



COLLECTING AND SUBMITTING SOIL SAMPLES FOR NEMATODE ANALYSIS

The roots of virtually every plant are naturally infested by one or more forms of parasitic nematodes. Most nematodes are too small or transparent to be seen with the unaided eye but, under certain conditions, these microscopic roundworms can build up to population levels that cause economic or aesthetic damage to plants.

Some effects of nematode damage are stunting, chlorosis (yellowing), nutrient deficiencies, wilting, root abnormalities, and reduced yield, but nematode damage cannot be positively determined as the cause merely by looking at the generalized plant symptoms that are produced in the field or garden.



Figure 1. Corn field showing nematode damage.

To correctly diagnose nematode damage, it is also necessary to see and identify the nematodes associated with the injured plants. Nematodes must be extracted from root or soil samples, identified, and then counted by trained personnel.

COLLECTING SAMPLES

1. **Where to sample.** Any location in which plants do not grow properly (considering weather, soil fertility, and other conditions), could be an area of nematode damage. In a field, an orchard, or in turf, such areas may be circular to oval or rectangular in outline (Figure 1), although in row crops poor growth may follow the rows. On rare occasions, an entire field may be affected. Trees, ornamental plants, and potted plants may exhibit unthriftiness on an individual basis. Soil samples should be taken from around the roots of plants that are not growing properly.
2. **When to sample.** Soil samples can be collected at any time of year, as long as the sampling tool can be inserted into the ground to the proper depth. Sampling of excessively wet or dry soils, however, should be avoided; it is difficult to collect and prepare samples for analysis under these conditions. The best times to sample are when the damage is first observed or in autumn. An analysis for soybean cyst nematode in the fall can determine what crop or variety should be planted the following spring. Samples should be protected from direct sunlight at all times and kept cool until processed.

For further information contact an Extension Specialist in the Department of Crop Sciences, University of Illinois, Urbana-Champaign.

3. **How to sample.** The depth to which the sample should be taken will vary with the type of plant. Whenever possible, collect soil from the root zone of growing plants, where plant-feeding nematodes will be concentrated. Do not take samples from dead or severely injured plants, since the nematodes will have moved away from these roots. Except in turf samples, **do not** include soil taken from the top inch of the soil, where temperature and moisture extremes limit nematode populations. **Do** include feeder roots in the sample, since many nematodes live within plant roots.

a. Agronomic and vegetable crops. Collect soil and roots at a distance of 2 inches from the plant base and to a depth of 6 to 8 inches. Collect subsamples from spots around 10 to 20 plants showing moderate symptoms, or from the margin of a severely damaged area (Figure 2a). For sandy soils in the fall, sample to a 10-inch depth. Use a soil sampling tube, trowel, or narrow-bladed shovel. Save only about half a cup of soil with roots from each spot that is sampled. Thoroughly mix the soil collected, and save at least **1 quart** for mailing.

Root symptoms are sometimes diagnostic of nematode or other soilborne problems. If the crop is still in the seedling stage, carefully dig up 3 or 4 plants from the affected area. Gently shake off the original soil from the roots and include the plants in the soil sample package. If the crop is more advanced, 1 or 2 plants with the tops discarded and the soil shaken from the root systems will suffice. Mature plants are usually too bulky for inclusion, in which case a portion of the root system taken from the soil profile will be sufficient.

b. Fruit crops and ornamentals. Around affected trees and shrubs, remove the upper 2 inches of soil and dig down 12 to 15 inches with a shovel. Dig in the area between the outer branch tips and the stem or trunk (within the circumference of the dripline) of the plant as shown in Figure 2b. Using a trowel, take a small quantity of soil and some feeder roots from several depths down the exposed soil profile where roots are visible. Repeat this process three or four times around the plant. If possible, avoid taking samples in areas with weeds and grass. Do not include the roots of weeds and grass in the sample. Mix the soil collected in the subsamples and set aside at least **1 quart** for mailing.

Use a core sampler for large, container-grown plants. Annual ornamentals should be sampled in the same way as agronomic and vegetable crops. Small potted plants may be submitted whole.

Many ornamentals, particularly those grown in the home or in a greenhouse, are susceptible to foliar nematodes that attack above-ground parts of plants. Although these nematodes are not common in Illinois and rarely occur in the soil, they can distort or kill the buds, stems, leaves, or floral parts of plants and can cause lesions or discolored blotches (spots) on the leaves. If foliar nematodes are suspected, the entire crown or half a dozen leaves of the affected plant should be sent, and no soil should be included in the sample.

c. Commercial turf and home lawns. From the margin of the affected area where the grass is still living, collect 10 to 20 cores in a uniform pattern. Take cores to a depth of 6 inches. Although a core sampler is best, a narrow-bladed trowel may be used. Label and submit the entire sample.

d. Bare soils. In fields with a history of subnormal production, the potential for nematode problems on a succeeding crop can often be determined by sampling prior to planting, either before or after land preparation. Take 12 to 24 subsamples in a zig-zag pattern through the area of subnormal production (Figure 2c). With a trowel or narrow-bladed shovel, collect soil to a depth of 8 inches, first discarding the top inch. Follow the remaining steps outlined under the **agronomic and vegetable crops** section above. Limit each composite sample to a 10-acre area.

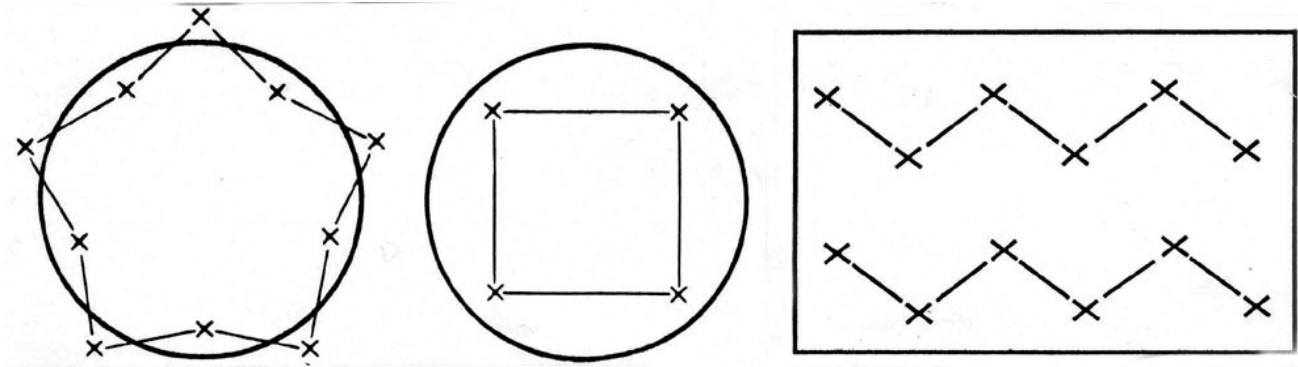


Figure 2. Sampling patterns. X = One subsample. Left, Star Pattern. Sampling from a damaged area. Center, Circle pattern. Sampling within the dripline of trees and shrubs. Right, Zig-zag Pattern. Sampling a fallow field or one with no obvious symptoms in the current crop.

SUBMITTING SAMPLES

1. **Packaging the sample.** Soil samples for nematode analysis must be handled differently than samples taken for fertilizer recommendations. Nematodes are living animals and require moisture for survival. To be recovered and identified, they must reach the laboratory **alive**. All precautions must be taken to prevent the samples from drying out. Never leave samples in the trunk of a car, in a car with the windows closed, in the back of a truck, or in any location where the temperature is likely to exceed 90°F (32°C).
 - a. Place the 1-quart soil sample in a sturdy plastic bag. Strong freezer bags are excellent. Very thin plastic bags, paper bags, or cardboard boxes will **not** work.
 - b. Fasten the open end of the bag securely. Keep the sample out of direct sunlight because overheating will quickly kill the nematodes and that will result in an erroneous analysis.
 - c. Place the bag in a **strong** container packed with newspaper or other insulating material. Metal cans, rigid plastic containers, or large mailing tubes are recommended for single samples. Heavy duty shipping boxes are necessary for shipping multiple samples. Seal the container securely to avoid rupture and spillage during shipment.
2. **Shipping the sample.** Speed is essential! Deliver or mail the package, preferably by private parcel delivery service, as soon as possible after collection. Mail it early in the week, so the sample will not remain in a post office over a weekend. If the sample must be held overnight or for a longer period of time, store it in a refrigerator at a temperature above 40°F (4°C). Address the package(s) to: Plant Clinic, 1401 W. St. Mary's Road, University of Illinois, Urbana, Illinois 61802.

COST

There is a service charge for analysis of soil samples. Check with your nearest Extension office for current prices.

RESULTS AND RECOMMENDATIONS

A copy of the Nematode Assay Report, stating the results of the nematode analysis, will be returned to you as soon as possible. If any control practices are advisable, recommendations will be included. Should the use of a nematicide be suggested, read and follow the manufacturer's directions carefully!

NEMATICIDE STRIP TESTS

Economic threshold levels (that is, the number and species of nematodes required in a given volume of soil, or weight of roots, to cause economic injury to a plant) have not been determined for most forms of nematodes. There are infinite combinations of plant species, nematode forms, and environmental conditions that may affect the amount of nematode damage. Thus, a nematode analysis often cannot confirm that these parasites are the primary cause of poor growth. In such a situation, a strip test conducted by the grower, with a nematicide registered for use on the particular crop, is usually recommended.

The strip test is most appropriate for annual row crops, small fruits, nursery plants, and established turf but may also be feasible for fruit trees and established woody ornamentals. The response of plants to the treatment, compared to the growth of untreated plants, will frequently confirm that nematodes are the causal agents and thus justify the expense of a more extensive nematicide application that is targeted at the grower's specific set of conditions.

The strip test involves chemical treatment of a limited amount of land and should be conducted within the problem area. Either a fumigant nematicide applied preplant or a nonfumigant (granular) insecticide-nematicide applied at planting time or post-plant can be utilized, depending on the type of crop and use regulations. The test should consist of a minimum of three treated strips accompanied by a similar number of untreated strips. For annual and herbaceous perennial row crops, each strip should be composed of one or more rows. A band at least 3 feet wide should be used for drilled crops and turf, a minimum of 6 plants for small woody perennials, and 3 plants for large woody perennials. Treated and untreated strips must be alternated because of the wide natural variation in nematode populations across a field, lawn, or orchard. In each strip, the number of rows, the width of the bands, or the number of plants included should be sufficient to allow the grower to measure growth and yield response adequately.

To determine the efficacy of the nematicide application and to correlate plant response with nematode control, the grower, the Extension adviser, or a professional crop consultant should take a soil sample from each treated and untreated strip, 6 to 10 weeks after application, and submit the labeled samples to the Plant Clinic for a follow-up nematode analysis. The sampling procedure is the same as that outlined above for the particular crop type involved.



NEMATODE SOIL SAMPLE FORM

University of Illinois at Urbana-Champaign
PLANT CLINIC, 1401 W. St. Mary's Road, Urbana, IL 61802
(217) 333-0519

Submitted by _____ Date of Sampling _____
Address _____ Total Acres Sampled _____
County _____ Date Submitted _____
Phone _____ Date Received _____

Clinic Numbers	Your Sample Number	Soil Type	Present Crop		Previous Crop		Crop 2 yrs ago		Next Crop To Be Grown	Past Nematicide/ Insecticide Treatments	
			Crop	Variety	Crop	Variety	Crop	Variety		Year	Chemical

Circle Appropriate Information

Distribution of Symptoms: Scattered Clustered in Spots Uniform
Association with Terrain or Soil Type: Yes No
Weather Conditions Prior to Symptom Development:
 Rainfall: Low Medium High Temperature: Low Medium High
Soil Test Information or Fertilizer Application: 2 yrs past _____ 1 yr past _____ Current yr _____
Herbicides Applied This Year _____

COMMENTS:

For Lab Use	Soil	Roots	Juveniles	Cysts	Comments:
Date Processed					
Date Read					

Key Points for Submitting Nematode Samples

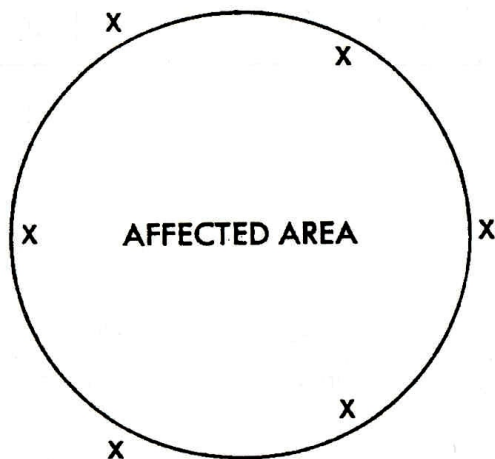
Collecting Samples

1. Take the sample from the margin of the affected areas to a depth of 8-10". When sampling from sandy soils, go to a depth of 10-12".
2. Dig several samples from the affected area, mix and package 1 qt of the mixed soil.
3. Include a handful of roots, including feeder roots if possible.

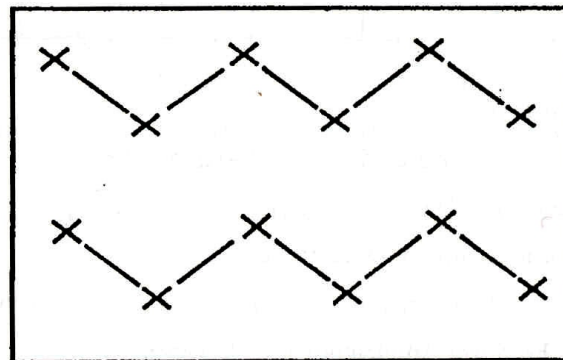
Packing and Shipping Samples

1. Use a nematode soil sample bag or a thick, sturdy plastic bag.
2. Tie the bags closed with twist ties, light wires, or use zip-lock bags.
3. Label each bag clearly and simply. Write directly on the bag or attach the label securely
4. Place the bags in a strong container and pack them with newspaper or another insulating material.
5. Complete the reverse side of this form.
6. Ship the samples immediately, so they remain as fresh as possible. Send them early in the week to avoid drying out in weekend storage or mailing.
7. Keep the samples cool; don't allow them to dry out, but don't add water.

SAMPLING PATTERNS



HEALTHY AREA



**RANDOM SAMPLING PATTERN
(10 ACRES)**