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Nutrient Status of Your Fields?

Carrie Laboski
Dept. of Crop and Soil Sciences

Soil sampling is the best tool that you have to assess the nutrient status of your fields. There are several steps involved in taking a good soil sample. First, a field should be sampled once every 3 years. In order to spread out costs and labor, you should soil sample one-third of your farm's fields each year.

Second, a soil sample should represent no more than 20 acres. As many fields are larger than 20 acres, it is necessary to break them into smaller sections. Generally, it is not appropriate to divide a field into equal parts. This is because there can be a lot of soil variability within a field. Soil variability is the result of natural features and human activity. When breaking a larger field into smaller sections, use your knowledge of the field's history along with soil survey maps, yield maps, or perhaps elevation maps. Different methods of breaking large fields into smaller sections are shown in Figure 1. For example, if there are several soil types within a field, soil sampling by soil type can be quite useful. Additionally, if you have a field in which only a portion of the field was limed in the past, dividing the field between limed and unlimed areas would be appropriate.

Let the Soil Sampling Begin

Once fields are broken into sections that are less then 20 acres, soil sampling can begin. Start by walking through a section in a zig-zag pattern (Figure 2). Collect 20 soil samples and composite (mix) them together. This is now your sample for a section. Soil samples should be taken to the depth of tillage. It is very important to be consistent in the depth to which soil samples are taken. Thus, one should not start sampling a field to 9" deep and finish by sampling to 6". The inconsistency makes it difficult to provide accurate nutrient recommendations. If sampling a no-till field, two samples can be taken: a 0-2" sample and 0-8" sample. The shallower sample is used for pH and lime recommendations, while the deeper sample is used for nutrients.

Be sure each sample is uniquely labeled and record which field or section of a field each sample came from. After collection, samples should be air-dried and stored in paper bags or boxes prior to submission to a laboratory. Soil samples can be submitted to the Soil and Plant Nutrient Laboratory at Michigan State University. See your county Extension office for details on how to submit samples or visit the lab on the web at http://www.css.msu.edu/soiltesting. You also may choose to use a private laboratory. Be sure to contact private laboratories before sampling so that you understand the procedures they would like you to follow with regard to sample labeling, packaging, and submission.

MICHIGAN STATE UNIVERSITY

MSU Extension Dairy Agents

Ben Bartlett **906-439-5880**
(bartlett@msue.msu.edu)
The Upper Peninsula

Dann Bolinger **989-224-5240**
(bolinged@msue.msu.edu)
Clinton, Gratiot, Shiawassee

Phil Durst **989-826-1160**
(durstp@msue.msu.edu)
NE-MI-(North & East of US-127 & I-75)

Ira Krupp **616-846-8250**
(krupp@msue.msu.edu)
Muskegon, Montcalm, Newago, Oceana, Ottawa

Kathy Lee **231-839-4667**
(leek@msue.msu.edu)
NW-MI- (Osceola, Lake, Mason, Mecosta, North & West of US-127 & I-75)

Mike McFadden **989-772-0911 E-302**
(mcfadden@msue.msu.edu)
Isabella, Clare, Gladwin, Midland, Saginaw

Roxanne Pillars **517-439-9301**
(pillarsr@msue.msu.edu)
Branch, Hillsdale, Jackson, St. Joseph

Bill Robb **269-673-0370**
(robb@msue.msu.edu)
Allegan, Berrien, Cass, Kent, Kalamazoo, Van Buren

Dean Ross **517-546-3950**
(rossd@msue.msu.edu)
Genesee, Ingham, Monroe, Macomb, Livingston, Oakland, Lenawee, Washtenaw, Wayne

Phil Taylor **517-543-2310**
(taylorp@msue.msu.edu)
Barry, Calhoun, Eaton, Ionia

Craig Thomas **810-648-2515**
(thomasc@msue.msu.edu)
Sanilac, Huron, Lapeer, St. Clair, Tuscola

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The analytical laboratory will provide you with a soil test report. In this report, it will tell you the amount of nutrients that are in your soil. The concentration of phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and micronutrients are reported as parts per million (ppm) or as pounds per acre (lb/a). These two units are related in the following way: ppm x 2 = lb/a. Additionally, soil pH is provided. Most soil test reports will also tell you if a given nutrient level is low, optimum, or above optimum. Fertilizer recommendations are then provided. If your soil tests optimum for a nutrient, this means that there is an adequate amount of that nutrient for plant growth. The fertilizer (nutrient) recommendation for optimum P and K levels are equivalent to the estimated crop removal of these nutrients. When a soil tests low in P and K, the nutrient recommendation will be larger than when it tests optimum. This is because the nutrient recommendation will provide enough fertilizer to build the soil test up to a critical level and to accommodate the estimated crop removal. When soils test above optimum, there is more than adequate amounts of a nutrient for crop growth. Because of this, the nutrient recommendation is either very small or zero. MSU Extension will be releasing updated nutrient recommendations this spring. These recommendations will replace Fertilizer Recommendations for Field Crops in Michigan (E-550A). The new bulletin (E-2904), "Nutrient Recommendations for Field Crops in Michigan," will be available in late May. Ask your county Extension office for more information.

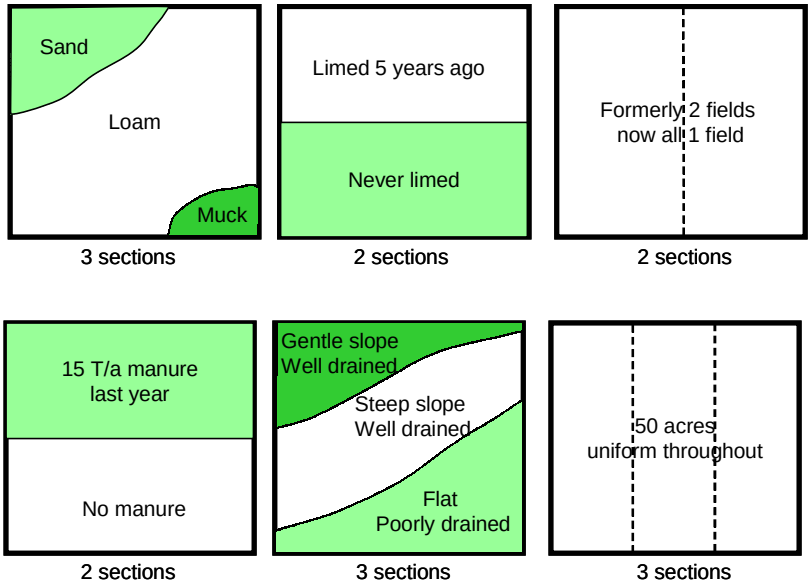

Figure 1. Examples of different ways to break a large field into smaller sections for soil sampling. A soil sample should be taken that is representative of each section.

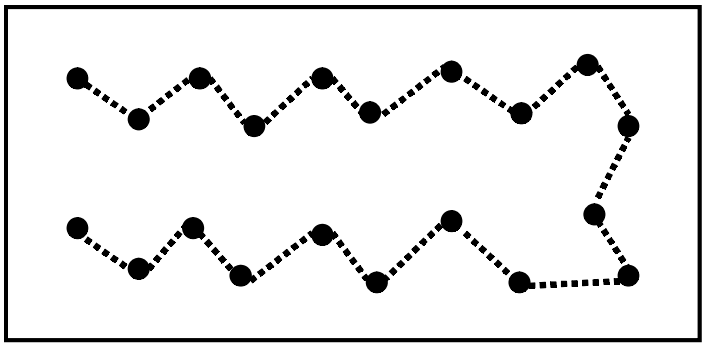

Figure 2. How to take a soil sample in a section of a field. Walk through the section in a zig-zag pattern taking 20 soil cores. Composite the cores for one soil sample.

The Optimum Soil Test Range

The optimum soil test range for P and K for various crops is provided in Table 1. Most crops do not need more than 60 to 80 lb of P/a on any soil type or more than 230, 260, or 290 lb of K/a to produce good crops on sandy, loamy, and clayey soils, respectively. As a reminder, the Generally Accepted Agricultural and Management Practices (GAAMPs) for Manure Management and Utilization state that when Bray P1 soil test levels are between 150 and 300 lb/a (75 and 150 ppm), manure and additional P fertilizer should be applied at no more than the amount of P removed by up to 4 years of crops. (Note: the Natural Resource and Conservation Service (NRCS) 590 standard recommends P rates at no more than 2 years of crop removal.) When soils test more than 300 lb P/a, all manure and additional P fertilizer application should cease. These P levels in the GAAMPs are well above the agronomic optimum, and were put into place to provide a level of environmental protection while acknowledging that livestock facilities need to be able to apply manure to fields. Please note, that to be in compliance with GAAMPs, one should be applying nutrients based on MSU's recommendations. Often recommendations made by private laboratories, fertilizer dealers, or co-ops are greater than those of MSU.

Soils with above optimum soil test P levels have adequate P for crop growth. Because of this, it is unlikely that crops grown on these soils will respond to phosphate (P_2O_5) in starter fertilizers. In this situation, if one were to plant corn with and without starter, side by side, some early season differences between the starter and no starter areas may be seen. The differences may include purpling on the leaves, a sign of P deficiency, and the corn may be shorter. However, these differences typically do not last long and almost never translate into an economic yield gain where starter was applied to high P testing soils. The research results in Table 2 show that corn grain or silage yield was not increased by starter fertilizer application on soils that test in the 90 to 100 lb P/a range. Because there was no yield advantage, this was not an

Table 1. Optimum soil test phosphorus and potassium ranges for various crops.[a]

Crop	Phosphorus (P)[b]	Potassium (K)[c]		
		Sandy CEC=4	Loamy CEC=10	Clayey CE=16
	lb/acre		lb/acre	
Alfalfa	50-80	170	200	230
Corn silage	30-60	170	200	230
Corn grain	30-60	170-230	200-260	230-290
Soybean	30-60	170-230	200-260	230-290
Sugar beet	30-60	170-230	200-260	230-290
Wheat	50-80	170-230	200-260	230-290

[a]From Warncke, D.D. and J. Dahl. 2003. Nutrient recommendations for field crops grown in Michigan: The structure. Nutrient Management Info. Sheet No. 2.1. Dept. of Crop & Soil Sciences, Michigan State University.

[b]These ranges are based on Bray P1 and 1 N neutral ammonium acetate extractable P and K, respectively.

[c]Optimum K ranges are based upon the soil's cation exchange capacity (CEC) which is related to soil texture.

economically sound practice.

Livestock operations need to have adequate land to apply manure; thus, it is important to ensure that soil test P levels are not increased by using P-containing fertilizers when there is no economic advantage. Many producers are uncomfortable with not applying starter fertilizer, even on high P soils. In this situation, using a N only starter would produce adequate yields and provide the crop with some N early in the season. Also, one might consider using ammonium sulfate as a starter. This is the most acidifying fertilizer, so when it is applied in a starter band (2" to the side and 2" below the seed), the soil pH tends to be reduced for a period of time. The lower pH results in P and micronutrients being more available. So there might be some yield advantage to using ammonium sulfate. However, ammonium sulfate is a more expensive N source and thus may not be economical.

Table 2. Effect of starter fertilizer on corn yield.

Year	Crop	Soil Test P lb/acre	2 x 2 Band Starter Treatment	Yield[a]
2002	Corn silage	90	10-34-0 (3 gal/a)	21.6 [a]
2002	Corn silage	90	None	21.7 [a]
2003	Corn grain	98	30-20-20 (100 lb/a)	120 [a]
2003	Corn grain	98	None	121 [a]

[a]Yields with the same letter in a given year are not significantly (P > 0.05) different from one another. Silage yield is in tons per acre and grain yield is in bushels per acre.

Summary

Taking good soil samples that are representative of your fields is important to determine the nutrient status of your soil. After the samples have been analyzed, follow MSU nutrient recommendations to insure each crop is fertilized properly. Following these practices will help insure the long term economic and environmental sustainability of your farm.

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