SOIL ANALYSIS REPORT FOR GRASS-LEGUME HAY AND PASTURE 10/16/12

SOIL AND PLANT TISSUE TESTING LAB
WEST EXPERIMENT STATION
UNIVERSITY OF MASSACHUSETTS
AMHERST, MA 01003

LAB NUMBER: S121011-106
BAG NUMBER: 112092

SOIL WEIGHT: 4.75 g/5cc
CROP: HAY/PASTURE

SONOMA MOUNTAIN INSTITUTE
PO BOX 228
GLEN ELLEN, CA 94942

COMMENTS: NATEC191@GMAIL.COM

SAMPLE ID: FRONT

RECOMMENDATIONS FOR GRASS-LEGUME HAY AND PASTURE:

Limestone requirement for grass-legume mixtures containing alfalfa is 1.0 tons per acre or 50 lbs/1000 sq.ft.

For grass and mixtures containing any other legumes, the limestone requirement is 1.0 tons per acre or 50 lbs/1000 sq.ft.

A calcite limestone is acceptable since soil magnesium is high.

*** RECOMMENDATION FOR GRASS-LEGUME ESTABLISHMENT ***
Apply 0-50 lb/acre nitrogen, using lower rate if legume is included.
Apply 90-100 lb/acre P2O5 and 20- 30 lb/acre K2O. Recommended K2O for first year after seeding year 10 lb/acre. Use nitrogen rates below.

*** RECOMMENDATION FOR TOPDRESSING ESTABLISHED GRASS-LEGUME HAYCROP ***
Apply nitrogen if less than 50 percent legume: 50 lb/acre early spring, 50 lb/acre after first cut.
Apply 90-100 lb/acre P2O5 and 0- 10 lb/acre K2O.

*** RECOMMENDATION FOR TOPDRESSING ESTABLISHED GRASS-LEGUME PASTURE ***
Apply nitrogen if mostly grass: 50 lb/acre early spring & again in August.
Apply 90-100 lb/acre P2O5 and 0- 10 lb/acre K2O.

MICRONUTRIENT		PPM	SOIL RANGE	MICRONUTRIENT		PPM	SOIL RANGE
Boron	(B)	0.1	0.1-2.0	Copper	(Cu)	0.4	0.3-8.0
Manganese	(Mn)	33.6	3 - 20	Iron	(Fe)	2.9	1.0- 40
Zinc	(Zn)	0.6	0.1- 70	Sulfur	(S)	36.7	1.0- 40

SOIL pH 6.1
BUFFER pH 6.8

ORGANIC MATTER: 7.4 % (Desirable range 4-10%)

NUTRIENT LEVELS:		PPM	Low Medium High Very High
Phosphorus	(P)	2	XXX
Potassium	(K)	246	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Calcium	(Ca)	1992	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Magnesium	(Mg)	420	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CATION EXCH CAP
16.0 Meq/100g

PERCENT BASE SATURATION
K= 4.0 Mg=21.6 Ca=62.5

MICRONUTRIENT LEVELS
ALL NORMAL

EXTRACTABLE ALUMINUM: 27 ppm (Soil range: 10-250 ppm)

The lead level in this soil is low.

VISIT www.umass.edu/soiltest FOR FURTHER INFORMATION ON SOIL TESTING AT UMASS.

SOIL ANALYSIS REPORT FOR GRASS-LEGUME HAY AND PASTURE 10/16/12

SOIL AND PLANT TISSUE TESTING LAB
WEST EXPERIMENT STATION
UNIVERSITY OF MASSACHUSETTS
AMHERST, MA 01003

LAB NUMBER: S121011-107
BAG NUMBER: 112092

SOIL WEIGHT: 4.77 g/5cc
CROP: HAY/PASTURE

SONOMA MOUNTAIN INSTITUTE
PO BOX 228
GLEN ELLEN, CA 94942

COMMENTS: NATEC191@GMAIL.COM

SAMPLE ID: MID

RECOMMENDATIONS FOR GRASS-LEGUME HAY AND PASTURE:

Limestone requirement for grass-legume mixtures containing alfalfa is 1.7 tons per acre or 80 lbs/1000 sq.ft.

For grass and mixtures containing any other legumes, the limestone requirement is 1.4 tons per acre or 68 lbs/1000 sq.ft.

A calcite limestone is acceptable since soil magnesium is high.

*** RECOMMENDATION FOR GRASS-LEGUME ESTABLISHMENT ***
Apply 0-50 lb/acre nitrogen, using lower rate if legume is included.
Apply 90-100 lb/acre P2O5 and 40- 50 lb/acre K2O. Recommended K2O for first year after seeding year 50 lb/acre. Use nitrogen rates below.

*** RECOMMENDATION FOR TOPDRESSING ESTABLISHED GRASS-LEGUME HAYCROP ***
Apply nitrogen if less than 50 percent legume: 50 lb/acre early spring, 50 lb/acre after first cut.
Apply 90-100 lb/acre P2O5 and 10- 20 lb/acre K2O.

*** RECOMMENDATION FOR TOPDRESSING ESTABLISHED GRASS-LEGUME PASTURE ***
Apply nitrogen if mostly grass: 50 lb/acre early spring & again in August.
Apply 90-100 lb/acre P2O5 and 0- 10 lb/acre K2O.

MICRONUTRIENT		PPM	SOIL_RANGE	MICRONUTRIENT		PPM	SOIL_RANGE
Boron	(B)	0.1	0.1-2.0	Copper	(Cu)	0.4	0.3-8.0
Manganese	(Mn)	30.5	3 - 20	Iron	(Fe)	3.8	1.0- 40
Zinc	(Zn)	0.7	0.1- 70	Sulfur	(S)	35.2	1.0- 40

SOIL pH 6.2
BUFFER pH 6.7

ORGANIC MATTER: 6.7 % (Desirable range 4-10%)

NUTRIENT_LEVELS:		PPM	Low___Medium__________High_______ Very High
Phosphorus	(P)	2	XXX
Potassium	(K)	199	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Calcium	(Ca)	2020	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Magnesium	(Mg)	444	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CATION EXCH CAP
17.4 Meq/100g

PERCENT BASE SATURATION
K= 3.0 Mg=21.0 Ca=58.1

MICRONUTRIENT LEVELS
ALL NORMAL

EXTRACTABLE ALUMINUM: 22 ppm (Soil range: 10-250 ppm)

The lead level in this soil is low.

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SOIL ANALYSIS REPORT FOR GRASS-LEGUME HAY AND PASTURE 10/16/12

SOIL AND PLANT TISSUE TESTING LAB
WEST EXPERIMENT STATION
UNIVERSITY OF MASSACHUSETTS
AMHERST, MA 01003

LAB NUMBER: S121011-108
BAG NUMBER: 112092

SOIL WEIGHT: 4.86 g/5cc
CROP: HAY/PASTURE

SONOMA MOUNTAIN INSTITUTE
PO BOX 228
GLEN ELLEN, CA 94942

COMMENTS: NATEC191@GMAIL.COM

SAMPLE ID: ORCH

RECOMMENDATIONS FOR GRASS-LEGUME HAY AND PASTURE:

Limestone is not required.

*** RECOMMENDATION FOR GRASS-LEGUME ESTABLISHMENT ***
Apply 0-50 lb/acre nitrogen, using lower rate if legume is included. Apply 60- 70 lb/acre P2O5 and 80- 90 lb/acre K2O. Recommended K2O for first year after seeding year 80 lb/acre. Use nitrogen rates below.

*** RECOMMENDATION FOR TOPDRESSING ESTABLISHED GRASS-LEGUME HAYCROP ***
Apply nitrogen if less than 50 percent legume: 50 lb/acre early spring, 50 lb/acre after first cut.
Apply 60- 70 lb/acre P2O5 and 50- 60 lb/acre K2O.

*** RECOMMENDATION FOR TOPDRESSING ESTABLISHED GRASS-LEGUME PASTURE ***
Apply nitrogen if mostly grass: 50 lb/acre early spring & again in August.
Apply 60- 70 lb/acre P2O5 and 0- 10 lb/acre K2O.

MICRONUTRIENT		PPM	SOIL RANGE	MICRONUTRIENT		PPM	SOIL RANGE
Boron	(B)	0.3	0.1-2.0	Copper	(Cu)	0.5	0.3-8.0
Manganese	(Mn)	29.2	3 - 20	Iron	(Fe)	3.0	1.0- 40
Zinc	(Zn)	0.5	0.1- 70	Sulfur	(S)	51.2	1.0- 40

SOIL pH 6.8
BUFFER pH 7.3

ORGANIC MATTER: 6.4 % (Desirable range 4-10%)

NUTRIENT LEVELS:		PPM	Low Medium High Very High
Phosphorus	(P)	7	XXXXXXXXXXX
Potassium	(K)	186	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Calcium	(Ca)	3467	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Magnesium	(Mg)	575	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CATION EXCH CAP
22.6 Meq/100g

PERCENT BASE SATURATION
K= 2.2 Mg=21.0 Ca=77.0

MICRONUTRIENT LEVELS
ALL NORMAL

EXTRACTABLE ALUMINUM: 22 ppm (Soil range: 10-250 ppm)

The lead level in this soil is low.

VISIT www.umass.edu/soiltest FOR FURTHER INFORMATION ON SOIL TESTING AT UMASS.

UMass Extension

CENTER FOR AGRICULTURE

Soil and Plant Tissue Testing Laboratory
West Experiment Station
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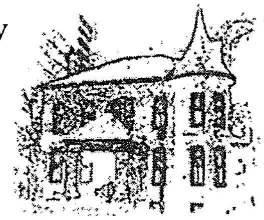

West Experiment Station

Soil Test Interpretation & Recommendations

The primary goal of soil testing is to provide guidelines for the efficient use of soil amendments, such as lime and fertilizers. The recommendations that we provide with your soil test report are specific to the crop selection that you identify on your soil sample submission form.

Numerical results reported on your soil test reflect the properties of the sample submitted and the testing procedures used by the UMass Soil and Plant Tissue Testing Laboratory. The analytical methods used by the UMass Laboratory were developed for climate and soil types common to the Northeastern U.S. Interpretation of the results, along with lime and fertilizer recommendations, are based on field and greenhouse trials conducted in Massachusetts and other Northeastern states.

Implementing the provided recommendations will correct the nutrient status of your soil for the crop that you indicated. It may or may not solve a given plant growth problem; other factors may need to be evaluated. Problems directly related to disease, insects, weather, and cultural practices cannot be diagnosed by a soil fertility test.

SOIL TEST RESULTS

Soil pH, Buffer pH, and pH adjustments -- Soil pH is a measure of the soil's acidity and is a primary factor controlling nutrient availability, microbial processes, and plant growth. When pH is maintained at the proper level, plant nutrient availability is optimized, toxic elements are often at reduced availability, and beneficial soil organisms are most active. Most plants grow best in a soil pH between 6 and 7, and the majority does best in the middle part of this range. Some notable acid-loving exceptions are blueberry and rhododendron, which grow well under the nutritional conditions imparted by soil acidity.

Due to the climate and geology of New England, soils here tend to be naturally acidic (4.5-5.5) and must often be amended with materials that neutralize soil acidity. Many products are available to accomplish this, but ground limestone is the most common. By convention, lime requirements are made in amounts (tons/acre or lb/1000 sq ft) of agricultural limestone to be added assuming Calcium Carbonate Equivalence (CCE) is 100%. Application rates for liming materials with higher or lower CCE should be adjusted accordingly.

Occasionally soil pH must be lowered, because either the plant requires acid soil or the soil was previously over-limed. Incorporating elemental sulfur is the most effective way to lower soil pH. Once applied, the sulfur oxidizes to sulfuric acid. One to two pounds of sulfur per 100 sq-ft will lower the pH of most New England soils by approximately half a unit.

Buffer pH is a value used by the lab to determine lime requirement. It is the resulting pH after a buffering solution has been equilibrated with the soil. The change in pH of the buffering solution is a measure of the soil's capacity to resist pH change after lime has been added. The extent to which the buffer pH is lower than 6.8 is directly related to the amount of limestone needed.

Cation Exchange Capacity and Percentage Base Saturation–Cation exchange capacity (CEC) is an important measure of the ability of soils to retain and supply nutrients. The bulk of this capacity in limed New England soils resides in finely divided soil organic matter; a smaller contribution comes from the clay minerals in soil. The basic nutrient cations (positively charged ions) of Calcium (Ca^{++}), Magnesium (Mg^{++}), and Potassium (K^{+}), and the acidic cations of Aluminum (Al^{+++}) and Hydrogen (H^{+}) account for nearly all the absorbed cations in the soil. Very sandy soils with low organic matter commonly have CEC's less than 5 meq/100 g. New England soils with very high CEC's (greater than 40) are invariably rich in organic matter. A CEC between 10 and 15 is typical for most soils found in the region.

Individual Nutrients

Nitrogen (N) –Nitrogen is **essential** to nearly every aspect of plant growth. Nitrogen is absorbed from the soil as nitrate (NO_3^-) and ammonium (NH_4^+). Soil NO_3^- and NH_4^+ levels can fluctuate widely with soil and weather conditions over very short periods of time. For this reason, NO_3^- and NH_4^+ are not routinely tested, and we make recommendations based on the assumption that very little NO_3^- and NH_4^+ remain in the soil after the growing season; however, adjustments are often made for soils recently or continuously supplied with manure or compost, which contain nitrogen that will be released during the growing season.

Under certain specific conditions soil NO_3 testing can be useful for predicting fertilizer needs. The Pre-sidedress Soil Nitrate Test (PSNT) has been shown to successfully predict sidedress fertilizer N needs for a few crops (e.g., corn, pumpkin, peppers), but the PSNT requires stricter sampling (depth and timing) and handling than a standard soil fertility sample. Contact the laboratory for more information on this test.

Phosphorus (P) –Among other important functions, phosphorus provides plants with a means of using the energy harnessed by photosynthesis to drive its metabolism. A deficiency of this nutrient can lead to impaired vegetative growth, weak root systems, poor fruit and seed quality, and low yield; however excessive soil phosphorus levels are a concern due to the potential negative impact on water quality. Phosphorus does not generally leach from soils, but where soil P levels are excessive, runoff losses can occur. Phosphorus enrichment is a leading source of water quality impairment of many lakes, streams, and rivers.

Soil phosphorus exists in a wide range of forms. Some phosphorus is present as part of soil organic matter and becomes available to plants as the organic matter decomposes. Most inorganic soil phosphorus is bound tightly to the surface of soil minerals (e.g., iron and aluminum oxides). Warm, moist, well-aerated soils at a pH level of about 6.5 optimize the release of both of these forms. Plants require fairly large quantities of phosphorus, but the levels of phosphorus available to plant roots at any given time are usually quite low. Soil tests attempt to assess the ability of soil to supply phosphorus from bound forms during the growing season. When a soil test indicates that phosphorus is low and fertilizer in needed, the rate recommended is intended to satisfy immediate crop needs and begin to build soil phosphorus levels to the optimum range (i.e., build and maintain). By convention, phosphorus recommendations are expressed, as P_2O_5 to correlate with fertilizer analysis.

If your soil test results indicate excessive, or *Very High*, soil phosphorus levels, phosphorus application should be significantly reduced or eliminated, and steps should be taken to minimize the risk of surface water contamination by limiting runoff losses.

Potassium (K) – Potassium rivals nitrogen as the nutrient absorbed in greatest amounts by plants. Like nitrogen, crops take up a relatively large proportion of plant-available potassium each growing season. Plants deficient in potassium are unable to utilize nitrogen and water efficiently and are susceptible to disease. Most available potassium exists as an exchangeable cation (see above). The slow release of potassium from native soil minerals and from fixed forms in clays can replenish some of the potassium lost by crop removal and leaching. This ability, however, is limited and variable. Fertilization is often necessary to maintain optimum yields.

When a soil test indicates that fertilizer potassium is required, the rate of fertilizer recommended is intended to satisfy crop needs and build soil potassium levels to the optimum range. Sandy soils with very low CEC will tend to lose substantial quantities due to leaching and will require more frequent applications of fertilizer. Even when soils test in the optimum range, some potassium generally is recommended to account for crop removal. By convention, potassium recommendations are expressed, as K_2O to correlate with fertilizer analysis.

Calcium (Ca) – Calcium is essential in the proper functioning of plant cell walls and membranes. Sufficient calcium must also be present in actively growing plant parts, especially storage organs such as fruits and roots. Properly limed soils with constant and adequate moisture will normally supply sufficient calcium to plants. If soil calcium levels are less than optimal and lime is not required, gypsum (calcium sulfate) may be recommended.

Magnesium (Mg) – Magnesium acts together with phosphorus to drive plant metabolism and is part of chlorophyll, a vital substance for photosynthesis. Like calcium, magnesium is ordinarily supplied through liming. If magnesium levels are low and lime is required, dolomitic lime (rich in Mg) will be recommended. If Mg is low and lime is not required, Epsom salts (magnesium sulfate) may be recommended.

Micronutrients – Micronutrients are elements essential to plants, but required in very small amounts. In most properly limed soils they are available in sufficient quantities. Five of these (iron, manganese, zinc, copper, and boron) are tested routinely. Micronutrient deficiencies and response to micronutrient fertilizers rarely are observed in the Northeast. For this reason, soil test recommendations for micronutrients are not available. Your soil test values are compared to levels normally found in Northeast soils. When levels are below this range, we recommend collecting a plant tissue sample to determine if a deficiency exists and a micronutrient fertilizer is required.

Aluminum (Al)–Aluminum is not a plant nutrient and at elevated levels it can be extremely toxic to plant roots and limit the ability of plants to take up phosphorus by reducing phosphorus solubility. Aluminum sensitivity varies greatly with plant type. Acid-loving plants, such as rhododendrons and blueberries can tolerate moderately high aluminum levels, whereas lettuce, carrots and beets are very sensitive. Extractable aluminum increases greatly at soil pH below 5.5. Proper liming will lower aluminum solubility to acceptable levels.

Lead (Pb)–This laboratory routinely tests for extractable lead. Lead is naturally present in most New England soils in the range of 15-40 parts per million (ppm or mg/kg) total lead. At these levels lead generally is thought to present minimal danger to people or plants. Soil pollution with lead-based paint and the tetraethyl lead of past automotive fuels have increased soil lead levels to several thousand ppm in some places. Unless the estimated total lead level in your soil exceeds 150 ppm, it is simply reported as low and can be considered safe (assuming the sample submitted was representative of the area of concern). Estimated total lead levels above 300 ppm are a concern. In such cases, consult the separate insert on soil lead levels.

Soluble Salts–Soluble salts, such as those used on roads to promote melting and those present in many commercial (and some natural) fertilizers, can cause severe water stress and nutritional imbalances in plants. Generally, seedlings are more sensitive than established plants to elevated soluble salts levels, and great variation exists between plant species. Most soils tested by the UMass laboratory have values between 0.08 and 0.50 dS/m (mmho/cm) with the middle of range typical of most fertile mineral soils; values greater than 0.60 may cause damage to sensitive plants (such as onions, etc.). The level of soluble salts can change rapidly in the soil due to leaching, so the effects of time and growing conditions are important considerations when evaluating the significance of the soluble salts level. Excessive levels can often be corrected by leaching with liberal amounts (2- 4 inches) of fresh water. Normal off-season precipitation usually will correct salt problems resulting from over-fertilization.

Prepared by John Spargo, Assistant Extension Professor of Soil and Nutrient Management and Director, UMass Soil and Plant Tissue Testing Laboratory; Allen Barker, Professor of Soil Fertility and Plant Nutrition, Stockbridge School of Agriculture; and Tracy Allen, Laboratory Supervisor, UMass Soil and Plant Tissue Testing Laboratory. Revised January 2012.