

Soil Testing for Lawns

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Soil testing provides an estimate of the plant-available nutrients in the soil and is an essential tool for a sound fertilization program. Periodic soil testing will help to correct nutrient deficiencies, avoid excess fertilizer applications and maintain a healthy lawn.

A routine soil fertility test (pH, neutralizable acidity, phosphorus, potassium, calcium, magnesium, organic matter, and cation exchange capacity) is recommended under the following circumstances:

- Before establishing a new lawn, whether from seed, sod, or sprigs.
- Every three years on established lawns (late summer).
- Annually when attempting to correct a nutrient deficiency or change the soil pH.
- When fertilizers containing phosphate or potash have been used on a regular basis for a number of years.

Soil test report

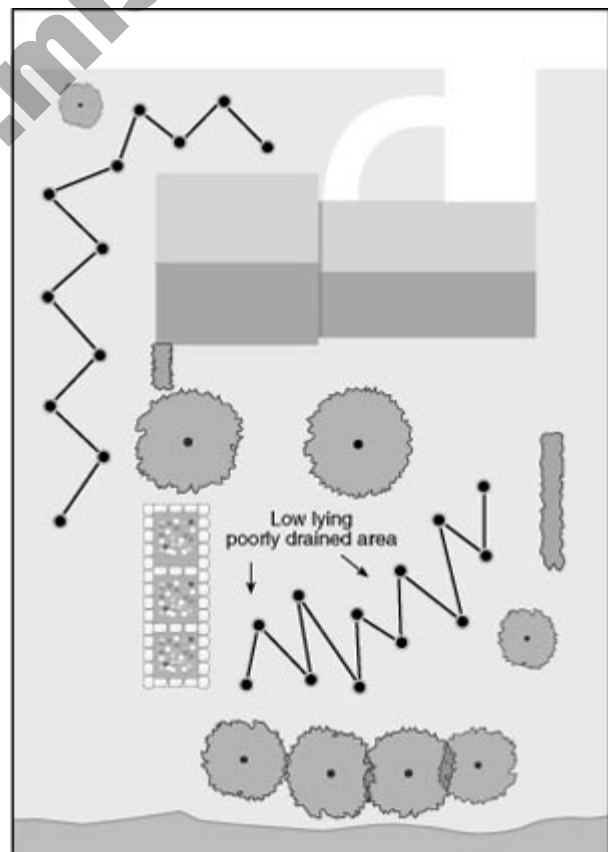
After processing your sample, the testing lab will send you a soil test report. Analyses in the following areas are usually included:

Soil pH

Soil pH is a measure of the acidity or alkalinity of the soil. A pH of 7.0 is neutral, less than 7.0 is acid, and greater than 7.0 is alkaline. Most of the essential plant nutrients are available at optimum levels between a pH of 6.0 and 7.0. Acidic soils (pH < 6.0) and alkaline soils (pH > 7.5) may require amendments that modify pH.

Soil pH below 6.0

If a soil pH is less than 6.0 (acidic), then a lime requirement will be calculated. Limestone is used to raise the pH of acid soils, resulting in greater availability of soil nutrients. Do not apply lime unless it is recommended. If lime is recommended, review the following guidelines before making the application.



Figure

1. If your lawn has areas with distinctly different soil conditions that need to be considered separately,

- Lime can burn grass. Do not apply more than 50 pounds per 1,000 square feet per application on established lawns. Liming of established lawns should be done in the cool spring or fall following core aeration and watered in to help move the lime into the soil and increase the rate and efficacy of pH change.
- The preferred time to add lime to the soil is at establishment (just before seeding) when levels higher than 50 pounds per 1,000 square feet can be tilled into the soil, if needed.
- Ground agricultural limestone (CaCO_3) or ground dolomitic limestone [$\text{CaMg}(\text{CO}_3)_2$] are the preferred forms of lime for use on all turfgrass areas; hydrated lime (CaO) is less preferred on lawns because of its high burn potential.
- Wood ashes from a home fireplace can also be used to increase soil pH. However, wood ashes are only about 40 percent as effective as limestone; a lime recommendation of 100 pounds per 1,000 square feet would require 250 pounds per 1,000 square feet of wood ashes. Exercise caution when using wood ashes because they can build up soil potassium to very high levels, which may cause an imbalance of soil nutrients.

Soil pH from 6.0 to 7.5

The pH range between 6.0 and 7.5 is the optimum range for turfgrass. Thus, there is not a need for any amendments at this range.

Soil pH above 7.5

At higher pH (>7.5) the soil is alkaline and not favorable for plant growth. Applying elemental sulfur at the recommended range given on the soil test report prior to lawn establishment will bring the pH down. At higher pH levels, phosphorus and iron availability may become limited, and yearly soil tests may be required to correct the problem by applying appropriate amounts of nutrients or amendments. Do not apply more than 10 pounds of elemental sulfur per 1,000 square feet on established lawns, as it may cause leaf burn.

Phosphorus

Soil test results represent the amount of phosphorus (P) available to plant roots from the soil. Established lawns generally require lower quantities of available phosphorus than vegetable and field crops. Turfgrass, with its dense, fibrous root system, is efficient at extracting the immobile phosphorus from the soil. However, new lawns have a limited root system and require higher phosphorus levels for root growth and healthy seedling

collect soil samples from each area (at points in a zigzag pattern).

Taking a soil sample

- Your local MU Extension center has soil sample boxes available for use at no charge. One box (1.5 to 2 cups) is all the University lab needs for analyses.
- Using a small shovel or soil probe, sample to a 4-inch depth on established lawns or, before seeding, to a 6-inch depth.
- Take 12 or more random cores from each area of the lawn to be tested and remove the thatch and live plant material before breaking up the cores and mixing thoroughly in a dry plastic bucket. (Metal buckets contaminate the sample with micronutrients.) Take random samples from the lawn as a whole unless there is a need to sample problem areas separately (Figure 1).
- Air dry the sample overnight before sending.
- Obtain a [MP555, Soil Sample Information Form](#) (<https://extension.missouri.edu/publications/mp555>) from your local MU Extension center or on the Web. Send the sample to the [Soil and Plant Testing Laboratory](#) (<https://extension.missouri.edu/programs/soil-and-plant-testing-laboratory/spl-soil-analysis>), at either of the following addresses:
 - 23 Mumford Hall
Columbia, Mo. 65211
 - Delta Research Center
P.O. Box 160
Portageville, Mo. 63873

development. Refer to Table 1 for phosphorus fertilizer recommendations. The phosphorous content of fertilizers is expressed as percent phosphorus oxide (P_2O_5); therefore, phosphorus fertilizer recommendations are given in pounds of P_2O_5 per 1,000 square feet.

There are a number of different phosphorus fertilizer sources available. Relatively inexpensive phosphorus-only sources are super phosphate (0-18-0) or triple superphosphate (0-45-0). Use these sources when a soil test calls for large amounts of P_2O_5 on an established lawn. For example, if the soil test reports a need to apply two pounds P_2O_5 per 1,000 square feet, then 4.4 pounds of 0-45-0 would be required per 1,000 square feet.

Other phosphorus sources are starter fertilizers that contain relatively high percentages of P_2O_5 such as 20-27-5 or 16-25-12. At establishment, incorporate these sources into the surface 1 to 2 inches. For example, if your soil test indicates that you should apply three pounds P_2O_5 per 1,000 square feet and you have purchased some 20-27-5, how much of the fertilizer should you apply? Dividing 3 by 0.27 (the proportion of P_2O_5 in the fertilizer bag) gives you the answer: 11 pounds per 1,000 square feet of the 20-27-5 is needed to supply the required three pounds of actual P_2O_5 per 1,000 square feet.

For general lawn maintenance, many complete fertilizers are available with analyses such as 29-3-4, 26-3-5, or 13-13-13. For the first two, each time you apply one pound of nitrogen per 1,000 square feet, you are applying approximately 0.1 pound of P_2O_5 . These two sources would be good to use if your lawn soil falls in the medium category. For the 13-13-13, each time you apply one pound of nitrogen per 1,000 square feet, you are also applying one pound of P_2O_5 . This would be a good fertilizer to use if your lawn falls in the low available phosphorus category.

Potassium

The soil test results represent the amount of potassium (K) that is available to the turfgrass plant. Potassium plays important roles in enhancing turfgrass stress tolerance (i.e., drought, heat, wear, disease) in addition to its essential roles in plant growth. Potassium fertilizer recommendations in the past relied heavily on yield response data from other crops, and, therefore, may have underestimated the quantities needed for healthy, stress-tolerant turf. The recommendations in Table 2 reflect current thinking on potassium's role in turf. Potassium is not held very strongly in sandy soils and can be leached past the turf root zone. Sandy Missouri soils should therefore be tested more frequently — once a year rather than every three years.

The concentration of potassium in fertilizer is expressed as percent potassium oxide, or potash (K_2O). Therefore, potassium fertilizer recommendations are given in pounds of (K_2O) per 1,000 square feet. Two common potassium fertilizer sources are available: potassium chloride (0-0-60) and potassium sulfate (0-0-50). To deliver 1.5 pounds of potash to 1,000 square feet, you would need to apply three pounds of potassium sulfate over that area. Both of these potassium sources can burn turf, especially potassium chloride, so apply in cool weather and water the area soon after application.

Calcium and magnesium

Calcium (Ca) and magnesium (Mg) are rarely deficient in Missouri soils, but deficiencies can occur on acid sandy soils. In most instances calcium amounts sufficient for plant growth are supplied by liming the soil to increase soil pH. Use of dolomitic limestone [$CaMg(CO_3)_2$] to raise pH will also supply magnesium, along with calcium.

Organic matter

Soils with adequate organic matter (3 to 6 percent OM) will have better structure and therefore better resistance to compaction as well as improved water- and nutrient-holding capacity. The addition of organic matter to soil, at the time of lawn establishment, is the best way to enhance structure, as well as water and nutrient retention capabilities. It is important that the source of organic matter be free of pathogens and weed seeds and that it be

low in soluble salt content. Well-aged (1 to 2 years) manure, composted bark/sawdust, leaf and grass clipping compost, and peat are good sources of organic matter. Mix a 1-inch layer (about 2 cubic yards per 1,000 square feet) into the surface 4 to 6 inches of soil as uniformly as possible.

Soil organic matter and nutrient content can also be increased by leaving clippings on your lawn and mowing tree leaves back into your lawn in the fall instead of raking and collecting. Best results occur with the use of a mulching mower.

Cation exchange capacity

Cation exchange capacity (CEC) is a measure of your soil's capacity to hold nutrients; specifically, positively charged ions such as K, Ca, and Mg. Clay and organic matter contribute to cation exchange capacity; thus, soils with high CEC will retain nutrients better than low-CEC soils.

Nitrogen

Nitrogen (N) is the nutrient that is required in the highest quantity for the maintenance of a healthy lawn. Soils generally contain large amounts of nitrogen, but it is mostly present in soil organic matter. Nitrogen is released from organic matter relatively slowly, but the amount is generally insufficient to supply the needs of a medium to high quality lawn. Several soil and weather variables affect the release of soil nitrogen and what happens to the nitrogen in the soil following release. Also, nitrogen can be easily leached from the soil when it is in nitrate form. Thus it is not a stable element in the soil and is not normally test by soil testing labs. Rather, yearly nitrogen applications, based on field experiments, have been developed by turfgrass scientists.

Table 1

Phosphorus fertilizer recommendations for all Missouri lawns based on soil test results.

Soil test available phosphorus**

0 to 20 pounds per acre

- Very low
- 1 to 1.5 pounds P₂O₅ per 1,000 square feet* for lawn maintenance
- 2 to 4 pounds P₂O₅ per 1,000 square feet* for lawn establishment***

20 to 40 pounds per acre

- Low
- 0.5 to 1 pound P₂O₅ per 1,000 square feet* for lawn maintenance
- 1 to 1.5 pounds P₂O₅ per 1,000 square feet* for lawn establishment***

40 to 60 pounds per acre

- Medium
- 0 to 0.5 pound P₂O₅ per 1,000 square feet* for lawn maintenance
- 0 to 0.5 pound P₂O₅ per 1,000 square feet* for lawn establishment***

60 to 120 pounds per acre

- High
- 0 pound P₂O₅ per 1,000 square feet* for lawn maintenance
- 0 pound P₂O₅ per 1,000 square feet* for lawn establishment***

120 + pounds per acre

- Very high
- 0 pound P₂O₅ per 1,000 square feet* for lawn maintenance
- 0 pound P₂O₅ per 1,000 square feet* for lawn establishment***

* Do not apply more than two pounds P₂O₅ per 1,000 square feet to established turf at any one time. Where a range of recommended rates is given, use the higher rate if available P from the soil test is in the lower end of its respective range.

** Bray-1 P test method

*** Incorporate into the surface 1 to 2 inches before planting.

Table 2

Potassium fertilizer recommendations for all Missouri lawns based on soil test results.

Soil test available potassium**

0 to 100 pounds per acre

- Very low
- 1.0 to 2.5 pounds (K₂O) per 1,000 square feet* for lawn maintenance
- 1.5 to 4.5 pounds (K₂O) per 1,000 square feet* for lawn establishment

100 to 200 pounds per acre

- Low
- 0.5 to 1.0 pound (K₂O) per 1,000 square feet* for lawn maintenance
- 0.5 to 2.5 pounds (K₂O) per 1,000 square feet* for lawn establishment

200 to 300 pounds per acre

- Medium
- 0 to 0.5 pound (K₂O) per 1,000 square feet* for lawn maintenance
- 0 to 1.0 pound (K₂O) per 1,000 square feet* for lawn establishment

300 to 400 pounds per acre

- High
- 0 pound (K₂O) per 1,000 square feet* for lawn maintenance
- 0 pound (K₂O) per 1,000 square feet* for lawn establishment

400 + pounds per acre

- Very high
- 0 pound (K₂O) per 1,000 square feet* for lawn maintenance
- 0 pound (K₂O) per 1,000 square feet* for lawn establishment

* Do not apply more than 1.5 pounds (K₂O) per 1,000 square feet to established turf at any one time. Where a range of recommended rates is given, use the higher rate if available K from the soil test is in the lower end of its respective range.

** Ammonium acetate extractable K.

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