LOUISIANA PLANT PATHOLOGY
DISEASE IDENTIFICATION AND MANAGEMENT SERIES
LSU AgCenter Research & Extension

Strategies for Sampling Plant-Parasitic Nematodes in Field Crops

Plant-parasitic nematodes attack every field crop grown in Louisiana, including cotton, soybeans, corn, milo, rice, sugarcane, sweet potatoes and wheat. Because most of the injury occurs to plant roots, recognizing nematode symptoms is often very difficult. Typical symptoms of nematode injury to plants include stunting, discoloration, poor yield and premature death. Even though plant-parasitic nematodes are found in every soil, only when the right combinations of nematodes, susceptible plants, time and environmental conditions come together do nematodes cause serious injury. Very few nematodes cause distinctive symptoms that can be easily recognized as nematode injury. Root-knot nematode, however, does produce galls or swellings on the roots of plants it attacks. Most types of nematodes found in Louisiana cannot be easily identified and require some type of assistance from a laboratory to identify them. A Nematode Advisory Service is provided by the LSU AgCenter to help homeowners, farmers, county agents and consultants identify nematode problems.

Sampling time

There are certain times of the year when nematode samples should be collected. Probably the best time is during the fall or early winter. Nematode populations have generally built up during the growing season and are generally still very high from September through December. Soil moisture may be scarce during September and October, so it is best to wait until sufficient rainfall has occurred before collecting samples. Spring samples are usually not quite as dependable for nematodes such as the Southern root-knot (Fig. 1). This nematode tends to survive the winter months as eggs, which makes it much more difficult to detect and identify in the soil. Spring samples should be taken as soon as possible to allow sufficient time for processing in the laboratory and especially to allow time to make crop changes if serious problems are detected. Crop rotation is important in the management of some types of nematodes and should not be overlooked.

Because nematode problems may be suspected during the growing season, don't forget about sampling during this period. If you simply want to find out if nematodes are the cause of problem areas within a field, collecting soil samples from the roots of the plants is reliable for nematode identification. Sometimes nematode damage is so severe that plants die. Don't collect samples from areas containing dead plants but take them from transition areas or areas that are still showing symptoms. Very few nematodes can be identified in the field. The Southern root-knot nematode, however, does produce large knots or galls on the roots of most plants and is very easy to identify on crops such as cotton or soybeans. It is much more difficult to recognize root-knot nematode symptoms on corn or sweet potato. Galls are usually very small on these two plants and may be overlooked. If damage caused to plants is suspected to be from the Southern root-knot nematode, dig up some of the stunted plants during the growing season with a shovel and look at the root system. When galls or knots are present and found in large numbers, then root-knot nematode is the causal agent. If galling is not detected, then it may be one of the other types of nematodes that don't produce these visible symptoms. Collect some soil from these problem areas and check for other nematodes.

Field size

Nematode distribution is not uniform throughout a field, so it's important to try to identify the areas where they are present and at high enough populations to cause injury to the crop you intend to plant. Divide fields into areas that are as similar as possible with respect to crop history, soil type, topography or personal history. The use of apparent electrical conductivity (ECa) has become widespread in the past few years using the Veris 3100 EC Soil Mapping System to help define soil texture within a field (Fig. 2). This device emits an electrical current into the soil, and the readings obtained are a good substitute for soil texture. Very low readings indicate that the soil is usually very sandy, while high readings indicate more clay is present (Fig. 3). A second method of obtaining information about the soil texture within a field comes from soil maps that can be obtained from the Natural Resources

Conservation Service (Fig. 4). These maps can show the different soil types that are present within a field. Although either method can be used to define texture, the use of the ECa is probably more precise for defining similar soil types within a field.

Be sure to limit the size of the area representing a field to no more than 5-20 acres. Otherwise, problem areas may be missed or populations of nematodes may be diluted across the whole field so that an incorrect recommendation may result. The idea is to obtain enough samples to represent the field and give a good indication of the nematodes present and whether they are at high-enough populations to cause injury to plants.

Sampling procedures

Fields can be sampled for nematodes in several ways.

The first method is referred to as stratified random sampling (Fig. 5). This is nothing more than selecting individual soil cores in a random, systematic pattern within a designated area within a field. In this case, a field is often simply divided up into several blocks that may be up to 20 acres each. Samples are usually collected with a soil probe from about 15-20 locations that thoroughly represent the area. Each soil core is taken to a depth of 6-8 inches in a systematic pattern. If possible, soil samples should be collected from the rows where the previous crop was grown to give the best indication of population levels of nematodes. All of the soil cores are collected in a bucket and thoroughly mixed, and approximately one pint is removed and added to a plastic bag. Quart-sized freezer bags are one of the best types of bags to use. Sandwich bags are fragile and should not be used for soil samples. Don't use boxes that are intended for nutrient analysis at the soils laboratory because boxes will allow the samples to dry out, killing any nematodes present. Be sure to mark each bag with sufficient information to make it identifiable, including producer name, field name and location within the field where the sample came from.

The second method of collecting soil samples that is used by a number of producers is grid sampling (Fig. 6). Grid sampling uses a systematic approach to divide a field into a number of squares or grids of equal size. These grids can be any size but are usually between 2.5-5.0 acres. A point is assigned to the center of the grid and soil samples are collected from an area 10-15 feet around this center point. A total of 8-10 soil cores collected at a depth of 6-8 inches should be obtained from each grid. Grid sampling requires a GIS program that can take a field boundary and assign a grid pattern to that field. Once the grid pattern has been assigned, the information can be loaded into a handheld GPS device so it can locate accurately each of the sampling sites within a field.

The third method that has recently become used is zone sampling (Fig. 7). Zones are nothing more than a method of dividing the field into similar areas usually based on soil texture. The use of ECa and the Veris Soil EC Mapping System is being more widely used to develop zones. Once the machine has been run through a field, a map can be made showing the areas of the field with the lightest to heaviest soil. The field can be divided into a number of zones, but usually three to seven based on soil variability within the field. Once an EC map has been developed, each zone can be sampled separately. A total of 10-15 soil cores can be systematically collected from each zone to thoroughly represent it. If a field is very large or zones separated within the field, then additional samples should be collected from these areas.

Handling Nematode Samples

Because nematodes are living animals, it is important to handle soil samples in a correct manner to insure their survival before reaching the nematode diagnostic lab. Nematodes are sensitive to temperature extremes and can easily be killed below 32 degrees F and above 115 degrees F. Once the samples have been collected, keep them in a cool location out of direct sunlight. Samples can be stored between 60-80 degrees F for several days without seriously injuring the nematodes that are present.

Sample History

Information about each sample should be included on a Nematode Assay Information sheet. The information that is required includes the producers name and address, cropping history and planned crop. Nematode population will change over time and especially when different crops are planted. However, the previous crop will have the most impact on the current nematode population present in each sample. Be sure to include the information about the next crop that is planned. It also is a good idea to list several crops if crop rotation is an option. Crop rotation remains one of the best methods of dealing with some very high populations of some nematode types that are found in Louisiana. Each form has space for a total of eight samples. Samples along with the forms can be brought to the local county agent in each parish for mailing to the Nematode Advisory Service.

Once the samples are received by the Nematode Advisory Service, they are processed and nematodes are extracted from the soil. Each sample will be counted using a microscope, and both nematode types and population levels present will be estimated. Recommendations for each sample will be made based on the types and population levels of nematodes present as well as the next planned crop. The management plan may be as simple as just using a resistant variety, rotating to another crop that will not be injured or using a nematicide.

Nematodes are a major problem for a number of the crops grown in Louisiana. However, recognizing and identifying the areas where they are causing problems can often be accomplished only by collecting good samples. A good sampling plan, careful collection and handling of samples, and proper information about each sample can be very useful in developing a management strategy to deal with nematode problems.

Figure 1. Galling symptoms from the Southern root-knot nematode on soybean.

Figure 2. The Veris 3100 Soil EC Mapping System collecting data in a field.

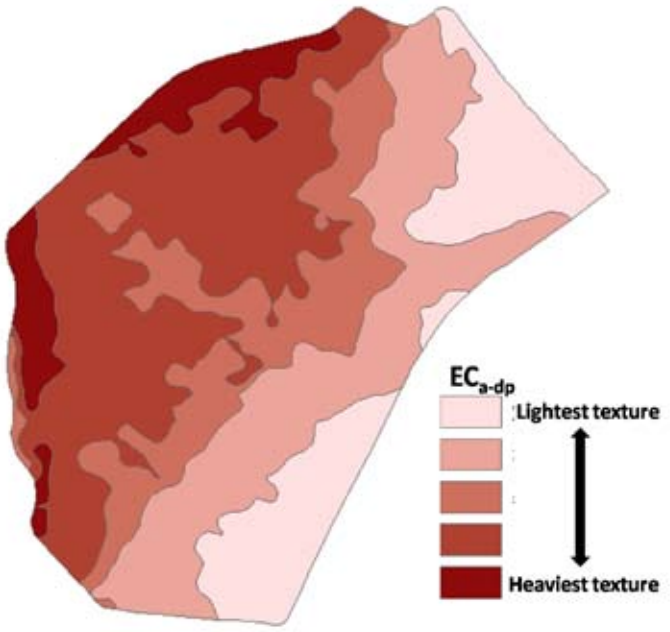

Figure 3. An example ECa collected from an 82 acre field.

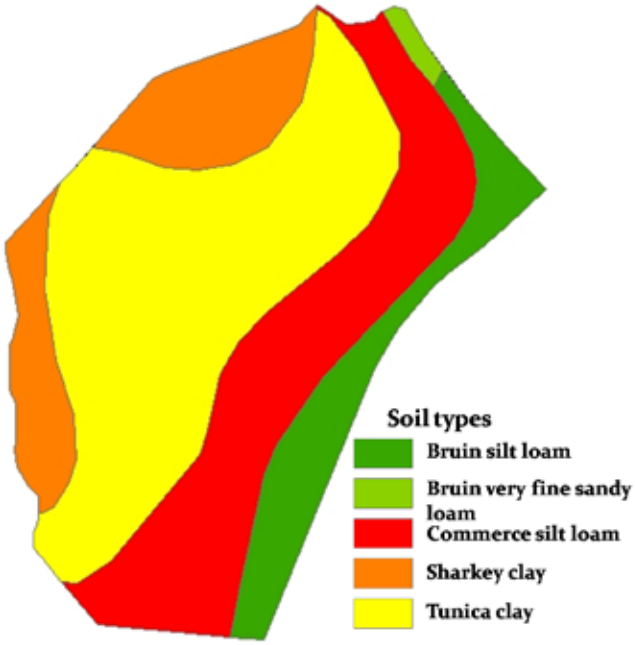

Figure 4. The same field that has been divided into soil types based on NRCS data.

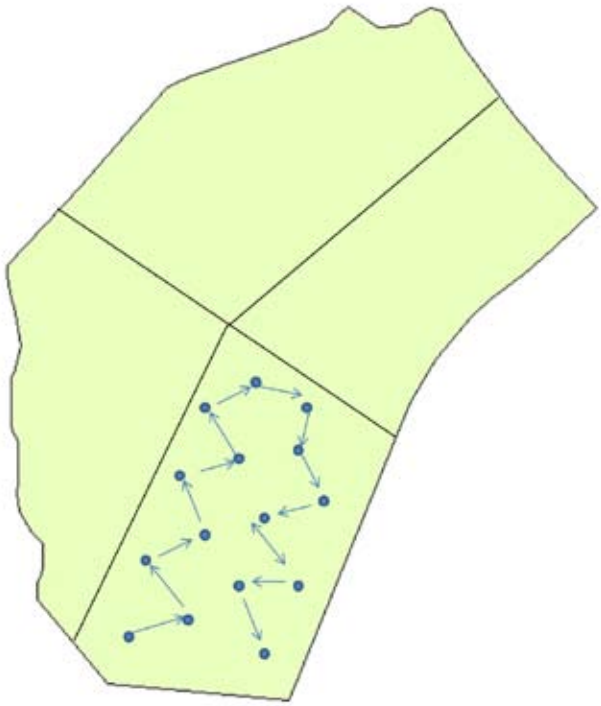

Figure 5. A field that has been divided into four areas using stratified random sampling. The dots represent where soil cores would be collected in that block.

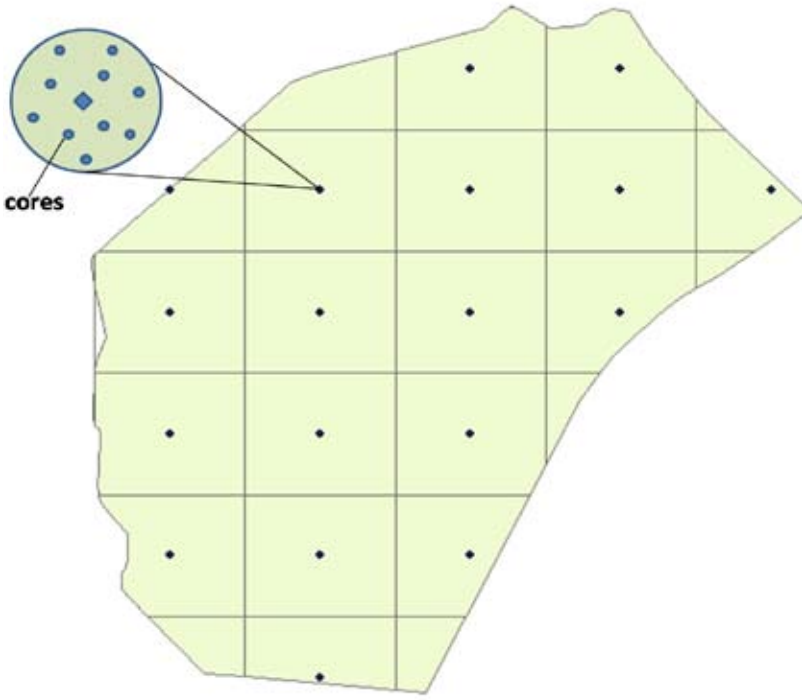

Figure 6. The same field divided using grid sampling with 5-acre grids. A total of 18 samples would be collected. The insert shows the sampling point and how 10 sample cores would be collected around it.

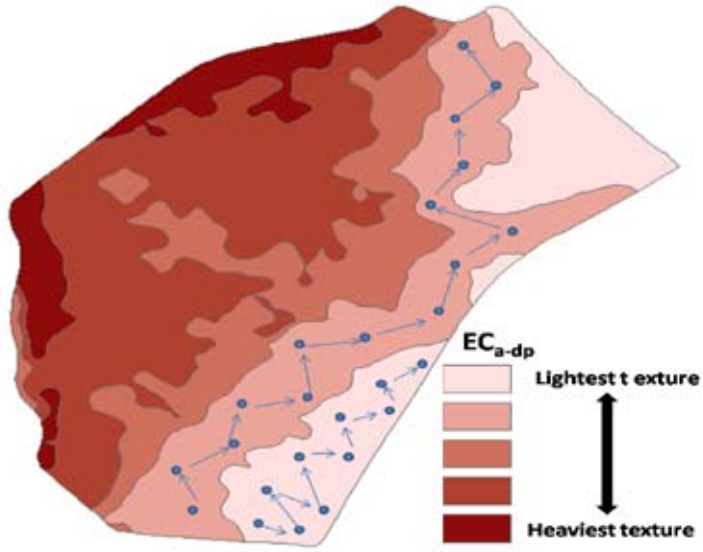

Figure 7. The same field divided for zone sampling. The lightest soil zone would be divided into two separate samples because these areas are not adjacent. The sampling sites are outlined in the lightest zone where soil cores would be collected. The next zone is not divided and is treated as one sample.

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Authors and Photo Credits

Charles Overstreet, Ph.D.
Extension Nematologist

Edward C. McGawley, Ph.D.
Nematologist

Clayton Hollier, Ph.D.
Extension Plant Pathologist

Don Ferrin, Ph.D.
Extension Plant Pathologist

Raghuwinder Singh, D.P.M.
Plant Disease Diagnostician

Louisiana State University Agricultural Center
William B. Richardson, Chancellor
Louisiana Agricultural Experiment Station
David J. Boethel, Vice Chancellor and Director
Louisiana Cooperative Extension Service
Paul D. Coreil, Vice Chancellor and Director

Pub. 3143 (online only) 2/10

Issued in furtherance of Cooperative Extension work, Acts of Congress of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. The Louisiana Cooperative Extension Service provides equal opportunities in programs and employment.