Soil Testing for Turf Areas

University of Nebraska-Lincoln Turfgrass Science Program | turf.unl.edu Pub. Turf 2012g

Evaluating the nutrient status of a soil is important for maintaining any turf area. Soil testing is critical for determining the nutrient status and fertilization needs of a soil. Most soil testing labs recommend that you check the status of your soil every three to five years. However, on particularly troublesome soils or turf areas, annual testing may be needed. You can obtain information, forms, and sampling bags by contacting a local soil testing laboratory directly and a list of labs is on the third page of this document.

Taking a Soil Sample

The quality of a soil test depends on the accuracy of the sample. A soil test report is useless if the sample is not representative of the area being tested, so take accurate and consistent samples.

- Contact your soil testing lab for fee structure, mailing containers, and specific instructions on taking soil samples. Depending on the lab, soil sampling instructions may vary considerably.
- Sample to the depth of rooting and no more than 4 inches. If the soil is compacted and you cannot get down to 4 inches, sample as deeply as possible and take all samples from a uniform depth.
- Take 10 to 15 cores per area and remove thatch and live plant material.
- Combine the cores to make one composite sample per area. Divide area if necessary to avoid combining cores from:
  - soils of different texture and color
  - areas differing sharply in elevation
  - disturbed and undisturbed soils
  - healthy and troublesome areas
- Air dry the sample before submitting to soil testing lab.

Soil Test Report

After processing your soil sample, the soil test lab will send you a soil test report. The report will normally include many measurements, but the most important are cation exchange capacity (CEC), levels of phosphorus, potassium, calcium, magnesium and other nutrients, soil pH and soil buffer pH.

Cation Exchange Capacity

This number represents a measure a soil's capacity to hold cations and is a measure of potential soil fertility. The higher the CEC, the more fertile the soil. The CEC of an established turf will not change significantly with time, nor can it be affected significantly by adding fertilizer or chemicals. However, CEC may be increased by adding organic matter to a sandy soil.

Phosphorus (P)

Soil test results represent the amount of phosphorus available to the plants from the soil. Phosphorus deficiencies are rarely observed in established turf in Nebraska, except on soils with very high or very low pH. However, applications of phosphorus are effective when establishing or renovating an area. Applying 1.0 lb P_2O_5/1000 ft^2 with a fertilizer high in phosphorus (often sold as starter fertilizer with usually twice as much P2O5 vs N) will improve establishment. If your soil tests show a deficiency in P, fertilizers that contain P can be used throughout the year or a fertilizer high in phosphorus can be used early in summer when uptake is most rapid. Table 1 lists P applications for establishing turf and Table 2 lists recommendations for mature turf.

Potassium (K)

Soil test results represent the amount of K that is available to the turfgrass plant. Potassium deficiencies are rare in turf in Nebraska soils except possibly on coarse-textured, sandy soils. Table 3 lists K ranges on a soil test report and the recommended fertilizer rates.

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Calcium (Ca) and Magnesium (Mg)

Calcium and magnesium are rarely deficient in Nebraska soils when the pH is above 6.0. Occasionally a report may list Mg as deficient, but this is likely solely due to the testing methodology. Analysis using base cation saturation ratios (BCSR) often indicate false Ca or MG deficiencies compared to more the more traditional and reliable analysis with sufficiency level of available nutrients (SLAN). If a soil test report lists Mg as deficient, consider applying magnesium sulfate (epsom salts) at 1.0/1000 ft^2 in 3 gals water/1000 ft^2 to a test area. If a response is seen, 2-4 lbs epsom salts/1000 ft^2 can be applied in a granular form and watered in immediately to limit salt burn of turf.

Sulfur and Micronutrients

Nutrients such as sulfur (S), iron (Fe), manganese (Mn), copper (Cu), boron (B), and molybdenum (Mo) may also be listed on a soil test report. Though S is used in fairly large amounts by plants (macronutrient), these other nutrients are micronutrients and are used in extremely low amounts by grass plants, thus are rarely limiting even in extreme conditions. High sand soils with frequent irrigation may need an application of micronutrients on an annual basis. Toxicity from too much of these elements is more common than deficiencies so use caution to avoid overuse of micronutrient fertilizers.

Soil pH

A soil pH (also known as active acidity) indicates whether the soil is acidic, alkaline, or neutral. The availability of soil nutrients will vary depending on soil pH (Figure 1). Optimum turf growth occurs between 6.0 and 7.5 pH because most of the elements are easily available within that pH range. Few turf problems in Nebraska are caused by nutrient deficiencies resulting from high pH, but these problems would be most likely on sandy soils.

Soil Buffer pH

Soil buffer pH is a measure of acidity present on the CEC. It may be listed as lime index or SMP reading and it indicates the soils capacity to resist a change in pH. The higher the buffer pH, the more resistant the soil is to changes in pH. This number is used by soil testing labs in determining the amount of lime to apply to change the pH.

Adjusting Soil pH

Soil pH below 6.0

If a soil pH is less than 7.0 (acidic), then a lime index is calculated to help make a more accurate lime recommendation. DO NOT APPLY LIME UNLESS IT IS RECOMMENDED. Most Nebraska soils under turfgrass do not need liming.

If lime is recommended, review the following guidelines before making the application.

- No more than 100 lb of agricultural lime/1000 ft^2 should be applied in a single application on higher mowed turf like lawns. On close-mown turf like fairways, application should not exceed 50 lb lime/1000 ft^2 in a single application.
- Ground agricultural limestone or ground agricultural dolomitic limestone are the preferred forms of lime for use on all turfgrass areas.
- Lime is very slow-acting, so the pH will not change quickly. Applying lime after an aerification will increase the rate of pH change
- Lime does not replace a sound fertilization program.
- The limed area should be retested in 2 years to check for a change in the pH.
- Hydrated lime ($Ca(OH)_2$) should not be used on turfgrass because it could severely burn grass.

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Soil pH from 6.0 to 7.5
It is unnecessary to adjust the pH. This is the pH optimum range for turfgrass growth.

Soil pH above 7.5
The only product recommended to reduce a high soil pH (alkaline) is sulfur. Unfortunately, the success of adding sulfur to established turf areas to reduce a soil pH long-term has been limited and is not practical or economically feasible. To compensate for high pH, increase the annual application rate of nitrogen, phosphorus, and potassium by 25%. However, significant sulfur can be tilled into bare soils before establishment to decrease soil pH.

Nitrogen(N)

Nitrogen soil test are improving, but N levels are rarely presented on a soil test because it is difficult to get an accurate reading on the constantly changing levels of N in a soil. Thus nitrogen recommendations are made based on the use of the turf and not soil nitrogen levels. Nitrogen recommendations are determined by the turf manager and are affected by soil type, irrigation, length of growing season, species, age of area, whether clippings are returned or not, and weather.

A Last Word

The recommendations on soil test reports have been made from years and years of field data on the expected crop response to a given level of nutrient in the soil. Though most of the work has been done in field crops, more data are being generated from turf areas and recommendations are gradually being revised for turf. However, each specific soil and site can respond differently to nutrients and thus the ultimate test for soil test recommendations, or any other recommendations for that matter, is the performance of turf on your site.

Soil Testing Labs in Nebraska

AgSource/Harris Laboratories
300 Speedway Circle
Lincoln, NE 68502
402-476-0300
http://agsource.crinet.com/

Midwest Laboratories
13611 B. St.
Omaha, NE 68144
402-334-7770
https://www.midwestlabs.com/

Olsen's Agricultural Laboratory
210 East 1st St.
McCook, NE 69001
308-345-3670
http://www.olsenlab.com/

Platte Valley Laboratories
914 Highway 30
P.O. Box 807
Gibbon, NE 68840
308-468-5975
http://www.soillab.com/

Servi-Tech Laboratories
1602 Park West Drive
P.O. Box 169
Hastings, NE 68902
800-557-7509
http://www.servitechlabs.com

Ward Laboratories
4007 Cherry Ave
P.O. Box 788
Kearney, NE 68848-0788
800-887-7645
http://www.wardlab.com/

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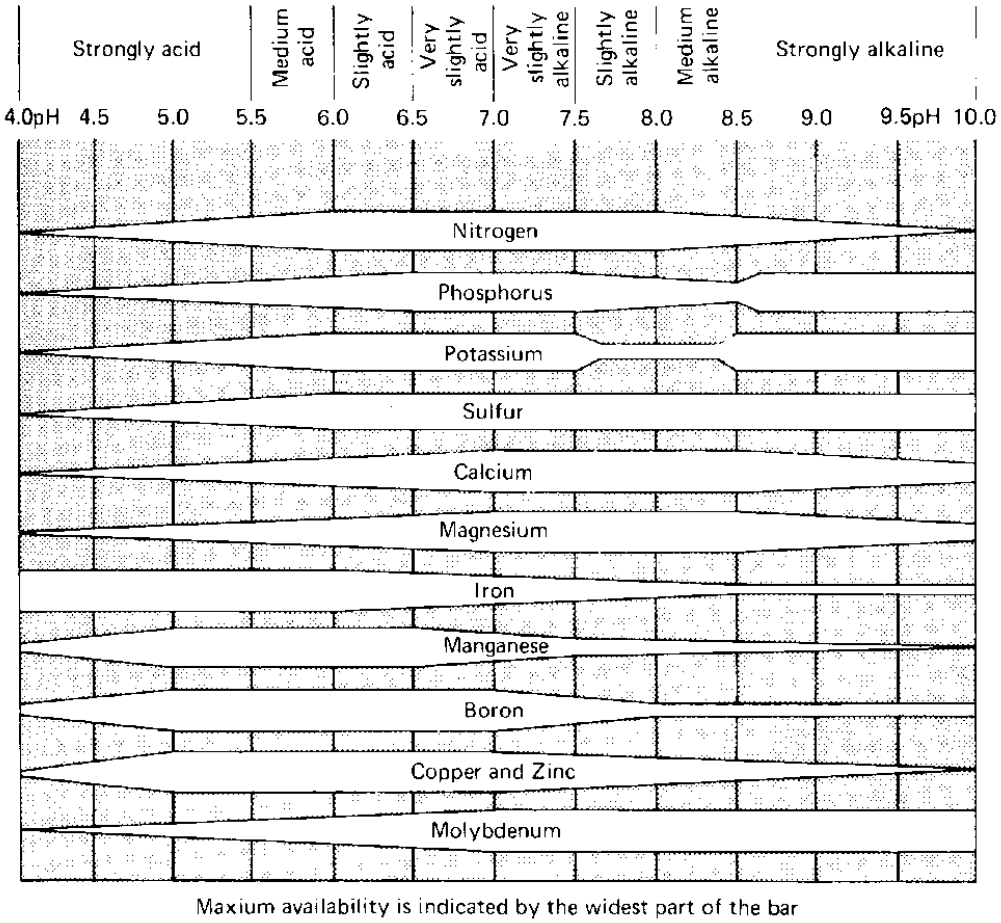

Figure 1. Availability of essential elements as affected by soil pH.

Table 1. Recommended total lbs P_2O_5/1000 sq ft applied between soil tests for bare soil or overseeding. Soil tests should be run every 3 to 5 years after establishment. A corrective one-time application of the amount of phosphorus recommended can be made or a series of applications totaling the amount recommended can be made to gradually build-up the phosphorus level. Modified from the University of Wisconsin's "Interim Turf Nutrient Management Guide" at http://www.turf.wisc.edu/docs/dnr1100-TurfNutrientManagement.pdf.

Bray P1 soil test result		Bare soil establishment from seed or overseeding of existing turfs to improve density	Bare soil establishment from sod
ppm P	lbs/A P	lbs P2O5/1000 sq ft recommended to be applied between soil tests	
0-5	0-11	3	3
6-10	12-21	3	3
11-15	22-30	3	2
16-20	31-40	2	2
21-30	41-60	2	1
31-40	61-80	1	0
41-50	81-100	1	0
>50	>100	0	0

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Table 2. Recommended total lbs P_2O_5/1000 sq ft applied between soil tests, given the type of soil test, soil test results, and specific turf area. Soil tests should be run every 3 to 5 years after establishment. A corrective one-time application of the amount of phosphorus recommended can be made or a series of applications totaling the amount recommended can be made to gradually build-up the phosphorus level. Modified from the University of Wisconsin's "Interim Turf Nutrient Management Guide" at http://www.turf.wisc.edu/docs/dnr1100-TurfNutrientManagement.pdf.

		Bray P1 Soil Test				Mehlich III Soil Test		
Soil test results		Established, lower traffic turf (lawns, parks, golf course roughs)	Established high traffic turf (athletic fields, push-up greens and tees)	Fairways	Sand tees and greens (>50% of rootzone is sand)	Fairways	Sand tees and greens (>50% of rootzone is sand)	Push-up greens and tees
ppm P	lbs/A P	lbs P2O5/1000 sq ft recommended to be applied between soil tests				lbs P2O5/1000 sq ft recommended to be applied between soil tests		
0-5	0-11	3	5	4.5	3	6	3	5
6-10	12-21	2	5	4.5	3	6	2	3.5
11-15	22-30	1	3.5	3	2	4	1	3
16-20	31-40	0	3.5	3	2	4	1	3
21-30	41-60	0	2	2	1	2.5	0.5	1
31-40	61-80	0	2	2	1	2.5	0	0
41-50	81-100	0	1	1	0.5	1.5	0	0
>50	>100	0	0	0	0	0	0	0

Table 3. Recommended total lbs K_2O/1000 sq ft applied between soil tests given the specific turf area.

Soil test results		Established, lower traffic turf (lawns, parks, golf course roughs)	Established high traffic turf (athletic fields, greens and tees)
ppm P	lbs/A K	lbs K2O/1000 sq ft/yr	
0-25	0-50	4-5	4-5
25-50	50-100	2-3	3-4
50-75	100-150	1	2
75-100	150-200	0	1
100+	200+	0	0