OREGON VEGETABLE Digest

VOLUME IX OREGON STATE COLLEGE, JULY 1960 NUMBER 3

Soil Insecticides Tested for Residues

Crop Field Days Planned; Dates to Be Announced

Specific crop field days have been planned this year--marking a return to a more formal handling of these annual events.

One field day already has been held. The bush and pole bean field day was held Tuesday, July 26, and a miscellaneous crops field day will be held in August or September. Exact dates will be announced later, and the information will be sent to fieldmen, representatives of seed companies, growers, and others through county agents and letters.

Visitors are always welcomed at the vegetable research farm. To get there from Corvallis, travel east on Van Buren Street and cross the Willamette River Bridge on the "old"

(Continued on page 5)

In This Issue . . .

In Oregon, soil inhabiting insects including wireworms, tuber flea beetles, white grubs, root weevils, carrot rust flies, and others have been effectively controlled with such materials as aldrin, dieldrin, DDT, and heptachlor for many years. Recently, recommendations for the use of heptachlor on certain crops have been rescinded, pending additional research on the residues of heptachlor epoxide. Work now underway may again lead to recommendations for use of heptachlor in soil insect control.

Questions have been asked recently about accumulation of chemical residues in soil and what effect they may have on plant vigor and chemical residues appearing on various crops. Problems of this kind have been anticipated and various workers have approached them in different ways.

When the chlorinated hydrocarbon insecticides were found effective for control of soil pests, it was generally assumed that most of the materials were stable, would not decline rapidly, and could eventually result in excessive accumulation in the soil. Accordingly, high rates of materials were applied and crop response was studied. These studies generally

(Continued next page)

Soil Insecticides . . . (Continued from page 1)

showed that depending on the material and rate of application, soil, and crops, some phytotoxicity could be measured. However, with materials such as BHC, plant growth of cruciferous crops seemed to be stimulated. At the same time, BHC had a depressing or phytotoxic effect on other plants.

In another approach to the problem, workers at Oregon State College have attempted to determine longevity of soil insecticides in protecting certain crops from insect damage. These tests are still in progress. It has been learned that initial applications of low to moderate dosages (2 to 5 pounds toxicant per acre) of aldrin, dieldrin, and heptachlor have measurably prevented insect damage for seven years.

In other work, the rate of decline of aldrin, dieldrin, and heptachlor in the soil has been measured over an 11-month period. When mixed with the soil at the rate of 10 pounds toxicant per acre (5 ppm), bioassay methods showed only about 31% of the materials remained after this period. The more rapid rate of decline took place during the warm summer months.

In an unpublished report by L. D. Anderson, F. A. Gunther, and H. H. Shorey, another interesting approach to the soil insecticide problem is reviewed. Starting in 1953 at the Citrus Experiment Station, Riverside, California, DDT and toxaphene (20 pounds), Chlordane (10 pounds), lindane (1 pound), aldrin, dieldrin, and heptachlor (5 pounds) toxicant per acre were added to the soil each year. In 1954, endrin at the 5 pounds toxicant per acre rate was also included. A similar set of plots was started in 1954 in the Imperial Valley, at Meloland, California. Each season chemical residue of organic chloride remaining in the soil was determined through 1959. Figures 1 and 2 show the results of this study and are taken from a report of December 31, 1959, of Project 1611, "Effect of Pesticides in the Soil Upon Growth, Flavor, and Yield of Various Crops and Upon Insecticide Residues in the Soil and Crops."

A generally accepted estimate of the weight of a 6-inch acre of soil is 2 million pounds. Thus for example, DDT was added to the soil at the Citrus Experiment Station at the rate of 20 pounds (10 ppm). Total application rate over the 5-year period was 100 pounds toxicant or 50 ppm. Since the maximum recovery was slightly over 25 ppm, some decline of DDT must have occurred. However, rate of accumulation in this instance greatly exceeded rate of decline.

Other materials generally show the same tendency, but when added at a lower rate of material the rate of accumulation and rate of decline are more nearly in balance. Of the materials under test, lindane and aldrin have less tendency to accumulate in the soil.

Concentration of DDT and toxaphene in the soil seems to be associated in some way with phytotoxicity on certain crops. In some instances the relationship is not clear because definite plant stunting may result, but yields were not significantly reduced. Relationship of insecticide concentration in the soil and plant injury is more perplexing in the case of endrin and dieldrin. In 1955, after a total amount of endrin (10 pounds) and dieldrin (15 pounds) toxicant had been added to the soil, serious injury was evident to lima beans. An additional amount of 5 pounds toxicant in 1956 and 1957 did not show the same phytotoxic tendencies.

(Continued on next page)

Oregon's Vegetable Digest is published four times a year by the Agricultural Experiment Station, Oregon State College, Corvallis. F. E. Price, Director. Address correspondence to the author concerned or to the Department of Horticulture.

Soil Insecticides . . . (Continued)

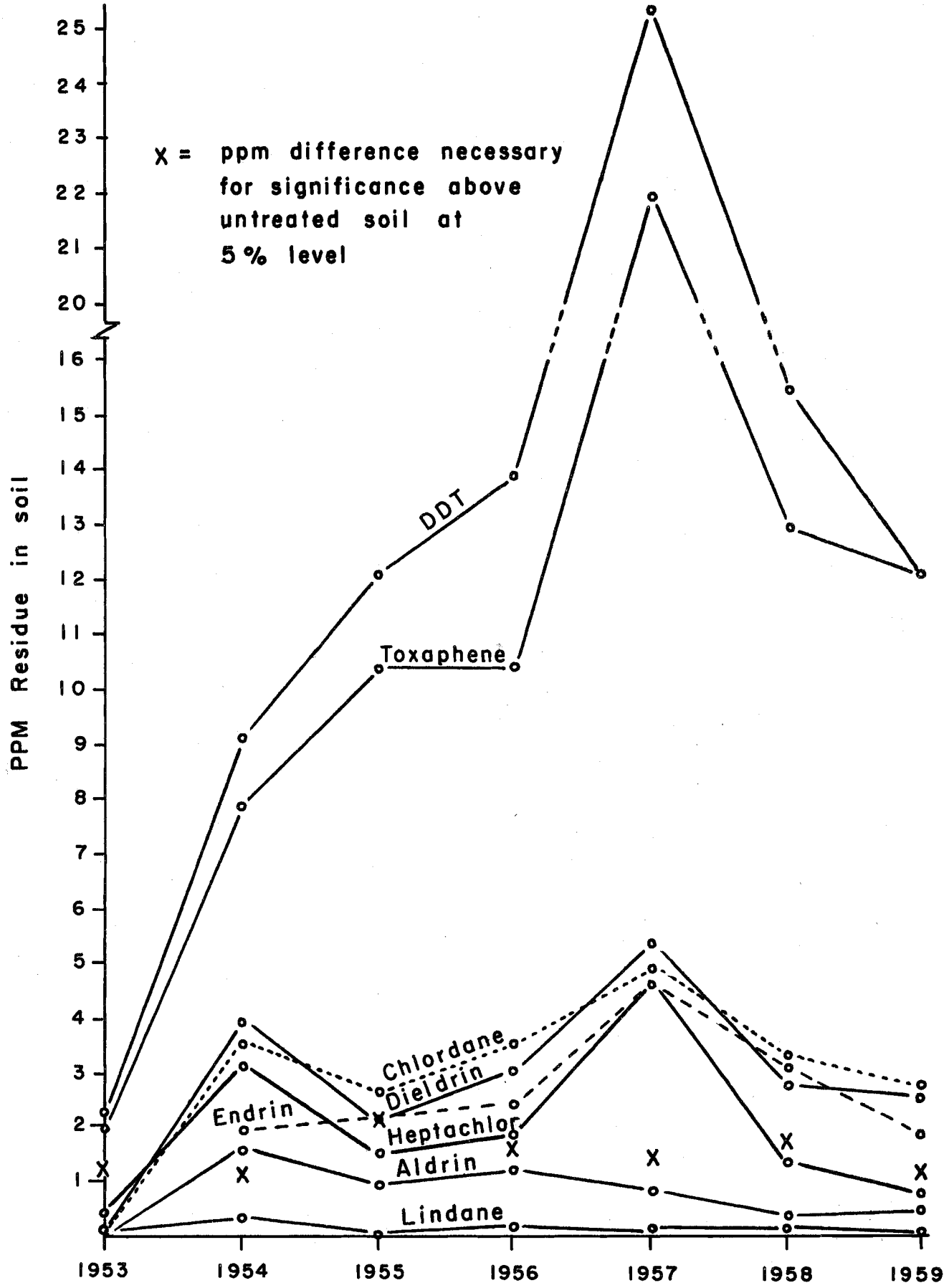

Figure 1. Chemical residue in soil from CES plots.

Soil Insecticides . . . (Continued)

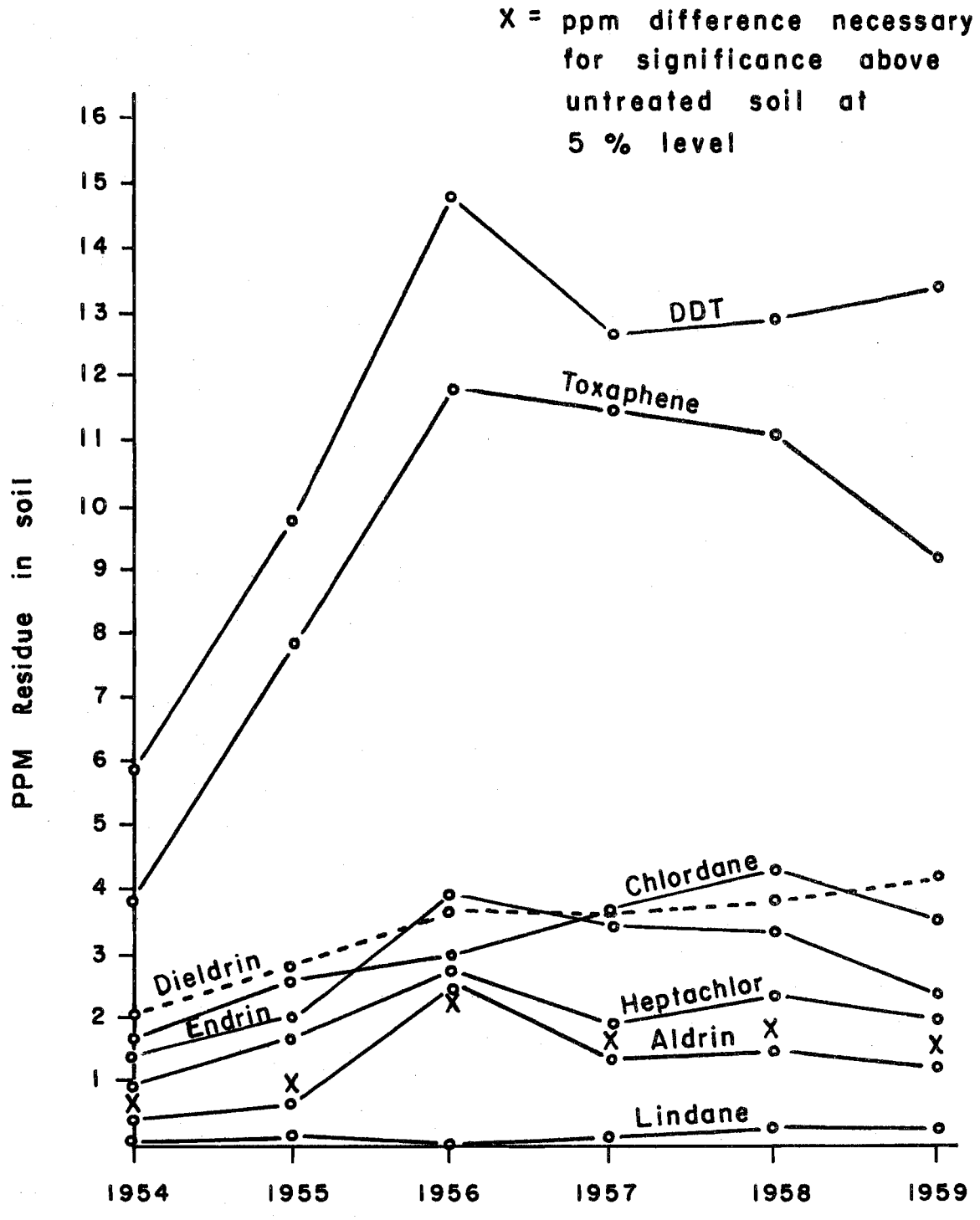

Figure 2. Chemical residue in soil from Imperial Valley plots.

Soil Insecticides . . . (Continued from page 2)

Carrots appear to be one of the most sensitive crops in showing insecticidal residues. However, there appears to be little relationship between insecticidal accumulation in the soil and chemical residues which are found in the crop.

Although this review of soil insecticide work may leave many unanswered questions, it would seem, in general, that applications of maximum rates of some materials could lead to difficulties in growing certain crops. However, for practical control of most pests, it is not likely that maximum yearly rates of soil pesticides will be necessary. A 20-pound toxicant rate of DDT will control wireworms for many years, and it will be unnecessary to reapply material until the soil again becomes infested.

In Oregon, aldrin has probably been the most commonly used soil insecticide. When applied at the rate of 2 to 3 pounds toxicant per acre, it has been effective for control of wireworms, tuber flea beetles, carrot rust flies, and other soil pests. Since it does not appear to accumulate appreciably in the soil after being applied at the rate of 5 pounds for five consecutive years, it is not likely that an accumulation problem would result when it is used at a lower dosage.

--H. E. Morrison
Entomology Department

▲ ▲ ▲

Crop Field Days . . . (Continued from page 1)

Albany Highway. Take the first road to your left (Smith Lane) about one-half mile after crossing the bridge. Continue past the plant pathology farm through the old "railway cut," and you will be on the farm.

Experiments underway at the farm in 1960 include pea breeding (an especially good test area for virus resistance); bush and pole bean breeding (yield, growth habit, varieties, disease resistance); bush bean time of planting, spacing, mulching, fertilizer, and growth habit studies; pole bean irrigation, pod set; control of slugs; control of symphylids; long-time soil-applied insecticide studies; sweet corn varieties; chemical weed control on several vegetable crops; and less extensive tests on carrots, beets, lima beans, tomatoes, broccoli, and rhubarb.

▲ ▲ ▲

Vegetable Note. . .

Brown rib of lettuce according to Jenkins (A.S.H.S., Vol. 74, pp 500-590) is due to a "physiological disorder that develops as a result of high temperature conditions to which most lettuce varieties are not adapted." He found some varieties and breeding lines resistant to brown rib. Daily overhead sprinkling late in the season reduced occurrence of the disease, but was not considered a practical method of control.

OSC Bush Beans Maintain Quality in Experiment

One of the important factors contributing to acceptance of Blue Lake pole beans has been stability of quality under steamtable conditions for institutional use.

This is one factor which has been sought in developing a bush bean which would compare favorably with the Blue Lake pole bean. Purpose of this investigation was to determine the extent of damage to color and epidermal tissues on new selections during a 5-hour exposure to a temperature of 165° F. in a water bath.

Four lots of pole beans and four lots of bush beans were chosen from the strains and selections on trial at the vegetable research farm. Duplicate samples (303 x 406 cans) of each lot were analyzed for color and percent of sloughing. After the samples were heated to 165° F., the second set of color readings was taken. Samples were then transferred to glass beakers with watch glass covers and the time taken as zero at this point. After 2- and 5-hour periods in a water bath, the color was taken again on the hot samples. Percent of sloughing was determined again at the test's completion.

Results indicated that steamtable conditions do not increase sloughing in canned beans (Table 2). Color of the beans was lost slowly as reflected in the increase in Rd values by the Hunter Color Meter (Table 1). No differences existed between the two types of beans in ability to withstand steamtable conditions. Flavor of the beans appeared to be normal after the 5-hour exposure to steamtable conditions. Disturbing the beans during the time of exposure to heat apparently did not affect the percent of sloughing (Table 2).

--W. A. Sistrunk
Food and Dairy Technology Department

--W. A. Frazier
Horticulture Department

Vegetable Note. . .

Waters and Atkin (A.S.H.S., Vol. 74, pp 591-595) found in New York that bean seedlings "with more than half of the cotyledonary tissue remaining were inferior to those with complete cotyledons, and seedlings lacking more than half of the cotyledon tissue were even less productive." The plants with part of the cotyledons missing were smaller and less productive. They suggest that germination tests might well include data on broken or missing cotyledons if they "are to indicate accurately the potential planting value of snap bean seed."

Bush Beans . . . (Continued from page 6)

Table 1

Hunter Color Measurement of Canned Beans
Subjected to Steamtable Conditions

Cold Selections	Rd	-a	b	Hot, zero time Rd	-a	b
FM-1-K (Pole)	8.5	2.0	13.5	8.9	2.4	13.7
1484 "	8.5	2.0	14.1	8.9	2.3	13.9
1652 "	9.3	2.0	13.9	8.4	2.4	12.6
FM-1 "	8.9	2.4	13.9	9.3	2.4	14.4
410 (Bush)	9.1	1.4	13.8	9.4	1.3	12.7
949 "	9.5	1.9	13.6	8.5	1.8	13.6
2151 "	7.6	1.4	12.4	7.7	1.6	12.5
545 "	9.6	2.3	14.4	8.8	1.8	14.1
2-hours time				**5-hours time**		
Selections	**Rd**	**-a**	**b**	**Rd**	**-a**	**b**
FM-1-K (Pole)	9.4	2.5	14.4	9.4	3.3	14.1
1484 "	9.4	2.5	15.1	9.4	3.6	14.6
1652 "	8.5	2.5	11.2	8.9	3.3	13.9
FM-1 "	9.7	2.4	15.2	10.1	3.6	15.5
410 (Bush)	9.5	1.2	10.9	8.4	2.6	13.5
949 "	8.7	1.8	13.6	8.9	3.0	13.6
2151 "	7.8	1.9	12.6	8.1	3.0	13.0
545 "	8.9	1.1	13.6	9.5	3.3	14.9

Table 2

Percent of Sloughing in the Canned Beans
Subjected to Steamtable Conditions

Selections	Unheated cold	Heated 5 hours	Heated 5 hours undisturbed
FM-1-K	.0692	.0729	--
1484	.0961	.0938	.0987
1652	.1051	.1067	--
FM-1	.0757	.0749	.0770
410	.1106	.1097	.1128
949	.0986	.0996	.0961
2151	.0702	.0674	--
545	.0875	.0942	--

▲ ▲ ▲

Vegetable Farm Has Low Heat Units in May

Higher than average rainfall accompanied by lower average temperatures hampered planting of vegetables in late April and May in western Oregon. Lower heat unit accumulation was noted last May than in most previous years at the vegetable research farm near Corvallis.

Heat units in April and May, using both air and soil temperatures, are shown in Table 1. (Heat units per day are calculated by subtracting the base temperature of 50° F. from the average of minimum and maximum temperatures.) The average air temperature in May was 57° F. as compared to an 8-year average of 58° F. The soil temperature at the 2- to 3-inch depth averaged 60° F. for May, four degrees lower than the 8-year average.

Five to eight year averages of air and soil temperatures for the months of April through October at the vegetable research farm are shown in Table 2. Soil temperatures in April and May would be of particular interest in relation to germination and emergence of vegetables.

--H. J. Mack
Horticulture Department

Table 1

Heat Units -- 50° F. Base
Vegetable Research Farm, Corvallis

	April		May	
Year	Air	Soil 2-3"	Air	Soil 2-3"
1956	---	---	242	428
1957	111	139	291	407
1958	88	105	268	452
1959	149	203	202	408
1960	133	146	216	325

Table 2

Air and Soil Temperatures Summary*
Vegetable Research Farm, Corvallis

	Air Temp. °F.			Soil Temp. °F.								
				2-3" level			5-6" level			8-9" level		
Month	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
April	44	63	53	50	63	57	50	56	53	53	56	55
May	48	68	58	55	72	64	56	63	60	59	62	61
June	51	70	61	59	76	68	60	67	64	64	67	66
July	53	80	66	65	88	77	67	77	72	71	75	73
August	53	79	65	65	84	75	67	75	71	71	75	73
September	51	76	64	60	76	68	63	69	66	67	69	68
October	45	65	55	51	63	57	52	56	54	--	--	--

* 5-8 year average.

▲ ▲ ▲

New Equipment Noted for Soil Fumigation

Now is the time to start getting ready for fumigation control of symphilids and nematodes.

In addition to equipment described in Station Bulletin 555, Soil Fumigation Equipment for Nematode Control, the Agricultural Engineering Department at Oregon State College has fitted a 6-foot sweep plow (Figures 1 and 2) for applying soil fumigants. A three-plow crawler tractor is required for traction.

Soil should be free of undecomposed organic matter and in fine tilth with a complete absence of clods for effective fumigation. Plant residue interferes with application and requires higher dosage for effective kills. Clods are hard to penetrate and furnish protection against the fumigant.

Late July and August is a good time for treating soil to control symphilids and nematodes. Consult the Oregon Insect Control Handbook on symphilids and the Oregon Plant Disease Control Handbook on nematodes for the rate of application and the crops for which the chemicals are cleared for use.

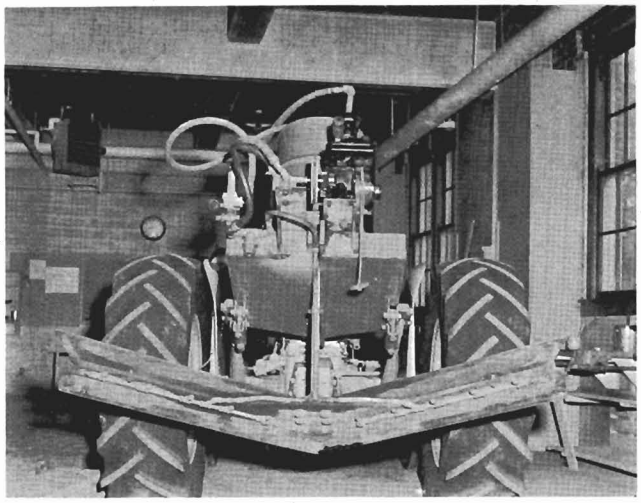

Figure 1

Location of boom and nozzles on 6-foot Noble sweep to adapt it for soil fumigation.

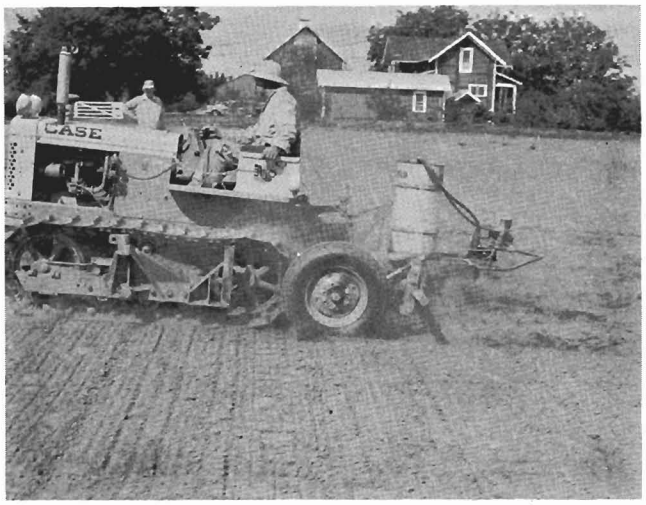

Figure 2

Modified Noble Cultivator applying soil fumigants on the Northern Willamette Experiment Station, 1959. Depth gauge wheels insure uniform depth of application.

--Glen E. Page
Agricultural Engineering Department

▲ ▲ ▲