

plants involved and a complete description of symptoms. For current forms, visit www.ncagr.gov/agronomi/forms.htm.

- When submitting samples for different kinds of tests, mention this on each information form. For example, if you are sending soil and nematode samples to the Agronomic Division and another sample from the same problem area to the Plant Disease and Insect Clinic at N.C. State University, make a note on each sample information form indicating that matching samples related to the same problem have been sent to other laboratories for other types of tests.
- Since problem sample shipments usually include plant tissue samples that require prompt attention, it is best to send the samples to the Plant/Waste/Solution/Media Section. Likewise, if a shipment contains nematode and soil samples, address it to the Nematode Assay Section.
- Write “Problem Samples” prominently on the outside of the shipping container.

Receiving agronomic reports

The Agronomic Division gives priority to problem samples. Specialists review test results and provide comments on how best to manage the problem identified. Completed reports are posted online and remain available for about three fiscal years. Select the **Find Your Report (PALS)** link on the [Agronomic Division home page](#) to access the report-search utility.

North Carolina Department of Agriculture and Consumer Services

Steve Troxler, Commissioner of Agriculture

Agronomic Division

Colleen M. Hudak-Wise, Ph.D., Director

www.ncagr.gov/agronomi/

(919) 733-2655

Mailing Address

1040 Mail Service Center
Raleigh NC 27699-1040

Physical Address [DHL, FedEx, UPS]

4300 Reedy Creek Road
Raleigh NC 27607-6465

*For more information on
sampling, interpreting agronomic reports or
implementing recommendations,
contact the regional agronomist
assigned to your county.*

www.ncagr.gov/agronomi/rahome.htm

Agronomic Sampling
Folder No. 3

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Diagnosing Plant Growth Problems:



Services available through the
NCDA&CS Agronomic Division
& N.C. Cooperative Extension

For help diagnosing a plant growth problem, your first step should be to contact your county Cooperative Extension office. Locations and contact information are available online at www.ces.ncsu.edu/index.php?page=countycenters. Extension agriculture or horticulture agents can identify the more common problems and/or recommend appropriate specialists or testing services. If necessary, an extension agent can submit samples to the Plant Disease and Insect Clinic at N.C. State University.

If you or your county agent suspect that the problem is primarily a nutrient issue, the NCDA&CS Agronomic Division offers several diagnostic tests that can help pinpoint the exact cause. Nutrient problems are best identified through a combination of soil testing and plant tissue analysis. In some cases, other agronomic tests—nematode assay, waste analysis, solution analysis or soilless media analysis—may also be appropriate.

Diagnosing nutrient problems

The best way to troubleshoot plant nutrient problems is to submit plant tissue samples with matching soil samples for diagnostic analysis. Matching samples—plant tissue and soil from both good and poor areas—make it possible to compare nutrient levels in the soil with nutrient levels in the plant. Test results

can pinpoint what the nutrient problem is and help distinguish whether it is an uptake problem or an availability problem.

■ Diagnostic plant tissue analysis.

Tissue analysis measures levels of 11 essential nutrients within plants, including nitrogen, iron and boron (which soil tests do not measure). The test indicates whether growth problems could be due to a lack or an excess of nutrients.

As a rule, the best part of the plant to sample is the most recent mature leaf, which is usually the 3rd to 5th leaf away from the growing point. About 10 to 30 leaves are needed, depending on leaf size. Submit tissue samples in paper (not plastic) containers, leaving enough air space to prevent moisture buildup around the sample.

The basic fee for tissue analysis is \$5. Extra fees are charged for out-of-state samples and for some crops that require additional tests. For detailed information on sampling methods and fees, visit www.ncagr.gov/agronomi/sampleinfo.htm.

■ **Diagnostic soil testing.** When trying to identify a problem, take two soil samples—one from an area where plants look healthy (good) and one from an area where they do not (poor). Soil analysis can help identify many current and potential deficiencies or toxicities as well as suggest appropriate corrective action. Keep in mind, however, that it cannot identify problems caused by nematodes, insects, disease organisms or agrochemicals.

Collect soil samples with clean shovels, trowels, probes or augers. Steel instruments are best. Never use galvanized metal.

Take several soil cores 4 to 8 inches deep. Put all cores for one sample in a clean, plastic bucket, and mix thoroughly. Fill an Agronomic Division soil sample box to the indicated line.

NCDA&CS soil tests are available only to North Carolina residents. A peak-season fee of \$4 per sample is charged from about Thanksgiving through March. There is no fee at other times of the year.

■ **Diagnostic nematode assay.** Most plant-parasitic nematodes damage roots and reduce absorption of water and nutrients. Stunted, yellowed plants are often one of the first symptoms of a nematode problem. Adding some fertilizer may alleviate the symptoms slightly, but it will not correct the problem. The existing root damage will continue to interfere with plant nutrient uptake.

If tests associated with a problem sample indicate sufficient nutrient levels in the soil

but deficient levels in plant tissue, it may be worthwhile to investigate the possible existence of a plant-parasitic nematode problem. The fee for this test depends on whether the sample is from North Carolina (\$3) or from another state (\$10). Keep in mind that there are no chemical nematicides registered for homeowner use.

To collect a soil sample for a diagnostic nematode assay, take soil cores from the margin of the affected area (e.g., notice the location of the black circles in Figure 1). Take all cores from the root zone of affected plants and include feeder roots in the sample. Do not take cores from areas where plants are already dead.

Mix soil cores together in a bucket. Using this mixture, fill the plastic bag that comes with the nematode assay sample box. Tie off the bag and place it in the sample box. Protect samples from extreme temperatures. Do not freeze, refrigerate or leave them in a hot vehicle.

For more information, visit www.ncagr.gov/agronomi/pdf/files/samnemas.pdf.

Preparing samples for shipment

- Identify all samples from the same problem area with the same name. For example, if you submit a soil sample, plant tissue sample and nematode assay sample from the same area of a flower garden, make sure that each related sample has the same name, perhaps ROSE1. Use permanent ink to label sample container(s).
- Complete appropriate sample information forms, providing as many details as possible, especially the exact names of any

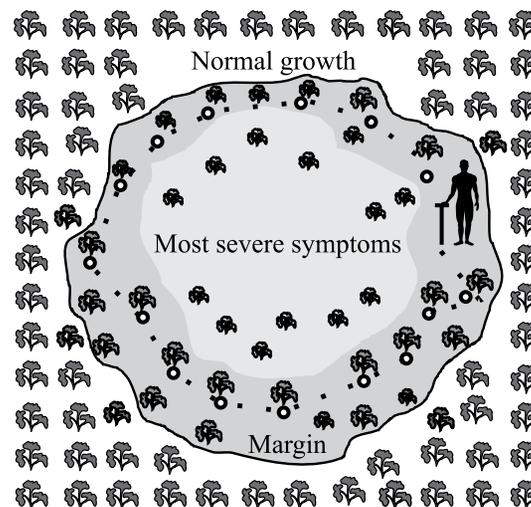


Figure 1. Nematode sampling in problem