Management of Rootknot Nematode in Arizona Cotton

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INTRODUCTION

Nematodes are microscopic-sized worms that are parasitic on the roots of cotton. They prevent the normal uptake of water and nutrients into the plants. While other nematode species inhabit the soil, only rootknot nematode (Meloidogyne incognita) significantly affects cotton production in Arizona. The pest is restricted to the sandier soils where it attacks both short and long staple cotton varieties and causes reductions in yields and fiber quality. Its invasion of roots can predispose the plants to secondary infection by other pathogens such as Pythium, Rhizoctonia and Fusarium spp. Economic losses may be reduced by crop rotation or soil treatment with recommended nematicides.

DETERMINING ECONOMIC THRESHOLDS

Economic thresholds vary with each field and growing situation. Factors involved are the cost of producing the crop, estimated yield, crop value, cost of nematode control, damage threshold, population density, and climatic factors influencing both host and parasite. To develop the economic threshold it is first necessary to determine population numbers that are or will be present during the critical period of growth. In cotton grown in Arizona, that period lasts from seed emergence through the first 6 to 8 weeks of root development. Once the tap root has extended beyond the 8-inch depth, the laterals can be attacked without serious consequences unless other plant pathogens are in complex with the nematode infection.

The number of rootknot nematodes required to damage cotton can vary dependent on geographic areas, soil types, and most important, their associated temperatures. Cotton can germinate and establish a tap root at temperatures below that required for nematode development. In the lower desert valleys, larval counts of 350 to 400 per liter of soil, under most circumstances, will warrant the cost of nematicide treatment. The damage threshold is considered to be one larva for each gram of soil, (100/kilo). In the highest elevations with cooler spring temperatures, populations required to determine an economic threshold may be twice that encountered in the warmer desert soils.

Correct sampling procedures and timing are essential in determining the population density. Since rootknot nematodes are found in soils consisting of the sandy to sandy-loam types, it is helpful to know or learn from Soil Conservation Service maps the total percent of the field that contains those soils. In most situations encountered in the desert valleys of Arizona, only a small portion of a field may have sandy soils. Those areas, irregular in shape, make it difficult to chemically treat only the heavily infested portion of the field. As a consequence, it may not be economically feasible to consider nematicide treatment as an alternate method of control.

Soil samples should be taken with a shovel or soil probe to a depth of 8 to 10 inches prior to planting but with sufficient time for nematode analysis and time to inject soil fumigants if results indicate that treatment is warranted. Sample those areas consisting of soil 70% or more sand. Twenty or more subsamples may be combined from no more than 10 acres to make a 1-liter sample. Nematode analysis should be made by a competent laboratory with experience in nematode identification. Since more than 1 rootknot species may be present, it is highly recommended that a portion of each sample be used for a bioassay (greenhouse test). Using cotton and peanuts, rootknot species can be differentiated. Additional advantages are obtained when the procedure is used since eggs, which cannot be directed by other methods, may hatch and increase the total population. Knowledge of the previous crops and nematode history assist in making management decisions.

CONTROL PROCEDURES

1) Where practical, crop rotation frequently can be the most economical method of preventing rootknot nematode damage in cotton. Less susceptible crops, such as non-dormant alfalfa cultivars, grain crops, peanuts, grasses and various specific rootknot resistant vegetable varieties, grown in rotation with cotton, can help reduce nematode populations. Cotton cultivars resistant to the nematode have not been developed for Arizona.

2) Summer fallowing can be used effectively in crop rotation patterns. However, the cost of leaving land idle until the following spring usually makes that an uneconomical choice. Weed hosts must be controlled if fallowing is used as a means of reducing nematode populations. The best control is obtained by irrigating and discing the field once or twice during the fallow period.

3) When crop rotation is impractical, consideration must be given to soil treatment with a suitable nematicide. The decision is based on the number of rootknot nematodes in the soil, the anticipated temperature during seed germination and development of the tap root, the percent of the field with sandy areas, where the soil texture is 70% or more sand, and the anticipated price of cotton.

NEMATICIDE APPLICATION

Soil fumigants remain the most effective and economical method of controlling rootknot nematodes in cotton. Non-fumigants, such as the carbamates and phosphate insecticides, also have nematicidal activity, but are usually less effective and more expensive than soil fumigants. Where early season insects are present, those compounds may deserve consideration.

The only soil fumigant presently available for use in cotton is 1-3,D (Dichloropropene) sold as Telone II. A liquid compound, it is injected into the soil before planting. Soil should always be in excellent tilth with temperatures above 50°F. Soil moisture should be no higher than 20% of its water-holding capacity. Rates vary with temperature, moisture, and soil texture. The manufacturer's label gives instructions for the correct dosage.

For best results with the soil fumigant, beds should be listed and irrigated before the material is applied. Application may be made at the time the beds are listed if moisture is adequate. A light irrigation may be necessary before application. The injector shank should be ahead and between the listers. By combining listing and irrigation, it is easier to meet minimum time requirements before planting. Caution should be taken to avoid heavy pre-plant irrigations immediately after application to prevent leaching the fumigant.

The low rates of Telone II recommended for rootknot control in cotton protects the plant only long enough for the tap root to develop. As the season progresses, many of the lateral roots may become infested. While it would be advantageous to avoid the damage, the cost of higher rates of nematicide to prevent later infection is prohibitive.

Remember! Follow the label specifically as directed by the manufacturer of the nematicide.

REFERENCE

Nematodes. 1984. Integrated Pest Management for Cotton in the Western Regions of the United States. Publication 3305. Available from: Publications, Div. of Agriculture and Natural Resources, Univ. of California, Oakland. $15