ABSTRACTS OF REPORTS FROM THE
24th ANNUAL PACIFIC NORTHWEST VEGETABLE INSECT CONFERENCE

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NOT FOR PUBLICATION OR FURTHER REPRODUCTION

These are abstracts of progress reports on research conducted on principal insect pests of vegetables, small fruits, and certain ornamentals in the Pacific Northwest and are not intended in any way to constitute recommendations of the Conference. Recommendations can only be made by public service entomologists from their respective areas.

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TABLE OF CONTENTS

SMALL FRUITS, ORNAMENTALS, HOPS, MINT, DILL--Section I . . . . . . . . 1
SYMPHYLANS, WIREWORMS, WHITE GRUBS & SOIL INSECTICIDES--Section II . 11
CRUCIFERS, CARROTS, CELERY, ONIONS--Section III . . . . . . . . . . . . . . 17
BEETS, LETTUCE & ASPARAGUS--Section IV . . . . . . . . . . . . . . . . . . . 23
BEANS, TOMATOES, SWEET CORN, PEAS--Section V . . . . . . . . . . . . . . 25
POTATO INSECTS AND EQUIPMENT--Section VI . . . . . . . . . . . . . . . . 27
PESTICIDE RESIDUES--Section VII . . . . . . . . . . . . . . . . . . . . . . . . . 39
# Table of Contents

1. Small fruits, ornamentals, hops, mint, and -- Section I
2. Syphilis, tuberculosis, white grub, and soil insecticides -- Section II
3. Carrots, celery, onions -- Section III
4. Beets, lettuce, asparagus -- Section IV
5. Beans, tomatoes, sweet corn, peas -- Section V
6. Rodney insects and equipment -- Section VI
7. Pest control residues -- Section VII
SECTION I

SMALL FRUITS, ORNAMENTALS, HOPS AND MINT

Slug Control

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A number of dried, powdered plant derivatives were compared as attractants for slugs in efforts to find suitable base materials for molluscicidal baits. Slugs were attracted to all of the materials tested. The greatest numbers of the reticulated slug, Prophysaon andersoni, were found at bait stations containing bran, ground milo, wheat, clover, rye and oats. Fruit pomaces and ground potatoes attracted the fewest slugs. Arion ater favored ground potato over the other materials tested.

A comparison of commercial metaldehyde preparations indicated that slugs were attracted in larger numbers to those baits containing ground grain when evaluations were made by a bait station technique. However, when the baits were broadcasted to small plot areas in a strawberry field, the differences between treatments could not be explained solely on a basis of the nature of the inert constituents. When rain fell after the applications were made, pelletized baits gave better slug control than meal. The inclusion of additional toxicants with the metaldehyde offered no apparent advantage, regardless of the environmental conditions following treatment.

In additional tests, Bayer 37344 baits compared favorably with commercially available metaldehyde baits.

Slug and Snail Control Studies

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1. Greenhouse screening tests were continued in 1964, but no materials were found which showed more promise than the carbamate, Bayer 37344 (Mesural), for both slug and snail control with baits. Trials on slugs with Zoom cereal and bran baits of different concentrations indicated that (1) mill-run bran was as good or better than the dry cereal, Zoom, as an attractant-carrier, and (2) that 1, 2 and 3% concentrations of Bayer 37344 were equally effective, with 4% being slightly less so. Studies with the gray garden slug, Deroceras reticulatum, and the European black slug, Arion ater, continued to indicate a definite difference in susceptibility to metaldehyde according to age -- immature slugs being more tolerant of this chemical than mature forms.
2. Field trials on grass-clover plots in Clatsop County with metaldehyde and Bayer 37344 flake-type baits indicated that 37344 was superior to metaldehyde in reducing gray garden slug populations, but that application rates of at least 20 lbs of bait per acre were needed for good control. A wettable powder spray of 37344 at 4 lbs actual per acre was needed to compare favorably with the baits for effectiveness.

Strawberry Aphid Control by Systemic Insecticides

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Strawberries were treated with phorate or Di-Syston after planting by one of three methods: (1) drenching the soil around each plant with a cup of diluted chemical; (2) side-dressing the chemical; (3) a drenching spray (1 gal water per 25 ft of row). The drenching spray (1 lb actual of phorate or 0.67 lb actual of Di-Syston per acre) was not successful.

Phorate as a soil drench at 2 lb actual per 10,000 plants per acre controlled the strawberry aphid from April 25 through August. Di-Syston at 1.33 lb was equally effective.

Six weeks after treatment, the side-dressed plots of both chemicals had more aphids than the check. The increase in population was proportional to the amount of chemical used. Two weeks later this effect was seen in only part of the lower rate plots. Good aphid control was given by most of the side-dresses treatments for a short time in July.

Laboratory Tests of Insecticides Against Root Weevils

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Chemicals were screened against the adult obscure root weevil (Sciopithes obscurus) by spraying filter paper in a Potter spray tower and then confining weevils on the paper in petri dishes. Malathion, parathion, and diazinon at 0.0011 mg of actual per cm² of filter paper killed 90, 100, and 70%, respectively, in 24 hr. At 0.0045 mg per cm², these three chemicals killed 100% in 24 hr and Guthion killed 90%. Endosulfan, carbophenothion, and carbaryl were ineffective at these rates.

Chemicals were tested against adults of the strawberry root weevil (Brachyrhinus ovatus) in the manner described above. Aldrin, the standard, killed 7 of 9 weevils in 24 hr at the rate of 0.000018 mg per cm² of filter paper. Endosulfan killed none at that rate but killed 9 of 9 at 0.00036 mg per cm². UC-10854 killed 3 of 9 at 0.000026 mg per cm² and 9 of 9 at 0.0009 mg per cm². Other chemicals showing promise in the 0.0009 - 0.0035 mg per cm² range were Bayer 37289, parathion, Guthion, diazinon, and Zinophos. Carbophenothion, carbaryl, Imidan, Bayer 25141,
Malathion, GC-4072, and Bayer 37344 showed less or no promise at 0.0035 mg per cm².

Granular chemicals were tested against adult B. ovatus by sprinkling the granules on the surface of the soil and confining adult weevils on the soil under a petri dish. All were tested at 5 lb actual per acre. Zinophos killed 9 of 9 weevils in 24 hr. None of the other chemicals killed more than 1 or 2 of 9 weevils in 24 hr. N-2790 killed 8 of 9 in 3 days. GC-4072, GC-9160, GC-9879, UC-8305, UC-21149, and parathion killed 3–6 of 9 weevils in 3 days. Aldrin and heptachlor killed 12 of 12 weevils in 3 days after the granules were "aged" in the field 11 weeks. Chlordane in the same test killed only 3 of 12 weevils.

Aldrin, Zinophos, and Bayer 39007 were mixed in soil at 2 ppm and tested against B. ovatus larvae collected in May. All prevented pupation but killed only 1–3 of 15 larvae in 2 weeks. Parathion neither killed any larvae or prevented their pupation. Twelve of 15 larvae in the check survived and 9 pupated and none died. In a second test, aldrin at 40 ppm killed only 4 of 15 larvae in 2 weeks but none pupated while 13 of 14 survivors in the check pupated.

Zinophos and phosphamidon were tested against B. ovatus larvae collected in September. Neither chemical killed any larvae in a week.

Control of Weevil Grubs with Soluble Insecticides

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An attempt to control root weevils in strawberries by drenching the rows with soluble insecticides was not successful. Fifteen compounds were tried, mostly at 5 pounds active ingredient per acre in water equal to about 1,000 gallons per acre. An identical plan was used in two fields, one infested with two species in the Brachyrhinus group and one with Nemocestes. Zinophos, considered the most promising material, was used at three rates of application and one rate with double the amount of water with no effect.
Control of Insects and Mites on Currants

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Currant borer:

Fourteen insecticides were tested on two varieties of red currants for control of the currant borer, Ramosia tipuliformis (Clerk), in 1963. Of these parathion (1 lb. act./acre) and Bayer 25141 (1 lb. act./acre) gave 78.8 per cent control and Dylox (1.5 lb. act./acre) gave 68.2 per cent control. Other compounds and their per cent control are: Imidan (61.1), Bayer 29493 (52.3), Meta-Systox-R (45.2), N-2404 (41.6), NIA-9227 (41.6), Bayer 37289 (41.6), Bayer 41831 (41.6), Sevin (38.1), Guthion (34.6), Bayer 44646 (15.1) and Bayer 38156 (9.8). All insecticides tested were better than the untreated check. Parathion, Bayer 25141 and Dylox were tested in larger, replicated plots in 1964.

Two-spotted spider mite:

Eight acaricides were tested for control of Tetranychus telarius (L.) on two varieties of red currants in 1964. Satisfactory control was achieved with sprays of Aramite (2 lb.), Morocide (1 lb. and 2 lb.), Morestan (1 lb. and 2 lb.) and Aramite (1 lb.) were intermediate giving some control. Banol at 1 and 2 lb. rates was unsatisfactory.

Grape Insect Investigations

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Black vine weevil:

Most vineyards in the Yakima Valley that had a black vine weevil population in 1963 used 5 lbs. of actual aldrin per acre applied as 10% granules to the soil surface to control the weevils in 1964.

In aldrin-treated vineyards cluster injury ranged from 0 to 8.2% on the lower wire of the trellis while an untreated vineyard sustained 40% cluster injury on the lower wire.

Work was started to explain why the aldrin application to the soil surface is effective. Three factors investigated were: temperature, insecticide and solar radiation. Preliminary results indicate: (1) weevils die in the shortest time when subjected to high temperature (over 108°F), (2) weevils die during an intermediate time period (less than 5 hours) in full sunlight at temperatures of 90°F to 107°F, and (3) weevils die during a longer time period (less than 72 hours) at temperatures less than 92°F when treated with .5 micrograms of aldrin.
Thrips:

Thrips, primarily flower thrips, Frankliniella spp., caused considerable scarring of grape berries in 1963. Experiments were conducted in two locations to evaluate the effect of 2 lbs. actual DDT per acre applied at bloom for control of thrips. Results indicate excellent control of nymphs was obtained up to 2 weeks following treatment but very poor adult control was achieved. There was no difference in per cent injured berries or berry number per cluster between treated and untreated areas.

An application applied during bud-stage and prior to bloom will be tested in 1965.

Tolerance of Lilium longiflorum (Easter Lily) to Systemics

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Evenly graded yearling bulbs of the Easter lily varieties Ace and Croft were treated with granular formulations of phorate (Thimet) and DiSyston at planting time, fall of 1963. Rates of 4, 8, 12, 16 and 20 lbs actual per 12,000 row-feet were used for each material. No differences in top growth were evident during the growing season of 1964. Bulbs were dug Sept. 1964. Weight increases of treated bulbs generally were slightly under the untreated checks, but varied. The higher rate produced some of the higher increases. The differences did not appear to be significant. Root development in all treatments was excellent to good, but only fair in the untreated check lots. DiSyston had a stimulating effect on stem bulblet production. The experiment was carried on at the Pacific Bulb Growers' Association Research Station, Harbor, Oregon.

Evaluation of Several Organic Phosphates for Tulip bulb aphid, Anuraphis tulipae (Fonsc.), Control on Greenhouse Forced Iris

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Pot drenches of phorate, Di-syston, Bidrin, and Meta-Systox R all gave control of the tulip bulb aphid when applied at the rate of .2 oz per 4-in. pot. However, Bidrin took longer to become effective and was not as persistent as the other materials.
Orange tortrix, Argyrotaenia citrana (Fern.),

Sex Attractant Studies

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Procedures, techniques, and observations on the rearing, biology, and sex attractant studies of the orange tortrix are described. A simplified semisynthetic diet for laboratory rearing and procedures for handling of the insect are discussed as well as observations on sex ratio of adults, multiple mating habits, and methods of isolation of a natural sex lure.

Soil Drenches of Bidrin at Several Rates
Ineffective in Controlling the
Western Lily Aphid, Macrosiphum scoliopi Essig., on Easter Lilies

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Bidrin applied at .25 oz, .5 oz, 1 oz, and 3 oz in 1/4 cupful of water per pot indicates that if a sufficient amount of Bidrin is used to control the western lily aphid throughout the forcing period on either Ace or Croft lilies, the resultant phytotoxic effects would produce unsalable plants.

Insect Control on Ornamentals

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Insect control on greenhouse chrysanthemums


Greenhouse trials on pot chrysanthemums showed that Meta-systox-R applied as a soil drench to plants treated with B-995 significantly increased bloom diameter and weight compared to B-995 alone, but did not affect the stem-retarding function of B-995. Blooming date of plants treated with Meta-systox-R with or without B-995 coincided with that of untreated plants. Those treated with B-995 alone were delayed about 7 days. These results were obtained with Yellow Shasta plants sprayed with B-995 5 percent liquid at 1:19 dilution, then soil-drenched twice at 3- and 8-week intervals with Meta-systox-R 25 percent S.C. 1 pt. per 100 gal. at 4 fl. oz. drench per 6-inch pot.
2. Systemic insecticide-soluble fertilizer combination.

Dilute drenches prepared from stock solutions of Meta-systox-R alone and in combination with soluble fertilizer and applied daily to the soil for a period of 30 days gave aphid control equal to that obtained with two drenches of freshly prepared Meta-systox-R. Growth and quality of plants treated daily with systemic-fertilizer combination was equal to those treated daily with fertilizer only. The stock solutions were prepared with 6.7 ml. Meta-systox-R 25 percent S.C. and 48 gm. Rapid-gro soluble fertilizer (23-21-17) in 2 liters of water (equivalent to 3 pints and 24 lb. respectively per 100 gal.). This stock solution was diluted 1:22 for daily drenches of 50 ml. per 4 1/2-inch pot. Total toxicant was .054 gm. and total fertilizer was 1.6 gm. per pot for the 30-day treatment period.

Holly budmoth control

Low temperatures during April and May of 1964 delayed hatching of holly budmoth eggs by two to three weeks. Normal larval emergence begins in late April and early May. Sprays of malathion 55.7 percent E.C. 2 pt. and Zectran M-1888 E.C. 2 pt. per 100 gallons applied May 6 were completely ineffective. Sprays applied May 19 gave good control, including Zectran M-1888 E.C. 2 pt. with 0.5 percent terminals infested, malathion 55.7 percent E.C. 2 pt., 4 percent infested, and phosphamidon 49 percent E.C. 1 pt. per 100 gal., 7 percent infested. Untreated replicates had 65 percent of the terminals infested.

Control of leafhopper, sawfly, and aphids on outdoor roses with systemic Insecticides.

Treatments consisted of foliage sprays of dimethoate 20 percent E.C. 1 pt., Meta-systox-R 25 percent S.C. 2 pt., bidrin 81 percent E.C. 1/2 pt., Zectran M-1888 E.C. 2 pt., and phosphamidon 49 percent E.C. 1 pt., per 100 gallons. The same materials were also used undiluted as 1-inch bands painted around the base of canes. In addition, bidrin 20 percent resin granules at 3/8 oz. per bush and Zectran 10 percent granules at 1 oz. per bush were applied as soil surface treatments around the plant crowns.

1. Rose leafhopper control

Cane-banding treatments and foliage sprays of Meta-systox-R, Dimethoate and bidrin gave complete control. Phosphamidon gave complete control as a foliage spray but was inadequate as a banding treatment. Zectran was highly effective as a foliage spray, but only partially effective as a banding treatment or as granules. Bidrin granules were partially effective.

2. Rose slug control.

Cane-banding treatments and foliage sprays of phosphamidon, Meta-systox-R, dimethoate and bidrin gave excellent control. Zectran as a foliage spray gave complete control, with partial control from banding treatment and granules. Bidrin granules were partially effective.

3. Rose aphid control.

Meta-systox-R, dimethoate and bidrin as banding treatments or foliage sprays gave good control for periods of 4 to 6 weeks, with Meta-systox-R giving the longest residual effect. Phosphamidon as a banding treatment or foliage spray was effective initially but the residual period was not longer than 10 to 14 days. Bidrin granules were ineffective, and none of the Zectran treatments controlled aphids.
Meta-systox-R, dimethoate and bidrin as cane-banding treatments or foliage sprays gave excellent control of all three pests. No plant damage from any treatments was apparent during 1964.

Control of sod webworm (Crambus spp., prob. bonifatellus) in lawns

Zectran at 4.8, 2.4, and 1.2 oz., methoxychlor at 4.8 oz., phosphamidon at 4.8 oz., and DDT at 4.8 oz. toxicant per 1000 sq. ft. of lawn gave good control of sod webworm with average larval infestations per sq. ft. after treatment ranging from 0 for Zectran at 4.8 oz. to 3 for DDT at 4.8 oz. DDVP at 4.8 oz., naled at 4.8 oz., and chlordane at 9.6 oz. provided only partial control with average infestations after treatment of 8 to 10 larvae per sq. ft.

Both naled and DDVP used as emulsifilable concentrates caused burned areas on the grass. Chlordane at 4.8 oz. toxicant gave poor control with 17 larvae per sq. ft. Untreated replicates showed a mean infestation level of 28 larvae per sq. ft. Chlordane, naled, DDVP, DDT, Zectran, and phosphamidon were all used as emulsifilable concentrates and applied with a watering can at 5 gallons of water per 1000 sq. ft. In addition, Zectran was used as wettable powder in 5 gallons, and as granules. Methoxychlor was used as wettable powder.

Increasing the amount of water to 25 gallons per 1000 sq. ft. did not materially improve webworm control with any of the treatments. From the results obtained in this trial and from other reports received it is apparent that chlordane is not providing effective control for sod webworm in the Vancouver Island area.

Effectiveness of systemic insecticides for control of narcissus bulb fly

King Alfred bulbs receiving in-furrow treatments at planting time with granules of Bayer 25141 10 percent at 5 lb. toxicant per acre, phorate 10 percent at 3 lb., Zinophos 10% at 5 lb., V-C 13 5 percent at 10 lb., Di-Syston 10 percent at 2 lb., and N2790 10 percent at 2½ lb. had practically no bulb fly infestation at harvest compared to about 30 percent infested bulbs in untreated plots.

Control of Hop Pests

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1. On June 30 and August 5, Banol (U-12979) or 6-Chloro-3, 4-xylxy methylcarbamate (75% W.P.) and Morestan (Bayer 36,205) or 6 methyl-2, 3-quinoxylinedithol cyclic carbonate (25% W.P.) were applied with a speed sprayer to 42 hop plants at the rate of 2 pounds toxicant per acre. Delivery rate of the sprayer was 100 gallons per acre. One-half pint of colloidal X 77 per 100 gallons was added to the spray tank to improve wetting of the hop foliage.

Following the second application, moderate chlorosis was observed on the Morestan sprayed foliage. Good spider mite control was indicated
for both Morestan and Banol sprayed hops for several days after spraying. However, one week afterward, spider mite resurgence was very evident, and sprayed plots seemed more heavily infested than unsprayed checks. The second application of these sprays did not appear to lower spider mite populations.

2. Di-syston (granular formulation) was again used as crown treatments for hops at the rate of 2.5 pounds toxicant per acre with a pogo-stick type applicator as developed by the Department of Agricultural Engineering. By this method, the equivalent of 1 1/2 tablespoonsful of 10% granules were deposited about each hop crown.

After about 10 days the expected reduction in numbers of hop aphids did not occur. A second application of Di-syston to untreated hop plants was made. Special care was taken to contact the stems of the hop plant with the granules. This test resulted in satisfactory control of hop aphids and spider mites from the time of treatment (July 12) until harvest in mid-August.

Investigations of Mint Pests

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Root weevils

Prior to 1962, root weevils in mint were effectively controlled with soil treatments of aldrin or dieldrin. However, in 1962 a heavy infestation of strawberry root weevil, Brachyrhinus ovatus, was found in a field near Jefferson, Oregon. This field had been treated with aldrin for three successive seasons, and no control was being accomplished.

No promising results were obtained when 23 different insecticides were used against root weevils from this infested field. Malathion, at the rate of one pound toxicant per acre has been effective on B. ovatus on strawberries. However, both malathion and parathion, at the rate of 2 pounds toxicant per acre, were not effective in this mint field.

A 1964 survey of mint fields showed three species of root weevils present in mint fields along the Santiam River in western Oregon. These species were B. ovatus (98%), B. sulcatus (1%), and B. rugosundatus (1%) of the total root weevil population. B. ovatus was also found in mint fields at Madras, Oregon.

In general, these species overwinter as partially mature or mature larvae, in the soil, and feed on mint roots whenever soil temperatures are favorable. About 25% of specimens collected on May 12 were in the pupal stage of development. All specimens collected May 20 were pupae.

The first adults were found June 3, and by June 30, 90% of adults had emerged from the soil, and were feeding on mint foliage. There was no clear cut difference in the seasonal history of the three species of root weevils.
Prior to any adult emergence, two non-persistent phosphate soil insecticides were tested for control of root weevil larvae. Bayer 25,141 (3.7 lbs) and Bayer 37,289 (2.5 lbs.) toxicant per acre were sprayed on the soil and immediately incorporated (double disced) with the soil. Size of plots was 0.4 and 0.6 acres respectively. Comparisons of adult populations in the treated and check plots showed no measure of control.

Since most insecticides, when applied to mint as foliar or soil treatments, tend to be recovered in mintoil, tests were designed to determine if this affinity followed the use of granular formulations. On June 10, after many root weevils had emerged as adults, granular formulations of Bayer 25,141 (5.9 pounds), Bayer 37,289 (7.4 pounds) Di-syston (6.5 pounds), and diazinon (5 pounds) toxicant per acre were applied to the soil surface. Size of plots was .34, .34, .45, and .49 acres respectively. Mint, at the time of application, was growing vigorously. Some granules were noted to be impinged on the mint foliage, but these fell to the soil surface within a short time.

Samples of mint hay were collected at regular intervals from all the treated and check plots. At harvest, samples of spent mint hay and mint oil were taken for chemical residue analyses if sufficient interest could be generated in this phase of the problem.

During the season, it was observed that the granular formulations of insecticides were toxic to carabid beetles. Since carabid beetles are known to be predaceous to root weevil adults, it is possible that they could have exerted an unrecognized population pressure on root weevil adults. By actual count, over 80 per cent more adult root weevils were collected from plots treated with granular insecticides than from untreated plots.

As the 1964 season progressed, the need for a rearing technique for mass production of adult root weevils became evident, if future testing with insecticides should be required. Accordingly, the three species were caged. Eggs of the three species were allowed to hatch and reared into second and third instar larvae. More time is needed to determine if the larvae can be reared into adults.

Mint flea beetle

Resulting also from the survey of mint pests, it was evident that the mint flea beetle, Longitarsus waterhausi, was again very prominent in Ontario, Hermiston, and the Willamette Valley. This important mint pest in former years has been effectively controlled with soil treatments of aldrin and dieldrin.
Symphylan Control

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Bayer 37289 and N-2790 at 2 lb actual per acre gave good control of the garden symphylan in pole beans and sweet corn. Zinophos at 2 lb actual per acre was less effective than usual in the beans but was very effective in the corn. Diazinon at 10 lb per acre gave good control in another test on corn. At 4 and 10 lb per acre, diazinon increased yields of pole beans. Diazinon 4 EC seemed to be superior to 10% granules.

HRS-1655 fumigant failed to control symphylans in pole beans and yields were lower in those plots than in the checks. In squash and pumpkin plots, HRS-1655 gave good temporary control of symphylans. In addition, there was a stimulation of squash and pumpkin growth which was not explained by symphylan or nematode control.

The residual activity against symphylans was measured for several compounds by exposing symphylans to soil samples taken from treated plots at intervals after application. N-2790 and Bayer 37289 10G at 2 lb actual per acre and diazinon 4 EC at 10 lb per acre were effective the longest time. Zinophos 10G at 2 lb actual per acre was effective nearly as long. Granular Zinophos and Bayer 37289 were effective longer than emulsifiable concentrates, the reverse was true with diazinon, and there was no difference with parathion.

Strawberries were treated for symphylans in August, 1963. Zinophos (1 or 3 ml of 4 EC per gal of water) and parathion (1 ml of 4 EC per gal of water) were applied at the rate of 1 gal of diluted chemical per 25 ft of row. An inch of water was immediately applied by sprinkler irrigation. Parathion and the low rate of Zinophos gave no increase of yield in 1964. The high rate of Zinophos gave a yield of 3.7 tons per acre compared with 2.1 tons from the check.

Zinophos (5 lb actual per acre) and N-2790 (5-7 lb actual per acre) were applied to crop land and plowed under in October and November, 1963. Observations the following spring showed little or no decrease in the population.
Extent of plant damage associated with various infestation levels of the garden symphylan.

The threshold level of economic damage to container-grown sweet pea and bush bean seedlings occurred with infestations of 10 to 20 symphyllans per plant. Stunted growth was marked but not significant at this population level. Infestations of 40 or more symphyllans per plant caused severe stunting. These results were obtained when symphyllans were confined close to the plant root zone in a small soil volume of 8 to 28 cu. in. Plants grown in 48 cu. in. of soil did not show marked damage until infestation levels reached 40 to 60 symphyllans, and severe stunting occurred with 100 symphyllans per plant.

Published data on symphyllans indicates that under field conditions only about 30 percent of the total population present feeds actively at a given time. Counts of 10 or more symphyllans in the root zone of a plant are suggested as indicative of a potentially damaging infestation. Results of the trials reported herein agree closely with these estimates.

Length of residual effect of soil treatments for control of garden symphylan

Bayer 37289 EC (4 lb. per U.S. gal.) and lindane 20 percent EC gave good symphylan control for 20 weeks after soil treatment. V-C 13 gave partial control for 12 weeks. Diazinon 25 percent EC gave partial control for one week sufficient to warrant further trials at higher rates. These results were obtained with soil treated by drenching with insecticide at a rate equivalent to 5 lb. toxicant per acre. Treated soil was weathered outdoors with samples taken at intervals and bioassayed with symphyllans for an exposure period of 3 days.

Symphylan Control In California Asparagus

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Symphyllans can be controlled in asparagus by preplant flooding or by applying Zinophos to the soil at transplanting. Both of these measures are temporary. The problem of controlling symphyllans in established asparagus beds is unsolved; in recent field experiments Stauffer N-2790 appeared promising, Bayer 37289 partially effective, and Urea-formaldehyde ineffective.
Symphylan Investigations

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2. Soil fumigants such as Telone, Vorlex, D-D Mixture, and Vidden-D, when properly timed and applied in well-prepared soil have reduced symphylan numbers to a non-economic level for from 3 to 5 years.

3. Bayer 37,289 (5.25, 9.25, and 10.5 pounds), Stauffer N-2790 (5.25, 11.5, and 23 pounds) and Diazinon (3.2, 6.25, and 12.5 pounds) toxicant per acre were tested in a replicated series of plots May 25, 1964. Both rotary-tilled and non-tilled check plots were used for comparisons. The materials were immediately incorporated (rotary tilled) with the soil. Both Bayer 37,289 and Stauffer N-2790 showed significant persistency in symphylan laboratory tests.

Symphylan populations (10 samples per plot) determined July 8, and symphylan damage (Beet index rating) were measured August 10-11, and again Sept. 8-9. The Index rating was determined from the formula (Percentage clean beets plus 1/2 percentage slightly injured beets). Perfect control would show a value of 100. The results are indicated in the following table:

<table>
<thead>
<tr>
<th>Treatment and rate:</th>
<th>Mean symphylans per plot</th>
<th>Beet Index Rating Aug. 10-11</th>
<th>Sept. 8-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lbs. toxicant/acre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotary tilled Check</td>
<td>4.5</td>
<td>54.5</td>
<td>34.3</td>
</tr>
<tr>
<td>Untilled Check</td>
<td>8.2</td>
<td>37.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Diazinon 3.1</td>
<td>9.2</td>
<td>55.2</td>
<td>55.7</td>
</tr>
<tr>
<td>Diazinon 6.2</td>
<td>4.2</td>
<td>72.3</td>
<td>37.2</td>
</tr>
<tr>
<td>Diazinon 12.5</td>
<td>1.5</td>
<td>34.7</td>
<td>47.0</td>
</tr>
<tr>
<td>Stauffer** N-2790 5.75</td>
<td>.26</td>
<td>82.8</td>
<td>53.3</td>
</tr>
<tr>
<td>Stauffer** N-2790 11.5</td>
<td>.20</td>
<td>79.3</td>
<td>50.5</td>
</tr>
<tr>
<td>Stauffer** N-2790 23.0</td>
<td>.40</td>
<td>89.8</td>
<td>63.3</td>
</tr>
<tr>
<td>Bayer * 37,289 5.75</td>
<td>2.0</td>
<td>78.6</td>
<td>56.7</td>
</tr>
<tr>
<td>Bayer * 37,289 9.25</td>
<td>.5</td>
<td>79.0</td>
<td>67.0</td>
</tr>
<tr>
<td>Bayer * 37,289 10.5</td>
<td>2.1</td>
<td>86.1</td>
<td>67.8</td>
</tr>
</tbody>
</table>

* Ethyl 0-2, 3, 4- trichlorophenyl ethylphosphonothioate
** O-Ethyl-S-phenylethylphosphonothioate
In these trials, such variables as contiguous symphylan distributions were superimposed on variables such as soil tillage and symphylan and plant responses to soil chemicals.

The results show that depending on the criterion used (symphylan population, crop stand, or degree of symphylan root damage) almost any interpretation can be assigned to these data. For example, rotary tillage seems to be equally effective as soil chemicals in obtaining a stand of germinating seeds (in this case, table beets). The results attest to the futility of using small plots to evaluate soil chemicals for symphylan control and demonstrate the need of proving a technique right or wrong before forming definite conclusions.

Samples of beet tops and roots were checked by the sulfide method for diazinon residues by the Geigy Research Laboratories. Both check and samples from the treated plots showed less than 0.05 ppm.

Millipedes in moderate numbers were found in these experimental plots and seemed to be causing primary feeding damage closely resembling that caused by symphylans on table beets.

4. Baits placed under tar paper squares in the field were tested for their attractiveness to symphylans and other soil arthropods. GC 9160 2% crop bait (SN 3-10453-23) and 4% Kepone tobacco bait (SN 3-10453-16) were attractive, but not toxic to symphylans. Kepone 4% field bait (SN-10453-32), GC 9160 2% crop bait (SN-3-10453-23), 4% Kepone tobacco bait (SN-1-10287-16) and Bombyl 1% drosophila bait (1-10287-34) were all attractive to, and toxic to, pillbugs and sowbugs.

Bio-assay Experiments with Wireworms

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Yakima, Washington

In order to determine the period during which insecticides distributed in soil remained effective for wireworm control, several registered as well as experimental organic phosphate and carbamate insecticides were incorporated in soil by means of a cement mixer and then allowed to weather out of doors in sunken barrels. Some samples of the treated soils were taken immediately after mixing and others at two week intervals thereafter. All were frozen and kept until bio-assays could be conducted. The soil used was a silt loam containing about 1 1/2 to 2 percent organic matter. The moisture of the insecticide-soil mixture was maintained between 16 1/2 and 19 percent for the bio-assay at room temperature.

Twenty-five larvae of the sugar beet wireworm, Limonius californicus, were divided into 5 groups of 5 larvae each and exposed to each treatment. The number of dead and moribund larvae was recorded at 24 and 72 hour intervals after introduction and also at 2 and 7 day intervals thereafter. After correcting for mortality in the untreated control, the mortality data was plotted on log probability paper and the time of continuous exposure required to kill a given percent of the test insects was calculated. When larvae in the untreated control began to die at a
rate equal to or faster than those in a treatment, the corrected log probit mortality departed significantly from a linear relation with time, thereby indicating when the treatment was no longer effective. Treatments under which the LT90 was 14 days or less included 4 lb. of granulated diazinon, 4 lb. of granulated parathion, 4 lb. of emulsifiable parathion, 4 lb. of granulated Stauffer N-2790 and 3 lb. of Union Carbide 10854. Determinations of the effective persistence of chemicals in the soil has not yet been completed.

Wireworm Control with Organic Phosphate Insecticides

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Diazinon, parathion, phorate, Zinophos and three experimental insecticides were applied for control of three species of wireworms in soils of different types and in which different crops were grown. Because of several factors involved in the experiments, control is expressed as percent reduction of damage, or wireworm survival, as compared to untreated checks.

Although diazinon, parathion, and phorate were most effective, control with diazinon was not consistent under a variety of conditions. Broadcast applications of granular parathion at 4 lbs. and diazinon at 2 lbs. per acre were effective against the Pacific Coast wireworm, Limonius canus, in sandy soil. However, in a similar soil, 3 lbs. of diazinon applied for control of the Great Basin wireworm, Ctenicera pruinina, gave only 60 percent control when applied in granular forms and only 40 percent when applied as an emulsion-type spray. In a silt loam soil containing 5 to 6 percent organic matter and infested with the sugar beet wireworm, Limonius californicus, 3 lbs. of diazinon applied as a spray was two-thirds as effective as 4 lbs. of parathion, also applied as a spray. In a similar soil, 3 lbs. of diazinon in granular form gave no apparent reduction of the L. californicus population.

Broadcast applications of granulated phorate at 3 lbs. per acre provided 86 to 100 percent control of all three species of wireworms in all types of soil in which it was applied. Granulated Zinophos applied at 2 lbs. per acre in each of two fields gave erratic control of Ctenicera pruinina, I. E., 100 percent control in sandy loam soil and no apparent control in silt loam soil.

Of the three experimental compounds tested, sidedress applications of Stauffer N-2790 and Bayer compounds 25141 and 37289 made at 3 lbs. per acre in sandy loam soil containing less than 1 percent organic matter gave 78, 75 and 43 percent control, respectively, of Limonius canus. In a silt loam soil containing 5 to 6 percent of organic matter and infested with L. californicus, 4 lbs. of Stauffer N-2790 gave excellent control, 4 lbs. of Bayer 37289 gave fair control and 5 lbs. of Bayer 25141 failed to control the wireworms.
Diazinon Degradation in Soil

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Puyallup, Washington

In laboratory experiments with carbon-labeled diazinon in four western Washington soils, radioactivity was recovered in the form of volatilized toxicant, carbon dioxide, diazinon and soil extractable watersoluble products. Volatilization was a slight factor in the loss of diazinon, initially, but was not detectable after 3 weeks. The loss of radioactive carbon was primarily accounted for by the evolution of radioactive carbon dioxide.

The half-life of diazinon varied from one week to eight weeks and the rate of degradation was influenced by application rate and soil type. The insecticide was degraded more rapidly in 3 mineral soils than in an organic soil. The half-life for insecticide applications of 1.3, 6 and 60 ug/cm³ of muck soil was 3, 5 and 8 weeks, respectively. These data indicate the importance of concentrating the diazinon in a furrow or narrow band when possible for maximum residual biological effectiveness.
SECTION III

CRUCIFERS, CARROTS, CELERY, ONIONS

Cabbage Maggot Studies

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Western Washington Experiment Station
Puyallup, Washington

Economic control of the cabbage maggot, Hylemya brassicae, on rutabagas was obtained with band applications of insecticides incorporated in the top inch of soil at planting time. Compound 4072, Bayer 37289, and Bayer 25141 applied at 2 ounces per 1000 feet of row in a 4-inch band provided 90% marketable rutabagas. Diazinon, N-2790 and Zinophos were less effective. Phytotoxicity from N-2790 and Zinophos resulted in decreased seedling emergence.

Fly populations were moderately heavy during the initial 4 weeks after treatment but rapidly declined thereafter. The low population pressure contributed to the favorable results and it is doubtful that economic control would be obtained when late second and third generation flies are present in large numbers.

Control of Resistant Cabbage Maggots in Stem Brassicas

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Vancouver 8, B. C.

Five unregistered insecticides and diazinon were applied as granules in a band at seeding, or as emulsion drenches in a band at transplanting, to broccoli, Brussels sprouts, cabbage, and cauliflower. The attacking maggots were demonstrably resistant to cyclodiene insecticides. The average percentage damage per treatment was:

<table>
<thead>
<tr>
<th></th>
<th>Peat Sandy clay loam</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Granules Drenches</td>
</tr>
<tr>
<td>B.25141</td>
<td>17.2 32.2</td>
</tr>
<tr>
<td>B.37289</td>
<td>20.0 44.1</td>
</tr>
<tr>
<td>Diazinon</td>
<td>55.9 69.8</td>
</tr>
<tr>
<td>GC.4072</td>
<td>22.5 42.8</td>
</tr>
<tr>
<td>N.2790</td>
<td>30.9 41.6</td>
</tr>
<tr>
<td>Zinophos</td>
<td>38.1 30.3</td>
</tr>
<tr>
<td>Untreated</td>
<td>93.2</td>
</tr>
</tbody>
</table>
The puparia were counted from six-inch soil cores, each with a plant at its centre, with the following result:

<table>
<thead>
<tr>
<th></th>
<th>Peat</th>
<th>Sandy clay loam</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Granules</td>
<td>Drenches</td>
</tr>
<tr>
<td>B.25141</td>
<td>0.4</td>
<td>4.7</td>
</tr>
<tr>
<td>B.37289</td>
<td>0.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Diazinon</td>
<td>1.3</td>
<td>8.1</td>
</tr>
<tr>
<td>GC.4072</td>
<td>0.4</td>
<td>1.8</td>
</tr>
<tr>
<td>N.2790</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>Zinophos</td>
<td>0.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Untreated</td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

All the treatments resulted in marketable crops, even under heavy attack. Granular treatments were consistently superior to drenches. Diazinon was the least effective material, but is recommended because it is the only one registered for use. There were no marked differences by crops in damage inflicted or in the numbers of puparia found.

Control of Resistant Cabbage Maggots

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In British Columbia cabbage maggots (Hylemya brassicae) attacking rutabagas are now highly resistant to cyclodiene soil insecticides such as aldrin, dieldrin, and heptachlor. So widespread and complete is the resistance that the 1964 provincial control calendar advised against planting turnips where resistance is established even though the crop is a profitable one.

New and promising materials were tested at the coast in 1964 using 2 oz. granular toxicant per 1000 row-feet, in peat soil and in sandy clay loam. Emergence of seedlings was adversely affected as shown by the number of seedlings in 30 row-feet.

<table>
<thead>
<tr>
<th></th>
<th>Furrow</th>
<th>Drench</th>
<th>Peat Soil</th>
<th>Sandy Clay Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banol</td>
<td>10G,</td>
<td>75WP</td>
<td>122</td>
<td>33</td>
</tr>
<tr>
<td>B-25141</td>
<td>10G,</td>
<td>6E</td>
<td>89</td>
<td>15</td>
</tr>
<tr>
<td>B-37289</td>
<td>10G,</td>
<td>4E</td>
<td>126</td>
<td>49</td>
</tr>
<tr>
<td>Diazinon</td>
<td>5G,</td>
<td>50E</td>
<td>88</td>
<td>12</td>
</tr>
<tr>
<td>GC.4072</td>
<td>10G,</td>
<td>4E</td>
<td>102</td>
<td>41</td>
</tr>
<tr>
<td>GS.12968</td>
<td>5G,</td>
<td>2E</td>
<td>136</td>
<td>62</td>
</tr>
<tr>
<td>GS.13005</td>
<td>5G,</td>
<td>4E</td>
<td>122</td>
<td>44</td>
</tr>
<tr>
<td>N.2790</td>
<td>10G,</td>
<td>4E</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>NIA.10242</td>
<td>10G,</td>
<td>50WP</td>
<td>107</td>
<td>12</td>
</tr>
<tr>
<td>SD.9098</td>
<td>10G,</td>
<td>2E</td>
<td>118</td>
<td>5</td>
</tr>
<tr>
<td>Zinophos</td>
<td>10G,</td>
<td>4E</td>
<td>75</td>
<td>20</td>
</tr>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
<td>135</td>
<td>81</td>
</tr>
</tbody>
</table>
The furrow treatments above were supplemented by one, two, three, four, and five drenches of the same materials at 30, 45, 60, 75, and 90 days after seeding. In spite of its phytotoxicity the best all-around results with a registered insecticide were obtained with three supplementary drenches of diazinon. This finding was confirmed by another experiment run in the interior. The diazinon treatment will be refined in 1965.

Cabbage Maggot Control on Cauliflower and Turnips

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Corvallis, Oregon

1. Two identical tests were conducted in the Corvallis area to determine whether certain registered insecticides would protect cauliflower transplants from maggot damage if sprayed in a narrow band along the rows and followed immediately by a sprinkler irrigation. Parathion (at 2 and 4 oz. actual per 1000 feet of row) gave adequate control for about 45 days, but the plants so treated were heavily infested by harvest time, 85 days after transplanting and treatment. Diazinon and Zinophos gave fair control to harvest, the 4 oz. rate being significantly better than 2 oz. for both materials. An unregistered material, Compound 4072, gave excellent protection at both rates of application throughout the 85 day growing season.

2. A series of six trials with purple top turnips were conducted to screen certain new chemicals and to investigate methods and rate of application of promising insecticides. Furrow treatments at seeding time seriously reduced seedling stands with most materials. Good to excellent control was obtained on both aldrin-susceptible and aldrin-resistant maggots with 5 inch band treatments 4072, Bayer 37289 and Bayer 25141 (granular formulations applied either pre-planting or post-planting at 2 oz. actual/1000 feet of row). Zinophos was effective for a longer period of time than diazinon, but neither material gave satisfactory control throughout the growing season (approximately 60 days) with single applications.

Control of Aldrin-Resistant Maggots in Cole Crops

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Washington State University
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The maggots affecting cole crops in Skagit County, Washington, are apparently completely resistant to treatments of aldrin and related compounds. The build-up of resistance was delayed in this area, perhaps because of large acreages of cruciferous seed crops which support the maggots but to which no control is usually applied. Three phosphate type insecticides were approved for use on broccoli and cauliflower at
the beginning of the 1964 season: Zinophos (American Cyanamid Co.), Guthion (Chemagro Corp.), and diazinon (Geigy).

Field observations and tests were carried out to determine the best method of application for this particular area. For transplants, the "drench" method was the most effective and least expensive. With this method the insecticide was added to the transplant water on the planting machine. Two ounces by weight of active ingredient were used in 50 gal. of water, with the machine set to deliver 5 to 6 oz. (liquid) per plant. Although both Zinophos and Guthion were both slightly superior to diazinon in previous tests, only the latter in emulsion form was used commercially, mostly for safety reasons. The Guthion emulsion had proved phytotoxic although the wettable powder was safe enough.

About half of the broccoli in Skagit County is direct-seeded rather than transplanted and must be treated by some other means than the drench method. Two methods were generally used: a spray along the row after the plants emerge, and a granular furrow application at planting time.

The later proved to be the best and least expensive in commercial applications. Either 5 to 10 per cent granular diazinon was used. It was applied in a two-inch band directly in front of the planter shoe in one operation and directly behind, or in the shoe as the seed was being covered in other operations. All gave good control with no sign of phytotoxicity.

The sprays along the row gave poorer control and were more costly, but in certain situations were all that could be used. One pound of active ingredient per 150 gallons of water per acre was used. Both Zinophos and Guthion emulsions were superior to diazinon by this method.

Two compounds, Bayer 25141 and G.C. 4072 were both superior to Zinophos when used as sprays, but when used a drenches were very phytotoxic. Bayer compounds 37289 and 37007 both gave fair control when used as sprays, while the green weight of broccoli in plots where they were used were highest on the list. Compounds S.D. 9129, G.C. 9879, S.P.6900 (Spencer Chem. Co.), and Banol (Upjohn Co.) were not effective against cabbage maggots in these tests.

Carrot Rust Fly - British Columbia, 1964

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Vancouver, British Columbia

At Cloverdale in British Columbia, seven insecticides were compared as granules in the furrow with the seed, at two pounds of toxicant per acre, to control carrot rust fly resistant to cyclodiene compounds. Further comparisons were made using the same materials in liquid form as drenches, at one pound toxicant per acre, applied directly on the rows at fortnightly intervals, beginning thirty days after the furrow treatment. A heavy infestation of the Northern root knot nematode (Meloidogyne hapla) developed in the plot area and made results difficult to assess.
Plots were planted in mid-May when adults of the overwintered generation were emerging. Two counts of infestation were made: one at 75 days after sowing and the other, 75 days later. Damage was very light at the first count. The final assessment showed that B 25141 gave superior control to all other materials, when applied in the furrow and as furrow and drench combined. Diazinon and B 37289 were satisfactory when furrow applications were supplemented with surface drenches. However, Diazinon as a furrow treatment alone did not give satisfactory control. Zinophos, N 2790 (Trithion as drench), and GC 4072 gave only fair control applied in the furrow and not much better when supplemented with drenches. SD 9098 used as a wettable powder did not give satisfactory control.

In a second experiment, carrot plants from seed sown in March, were treated with the granular insecticides previously mentioned. The granules were applied as surface band treatments when carrot flies first appeared. Two drenches followed, one at 30 days after the band application, the other, ten days later.

As this was an isolated field, a program to kill adults was also adopted. Five bait sprays were applied at ten day intervals; the first on May 15, when flies were first observed. The first spray contained Malathion (1 1/3 pounds actual) and molasses (48 pounds) in 50 gallons of water. One pound actual DDT was added to the other four sprays.

Examination of the plots was made on July 29, 75 days after the first treatment. No significant differences in infestation were found between treatments, between treated plots, checks, and the main field. The entire field was harvested before the middle of September without loss from rust fly damage. It appears that adulticiding with a bait spray applied at the proper intervals will give satisfactory control of the carrot rust fly.

The Effect on Carrot Plants of Lygus Feeding on the Developing Seed from Which the Plants Were Grown

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University of Idaho  
Moscow, Idaho

Individual second-order carrot umbels were caged just after pollination in 1962 and 1963. In 1962, four population levels, 0, 1, 2, and 4 lygus per umbel were used; in 1963, five levels, 0, 1, 2, 3 and 4 lygus per umbel, were used. Seed was harvested from the individual umbels, bulked according to treatment, and planted the following year. In 1963, high significant differences due to treatment were found in the weight of roots grown from the 1962 seed: A positive correlation between numbers of lygus per umbel and the average weight of carrot roots grown from the seed existed. The tests with the 1963 seed did not confirm the above results statistically; however, the same trend in carrot root weights existed.
Control of the cabbage maggot, *Hylemya brassicae*, in the Outlook area of the Yakima Valley has been achieved with a soil application of aldrin until 1963. Less than 25% of the 1963 crop was harvested because of cabbage maggot infestation. In 1964, diazinon was applied to the soil prior to planting and an aerial application of parathion (0.8 lb. act./acre) put on at 10-day intervals after plants emerged. The main portion of most fields were completely clean at harvest. Rows near field margins, trees or powerlines where planes couldn't get coverage had some maggot injury at harvest.
SECTION IV
BEETS, LETTUCE & ASPARAGUS

Green Peach Aphid Control in Beets
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Neither di-syston or Thimet soil treatments gave adequate control of green peach aphids on table beets grown for seed. These materials were applied in a 10% granular form, both as a side dressing and sprinkled over the row, at 10, 20, and 30 pounds per acre. The first application was made June 19, 1964, when the aphid flight began to get heavy.

Foliar sprays gave some control, but nothing to compare with the control of the same insect on potatoes in nearby plots at the same time.

Soil and Seed Treatments for Control of the Sugarbeet Root Maggot

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Twin Falls, Idaho

Arch W. Richards
Research Agronomist, Utah-Idaho Sugar Company
Idaho Falls, Idaho

Charles Stanger
Research Agronomist, Amalgamated Sugar Company
Burley, Idaho

Field plot experiments for control of the sugarbeet root maggot were continued at Rupert and Blackfoot, Idaho, during 1964 in cooperation with the Amalgamated and Utah-Idaho Sugar Companies. Various insecticides were applied as granular formulations in the drill row at planting time and incorporated into the pellets of pelletized seed. Maggot counts in samples taken from some treated plots were lower than counts from untreated check plots or plots treated with less effective insecticides. None of the insecticide-treated plots gave a yield that was significantly higher than the untreated checks. Phytotoxicity was probably responsible for the reduction in yield in some treated plots. Considering both maggot count and yield of the 16 materials tested, ethion, carbophenothion, schradan, stabilized phorate, VC-13, and Stauffer 2790 show enough promise to justify further testing.
Several insecticides gave excellent control of the beet webworm in laboratory screening tests. Thirty-one materials were compared with DDT and endrin, used as standards, in sprays at \( \frac{1}{4}, \frac{3}{4}, 1, \) and 2 pounds of toxicant per acre in 35 gallons of water. Twelve of these materials gave 100-percent mortality in 48 hours when the larvae were caged on the plants 1 day after spraying.
LEAFHOPPERS INFESTING FIELD BEANS ADJACENT TO RED CLOVER

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In 1964 a study was made in the Columbia Basin, Washington, of the insects found on beans which might be involved in the transmission of certain virus diseases of beans, presumably from red clover. Collections started July 2 and continued at 7-day intervals until August 26 in each of three fields of No. 34 Red Mexican field beans. These fields were selected on the basis of their geographical location and also because they lay on the leeward side of red clover fields. Although many kinds of insects with sucking mouthparts were collected, only the leafhoppers are considered in this report.

The insects were collected with a small, motor-powered, vacuum insect-sampling machine (D-Vac, Model 12). Samples were collected from 100 feet of bean rows located 40 rows from the nearest clover field. The collected material was taken to the laboratory where it was identified. Eleven species of leafhoppers were collected from these fields during the season. Of these, the intermountain leafhopper, Empoasca filamentos DeLong, was most abundant and was followed by the six-spotted leafhopper, Macrossteles fascifrons (Stal.).

Numbers of leafhoppers collected on beans were not large, nor were they abundant on red clover. It would appear, therefore, that some other insect with sucking mouthparts, probably a homopteran, was most likely to be an important vector of the bean virus diseases.

DIABROTICA LARVAL CONTROL ON SWEET CORN ROOTS

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Corvallis, Oregon

Diabrotica larvae attacking the roots of sweet corn can still be controlled by the use of aldrin or heptachlor pre-planting soil treatments, but less persistent materials are being sought because of the possibility of residue problems with other crops grown in rotation with corn. Two chemical screening trials in 1964 failed to produce results because of lack of infestation. Another trial of late planted corn at Corvallis was band treated and hilled with various experimental materials.
28 days after planting. Significant reduction of root injury was accomplished with heptachlor (used as a standard), SD 9098, V-C 3-764, Bayer 37289, V-C 3-759, GC 9160, and V-C 9-104. Materials showing no promise in this trial were V-C 13, SD 8530, RP 11974, UC 21149, Bayer 44646 and RP 11783.

A field trial of diazinon 14G was conducted with a grower-cooperator at Junction City. The granules were banded along each side of the rows with a fertilizer attachment at approximately 2 ounces actual/1000 feet of row (1.6 lbs/acre at 40 inch row spacing) and immediately covered with soil. Application was made about one month after planting. At harvest, 65 days after treating, results showed an average 56% "control" (based on Abbott's formula) with a light infestation of Diabrotica.

Cutworms in Peas

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Washington State University
Northwestern Washington Experiment Station
Mount Vernon, Washington

The variegated cutworm, Peridroma (Lycophotia) margaritosa, became very numerous in pea fields in Skagit County, causing some processors considerable concern. A few alfalfa looper larvae were also found.

Fields that had been treated for aphids with insecticides other than parathion were most seriously affected. Parathion at one quart (one pound active ingredient) gave fairly good control. The standard rate of one pint per acre gave some control. Phosphamidon at the rate used for aphids had no effect on cutworms by field observations. In laboratory tests, this material at the dilutions used in airplane applications had no effect on the larvae. This was also true of two other systemics, dimethoate and Meta-Systox. Dibrom at dilutions of one pint to 5 gallons or one quart to 100 gallons killed all larvae contacted in a matter of minutes. Parathion at one pint and one quart per 5 gallons killed 95% of the larvae in 24 hours.

Small plots sprayed with a mist blower to simulate airplane applications indicated that Dibrom as high as one quart per acre did not give adequate control. It apparently does not contact the larvae in the dense vines and lacks the residual toxicity to kill them when they come up at night to feed. Vines from parathion sprayed plots killed larvae in the laboratory after at least two days exposure. Sevin at approximately one pound per acre gave fair control in these tests, but not as good as parathion at one pound per acre.

Adult moths of the variegated cutworm were taken in light traps throughout June and most of July. Moths of the alfalfa looper were taken in lesser numbers, but in a much greater proportion than were found in the pea fields.
SECTION VI

POTATO INSECTS AND EQUIPMENT

Potato Tuber Flea Beetle Control

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1. Soil treatments were tested at Aurora, Oregon in newly broken pasture land for control of tuber flea beetle larvae and wireworms attacking potatoes. Essentially no wireworm damage occurred, but a medium flea beetle infestation developed late in the season. Potatoes were in the ground from May 30 to October 20. Materials were broadcast and rotary-tillled into the soil just before planting, except for a sidedressing of 1% diazinon-fertilizer, which was applied when the plants were up (33 days after planting). Excellent flea beetle control was obtained with SD 9098 (10 lbs. ac./acre) and satisfactory control with Bayer 37289 (5 lbs. ac./acre) and the diazinon-fertilizer side dressing. Broadcast treatments of diazinon (up to 20 lbs. ac./acre), 4072 at 10 lbs., Bayer 25141 at 5 lbs., and Union Carbide 10854 at 10 lbs. gave lower, and unsatisfactory, degrees of control.

2. Potatoes planted in 1963 soil treated plots at Aurora generally suffered more injury from tuber flea beetles than in the year of treatment with aldrin, dieldrin, and endrin. Soil analyses in 1963 and in the spring of 1964 showed a considerable drop in aldrin-dieldrin residue concentrations in this Willamette sandy loam soil. Compounds MC-A-600 at 10 lbs/A (applied in 1964) and Bayer 25141 at 5 lb/A (applied in 1963) failed to give any degree of control in this 1964 trial.

3. Small plot potato trials at Aurora, where various insecticides were applied as surface bands just before the first or second hilling, failed to attain satisfactory tuber flea beetle control. Observations showed, however, that an infestation was present before the first hilling (when the new tubers were about pea size) and before any of the treatments had been applied.

Potato Leafroll Virus Investigations

Guy W. Bishop
University of Idaho
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Di-System applied at planting time to potatoes in a commercial field reduced leafroll virus spread, as measured by infector units, from 41.5% to 26.8%. Leafroll virus net necrosis was reduced from 13.8% to 9.7%.
Green peach aphid numbers in 1964 were extremely low throughout the potato producing areas of Idaho. Leafroll virus spread in the seed potato areas was apparently negligible.

Control of the Green Peach Aphid on Potatoes with Sidedress Applications of Systemic Insecticides

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During the past several years, different formulations of biocides have been applied to potato foliage, or the soil in which they were grown, in many ways and with a variety of experimental and commercially available equipment. The methods and equipment used, as well as other labor-saving devices useful in obtaining performance data, will be illustrated from slides.

Special attention was given to placement studies of liquid and granular formulations of systemic insecticides in the soil during the 1964 season. Of those used, Di-Syston was most effective and phorate least effective for aphid control. Mixtures of schradan with Di-Syston, phorate or dimethoate were no more effective than each applied separately. Granular formulations seemed more effective than liquid formulations, although differences were not significant.

Experiments with New Biocides for Control of the Green Peach Aphid and the Two-Spotted Spider Mite on Russet Burbank Potatoes

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Ten experimental insecticides were compared to endosulfan for control of the green peach aphid, Myzus persicae, and 13 experimental miticides were compared to carbophenothion for control of the two-spotted spider mite, Tetranychus telarius. In each experiment the materials were used as emulsion-type sprays and applied at 1 pound of actual toxicant in 20 gallons of spray per acre. Plots were four, 34-inch rows wide and 24 feet long. Each treatment was replicated 5 times in a randomized block design.

Twenty-five compound leaves were collected from each plot 3, 7 and 14 days after treatment. In the aphid control experiment the living aphids found on the leaves were counted; in the mite control experiment the mites were removed with a brushing machine, collected on recently varnished glass plates and counted.
SD compound 9129 gave very good control of the green peach aphid. Anthio, Spencer S-6900, SD 9098, UC 21427, UC 19786 and Niagara 9227 were significantly inferior to endosulfan.

Phorate, binapacryl, dimethoate, UC 19786 and UC 20047 seemed more effective than carbophenothion, but were not significantly so. UC 21327, Naug. Chem. C940, Spencer S-6900, Bayer 25141 and mevinphos seemed less effective than carbophenothion, but were not significantly so. Mevinphos plus schradan and Bidrin-R were significantly inferior to carbophenothion.

Summary and Evaluation of a Three-Year Study of the Six-Spotted Leafhopper as a Vector of Aster Yellows on Potatoes in Eastern Washington

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Beginning in 1962, a study was made of the leafhopper vectors of a disease resembling aster yellows and this virus-vector relationship was evaluated for commercial potato production in eastern Washington. Aster yellows has been recognized throughout North America where it is epiphytotic on potatoes in some areas and during some years. Other workers found the six-spotted leafhopper (Macrosteles fascifrons (Stal.) to be the most effective vector. Therefore the six-spotted leafhopper was used in greenhouse, field cage and other tests and its biology studied.

During the winter and spring of 1962-3 and 1963-4, inoculation experiments were conducted at Yakima. Viruliferous leafhoppers were placed in cages containing small Russet Burbank, Kennebec or Red Pontiac varieties of potato. Of 143 plants exposed, 45 developed disease symptoms typical of those described by other workers for aster yellows. First symptoms appeared 35 to 40 days after inoculation. Aerial tubers and aerial spurs were formed on Red Pontiac plants 50 to 69 days after infection.

Leafhoppers were collected from various crops in the summer of 1964 and placed in groups of 5 on caged aster plants. Of these, only one plant developed typical aster yellows symptoms. However, this was not considered a thorough test because not enough insects were involved.

Collections of leafhoppers were made in potato fields at weekly intervals and also on other crops from 1962 to 1964, inclusive. This study indicated that the six-spotted leafhopper become abundant only in some late plantings. In 1964 the infection of potato plants in the Columbia Basin ranged from 1 to 5% in various fields. However, when aster plants were placed in or near the border of potato fields, and left for two weeks before returning them to the greenhouse, aster yellows symptoms resulting from field infection developed in 6.6% of the plants exposed in June, 15% in July and 10% in the first part of August. No control studies were conducted during this study.
Potato Insect Pest Surveys

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Corvallis, Oregon

1. Flea beetles. Surveys carried on throughout the season failed to indicate the presence of the tuber flea beetle, Epitrix tuberis, in Malheur County, Oregon. Tuber damage at harvest time was attributed to flea beetles, but later actually determined as caused by symphylans.

At Corvallis, Oregon, tuber flea beetles were found feeding extensively on bush beans and volunteer potato plants about 100 yards away were not molested.

2. Wireworms. In Malheur County, wireworms are now causing extensive damage to potatoes. The Federal-State Inspection Service in Malheur County has estimated that 20 per cent of the lots of potatoes examined were damaged by wireworms in 1964. Not more than one or two per cent wireworm damage has occurred in the last two to three years. Ore-Ida, a processing plant has estimated that wireworm damage to potatoes in 1964 was about $100,000.

Aphid Control in Potatoes

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As in the past five years, aphid traps have been maintained in the seed potato area of Whatcom County for the purpose of determining flights of green peach aphids which carry virus diseases of potatoes. This year's records show the same general trend, with the flight beginning in June and ending in October. The number of aphids caught was very low, only 280 in 13 pans during the season.

Small plots to test insecticides included di-syston and Thimet 10% granular as soil treatments; phosphamidon, Phosdrin, Zinophos, MCA-600, Thiodan, Meta-Systox, G.C. 9879, and S.D. 9129 as foliar sprays. These were used as 0.25 and 0.50 pounds active ingredient per acre. The soil treatments were applied twice during the season at 20 and 40 pounds per acre, while the sprays were applied six times between July 1 and August 31. The flight of aphids was very heavy, as indicated by pan traps located near the plots.

All of the treatments gave control, as shown by leaf counts between spray applications compared to an untreated check. Outstanding results were obtained with Meta-Systox R at 0.25 pounds and S. D. 9129 at 0.50 pounds.
In spite of the heavy population of aphids and the presence of volunteer potatoes with leafroll symptoms within 100 feet of the plots, only one plant with current season leafroll was noted. Samples from each plot forced in the greenhouse have as yet shown no leafroll symptoms.

**Spray Deposit Pattern Studies with a Bell 47D Helicopter**

**V. D. Young, R. G. Winterfield**

**C. W. Getzendaner and C. E. Deonier**

*Agricultural Research Service, U.S.D.A.*
*Forest Grove, Oregon*

Spray deposit pattern studies using a government-owned Bell 47D rotary wing aircraft were initiated in 1964 by the Agricultural Research Service at Forest Grove. The objective of these research investigations is to ascertain the effect of boom length and location, height of flight and speed of application on the shape of the spray pattern and the swath width obtained.

The spray system consists of a gas-powered turbine pump assembly mounted on one side to the skid cross bars by a cradle, a pilot-controlled electric solenoid valve for controlling the spray valve, a spray boom and two fiberglass reinforced plastic saddle tanks mounted to the sides of the aircraft. Two lengths of boom are being tested, namely 26 feet and 48 feet. Three boom positions in relation to the longitudinal axis of the aircraft are being used, namely, forward, amidship and rearward of the C.G. In the test series herein discussed no attempt has been made to iron out irregularities in the deposit pattern rates by changing the nozzle arrangement. Instead a symmetrical nozzle arrangement is being employed for all the tests. Spraying Systems diaphragm type nylon nozzles are being used. Some tests were made using D8 orifices and No. 56 cores and the balance with D6 orifices and No. 46 cores in order to reduce the extremely high discharge rate.

Flight speeds of 30 mph, 45 mph and 60 mph were arbitrarily selected for the application speeds of this test series. The actual application speed of each flight was determined with a radar unit similar to those used by police units. In the analysis of the patterns the tests with application speeds which were within plus or minus 5 miles of the selected speed were grouped for analysis purposes. Two application levels were arbitrarily selected, namely, 5 to 8 feet and 20 to 25 feet.

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2Respectively, agricultural engineer and aircraft pilot, Agricultural Engineering Research Division, Agricultural Research Service

3Entomologists, Entomology Research Division, Agricultural Research Service
The deposit pattern curves for tests conducted using a 26-foot boom mounted both in the forward and amidship positions and using three application speeds indicate the following:

1. At the 5-8 foot application level
   a. The swath widths measured at the mean deposit rate level were all approximately 40 feet.
   b. All pattern curves show a zone of low deposit located from 4 to 10 feet right of center and a second low deposit zone about 5 feet left of center. The general shape of the curve is pyramidal.

2. At the 20-25 foot flight elevation
   a. The application swath was approximately 5 feet wider than for the lower flights.
   b. The overall shape of the patterns was the same as for the lower flight levels.
   c. Height of flight made no appreciable difference in pattern shape due to boom location or speed of application.

The pattern studies for tests conducted with a 48-foot boom mounted both in the forward and amidship positions show that:

1. At all flight levels the swath widths were increased by an amount equivalent to the increased boom length.
2. Speed and boom location had no bearing on swath width.
3. The location of the low deposit zones was approximately the same as for the shorter boom.
4. The deposit curves for the 20-25 foot application height were more trapezoidal in shape.
5. The most reasonably uniform deposit pattern curve was obtained with the forward mounted boom, a 60 mph application speed and the 20-25 foot application height.

SUMMARY

The spray deposit studies with the Bell 47 D1 helicopter, thus far, show that increasing the boom length proportionately increases the swath width. There is no appreciable difference in patterns or swath widths due to boom mounting position. The tests do not indicate any effect on the pattern due to the three different speeds other than perhaps improved uniformity when the application height is 20 to 25 feet and speed is 60 mph. No attempt was made to improve the patterns by altering the nozzle arrangement.

Future investigations with the boom mounted aft of the mast or center of gravity, will be conducted.
Two aerial spray applications were made to corn foliage with a Bell 47D-1 helicopter owned by the U.S.D.A. The objective was to determine the effects of spray penetration when the helicopter was flown at high (57 mph) and low (30 mph) speeds three to five feet above the plant canopy.

The corn row spacings were 36 inches. The average height of corn plants exceeded six feet. Two swaths of water-based dye spray were applied on 39-foot swath spacings in each test. The spray nozzle arrangement consisted of 27 nozzles spaced one foot apart on the spray boom. D6-46 orifice discs were used in test 1 and D8-56 orifice discs in test 2. The boom was mounted on the upper tips of the forward ends of the helicopter skids.

Three transects of stainless steel plates spaced on the ground one foot apart were used to obtain the spray pattern at that level between the two center lines. Two of these transects were placed in 13 rows of the corn and the other one was placed in the open. Spray being deposited on upper and under leaf surfaces were sampled by two transects of 1/2 x 1" Mylar tabs placed on the leaves at the 6', 4', 2', and 6" levels on or within the plant foliage of 13 rows. The usual laboratory procedures of colorimetric analysis were used for measurement of the spray deposits.

The spray recovery mean rate in the open were: 5.59 gpa, high speed, and 8.87 gpa, low speed. Those in the field were: 2.71 gpa, high speed, and 6.39 gpa, low speed, for transects 1; and 2.31 gpa, high speed, and 6.25 gpa, low speed for transects 2. The differences in gallonages between the two tests was due to speed of application and size of nozzle orifice openings.

For the high speed test the mean recovery rate of spray deposited on the Mylar tabs at the 6-foot level was 4.03 gpa on the upper leaf surfaces and 0.54 gpa on the under leaf surfaces. The rate at the 4-foot level were 3.39 gpa and 0.45 gpa for the upper and under leaf surfaces, respectively. Those at the 2-foot level were 2.13 gpa and 0.39 gpa; while at the 6-inch level 2.35 gpa and 0.55 gpa were recovered (see table 1).

| Table 1. Spray and percentage deposits on leaf surfaces at different levels in corn foliage. Spray applied by helicopter at 57 mph. USDA, Forest Grove, Oregon. August 25, 1964. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Upper Leaf Surfaces** | **Mean Rate GPA** | **%** | **Under Leaf Surfaces** | **Mean Rate GPA** | **%** |
| **Foliage Level** | **Mean Rate GPA** | **%** | **Mean Rate GPA** | **%** |
| 6' | 4.03 | 100.0 | 13.0 | 0.54 | 100.0 |
| 4' | 3.39 | 84.0 | 11.0 | 0.45 | 83.0 |
| 2' | 2.13 | 53.0 | 10.0 | 0.39 | 72.0 |
| 6" | 2.35 | 58.0 | 14.0 | 0.55 | 102.0 |

*As compared to upper leaf surfaces, 6' level in preceding column.

Note that the spray deposits at the 6' level are higher than those recovered at the 2' level. The under leaf surfaces all received a deposit in a range of 10 to 14% of that on the upper leaf surfaces at the 6 ft. level.
For the low speed tests, the following spray recovery rates were recorded at the 6-foot level: 9.51 gpa on the upper leaf surfaces and 0.59 gpa on the under leaf surfaces. At the 4-foot level, they were 8.01 gpa and 0.39 gpa. The 2-foot level had 4.63 gpa and 0.31 gpa; while the 6-inch level showed 4.06 gpa and 0.92 gpa (see table 2).

Table 2. Spray and percentage deposits on leaf surfaces at different levels in corn foliage. Spray applied by helicopter at 30 mph. USDA, Forest Grove, Oregon. September 18, 1964.

<table>
<thead>
<tr>
<th>Foliage Level</th>
<th>Upper Leaf Surfaces</th>
<th>Under Leaf Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Rate GPA</td>
<td>Mean Rate GPA</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>6'</td>
<td>9.51</td>
<td>6.0</td>
</tr>
<tr>
<td>4'</td>
<td>8.01</td>
<td>4.0</td>
</tr>
<tr>
<td>2'</td>
<td>4.63</td>
<td>3.0</td>
</tr>
<tr>
<td>6&quot;</td>
<td>4.06</td>
<td>10.0</td>
</tr>
</tbody>
</table>

*as compared to upper leaf surface, 6' level, in preceding column.

Note that the gallonage rates on the upper leaf surfaces are approximately twice the rates recorded at 57 mph.

At the higher discharge rate, and slower speed (Table 3), the under leaf surface deposits were comparable with the exception of the 6" level where 0.37 gpa more spray was recovered.

Table 3. Comparison of mean gpa rates, 57 and 30 mph (Tables 1 and 2).

<table>
<thead>
<tr>
<th>Foliage Level</th>
<th>Upper Leaf Surfaces</th>
<th>Under Leaf Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>57 mph GPA Rates</td>
<td>30 mph GPA Rates</td>
</tr>
<tr>
<td>6'</td>
<td>4.03</td>
<td>9.51</td>
</tr>
<tr>
<td>4'</td>
<td>3.39</td>
<td>8.01</td>
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<tr>
<td>2'</td>
<td>2.13</td>
<td>4.63</td>
</tr>
<tr>
<td>6&quot;</td>
<td>2.35</td>
<td>4.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>57 mph GPA Rates</th>
<th>30 mph Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'</td>
<td>0.54</td>
<td>0.58</td>
</tr>
<tr>
<td>4'</td>
<td>0.45</td>
<td>0.39</td>
</tr>
<tr>
<td>2'</td>
<td>0.39</td>
<td>0.31</td>
</tr>
<tr>
<td>6&quot;</td>
<td>0.55</td>
<td>0.92</td>
</tr>
</tbody>
</table>

There were 208 tab sample positions used in each test. Only five of these areas failed to receive any measurable spray deposits. These were all in the high speed test where blank positions on the under leaf surfaces were as follows: two at the 4-foot level and three at the 2-foot level.
Six, or less, applications of demeton, methyl demeton, dimethoate and phosphamidon sprays were applied to large plots of sugarbeets in each of 7 commercial fields in the Walla Walla-Milton Freewater area with a Rawdon airplane for the seasonal control of aphids and prevention of spread of the destructive beet yellows and beet western yellows viruses carried by them. The emulsion-type sprays were buffered to 6.5 pH and applied at the rate of 1 lb. active insecticide in 9 gals of spray per acre/application. Applications started May 12 and continued at 10 to 12 day intervals. Plots were sampled 8 times to determine aphid control, twice late in the season to determine virus spread, and 12, 15-foot rows of beets harvested from each plot immediately prior to harvest to determine yields and sugar content of the beets.

Demeton and methyl demeton gave best control of aphids; phosphamidon gave fairly consistent control, but dimethoate control was erratic. In general, dimethoate allowed least spread of virus spread, produced greater yields of beets and in some cases also higher sugar content in beets. The most striking example of effective aphid control was observed in a field where beets were grown the second year in succession and diseased volunteer beet plants were abundant. Results were as follows:

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Wingless aphids on 460 leaves during the season</th>
<th>Yields per acre beets (tons)</th>
<th>Sugar (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demeton</td>
<td>75</td>
<td>19.03</td>
<td>15.02</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>225</td>
<td>18.82</td>
<td>14.66</td>
</tr>
<tr>
<td>Phosphamidon</td>
<td>177</td>
<td>15.00</td>
<td>14.59</td>
</tr>
<tr>
<td>Check</td>
<td>1,238</td>
<td>13.11</td>
<td>14.41</td>
</tr>
</tbody>
</table>


2/ Agronomist, U & I Sugar Co., Toppenish, Washington

3/ Pilot, Agri. Eng. USDA, Forest Grove, Oregon
An aerial spray application was made to pole bean foliage with a Bell 47D-1 helicopter, owned by the U.S.D.A. The objective was to determine the effects of spray penetration when the helicopter was flown three to five feet above the plant canopy at a speed of 60 miles per hour.

The spray nozzle arrangement consisted of 27 nozzles, D6-46 orific discs and plates, spaced one foot apart on the spray boom. The boom was mounted on the upper tips of the forward ends of the helicopter skids.

The bean row spacings were 5-1/2 feet and the bean plants were trellised to the height of 6 feet. Two swaths of a water-based dye spray were applied on 39-foot swath spacings.

Two transects of stainless steel plates spaced 1 foot apart were used to obtain the basic spray patterns between the two center lines. One transect was placed in eight rows of the beans and the other one was placed in the open. Upper and under leaf surfaces were sampled by two transects of Mylar tabs placed at the 6', 4', 2', and 6" levels on or within the plant foliage of eight rows. Usual laboratory procedures were used in analysis of the spray deposits. The spray and percentage deposits recovered from the leaf surfaces at different levels in the pole bean foliage are given in Table 1.

<table>
<thead>
<tr>
<th>Upper Leaf Surfaces</th>
<th>Lower Leaf Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foliage Level</strong></td>
<td><strong>Mean Rate GPA</strong></td>
</tr>
<tr>
<td>6'</td>
<td>2.78</td>
</tr>
<tr>
<td>4'</td>
<td>1.61</td>
</tr>
<tr>
<td>2'</td>
<td>1.35</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1.41</td>
</tr>
</tbody>
</table>

*Compared to upper leaf surface 6' level.

The mean recovery rate of spray deposited on the Mylar tabs at the 6-foot level was 2.78 gpa on the upper leaf surfaces and 0.44 gpa on the under leaf surfaces. The rates at the 4-foot level were 1.61 and 0.34 gpa. At the 2-foot level they were 1.35 and 0.28 gpa, while at the 6-inch level 1.42 and 0.39 gpa were recorded. The spray deposits on the upper leaf surfaces at the 6" level averaged just over one-half
(50.8%) of those recorded at the 6' level. While the under leaf deposits at all levels when compared to the upper leaf surfaces ranged from 14 to 16%. It is to be noted that the deposits on both sides of the leaves at the 6" level are slightly higher than those that were recorded at the 2' level. There were 256 tab sample positions and only four of these positions failed to receive any measurable spray deposits. Two of these were on under surfaces at the 2-foot level and two were at the 6-inch level, 1 upper and 1 under leaf surface.

Study of Aerial Application Methods for Control of Aphids on Sugar Beets


In applying a series of cooperative tests of applications of aerial insecticide sprays for control of green peach aphids on sugar beets in small fields it was essential to keep the plots as small as possible.

In the past we had considered 3-swath plots to be minimal for reliable results. However, further study of data indicated that, with proper nozzle arrangement and swath spacing, a reasonably uniform distribution of spray could be expected across the area from center to center of 2 adjacent swaths 40 feet apart when applied with the Rawdon airplane we were using.

Aerial spray applications of three different insecticides were applied, under general direction of B. J. Landis, to 2-swath plots of sugar beets near Walla Walla, Washington in from 3 to 6 applications to 7 fields at various intervals from May 12 through July 7, 1964. The insecticides used were demeton, methyl demeton and phosphamidon.

The main objective of these cooperative tests was to determine the effectiveness of certain insecticides in scheduled aerial spray applications for the control of green peach aphids and the resultant effect on disease incidence in the beets. The results of the biological and chemical assays associated with the main objective are being reported by our cooperators.

The secondary objective was to obtain information on the reliability of the methods of aerial application used in these studies.

To evaluate the methods of application, plots in two of the seven fields were selected for detailed aphid counts in transects across the swaths. Nine days after the last treatment, one transect of aphid counts was made across 3 plots in Field 1 to which six applications of insecticides had been made at 10-day intervals. No aphids were found on leaf samples from the 23 rows within the demeton plot, indicating

that there was adequate coverage of spray across the entire plot, especially when compared with results in the phosphamidon plot, below.

Examination of beet leaves in the phosphamidon plot in Field 1 started with row 1 at the edge of the plot. Twenty-five leaves were picked from every third row across and for 17 adjacent rows outside the plot in the direction of the prevailing wind. These counts showed 123 aphids on 400 leaves in the transect across the plot, with at least a few in every row sampled. There were also 65 aphids per 300 leaves in 6 rows examined of 23 outside the plot.

A transect of 25-leaf samples taken in each third row across the methyl demeton plot yielded no aphids within the plot, and these results, especially when compared with the phosphamidon plot, again indicate that the spray coverage across the plot was excellent.

Evaluation of the spray coverage in the demeton plot in Field 3 (sprayed four times) was made by counting aphids on one leaf per row in 10 transects 15 feet apart across the plot.

Only 6 aphids were found on 198 leaves in 9 of the 10 sampling transects across the plot, again indicating excellent control, but, on the other hand, 6 aphids were found on 22 leaves in transect No. 6. It is thought that this transect fell along the course of an irrigation sprinkler line that was set up and probably operated immediately after the spray was applied.

On the whole these tests indicate that, even in conditions of cross winds up to about 4-5 mph an adequately uniform coverage of spray can be expected on plots in the area from center to center of two aerial swaths of proper spacing and that even better coverage could be expected on an entire field sprayed with multiple swaths of the same spacing.

A 24-Hour Directional Aphid Trap

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Colorado State University
Fort Collins, Colorado

The construction of a 24-hour directional aphid trap, its application and use in the field will be discussed. Slides will be presented also.
Maneb on cranberries: The effect of a new spray adjuvant, Paco Adhesive, on residual properties on Maneb fungicide on cranberries was tested this summer. Maneb was applied at 1.5 lbs./100 gal. with and without Paco five times during the growing season. Maneb residues on leaves declined from 90 ppm to 2 ppm with Paco and from 74 ppm to <0.5 ppm without Paco in 28 days. The persistence of Maneb on berries seemed improved. Harvest residues in both plots were well under the tolerance.

Zinophos on turnips and cauliflower: Turnips and cauliflower receiving a foliar application at 1 lb./acre were analyzed for Zinophos residues. A residue of about 1 ppm Zinophos was found on turnip foliage immediately after spraying. At harvest, 45 days after application, no detectable residues were found in either crop.

Insecticide residues in carrots and table beets: Carrots and the aldrin treated soil in which they had overwintered were analyzed for aldrin and dieldrin in an effort to establish a correlation between soil and carrot residues. The results indicated that the concentration of aldrin and dieldrin in carrots would not be more than \( \frac{1}{3} \) the concentration of these insecticides in soil. On this basis it would be expected that soils carrying less than 0.5 ppm aldrin-dieldrin could be used for carrot production.

Approximately 50 analyses were made of soils previously treated with aldrin. This survey indicated that soil treated in 1962 or earlier with \( 2\frac{1}{2} \) lbs. or less aldrin per acre generally contained less than 0.5 ppm of insecticide.

Harvest samples from the 1964 crop were also checked for chlorinated hydrocarbons. Only one sample of table beets out of 64 contained detectable aldrin, 40 samples contained dieldrin (maximum 0.08 ppm), 35 samples contained DDT (maximum 0.29 ppm), and 45 samples contained DDE (maximum 0.24 ppm).

A total of 82 harvest samples of carrots were analyzed and only one was found to contain aldrin and dieldrin residues over tolerance. Three samples contained detectable residues of aldrin (maximum 0.03 ppm), 59 samples contained dieldrin (maximum 0.12 ppm), 29 samples contained DDT (maximum 0.21 ppm), and 48 samples contained DDE (maximum 0.11 ppm).