Instructions for using soil Nmin measurement with Nitrate App

Here we describe in 14 steps how to use the Deltares Nitrate App for measuring mineral nitrogen (Nmin) content in soil. This do-it-yourself method is similar to the laboratory procedure and gives an indicative estimate of soil Nmin content (both in mg/l NO3-N and in kg/ha NO3-N in 30 cm soil). The measurement only involves nitrate-nitrogen (NO3-N) and if present nitrite-nitrogen (NO2-N); ammonium-nitrogen (NH4-N) is not included in the measurement.

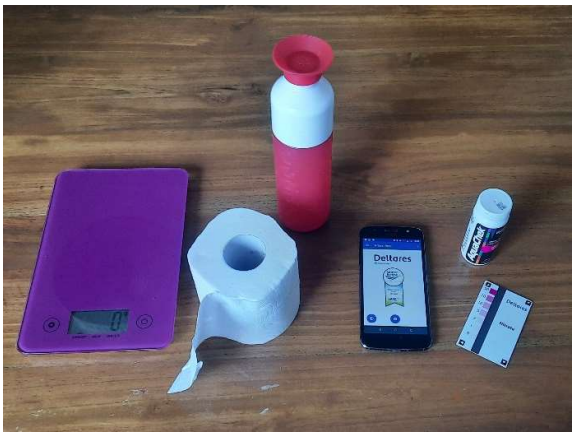
1. Take a soil sample

- Collect soil with a soil auger, gouge or shovel in a bucket.
- The standard depth is 0-30 cm, but 30-60 cm or 60-90 cm is also possible. It is important for the conversion to kg/ha that a soil layer of 30 cm is sampled
- Preferably make a mixed sample per plot. This can be done by collecting soil from several representative locations. The standard is 40 locations, the minimum for a good average is 10 locations. Mix the soil samples well in the bucket

2. Gather supplies

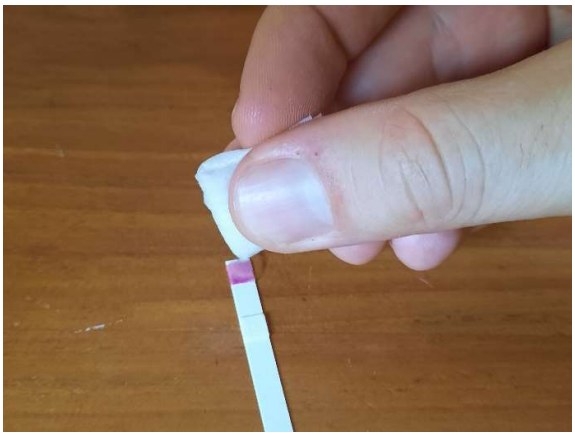
- Kitchen scale
- Non-recycled toilet paper
- Standard 450 ml Dopper drinking bottle (see www.dopper.com)
- Smartphone with the Deltares Nitrate App (from App store)
- Jar of nitrate test strips from Hach
- Nitrate App reference card
- Other: pen, paper, teaspoon, water

Note: work in good daylight (outside or by the window). Artificial light can give disturbing reflections when making the scan (step 11).



3. Check the water and toilet paper

- Possibly the tap water or toilet paper already contains nitrate which can interfere with the measurement
- Check this by folding and rolling up a piece of toilet paper, putting it 5 mm in the water to suck up some water, and squeezing a drop from it on a nitrate strip
- At concentrations > 5 mg/l NO3-N, it is better to use other (bottled) water or other toilet paper (non-recycled)
- The (tap) water itself can also be checked directly with a regular nitrate strip measurement

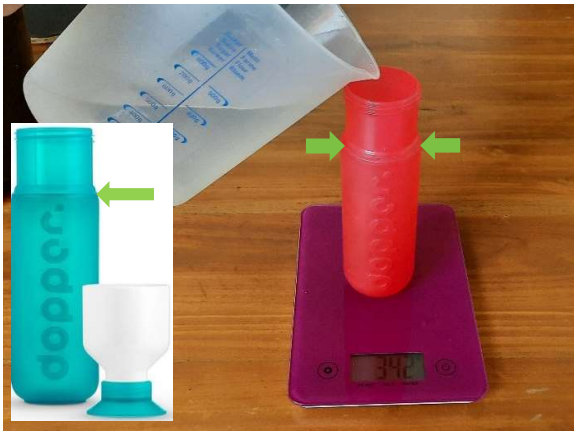


4. Weigh the Dopper bottle

- Put the Dopper on the scale
- Tare the scale by setting it to zero (often the button to the right of the display)

5. Fill the Dopper with water

- Fill with water to where the taper begins (indicated by green arrows on the photo to the right), this is 340 ml
- For extra accuracy, fill the Dopper with water to a weight of 340 gr



6. Top up with soil and measure the weight

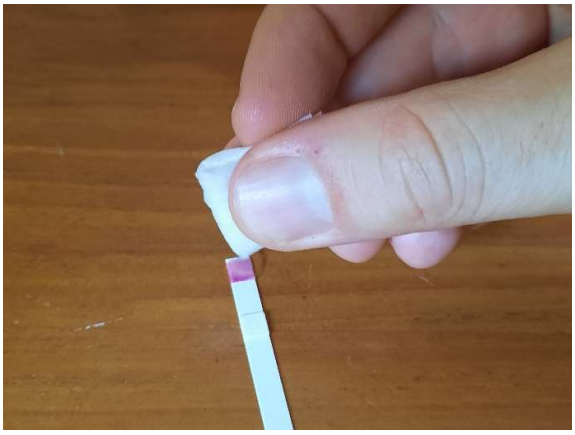
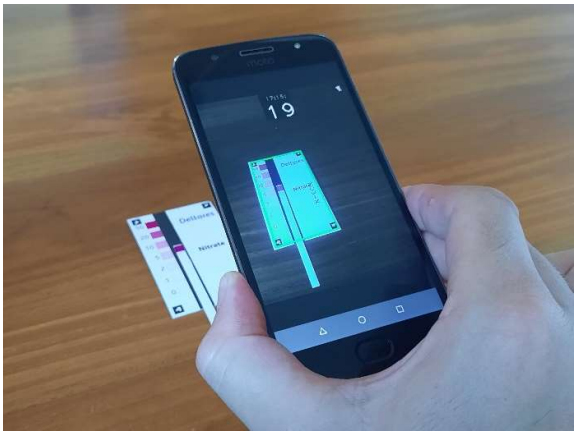
- Tare the scale again by setting it to zero
- Use a teaspoon to scoop the well-mixed soil from the bucket into the Dopper with small scoops
- Fill the Dopper with soil up to the screw thread just below the top edge (indicated by green arrows on the picture on the right)
- Note the weight of the added soil on a piece of paper (e.g. 142 gr in the picture)

7. Shake

- Place the cap on the Dopper
- Shake firmly for 1 minute

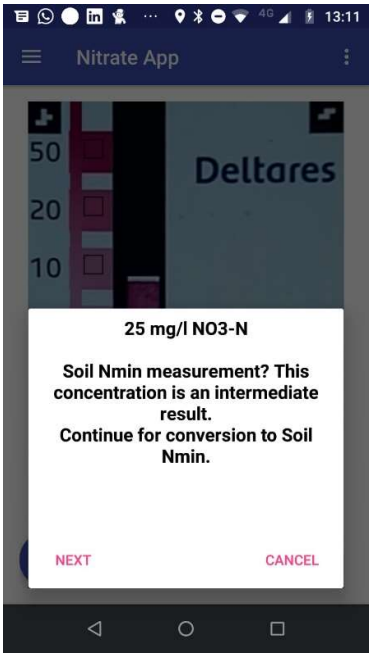
8. Preparation for measurement

- After shaking, place the Dopper upright on the table and remove the cap from the Dopper
- Make sure your hands are clean
- Have a nitrate strip ready next to the reference card
- Have the smartphone ready with the Deltares Nitrate App in scan mode (camera button) so you have a seconds counter
- Provide good diffused daylight (work outside or near a window, preferably no artificial light)

9. Sucking up sample • Fold a piece of toilet paper in half lengthwise and then roll it up • Stick the toilet paper 0.5 cm into the water-soil mixture. The toilet paper will now suck up water • Wait until the water has reached up about three quarters of the toilet paper • Remove the toilet paper from the Dopper and tear off the bottom soil-stained part	
10. Drip on the nitrate strip • Fold the toilet paper in half • Squeeze a clear drop of water on the top reaction surface of the nitrate strip. Immediately read the number of seconds in the app to take a scan 60 seconds later • Tap the test strip 2x to remove excess water	
11. Measure nitrate concentration • Place the nitrate strip upright on the black strip on the Nitrate App reference card • Point the smartphone at the reference chart so that all corner markers are recognized (green frame) • Take a scan 60 seconds after dripping by pressing the screen	

12. Check the intermediate result

- The Nitrate App automatically displays the nitrate concentration of the water-bottom mixture on the screen.
- Check the measurement value (in mg/l NO3-N) by comparing the color of the reaction surface on the nitrate strip with the colors on the reference card. The number next to the colors on the reference card gives the NO3-N associated with the color.
- Proceed to convert the concentration in the water-soil mixture to the amount of Nmin in the soil sample (press 'next')



13. Enter the weight of the soil

- In the next screen, the category should be set to 'Soil Nmin' (see screenshot on the right). Adjust this first if there still is another category
- Add under 'Remarks' possibly a characteristic of the sample or the measured plot
- If necessary, adjust the depth range from which the soil sample was taken (default is 0-30 cm)
- Enter the soil sample weight measured in step 6 (default is 135 gr, in the screenshot 142 gr)

14. Measurement result and send measurement!

- At the top of the screen in the blue frame the measurement result is shown in mg/l NO3-N and in kg/ha NO3-N.
- Press the blue circle with arrow to send the measurement to the database.
- The measurement can be seen in the map and the measurements list (through the menu)
- Optionally do a second and third measurement (from step 8) for more certainty