 acres in size. The following number of egg masses per block under treatment listed was recorded in a one hour search: Endrin 1.6 EC - 5 pts -62, Sevin 50 WP - 2# -62, Imidan 50 WP - 1# plus 70 sec oil 2 gal - 11, Guthion 25 WP - 1.25#+ 70 sec oil 2 gal - 6, 70 sec oil - 2 gal -59. Amitrol - T applied within 2 days of oil injured Rome Beauty and reduced fruit set 80%.

PEAR INSECTS AND MITES:

Codling Moth

Harold F. Madsen:

Perthane and Phosphamidon were tested for pear psylla control in an orchard with an extremely heavy population of codling moth. Two sprays were applied, and harvest counts showed 22% infested in the Phosphamidon plot as compared to 77% in the check. Under the circumstances this was considered fair control. Perthane treated trees showed 52% infested fruit which was little better than the unsprayed.

F. W. Peifer:

Anjou pear blocks receiving applications of Sevin or Guthion for pear psylla control were virtually 100% free of codling moth injury. However, so were Anjou pear blocks receiving four Perthane cover sprays for psylla control.

P. H. Westigard:

In field trials, elimination of the codling moth sprays resulted in approximately 1% wormy fruit at harvest. Plots which received only one application of Guthion at second cover timing and those which received two Guthion applications were free of worms at harvest.

Pear Psylla

Harold F. Madsen:

Oils, insecticides, and oil-insecticide combinations were tested for control of the pear psylla. Humble oil (vis. 57.6) and Moyer oil (vis. 991) in combination with 1/2 lb. 25% Guthion per 100 gallons gave excellent control. The two oils alone were also effective, but required retreatment in four weeks. Dilan as a pre-bloom spray was very effective, and Bidrin as a foliage treatment gave excellent control. The latter compound caused marginal burn on the foliage, but the injury was not severe. DDT was combined with the two oils for codling moth, and the combination caused severe leaf mottling and some fruit russet. Perthane and Phosphamidon were used in a plot to determine their effect upon both pear psylla and psylla predators. Both materials gave control of the pear psylla, but were toxic to lacewings and anthocorids. At the end of the season, the plots had the same psylla population as the unsprayed checks.

F. P. Dean:

Prebloom sprays--Tests of insecticides were conducted in Bartlett pear orchards in which the sprays were applied with an air blast sprayer at the rate of 600 gallons per acre. Results of the treatments were measured by counting the number of nymphs on samples of 15 spurs per plot after the first brood eggs had hatched (May 13). Delayed dormant sprays were applied March 22. No live nymphs were found on the samples taken from plots sprayed with Morestan 25% WP at 1.5 pounds or superior oil at 1.5 gallons plus lime-sulphur at 3 gallons. Oil alone used in several concentrations gave

good control. In prepink applications (April 8) Perthane 4 pounds per gallon EC at 1.0 quart was more effective than Guthion or Dilan. Polybutene 75% water emulsion at 2 gallons per 100 gallons was ineffective in both the delayed dormant and the prepink applications.

Summer sprays--Tests of several insecticides were made in a Bartlett pear orchard in which the sprays were applied with hand guns on June 13, July 5 and August 5. In this orchard the standard treatment of Guthion 25% WP at 2.0 pounds per 100 gallons resulted in fair control during most of the season but allowed the population to increase greatly during September. Outstanding results were obtained with Union Carbide 21149 and Farbwerke Hoechst 2813. Results with Perthane were similar to the standard allowing a buildup late in the season. The best control by insecticides available for commercial use was 1 pound of Guthion plus 2.0 quarts of oil. Imidan and Bayer-37344 were equal to Guthion when used at 2.0 pounds but were less effective at 1.0 pound. General Chemical 3707 20% WP at 2.5 pounds gave good control and was superior to Guthion late in the season.

Other pear psylla control tests were conducted in an orchard in which the sprays were applied with an air blast sprayer on June 11, July 18 and August 1. In this series of tests Guthion at 1.0 pound plus superior oil at 2 quarts and superior oil used alone at 3 quarts per 100 gallons gave the best control. Guthion was applied in concentrations of 2, 3 and 4 pounds and the results indicate that there is very little advantage of increasing the dosage above 2 pounds per 100 gallons. Perthane 4 pounds per gallon EC at 1.0 quart and UC-20047 2 pounds per gallon at 1 quart were about equal to Guthion but allowed a buildup of psylla during September. Imidan 50% WP at 1.0 pound was a little more effective than Guthion until late in the season.

Everett Burts:

Apholate, terramycin and streptomycin were found to be toxic to pear psylla in greenhouse tests. Terramycin also showed promise against this insect in field trials.

Perthane-oil combinations and Morestan were found to be highly effective as cluster bud sprays against the pear psylla, however, early postbloom sprays of Perthane were not as effective as the prebloom applications and generally two sprays 7 to 10 days apart were necessary to bring high populations under control. Experimental compounds that showed promise this year against pear psylla in field tests include NIA 9203, nabam (a carbamate fungicide too phytotoxic for commercial use), UC 20047, UC 21149 (also phytotoxic as an emulsifiable concentrate) and HOE 2831 (a haloginated urea derivative). DEF Defoliant showed some synergistic activity with Malathion against organophosphate resistant pear psylla but effective concentrations caused considerable fruit and foliage burning.

A. J. Howitt:

Incipient resistance to parathion in eastern Michigan, none at present in western Michigan. In eastern Michigan the following materials gave excellent control at stated amounts per 100 gal : Guthion 2EC - 1 pt., Imidan 50WP - 1#, Dilan 8EC - 1 qt., Morestan 25WP - 1#, Diazinon 50 WP - 1#, 4072-4 EC -40 oz., dieldrin 1.5 EC - 22 oz., Bidrin 7.5 EC -18 oz., Delanav

8 EC - .5 pt, Nia 9203 - 25 WP - 2#, and UJ12927 - 75 WP - 1#. Perthane 4EC - 1 qt., Parathion 4EC - 9 oz. and GC3707 - 25 WP did not give commercial control.

F. W. Peifer:

Delayed dormant sprays: AGA Flowable Oil - 3 gals./100 plus lime sulphur - 5 gals./100 continued to provide excellent early season control of pear psylla. Humble Oil WSX 5494 - 1.5 gals./100 plus lime sulphur - 5 gals./100 provided only moderately good early season control of pear psylla.

Pre-bloom sprays: Dilan - 5E-EC - 1 pt./100 and Perthane -4-EC - 1 qt./100 gave excellent pre-bloom control of pear psylla. Dilan 50% WP - 1.25 lbs./100, Perthane -4E- Flowable - 1 qt./100 and Morestan 25% WP - 0.5 lb./100 also provided good pre-bloom control of pear psylla.

Cover sprays: The ninth application of Sevin 50% WP - 2.0 lbs./100 and the eleventh application of Guthion 25% WP - 1.5 lbs./100 applied for 5 consecutive years to a commercial Anjou pear block failed to provide the good to excellent control attributed to previous applications of these materials.

The following list of compounds provided excellent to only fair psylla control. Listed in decreasing order of effectiveness:

(1) Hoechst 2836 37.5%WP- 3 lbs./100
(2) Hoechst 2813 50% WP - 2 lbs./100
(3) Morestan 25% WP - 1.5 lbs./100
(4) UC 21149 1E - 4 qts./100
(5) Perthane 4EC - 1 qt./100
(6) Bayer 37344 50% WP - 2 lbs./100
(7) Perthane 4E Flow. - 1 qt./100
(8) NIA 9203 25% WP - 2 lbs./100
(9) Perthane 40% WP - 2 lbs./100
(10) Guthion 25% WP - 1.5 lbs./100

Post-harvest sprays: All of the following compounds are registered and available for post-harvest applications on pears for psylla control, with the possible exception of the Humble Oil. Morestan 3E Flowable - 1.5 pts./100 and Perthane 4EC provided excellent psylla control for 5 weeks or longer, essentially from the completion of Anjou harvest until leaf fall. The combinations of Guthion-Ethion, Guthion-Perthane and Humble Oil WXS 5494 - 2 qt./100 plus Perthane Flow. - 1 qt./100 provided very good post-harvest control. Each material in the Guthion combinations was applied at its individual recommended rate.

P. H. Westigard:

Comparison of six oils applied to D'Anjou pear in the prebloom period revealed heavier oils (Volck Supreme, Canadian Dormant and Shell Carnea) to be more effective than the lighter viscosity oils tested (Humble, Pennsalt 70 and Niagara Dormant Quick Mix).

Summer evaluation of available and non-registered materials revealed the following materials to be the most effective: Guthion, Rotenone plus Humble Oil, Bayer 37344, G.C. 3707, Imidan, R. 5092 and S.D. 8447.

No indication of resistance by this pest to Guthion was evident in the Rogue Valley during 1963.

Orchard Mites

F. W. Peifer:

No acaracide evaluations were conducted on pear varieties this year (all trees needed for psyllacide evaluations). Commercially, Tedion provided good European red mite control only for the first cover spray, under low mite population conditions. Tedion 25% WP -1.0 lb./100 plus Kelthane AP 18.5% WP - 2.0 lbs./100 provided excellent third cover control of E. red mites. (See section on Spray Residues, Compatibility and Phytotoxicity).

P. H. Westigard:

The following table summarizes results of summer field trials for control of the two-spotted mite.

Control Rating	Materials
Good	Morestan, Bayer 37344, Kelthane (1st cover), Morocide, Trithion
Fair	HRS 1654, Kelthane (2nd cover), Humble Oil, Pennsalt oil, Volck Supreme, Meta-Systox R
Poor	MC-A-600, Animert, Tedion

Everett Burts:

Animert gave good control of European red mites in cluster bud applications. The standard oil and oil organophosphate treatments were also effective. Morestan was not effective at a dosage of one-half pound of the 50% wettable powder per 100 gallons but a one pound dosage was comparable to the standard treatments.

In postharvest treatments two carbamate insecticides, Sevin and Bayer 37344 were as effective as the standard diazinon treatment against the pear leaf blister mite.

P. H. Westigard:

The following observations were made during the 1963 season of pesticides against the pear rust mite.

Pre-pink applications: Materials giving longest residual control included Diazinon, Diazinon plus lime-sulfur, Magnetic Sulfur 6, Sevin and Morocide.

Parathion plus lime-sulfur and Volck Supreme oil were moderately effective.

The least effective were Parathion, Tedion, Humble oil and Pennsalt 70 oil.

1st Summer application: At this time Morocide, Trithion and Volck Supreme oil were the most effective materials. Less effective were Humble oil, Pennsalt oil 70, Parathion and Diazinon.

2nd Summer application: Excellent initial knock-down was obtained with all materials tested except Guthion.

Those materials giving longest residual control included Chlorobenzilate, Kelthane, Morestan, Bayer 37344 and Volck Supreme oil.

John A. Quist:

A number of miticides were evaluated for control of the two spotted mite on Bartlett pears. Three weeks following the August 1 spray application date, counts from brushed leaves indicated that Animert, UC 19786 and Kelthane had provided the best control. Monocide, UC 20047, Chlorobenzilate, and Morestan respectively provided moderate to good control. Numerous rains during the test period probably effected these results.

San Jose Scale

A. J. Howitt:

The following oil combinations applied in delayed dormant followed by 4 cover sprays of the stated materials yielded the % of San Jose Scale infested pears at harvest. 70 sec oil - 2 gal plus Sevin 50 WP - 2# covers -.8%. Imidazole 1# in 2 gal 70 sec oil plus DDT covers - .8%. Ethion-oil - 2 gal plus DDT 50 WP - 2# covers - 0; 70 sec oil 2 gal plus parathion 15WP - .5# covers 0; 70 sec oil 2 gal plus DDT 50WP - 2# - 6%. Parathion 15 WP - 1.5# and Sevin 50WP - 2# in petal fall and 4 cover sprays gave 0, and 9%, respectively scale infested pears. Untreated trees 26.5% of pears infested with San Jose.

SECTION II

INSECT AND MITE PESTS OF STONE FRUITS

CHERRY INSECTS AND MITES

Cherry Fruit Fly

S. C. Jones:

The first cherry fruit fly emerged in a ground cage placed in the open without shade on May 31. The first fly to emerge in ground cages under trees with partial shade was on June 10 in Linn County and June 12 in Marion County. The peak of fly emergence occurred in Marion and Linn Counties on June 18 and 20 respectively.

Sevin emulsifiable (2#/1 gallon) was applied on five small cherry orchards. No maggots were found in any of the cherry samples harvested at the normal time. Cherries harvested on July 22 were infested. Bayer 37344 controlled the cherry fruit fly but caused foliage burn. Laboratory bioassay tests with Bayer 37344 showed good control of the cherry fruit fly at the rate of ½# and 1#/100.

Peach Tree Borer

A. J. Howitt:

At Hart, gun applications at rates listed for 100 gal applied 6/11 resulted in the following average number of borers per tree: Thiodan 2EC - 6 pts - 1.0, Endrin 1.6EC - 3.7 pts - 2.0, Dieldrin 75 WP - 2# - 1.7, Lindane 1.7EC-3.7 pts plus Arochlor 2 qts - 3.3, Endrin 1.6 EC - 3.7 pts plus Arochlor 2 qts - 4.7. Thiodan 2EC - 3 pts applied 6/11 and 7/3 - 7.7. Guthion 2EC applied with a speed sprayer in 3 cover sprays - 22.0. Untreated 14.3.

At Charlevoix near Mackinac Straits, gun applications applied 6/5 gave the following average number of borers per tree: Thiodan 2EC - 6 pts - 1.3, Endrin 1.6EC - 5 pts - 2.3, Dieldrin 75WP - 1.25# - 5.6, Dieldrin 75WP - .3# plus Endrin 1.6 EC - 1.5 pts - 4.2, Bidrin 7.5EV - .5 pts - 5.8. Gun applications applied 6/5 and 7/3 gave results as follows: Thiodan EC - 3 pts - 1.6, Guthion 2EC - 5 pts - 2.0, Sevin 50WP - 2# - 4.3, UJ12927 - 75WP - 2.1, Bidrin 7.5EC - .5pts - 1.1. Untreated 11.0.

Peaches and cherry plots were evaluated in mid-October. Cocoons, pupae, and many newly emerged larvae strongly suggested the presence of a second generation. The late hatch resulted in poor control since it was not anticipated that oviposition and hatching would occur in October.

Orchard Mites

E. W. Anthon:

The following five acaricides showed the most promise for the control of the plum nursery mite: Morestan, Kelthane, Union Carbide's 21149 and Hoechst 2836 and 2813.

Black Cherry Aphid

S. C. Jones:

Systox, Meta-Systox and Di-Syston were tested against the black cherry aphid in the petal-fall stage of fruit development. Control was excellent at dosages of 1-800.

San Jose Scale

E. W. Anthon:

Prebloom sprays of Humble oil, Volck oil, and oil combinations of ethion, Trithion, and parathion, all gave good control of San Jose scale on cherries.

PEACH INSECTS AND MITES

Orchard Mites

F. H. Harries:

New pesticides are effective against mites. In screening tests of 70 new compounds on the two-spotted spider mite with 10 replications of 10 adult mites on leaf disks from sprayed plants, the most effective materials were Bayer 36205, 41522, Stauffer N-3336, N-4539, N-4168, B-10095, N-4539, B-9323, B-9381, R-6395 and R-6482. In most cases these materials were much more effective than Kelthane used as a standard of comparison. Stauffer N-3336 was phytotoxic in one test.

Male sterility in the two-spotted spider mite is apparently produced by Acti-dione. Female deutonymphs of the two-spotted spider mite were isolated and then were paired on untreated leaf disks with males that had been exposed for 24 hours on leaf disks treated with acti-dione. Other female deutonymphs were also paired at the same time with some untreated males. After 18 days at 75°F., the numbers of male and female progeny on the disks were recorded and the number of sterile males or infertile matings was shown by the disks infested only with male mites. The results were as follows:

Treatment	No. pairs	Progeny		Percent fertile matings
		males	females	
Males exposed to Acti-dione	47	66	33	45
Males not exposed to Acti-dione	40	52	69	95

Some effect of acti-dione seems indicated by the fact that only 5 percent of the pairings with untreated males were sterile and 55 percent of the females mated with treated males were unfertilized. Similar tests of acti-dione and cytovirin are proceeding.

Peach Twig Borer

E. W. Anthon:

Petal fall sprays of Thiodan, Sevin, Imidan, Bayer 37344 and DDT + parathion all gave satisfactory control of the peach twig borer. None of these materials applied at this time gave satisfactory control of cat-facing insects.

John A. Quist:

Surveys of parasite population levels were conducted in ten commercial orchards of Mesa County. The naturally occurring parasite of the peach twig borer (Paralitomastix pyralidis) accounted for slightly more than five percent parasitism. This low level of parasitism indicates that decimation of parasite populations is an important consideration in peach twig borer control studies.

Green Peach Aphid

E. W. Anthon:

Laboratory trials in the greenhouse showed the following new compounds to give good control of the green peach aphids: Bayer's 45556, 47416, Union Carbide's 21149 and 20047.

Under field conditions the following materials showed the most promise: Thiodan, Chemagro's 39007, American Cyanamid's 38906 and Mobil's Mc A-600.

F. H. Harries:

In tests of new compounds in 10 replicates of 10 alate adult green peach aphids on leaf disks from sprayed plants, Stauffer B-9323, R-6482, N-4446, B-9564, R-6395, B-9625 and Mobil A-600 were equal to or better than parathion.

Mortality and fecundity of the green peach aphid is affected by some antibiotics. In tests of 10 alate adults in each of 10 replicates on leaf disks from sprayed plants, ristocetin, cytovirin, and acti-dione at 600 ppm. caused some mortality of the adult aphids. As compared with the untreated check, ristocetin caused about 50 percent mortality of the adult females and reduced the number of progeny by about the same proportion. In causing mortalities of 44 and 43 percent, respectively, acti-dione and cytovirin reduced the number of females less than 50 percent, but reduced the number of progeny about 90 percent which indicates some inhibition of reproduction.

Trunk injections of dimethoate emulsions and some water soluble compounds gave good control of the green peach aphid on the terminal twigs of large peach trees.

Peach Tree Borer

E. W. Anthon:

Summer trunk spray applications of the following materials all gave good control of this insect: Thiodan, Endrin and DDT + parathion.

A. J. Howitt:

Six applications of materials listed were applied with a speed sprayer with lower 2 nozzles fitted with No. 8 discs. The results list the average number of borers per tree: Sevin 50 WP - 2# -6, B37344 - 50WP - 1.2, B41831 - 25WP - 1# - 4.2, Guthion 2EC - 1 pt - 2.7, Imidan 50WP - 1# - 9.2, 4072 - 25WP - 2# - 1.0, Diazinon 50WP - 1# - 2.5, Colep 25WP - 1# - 8.0, CP40273 - 25WP - 1# - 1.7, SD7438 - 1.6EC - 5 pts - 7.0, Bidrin 8EC - 200 ml - 0, UJ12927 - 75WP - 1.3# - 1.0, Untreated - 8.7.

At Glenn materials were applied with a gun on 6/27 at rates listed per 100 gal. The average number of borers per tree were as follows: Thiodan 2 EC - 6 pts - 1.8, Thiodan 2EC - 6 pts plus Arochlor 1 gal - 3.2, Endrin 1.6EC - 5 pts - 0.8, Endrin 1.6 EC - 5 pts plus Arochlor 1 gal - 2.4, Dieldrin 75WP - 4# - 2.0, Endrin 1.6EC plus Indopol H100 - 5 gal - 1.0, Thiodan 2EC - 6 pts plus Indopol H100 - 5 gal - 0.8. Thiodan 50WP - 1.5# applied 6/27 and 7/5 - 0.8, Thiodan 2EC - 3 pts applied 6/27 and 7/29 - 5.6.

At Hart in north central Michigan, gun applications applied 6/14 resulted in the following average number of borers per tree: Thiodan 2EC - 6 pts - 5.5, Thiodan 2EC - 6 pts plus Arochlor 1 gal - 8.5, Endrin 1.6EC - 5 pts - 2.0, Endrin 1.6EC - 5 pts plus Arochlor 1 gal - 8.0, Dieldrin 75WP - 4# - 11.3, Endrin 1.6EC - 2.5 pts plus Thiodan 2EC - 3 pts - 3.5, Thiodan 2EC - 3 pts - 3.5. Thiodan 2EC - 3 pts applied 6/14 and 7/3 - 1.7, Guthion 2EC applied 3X with speed sprayer in 5 cover sprays - 27.0. Untreated - 31.2.

PRUNE INSECTS AND MITES

Orchard Mites

E. W. Anthon:

Tedion and Kelthane both failed to control European red mite in the field. Morestan, Bayer's 47416, Hoechst's 2813 and 2836 all looked promising for the control of resistant European red mite.

E. W. Anthon:

Experimental field trials this year showed that McDaniel mites on prunes and peaches were resistant to both Tedion and Kelthane. A number of new experimental compounds gave good control of this mite.

Under field trials the following materials gave the best results: Morocide, Morestan, Union Carbide's 20047, 19786, 20036, Bayer 47416 and Hoechst 2813 and 2836.

Under laboratory experimental trials, Bayer 47416 gave good control of both mites and eggs. Four new Naugatuck compounds C-940-2, DO 14-2, DO 48-1 and C-912-1 and Shell's SD-9129 all gave excellent control of resistant two-spotted mites.

Aphids

S. C. Jones:

A dormant spray including DMSO 1 qt./100 and Thiodan 50% WP., 2#/100 gave excellent control of aphids on Italian plums. Aphids in the curled leaves were: Anuraphis helichrysi Kalt; Anuraphis cardui (Linn); and Phorodon humuli (Shrank).

S E C T I O N III

INSECT AND MITE PESTS OF NUT CROPS

FILBERT INSECTS AND MITES

Filbertworm

S. C. Jones:

Bayer 37344 WP., 2#/100 and Sevin 50% WP., 2#/100 were compared against the filbertworm in two heavily infested orchards. Good control was obtained in both orchards. The infestation spread was from .02% to 1.4% for Sevin and from 0 to .08% for Bayer 37344.

An Electrosect Insect Killer was used in a heavily infested orchard and compared with the infestation of nuts under trees without the insect killer.

Two samples of 500 nuts each was taken from trees in the vicinity of the light and the same sized sample from trees 150 to 200 feet distant from the light killer. There were 22 and 31 filbertworms in the nuts in the near vicinity of the light killer and 28 and 48 filbertworms respectively in the area 150 to 200 feet from the light killer.

Filbert Aphid

S. C. Jones:

Phosphamidan EC 1-800, was tested against the filbert aphid. Two randomized samples of 50 leaves each were examined 8 days after spraying with phosphamidan and found to be free of aphids. Two other samples taken 20 days after spraying showed 6 and .12 aphids per leaf.

Big Bud Mite

S. C. Jones:

Eight materials used alone and combined with DMSO and spreaders were tested against the big bud mite inside the enlarged buds. No material controlled the mites inside the buds. Foliar sprays late in the season reduced the mite infestation. Sevin, Thiodan and Bayer 37344 all gave good control of the mites on the foliage.

WALNUT INSECTS AND MITES

Codling Moth

Harold F. Madsen:

A number of aphicides were evaluated for their effect upon codling moth. In an orchard which received two applications (May 14 and July 1), Bayer 37344 gave outstanding control. However, the trees were defoliated at harvest because of poor walnut aphid and mite control. Imidan gave good codling moth control but was also ineffective against aphids and mites. Bidrin was the only compound that controlled both codling moth and walnut aphid, but was not effective against mites. Morestan was poor against codling moth but gave excellent control of aphids and mites. In an orchard with a relatively low codling moth population, Phosphamidon and Thiodan 2 gave better control than either Thiodan or Morestan.

Walnut Aphids and Mites

Harold F. Madsen:

Several insecticides were applied to walnuts for both walnut aphid and codling moth control. In a hand sprayed plot, Morestan and Bidrin gave good initial and residual control of the aphids. Imidan and Bayer 37344 gave an initial reduction, but aphid numbers rose to treatment level three weeks after application. The latter materials were toxic to predators, and the aphid population was higher than that recorded on the check. In blower-sprayer plots, a single application of Morestan and Phosphamidon in May gave seasonal control of the walnut aphid. Thiodan and Thiodan 2 were also effective but not as outstanding as the above compounds. Morestan sprayed trees were not only free of aphids, but spider mites as well. All of the other plots required an acaricide by July.

M. M. Barnes:

Morestan again proved to be outstanding in initial and residual control of walnut aphid, displaying residual effects of from 4 to 9 weeks, depending on dosage. Hoe.2813 also provided outstanding residual action being superior to Hoe.2836 when compared at 2 lb. dosages of their formulations. SD7438 also provided good initial and residual control. In late season trials, N-2404, MC-A-600, U-12927 and 37344 provided good initial control, but were less effective than Morestan in residual effects.

M. M. Barnes:

In preventive treatments, Morestan and Hoe.2813 provided excellent control of European red mite. UC20036 and UC21427 and Hoe.2836 were less effective and SD7438 was ineffective.

S E C T I O N I V

DISEASES OF POME FRUITS

APPLE DISEASES

Apple Scab

Norman D. Dobie:

For the control of apple scab, Chemagro 47531 (2 lbs./100 gallons), Difolatan (1¼ lbs./100 gallons), and DAC 2787 (1½ lbs./100 gallons) show promise, and further tests should be conducted. Only limited tests with DAC 2787 were established. Consequently, one more year of comparative testing is necessary to determine the true fungitixicity of this fungicide.

D. L. McIntosh & J. E. Swales:

Sprays of the following materials were applied by airblast sprayers at the pre-pink, calyx, first and second cover stages to compare their efficacy in controlling apple scab: Cyprex 65% WP 3 lb. per acre, Delan 75% WP 3 lb. per acre, Delan 25% liquid 6.3 pints per acre, Glyodex (proprietary mixture of Cyprex and Glyodin) 4½ lb. per acre, and Cyprex ½ lb. plus Glyodin 3 quarts per acre. Prolonged wet weather delayed application of the first spray and permitted a heavy infection to occur. Weather conditions throughout the remainder of the season favored scab development, so this combination of abundant secondary inoculum and frequent rains provided a severe test for the materials being evaluated. A relatively high and about equal percentage of scab-free fruit was harvested from the Cyprex and Glyodex plots. The mixture of Glyodin and Cyprex was slightly less effective. The skin on much of the fruit sprayed with all these materials was roughened or russeted. Delan powder and Delan liquid at the concentrations used were much less effective, and caused some, but much less, russeting. Russeting from Cyprex sprays is not common in B.C. Interior orchards; has occurred in only this one district.

Blue Mold

N. S. Luepschen:

Five-minute dips with fungicides were tried to control blue mold on inoculated Golden Delicious apples. When applied within 24 hours, 2-aminobutane acetate at 2% gave excellent decay control; 2-aminobutane acetate at 1% and Dowcide A at 0.5% were slightly less effective. When dips were applied 48 hours after inoculation, only Dowcide A gave effective control of blue mold.

Apple Powdery Mildew

Ronald P. Covey, Jr.:

Thirteen compounds or formulations of compounds were compared in replicate plots for the control of powdery mildew of apples. The most satisfactory control on the terminals was obtained with Wepsyn 1 lb. 25%

W.P., Morocide 1/2 lb. 50% W.P. and Karathane L.C. 6 oz. with or without 4 oz. B 1956. Good, but more erratic, control was obtained with Karathane 3/4 lb. 25% W.P. + 4 oz. B 1956, Mag 6, 3 pts. and ammonium polysulfide 4 pts., 3 pts., 2-1/2 pts., i.e., concentrations of spray were reduced with each successive spray. Each of the above compounds, except Wepsyn, gave good control of mildew russet. Sprays were applied at pre-pink and 10-16 day intervals thereafter.

Norman D. Dobie:

For the control of apple mildew, Karathane ($\frac{1}{2}$ lb./100 gallons) applied at seven-day intervals starting at prepink, has given significantly better control than Karathane (3/4 lb./100 gallons) applied at the recommended spray intervals. Trials have been conducted over a three-year period. Tests conducted in 1962 with Morocide (3/4 lbs./100 gallons) showed promise, but tests this year with Morocide (1/2 lb./100 gallons) resulted in mediocrity. Further tests with Morocide at increased dosage levels should be tried. Niagara 9102 (2 lbs. early, then $1\frac{1}{2}$ lbs./100 gallons) has shown promise, and further tests are warranted.

D. L. McIntosh:

The efficacy in controlling apple powdery mildew of Morestan and Morocide, two new acaridide-fungicides, was compared with that of Magnetic 6 paste sulphur. Five sprays of Morestan 1 lb. 25% WP per 100 gal., Morocide 1 lb. 25% WP per 100 gal., and Magnetic 6 sulphur paste 2 lb. per 100 gal. were applied at two-week intervals beginning at the pink stage. Good control of foliage and fruit infection was obtained with all three materials.

Duane L. Coyier:

Fourteen treatments were tested for control of powdery mildew on apple and pear seedlings. Karathane in both wettable powder and liquid form was more efficient than other materials tested. Ammonium polysulfide®, Morestan®, dimethyl sulf-oxide plus iron, Bayer 47531, and U.C. 19786 were among the new compounds tested. The efficacy of each of these materials against powdery mildew justified further tests.

A second mildew fungicide study on bearing Newtown apple trees showed that good commercial control of powdery mildew could be achieved with 8 applications of $\frac{1}{2}$ lb/100 gal each of dodine and karathane, if treatments commenced at pre-pink and were repeated every 7 days. Low dosage was only slightly less effective than the higher concentration when both were applied frequently. Fair control was maintained with the high dosage rate applied on a 5-spray schedule, but low dosage resulted in only slightly better control than was found in unsprayed check trees.

In a third test for powdery mildew control treatments were applied to a commercial block of bearing Newtown apple trees. These plots were designed to test the effectiveness of dust versus spray treatments on frequent (10 application) and infrequent (6 application) schedules. The spray contained $\frac{1}{2}$ lb/100 gal each of karathane and dodine, and the dust was composed of 2% karathane plus 2% dodine. Control of powdery mildew (as measured by percent infected terminals) was nearly equal in spray and dust plots when treated 10

times during the season. When a less frequent application schedule was used, dusting gave better control than spray treatment.

Perennial Canker

L. E. Lopatecki:

In the Okanagan, a number of apple orchards have become uneconomic through infection with perennial canker. Where attempts have been made to interplant these orchards with resistant varieties, frequently the young nursery stock itself has become seriously infected with the disease.

A test was carried out to determine if the shock of transplanting produced a more susceptible tree. For this purpose groups of one- and two-year old Spartan and Antonovka trees were transplanted in the orchard and then inoculated with a culture of the Gloeosporium fungus. A similar number of trees were inoculated but left in place to serve as checks.

Measurements in the spring indicated the average canker extension in the two-year old trees left in place was 4 inches; in transplanted trees was 11 inches. Furthermore, all one-year old trees in the transplanted group were girdled by the fungus, compared to 70% in the control.

Seemingly resistance to the perennial canker fungus is low in very young trees, and is further reduced when the trees are transplanted.

Storage Rot

L. E. Lopatecki & S. W. Porritt:

Additional data were obtained showing that low oxygen tension suppresses bull's eye rot of apple under Controlled Atmosphere (C.A.) storage conditions. In order to obtain high infection rates, fruit was artificially inoculated by rubbing the fruit with a pad dipped in a spore suspension of the bull's eye rot fungus. In general, when CO_2 was held constant at 7%, raising oxygen from 3 to 14% increased bull's eye rot from 20 to 40%. Over the same period, samples of inoculated fruit held under conditions of common air storage developed 33% rot. These figures are based upon the percentage of apples showing evidence of rot. If the amount of rot per apple is taken into consideration, the increase of rot with higher oxygen tension is very much more evident.

PEAR DISEASES

Pear Scab

Duane L. Coyier:

Field tests were used to screen chemicals for scab control on Bartlett pears. Fourteen treatments were applied as sprays at the pre-pink, pink and calyx stage of development. Very little scab developed under field conditions. To initiate development of fruit scab it was necessary to respray and inoculate fruits on single limbs before harvest. Lesion counts made after the

fruits had been stored in an incubation chamber indicated that several chemicals reduced the occurrence of pin-point scab lesions. Dodine (with E.F.A. 2118 additive) was the only material to completely eliminate the disease. Ammonium polysulfide®, Difolatan®, and a Glyodin®-dodine combination gave good control and should be tested further under conditions more favorable for scab development in the field.

S E C T I O N V

DISEASES OF STONE FRUITS

PEACH DISEASES

Rhizopus Rot

L. E. Lopatecki:

Commercial lots of cannery peaches treated with a drench or dip of Botran developed little Rhizopus rot in storage in a year when the disease was potentially severe. Continuous agitation was essential to produce uniform coverage of treated fruit. Botran is fungistatic, not fungicidal, and sufficient material must be maintained on the fruit surface to inhibit Rhizopus rot throughout the storage period. The rate at which Botran disappears from the fruit varies according to the storage temperatures. In the Okanagan, Botran has a half life of 8 to 10 days when applied to cannery peaches.

N. S. Luepschen:

Botran (2,6-dichloro-4-nitroaniline) impregnated fruit tissue wraps were used in commercial peach lugs where the corner fruits were inoculated with Rhizopus stolonifer. The following percentages represent the mean decay (3 tests combined) of non-inoculated peaches due to contact infections.

	DCNA Content of Wraps, ppm				
	0	675	1250	2090	4130
Percent decay	68.8	9.7	7.5	3.4	5.6
Percent decay control	----	86.2	89.1	95.1	92.0

Use of protective fungicidal dips to reduce Rhizopus decay showed Botran to be far superior than such materials as Difolatan, Captan, Mycostatin and Harven at equal concentrations. Surfactants seem to influence toxicant effectiveness. In a test where the Botran concentration was 800 ppm for all dip solutions, the following surfactants were used at 0.1%.

Dip Solution	Percent Rhizopus Decay
Water + Triton X-100	58.8
Botran + Triton X-100	13.8
Botran + Triton X-114	2.5
Botran + Triton B-1956	4.0
Botran + Multifilm X-77	14.0
Botran + Multifilm Buffer -X	22.8
Botran + Vatsol OT	16.6

Peach Leaf Curl

Norman D. Dobie:

Test plots for control of peach leaf curl were hit by a Coryneum blight epiphytotic in early spring prior to peach leaf curl readings. No readings were obtained, and two plots were abandoned. The trees were removed by the aid of a chain saw. Ninety to one-hundred percent of all buds were killed by the unseasonal outbreak of Coryneum. Fungicides included in these tests must be rerun next year.

Coryneum Blight

Norman D. Dobie:

No significant data were obtained with fungicides tested for Coryneum blight control. Spray timing and non-uniformity of disease inoculum must be involved in the problem.

GENERAL

Norman D. Dobie:

During the 1962-1963 spray season, 52 fungicides were tested for efficiency against peach leaf curl, Coryneum blight, brown rot blossom blight and fruit rot on peaches; brown rot blossom blight, fruit rot and leaf spot on cherries; mildew on apples and scab on apples and pears. No new fungicides will be added to the list of recommended fungicides for control of the listed diseases.

Several fungicides have shown promise for control of tree fruit fungus diseases. However, one or more years testing is necessary before placing on the recommended list in the Oregon tree fruit spray schedules.

S E C T I O N V I

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

SPRAY RESIDUES

R. R. Legault and Richard Maxwell:

Plot work and residue analysis for Perthane in Bartlett and D'Anjou pears were continued during the 1963 season. This was done to obtain the necessary data for the recommendation of a maximum of four cover sprays. Handgun applications were made at the proposed recommended rate of 8 lbs. actual per acre at a spray concentration of 1 lb. actual per 100 gallons, and at twice this rate. Samples were collected 1, 7, and 14 days after the fourth application.

Residue analyses showed 7.3 and 8.0 p.p.m. Perthane present on the fruit one day after the fourth cover spray of 8 lbs. actual per acre. These values decreased to 3.8 and 6.0 p.p.m. 14 days after the fourth cover spray. A maximum of 16.1 p.p.m. Perthane was found one day after the fourth cover spray of 16 lbs. actual per acre.

Harvest samples of Bartlett pears were collected by WSU personnel from several commercial orchards near Wenatchee, Washington. The spray histories of these orchards were reported to have included Perthane, Kelthane, Tedion, and DDT among the chlorinated pesticides. Subsequent analyses confirmed these reports, and in no case, even when three of the chlorinated compounds were included in the spray schedule, did the combined residues exceed 28 percent of the allowable tolerance at harvest.

Each sample was surface stripped with n-hexane and analyzed for the individual pesticides according to established procedures. Total chlorine was determined by neutron activation analysis and compared to the chlorine content as determined by the specific method for each of the chlorinated compounds. The results show that the specific methods account for most of the chlorine present in the extracts.

L. C. Terriere and Ulo Kiigemagi:

The effect of various surfactants on the amount of cyprex deposited on leaves and fruit of sweet cherries was determined. The treatments included Cyprex only (1/2 lbs/ 100 gal.) and Cyprex plus surfactants EFA 2118, Vatsol OT, or Colloidal Spray Modifier. Analyses indicated that the highest initial deposit and the most persistent residues were achieved without the added surfactants.

Mercury could not be detected in harvested cherries treated three times prior to May 7 with Puratized Agricultural Spray, 1 pt./100 gal.; peaches treated two times prior to April 4 with PAS at 1 pt./100 gal; or walnuts treated with TAG in May at 1/2 pt./100 gal.

PHYTOTOXICITY

F. W. Peifer:

Anjou Pear - A combination of Perthane 4E Flowable and Ziram caused slight fruit russetting and discoloration under spray deposits. Perthane WP and Ziram in combination caused yellow bleached spots on fruit under the extremely heavy wettable powder deposits. Trithion plus Perthane 4E Flowable caused some slight lenticel roughening and ring formations under the heavier deposits. UC 19786 plus Guthion caused a slight amount of fruit russetting.

Bartlett Pear - Single applications of AC 47031, AC 47470 and MC-A-600 caused moderate to severe marginal leaf necrosis applied at high rates, -- 2 lbs. actual/100.

Red Delicious Apple - Both the emulsifiable and wettable powder formulations of Karathane caused consistent russetting around the calyx lobes of newly formed fruit. A full bloom or petal fall application is thought to be responsible. Additional summer applications of these formulations failed to cause further russetting, even when applied at temperatures between 85 - 95°F.

D. L. McIntosh:

For several seasons severe injury to the bark of one- and two-year wood has been observed in February and March in peach trees that were sprayed the preceding fall, i.e., in September or October, with either ferbam or ziram for the control of both leaf curl and coryneum blight. It is surprising that materials that are apparently as innocuous to a wide range of plants during the growing season as are ferbam and ziram, should be so damaging to peach trees during the winter. However the occurrence of this injury has been associated in every case with the use of these fungicides. It may be that fall sprays of these compounds predispose one- and two-year wood to winter injury.

P. H. Westigard:

The following summarizes phytotoxicity to D'Anjou pear during 1963:

Material	Rate per 100	Time of Application	Injury
Ethion 8.0 E.C. plus Supreme Oil	.25 pt. 1 gal.	March 22	Increase fruit russet.
Morestan 25% W.P.	1.5 lbs. 0.5 lb. 0.25 lb.	May 15) June 4) July 20)--))	Severe marking of fruit and foliage at all concentrations. Severe defoliation where Volck Supreme oil sprayed over 1.5 lbs./100 rate of
Morestan 3 lbs./gal.F.C.	2.6 ozs.	July 20)	Morestan, 1 week after application.

Material	Rate per 100	Time of Application	Injury
Morocide 50% W.P.	0.5 lb.	March 22 May 15	No injury when applied in pre-pink bud application. Subsequent application resulted in bleached spots on fruit and foliage. This fruit marking had disappeared by harvest on trees sprayed May 15 but was still present on fruit treated June 7. Severe defoliation occurred on trees treated with dust and W.P. on June 7; this was 4-5 weeks following application of Volck Supreme Oil.
	(4.0 lbs.A.)	June 7	
4% Dust	60 lbs. A.)	June 7	
Trithion 25% W.P. plus Supreme oil	1 lb. 1 gal.	March 22	Increase fruit russet.

Everett Burts:

Cluster bud applications of Morestan did not injure Bartlett or D'Anjou fruit. Late pink applications of oils were found to cause very serious russeting of both Bartlett and D'Anjou fruits, while earlier applications at the delayed-dormant and cluster bud stages were safe. Perthane emulsifiable concentrate formulations were found to be phytotoxic when combined with oil, Kelthane or Guthion. An experimental wettable powder formulation of Perthane did not cause injury when combined with Kelthane or Guthion in summer sprays on Bartlett and D'Anjou pears.

Duane L. Coyier:

Application of liquid lime-sulfur (5 gal/100 gal) plus oil emulsion (3 gal/100 gal) to D'Anjou pears at the late delayed dormant stage of bud development reduced fruit set approximately 50 percent. This was a preliminary test, but the results obtained were significant. Further tests are planned to determine more precisely the stage of bud development necessary to cause lime-sulfur and oil injury.

BEE POISONING

Carl Johansen:

Following are the results of small-scale field tests of toxicity to honey bees conducted during 1963:

Material	Lb/acre	Direct Toxicity	Residual Toxicity
UC 19786	0.5*	low	low (3 hr)
Morestan WP	0.5	low	low (2-1/2 hr)
Morestan D	0.5	low	low (2-1/2 hr)
Bayer 39007 G	1.0	low	low (2 hr)
Bayer 25141 G	1.0	low	low (2 hr)

Bee Poisoning (Cont.)

Material	Lb/acre	Direct Toxicity	Residual Toxicity
Dimetilan	0.25	moderate	low (3 hr)
UC 20047	1.0	moderate	low (3 hr)
SD 8447	1.0	high	low (3 hr)
GC 4072	0.5	high	low (3 hr)
Isolan	0.25	high	low (3 hr)
Di-Syston	1.0	high	low (3 hr)
Thiocron	0.5	high	low (3 hr)
Phosphamidon	0.25	high	low (2-1/2 hr)
Aspon	0.5	high	low (2-1/2 hr)
DDT	1.0	high	low (4 hr)
Methoxychlor	2.0	high	low (4 hr)
Methoxychlor	3.0	high	low (4 hr)
Toxaphene	4.0	high	low (4 hr)
SD 7438	0.5*	high	moderate (3 hr)
AC 47031	1.0	high	low-moderate (3-4 hr)
UC 8305	1.0	high	moderate (3 hr)
Phosphamidon	0.5	high	moderate (5 hr-1 day)
Phosphamidon	1.0	high	moderate (10 hr)
Stauffer N-2788	2.0*	high	low (1 day)
Bayer 25141	0.75	high	low (1 day)
UC 10854	1.5	high	low (1 day)
DDT	2.0	high	low (1 day)
Malathion	1.0	high	low (1 day)
Bayer 39007	0.75*	high	moderate (1 day)
Colep	1.0	high	moderate (1 day)
Diazinon	1.0	high	high (1 day)
Parathion	0.5	high	high (1 day)
Bomyl	0.5*	high	low-high (2 days)

*Lb. per 100 gal. in dilute application on apple.

CONCENTRATE SPRAYING

Everett Burts:

Concentrated spray applications have proven to be effective against several of the common insect pests of tree fruits in trials during the past three years. However, this method of spraying has not been as effective against spider mites as the high volume sprays. A power take-off driven machine was added to the program this season and results to date are very encouraging. An air atomizer nozzle which uses the air blast from the machine to break up the spray also showed promise and will be studied further next season as a means of reducing costly nozzle wear.

OCCUPATIONAL EXPOSURE

H. R. Wolfe and W. F. Durham:

In evaluating occupational exposure to spraymen and fruit thinners, thirty-five airblast spray machines being used for application of parathion in apple orchards in North Central Washington were checked for variation in concentration of spray and resultant residue levels on foliage. Spraying time for each machine was first determined. Samples of dilute spray were then taken directly from the nozzles at three different periods: (1) at the end of one minute of spraying, (2) when the tank was approximately half-empty, and (3) during the last minute of spraying before the tank became empty. The tree being sprayed at the time the spray sample was taken was marked and a foliage sample taken for residue analysis as soon as the spray dried. Each spray machine operator followed his usual procedure and each felt he was adding the recommended amount of pesticide to the tank. This theoretically should have resulted in approximately 0.033% parathion spray. The mean level of parathion concentration in the spray mixtures tested (0.029%) represented about 88% of the theoretical amount present in the recommended formulation. In the test as a whole, a rather large variation in spray concentration was seen. The lowest value recorded was 0.010% (30% of the theoretical level) and the highest value noted was 0.062% (187% of the theoretical level). However, there was a tendency for these variations to be randomized between the various levels in the tank. There appeared to be some tendency with the wettable powder formulation for the first part of the tank to be more concentrated than later portions in most machines. However, the spray formulation prepared from emulsifiable concentrate was quite homogeneous. During the usual practice of spraying the trees from both sides there was an "evening out" of the deposit due to tendency of the spray to carry through the trees from one side to the other. Instances where trees are sprayed with either the relatively weak or relatively strong solutions from both sides would probably not occur very often.

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