

Soil Testing for Lawns

Division of Plant Sciences

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.

Authors

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Taking a soil sample

- Your local University of Missouri 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 micro-nutrients.) Take random samples from the lawn as a whole unless there is a need to sample problem areas separately (see Figure 1).
- Air dry the sample overnight before sending.
- Obtain a horticulture Soil Sample Information form, MP 555 (see page 4), from your local University of Missouri Extension center or on the World Wide Web at soilplantlab.missouri.edu/soil/forms

Send the sample to the Soil and Plant Testing Laboratory at either of the following addresses:

23 Mumford Hall	Delta Research Center
University of Missouri	P.O. Box 160
Columbia, MO 65211	Portageville, MO 63873

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.

- Lime can burn grass. Do not apply more than 50 lb/1,000 ft² per application on established lawns. Liming of established lawns should be

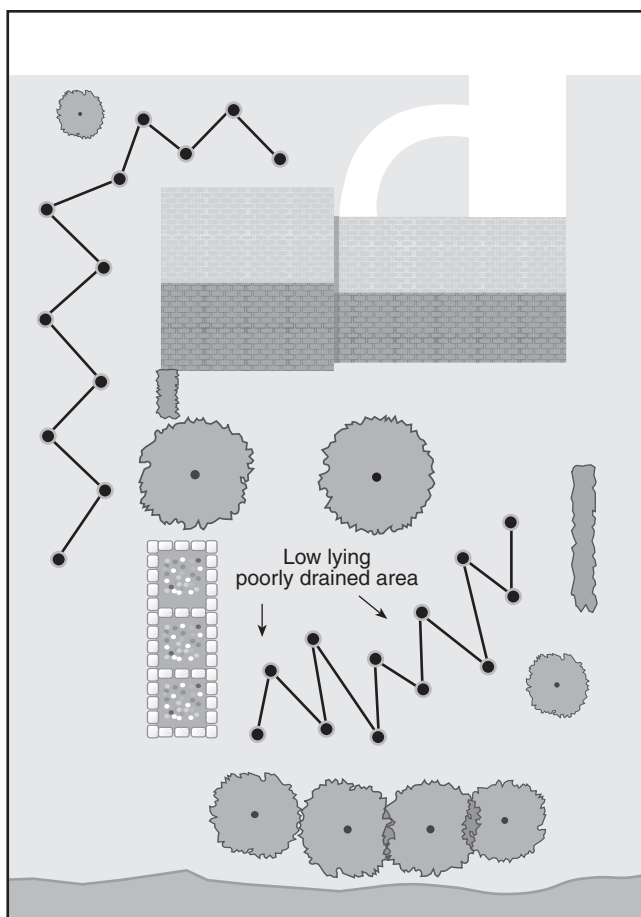


Figure 1. If your lawn has areas with distinctly different soil conditions that need to be considered separately, collect soil samples from each area.

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 lb/1,000 ft² can be tilled into the soil, if needed.
- Ground agricultural limestone (CaCO₃) or ground dolomitic limestone [CaMg(CO₃)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 lb/1,000 ft² would require 250 lb/1,000 ft² 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 lb of elemental sulfur per 1,000 ft² 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 development. Refer to Table 1 for phosphorus fertilizer recommendations. The phosphorus content of fertilizers is expressed as percent phosphorus oxide (P₂O₅); therefore, phosphorus fertilizer recommendations are given in pounds of P₂O₅ 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 P₂O₅ on an established lawn. For example, if the soil test reports a need to apply 2 pounds P₂O₅ per 1,000 ft², then 4.4 pounds

Table 1. Phosphorus fertilizer recommendations for all Missouri lawns based on soil test results.

Soil test available P** (lb/acre)		lb P ₂ O ₅ /1,000 ft ² *	
		Lawn maintenance	Lawn establishment***
0–20	very low	1–1.5	2–4
20–40	low	0.5–1	1–1.5
40–60	medium	0–0.5	0–0.5
60–120	high	0	0
120 +	very high	0	0

* Do not apply more than 2 pounds P₂O₅/1,000 ft² 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.

of 0-45-0 would be required per 1,000 ft².

Other phosphorus sources are starter fertilizers that contain relatively high percentages of P₂O₅ 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 3 pounds P₂O₅ per 1000 ft² and you have purchased some 20-27-5, how much of the fertilizer should you apply? Dividing 3 by 0.27 (the proportion of P₂O₅ in the fertilizer bag) gives you the answer: 11 pounds per 1,000 ft² of the 20-27-5 is needed to supply the required 3 pounds of *actual* P₂O₅ per 1,000 ft².

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 1 pound of nitrogen per 1,000 ft², you are applying approximately 0.1 pound of P₂O₅. 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 1 pound of nitrogen per 1,000 ft², you are also applying 1 pound of P₂O₅. 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

Table 2. Potassium fertilizer recommendations for all Missouri lawns based on soil test results.

Soil test available K** (lb/acre)		lb K ₂ O/1,000 ft ² *	
		Lawn maintenance	Lawn establishment
0–100	very low	1.0–2.5	1.5–4.5
100–200	low	0.5–1.0	0.5–2.5
200–300	medium	0–0.5	0–1.0
300–400	high	0	0
400 +	very high	0	0

* Do not apply more than 1.5 pounds K₂O/1,000 ft² 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.

expressed as percent potassium oxide, or potash (K₂O). Therefore, potassium fertilizer recommendations are given in pounds of K₂O 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 3 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(CO₃)₂] to raise pH will also supply magnesium, along with calcium.

Organic matter

Soils with adequate organic matter (3–6% 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 (1–2 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 ft²) into the surface 4–6 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. See MU publication G6959, "Don't Bag It" *Lawn Care*, for more information.

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. Refer to MU publication G6705, *Lawn Maintenance Calendar*, for recommended rates and timing of nitrogen fertilizer applications.



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 23 Mumford Hall,
 Columbia, MO 65211
 Phone: 573-882-0623
 Fax: 573-884-4288 • E-mail:
 SoilTestingServices@missouri.edu

or: **Delta Soil Testing Laboratory**
 P.O. Box 160
 Portageville, MO 63873
 Phone: 573-379-5431
 Fax: 573-379-5875
 E-mail: drstl@missouri.edu

<http://soilplantlab.missouri.edu/>

Soil Sample Information for Lawns and Gardens		Serial No. H H
Name _____	Date ____/____/20____	
Address _____	Account No. Firm _____ Outlet _____	
City _____ State _____ ZIP _____	Firm _____ (if applicable) _____ (if applicable)	
Phone _____ Fax _____	Address _____	
E-mail _____	City _____ State _____ ZIP _____	
County of origin _____ <input type="checkbox"/> Bill county or <input type="checkbox"/> Bill firm	Phone _____ Fax _____	
Billing County Code _____	E-mail _____	

Plant Code for Lawn and Garden Options (for instructions see back of form)

Plant Code	Plants	Lawns	Shrubs/Trees/Fruits/Ornamentals	16 Trees (specify)	21 Strawberries, blackberries, gooseberries, raspberries
		3 Fescue, bluegrass, ryegrass (establishment)	6 Bermudagrass, buffalograss, zoysia (establishment)	(e.g., magnolia, white pine, pin oak, holly, sweetgum, ash, birch, spruce, junipers, redbud)	22 Grapes
		4 Fescue, bluegrass, ryegrass (avg. maintenance)	7 Bermudagrass, buffalograss, zoysia (avg. maintenance)	12 Shrubs (specify)	23 Vines, ground covers (specify)
		5 Fescue, bluegrass, ryegrass (high maintenance)	8 Bermudagrass, buffalograss, zoysia (high maintenance)	(e.g., azalea, hydrangea, rhododendron, Am. bittersweet, boxwood, forsythia, honeysuckle, lilac, arborvitae, barberry)	24 Bulbs (specify)
				18 Fruit trees (specify)	25 Roses
				19 Nut trees (specify)	27 Other or not specified
				20 Blueberries	

Lab No. (lab use only)	Lawn and Garden Options										Check (✓) Test(s) Desired											
	Sample	Sample identification No more than 12 letters or numbers	Sampling depth	Last Lined (<1; 2-5; >5)	Plant Code	1		2		3		Regular	Zinc	Sulfur	Fe, Mn, Cu	Salts	Sodium	pHw	Nitrate-N	Boron	Soil texture	
						Plant Code	Specific plant	Plant Code	Specific plant	Plant Code	Specific plant											
1																						
2																						
3																						
4																						

Regular fertility test includes pH, N.A., P, K, Ca, Mg, CEC and OM

Comments: _____

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MP 555 (Revised 7/06)

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