

## Preparing samples for shipment

- All samples (plant, soil, nematode) submitted for problem analysis can be packaged together. Write “Problem Samples” prominently on the outside of the shipping container.
- Use permanent ink to fill out the information form(s) and to label sample container(s).
- Provide all information requested, especially the exact names of any plants involved and a complete description of symptoms.
- If you are sending samples for different kinds of analyses, mention this on each information form. For example, if you are sending a soil sample and a nematode sample 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 information form indicating that matching samples have been sent to other laboratories for analysis/diagnosis.
- When giving each sample a name (up to five letters and/or numbers), 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, give them all the same name, perhaps ROSE1.

## Receiving agronomic reports

The NCDA&CS Agronomic Division gives priority to problem samples. Specialists review test results and provide comments on the nature of the problem and how best to manage it. Although clients receive sample test results in the mail, they can also access their reports online.

## North Carolina Department of Agriculture and Consumer Services

Steve Troxler, Commissioner of Agriculture

### Agronomic Division

Colleen M. Hudak-Wise, Director

[www.ncagr.gov/agronomi/](http://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 your NCDA&CS regional agronomist  
or other agricultural advisor.*

Agronomic Sampling  
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## Diagnosing Plant Growth Problems:



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

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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](http://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 or solution 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. To ensure that problem samples receive priority attention when they arrive at the NCDA&CS Agronomic Division laboratory, write “Problem Samples” prominently on the outside of the shipping container and fill out the correct sample information forms (forms AD-2 and AD-4) completely.

### ■ Diagnostic plant tissue analysis.

Tissue analysis measures levels of 11 essential nutrients inside plant tissue, including nitrogen, iron and boron, which soil tests do not measure. The basic fee for tissue analysis is \$5. Extra fees are charged for out-of-state samples and for some crops that require tests for additional 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. Detailed sampling methods, fee information, sample information forms and crop-specific advice are available online at [www.ncagr.gov/agronomi/pubs.htm](http://www.ncagr.gov/agronomi/pubs.htm).

Do not put tissue samples in plastic bags. If a paper container is used, leave enough air space to prevent moisture buildup around the sample. Fill out form AD-4, *Plant Sample Information*, listing all samples and providing the requested details. This form is available online and at county Cooperative Extension offices.

■ **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 equipment—shovels, trowels, probes or augers. Steel instruments are best. Never use galvanized metal.

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

On form AD-2, *Diagnostic Soil Sample Information*, list your samples and provide information about the problem. The form is available online and at county Cooperative Extension offices. Standard NCDA&CS soil tests are free and available only to N.C. residents.



FIGURE 1. Nematode sampling in problem areas.

■ **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 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, consult your agricultural advisor about the need to submit a sample for diagnostic nematode assay. 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 the 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 or refrigerate. Do not leave them in a hot vehicle.

Fill out form AD-5, *Nematode Problem-Diagnosis Information*. The form is available online and at county Cooperative Extension offices. For more information on how to collect and submit samples for nematode assay, visit [www.ncagr.gov/agronomi/pdf/files/samnemas.pdf](http://www.ncagr.gov/agronomi/pdf/files/samnemas.pdf).