ENY-005

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Tobacco Nematode Management [1]

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Nematodes That Attack Tobacco

Southern root-knot nematode *(Meloidogyne incognita)*, Javanese root-knot nematode *(M. javanica)* and peanut root-knot nematode *(M. arenaria)* are the most important soil-borne pests of tobacco in Florida. They are ubiquitous in tobacco fields and often more than one species is present. Root-knot nematodes cause serious yield and quality losses in tobacco, and in addition, they make the crop more susceptible to other diseases such as brown spot and black shank. Since tobacco is highly susceptible to nematode damage, a high priority must be given to nematode management each time the crop is grown.

Diagnosis

Foliar and Root Symptoms

Early season symptoms of nematode damage include plant stunting and poor growth in oval patterns in a field. Leaves of the tobacco plant may or may not show typical yellowing at this stage, and root galls are very small. Within two months after transplanting, leaves of tobacco plants suffering from root-knot disease turn pale-green then yellow in a process of early maturation. In severe stages of infection, a condition known as 'rim-firing' occurs that includes necrosis of leaf tips and leaf margins (Figure 1). These symptoms are caused by lack of water and nutrient uptake and can be misdiagnosed as such. Examination of roots for nematode-induced galling (knots) is an easy and accurate method to diagnose the disease (Figure 2).

Figure 1. Severe root-knot nematode damage in maturing tobacco, leaf margin necrosis "rim-firing" is common.

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Figure 2. On the left, a tobacco root system heavily galled by root-knot nematodes. On the right, a healthy tobacco root system.

Soil Samples

Nematode problems of tobacco, and in particular, the root-knot nematode species involved can be accurately determined only by sample submission to a nematology advisory laboratory. Prior to taking samples, contact your county Extension agent for information concerning available sampling tools, shipment bags and proper procedures for submitting samples. Samples should not be taken when the soil is dusty dry or soggy wet. Two sampling strategies may be employed. A general survey should be performed in the fall prior to tobacco planting the following spring. Two soil cores (1-inch wide by 8-10-inches deep) should be taken for each acre of tobacco to be planted in a 10-acre block containing a uniform soil type and cropping history (Figure 3). The cores should be thoroughly mixed and a 1-pint sample extracted and placed in a sealed plastic bag and kept cool (not frozen) before immediate shipment to an advisory laboratory. Do not allow samples to be exposed to the sun. If possible, include living crop or weed roots and fragments in the soil sample.

Where a nematode problem is suspected, several soil cores and plant roots from within and immediately around a poor growth site should be taken while the crop is still growing. These samples should be collected and handled as described above.

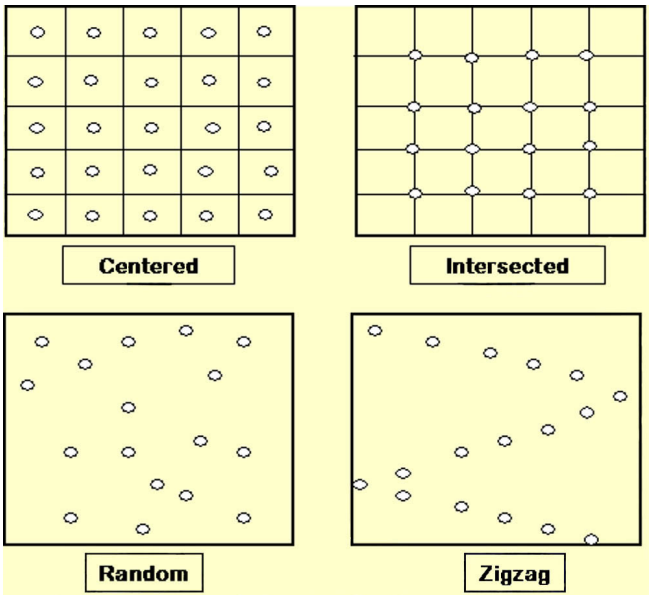

Figure 3. Ten Acre Sampling Patterns - Take 15 to 20 cores.

Management

Crop Rotation

Even when other nematode management practices are included in production, rotation of a tobacco crop for three to four years with non-hosts or less susceptible hosts to root-knot nematodes is recommended. Grasses such as bahiagrass, bermudagrass, millet, and sorghum are among the most effective crops in reducing soil populations of root-knot nematodes and should be grown for at least one year before planting tobacco. Though some root-knot nematode reproduction could be expected on field corn, this crop is considerably less susceptible than tobacco and is useful in the reduction of root-knot nematode soil populations. Cotton is not a host for Javanese or peanut root-knot nematodes and is an acceptable rotational crop when it is known that these are the problem nematodes. However, cotton is very susceptible to southern root-knot nematode and tobacco cultivars resistant to this nematode should be grown when tobacco follows cotton production. Peanut is a host to the peanut root-knot nematode but not the Javanese and southern root-knot nematodes. Tobacco should not be grown in years following root-knot susceptible crops such as lupine or other winter legumes nor following summer legumes as soybean, cowpea, or alyce clover, etc., which are highly susceptible to root-knot nematodes.

Crop Destruction and Weed Management

Tobacco plants continue to live after harvest and even after mowing, and hence, can survive several months before a killing frost. Nematodes will continue to feed and reproduce on these plants and associated weed hosts. This increases nematode soil population densities surviving through to the next planting season. Therefore, roots should be exposed and destroyed with a middle-buster or turn plow immediately following tobacco harvest to help eliminate these breeding sites. Bare fallowing after a tobacco crop should not be practiced since it can seriously deplete soil organic matter and contribute to soil erosion. It is recommended that tobacco land following post-harvest plowing be planted to a winter cover crop. This will help in the suppression of weeds that may be hosts for root-knot nematodes. The cover crop must be a poor or non-host of the problem nematode. Winter cereals are most suitable for managing root-knot nematodes in this regard.

Use of crop rotation systems that include bahiagrass has been increasing, and this perennial grass is a non-host for nematodes affecting tobacco. However, weeds must be managed in the bahiagrass or nematode populations will be maintained in such a system resulting in damage to the following tobacco crop. A bahiagrass rotation of two or more years will greatly reduce nematode populations providing broadleaf weeds are controlled early and regularly in the first year bahiagrass and is continued through the life of the rotation.

Resistant Varieties

Root-knot nematode resistant tobacco varieties are available for only the southern root-knot nematode. However, since the southern root-knot nematode usually is present in co-incident infestations with one and/or the other root-knot species that attack tobacco, these resistant varieties should be grown in any field known to be infested with root-knot nematode, irrespective of the species. Tobacco varieties without this resistance should not be planted in fields where root-knot nematode damage is likely. Root-knot resistant tobacco varieties should be expected to assist and not replace other root-knot nematode management practices.

Transplanting and Fumigating Beds

Tobacco transplants should be healthy and free from nematode infection. Plants that are grown under controlled conditions in soil-less media are almost always nematode-free. However, growers who produce their tobacco transplants in field plant beds should do so only in fumigated soil to reduce the risks of carrying nematode or other soil-borne diseases into the field. Bedding sites should be selected that have not been planted to tobacco or other root-knot nematode susceptible crops for several years. Sites should have good drainage and be easily accessible for irrigation. Prior to fumigation, the beds should be worked until free of clods, stones, and plant debris. Fumigation should be performed when soil temperatures are between 50 - 80° F, and the soil is neither very dry nor very wet.

Fumigation products containing methyl bromide have been the choice of most growers over the years due to excellent management of many weeds, insects, diseases, and nematodes. However, methyl bromide supplies are becoming limited, and this active ingredient is scheduled for phase-out in the U.S. Other fumigants may also be used for tobacco transplanting beds, and these include Telone C-17, Telone C-35, Busan, Vapam, and Cholorpicrin.

Field Nematicides

Pre-plant soil fumigants are generally superior for the management of root-knot nematodes than non-fumigant nematicides (Table 1). Advantages of the latter, however, include a minimal waiting period prior to tobacco transplanting and some useful insecticidal activity. Successful nematicidal treatment requires proper land preparation. Soil should be well-prepared at least one month prior to treatment to allow decomposition of plant remains that could shield nematodes from treatments and interfere with application equipment. Irrespective of nematicide employed, the soil should be in good seed-bed condition with adequate but not excessive soil moisture.

Telone C-17 and Telone C-35 are multi-purpose fumigants with fungicidal properties in addition to the solely nematicidal property of Telone II. The latter is the least expensive product, and it is

generally more economical to use Telone II for nematode management coupled with a separate and specific fungicidal treatment. Fumigation with Telone products may be accomplished using pumps variously driven by the ground, PTO, or electricity. A more recent innovation using application from pressure sealed containers is available that provides less environmental and personal exposure to the fumigant. Consult with fumigant dealers who have been trained in proper equipment and application methods for further information.

Fumigation should be completed two to four weeks before transplanting tobacco. Heavy, wet, and cold soils will require longer waiting periods before transplanting tobacco. Do not fumigate soil that you would consider too dry for planting as this condition allows the fumigant to escape too rapidly from the soil and nematode management is impaired. Conversely, fumigants applied to soil that contains excessive moisture may not seal well allowing the fumigant to escape prematurely. The Telone fumigants listed in Table 1 should be placed 12-14 inches below the soil surface, and it is critically important to seal these chemicals in the soil. Suitable equipment should be used to completely close or destroy the chisel furrows and pack the soil surface to seal the fumigant into the soil immediately after application. The latter should be accomplished immediately using ring rollers, or disc harrows, and in the case of single chisel per row treatments, disc-hillers to form a raised bed behind the chisel. Row fumigation with one or two chisels generally is adequate to manage moderate populations of southern root-knot nematode if a root-knot nematode resistant variety is to be grown. However, if moderate to high populations of Javanese or peanut root-knot nematodes are present, broadcast fumigation at high rates may be required. This is especially important when tobacco follows tobacco or other root-knot nematode susceptible crops. Alternatively, broadcast fumigation can be made using a bottom plow where the fumigant is applied directly into the furrow ahead of the plowshare such that the subsequent furrow slice immediately covers the fumigant. Disking or rolling the soil within a few hours after bottom plow application is required for sealing to prevent escape of the fumigant. After application, observe re-entry requirements on the product labels and also allow sufficient time for fumigant dissipation to prevent injury to tobacco transplants.

Non-fumigant nematicides are usually less effective than the fumigants, but are sometimes the choice of growers favoring easy application immediately before transplanting. Failures in nematode management from non-fumigants generally can be traced to leaching of the nematicide from an overabundance of rain too soon after application. A good rotation program and root-knot resistant tobacco varieties must be used in conjunction with non-fumigant nematicide treatments.

Table 1. Nematicides that may be used for management of nematodes on tobacco.

Nematicide[1]	Rate	Application[2]
Telone II	9.0 -12.0 gallons / acre	Single chisel injection on 48-inch row centers. (106 - 141 fl. oz. / 1000 ft row / outlet). Apply 7-10 days before transplanting. Two chisels set 12 inches apart per row on 48-inch row centers. (53.0 – 70.5 fl. oz. / 1000 ft. row / outlet). Apply 7-10 days before transplanting. Broadcast through chisels set 12 inches apart (26.5 - 35.2 fl. oz. / 1000 ft. row / outlet). Apply 7-10 days before transplanting.
Telone C-17	10.8-17.1 gallons / acre	Single chisel injection on 48-inch row centers. (127 - 201 fl. oz. / 1000 ft. row / outlet). Apply 7-10 days before transplanting. Two chisels set 12 inches apart per row on 48-inch row centers. (63.5 – 100.5 fl. oz. / 1000 ft. row / outlet). Apply 7-10 days before transplanting. Broadcast through chisels set 12 inches apart (31.7- 50.2 fl. oz. / 1000 ft. / outlet). Apply 7-10 days before planting.
Telone C-35	13-20.5 gallons / acre	Broadcast through chisels 12 inches apart (38.2 - 60.2 fl. oz. / 1000 ft. / outlet). Apply 7-10 days before planting.
Vydate L	1 gallon / acre	Row Treatment: Based on 12,000 feet of row / acre; apply in at least 20 gallons of water per acre to 18-24 inch bands along row and incorporate 4-6 inches deep. Broadcast and Bed Treatment: Use at least 40 gallons of water/A

[1]Please consult labels for handling and use restrictions.
[2]The high labeled rates of Telone products are recommended in deep sandy soils.