Sugar-Beet Nematode

chemical control trials test two methods of applying soil fumigants

D. J. Raski, M. W. Allen and Roy D. McCallum

Plow type application of soil fumigants proved more effective than chisel type application in sugar-beet nematode control tests in light soil near San Juan but treatment was relatively expensive.

The results obtained in the experiment showed a significant increase in the yield as a result of the fumigation. There was a consistent difference of four tons more beets per acre when the plow was used instead of the chisel.

An important factor in the results was the soil of the experimental plot which was lighter than most of the soils on which sugar beets are grown.

The experiment was conducted on a field infested with sugar-beet nematode which was planted to sugar beets in 1948 and did not yield a satisfactory crop. The 1949 crop was garlic.

In addition to having the desired type of cropping history the field was selected because the soil was relatively light in texture with a moisture equivalent of 20.6%. Soil fumigants have generally failed to control sugar-beet nematode in soil with a higher moisture equivalent.

Prior to treatment the field was irrigated and worked to seedbed condition by subsoiling followed by cultipacking. The entire experimental area was then plowed and the fumigants applied to the plow plots during this operation. The plots were next harrowed in two directions. Chisel applications were made in the designated plots with a bar drag pulled behind the chisel applicator. Treatments were made November 2 to 4, 1949.

In these tests dichloropene mixture was applied at the rate of 250 pounds per acre to plots 28 x 200 feet replicated eight times. The materials were applied in separate blocks but the results have been combined in this report.

Sugar beets were planted December 14, 1949, but a killing January frost injured the stand of beets to the extent that the area was replanted February 16, 1950, and thinned on March 23, 1950.

Measurement of the control obtained by the fumigants was made by determining the percentages of nematodes killed and by yield data. The nematode counts were made by taking soil samples from treated and untreated plots. Two soil cores three inches in diameter were taken from each plot at three-inch levels to a depth of 18 inches. A total of 576 samples were collected by this method. The soil from these samples was potted in the greenhouse and seeded with sugar beets. Five weeks later the seedlings were washed free and the nematodes counted on the roots. The number of nematodes counted was limited to 100 for any one sample.

Results of Nematode Counts

Treatment	Total nematodes in 48 core samples	Average per sample	Per cent kill
Untreated check	4076	84.9	
Chisel application	1160	24.2	71.5
Plow application	691	14.4	83.1

Nematode counts were also made by means of soil profiles from an area two inches wide, 14 inches across and 18 inches deep taken across the line of injection. Each sample consisted of a two-inch cube of soil. There was a total of 63 samples in each profile. Nine profiles in all were taken, one in each of three replicates of the three treatments with a total of 567 samples.

These soil cubes were planted to sugar beets in pots in the same manner as the core samples and counts made of the nematodes on the roots after five weeks.

An analysis of the profile data to a depth of 18 inches to determine the percentage of nematodes killed by the fumigants may be summarized as follows:

Percentage Killed to 18-Inch Depth

Treatment	Average nematode count per two inch sample	Per cent kill
Untreated check	46.9	
Chisel application	26.4	43.9
Plow application	22.4	52.3

Examination of the profile data indicates that the fumigant was least effective in the top two inches and at depths below 12 inches. The control obtained in the first 12 inches of the soil is probably more significant than at the lower depths, especially for preventing damage early in the season.

Percentage Killed to 12-Inch Depth

Treatment	Average number of nematodes per two inch sample	Per cent kill
Untreated check	46.2	
Chisel application	15.5	66.5
Plow application	8.2	82.3

The figures in the above table may be more significant in explaining the differences obtained in the yield data.

The plot was hand harvested on August 15, 1950. The four center rows of each plot were used, 50 feet in from each end giving 400 row feet per plot.

Average Yield for Each Treatment

Treatment	Tons per acre
Untreated checks	4.5
Chisel treatment	12.4
Plow treatment	16.4

Continued on page 15

Profile Count from Untreated Check Plot

Depth in inches	Lateral distance in inches 0–2	2–4	4–6	6–8	8–10	10–12	12–14	Total
0– 2	36	77	52	84	96	100	100	545
2– 4	26	29	68	25	44	28	87	307
4– 6	14	56	61	16	74	100	100	421
6– 8	1	8	48	100	100	78	47	382
8–10	39	81	62	100	100	96	39	517
10–12	61	100	100	49	53	39	38	440
12–14	14	5	83	63	5	100	34	304
14–16	3	36	38	75	89	62	100	403
16–18	67	8	42	96	90	100	100	503
								3,822

Profile Count from Plot Applied by Chisel

0– 2	11	13	32	29	37	37	73	232
2– 4	0	3	0	1	1	1	24	30
4– 6	0	0	0	0	0	0	0	0
6– 8	0	0	0	10	0	1	15	26
8–10	8	0	0	0	0	0	22	30
10–12	100	25	23	3	70	30	46	297
12–14	69	37	25	100	35	50	83	399
14–16	74	—*	11	69	42	100	100	396
16–18	91	100	100	100	45	70	8	514
								1,924

*The test plants in some samples either failed to germinate or suffered damping off and the counts in such cases were lost.

WALNUTS

Continued from page 9

It has long been recognized that dust in some manner favors an increase in the mite population. Severe infestations are frequently encountered along dusty roads and similar locations. In the course of the walnut insect investigations it has been observed that the frequent application of certain insecticides in the form of dusts to control aphids has resulted in an accumulation of heavy dust deposits on the foliage. This condition is frequently correlated with an increase in the mite population. This does not mean that dusts should not be used in the walnut insect control program. It does mean, however, that the grower should use proper formulations and apply the correct amount carefully so that maximum control can be obtained with a minimum of material thus obviating the necessity of frequent treatments and heavy accumulations of dust.

Mites are less likely to be destructive in orchards that receive good cultural care than in those that are neglected. Dryness in particular is favorable to mites, and orchards should never be allowed to suffer for want of water. It is also a bad practice to permit a cover crop or weeds to persist too long in an orchard. It may support large numbers of mites which later move to the trees.

Most of the experimental studies dealing with orchard mites have been conducted at Linden in San Joaquin County, although some investigational work has been done at San Jose in Santa Clara County. During the past season in the experimental orchard at Linden it became evident by the middle of July that a serious mite infestation was going to develop. A series of experiments with the acaricide aramite—beta chloroethyl beta (p. tertiary butyl phenoxy) alpha methyl ethyl sulfite—were conducted in a portion of the orchard where the early mite infestation was heavy. This portion of the orchard had received a previous codling moth spray of Linden-Mix—three pounds of standard lead arsenate, one half pound of 50% wettable DDT, one half pound of safener—plus one pound of 6% gamma isomer BHC per 100 gallons of water applied with a conventional rig. To compare populations, the mites that occurred along the upper side of the midrib on a number of sample leaflets were counted. Examinations were made with a binocular stereoscopic microscope equipped with 9X oculars and a 1X objective. As the leaflet was slowly moved across the stage, all mites in the field were counted. This meant that all mites on a three-quarter inch strip along the upper midrib were included. The leaflets were picked at random from the southeast side of the trees where the mite infestation was the heaviest. The size of the sample varied from 25 to 50 leaflets per plot. The Pacific mite was most abundant, although there were a few European red mites present. The aramite was applied as a wettable powder, as an emulsion and as a dust. The wettable powder and the emulsion were applied with a conventional sprayer having a 25 foot tower equipped for automatic spraying. About 50 gallons of spray were applied per tree at a pressure of approximately 600 pounds per square inch. A 2% dust was applied with an orchard duster at the rate of approximately 60 pounds per acre. The treatments, dates of application and the degree of control obtained are given in the table. All the treatments except the dust resulted in satisfactory control. In this plot some defoliation occurred late in August. In the one pound wettable plot where the averages closely parelleled those of the dust plot the trees late in August looked very good with little defoliation. The explanation for this apparent anomaly appears fairly simple.

The dust coverage was good and there resulted a fairly uniform, but not exceptionally good kill of mites. There were very few leaflets with heavy populations and very few with no mites. Inspection of the leaves revealed that the webbing was undisturbed. In the spray plots it was noticed that the webbing was matted and disturbed on most leaflets. The coverage was not as good in the one pound sprayed plot and some leaflets escaped the treatment. As a result there were a number of leaflets in the samples left with large populations which tended to obscure the good kill which resulted where the mites were contacted. The mites were increasing by the end of the season when the effects of the material had worn off.

Although no destructive mite populations occurred in any of the sprayed blocks, control was best where the two pound dosage per 100 gallons of water was applied. In the portion of the orchard not treated serious defoliation occurred and the contrast between the treated and untreated portion of the orchard is well shown in the photograph.

The treatments did not greatly effect the predator population. The most abundant predator present was the small ladybird beetle—*Stethorus*. This predator may have been partially responsible for helping to hold at a low level the mite population once it had been reduced by the aramite treatments. Whatever the cause may have been, the population in these plots continued low for the rest of the season. Egg kill appeared to be fairly good on those leaves with small numbers of mites, indicating that coverage is very important.

Crack tests of the harvested nuts were made to determine if heavy mite infestation and defoliation seriously affected quality. Where noticeable defoliation and heavy mite damage appeared by the first of August, there was some evidence that quality was reduced. It is possible that serious infestations especially if repeated the following year, may have an adverse effect on the subsequent crop. Where defoliation occurred early, the trees tended to send out new growth, a condition which may adversely affect the physiology of the trees. In case of a very cold winter a lot of this new wood growth would be killed back.

Woodrow W. Middlekauff is Assistant Professor of Entomology, University of California College of Agriculture, Berkeley.

A. E. Michelbacher is Associate Professor of Entomology, University of California College of Agriculture, Berkeley.

NEMATODE

Continued from page 6

There appears to be a distinct advantage in the use of the plow application as against chisel application which would indicate that in future work on soil fumigation the use of the plow as a means of application must be included.

It is possible that further work may be of value in developing a program of rotation in which soil fumigation can be effectively used. In San Benito County, for instance, a three-year rotation program is commonly used with sugar beets. If the sugar-beet nematode populations in infested fields could be reduced enough in two years of rotation with nonsusceptible crops, a fumigation treatment might result in satisfactory yields. A field plot designed to test the practicability of such a program is under consideration and will be tried this winter if weather conditions permit.

One of the most significant results of this experiment was the demonstration of the more effective control obtained by the plow type application. However, the cost of the treatment was relatively high—approximately $40.00 per acre at the rate of 250 pounds per acre.

The reduced effectiveness of fumigants in heavier soils makes control by fumigation even more uncertain. Therefore it is not possible at the present time to recommend the use of soil fumigants in the control of sugar-beet nematode in California.

D. J. Raski is Assistant Nematologist, University of California College of Agriculture, Berkeley.

M. W. Allen is Assistant Nematologist, University of California College of Agriculture, Berkeley.

Roy D. McCallum, County Director, San Benito County, University of California College of Agriculture.

The above progress report is based on Research Project No. 1354.