



Soil Nitrate Testing

This booklet covers five sections:

- **Soil Sampling for the Pre-sidedress Soil Nitrate Test (PSNT)**
- **Soil Sampling for the Fall Soil Nitrate Test (FSNT)**
- **Extracting Soil Nitrate**
- **Standardization and Analysis Procedures**
- **Quality Assurance Check**

Soil Sampling for the Pre-sidedress Soil Nitrate Test (PSNT)

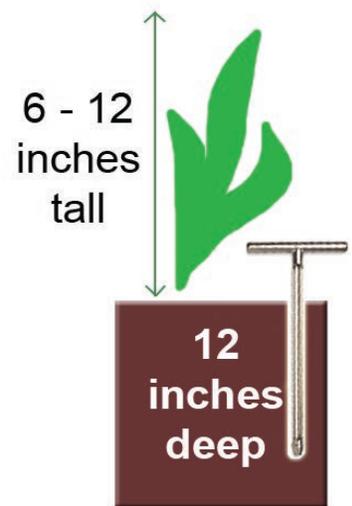
USE THIS TEST ON:

- fields that received manure or sludge or have grown a forage legume or a legume cover crop

DO NOT USE THIS TEST IF:

- commercial fertilizer is and has been the only source of nitrogen
- commercial fertilizer application rate (preplant and starter band) is greater than 50 lbs/A

1. Take the sample when the corn is 6-12 inches tall.
2. Take the samples approximately mid-way between the rows.
3. Randomly collect 30 - 40 soil cores to a depth of 12 inches across each field or management unit.
Avoid areas that are not representative of the entire field (rock outcrops, wet areas, etc.).
4. Sieve the samples through the sieve into the receiving box.
Rub the soil to help it through the sieve.
If the sample is hard, use a mallet to help break up the soil clods.
5. Transfer the soil to the ODJOB mixer. Roll the mixer **AT LEAST 50 revolutions**.
6. Return the soil to the receiving box. Spread the sample out.
7. Take 5 scoops of soil from different parts of the sample.
Place the 5 scoops of soil into the sample bag.
8. Spread soil in a thin layer on clean plastic or paper and dry quickly (over several hours) to prevent further microbial activity which could affect test results.
Use of a fan is acceptable to hasten drying.
However, never use a microwave or conventional oven to dry soil.
9. Pass the entire soil through the fine sieve. Place soil in a soil test bag or a plastic bag, labeling the bag with field name or number. The soil is now ready for testing.



Soil Sampling for the Fall Soil Nitrate Test (FSNT)

USE THIS TEST ON:

- fields where wheat or barley will be grown for grain production

1. Sample within 2 weeks of intended planting date.

2. Randomly collect 15 – 20 soil cores to a depth of 8 inches across each field or management unit.
Avoid areas that are not representative of the entire field (rock outcrops, wet areas, etc.).

3. Sieve the samples through the sieve into the receiving box.
Rub the soil to help it through the sieve.
If the sample is hard, use aallet to help break up the soil clods.



4. Transfer the soil to the ODJOB mixer. Roll the mixer **AT LEAST 50 revolutions**.

5. Return the soil to the receiving box. Spread the sample out.

6. Take 5 scoops of soil from different parts of the sample.
Place the 5 scoops of soil into the sample bag.

7. Spread soil in a thin layer on clean plastic or paper and dry quickly (over several hours) to prevent further microbial activity which could affect test results.
Use of a fan is acceptable to hasten drying.
However, never use a microwave or conventional oven to dry soil.

8. Pass the entire soil through the fine sieve. Place soil in a soil test bag or a plastic bag, labeling the bag with field name or number. The soil is now ready for testing.

Extracting Soil Nitrate

You will need:

1 measuring cylinder	extracting solution
beakers with lids	electronic balance
calibration weight	a small spoon

1. Switch on the electronic balance.

Allow it to warm up and stabilize for 2 minutes.

Be sure that the balance is set to the default units (grams).

2. Calibrate the balance before each session.

Press the RE-ZERO button.

With the display reading 0 g, place the calibration weight in the center of the tray.

The display should first read 200.0 ± 0.2 g.

Press the RE-ZERO button to reset the display to 0.

If “Error” appears, repeat the calibration process. If the error message recurs, call the Agricultural Nutrient Management Program for technical support.

3. Place the beaker onto the tray of the electronic balance.

Press the RE-ZERO button and wait for the display to read 0.

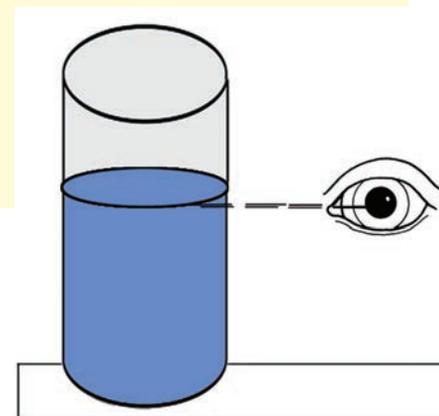
4. Use a spoon to add soil to the beaker until the display reads exactly 20.0 g.

NOTE: it is important to RE-ZERO each beaker every time it is used.

Do not assume that similar beakers have the same weight.

5. Place the graduated cylinder on a level surface.

Carefully add exactly 40 ml of extracting solution.
(Directions for making extracting solution are on the extracting solution packet. Confirm that the packets contain chloride.)



Read at eye level

6. Add the extraction solution to the beaker.

Place the lid on the beaker and shake for 1 minute.

Allow the beaker to stand for 10 minutes until the solution above the soil is clear.

Standardization and Analysis Procedures

You will need:

1 Nitrachek meter

1 tube of EM Quant nitrate sensitive test strips

1 bottle 10 ppm nitrate-N
standard solution

soil extract

Note: make sure all test strips, the soil extract and standard solution are at room temperature before you start.

Step 1 - Meter/Strip Standardization

It is important to calculate the standard reading:

- every time a new batch of strips is used
- each time a new batch of extracting solution is made
- every day the meter is used or prior to both the morning and afternoon sessions if the meter is being used all day

1. Remove 3 test strips from the tube.
Reseal the tube immediately.
Take care not to touch the raised end of the strip.

2. Pour a small amount of the standard 10 ppm nitrate-N solution into the cap.

3. Open the door of the Nitrachek meter.
Wait until the display reads **CAL**.
The flashing number in the right hand corner of the display should read 5.
If it does not, then use the triangular keys on top of the meter to adjust it until it reads 5.



Sensing pad facing
this direction



- Put the test strip **WITH THE SENSING PAD INWARDS** into the slot. Close the door.

- Wait until the display reads **GO**.

(This will take a few seconds. If **ERR** is displayed instead of **GO**, check to see if the strip is inserted correctly and close the door.)

- Open the door and remove the strip.

After a few seconds the meter will beep 2 times: 1 short followed by 1 long. (The older Nitratechek model will beep 3 times: 2 short followed by 1 long.)

Place the strip into the standard 10 ppm nitrate-N solution immediately after the first beep and remove it immediately after the last beep ends.

- After removing the strip from the solution, wait 2 seconds and then flick it vigorously with your finger **TO REMOVE ALL EXCESS LIQUID**.

The meter will count down from 60 to 0 as you do this.

- As the countdown approaches 5, reinsert the strip and close the door.

A few seconds after the countdown reaches 0, the reading will appear.

- After the strip is read, record the reading.

Remove the strip from the meter.

- Repeat the entire procedure with 2 more strips.

- Look at your results.

If the range of your readings exceeds 7, take additional readings until you obtain three readings within a range of 7.

If you have difficulty obtaining a range within 7, remove the test strip holder and wipe off any excess moisture.

Reattach the clean test strip holder to the meter.

- DISCARD ANY OF THE SOLUTION REMAINING IN THE BOTTLE CAP.**

- Use these 3 readings to calculate the average reading.

This is the 'Average Standard Reading'.

Step 2 - Extract Analysis

- Do not attempt to analyze soil without standardizing the meter and analysis strips first!
- Ensure the soil extract is clear of suspended solids before proceeding with this stage of the soil analysis.

1. Open the door of the Nitrachek meter and wait until the display reads **CAL**.
Insert a test strip with the sensing pad facing inwards.
Close the door.



2. Wait until the display reads **GO**. This will take a few seconds.
If **ERR** is displayed instead of **GO**, check to see that the strip is inserted correctly and re-close the door.



3. Open the door and remove the strip.
After a few seconds the meter will beep 2 times: 1 short followed by one long. (The older Nitrachek model will beep 3 times: 2 short followed by one long.)
Place the strip into the soil extract immediately after the first beep and remove it immediately after the last beep ends.
(Make sure the sensing pad does not come into contact with the soil that has settled to the bottom.)
4. After removing the strip from the soil extract, wait 2 seconds then flick it vigorously with your finger **TO REMOVE ALL EXCESS LIQUID**.
The meter will count down from 60 to 0 as you do this.
5. If any organic matter sticks to the strip, remove it carefully by flicking the strip.
Avoid touching the test surface.
6. As the countdown approaches 5, reinsert the strip and close the door.
A few seconds after the countdown reaches 0, the reading will appear.

7. Record the reading.

8. Repeat this procedure 2 more times.

If the range of your readings exceeds 7, then take additional readings until you obtain **three readings within a range of 7**.

An example of an acceptable range

40 38 44

No extra reading required.
Average may be calculated.

An example of an unacceptable range

40 36 44

Extra reading(s) required until range is 7 or less.

9. Calculate the average of the 3 readings.

This is the 'Average meter reading'.

10. Use the formula below to calculate the soil nitrate-N concentration in ppm.

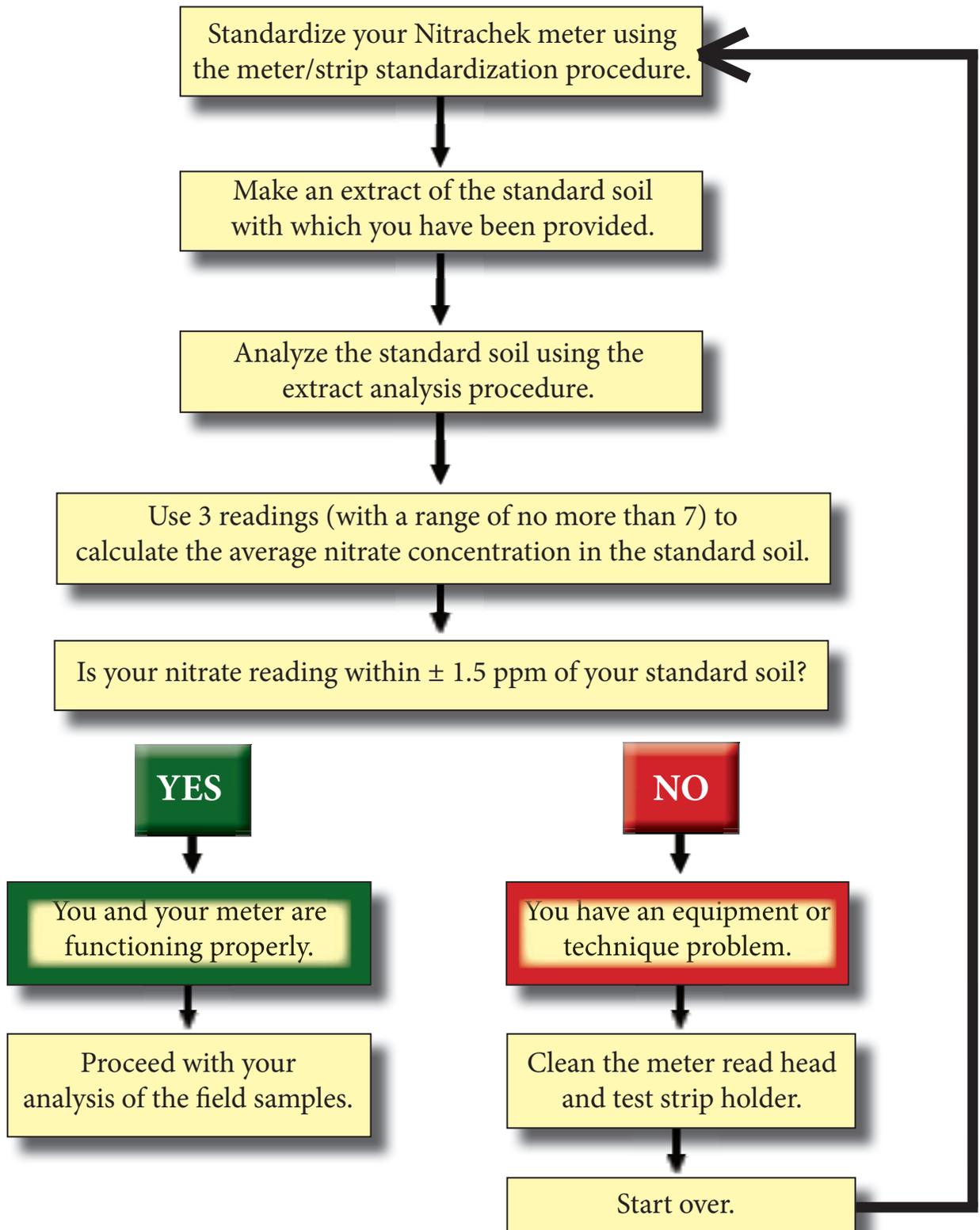
$$\frac{\text{average meter reading of soil extract} \times \text{Conversion}^* \text{ factor}}{\text{average standard reading}} = \text{Soil Nitrate-N in ppm}$$

* this is always 20 for this procedure

Quality Assurance Check

To check the accuracy of the test procedure, it's important to do this assurance check:

1. at least once each week
2. every time you make a new batch of extracting solution
3. whenever you suspect your meter is not working correctly



Quality Assurance Check

You have been given a jar of “standard soil”, a soil for which nitrate concentration was accurately determined. The average nitrate concentration of this soil is indicated on the container.

Analyze this soil at least once a week, when you make up a new batch of extracting solution and whenever you suspect an error in an analysis.

Standardize your Nitrachek meter. Extract and analyze the standard soil using the same procedure utilized for field samples, using the average reading of 3 strips to determine the nitrate concentration.

- If the nitrate concentration you measure in the standard soil is within ± 1.5 ppm of the concentration indicated on the label, proceed with the analysis of field samples.
- If the nitrate concentration you measure in the standard soil is more than ± 1.5 ppm of the concentration on the label, proceed with the following:
 1. clean the read head and the test strip holder on your Nitrachek meter;
 2. restandardize the Nitrachek meter;
 3. reweigh and re-extract a sample of the standard soil;
 4. determine nitrate concentration;
 5. if the nitrate concentration is within ± 1.5 ppm of the concentration on the label, proceed with analysis of field samples;
 6. if the nitrate concentration you measure in the standard soil is still outside the allowable range, call the Agricultural Nutrient Management Program Office.

10 Maxims of Soil Nitrate Testing

- collect an adequate number of samples per field (30 - 40 for PSNT, 15 - 20 for FSNT)
- mix soil thoroughly
- dry soil quickly
- weigh soil accurately
- measure extracting solution carefully
- always flick the test strip
- choose a time interval to read test strips and stick with it
- standardize the Nitrachek meter at least once a day, or when you open a new vial of strips
- analyze the standard soil at least once a week, when a new batch of extracting solution is used, and whenever you suspect a problem
- always follow the instructions

Agricultural Nutrient Management Program
Department of Environmental Science and Technology
0116 Symons Hall
College Park, MD 20742
301-405-1319
www.extension.umd.edu/anmp

Revised: 8/13/2013

The University of Maryland Extension programs are open to any person and will not discriminate against anyone because of race, age, sex, color, sexual orientation, physical or mental disability, religion, ancestry, national origin, marital status, genetic information, political affiliation, and gender identity or expression.