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Nematode Management

Louisiana Cotton Production

Several plant-parasitic nematodes are responsible for causing serious losses in Louisiana cotton every year. The nematode losses within any field can range from fairly minor to severe.

Unfortunately, many fields sustain fairly significant damage without nematodes being recognized as the cause. Southern root-knot (Meloidogyne incognita) and reniform nematodes (Rotylenchulus reniformis) are responsible for causing most of the nematode problems in cotton.

Southern Root-knot Nematodes

This nematode species has been in our state for many years and continues to be a persistent problem for cotton. It most often is associated with sandy soils such as those found near rivers such as the Mississippi, Red, Ouachita, and Tensas rivers.

Southern root-knot nematodes can be extremely damaging to cotton and can cause problems even when only a fairly small number are present in the soil. Symptoms of this nematode include stunting, yellowing, small bolls, delayed maturity or early senescence, and loss of yield (Figures 1 and 2). Damaged plants also show water and nutrient stress quicker than other plants. A diagnostic feature for this nematode is the presence of galls or swellings of the root system (Figure 3) formed during the feeding process. This nematode also can combine with the fungus Fusarium oxysporum to increase Fusarium wilt in susceptible cotton varieties.

Reniform Nematodes

Reniform nematodes appear to be an "introduced species" for our state. Although reniform nematodes were first found in the 1940s, the species did not develop into a serious problem until the late 1970s and early 1980s. Reniform nematodes are now the most dangerous nematode of cotton in our state.

These nematodes are not as restricted by soil type as southern root-knot nematodes and can be found in a range of soil types from sandy loams to silty clay loams. Generally, the highest levels of this nematode are found in silt loams, with fewer being found in lighter or heavier textured soils.

Symptoms of reniform nematodes are much like those observed with Southern root-knot. Plants can be stunted, slow growing, smaller bolls, delayed maturity and low yielding (Figures 4, 5 and 6). The major difference is the absence of galls (Figure 7). It is difficult to identify reniform nematode in a field since there are not any distinctive symptoms or signs of the organism. Although reniform nematode can occur with the Fusarium wilt fungus, the combination does not appear to be as serious as when southern root-knot nematodes are involved.

Management Options

Nematode Identification. Southern root-knot nematodes can be readily identified by the presence of galls on a plant's root system from mid- to late summer. Reniform nematodes require a soil sample sent to a nematode laboratory to make a positive identification. Population estimates can be made from soil samples collected in the fall for both nematodes, and these estimates can be used to make management decisions. Many fields now have both nematode species present.

Soil samples can be collected using zone sampling (similar soil types within a field as measured by Veris technology or NRCS soil maps), grid sampling (divide field into 2.5-5 acre blocks) or classical sampling procedures (field divided into several large blocks) (Figure 8). Any of these methods will provide some information about the types and populations present within a field. Zone sampling is perhaps the best method since it evaluates nematodes within similar soil types.

Crop Rotation. This method depends upon planting a different type of crop that is less susceptible to the nematode type you have in your field (Table 1). Corn, milo, resistant soybeans, peanuts and sugarcane can be used successfully to reduce reniform nematodes. Milo, peanuts and resistant soybeans can be used to reduce southern root-knot nematode. Corn is great for reducing reniform nematodes but is an excellent host for southern root-knot. Few varieties of soybeans are available for either reniform or southern root-knot nematodes.

An additional problem with soybeans is that the few resistant varieties available have resistance only to one type of nematode but not the other. A resistant crop can reduce nematode populations even after one year. When populations of nematodes such as reniform are extremely high, a two year rotation to a nonhost crop works best. Crop rotation currently is practiced by many Louisiana producers because of the favorable prices of grain crops.

Resistance. There are only a few cotton varieties that have some resistance against the southern root-knot nematode. These include varieties such as Stoneville 5458B2RF, Stoneville 4288B2F, Phytogen 417WRF or Phytogen 427WRF. There are not any commercial cotton varieties with resistance against the reniform nematodes. Even varieties with some resistance have been shown to be beneficial in reducing nematode populations and galling. High levels of nematodes may still damage even these partially resistant varieties, however, and may still need to be treated with a nematicide.

Nematicides. The use of chemical nematicides against nematodes in cotton has been widely used in Louisiana since the early 1980s. Temik 15G was the dominant chemical for many years but recently has been removed from the market. Seed treatment nematicides such as Avicta Complete Cotton, Aeris or Aeris/Poncho/Votivo now are the dominant nematicides in Louisiana cotton. Fumigants such as Telone, Vapam or K-Pam are effective but more costly to use (Table 2, Figures 9 and 10). Seed treatment nematicides are not intended to be used alone when populations of either southern root-knot or reniform nematodes are high.

Table 1. Host status of field crops to nematodes in Louisiana.

Crop	Southern root-knot	Reniform
Corn	Good	Poor
Cotton	Good	Good
Fallow*	Poor	Poor
Grain Sorghum**	Poor to fair	Poor
Soybeans	Good to fair (depends on variety)	Good to fair (depends on variety)
Sugarcane	Poor	Poor
Sunflowers	Good	Good
Sweet potatoes	Good	Good
Wheat	Fair	Poor

*Weeds present in a field may serve as excellent hosts for either nematode.

**Sorghum also has been reported as a fair-to-good host of root-knot nematodes.

Fields with high populations of either reniform or southern root-knot nematodes, or both, may require using both seed treatment and fumigant nematicides. Generally, most fields will have only some areas (soils that are lighter textured and deep within the profile) that are the most damaged by nematodes and require the application of a fumigant. Seed treatment nematicides usually are all that are required for the remainder of the field where the soil is heavier textured or where lighter soils are not very deep in the soil profile.

Cultural practices. Damage to cotton always is greater when there is some type of stress during the growing season. Stress includes anything that slows or reduces the plants' abilities to quickly grow and develop. Stress could include cool or wet springs, damage from insects such as thrips, drought or fertility issues.

Although nematicides may still be beneficial if nutrient issues are present, the responses will be much greater if the nutrient issue is corrected.

Drought is a big factor in causing increased problems with reniform nematodes. Consequently, timely irrigation can be beneficial in reducing losses from these nematodes. Southern root-knot nematodes can cause increased problems in dry times but are still quite capable of causing serious damage even when adequate moisture is present.

Subsoiling has been shown to be effective in increasing cotton yields in fields infested with root-knot nematodes. Winter cover crops such as rye or Cahaba White vetches are fairly poor hosts of southern root-knot nematodes and likely will not increase damage to cotton from this nematode. Other cover crops, such as most vetches and clovers, can build up populations of the southern root-knot nematodes and negatively affect the following cotton crop.

There are numerous weeds that serve as excellent hosts for either southern root-knot or reniform nematodes (Table 3). Weed management will prevent buildup of these pests, particularly when you are rotating to a crop or crops that will be beneficial.

Figure 1. Early season root-knot nematode damage to cotton.

Figure 2. Late-season damage from root-knot nematodes. Many plants are dying from the combination of high levels of root-knot nematodes and Fusarium wilt.

Figure 3. Severe root-knot nematode injury is evident on young cotton plants. The swelling spots on the roots are galls produced by these nematodes.

Figure 4. This area of a field shows stunted plants from reniform nematode damage.

Figure 5. Stunted cotton at midseason from high populations of reniform nematodes.

Figure 6. Severe stunting at the end of the growing season from reniform nematodes.

Table 2. Labeled nematicides in Louisiana for cotton. Please read and follow all label directions.			
Nematode type	**Nematicide**	**Rate per acre**	**Timing and method of application**
Root-knot or Reniform	Avicta Complete Cotton or Avicta Duo	*Seed applied	Use with low to moderate populations of nematodes.
	Aeris	*Seed applied	Use with low to moderate populations of nematodes.
	Poncho/Votivo	*Seed applied	Use with low to moderate populations of nematodes.
	Telone II	3-6 gallons per acre	Apply pre-plant, beneath rows, to a depth of 12-16 inches.
	Vydate C-LV	8.5-17 ounces per acre once or 8.5-17 ounces per acre for a second application	Apply as a foliar spray at the two- to five-leaf stage. The second application should be seven to 14 days later.
	*Seed treatment nematicides are applied to the seeds prior to purchase by commercial seed treatment equipment.		

Figure 7. Reniform nematode egg masses (stained red) on the small root of a cotton plant. Each egg mass contains 50-60 eggs but these usually are not identifiable without magnification.

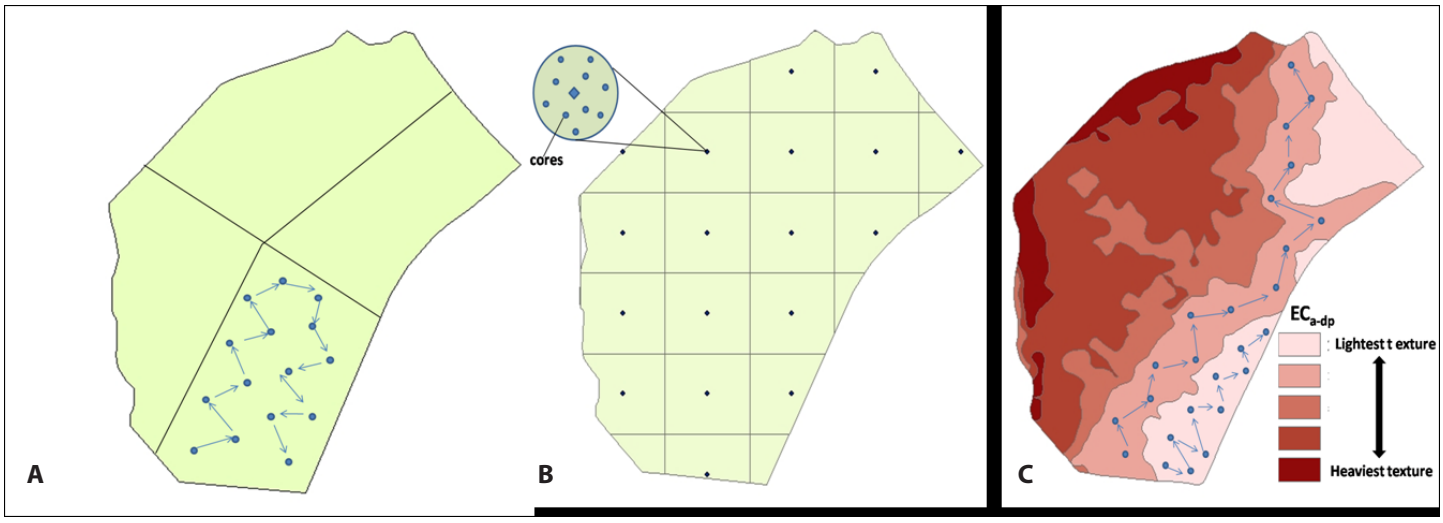

Figure 8. Examples of sampling strategies for nematodes with (A) classical methods of dividing field into large blocks, (B) grid sampling into 2.5-5 acre blocks and collection around the center of each block or (C) zone sampling by dividing field into similar soil areas (based on Veris readings) and collecting representative samples from each zone.

Table 3. Host status of several weeds that are susceptible to nematodes in cotton fields.		
Weed	**Southern root-knot**	**Reniform**
Amaranths (several species)	Moderate to good	Good to poor
Common purslane	Moderate	Good
Curly dock	Good	Poor
Hairy vetch	Good	Good
Hemp sesbania	Good	Moderate to poor
Morningglory (several species)	Moderate to good	Moderate to good
Prickly sida	Good	Moderate
Sicklepod	Poor	Good
Spurred anoda	Good	Unknown
Velvetleaf	Good	Moderate

Figure 9. Early season response of cotton to a nematicide . Plants on the right were treated with a nematicide, and plants on the left were not treated.

Figure 10. Mid-season response of cotton treated for root-knot nematodes with a nematicide. Cotton rows on left were treated with the fumigant Telone.

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Pub. 3354 (Online only) 7/14