TOPACCO ROOT-KNOT CONTROL BY SOIL FUMIGATION

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Soil fumigation effectively controls nematode diseases such as root knot. It is profitable if there is sufficient disease to materially reduce crop yields. While 3-year crop rotations are recommended for root-knot control, fumigation promises to fill the need for supplementary control where there is insufficient land for these rotations. A single treatment can be relied on for only one season. Unless the fumigants are applied at the right time and in controlled amounts, they may cause poor stands, retard growth or be ineffective against nematodes. The materials must be used with caution because they contain bromine or chlorine, either of which reduces leaf quality when absorbed in excessive amounts. Since the long-time effects of continuous fumigation are unknown, it is safer to fumigate in conjunction with short rotations than to treat the same field every year.

Fumigation Materials: Two volatile liquids have been used. One is a 40% ethylene dibromide mixture (EDB-40) sold as Dowfume W-40, Pascofume-40 and other trade names. The EDB may also be emulsified for diluting with water to prepare a home-made EDB-40 mixture, as is done with Miscible Soilsfume-75. The other liquid is a crude dichloropropene-dichloropropane mixture known as D-D. When poured into the soil, these liquids form gas which kills root-knot and certain other nematodes.

Equipment for Applying: Tractor-mounted applicators with pumps to deliver controlled rates through several delivery tubes are suitable for large fields and for broadcast fumigation. A small gravity flow rig with a single tube mounted on a plow stock or tractor is practical for row treatments in small fields. Gravity flow tanks should be provided with an air-tight filler cap and a breather tube or other device to permit a uniform rate of flow. A one-horse rig consists of a 2-gallon tank which rests on the plow beam or handles, and this is equipped with an adjustable valve for regulating the rate. A flexible delivery tube extends from the valve to the rear of the plow foot. The lower end of this tube is fastened to the bottom of the plow foot and just in the rear of a small 2-inch plow. Be sure to clean out the tank and valve occasionally and strain the liquids into the tank.

How to Apply: Row treatment is the most economical method of application and this consists of pouring a single continuous stream under each row. The liquid is released in the bottom of the furrow and immediately behind the plow foot in such a way that it is automatically covered with soil the instant it touches ground. This is necessary to prevent loss of vapors. A turnplow or disk tiller following closely behind the rig can be used to prepare the row bed. With tractors it is best to treat and bed in the same operation. Treat 10 inches deep on drier upland soils and 6 inches on wet lowlands. For broadcast treatments the plow shanks are spaced 12 inches apart and each is equipped with a delivery tube. If preferred, the fumigant may be applied in the furrow immediately in front of the turnplow wing at the time of turning the land. The soil should be smoothed with a drag immediately after broadcasting.

1/ In cooperation with Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, and the University System of Georgia.
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How Much to Use: The safe minimum rate of EDB-40 in the row is 1/2 pint to 136 feet of row; or 5 gallons per acre for 4-foot rows and nearly 6 gallons if the rows are 42 inches apart. The minimum rate of D-D to give the same control is 1/2 pint to 91 feet, or 7-1/2 gallons per acre for 4-foot rows. The maximum rate for EDB-40 is 1/2 pint to 91 feet; and the maximum for D-D is 1/2 pint to 68 feet, or 10 gallons per acre for 4-foot rows. Maximum rates give better disease control but are more likely to damage the tobacco, particularly in cold and low wetlands. In applying the desired rate, it is first necessary to find the exact valve adjustment that will deliver 1/2 pint in the time required for the rig to move the specified distance in the row. For broadcast treatments apply 15 gallons per acre of EDB-40 or 20 gallons of D-D. Where the streams are 12 inches apart, this means 1/2 pint of EDB-40 to 180 feet of furrow and 1/2 pint of D-D to 136 feet.

Conditions for Successful Treatment: Fumigants have been most effective when applied in thoroughly pulverized moist cool soil. All trash and clods should be eliminated. Quiet cloudy days are better for treating than hot, dry, or windy days. If possible, select a time when the temperature at night does not go below 40 degrees F., nor above 75 degrees during the day for the first 48 hours after treating. A large row bed is preferable and it is sometimes helpful to run out the middles immediately afterward to prevent heavy rains from washing over the beds. Do not disturb the beds for one week after treating. Plants may be set on the original bed, but if packing has occurred the row may be carefully opened and a fresh bed prepared in exactly the same location. The second bed should be slightly smaller than the first. CAUTION: To avoid personal injury by these poisonous chemicals, be sure to read and follow closely the warnings on the label.

When to Treat and Transplant: The interval between treating and planting should be long enough to permit the gas to escape from the soil, and this varies with the amounts used, soil moisture, and soil type. After minimum amounts of EDB-40 it has been safe to set within two weeks on all soil types used for tobacco, but on very wet lowlands it is safer to wait three weeks. Following minimum amounts of D-D mixture the waiting period should be at least a week longer than for EDB-40, and as long as four to six weeks on cold wet lowlands. Where more than minimum amounts are applied, it is safer to wait a week longer than usual. Light sandy soils, low wet lands, and cold soils usually require a week longer waiting period than the heavier and drier uplands. Longer waiting periods are always safest.

Fertilizer for Fumigated Soil: If the tobacco is to be set within two or three weeks after treating, it is practical to apply 60 to 75 percent of the fertilizer along with the fumigant, or immediately in advance of the applicator. If a tractor is used, both fertilizer and fumigant can be applied and the rows bedded in one operation. The remaining fertilizer may be applied as a side dressing at the first plowing. If the waiting period is expected to be four weeks or longer, it is better to withhold the fertilizer until a few days before planting. In this event, the row is carefully opened and fertilizer applied in the usual way, care being taken to keep the row in exactly the same location and to avoid moving in soil from the untreated middles. Since D-D contains chlorine, it is safer to use a fertilizer containing no chlorine in conjunction with this fumigant. Chlorine damage in tobacco may result from too much chlorine-containing fertilizer, too much D-D mixture, or both. Minimum rather than maximum recommended fertilizer rates are suggested for use with both fumigants.

NOTE: These fumigants may be used for broadcast treatments in tobacco bed soil to control root knot. For further information on planted soil treatments, consult Mimeograph Paper No. 79 on "Chemical Soil Treatments for Tobacco Beds".
A HOME-MADE ONE-HORSE RIG FOR APPLYING SOIL FUMIGANT

Flat 2-gallon tank attached in horizontal position in front of, or between, plow handles.

Vertical 1/4-inch discharge nipple

Upper 1/4-inch valve used as a cut-off

Lower 1/4-inch valve for regulating rate of flow. A single metering valve may be used both as cut-off and regulator

One-quarter inch flexible tube extending from valve to heel bolt may be tied to beam and plow foot with cord or wire.

Discharge end of tube against heel bolt, pointing straight down or slightly to rear and on level with heel bolt. The liquid should be covered the instant it touches ground, and should fall to the bottom of the scooter-furrow before any soil falls back into the furrow.

NOTE: For applying two parallel streams under each row, use a double foot plow stock and run a separate tube to each foot, using a regulating valve or disk for each tube; or make two furrows 12 inches apart with a single foot stock.