Soil Testing: Once You Have the Sample

by Clain Jones, Montana State University Extension Soil Fertility Specialist, and Kathrin Olson-Rutz, Research Associate

This Soil Scoop provides questions a person needs to ask once a soil sample has been collected, but before it is sent to the lab.

QUESTIONS TO ASK

1. **Has sample been collected?** If NOT go to The Soil Scoop *Soil Testing: Getting a Good Sample* for assistance with sampling method including area, timing, sampling, depth etc. If YES, continue below.

2. **What is the sampling date?** MT soil nitrogen (N) guidelines are based on spring soil test values. If this is a late-summer or fall soil sample, N rates based on this sample result will need to be adjusted. See *Developing Fertilizer Recommendations for Agriculture* (MT200703AG) or *Home Garden Soil Testing & Fertilizer Guidelines* (MT200705AG).

3. **What is the sampling depth?** Depth depends on soil characteristic being tested and intended land use (Table 1). Sampling to 24-inches will almost always require a hydraulic mounted probe truck. If it is not possible to get a sample to 2-foot depth, multiply the top 6-inch nitrate (NO_3) by 3 (based on a small MT data set) to estimate 0 to 24-inch nitrate-N and to reduce the risk of over-fertilizing N at a financial and environmental cost.

   Sample depth is also necessary to convert nitrate reported as ppm to lb N/acre to calculate N fertilizer rates (lb N/acre = ppm x 2 x actual depth in inches / 6). Most labs do this conversion for you.

4. **How many subsamples were collected?** Due to high variability across a field, garden, or lawn, in soil characteristics, 10 subsamples per composite sample is a reasonable average.

5. **Where were the subsamples taken?** Over a broad area of the field the sample is to represent, rather than in one small area?

6. **Is this for annual cropland, lawn/garden, or pasture/hay?** See Table 1.

7. **Is this sample for land enrolled in an NRCS program?** See Table 1.

8. **Are you submitting because you're seeing growth problems?** If so be specific. For example, stunted plants may suggest testing for saline or sodic soils (see #9).

9. **Are there soil issues?** White crusting on soil surface, issues with water ponding on surface, poor drainage, extreme shrink/swell, crusting, cracking? Is irrigation water saline or sodic? Electrical conductivity (EC) is a measure of soluble salts. Saline soils have EC > 4.0. Exchangeable sodium (Na) percentage (ESP) > 15 indicates a sodic soil. Determining ESP requires exchangeable Na and cation exchange capacity (CEC). ESP = (exch. Na/CEC) x 100. See *Salinity and Sodicity Management* (4481-2), and *Commercial Fertilizers and Amendments* (4449-10) for more information.

10. **Do you suspect micronutrient issues?** If N, phosphorus (P), potassium (K), and sulfur (S) fertilization seems adequate based on *Fertilizer Guidelines for Montana Crops* (EB0161) or *Home Garden Soil Testing & Fertilizer Guidelines*

Table 1. Soil depth to sample for land uses and recommended soil analysis

Depth (inches)	Soil analysis
0-3	pH for acidity assessment and liming rate calculations
0-6 for annual crops and gardens 0-12 for hay and pasture	***pH[1], organic matter (SOM), nitrate (NO_3), phosphorus (Olsen P), potassium (K), Electrical conductivity (EC)***, cation exchange capacity (CEC)[2], exchangeable Na, B, Cu, Cl (for cereals only), Fe, and Zn
6-12 for annual crops	***EC, exchangeable Na***
6-24 or 6-36 for annual crops	***nitrate (NO_3)***

[1]***Bold italics means required by MT NRCS*** for planning and programs (EQIP, CSP, AFO/CAFO)

[2] Some labs might list 'exchangeable bases' rather than CEC.

(MT200705AG), yet plants show nutrient deficiencies, (https://landresources.montana.edu/soilfertility/nutrientdeficient/) boron (B), chloride (Cl), copper (Cu), iron (Fe), and/or zinc (Zn) may be deficient. Consider confirming these deficiencies with plant tissue tests.

11. **Do you suspect low soil pH?** Test the top 0-3" in 'good' and 'poor' production areas. Plants in low soil pH are stunted, yellow/pink, with club roots. Legumes have poor or no nodulation. See http://landresources.montana.edu/soilfertility/acidif/index.html for more information.

12. **Do the plants look N deficient (uniform yellowing) but sufficient N was provided?** Yellow new growth may indicate sulfur (S) deficiency, while N deficiency appears as yellow older leaves. Soil tests for S are are generally not recommended. Rather, use prior crop production performance, current visual symptoms, and tissue tests.

13. **What is the history on the land?** Knowledge of past cropping and management practices (dryland, irrigated, manured, legume/pulse in rotation, stubble, etc.) is necessary to calculate N fertilizer rates. Home garden and cropland fertilizer N rates are adjusted based on soil organic matter (SOM). If the lab provides fertilizer recommendations, ask how they adjust their recommendations based on this information. See *Developing Fertilizer Recommendations for Agriculture* (MT200703AG), The Soil Scoop *Fertilizer Rate Calculations,* and *Home Garden Soil Testing & Fertilizer Guidelines* (MT200705AG) for details.

14. **What is the intended crop (e.g., canola or home garden)?** Soil nutrient level guidelines vary by crop, and for many crops by the expected yield. Ask the lab to use MT based rate guidelines, or do your own calculations based on soil test results and MSU Extension documents .

15. **Do you have a preferred laboratory to perform the soil analysis?** Use a lab that is part of a performance and proficiency testing program such as the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP https://www.naptprogram.org/about/participants) or Collaborative Testing Services Agricultural Lab Proficiency (CTS-ALP https://collaborative-testing.com/program-1.php). The NRCS requires the use of labs that are part of NAPT-PAP or another NRCS-approved proficiency program. Consider using a lab that provides fertilizer recommendations based on MT guidelines. A list of labs is posted at the MSU Extension Soil Fertility website https://landresources.montana.edu/soilfertility/soil-sampling-methods.html. For consistency, use the same laboratory over time.

16. **Additional decisions to make:**

Phosphorus. Request Olsen P because MT guidelines are based on Olsen P test values. Bray tests can be highly inaccurate when pH > 7 and Bray test values cannot be converted to Olsen P values. However,

[(Mehlich-3 P/2.05) – 14] ≈ Olsen P (Dari et al. 2019).

Potassium. Request the ammonium acetate test for K.

Texture. The lab can do a texture test for an extra fee, or the Mason Jar Test can be done at home for free.

For more information:

Dari et al. 2019. *Evaluation of soil test phosphorus extractants in Idaho soils*. doi:10.2136/sssaj2018.08.0314

The Soil Scoop at http://landresources.montana.edu/soilfertility/soilscoop/index.html

MSU Extension soil fertility publications for a variety of crops, market vegetable farms, and home gardens at https://store.msuextension.org/

USDA NRCS South Dakota. 2012. *Sampling Soils for Nutrient Management* https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_036444.pdf

Acknowledgement:

We thank Adriane Good, Mike Schuldt and Juli Thurston, the Pondera, Custer and Sanders County Extension Agents, respectively, for review of this document.

Soil sample checklist	
Date	
Location	
Garden/farm/forage	
Depth increment	
Tests	
1. NO_3, exch. K, pH, SOM, EC	
1. Olsen P (rather than Bray)	
2. B, Cu, Cl, Fe, Zn	
CEC and exchangeable Na	
Texture (or home test)	
Prior crop	
Past management	
Intended crop	
Yield goal (if farm)	

1. Required by NRCS

2. If evidence of deficiency in current or prior year.

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