



Interpreting Your Soil Test Reports

After you send in your soil sample to the lab you wait patiently for your test results, but when they arrive do you know what it all means?

Soil tests allow you to understand soil fertility in your fields. The accuracy of a soil test starts during the sampling process. Samples must be taken at a consistent depth and in a random nature. The objective is to collect multiple small samples representative of the field majority. Avoid areas where animals congregate, areas of over or under-performing vegetation, fence rows, tree lines, etc. For soil sampling instructions, visit [Soil Sampling Instructions](#) from Penn State Agricultural Analytical Services Lab.

[Soil Fertility Submission Forms](#) site. Now we wait. Delivery and processing take time, so remember to send your samples before you need them. Receiving the results as an email versus waiting for them to be returned through the mail can speed up the process.

No "uniform" soil analysis report exists, meaning results and analysis can differ depending on the provider. This article will break down the soil test reports from the Penn State Agricultural Analytical Services Laboratory (Images 1 and 2). In images 1 and 2, divide the soil tests into four sections.



Soil samples at the Penn State Agricultural Analytical Services Laboratory. Image Credit, J. Spargo, Ph. D, Penn State University

SOIL TEST REPORT FOR:				ADDITIONAL COPY TO:			
Your name and contact information				You can add your local extension educator's contact information to get a copy of your report			
DATE	LAB #	SERIAL #	COUNTY	ACRES	ASCSTID	FIELD ID	SOIL
00/00/2019	S00-LABID	00000	County field in	10		Field name	
SOIL NUTRIENT LEVELS							
				Below Optimum	Optimum	Above Optimum	
¹ Soil pH	5.9						
² Phosphorus (P)	31	ppm					
³ Potassium (K)	82	ppm					
⁴ Magnesium (Mg)	74	ppm					
RECOMMENDATIONS: <small>(See back messages for important information)</small>							
Limestone*: 5000 lb/A for a target pH of 7.0.				Magnesium (Mg): NONE			
<small>*Calcium Carbonate equivalent</small>							
Plant Nutrients: <small>(If manure will be applied, adjust these recommendations accordingly. See back of report.)</small>							
Year	Crop	Expected Yield	Nitrogen (lb N/A)	Phosphate (lb P ₂ O ₅ /A)	Potash (lb K ₂ O/A)		
1	Corn for Grain (no-till)	190 Bu/A	190	60	70	See ST2 for other crop recommendations	
Use a starter fertilizer. (See Back)							
2	Corn for Silage (No-till)	27 T/A	200	80	230	See ST2 for other crop recommendations	
Use a starter fertilizer. (See Back)							
3	Planting Alfalfa-Grass	4 T/A	0	50	210	See ST2 for other crop recommendations	
ADDITIONAL RESULTS:				Optional Tests:		Trace Elements	
¹ Calcium (ppm)	² Acidity (meq/100 g)	³ CEC (meq/100 g)	% Saturation of the CEC		Organic Matter %	Nitrate-N ppm	Salts mmhos/cm
			K	Mg	Ca		
1053	4.5	10.6	2.0	5.8	49.7		
						See back for comments	
						Zinc ppm	Copper ppm
						1.9	2.6
						Sulfur ppm	
						9.5	
Test Methods: ¹ 1:1 soil:water pH, ² Mehlich 3 (ICP), ³ Mehlich Buffer pH, ⁴ Summation of Cations							

Image 1. This soil test report is broken into four sections with recommendations for corn grain, corn silage, and planting alfalfa grass.

The first section comprises the information you filled out when you sent the soil sample and forms -- name, contact, and field information.

In the second section, we start to get into the measured soil fertility levels- pH, phosphorus (P), potassium (K), and magnesium (Mg). Phosphorus, potassium, and magnesium are essential plant nutrients measured in parts per million (ppm). As mentioned, all labs and analysis reports are different, so if looking at other labs' results, ensure they are not reporting in pounds per acre (lbs/acre). Soil pH measures the acidity or alkalinity, and pH levels will range from 0-14, with <7 indicating an acidic pH, seven a neutral pH, and >7 a basic pH. The pH scale is based on a logarithmic scale, meaning the difference from a pH of 6.0 is 10x more acidic than a pH of 7.

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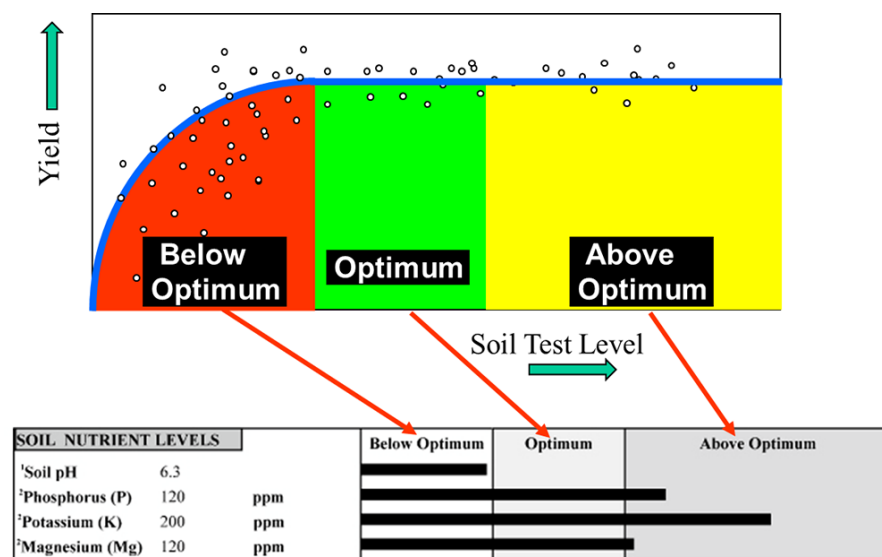


Image 3. Soil test calibrations, created by Doug Beegle (dbb@psu.edu), Emeritus Distinguished Professor of Agronomy.

You may notice that nitrogen (N) is not measured. Although nitrogen is a macro plant essential nutrient, required in larger quantities, and is often the limiting factor in plant growth, it is challenging to measure in the field. Nitrogen is a dynamic nutrient, moving quickly in the environment from one form to another. Because N is so difficult to measure and moves through the environment in so many ways, N is recommended based on crop needs—more on nitrogen in section 3.

Nutrient recommendations are reported in section 3 of the soil test report. The upper portion of section 3 is used for the recommendations of limestone and magnesium. Limestone is reported as pounds per acre required to reach a target pH of 6.5 and reduce soil acidity. Limestone recommendations are based on material with a calcium carbonate equivalency (CCE) of 100. Many materials can have values above or below this 100 CCE benchmark. Understanding CCE is becoming more critical with the variety of liming products becoming available. This section also has magnesium recommendations since magnesium deficiencies are usually remedied with a high magnesium content lime application. Using a high Mg lime will treat soil pH and Mg simultaneously. More information on calcium carbonate equivalency and liming can be found in the Penn State Extension article [Soil Acidity and Aglime](#).

Following section three, you will next find recommendations for plant nutrient needs. In this section, you will see the cropping year, the crop, expected crop yield, crop nutrient needs, and laboratory notes.

Recommendations from the Lab are based on the crop you are growing and the year of rotation. If you produce a grass crop, the nitrogen recommendations will be higher than those on a legume crop. Likewise, the nutrient recommendations will be higher in a crop that is being mechanically harvested, like corn silage, when compared to pasture. At their essence, recommendations are designed to keep nutrients from being the limiting resource to the crop, while maintaining economic and environmental balance. When all nutrients are in the optimum range, recommendations are based on crop removal, meaning nutrient additions are to replace the nutrients removed by the harvested crop. When nutrients are below optimum, recommendations are based on a building approach. The nutrient additions are designed to get the soil nutrients to the optimum range over the three years of the soil test.

As mentioned, nitrogen is based on average crop uptake and expected yield. This differs from phosphate and potash, which are recommended from soil measurements as P_2O_5 and K_2O , respectively. You must recognize how your recommendations and nutrient levels are reported.

Below the recommendation are the laboratory notes. Often in this section, you will find information about split applications of nitrogen, recommendations on application timing, animal health issues, etc. The laboratory note section can provide valuable insights and tips into proper applications and nutrient timing.

At the bottom of the page, section 4 contains many analytical results or other tests that can be purchased at an additional fee. A few keys to notice in section 4 are: Acidity is not the same as soil pH; these are very different things. As we see in Image 2. The soil pH is 5.2, and the soil acidity is 8.7. When purchasing additional tests such as organic material, nitrate-N, or salts, they will be found in section 4. Also, trace mineral concentrations for zinc, copper, and sulfur are found in this section. Although recommendations are not provided for trace minerals, a typical range table can be found on the back of your soil test result.

Reading soil test results can be overwhelming and seem challenging to process. This will help take some of the pressure off. If you have any concerns, comments, or questions about soil testing, please don't hesitate to contact your local Penn State Extension Office.

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