Soil Testing Basics

WHY YOU SHOULD SOIL TEST

Soil testing is an effective method for reliably predicting fertilizer and lime needs before crops are planted. It is a good business practice, one that can provide a high return for the investment of a few dollars per acre.

Soil testing helps Wisconsin farmers achieve more profits. One common way is by identifying fields where soil nutrient levels are already high, so that only minimal amounts of fertilizer, if any, should be applied. Another is by indicating fields where fertilizer or lime applications can increase crop yields.

Soil tests provide useful information that can help you determine how to most profitably allocate your fertilizer dollars. Applying fertilizer without soil testing can lead to excess nutrient applications to crops which, in turn, may contribute to production problems and water pollution.

WHAT A SOIL TEST TELLS YOU

Routine analysis of soil samples includes phosphorus (P) and potassium (K) levels, organic matter content (%), and soil pH. These analyses are combined with information you provide about your field, your planned crop, and yield goals to make crop-specific fertilizer and lime recommendations.

WHEN YOU SHOULD SOIL TEST

Fields should be sampled every three to four years or at least once in the cropping rotation. The best time for routine soil sampling is in the fall, in order to get results back in time to plan for the next cropping season. Soil tests can also be taken in the early spring after frost has left the ground.

Although many people have a few fields sampled every year, there is a real advantage to sampling your farm all at once. When you know the fertility status of every field, you can apply fertilizer, manure and lime on the fields where it will do the most good.

Nutrient and Pest Managment Program (608) 265-2660.
College of Agricultural and Life Sciences, UW-Madison. University of Wisconsin-Extension is an EEO/Affirmative Action employer and provides equal opportunities in employment and programming, including Title IX and ADA requirements.

HOW YOU SHOULD SOIL TEST

Most growers have someone else take soil samples on their land, but you can do it yourself. For directions, obtain University of Wisconsin Extension publication, *Sampling Soils for Testing* (A2100) from your county's Extension Office. You might be able to borrow a soil probe too. Laboratory analysis for routine soil samples at the University's labs and some private labs costs $6.50 per sample.

Whether you send in the samples or someone else does, there are important things to know so you can get the most out of the results.

Fill out the soil information sheet completely. The information you provide to the lab is important in obtaining accurate and reliable recommendations. Step-by-step instructions for each numbered section are on the back of the information sheet. The example on the following page provides further explanation and some additional information.

Accurately sample your fields. Soil samples that are not representative of the field will result in inaccurate nutrient and lime recommendations. A minimum of one soil sample should be collected per five acres. Each sample should be a mixture of at least five soil cores within the five-acre area. Sample to the plow depth (6-8 inches) and be certain to label each sample (with field ID and sample ID notation). Every field should have at least two soil samples. Crop strips should be sampled individually even when they are less that five acres in size - unless each strip has the same crop and management history.

Avoid fertilizer bands and places in the field that seem very different from the majority of the field when soil sampling.

Ask your soil testing lab or consultant for University of Wisconsin (UW) recommendations. Some labs provide fertilizer recommendations based on several different "systems." That means that for the same level of P or K in the soil, the lab might provide different fertilizer recommendations. The other systems were developed primarily in other states with different soil and weather conditions. University of Wisconsin recommendations are based on field trial research conducted in Wisconsin.

Make sure you receive the full results. Complete reports include field-by-field information on the analysis results as well as crop-specific fertilizer and lime recommendations for a three-year rotation. Sometimes growers only receive a fertilizer application plan. To get full value from your tests and to use them to evaluate future cropping plans, you should get both the analysis results and the interpretation.

COOPERATIVE EXTENSION
University of Wisconsin-Extension
University of Wisconsin-Madison
Soils Department, Madison, WI

Soil Information Sheet
For
Field, Vegetable and Fruit Crops
Use a separate sheet for each farm

LAB USE ONLY
Date Received
Lab No.
County Code

NAME AND ADDRESS
2 FSA Farm No. ____ Soil samples taken from Washington County
Name The Progressive Farm

1 PAYMENT
Enclosed $

3 No. of samples for Routine Test (pH, O.M., P, K) 8

4 Plow Depth 8 inches

The "3 Year Crop Rotation" section is a good planning tool. When in doubt, choose a rotation that includes all of your most likely crop choices, so you get the recommendations for each.

The "Fertilizer Credit Information" section is very important for obtaining accurate recommendations. A previous legume crop such as alfalfa or soybean will reduce the amount of N needed for the next crop. If you apply manure, it will reduce the final N, P and K fertilizer recommendations.

formation
Instructions on Back

5 FIELD ID	6 SAMPLE NO (S)	7 check(3) if irrigated	8 SOIL NAME	Lab Code	9 ACRES IN FIELD	10 Slope %	11 3 YEAR CROP ROTATION: Sequence to be Grown (use code)	Yield Goal	FERTILIZER CREDIT INFORMATION: 12A Previous Legume Crop: Previous Crop Grown (use code)	Legume Forage % stand	check(3) if more than 8" regrowth in fall	12B Manure Applied to Field Since Last Crop: Animal Species (circle one)	Liquid or Solid (circle one)	Application rate T/a or 1000 gal/a	Application method (circle one)	Consecutive years of application
1	13		Sisson		15	0%	17	150	17			dairy beef pig-finish pig-farrow poultry veal	Liquid (Solid)	20	Surface Incorporated Injected	1
							28	90								
							1	5								
2	48		Sisson		20	5%	17	150						20	Surface Incorporated Injected	1
							28	90								
							1	5								
												dairy beef pig-finish pig-farrow poultry veal	Liquid Solid		Surface Incorporated Injected	
												dairy beef pig-finish pig-farrow poultry veal	Liquid Solid		Surface Incorporated Injected	
												dairy beef pig-finish pig-farrow poultry veal	Liquid Solid		Surface Incorporated Injected	
												dairy beef pig-finish pig-farrow poultry veal	Liquid Solid		Surface Incorporated Injected	
												dairy beef pig-finish pig-farrow poultry veal	Liquid Solid		Surface Incorporated Injected	
												dairy beef pig-finish pig-farrow poultry veal	Liquid Solid		Surface Incorporated Injected	

Realistic yield goals. This is important for getting the right P and K recommendations.

The name of your soil. This is important because fertilizer recommendations vary with soil type. One way to find soil type is to look at your farm's conservation plan – it will have the name of the soil or an abbreviation on each field. If you don't know what the abbreviation stands for, call your Land Conservation Department or the Natural Resources Conservation Service. Percent slope should also be indicated on the conservation plan.

Use crop codes. A list of crop codes with yield goal units can be found on the back of the soil information sheet. In this example, 17 indicates corn for grain in bushels per acre, 28 indicates oats in bushels per acre, and 1 indicates alfalfa in tons/acre.

In the "Special Tests" section you can request analysis for soil nutrients beyond those included with a routine soil test. You must indicate the specific soil sample(s) and the type of analysis for each.

13 Special Tests -- Additional Fee (list field or sample identification)

Calcium-Magnesium	Zinc
Boron	Sulfur 13
Manganese	Other (chocies on fee schedule)

Comments / Special Instructions:

☐ Electronic Reporting Option - NO PRINTED REPORTS-
Recommendations Per Field Per Sample (circle one)

Soil and Plant Analysis Lab
5711 Mineral Point Road
Madison, WI 53705
(608) 262-4364

Soil and Forage Analysis Lab
8396 Yellowstone Drive
Marshfield, WI 54449
(715) 387-2523

Soil Test Results

Using University of Wisconsin Recommendations

Your soil test results will come back as a bunch of numbers on a sheet. At first it may look daunting, but the information can be divided into three main sections: nutrient recommendations, test interpretation and laboratory analysis. Each section will be explained below. On the following page, actual results will be discussed. But first, a couple of things about what a soil test actually determines.

A soil test **does** indicate the plant availability of two nutrients in the soil: phosphorus (P) and potassium (K). The result of these analyses is called the soil test level of the nutrients. A soil test **does not** directly indicate the amount of nitrogen (N) in the soil; however, the test does measure soil organic matter. Soil organic matter, along with information on your soil type (texture, yield potential, irrigation) and the crop to be grown, determine your N fertilizer recommendation.

NUTRIENT RECOMMENDATIONS

This section is the most important. That is why it is listed first. It gives the actual amounts of nutrients and lime to apply for your specific crop rotation and yield goals.

The "Nutrients to Apply" recommendation is your crop nutrient need (based on the interpretation of the actual soil test levels) minus the fertilizer credits (based on information you submitted with your soil test).

TEST INTERPRETATION

This section is a graphic interpretation of your soil test levels. Basically it tells you where your soil test levels fall on a relative low to high scale for your soil and crops. Your fertilizer recommendations are based on this interpretation.

The last line in this section is the rotation pH. The optimum is the target pH for the most acid-sensitive crop in the rotation. The lime recommendation (located under the "Nutrient Recommendations" section) is based on this interpretation.

LABORATORY ANALYSIS

This section has the actual results of the individual soil samples and the adjusted averages. It is interesting to look at the numbers and see the variation (or lack thereof) among the samples.

NUTRIENT RECOMMENDATIONS

The "Nutrients to Apply" recommendation (right side of the section), is made in pounds of **actual** nitrogen, phosphate (P_2O_5), and potash (K_2O) per acre. To determine the pounds of fertilizer material to apply, divide the actual pounds needed by the percent contained in the material. (Fertilizer analyses are written as percent of N - P_2O_5 - K_2O.)

In this example, 100 pounds actual N is recommended. If you are using urea with the analysis of 46-0-0, then divide 100 by 0.46 to get 217 pounds of urea to apply.

The soil tested in this example was excessively high in both phosphorus (P) and potassium (K), therefore, no additional P_2O_5 and K_2O is recommended. The "Additional Information" section suggests reducing manure application to the field or raising high P-demanding crops (i.e. alfalfa) to prevent further soil phosphorus build-up.

TEST INTERPRETATION

Soil test interpretations are based on three variables: the actual soil test levels, the crop demand levels in your rotation and your soil type. The report considers these variables to set optimum levels for phosphorus (P), potassium (K), and soil pH for your specific situation.

In this example, the P and K levels are excessively high for all crops in the cropping sequence. No P or K is recommended. The pH for the whole rotation is adequate, therefore no lime is required to reach the desired pH of 6.8.

The interpretations are based on extensive field trials conducted in Wisconsin to determine the response of crops to varying amounts of fertilizer at different soil test levels. The trials have been run at locations with a wide range of soil and climatic conditions. Through these trials, the amount of additional P or K needed to maximize economic return at a particular soil test level was measured. At optimum soil test levels, nutrient application recommendations are about equal to the amount of nutrient removed by the harvested portion of the crop.

LABORATORY ANALYSIS

This section shows the individual soil test results of each sample indicated on the soil information sheet you submitted.

In this example, tests for soil pH, organic matter content, P, K and sulfate-sulfur ppm (parts per million) were run and the actual test values are listed. It is interesting to look at the ranges of values within a category. The adjusted average take the extreme high values (if any) into account and modify them so they do not influence the average too dramatically.

SOIL TEST REPORT

Samples Analyzed By:
Soil and Plant Analysis Lab
5711 Mineral Point Road
Madison, WI 53705

LAB NO.

County	Account No.
Washington	800
Date Received	**Date Processed**
10/15/99	15-Oct-99
Field	1
Acres	15.0
Soil Name (or suboil group)	Sisson
Plow Depth	8.0

The "Crop Nutrient Need" section is the field's nutrient recommendations based on your soil test results and crop to be grown. These recommendations have NOT been adjusted for any fertilizer credits.

This "Fertilizer Credit" section is based on the numbers you entered on your soil test information form. If you didn't put them on the form but do have credits, you can subtract them from the "Crop Nutrient Need" to get the "Nutrients to Apply."

This is the most important information on the entire report!

The "Nutrients to Apply" section tells you the actual pounds of N, P_2O_5 and K_2O to apply. This recommendation has been adjusted to reflect any fertilizer credits you indicated.

NUTRIENT RECOMMENDATIONS

Cropping Sequence	Yield Goal	Crop Nutrient Need N	Crop Nutrient Need P_2O_5	Crop Nutrient Need K_2O	Fertilizer Credit Legume N	Fertilizer Credit Manure N	Fertilizer Credit P_2O_5	Fertilizer Credit K_2O	Nutrients to Apply N	Nutrients to Apply P_2O_5	Nutrients to Apply K_2O
Corn, grain	131-150 Bu	160	0	0	0	60	60	160	100	0	0
Oats	61.0-90.0 Bu	40	0	0	0	0	0	0	40	0	0
Alfalfa	4.6 - 5.5 T	0	0	0	0	0	0	0	0	0	0

The lime required for this rotation to reach pH 6.8 is No T/a of 80-89 lime.

ADDITIONAL INFORMATION

Reduce nitrogen by 50% if barley or oats are underseeded with a legume forage. Due to very high P levels reduce fertilizer or manure applications and raise high P-demanding crops.

The "Additional Information" section may be empty or may have suggestions for modifying the recommendations based on crop management practices.

Standard comments are printed on all reports.

A lime recommendation is calculated only when soil is more than 0.2 units below the optimum pH.

Starter fertilizer (e.g.10+20+20 lbs N+P_2O_5+K_2O/a) is advisable for row crops on soils slow to warm in the spring.

A soil nitrate test may better estimate actual corn needs.

If conservation tillage leaves > 50% residue cover when corn follows corn after corn, add an additional 30 N lbs/a.

If alfalfa will be maintained for more than three years, increase recommended K_2O by 20% each year.

TEST INTERPRETATION

Cropping Sequence	Very Low	Low	Optimum	High	Very High	Excessive
Corn, grain	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Oats	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Alfalfa	PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP					
	KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK					
Rotation pH			XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			

LABORATORY ANALYSIS / LAB USE

Sample Identification	Soil pH	O.M. %	Phosphorus ppm	Potassium ppm	Calcium ppm	Magnesium ppm	Estimated CEC	Boron ppm	Manganese ppm	Zinc ppm	Sulfate-Sulfur ppm	Sulfur Avail. Index	Texture Code	Sample Density	Buffer Code	
1	7.6	3.2	106	205							1.0	41	2	1.06	NR	
2	7.4	2.9	96	195							1.0	40	2	1.04	NR	
3	7.5	2.7	102	210							1.1	40	2	1.08	NR	
Adjusted Avg.	7.5	2.9	101	203							1.0	40		1.06		

SECONDARY AND MICRONUTRIENT RECOMMENDATIONS

NR = Not required for calculation of lime requirement when the soil pH is 6.6 or higher.

INTERPRETATIONS---------- Ca- Mg- B- Mn- Zn- SAI-H

For all 3 years, Response to sulfur is unlikely.

Don't be misled by this section. The micronutrients that are listed are not analyzed for unless you specify that they should be. In this example, the only one tested was sulfur. The sulfur result (Sulfur Available Index or SAI) is shown and interpreted as H (high). The others are left blank because they were not tested.