Control of Nematode on Cotton

investigations indicate preplanting fumigation of cotton land effective treatment for control of root-knot nematode

M. W. Allen, Vernon Burton, and Alan George

Cotton root-knot nematode—*Meloidogyne incognita* var. *acrita*—can be controlled by crop rotation, by summer fallow, by a combination of these two practices, or by preplanting fumigation of infested soil.

High populations of the cotton root-knot nematode result when a continuous sequence of host plants are grown on infested land, and cotton planted in such soils is frequently damaged. Alfalfa-cotton rotations generally result in satisfactory control because the northern root-knot nematode—*Meloidogyne hapla*—which most commonly attacks alfalfa in California, does not reproduce on the roots of cotton. Alfalfa, moreover, is not a good host of cotton root-knot nematode, so populations of the nematode are reduced during the time alfalfa is grown.

When preceded by early maturing crops, such as grains, a summer fallow of six weeks to two months—during which period the soil is listed two or three times—gives adequate control for the successful growing of one cotton crop. A more intensive and prolonged fallow period has been observed to give adequate control for more than one season.

The preplanting fumigants in general use for the control of root-knot of cotton are EDB—ethylene dibromide—and DD—dichloropropane-dichloropropene mixture. As area treatments, injected to a depth of 8″ with chisels spaced 12″ apart, DD—at 20 gallons per acre—or EDB—at 5–6 gallons per acre of an 83% by weight formulation—gives satisfactory control. As row treatments, injected to a depth of 12″ to 14″ in beds or of 8″ to 10″ if the planting is not made on beds, DD—at eight to 10 gallons when cotton is planted in 38″ rows—or EDB—at 2.5 to 3.0 gallons per acre of the 83% formulation—gives satisfactory control. Dosage rates lower than these usually fail to give adequate control, and the increase in yield is lower.

In row treatments one chisel in the center of the bed or two chisels spaced eight to 10″ apart may be used to inject the fumigants. Comparative tests have failed to demonstrate any advantage from the use of two chisels in row and bed treatments so far as nematode control or increased yield of cotton is concerned. The use of one chisel has certain advantages because there is less tendency to drag down the beds and because the fumigants are placed more directly in the area that will be occupied by the plant roots. Furthermore, a single chisel injects the fumigant deeper—in most instances—than is possible with a two-chisel setup. However, if proper precautions are exercised regarding depth of application, the use of two chisels or one is optional.

From tests made in two successive years—1952 and 1953—information was obtained concerning the possible carry-over effect of fumigation treatments on a second cotton crop. In 1952, fumigation tests were made with DD—as an area treatment—at the rate of 20 gallons per acre, and—as a row treatment—at the rate of nine gallons per acre. In 1953, portions of the experimental area were retreated with DD at nine gallons per acre and with EDB at 1.65 gallons per acre. Some areas were left untreated—in the second year—in order to get comparison yields.

In the retreated areas, there was an increase of 0.3 bale of lint cotton per acre over the yield obtained in the portions not retreated. Thus it seems profitable to treat infested land on subsequent years regardless of the type of treatment used the previous year.

Root-knot nematode control in cotton. *Left:* treated. *Right:* not treated.

New Nematocides

Experiments were made during 1953 and 1954 with two new nematocides, N-339 and OS-1897—1,2 dibromo-3-chloropropane—to compare them with the standard DD and EDB row and area treatments. The chemicals were applied to land that was known to be infested with cotton root-knot nematode and where damage to the cotton crop had been observed the previous year.

The soil in each of the experimental plots was a light sandy loam with a water-holding capacity of from 7.5% to 11%. At the time of treatment, the moisture content was at, or slightly above, field capacity, and the soil temperature varied from 56F to 60F. In all the plots the soil had been well worked and was in seedbed condition at the time of treatment. An interval of 10 to 14 days was allowed between treating and planting. Row treatments were made with a single chisel in the center of the bed. Immediately following treatment, the beds were reformed with a bed-shaper or rolled with a ring roller to seal and firm the surface in order to minimize escape of the nematocide from the soil. Area treatments were made with chisels 12″ apart,

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SEEPAGE

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feet—was applied to backfill soil over the lining in portions of the asphalt *A*, asbestos, and wood fiber sections.

The surface linings were laid on the surface of the excavated ditch following a minimum of hand labor required to remove loose clods.

The wood fiber and plastic were rolled out longitudinally with no laps or joints and secured on the ditch berm—edge of the ditch at the top of the slope—by piling 4″ to 6″ of soil over a foot or more of the lining. The asphalt *C* material of ½″ × 3′ × 8′ strips was laid across the ditch section, lapped 3″ and sealed with asphalt cement. The 8′ length provided sufficient material to extend approximately 1′ over the berm and this was then covered with soil.

Several seepage tests were made by the ponding method in the lined and unlined sections. The amount of water loss was computed from the field measurements and the results averaged together for all the tests.

All linings reduced the seepage loss over that of the unlined section. The seepage control of asphalt *A*, *B*, and *C* was 36%, 47%, and 78%; asbestos 58%, wood fiber 63%, and the plastic film 96%. All these percentages would have been even greater had the experimental test section been located in a more permeable soil because the seepage loss of the unlined sections would have been greater.

Summary of Seepage Control

Lining	Ditch Dimensions: Mean depth	Ditch Dimensions: Mean wetted perimeter	Seepage loss	Seepage control*
	ft.	ft.	cu. ft/ ft²/ 24 hrs.	%
Asphalt *A*	.94	4.3	.47	36
Unlined	.88	4.2	.63	
Asphalt *B*	1.09	4.8	.28	47
Unlined	1.05	4.4	.59	
Asphalt *C*	.86	3.5	.55	78
Unlined	.55	2.9	2.48	
Asbestos	1.03	4.9	.29	58
Unlined	.90	4.4	.67	
Wood fiber	.90	4.1	.45	64
Unlined	.91	3.9	1.31	
Plastic	1.00	4.0	.09	96
Unlined	.55	2.9	2.48	

* Difference between the seepage loss of the unlined section and the lined section divided by the seepage loss of the unlined section multiplied by 100.

Laminated paper did not prove to be satisfactory because bacterial attack and decay of the paper resulted in a complete breakdown of the material in less than two months. Coating with plastic and incorporation of materials to combat bacterial attack might produce a satisfactory lining.

A comparison of seepage control of buried and surface linings shows the buried linings to be less effective. This is attributable to the large number of joints which cannot be made completely water tight. Also, in the case of the asphalt *A*, roots of plants and gophers penetrated the lining and reduced its effectiveness.

A high percentage of control by the plastic film was indicated by the tests. Problems such as proper formulation to give reasonable life when exposed to the sun and wetting and drying in the ditch and resistance to certain forms of mechanical damage are yet to be worked out. These materials are still considered to be in the experimental stage of development.

V. H. Scott is Assistant Professor of Irrigation, University of California, Davis.

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NEMATODE

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delivering the nematocide to a depth of 8″; and immediately following treatment, the surface was rolled with a ring roller.

Comparative results of the 1953–1954 tests with DD, EDB, N-339, and OS-1897 are shown in the table to the right. It was found that N-339 did not equal DD or EDB in nematode control or increased yield of cotton, but that OS-1897 compared favorably with them. With OS-1897, as shown in the accompanying table, the dosage rate of 1.25 gallons per acre—as an area treatment—required to achieve satisfactory increases in yield was lower than with DD or EDB, and the degree of nematode control—based upon root examinations made at the end of the season—was higher. The effective dosage rate—in row treatments—was within the range of 0.5 to 1.0 gallon per acre, and the effective rate may vary with soil type.

Investigations are being continued with OS-1897 as a nematocide to determine its effectiveness in controlling cotton root-knot nematode.

M. W. Allen is Associate Professor of Plant Nematology, University of California, Berkeley.

Vernon Burton is Farm Advisor, Kern County, University of California.

Alan George is Farm Advisor, Tulare County, University of California.

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Experimental Plots Showing per Cent Control, Bales of Lint Cotton per Acre, Bales Increase, Estimated Cost of Treatment, Estimated Net Profit from Treatment

Treatment per acre	% Control	Bales lint cotton per acre	Bales increased per acre	Estimated cost of treatment	Estimated net profit[1]
1953 Kern County Plot—Row Treatment					
Untreated	0.0	1.26	...	.....	.....
339 (5 gal.)	6.2	1.46	.20	experimental	.....
339 (10 gal.)	16.5	1.63	.37	experimental	.....
EDB (1.65 gal., 83%)[2]	28.7	1.72	.46*	$12.90	$67.87
OS-1897 (1 gal.)	93.1	1.80	.54*	16.50	87.18
OS-1897 (2 gal.)	96.0	1.90	.64*	30.00	92.88
DD (8 gal.)	75.0	1.95	.69*	16.00	104.27
1954 Tulare County Plot—Row Treatment					
Untreated	0.0	1.38	...	.....	.....
DD (9 gal.)	88.5	1.83	.45*	18.00	60.72
EDB (2.5 gal., 83%)	67.3	1.70	.32	18.00	38.04
OS-1897 (1 gal.)	92.3	1.79	.41*	16.50	62.22
OS-1897 (0.5 gal.)	93.1	1.75	.37*	9.75	60.29
1954 Kern County Plot No. 1 (one picking)—Row Treatment					
Untreated	0.0	1.71	...	.....	.....
DD (9 gal.)	88.	2.04	.33**	18.00	48.00
OS-1897 (1 gal.)	92.5	1.91	.20**	16.50	23.50
OS-1897 (1 gal.) (gravity-flow)	95.2	1.89	.17**	16.50	16.55
OS-1897 (0.5 gal.)	81.	1.85	.14	9.75	18.30
OS-1897 (0.5 gal.) (gravity-flow)	90.	1.82	.11	9.75	13.25
1954 Kern County Plot No. 2—Area Treatment					
Untreated	0.0	2.45	...	.....	.....
OS-1897 (1.25 gal.)	96.9	2.76	0.31	19.80	34.00
OS-1897 (2.5 gal.)	98.5	2.75	0.30	36.60	15.76
EDB (5.5 gal., 83%)	76.0	2.75	0.30	36.00	16.50
DD (20 gal.)	97.4	2.68	0.23	36.00	4.47

[1] Calculated on lint cotton at $0.30 per pound and seed at $60.00 per ton.
[2] Dosage rate of EDB reduced from 2.5 to 1.65 gal. per acre by error in application.
* Increase in yield over untreated significant at 1% level.
** Increase in yield over untreated significant at 1% level; OS-1897 at 0.5 gal. per acre significant at 5% level.