

# MU Guide

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## Interpreting Missouri Soil Test Reports

John Lory, Plant Science Unit and Commercial Agriculture Program  
Peter Scharf and Manjula Nathan, Plant Science Unit

The Missouri Soil Test Report is an important tool for making management decisions for crop and forage production. This guide will help you understand the soil test report and make the results more useful for your farming operation.

Every soil test report includes the following nine sections (see Figure 1):

### (A) Field information.

This section contains information provided by you to identify the field and summarize previous management. This information includes, for example, the field name or number, field size and previous crop.

### (B) Soil test information.

This provides the results of the soil tests performed on your sample. The regular soil tests include the soil salt pH; available phosphorus, potassium, calcium and magnesium; organic matter; neutralizable acidity; and cation exchange capacity. Tests for other nutrients can be obtained at additional charge. The basic set of tests provides the necessary data to develop nitrogen, phosphate, potash, and ag lime recommendations for your intended cropping plan.

(C) Rating This section provides a rating for the salt pH and nutrients tested. The rating system helps you interpret the soil test information in Section B. The soil test rating indicates the relative level of each nutrient tested and provides

information on the probability that application of a particular fertilizer will increase crop yield. Use Table 1 to determine the probability of a yield increase from fertilizer applications for your soil test rating.

FIELD INFORMATION		Serial no.		Lab no.			
Field ID	Sample no. 1	Area	County	Region	3		
Acres	Last limed	Submitted	Processed				
Last crop		Soil sample submitted by:					
This report is for: Example Report University of Missouri Columbia, MO 65211							
B SOIL TEST INFORMATION		C RATING					
		Very low	Low	Medium	High	Very High	Excess
pH <sub>s</sub> (salt pH)	4.9	*****					
Phosphorus (P)	22 lbs/acre	*****					
Potassium (K)	103 lbs/acre	*****					
Calcium (Ca)	2091 lbs/acre	*****					
Magnesium (Mg)	276 lbs/acre	*****					
Sulfur (SO <sub>4</sub> -S)	ppm						
Zinc (Zn)	ppm						
Manganese (Mn)	ppm						
Iron (Fe)	ppm						
Copper (Cu)	ppm						
Organic matter	%	Neutralizable acidity	meq/100g	Cation Exch. Capacity	12.8	meq/100g	
pH in water		Electrical Conductivity	mmho/cm	Sodium (Na)		lb/a	
Nitrate (NO <sub>3</sub> -N)	ppm	Topsoil	ppm	Subsoil	ppm	Sampling Depth	Inches
E Cropping options		D Yield goal		F Pounds per acre		G LIMESTONE SUGGESTIONS H	
Alfalfa/Grass	0	20	55	0	Zn	S	Effective neutralizing material (ENM)
Establishment	0	20	45	0			1,395
Clover/Grass Establishment	6	0	30	235			Effective magnesium (EMg)
Alfalfa/Grass Hay	150 CD7A	90	30	20			
I To determine limestone need in tons/acre, divide ENM requirements by the guarantee of your limestone dealer.  When N requirement for cool-season grass exceeds 90 lbs/acre, apply 2/3 of it during the period from December through February, and the remainder in August.  Do not use nitrogen on spring seedlings of legumes after May 1st because of potential weed competition.							
Area Agronomy Specialist		Agronomy Specialist		Phone (573) 862-1000		Signature	
White - Farmer, Yellow - ASCS, Blue - Firm, Pink - Extension		MP 188		Revised 1/98			
University of Missouri, Lincoln University, U.S. Department of Agriculture & Local University Extension Councils Cooperating equal opportunity institutions							

Figure 1. Sample soil test report.

Table 1. Your probability of yield increase from fertilizer drops as your soil test ratings in Section C rise.

RATING						Probability of response to fertilizer
Very low	Low	Medium	High	Very high	Excess	
*****						very high
*****						high
*****						medium
*****						low
*****						none
*****						none

(D) **Nutrient requirements.** This section contains three parts: cropping options, yield goal, and fertilizer recommendations.

(E) **Cropping options.** This section lists cropping plans or crops for which you requested fertilizer recommendations. You can request recommendations for up to four different cropping scenarios. Additional scenarios can be done at your local University Extension center if you change plans after you receive your lab report.

(F) **Yield goal.** The yield goal section shows the level of production you selected for the crops listed in Section E, "Cropping Options." Common yield goal ranges for Missouri crops are given in the appendix table on page 5 of this publication. The yield goal you choose should be based on soil type, yield history, fertility level, irrigated versus nonirrigated land, and economic considerations.

(G) **Pounds per acre.** This section lists the fertilizer recommendations for the crops and yield goals listed. The recommendations are reported as pounds of N (nitrogen), P<sub>2</sub>O<sub>5</sub> (phosphate), and K<sub>2</sub>O (potash) per acre. The fertilizer recommendation is designed to provide an agronomic recommendation of the nutrients needed to meet yield goal in Section F and

improve soil fertility over time. Following these soil test recommendation will build or maintain soil test phosphorus and potassium to the high rating category if the recommended fertilizer rate is applied annually for eight years. Micronutrient recommendations, for example zinc and sulfur, should be applied once and the soil resampled in three to five years to determine the need for additional applications.

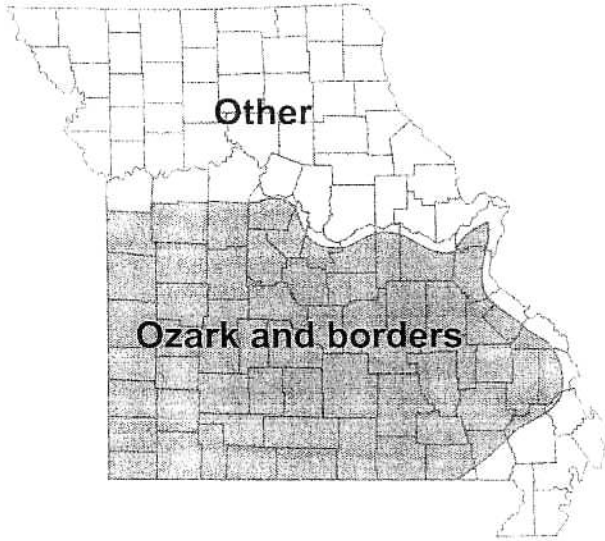
(H) **Limestone suggestions.** This section gives the suggested amount of limestone to raise soil salt pH to an optimal level for the cropping options listed. Desired soil salt pH ranges for Missouri crops are given in Table 2.

The limestone recommendation is given for the cropping option requiring the highest salt pH range. For example, if a cool-season grass and alfalfa were both listed in Section E, the limestone recommendation would be for alfalfa since it requires a higher soil salt pH level. The recommendation is reported as pounds of ENM (effective neutralizing material) per acre.

To determine the amount of lime needed in tons per acre, divide the ENM value by the ENM guaranteed by your ag lime dealer. If the soil test ENM requirement is 1,395 pounds per acre and lime quarry guarantees 400 pounds ENM per ton of limestone,

Table 2. Desired soil salt pH (pH<sub>s</sub>) ranges for Missouri crops.

Crop	Soil region	
	Ozark and borders	Other
Alfalfa and alfalfa-grass establishment	6.6-7.0	6.1-6.5
Birdsfoot trefoil and birdsfoot trefoil-grass establishment	6.1-6.5	5.6-6.0
Clover and clover-grass establishment	6.1-6.5	5.6-6.0
Cool-season grass establishment and production	5.6-6.0	5.6-6.0
Lespedeza and lespedeza-grass establishment	6.1-6.5	5.6-6.0
Overseeding legumes	6.1-6.5	5.6-6.0
Warm-season grass establishment and production	5.6-6.0	5.6-6.0
Sudan grass and sudan/sorghum crosses	5.6-6.0	5.6-6.0
All row crops	6.1-6.5	6.1-6.5



then you need 3.48 tons of limestone per acre ( $1,395 \div 400 = 3.48$ ).

Limestone is applied to neutralize soil acidity and increase salt pH. It does contain calcium, but its main use is to neutralize acidity. Dolomitic limestone contains appreciable amounts of magnesium and is often used on magnesium-deficient soils. Some liming materials have higher ENM ratings than calcitic limestone. For more details on these materials, refer to MU publication G 9107, *Missouri Limestone Quality — What is ENM?*

Applied limestone may take as long as one year to correct soil acidity problems. For a complete discussion of the effects of limestone on soils, refer to MU publication G 9102, *Liming Missouri Soils*.

(I) **Special notes.** Many times notes appear at the bottom of the soil test report to help you interpret and use your results and recommendations.

## Common questions about soil tests

Q: How accurate are the soil test results?

A: The soil testing laboratories do a good job of determining the salt pH and nutrient content of the soil sample you submitted. The University of Missouri has two soil testing labs, one in Columbia on the University campus and the other in Portageville at the University Delta Center.

To ensure accuracy, check samples are continually run with samples submitted by you. Also, the University lab exchanges samples with several private labs to assure accurate results from all labs involved. Even though the tests are accurate, the results are only as good as the sample you submit. Well taken soil samples yield good results while poorly taken samples yield poor results.

Q: How do I get a good soil sample?

A: Most problems with unreliable test results are due to improper sampling. In general, you should take at least 10 to 15 soil cores per soil sample per field. More detailed information is given in MU publication G 9110, *How to Get a Good Soil Sample*.

Q: When and how often should I take a soil sample?

A: Sampling at any time of year is fine, but it's best to do it when the soil is moist during the fall and spring. If you try to take a sample when the soil is very dry, much of the soil falls off the soil auger or you can't get a probe deep enough into the ground. Either situation yields poor samples and poor test results. In general, fields should be retested every three to four years to keep track of soil fertility changes.

Q: I took two soil samples from the same field in the same area and the results were completely different. What is wrong?

A: Soils can have wide variations in fertility levels in the same field. The distribution of nutrients through the soil surface is not exactly uniform over every square inch. A good example is a box full of colored marbles, the same number of each color. If you grab a handful of marbles from the box, you are likely to get a different number of each color. But after several handfuls, the number of each color will average nearly the same.

Soils are somewhat similar to this example. You should take enough soil cores for an adequate representation of the field's soil content. More information on proper soil sampling techniques can be found in MU publication G 9110, *How to Get a Good Soil Sample*.

Q: I have four fields that have been managed the same way for many years and are of similar soil type. Can I take one composite sample for all four fields?

A: No. A specific example concerns a producer who took a composite sample from three small fields of similar soil type and history. The test results showed high soil salt pH and phosphorus levels he didn't believe. He re-sampled each field separately and the results showed very low phosphorus on two fields and high in another. The salt pH was high in two fields and low in the other. As a result, the fertilizer and limestone recommendations changed drastically.

Q: I've got a pasture full of weeds and broomsedge, but my soil test says I don't need any lime. That can't be right, can it?

A: It can be very right if you took a good sample. Many times the soil salt pH is adequate but another nutrient (usually phosphorus) is deficient in the soil. Most weeds and broomsedge become established in a pasture because of overgrazing or lack of competition from the desired forage. Research has shown that adequate yearly fertilizer applications will reduce or eliminate broomsedge on initially low-phosphorus soils that have adequate soil salt pH.

Q: I took a soil test from my hay field three years ago and brought the soil "up to test" with fertilizer and lime. The production was good that year, but has declined since that time. Why?

A: The nutrient requirements are annual treatments that should be applied each year to maintain good yields. The recommendation has two parts: one for the amount of fertilizer necessary for the plant to reach the desired yield goal that year, and one for building the soil nutrients to a high level over eight years of yearly fertilizer applications.

Q: I limed a field according to soil test recommendations last year but decided to overseed clover instead of fertilizing for straight grass. My updated soil test says I still need more lime. Why is this?

A: Different crops and forages have different optimum soil salt pH levels. You applied lime for straight grass according to the first soil test correctly, but clover and alfalfa have higher soil pH requirements, so the updated test recommended more lime.

Q: My soil test recommends an application of 20-100-70. How many pounds per acre should I apply?

A: This is a common question due to misinterpretation. The 20-100-70 means that to reach the specific yield goal on this test report you need 20 lbs. nitrogen, 100 lbs. phosphate and 70 lbs. potash per acre. This adds up to 190 lbs. actual plant food, but the pounds of actual fertilizer material to be applied will be more than 190 lbs. since fertilizer materials contain only certain percentages of plant food nutrients.

You pay for pounds of plant food and the recommendation is in pounds of plant food. You need only tell the fertilizer dealer that you need an application of 20-100-70 per acre. The dealer will mix that analysis and apply the correct amount of plant food per acre.

Q: My soil test report shows a recommendation of 0-20-0 for clover/grass pasture, but my fertilizer dealer says he can't spread such a small amount and that I should apply more. Is this true?

A: Many soil test reports have low recommendations when fertility levels are near optimum for the desired crop. Accurate spreading of small amounts of fertilizer is difficult. In this example the dealer need-

ed more bulk to make an even and accurate application. In the case of very low fertilizer recommendations, it's OK to add enough more phosphate or potash to provide the necessary bulk for spreading or just disregard the application for that season.

Q: I took a soil sample, but don't want to plant the crop for which the soil test gave fertilizer recommendations. Do I need to take a new soil sample?

A: No. If you didn't make any large applications of lime or fertilizer, the fertility probably hasn't changed. Take your soil test report to your local University Extension center and it will be updated with the crop options you need. Yield goals can also be updated if different yields are desired.

Q: What is a CD/A?

A: A CD/A is a pasture yield goal that means "cow day per acre." This is enough forage dry matter for a 1,000-pound cow with a calf less than 4 months old for one day. In Missouri this is considered to be 30 pounds of forage dry matter per day. For example, a yield goal of 200 CD/A is roughly equivalent to 3 tons of forage dry matter per acre.

Q: Can I receive my soil test results on a computer disk or electronically?

A: Yes, contact the Soil Testing Lab in Columbia for more information on this service (see address on page 6).

Appendix: Guidelines for yield goal estimates by crop code.

Crop code		Range of yield goal	Yield unit
<b>Forages</b>			
1	Alfalfa, Alfalfa-grass establishment	0	none
2	Birdsfoot trefoil-grass establishment	0	none
3	Clover, Clover-grass establishment	0	none
4	Cool-season grass establishment	0	none
5	Lespedeza-grass establishment	0	none
6	Overseeding legumes into existing grass	0	none
7	Warm-season grasses establishment	0	none
10	Alfalfa, Alfalfa-grass hay	3-6	tons/acre
11	Alfalfa, Alfalfa-grass pasture	100-250	cow days/acre
12	Birdsfoot trefoil-grass pasture	100-200	cow days/acre
13	Bluegrass pasture	100-200	cow days/acre
14	Bermudagrass hay	2-5	tons/acre
15	Bermudagrass pasture	100-250	cow days/acre
16	Clover, Clover-grass hay	2-5	tons/acre
17	Clover, Clover-grass pasture	100-250	cow days/acre
18	Cool-season grass hay	3-6	tons/acre
19	Cool-season grass pasture	100-250	cow days/acre
20	Cool-season grass-seed residue hay or pasture	0	none
21	Cool-season grass-stockpile fall growth	0	none
22	Lespedeza-grass hay	1-3	tons/acre
23	Lespedeza-grass pasture	100-250	cow days/acre
24	Sudangrass etc. hay	3-5	tons/acre
25	Sudangrass pasture	100-250	cow days/acre
26	Warm-season grass hay	2-4	tons/acre
27	Warm-season grass pasture	100-250	cow days/acre
999	Idle land	0	none
<b>Row crops</b>			
100	Barley	40-80	bushels/acre
101	Buckwheat	500-1,000	pounds/acre
102	Cotton (lint)	500-4,500	pounds/acre
103	Corn (grain)	80-200	bushels/acre
104	Corn (silage)	10-25	tons/acre
105	Double crop: wheat-soybeans <sup>1</sup>	30-70	bushels/acre
106	Double crop: wheat-sunflowers <sup>2</sup>	30-70	bushels/acre
107	Double crop: wheat-sorghum (grain) <sup>3</sup>	30-70	bushels/acre
108	Double crop: wheat-sorghum (silage) <sup>4</sup>	30-70	bushels/acre
109	Oats	50-100	bushels/acre
110	Popcorn	1,500-4,000	pounds/acre
111	Rice	3,000-9000	pounds/acre
112	Rye	30-70	bushels/acre
113	Sorghum (grain)	4,000-10,000	pounds/acre
114	Sorghum (silage)	12-30	tons/acre
115	Soybeans	30-60	bushels/acre
116	Sugarbeets	15-24	tons/acre
117	Sunflowers	1,200-2,500	pounds/acre
118	Tobacco	3,000	pounds/acre
119	Wheat	40-80	bushels/acre
999	Idle land	0	none

<sup>1</sup> Assumes soybean yield is 30 bushels/acre.

<sup>2</sup> Assumes sunflower yield is 1,000 pounds/acre.

<sup>3</sup> Assumes sorghum yield is 5,000 pounds/acre.

<sup>4</sup> Assumes sorghum silage yield is 10 tons/acre.

**Send soil samples to**

**Soil Testing Laboratory**  
23 Mumford Hall  
University of Missouri  
Columbia, MO 65211  
Phone: (573) 882-0623

or

**Soil Testing Laboratory**  
P.O. Box 160  
Portageville, MO 63873  
Phone: (573) 379-5431

For additional help in interpreting and using your soil test report, ask for the following MU publications at your local University Extension center:

- G 9102, *Liming Missouri Soils*
- G 9107, *Missouri Limestone Quality — What is ENM?*
- G 9110, *How to Get a Good Soil Sample*
- G 9111, *Using Your Soil Test Results*
- G 9174, *Nitrogen in Missouri Soils*
- G 9180, *Phosphorus in Missouri Soils*
- G 9185, *Potassium in Missouri Soils*



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