ABSTRACTS OF REPORTS FROM THE
37th ANNUAL WESTERN COOPERATIVE SPRAY PROJECT

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NOT FOR PUBLICATION OR FURTHER REPRODUCTION

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
37th 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

F. E. Ellertson:

Three covers of DDT 50% WP at 2 lbs. plus malathion 25% WP at 2 lbs./100 continued to provide excellent control of codling moth on Newton apples.

Stan Hoyt:

Bayer 37344, Guthion, Guthion plus oil, and dimethoate plus Sevin provided excellent control of the codling moth in field plots. Imidan, Zectran, Stauffer R-3413, and Monsanto CP 40294 gave good control. Fair control was provided by Union Carbide 10854, and applications of Thiodan II, DDT, DDT - antiresistant, Bacillus thuringiensis plus Sodium Carbonate, Stauffer R-2404, and American Cyanamid 43064 resulted in poor control. It should be noted that DDT - antiresistant allowed substantially fewer worm entries than DDT.

Black light traps attracted very few codling moths. The percentage of wormy fruit on the trees adjacent to the black lights was considerably less than the percentage on other untreated trees in the same block.

Entomology Laboratory, Summerland, B. C.:

In an orchard experiment in the control of the codling moth the non-ionic surface-active preparations, Triton B 1956 (Rohm & Haas), and Nonidet P 40 (Shell), were added to the insecticides Sevin (Union Carbide) and Guthion (Chemagro). The spray mixtures were applied with low-volume air-blast equipment at 50 gallons per acre. Without added surfactant both Sevin and Guthion produced obvious spotted deposits on the fruits. Added to the spray mixtures at 0.12% by volume both Triton B 1956 and Nonidet P 40 changed the deposits to uniform, barely visible films. In view of current concern about spray residues on food crops the point is significant.

The surfactants did not measurably alter the amount of deposit either in the bottoms of the trees or in the tops. Codling moth infestation was not affected by the addition of the surfactants.

Marvin H. Brunson:

Control of codling moth, and McDaniel mite, in apple orchards with only two applications of pesticide during a season has been studied in the Yakima Valley during the past three years. Cooperating growers have applied materials according to our directions each year about May 25 and July 25. During the past two years, they have applied Guthion 25% WP 18 lb. per

acre (1.5 times normally recommended quantity) in the first cover spray and only 12 lb. (the usual recommended quantity) in the last cover. Since this station has demonstrated repeatedly that McDaniel mite can be controlled throughout a season with two applications of acaricide, normally recommended quantities of Tedion were included in the first cover spray and Kelthane in the second cover. Bioassay in the laboratory this year of the toxicity to codling moth adults, eggs, and newly hatched larvae of residues on randomized samples of leaves and twigs from the orchards seven weeks after the first cover spray was applied indicated that the Guthion present was capable of killing codling moth stages as follows: Adults, 96%; eggs, 43%; and larvae, 75% (average percentages). No fruits injured by codling moth could be found in the orchards at harvest time and none was reported by the cooperating growers. A close check of the mite population throughout the season did not show a need for an additional application of acaricide and no extra applications were made by the growers.

Marvin H. Brunson:

The comparative toxicity to codling moth adults, eggs, and newly hatched larvae of the residues of several experimental materials on samples of leaves, twigs, and fruit taken from orchard plots at weekly intervals after application was assayed biologically in the laboratory. Samples for residue assay were taken from orchard plots that were sprayed to compare the effectiveness of various materials in protecting fruits from injury by codling moth. Guthion 25% WP 1.5 lb. per 100 gallons was the standard used for comparison. Its residue on leaves and twigs 7 weeks after the last spray was applied caused mortalities as follows: Adults, 98%; eggs, 77%; larvae, 98%. The residue on fruit caused 100% mortality of larvae. None of the new materials tested this year equaled or exceeded Guthion in toxicity to the stages of codling moth six weeks after application. They were in order of greatest to least toxicity as follows: Bayer 39197, General Chemical 3707, Bayer 47940, and Stauffer R-3413.

Donald W. Davis:

One series of small block replicated treatments was applied at North Ogden using several of the newer materials. Guthion at 2# per 100 gallons was used as the standard (untreated trees in this area approach 100% injury). Zectran at 2 qts. per 100 gallons and Bayer 37344 at 1# per 100 were the most effective of the new materials. Counts on wormy picked fruit, stings and wormy windfalls showed no difference between these two materials and the Guthion treatment at either 1% or 5% level of significance. Antiresistant DDT at the 2# rate and Imidan at 1# showed considerable promise, but were generally less effective than the above three treatments. Union Carbide 10854 at 1# per 100 gave a high degree of control, but did not compare well with the other materials discussed.

A second series of blocks was applied by the grower in large replicated units. Again Guthion at the 2# rate was used as the standard. A mixture of Sevin plus Guthion at 3/4 pound each showed a very good control as far as wormy harvested fruit was concerned, but there was a significant increase in stings and in wormy windfalls, but in general the control was excellent. A reduced dosage of Guthion (1½# per 100) was also used in this series and performed equally as well as the heavier rate of Guthion.

All treatments were applied at three week intervals.

John A. Quist:

Bayer 37344, Imidan 50W at two rates, $\frac{1}{4}$ lb. actual and $\frac{1}{2}$ lb. actual, and Monsanto 40294 15W applied as four applications each for the season gave better than 99% control.

S. C. Jones:

The following materials were field tested against the codling moth on single tree plots replicated six times: Shell S. D. 7438, Bayer 39007, 36205; G. C. 4072, and 3707, and Stauffer Imidan. The plots received three cover sprays applied on June 6, June 21 and July 27. Bayer 36205 and G. C. 3707 caused considerable thinning and were discontinued after the first cover spray. The apples in the plots were checked for codling moth infestation in August and again in October. The infestation was light on all the plots in August. G. C. 4072 and Imidan were the most effective material tested. All the plots showed heavy codling moth stings in October. A fourth cover spray would probably have prevented the late stings.

M. M. Barnes:

Studies with 4 variations of low intensity ultra-violet light traps in comparison with bait pails for codling moth flight indexing were carried out with 5 replications rotated every 2 - 3 days in a 5 x 5 latin square in an untreated orchard with a light codling moth population. Results of this preliminary experiment indicate that as wattage consumption increases arithmetically codling moth catches increase arithmetically but catch of "contaminant" species of lepidoptera increase geometrically. Reasons for this will be discussed.

Catch from a small 2 watt UV lamp trap was equivalent per trap to a fermenting bait trap. Also, codling moth catch with this unit was more regular than from bait pails, i.e. there were considerably fewer "misses" during the flight period observed.

Orchard Mites

F. E. Ellertson:

Cover spray trials were conducted on Delicious apples for control of European red mites. One early season application (June 1) of the organic phosphates; AC 43064, AC 38023, GC 3707, N 2788 and Bayer 29493 failed to control E. red mites. Dosages of OW 9 - 5 oz.; Morocide - .75 lb. and Bayer 37344 - 1 lb./100 applied June 1 to a small population of E. red mites kept the population near the pre-treatment level for a period of 5 weeks.

Applications made in July with OW 9 at 7 oz./100 gave better control than at the 5 oz. rate. Bayer 37344 at 1, 1.25 and 1.5 lbs. and Morocide at .75 lbs./100 applied in July did not control a high population of E. red mites. Morocide applied in July and August at 1 and 1.5 lbs./100 gave good initial control, but did provide control for 3 weeks. The higher dosage of Morocide was no better than the 1 lb. rate. Bayer 37344 applied in August

at 2 lbs./100 gave a good knockdown of mobile mite forms but the population built up within three weeks. In August Bayer 36205 at .5 lb./100 gave excellent control for a period of 3 weeks. (See Section on Spray Residues, Compatibility and Phytotoxicity).

Entomology Laboratory, Summerland, B. C.

(a) Summer sprays for European red mite

The carbonate, Bayer 36205, 25 per cent, at 2 lb. per acre and OW 9, 85 per cent emulsifiable, at 34 or 50 fl. oz. per acre gave good control of the European red mite. The dinitro compound, 50 per cent Morocide gave poor control at 4 lb. per acre but when the rate was raised to 6 lb. per acre the control was fair. Where this dinitro compound had been applied to apple trees in 1961, the European red mite were, in 1962, more numerous on these trees than on any other trees in the orchards.

Stan Hoyt:

Over 20 materials were tested as summer sprays for McDaniel mite control with variable results due to high initial populations, the presence of resistant strains and dosage. The following summarizes the control obtained:

Excellent control	Shell Development 7438
Good to excellent control	Morocide, Union Carbide 19786
Good control	Tedion, Bayer 37344, Naugatuck OW-9, Union Carbide LB 625, Union Carbide DOP, Niagara 9042
Fair to good control	Bayer 36205, Hooker HRS-16A, Union Carbide 20047, Union Carbide 21149
Fair control	Kelthane plus Tedion
Poor control	Kelthane, Tedion, Crag Fly Repellent, Bayer 39007, Union Carbide 8305, American Cyanamid 43064 and 47300, Stauffer R-2404 and Monsanto CP 40294

A pre-bloom spray of Bayer 36205 also proved very effective against the McDaniel mite.

Pre-bloom timing studies indicated that better rust mite control was provided by green tip sprays than by pre-pink sprays, but the difference was not commercially significant. Thiodan and Sevin applied at the pre-pink period gave excellent control, while wettable sulfur and sulfur paste provided good control. Summer sprays of Thiodan, Thiodan II, Sevin, Zectran, Bayer 37344 and UC 10854 resulted in good rust mite control. Naugatuck OW-9 and Morocide gave good control in one test and rather poor control in a

second test. Poor control resulted from a single application of Union Carbide 8305.

(b) Summer sprays for McDaniel spider mite

In contrast to its poor control of European red mite, Morocide gave excellent control of the McDaniel spider mite. Bayer 36205 at 1/4 lb. per 100 gal. gave good control of this mite but at lower rates the control was erratic. OW-9 at 7 fl. oz. per 100 gal. or the carbamate 50 per cent Bayer 37344 at 1/2 lb. per 100 gal. gave good control of the McDaniel spider mite. A new chlorinated hydrocarbon acaricide 80 per cent HRS 16, at 1½ lb. per 100 gal. gave good control of this mite two weeks after the application.

(c) Summer sprays for Apple rust mite

Fifty per cent Bayer 37344 1/4 lb. or 1/2 lb. per 100 gal. or 18.5 per cent Kelthane 2 lb. per 100 gal. gave excellent control of the apple rust mite. Other compounds that gave good control were: 25 per cent Bayer 36205 1/4 lb., 50 per cent Morocide 1/2 lb., 85 per cent OW-9 7 fl. oz., 80 per cent HRS 16, 3/4 lb. or 1½ lb., 50 per cent Thiodan I. 3/4 lb. and 50 per cent Sevin 3/4 lb. per 100 gal. Guthion, 25 per cent, 1 lb. per 100 gal. gave poor control.

(d) Early sprays for European red and McDaniel spider mite

A spray of Penco Superior oil 6 gal. per acre, applied when the buds were showing green, gave very good control of the European red mite. It was ineffective against the McDaniel spider mite.

A pink spray of 25 per cent Bayer 36205 6 lb. or 8 lb. per acre gave excellent control of the European red mite. No further treatment was required during the season. Seventy five per cent Polybutene H 100 emulsion 8 gal. per acre, also at the pink-bud period, gave fairly good control of the European red mite. Fifty per cent Morocide, 4 lb. per acre, was unsatisfactory.

None of these pink-bud sprays gave adequate control of the McDaniel spider mite.

Harold F. Madsen:

Tests with new acaricides showed that OW-9 and Bayer 36205 provided the best control either as a preventative spray (petal fall), or as a treatment when populations were high. Morocide gave a good initial knock-down, but residual action was short. Animert and Pentac were ineffective. Tedion as a preventative spray gave control for the third consecutive season in an orchard where Tedion resistance is present.

A series of oils was tested against a high population of European red mite. Pennsalt Superior oil, British Columbia dormant, and Supreme oil gave the best control. Two sprays two weeks apart gave control for a 5-week period.

John A. Quist:

Nutritional-insecticide interrelationships studied. Sevin does not increase egg deposition of two spotted mite. Guthion retards egg deposition.

S. C. Jones:

Four apple trees heavily infested with European Red and Two-spotted mites were sprayed thoroughly on August 9 with malathion 25% W.P., 2 pounds to 100 gallons of spray. A power sprayer using hand guns was used to apply the spray. The average mite count per leaf before the spray was applied was: Tree No. 1, 23 mites; Tree No. 2, 11 mites and Tree No. 3, 8 mites. This count was based on 20 leaves taken at randon from each tree.

On August 13, four days after the trees were sprayed, a second mite count was made from each tree based on 20 leaves taken at random from each tree. Results of the counts were as follows: Tree No.1, 0 mites; Tree No. 2, 0 mites; Tree No. 3, ½ mite; Tree No. 4, 1.4 mites; and Tree No. 5 (Check - untreated tree) 14.8 mites.

Donald W. Davis:

Only one series of experiments was conducted on this mite during 1962. The codling moth program on the orchard was at three week intervals using Sevin. The mite control program was started on July 9 with the acaricide repeated whenever deemed advisable.

A rating of residual value based on 1962 work results in the approximate sequence as follows:

1. General Chemical 3707 about eight weeks or slightly more.
2. Trithion nearly eight weeks.
3. Ethion about seven weeks.
4. Bayer 37344 about seven weeks.
5. Morocide about seven weeks.
6. Cellosize (double applications) about six weeks.
7. Tedion about six weeks.
8. Kelthane nearly five weeks.
9. Systox nearly five weeks.
10. OW-9 about four weeks.
11. Dibrom about four weeks.
12. Imidan about three weeks.

In contrast to the residual value, only a few of the materials showed extreme knock-down value. These were: Imidan, General Chemical 3707 (not too clear from season's work), Bayer 37344, and Morocide.

Some of the materials such as Kelthane, Dibrom, and Tedion and Systox were definitely less effective than they have been in the past. Trithion and Ethion were continuing to hold up well, but they have not had the commercial use in Utah to equal the other four materials.

All five of the materials included in the research work for the first time proved to be interesting. General Chemical 3707 in particular, appears

to be a promising acaricide. Bayer 37344 and Morocide showed somewhat less residual action but combined with a highly effective quick knock-down. They are certainly worth more study. Imidan was the most questionable of the new materials tried, but the quick kill looked very good. Cellosize kills by mechanical action and for that reason we should look at it very carefully. On the other hand the paired applications at weekly intervals were difficult to manage, and will be even more difficult to the grower.

F. P. Dean:

McDaniel mite populations in apple orchards in the Yakima Valley were abnormally high in 1962 and many growers were unable to control them satisfactorily. Tests with experimental acaricides were conducted in an orchard consisting of mature Winesap trees. Plots were sprayed on May 29, June 22, and July 26 with Guthion to control codling moth and the experimental acaricides were included in the first and third sprays. Materials that gave excellent control with lasting residual effectiveness (8 mites or less 56 days after the first application) were: Kelthane 18.5% WP 1.5 lb., Kelthane AP 18.5% WP 1.5 lb., Bayer 47185 80% WP 0.5 lb., Bayer 47043 80% WP 0.5 lb., and Bayer 36205 25% WP 1.5 lb. per 100 gallons. Other materials that gave good control for as long as 43 days were OW-9 85% EC oz., Morocide 25% WP 0.75 lb. (0.5 recommended concentration), Tedion 25% WP 1.0 lb., Shell SD-7438 2 lb./gal. EC 1.0 qt., Volck Supreme Oil 2 qt., and Volck Supreme Oil 2 qt. plus Tedion 25% WP 1 lb. per 100 gallons. Materials that were unsatisfactory were: Bayer 41831 40% WP 1.0 lb. and Bayer 39197 80% WP 0.5 lb. per 100 gallons.

F. H. Harries:

In 1962 a number of common pesticides were screened against the two-spotted spider mite by the method of tree-trunk injection. It was found that certain water soluble pesticides would move to the leaves more readily with less phytotoxicity than many water insoluble compounds dissolved in various solvents. Some non-water soluble compounds such as dimethoate moved readily to the leaves and gave good control of the mites. In trunk injections of pear trees Bidrin gave 100 per cent mortality of the two-spotted spider mite in a bio-assay made 1 week after the injection. The water solubles, Bayer 47043 and Meta-Systox also gave good control of the mites. Bidrin persisted for considerable time in the trees, but most of the pesticides were hydrolyzed rather rapidly or were soon vaporized from the leaves. Actidione did not work very well in trunk injections of apple trees and was phytotoxic. Antibiotics such as pleomycin, venturicidin, phytoactin, cycloheximide acetate, and hygromycin were highly toxic to the mites when used at ordinary pesticide dosages of about 1 pound per 100 gallons.

In some tests on apple trees, sections of the limbs were liberally banded with pastes made by dissolving different pesticides in dimethyl sulfoxide and thickening the solutions with Bentone 38 or Carbowax 4000. Bio-assays of the leaves showed that in these tests there was not enough movement of the pesticides to have any effect on the mites. Studies of different solvents showed that 1.4, dioxane, diethylene oxide, and amyl acetate were more suitable than pyridine, syclohexane, cyclohexanol, and Cellosolve. In screening tests on the two-spotted spider mite, the most

effective spray materials were Bayer 47043, 47416, Stauffer B-10190, B-10119, 10094, Bayer 47185, SD-8447, Hercules 7845C, Morocide, General Chemical 3707, and Stauffer R-5723A.

It was also found that Sevin does not stimulate egg laying of the two-spotted spider mite.

Apple Aphid

Stan Hoyt:

Thiodan, Thiodan II, Zectran, Bayer 37344, Niagara 5767, Shell Development 7438, and Union Carbide 10854 provided good initial knockdown of the apple aphid, but none of the compounds were able to prevent reinfestation of new foliage. Monsanto CP 40294, Union Carbide 8305, and Imidan failed to give a good initial knockdown. Sprays of the systemic compounds Menazon and Bayer 39007 provided good initial knockdown and control up to four weeks. Bayer 39007 as a soil drench failed to control the aphids.

Excellent control of heavy populations of woolly apple aphid was provided by Thiodan, Thiodan II, Diazinon, Bayer 39007, Menazon and Dimethoate.

Entomology Laboratory, Summerland, B. C.:

The systemic pesticide Dimethoate was applied in two ways to 7-foot dwarf apple trees. One way was as a water-diluted foliage spray containing 2 millilitres of Dimethoate per tree. The other way was as a band of the same amount of undiluted material painted on the trunk of the tree. Chemical analyses showed that the initial residue from the spraying was 187 parts per million, and from the trunk painting zero. But within 6 days far more Dimethoate was recovered from the leaves of the trunk-painted trees than from the foliage-sprayed ones. Thereafter decline of the residue was decidedly slower in the case of the painted trees. These findings were reflected in records of infestation of the apple aphid. Bark application of Dimethoate gave more lasting control of the insect than foliar application.

A new material that also proved as effective as Dimethoate in bark application was Cyanamid RP 10,465. This relatively safe material was also tried to 1961 when it proved slightly superior to Dimethoate.

PEAR INSECTS AND MITES:

Codling Moth

F. E. Ellertson:

Two covers of Sevin 50% WP at 1.5 lbs. or Guthion 25% WP at 1.5 lbs./100 applied June 7 and July 11 provided excellent control of codling moth on Anjou pears.

Pear Psylla

F. E. Ellertson:

Delayed dormant sprays of the following combinations provided excellent early season control of pear psylla on Anjou pears: Flowable oil - 3 gals. plus lime sulphur - 5 gals./100 or Shell oil (SM-1069) - 1.5 gals. plus lime sulphur - 5 gals./100.

Two cover sprays of Guthion 25% WP at 1.5 lbs./100 applied June 7 and July 11 on Anjou pears gave excellent control of pear psylla in a plot which had received a delayed dormant application of oil-lime sulphur. Two covers of Sevin 50% WP at 1.5 lbs./100 applied June 7 and July 11 did not provide as high a degree of control as attained in the similar Guthion sprayed plot. Indications were that one additional cover spray of Sevin was needed in mid-August.

In summer evaluation trials against the pear psylla; the following chemicals provided the best control: Bayer 37344, Imidan, Zectran, Perthane, Pyrethrin and rotenone dust. A late season trial with Union Carbide 20047 and 21149 gave good initial kill of "hardshell" nymphs.

Five applications of Karathane 25% WP - .5 lb./100 at 10-14 day intervals had a suppressing affect on psylla nymphs.

The following materials applied during the summer failed to control psylla nymphs: Bayer 29493, 39007, 25141, 36205; American Cyanmid 43064, Cynem, Dimethoate: General Chemical 3707, 4072; Union Carbide 10854; Niagara 5767, 9214; Stauffer 2404, 2788, 3413; Diazinon, Diazinon plus Sevin, Wypsen and Delnav.

Entomology Laboratory, Summerland, B. C.:

Two dormant oils of low viscosity-index and of 200 and 400 seconds Saybolt viscosity, and one oil of high viscosity index and 140 seconds viscosity, were more effective in preventing egg deposition by overwintered pear psyllids than an oil of low viscosity index and 100 seconds viscosity. None of the oils, however, adequately controlled the insects for more than two months. Evidence is accumulating that predatory insects are often capable of playing a decisive role in the control of the pear psylla in British Columbia providing they are not drastically reduced by the application of non-selective contact insecticides.

Everett Burts:

In field plots, Bayer compound 37344, Zectran, Perthane, NIA 9042, Nicotine sulfate plus oil, and rotenone plus oil, were the most effective compounds tested against Guthion resistant and susceptible pear psyllid populations. A preliminary test indicated that DEF defoliant was a synergist for malathion against malathion resistant pear psylla. None of the many other compounds tested were effective enough to give commercial control of this insect.

Three sprays of two repellents, TD 222 and 248 at the delayed dormant, cluster bud and petal fall stages of growth, failed to reduce populations of overwintering adults or to inhibit egg deposition on the sprayed trees.

Apholate and Commercial Solvent compound, p. 252, did not kill adult pear psylla or inhibit egg deposition or development when applied to infested pear seedlings in the greenhouse.

Pear Decline Relationships

In a block of 400 young Bartlett pear trees in replicated blocks, the growth as measured by diameter of the trunk was about 20% less where psylla were not controlled, compared to trees receiving a standard psylla control program.

Biology Studies

There was no significant crystallization of honeydew in the pear psylla biology plot this year. Some crystallization of abandoned droplets and a few droplets containing live nymphs occurred in late July, but this had little effect on the population of psylla in the plot.

The populations of pear psylla in the plot reached a peak in mid-July and decreased slowly to nearly nothing by the end of September. This was the fourth summer that the plot has been left unsprayed for pear psylla and the trees are heavily damaged. Terminal growth this season was very short; the foliage was sparce and the leaves were small, as is found in the early stages of slow decline. By mid-June the foliage was light green, almost chlorotic in some trees, giving the appearance of nitrogen starvation although a normal application of ammonium nitrate had been made in late February. Additional nitrogen applications failed to correct the symptoms. The condition of the trees definitely reduced the populations of pear psylla.

Harold F. Madsen:

Studies were conducted with oils of varying viscosity alone and in combination with pyrethrins for pear psylla control. The oils alone provided promising control, and the addition of pyrethrins did not improve either the initial kill or the residual action. There was no significant difference between oils ranging in viscosity from 70 to 1000 seconds Saybolt.

S. C. Jones:

A single pear tree which had not been treated regularly for psylla control was sprayed on August 9, with malathion 25% WP, 2 lbs. to 100 gallons of spray. This tree was severely infested with all stages of psylla including numerous adults. The tree was partially defoliaged by psylla and the remaining foliage was heavily damaged. Based on psylla counts on the foliage of 20 leaves taken at random of the tree there was an average of 31 psylla per leaf. Four days after the tree was sprayed the psylla count showed one psylla on twenty leaves.

Three years ago it was difficult to find psylla on this tree. In 1961 there was a light psylla infestation and the grower sprayed the tree with Guthion using a hand sprayer.

F. P. Dean:

Pear psylla populations in orchards were greater than usual in the Yakima Valley during May and June but decreased during July and August. In late September they became more abundant but they were confined mostly to the younger and succulent shoots.

Tests of several experimental materials were made in a Bartlett pear orchard in which the sprays were applied with hand guns to unreplicated plots on May 28, June 25, July 10, and July 31. This orchard has been used for tests of experimental materials during several years and Guthion 25% WP 1.5 lb. per 100 gallons has been the standard treatment each year. Some degree of resistance to Guthion has apparently developed during this time since four summer applications were required in 1962, three applications in 1961, and two in 1960 to hold psylla populations to an economic level.

The materials tested that gave control equal to or better than Guthion were: Imidan 50% WP 1.0 lb., methyl-ethyl Guthion 2 and 2 lb./gal. EC .75 lb., and Bayer 36205 25% WP 1.5 lb. per 100 gallons. Guthion 25% WP 1.5 WP 1.5 lb. plus Volck Supreme Oil 2 qt. per 100 gallons gave excellent control when used in the last application. Bayer 41831 40% WP 1.0 lb. per 100 gallons gave good control between applications, but after the last application it appears to have shorter residual effectiveness than Guthion. Ethyl Guthion was fairly effective throughout the season. GC-3707 25% WP 2 lb. was poor after the first spray but gave good control from later applications.

Other pear psylla control tests were conducted in a Bartlett pear orchard in which the three sprays (600 gallons per acre) were applied with an air blast sprayer. In these tests Bayer 36205 25% WP 1.5 lb. and Guthion 25% WP .75 plus Volck Supreme Oil 2 qt. per 100 gallons gave control superior to the standard treatment of Guthion 25% WP 1.5 lb. per 100 gallons. Treatments that resulted in satisfactory control and were equal to Guthion were: Imidan 50% WP 1.0 lb., Zectran 25% WP 3.0 lb., and General Chemical 3707 25% WP 2 lb./100 gallons.

F. H. Harries:

In trunk injections of pear trees, bio-assays against the pear psylla adults showed that Bayer 47043 and Bidrin moved systemically to the leaves

and were effective for at least two weeks after the injections were made. In tests of 50 candidate insecticides by laboratory spray techniques only four materials were found to be very promising. These were Bayer 47043, General Chemical 4072, SD-8280, and Union Carbide 21149.

Orchard Mites

F. E. Ellertson:

No trials were conducted for control of European red mites on Anjou pears. (See Section on Spray Residues, Compatibility and Phytotoxicity).

John A. Quist:

Twelve insecticides evaluated: Bayer 37344, Bayer 36205, Morocide and Kelthane AP provided best initial control. Bayer 37344, Tedion, Bayer 36205, Kelthane AP, provided best residual control.

Grape Mealybug

Harold F. Madsen:

Pre-bloom treatments of Diazinon combined with oils of varying viscosities showed that the light oil (70 vis.) and the heavy oils (147 vis. and 205 vis.) gave better control than the standard dormant oil (110 vis.). Diazinon combined with X-77 was as effective as the better Diazinon-oil combinations. D.D.V.P. did not provide acceptable control.

S E C T I O N I I

INSECT AND MITE PESTS OF STONE FRUITS

CHERRY INSECTS AND MITES

Cherry Fruit Fly

S. C. Jones:

The first cherry fruit fly was found in the Willamette Valley in a ground cage near Salem on June 9. Two flies were taken from lures hung in cherry trees in Corvallis on June 11. The lures consisted of Stayley's No. 5 bait, dibasic ammonium phosphate and water. The period of greatest abundance of flies based on emergence in ground cages was between June 22 and June 29. A few flies were still emerging in ground cages on July 24.

Three formulations of Sevin were field tested. These were Flowable Sevin, Sevin wettable powder and 10% Sevin dust. The Flowable Sevin was used at the rate of 1½ pints to 100 gallons of spray. The Sevin 50% WP was tested at the rate of 1 pound and 1½ pounds to 100 gallons of spray. Three applications of 10% dust were applied in one orchard which had been heavily infested in 1961. No infestation was detected in 1962. One infestation was found in one orchard receiving one pound of Sevin 50% WP and one receiving 1½ pounds of Flowable Sevin. These infestations occurred in samples taken on August 6 and 9 or 24 and 29 days respectively after the last spray was applied. No infestations occurred in any sample taken at the normal time of harvest.

Orchard Mites

F. E. Ellertson:

The Two-spotted and the McDaniel mite on Montmorency cherry were controlled at The Dalles with: Morocide - 1 lb., UC 19786 - 1 lb., UC 20047 - 1 pt., OW 9 - 7 oz. and Kelthane EC - 1.5 pts. plus Volck oil - 1 qt./100.

E. W. Anthon:

A number of new compounds were tested against McDaniel mites on cherries. A quart of perthane was added to all materials for the control of cherry fruit flies.

Morocide, Imidan, and N-2404 causes slight necrotic spots on the leaves which eventually turned yellow. Union Carbide's 8305 caused moderate damage. General Chemical's 3707 caused severe injury with almost complete defoliation.

Six weeks after the post-harvest sprays, OW9 (Smite), Morocide, Kelthane, Union Carbide's 20047, and Chemagro's 37344 all gave good control.

E. W. Anthon:

Thiodan II, Kelthane and Chemagro's 36205, gave good control for six weeks. Bayer's 46676, Naugatuck's OW9 (Smite) and C-309, and Chemagro's 37344, gave good control of the plum nursery mite on cherries for three weeks.

Bayer's compound 46676 caused some of the leaves to turn yellow but damage was mild. Union Carbide's caused the leaves to turn yellow and drop.

San Jose Scale

E. W. Anthon:

The materials which gave the best results of delayed dormant spray applications applied against the San Jose Scale were: Ethion plus oil, Diazinon plus oil, and Pennsalt's Superior Oil 7.

PEACH INSECTS AND MITES

Orchard Mites

F. E. Ellertson:

The Two-spotted and the McDaniel mite on peach at The Dalles were controlled for a period of three weeks by: Morocide - 1 lb., UC 19786 - 1 lb. and UC 20047 - 1 pt./100.

E. W. Anthon:

Naugatuck's C-503, C-309 and Union Carbide's 19547 gave the best control of the compounds tested for the two spotted mites.

E. W. Anthon:

The compounds which provided the best control of peach silver mites for four weeks were: Union Carbide's DOP, Kelthane, Chemagro's 36205, Bayer's 25141, and Thiodan. The acaricides which looked good after three weeks were: Shell's 7438, Geigy's 24163, Chemagro's 37344, Naugatuck's C-309 and C-503, American Cyanamid's 43064, and Bayer's 44646.

F. H. Harries:

In trunk injections of orchard peach trees with dimethoate emulsion, the number of peach silver mites was greatly reduced and then declined slowly over the next three weeks of the observations. The predacious mites remained numerous after the injection and then outnumbered the phyrophagous mites toward the end of the period. This shows that in some cases the injection method of applying pesticides may act with rather than against biological control as occurs in most spray operations. The antibiotic Actidione was also effective against the mite in injection tests and when sprayed on the foliage.

F. H. Harries:

In laboratory screening tests on peach seedlings the two-spotted spider mite, the most effective materials were the Stauffer compounds, B-10190, 10094, and R-6723A, Bayer 47043, 47416, 47185, SD-8447, Hercules 7845C, Morocide, Union Carbide 20047, and General Chemical 3707.

In other tests by trunk injections of orchard cherry trees, Meta-Systox and Bidrin gave 100 per cent control of the mites in some tests. Other very effective materials were Bayer 47416, Bayer 47043, Bayer 47185, and Dimethoate. Dimethoate was translocated effectively in water emulsion and in solution with dimethyl sulfoxide, amyl acetate, N-butyl acetate, vinyl acetate, 1,4 dioxane, benzyl acetate, and alcohol. Unsatisfactory solvents were pyridine, cyclohexane, cyclohexanol and cellosolve.

The addition of 5 percent of DMSO to Trithion, Guthion, and Kelthane sprays increased the efficiency against the mites.

Some antibiotics were fairly effective in stem injections of peach seedlings in the greenhouse and many others were not effective.

Spray applications of some antibiotics at ordinary pesticide concentrations of about 1 pound per 100 gallons were also effective. The most active of the materials were pleomycin, venturicidin, hygromycin, actidione, cytovirin, phytoactin, and cycloheximide acetate.

Tests with Sevin on peaches and apples showed that applications of this material greatly increased the mite populations but that this was due to elimination of the predacious mites, Typhlodromus spp., and not to a stimulus derived from the chemical.

Studies of the effects of plant nutrition on mite populations have shown that deficiencies of the major nutrients have some effects, but it is the magnitude of these effects that is important and it may be that such results are of academic interest rather than of any practical importance.

Peach Twig Borer

John A. Quist:

The life history of the peach twig borer (Anarsia lineata) was studied under weatern Colorado growing conditions by means of extensive field observations. The important parasite species were evaluated, and the egg parasite Paralitomastix pyralidis accounted for 57% parasitism of overwintering twig borer larvae. Three other parasitic species were found. The importance of this biological control in western Colorado and the need for conservation of populations of the parasite species was developed.

Twelve insecticides were tried for peach twig borer control, applications at pink and shuck-split stages. Lead arsenate, Guthion 25W, Zectran 25E, Imidan 25W and Thiodan 50W provided best control.

Green Peach Aphid

E. W. Anthon:

Chemagro's 39007 gave excellent control of aphids which were in tightly curled leaves. Shell's SD 3562 and Bayer's 39007 caused slight tip burning on the leaves.

Systox and Shell's SD 3562 gave moderate control of this aphid.

PRUNE INSECTS AND MITES

Orchard Mites

S. C. Jones:

Acaricides tested against the European Red Mite on prunes were: Kelthane A. P., and Bayer 3744 and Bayer 26295 E. C. The single tree plots were replicated three times. One spray was applied on August 9. Each material controlled the mites but Bayer 26205 was the most effective.

S E C T I O N I I I

INSECT AND MITE PESTS OF NUT CROPS

FILBERT INSECTS AND MITES

Filbertworm

S. C. Jones:

The first filbert moths were taken from black light traps on July 12. The heaviest emergence of moths based on catches in the black light trap was between July 22 and August 6. Over 600 filbert moths were caught in one black light trap during the season. Very few filbert moths were caught in black light traps placed in orchards sprayed or dusted with Sevin.

Most growers contacted began spraying or dusting during the week of July 16. Due to the light crop of filberts many growers sprayed or dusted only once. Cracking tests by the writer in supervised and unsupervised sprayed or dusted orchards showed an increased infestation of filbertworm over 1961, but the infestation in most cases were less than 2%. These same growers last year applied two applications of 10% Sevin dust or sprayed with Sevin 50% WP, at the rate of 8 pounds per acre and had an infestation of less than one-half of one per cent.

Big Bud Mite

S. C. Jones:

Life history studies were made of the big bud mite on filberts to determine the most effective time to apply sprays. The mites did not depart from the old blasted buds entirely until late June or early July. New buds appear shortly after the old buds disappear. The mites attack the new buds soon after they form. Sevin and Thiodan were both effective against this mite on the foliage. No insecticide tested were effective against the big bud mite inside the old buds.

Systemics

S. C. Jones and Robert Herchler:

Dimethyl sulfoxide combined with 10% Lindane, 10% Thiodan, 10% Sevin, 10% Kelthane, 10% Guthion, and 10% Dieldrin were tested for possible systemic action on filberts and prunes during April and May of the current season.

Prune and filbert trees were treated by injecting the material into the trees and by spraying the tree trunks. From 3 ml. to 4.6 ml. of Lindane, Thiodan, and Sevin was injected into the trees. The materials

were also sprayed on other trees in the experiment. Larger filbert trees 8 to 12 inches in diameter were treated with 10% Kelthane, 10% Guthion, 10% Sevin, 10% Dieldrin and 10% Lindane. The trunks of these trees were sprayed using from 17 to 25 ml. per tree. These experiments were initiated on April 18.

Later on May 31, filbert and prune trees were treated with 25% Thiodan, Sevin, and Lindane. Limbs of large filbert trees were sprayed with 25% methoxychlor, 25% DDT and 5% DDVT. Dimethyl Sulfoxide was combined with each of these materials. Woolen cloth bands were wrapped around the tree trunks or limbs. The woolen bands were saturated with from 25 ml. to 30 ml. of each of these materials.

Later, checks were made of the insect and mite control on the treated check trees, and also for possible phytotoxicity. No phytotoxicity resulted from the tree trunk treatments. Minor phytotoxicity was observed on the foliage of limbs treated with dimethyl sulfoxide combined with 5% DDVT. Control if any was negligible.

WALNUT INSECTS AND MITES

Codling Moth

Harold F. Madsen:

Experiments were conducted with insecticides that might serve to control both codling moth and walnut aphid. Of the materials tested, Phosphamidon and Thiodan 2 gave excellent control of both pests. Morocide and Thiodan were effective against aphids, but did not provide acceptable control of the codling moth. Dimethoate gave results similar to the materials mentioned above, but is too phytotoxic to suggest for use on walnuts.

Walnut Aphid and Mites

M. M. Barnes:

Fourth year results from a study of the influence of walnut aphid and European red mite, alone and in combination, relate to the rate at which trees so infested recover from three years of infestation. Influence of such previous infestation carried over into the following year and the average yield from 16 trees of each "treatment" was as follows: previously infested for 3 years with aphids 97 lbs.; with mites 104 lbs.; with both aphids and mites 81 lbs.; and not infested, 134 lbs.

M. M. Barnes:

In an experiment for control of the walnut aphid, 7 single tree replications, observations were recorded on prevention of aphid buildup by seven insecticides during a five week period when check populations increased from 4 to 117 aphids per leaflet. Bayer 36205 was outstanding in preventing aphid buildup for five weeks, Thiodan and GC 3707 were effective for 3 to 4 weeks, Ortho 5305 and Zectran for 3 weeks, endothion for 2 to 3 weeks, and Bayer 37344 for 2 weeks. All trees were subject to reinfestation from unsprayed adjacent orchard.

S E C T I O N I V

DISEASES OF POME FRUITS

APPLE DISEASES

Apple Scab

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

Three sprays of Cyprex 3 lb. per acre applied at the pre-pink, pink and calyx stages provided very good control of apple scab for the remainder of the season, even though weather conditions were very favorable for its development. Three sprays of Cyprex 1½ lb. per acre applied on the same dates proved quite inadequate. As in previous years, some russeting occurred in all Cyprex plots. This problem seems confined to one particular district as it has not been encountered elsewhere in the B. C. Interior where this fungicide has been used for scab control.

Apple Powdery Mildew

D. L. McIntosh:

The efficacy of Moricide, a new dinitro acaracide, in controlling powdery mildew of apples was compared with that of Karathane and paste sulphur. Six sprays, beginning at the early pink stage, were applied to Jonathan trees at intervals of about 14 days until terminal growth ceased early in July. The amounts per 100 gallons were as follows: Moricide 3/4 lb. 25% W.P., Karathane 3/4 lb. 25% W.P., Magnetic 6 paste sulphur 2 lb. Mildew control with all three materials was good but Moricide was somewhat less effective than Karathane or sulphur.

Duane L. Coyier:

Sprays containing Karathane plus Cyprex were applied to bearing Newtown apple trees at 2 concentrations and on 2 application schedules. This combination is recommended for the control of scab and powdery mildew on apples in the Hood River Valley. One-quarter and one-half pound rates of the chemicals were compared on 3- and 8-spray schedules during the 1962 season.

Concentrations of ¼ and ½ lb./100 gal. on an 8-spray schedule resulted in approximately 90% control of terminal infection. The ½ lb./100 gal. rate on a 3-spray schedule resulted in approximately 82% control which was poorer than the two previously mentioned treatments but better than the control on those trees which received ¼ lb./100 gal. of each of the chemicals on a 3-spray schedule.

Commercial dusting and spraying equipment was used to compare Karathane-Cyprex dust and spray combinations on regular and intensified

schedules. The dust formulation contained Karathane (2%) plus Cyprex (4%) and was applied with a tractor-mounted duster at the rate of 50 lb./acre. The spray contained 3 lb. Karathane (22.5% WP) plus 3 lb. Cyprex (65W) per acre and was applied with a speed-sprayer. The regular schedule consisted of 3 applications at approximately 2-week intervals. As an incidental treatment, one-half of each block was sprayed with lime-sulfur (5 gal.) plus 83% oil emulsion (3 gal.) in the delayed dormant stage of bud development.

Dust treatments compared favorably with spray treatments on both schedules. The intensified schedule resulted in better control of powdery mildew (Podosphaera leucotricha) than the regular schedule. No effect due to treatment with lime-sulfur and oil was noted. There was no development of apple scab (Venturia inaequalis) in either of these experiments.

Storage Rot

Duane L. Coyier:

Twenty-six treatments were applied to Newtown apple fruits to determine their effect on storage rot control. These treatments included various concentrations of dusts and sprays, pre- and post-harvest application, and inoculated versus non-inoculated fruits. Fruit rot counts are not yet complete and will be reported at the 1964 meeting.

PEAR DISEASES

Pear Scab

Duane L. Coyier:

An experiment was set up late in June to determine the feasibility of pear scab (Venturia pyrina) eradication in a block of Bartlett pears. Due to an inadequate early season spray program, the disease incidence was high when the first sprays were applied on June 24, 1962. The following compounds were evaluated: Cyanamid Cyprex, Rohm and Haas CR 3030, and Stauffer N-3684. The first two materials reduced the incidence of scabbed fruits but Stauffer N-3684 was not effective in these tests.

Storage Rot

Duane L. Coyier:

Five pre-harvest treatment were applied to D'Anjou pears to determine their effects on storage rot control. Fruits were collected from each of the pre-harvest treatments and one-half of these were dipped in a spore suspension before storage. Fruit rot counts are not yet complete and will be reported at the 1964 meeting.

S E C T I O N V

DISEASES OF STONE FRUITS

CHERRY DISEASES

Brown Rot

L. E. Lopatecki:

Good control of brown rot blossom blight of sweet cherries was obtained in limited tests of two new compounds, Ortho 5865 and N-2777. These materials, used at 1/2 the recommended strength, compared favorably with magnetic sulphur and phygon.

Fungicides were applied at 10%, 50% and 100% full bloom. Ortho 5865 and N-2777 applied at the rate of 1 lb. per 100 gallons reduced cluster infection 60% and 81% respectively. In comparison, magnetic sulphur at 4 pints per 100 gallons, and phygon at 1/2 lb. per 100 gallons, reduced infection 50% and 76%. No phytotoxicity was noticed. The weather at the time of the tests was cool and wet, with no frost.

PEACH DISEASES

Rhizopus Rot

L. E. Lopatecki:

A number of materials reportedly of some effect against Rhizopus rot were tested for ability to prevent development of this disease in peaches during the ripening period. All materials were applied as a dip, either with or without addition of Triton B 1956 wetting agent. Concentration of Captan, Botran and Polyram was 1 lb. active per 100 gallons, dehydroacetic acid 0.4% and butyl amine 0.5%.

Every fruit was inoculated by nicking the skin and applying a drop of spore suspension on the break. Following inoculation, fruit was held at 70° for 6 hours and then samples dipped in the various fungicides for a period of 2 minutes. The relative amount of rot developed in the different treatments when the fruit had reached canning ripeness is as follows:

Treatment	% Rot
H_2O	85
Captan	70
Botran	0.8
Butyl amine	85

Treatment	% Rot
Polyram	98
Dehydroacetic acid	20

The control of Rhizopus by Botran is outstanding. In all cases, addition of Triton to the fungicidal mixtures decreased effectiveness.

S E C T I O N V I

SPRAY RESIDUES, COMPATIBILITY, PHYTOXICITY, BEE POISONING AND POLLINATION, CONCENTRATE SPRAYING AND EQUIPMENT

SPRAY RESIDUES

L. C. Terriere and Ulo Kiigemagi:

Multiple residues on pears: Pears from five plots at the Southern Oregon Branch Experiment Station treated with various combinations of chlorinated hydrocarbon insecticides were analyzed by the microcoulometric gas chromatographic method. At harvest only one combination (dieldrin, DDT and chlorobenzilate) resulted in a combined residue over a tolerance.

Perthane on pears: Late season application of Perthane to pears for pear psylla control resulted in the following residues: 2 qts./100 gal., 0 days, 10.8 ppm, 21 days, 8.3 ppm; 1 qt./100 gal., 0 days, 5.0 ppm, 21 days, 4.8 ppm. Assuming a tolerance of 15 ppm, the harvest residues would be 55% and 32% of tolerance.

R. R. Legault and R. C. Maxwell:

Dilan in pears: Bartlett pears grown in Wenatchee were sampled at intervals up to 61 days after spray application of Dilan, 0.5 pounds actual/100 gallons. Residues of Dilan after 61 days averaged 0.31 p.p.m.

Results from the analyses of D'Anjou pears from Vancouver which had received the same treatment were highly variable. This was apparently due to an unexplained loss of Dilan during storage of the extracts. Only 17 per cent recovery of Dilan was obtained from fortified extracts of D'Anjou pears as compared to 87 per cent recovery from extracts of Bartlett pears when both were stored 3 months at 35°F.

Perthane in Pears:

Bartlett and D'Anjou pears grown in Wenatchee were treated with Perthane, 1 pound actual/100 gallons. Average residues of Perthane 21 days after spray application were 1.6 p.p.m. in Bartletts and 1.9 in D'Anjous. The rate of disappearance of Perthane from both varieties was very slow.

COMPATIBILITY

Stan Hoyt:

Morocide was found to be compatible with Guthion, Diazinon, Sevin, Ziram, Captan and DDT plus parathion. Morocide plus Cyprex caused a russet ring on a small percentage of Golden Delicious fruit. Morocide plus B 1956 resulted in some foliage injury on Red Delicious.

Duane L. Coyier:

Ammonium polysulfide, alone and in combination with several other materials, was tested on Newtown and Red Rome apple foliage. Combination of ammonium polysulfide with Morocide or ziram resulted in good mechanical compatibility. The fermate combination was less desirable and ammonium polysulfide plus Cyprex resulted in an unacceptable product which thoroughly clogged the strainer screens.

Application of these combinations to apple foliage resulted in necrosis of the leaves which was indistinquishable from other sulfur compounds used. It would appear that the same precautions should be followed with use of ammonium polysulfide as with other sulfur compounds.

S. C. Jones:

Insecticides combined with karathane and cyprex were tested for phytotoxicity during the pre-blossom stage of bud development. The combination sprays were: karathane, cyprex and diazinon; karathane, systox and cyprex; karathane, cyprex, and Thiodan; and karathane and cyprex without an insecticide. Minor toxicity was observed on the upper branches of the trees on red delicious and Gravenstein varieties where systox and diazinon was used in combination with karathane and cyprex.

PHYTOTOXICITY

Stan Hoyt:

Guthion - ethyl Guthion emulsion, and iso-propyl chlorobenzilate caused a russeting of Golden Delicious apples. Bayer 36205 and Bayer 39007 caused some defoliation on apples. Union Carbide 8305 caused a burn on the calyx end of Red Delicious and Union Carbide 20047 caused a ring-type of injury on Winesaps. General Chemical 3707 produced severe foliage injury from a single application.

F. E. Ellertson:

One application on August 10 of the following on Anjou pear fruits and foliage produced injury or discoloration; Morocide - 1 lb. (yellow spots on fruit); Morocide - 1 lb. plus Cyprex - .5 lb. (smooth deposit, yellow spots not prominent on fruit); Morocide - 1 lb. plus Guthion W - 1.5 lbs. (russet ring on fruit, yellow spots on fruit); Morocide - 1 lb. plus Ziram - 1.5 lbs. (yellow spots very pronounced on fruit under spray deposit). Bayer 36205 - .5 lb. (leaf burn plus crescent and spot burn on fruit). OW 9 E - 7 oz. alone, or in combination with Cyprex - .5 lb., or Guthion W 1.5 lbs., or Ziram - 1.5 lbs. (leaf burn, russet ring and spot burn on fruit).

On the basis of one application on June 1 to Red Delicious apple fruits and foliage, GC 3707 25% W at 2 lbs. gave foliage injury on growing tips. Bayer 36205 at .5 lb. applied once on August 10 to Red Delicious apple fruits and foliage produced small brown spots on lobes of fruit. Morocide applied to Red Delicious apple fruit throughout the growing season at .75 and 1 lb./ 100 produced yellow discoloration under spray deposit. These spots disappeared as deposit weathered and fruit began to take on red color.

BEE POISONING AND POLLINATION

Carl Johansen and Robert Hutt:

Bee poisoning tests were conducted on apple and alfalfa. Bayer 29493 WP and E, Bayer 37344, and Bayer 44646 are highly toxic to honeybees by both direct and residual action; Bayer 25141, Vapona, Ethyl-methyl Guthion, Phosphamidon, and Imidan gave one day or more of residual hazard; Zectran continued to kill for about ten hours; Dimethoate, Bidrin, UC 8305, Bayer 39007, Bayer 36205, UC 10854, and GC 3707 only show 2 1/2 to 5 hours of residual toxicity; and GC 4072, SD 7438, and Metasystox gave no residual hazard. Several of the residual test results were modified by adverse weather conditions. Variations were shown with differences in formulation or dosage level in some cases. As usual, E formulations provided a reduced residual hazard to bees as compared to WP formulations.

Samuel G. Kelley:

Pollination of the Tree Fruit Experiment Station orchards was considered successful with one colony of bees per acre of blooming trees.

Weight records of individual colonies in three localities showed gains in proportion to freedom from spray poisoning and availability of nectar. Swarming caused poor gains in some colonies.

Beekeeping by orchardists would be considered feasible if the orchardist, or someone in his employ, has knowledge and liking for beekeeping. Stronger colonies and surplus honey yield can be attained by moving bees to a forage crop area after the pollination season to obtain better nectar flow and avoid excessive bee poisoning.

An experimental compound, propionic anhydride, was used for driving bees from supers when removing honey. Results were inconclusive and more experiments are planned for 1963.

CONCENTRATE SPRAYING AND EQUIPMENT

Everett Burts:

Concentrate spray applications were generally as effective as high volume applications in controlling insect and mite pests of tree fruits. In some plots, control of spider mites was slightly better with the high volume application, but in no case did the concentrate application fail to provide commercial control. Under severe infestations of spider mites, the concentrate application would probably not be effective in a single spray.

A method of evaluating the spray deposit from a helicopter was developed. Crystallin violet dye dissolved in Ethanol was sprayed onto filter paper discs placed at various locations in the trees. The dye was dissolved from the filter paper and the concentration measured on a colorimeter.

J. E. Dibble and H. F. Madsen:

Concentrate sprays gave equal or near equal control against insects and mites on pears, prunes, peaches, apples, walnuts, and almonds when compared with dilute sprays in tests in Northern California orchards. Possible advantages in the use of concentrate sprayers include reductions in the amount of water needed and number of fills now used per acre in dilute spraying (40 to 90 vs. 300 to 1500 gallons per acre). The amount of pesticide used per acre can possibly be reduced by 25 to 40 per cent. Reductions are also possible in time and man hours per job as well as sprayer costs and maintenance with use of concentrate spraying equipment. No phytotoxic effects were caused by any of the spray test applications. Little value was found in the semi-concentrate (125 gpa) over concentrate applications. Some dilute sprayers can apparently be used to apply effective concentrate application.

Fred P. Dean and Marvin H. Brunson:

Studies of concentrated sprays as a method of applying insecticides and acaricides to apple and pear trees was continued this year at Yakima. Sprays of Guthion 25% WP 12 lb. per acre were applied May 22, June 22, and July 25 to 1-acre blocks of apple trees. Tedion 25% WP 8 lb. per acre was included in the first application and Kelthane 18.5% WP 12 lb. per acre in the third application. Concentrations of spray used were 1X, 2X, 4X, 8X, and 16X (800, 400, 200, 100, and 50 gallons per acre, respectively) with an air blast sprayer (Orchard Master) and 13.3X (60 gallons per acre) with a concentrate sprayer (Turbo-Mist). Results showed that deposits of Guthion on leaves at the 6- and 12-foot levels were about the same for all concentrations, but the deposit at the 18-foot level decreased as much as 34%, in comparison with the deposit at the 12-foot level, as the number of gallons applied per acre were reduced.

Bioassay of the toxicity to codling moth adults, eggs, and larvae of residues on samples of leaves taken from trees at weekly intervals after spray application showed that the mortality caused by the residue was about the same regardless of the volume of spray applied per acre. The mite populations on samples of leaves from the blocks of trees were about the same in all experimental plots at the 6- and 12-foot levels, but there was considerable difference between the mite population at the 12- and 18-foot tree heights and the mite population increased markedly at the 18-foot level with the decrease in volume of spray applied.

Pear plots were sprayed for control of pear psylla three times during the season with Guthion 25% WP 9 lb. per acre in concentrations of 1X, 2X, 4X and 8X (600, 300, 150, and 75 gallons per acre) with a Turbo-Mist sprayer. Chemical analyses of Guthion deposits were made on samples of leaves taken immediately after each application at 6- and 12-foot tree heights, and the pear psylla nymph population was counted on samples of leaves taken from the same tree heights at intervals during the season. There was practically no difference in the deposit on leaves at the 6- and 12-foot levels or between plots sprayed with the Orchard Master sprayer at different concentrations. The trees sprayed with the Turbo-Mist sprayer showed about one-half as much deposit at the 12-foot level as at the 6-foot level. The different results with the two spray machines is believed to have been caused by the dense foliage of pear trees and the smaller amount of air delivered by the Turbo-Mist machine in comparison with the Orchard Master machine. Pear psylla in these tests was controlled satisfactorily with all concentrations applied with both spray machines.

A. D. McMechan, Summerland, B. C.:

A study was made of the relative efficiency of hydraulic and mechanical agitation systems for keeping wettable powder formulations in uniform suspension in the spray tank. In general, mechanical agitation proved superior to hydraulic agitation. Assistance was given to two British Columbia sprayer manufacturers in the design of satisfactory mechanical agitation systems for their sprayers.

Three p.t.o.-operated air-blast sprayers were assessed at the laboratory. The air velocity and air volume readings given were measured when the tractor p.t.o. shaft was turning at 600 r.p.m.

Sprayer	Average air velocity	Approx. air volume per side
Victair (double side)	124 m.p.h.	7,500 c.f.m.
Besler 325 (double side)	107 m.p.h.	7,600 c.f.m.
Power Blast (single side)	83 m.p.h.	13,650 c.f.m.

For satisfactory concentrate spraying in mature standard trees the sprayer must produce an airstream with average velocity of well over 100 m.p.h. and a volume of over 7,000 c.f.m. per side. Sprayers having average air velocity less than 100 m.p.h. invariably overspray the lower parts of the trees. On this basis the Victair would be considered satisfactory (but not exceptional), the Besler marginal, and the Power Blast unsatisfactory for concentrate spraying. Sprayers having characteristics like those of the Power Blast are better suited for high volume than for concentrate spraying.

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