Nematode on Cotton

root-knot nematode control by soil fumigation profitable in Kern County

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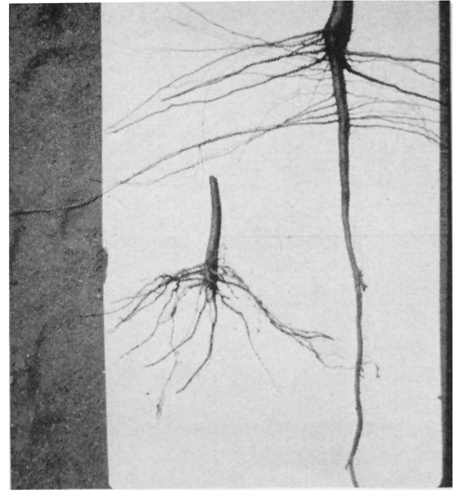

Cotton plant roots. Note the length of the important tap root of the plant from fumigated soil in contrast to the stunted roots from untreated soil.

Soil fumigation enables a grower to plant cotton on land infested with root-knot nematode, *Meloidogyne incognita* var. *acrita*,—and to obtain yields that give profit above cost of fumigation.

Because young root-knot nematodes do not move long distances in the soil and cotton is a row crop the plants will make good growth if planted in a fumigated area despite the fact that adjacent soil may be heavily nematode infested.

The amount of soil fumigant needed for row treatment can be reduced by two-thirds of the amount required for flat treatment—in plantings where the rows are spaced about 38″ apart—according to results obtained from experimental plots established near Weedpatch in 1952.

The field used for the test plots was planted to cotton in 1950 and in 1951 and was known to be heavily infested with root-knot nematode. The experiment occupied six blocks of 20 rows each, and every replicate consisted of two rows of cotton each approximately 380 feet long.

The standard flat treatment of 20 gallons of D-D per acre was applied for comparison with row treatments of various dosages of D-D applied in the row two weeks before planting and also at the time of planting. The row applications were made with one chisel in the center of the beds or two chisels approximately 9″ apart, 4½″ on each side from the center of the bed. Depth of application was approximately 13″ from the top of the bed. This was done to minimize the possible loss of fumigant from the sides of the bed.

The first fumigation test was by the flat treatment applied on March 15, 1952, the second test was by row treatment applied on March 28, two weeks before planting, and the third fumigation was the row treatment also but applied at the time of planting on April 14. The entire test area received the fertilizer treatment made on the adjacent commercial planting—10 tons of manure, 300 pounds of cyanamid and 97 pounds of ammonia gas per acre. The soil in the experimental area is a light sandy loam and at the time treatments were made the soil was in excellent seed-bed condition. The soil temperatures ranged from 57° to 61° F and the moisture content was approximately equal to the moisture equivalent, 9.1%.

Because the D-D mixture is known to be toxic to plants, stand counts were made on May 16 to determine whether the cotton was affected by any of the treatments, particularly those made at the time of planting. Counts were made of the total number of plants in a 100-foot section in each row. The counts were variable but did not show any correlation to treatments, either by dosage, the time or method of application.

The experimental plots were harvested by hand with the first picking on October 29–31, 1952. A second picking was made on January 24, 1953. The yields from both the untreated and the treated plots were above average, probably because of the abundant fertilizer.

The data show the increased value of the crop from each treatment was sufficient—in every case—to return to the grower an amount far greater than the cost of fumigation. Although the flat treatment involves a considerably higher cost it is an excellent method of controlling root-knot nematode and in these tests gave by far the greatest increase in yield or any of the treatments.

After the final picking, plant roots were examined to determine the degree of root-knot nematode infection at the end of the growing season. The roots of 100 cotton plants from each replicate were examined. These roots were placed in five classes from 0 to 4 according to the degree of infection found. Plants classed as 0 were free of root-knot nematode galls, those in class one had 1%–25% of the roots with galls, class two had 26%–50% of the roots with galls, class three had 51%–

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Average Yield of Lint Cotton per Acre from Treated and Untreated Plots, Calculated from the Number of Pounds of Seed Cotton Obtained in Two Pickings from 380 Feet of Row in Each of Four Replications per Treatment.

Treatment	Per cent of nematode control*	Bales per acre	Bales increase from treatment	Cost of material**	Estimated value of increase***
Gallons per acre	A. Row treatments prior to planting				
1 chisel					
3.9 gal.	25.4	2.56	.63	$6.43	$94.50
1 chisel					
6.9 gal.	46.6	2.62	.69	11.38	103.50
1 chisel					
9.5 gal.	75.7	2.77	.84	15.67	126.00
2 chisels					
12.0 gal.	83.0	3.07	1.14	19.80	171.00
Untreated	...	1.93	...	...	...
	B. Row treatments at planting time				
1 chisel					
3.4 gal.	21.7	2.57	.72	5.61	108.00
1 chisel					
6.6 gal.	49.6	2.66	.81	10.89	121.50
2 chisels					
6.5 gal.	43.0	2.89	1.04	10.72	156.00
2 chisels					
12.7 gal.	72.0	2.82	.97	20.95	145.50
Untreated	...	1.85	...	...	...
	C. Flat treatment prior to planting				
20 gal.	96.6	3.35	1.48	33.00	222.00
Untreated	...	1.87	...	...	...

* Weighted root index and percentage of control based on the intensity of the root infection of 400 plants per treatment (average of four replications) classed from 0 to 4.

** This does not include the cost of application which varies depending on the size of acreage treated and may also be applied by the grower along with other cultural operations.

*** Calculated on the basis of 30¢/lb. lint cotton.

ALFALFA

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ing does affect the quality of alfalfa hay. Carotene losses as result of leaf shatter are indicated by angle-lined portion of the graph in the first column on page 4 of windrows 1st, 2nd, 3rd and swath. The protein losses are similarly depicted in the graph in the second column on page 4.

The second windrow, made at 55% to 65% moisture content was well above all others in carotene retention. The slower drying of the first windrow retarded the inactivation of enzymes, causing a greater reduction of carotene than in the second windrow. The low carotene content of windrow three and the swath were the results of greater exposure to the elements.

The first and second windrows were highest in protein content, but the third windrow was lower than the swath. Some shatter occurred from hand raking at this lower moisture content, causing a loss of over one percentage point in protein, even though raking was usually done in the morning to minimize its effect.

To compare laboratory results with actual field operations using conventional haying equipment, machine raked windrows of hay made at varying moisture contents were studied. When cured, the hay was baled and weighed for each treatment and the results compared with similar laboratory tests.

Here, again, leaf shatter was low and the protein content high when the hay was raked at any point above 55% moisture content. Raking below that point caused progressively greater damage, except for periods of high relative humidity.

Maximum yield was obtained by raking just before leaf shatter begins, usually about 55% moisture content. Raking when the hay was damp or tough as a result of high humidity was equally effective in the retention of leaves.

Raking immediately after mowing—which is effective on light, mature hay and in areas of exceptionally low relative humidity—may, however, under less favorable conditions reduce yield as much as 3% and prolong the curing period one to three days.

For the least leaf shatter, the greatest carotene and nearly maximum protein retention, plus faster curing, it is recommended from the results of these tests that alfalfa hay be raked between 55% and 65% moisture content.

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The Feed Laboratory Bureau of Field Crops of the California State Department of Agriculture co-operated in the study reported above.

ACARICIDE

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Ovotran has shown a comparatively long residual value and ovicidal—egg-killing—properties against all three species of mites. As it is relatively slow in its kill of adult mites it should be used early—before the adult population is high—or in conjunction with another compound such as TEPP or parathion if used later. It will cause injury in combination with lime sulfur.

Aramite has shown a comparatively long residual value on two-spot and Pacific species of mites but not on European red or Bryobia. It has good ovicidal properties and a rapid kill of adult forms. It is incompatible with lime sulphur, Bordeaux mixture and other strong alkaloids. Its compatibility with sulphur, at first questioned, has now been confirmed.

Sulphenone has been erratic in control in past seasons, but has shown improvement recently probably due to change in formulation. It has only a fair residual value—two or more applications generally being required. High deposits on the foliage and fruit are apparently a necessity.

Genite 923 shows only a fair residual value but has good ovicidal properties though it will cause injury in combination with TEPP. It is not registered for use on apples due to spray injury.

Dimite has shown a long residual value except on European red mite. It has good ovicidal properties and shows a rapid knock-down of adult spider mite. Apparently it is nonphytotoxic at dosages required.

Parathion has shown a short residual and weak ovicidal value though the knock-down of adults is rapid. Several applications a season are usually required. It is highly toxic to humans but residual deposits disappear rapidly which makes it possible to use parathion within 21 days of harvest. Its efficiency is apparently better in the cool period of early season than in the warm days of early summer.

TEPP has shown no residual or ovicidal values. The knock-down of adults is rapid but inadequate without repeated applications. It is often used just prior to harvest in emergencies. TEPP is readily destroyed by alkaline materials and like parathion its human toxicity is high.

Malathon shows a fair residual value generally requiring two or more applications. It is effective against the egg and adult but has had only limited study in California. Its low toxicity to humans makes it much safer to use than other organic.

EPN shows a fair residual value, is a weak ovicide and rather specific as to species controlled. It has shown the most promise on European red mites but requires several applications per season. It is highly toxic to humans.

DN-111 has a short residual value, is weak as an ovicide and has a rapid knock-down of adults. It is not compatible with oil. Its efficiency is best in the early season while temperatures are cool.

Metacide has a short residual and a low ovicidal value and resembles parathion, in toxicity. Control with metacide may require several applications.

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NEMATODE

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75% and class four had 76%–100%. To arrive at the root index each class was weighted by the factor of 0, 1, 3, 5, or 7 for the classes 0 to 4 respectively, then the total divided by seven.

The results of these tests show that the flat treatment was much more effective than any of the row treatments in reducing the root-knot nematode population. Also it is apparent from the root gall examinations that it is not necessary to kill all of the root-knot nematodes in the area to obtain satisfactory growth of plants in fumigated soil.

One difficulty encountered in the row treatments resulted from the undecomposed roots and plant parts which caught on the chisels and disturbed the beds excessively, loosening the soil where the seeds were planted. This could possibly dry out the soil too rapidly and have an adverse effect on germination. In some cases the loose soil resulted in seeds being planted too deep.

Excessive disturbance of the soil probably can be avoided by fumigating at the same time the beds are formed. This would offer the additional safety factor of treatment well before planting time. Further investigations concerning the possibility of phytotoxicity—plant injury—in different soil types and under varying weather conditions are being continued. Fumigation at the time of planting can not be recommended for general use until more information on phytotoxicity is obtained.

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