



Soil Test Note 17: Lawn Fertilization for Cool Season Grasses

(Supplement to Soil Test Report)

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Applying Lime to Established Lawns

If less than 50 pounds of lime per 1,000 square feet is recommended, apply the full amount in one application. If more than 50 pounds of lime per 1,000 square feet is recommended, apply the lime in several applications of up to 50 pounds each at intervals of 1 to 6 months until the full amount is applied. Applying more than 50 pounds per 1,000 square feet at any one time may result in an undesirable residue on the turf.

Repair Bare Spots with Shallow Fertilizer Incorporation

Prepare bare spots for seeding, sodding, plugging or sprigging by raking the soil so that approximately 1 inch of loose soil is on the surface. Mixing topsoil and/or organic matter into these spots will help prepare these areas for seeding or vegetative establishment.

Apply the same amount of lime but only two-thirds of the fertilizer recommended for maintaining your lawn (too much fertilizer will burn your grass seedlings). Rake the fertilizer and lime into the upper inch of loose soil.

After seeding, apply mulch (1 bale of clean straw per 1,000 square feet) to conserve moisture. Seeded, sodded, plugged, or sprigged areas should be watered immediately after planting. Watering should continue as long as necessary to obtain satisfactory germination and establishment.

General Fertilizer Information

Fertilizer Analysis

Fertilizers are often described by three numbers, such as 12-4-8 or 46-0-0. These three numbers indicate, respectively, the percent by weight of nitrogen (N), phosphate (P_2O_5), and potash (K_2O) in the fertilizer and are required on every fertilizer bag or container. For example, a 12-4-8 fertilizer would contain 12 percent nitrogen, 4 percent phosphate, and 8 percent potash on a weight basis. Fertilizers containing all three nutrients (nitrogen, phosphorus, and potassium) are referred to as “complete” fertilizers or sometimes in the lawn and garden centers as “garden” or “starter” fertilizers because they contain phosphorus..

Fertilizer Ratio

If the fertilizer analysis is 16-4-8, the fertilizer ratio is 4-1-2; similarly, a 14-7-14 analysis would have a 2-1-2 ratio. Mature lawns generally require more nitrogen than phosphorus and potassium; therefore, ratios of 4-1-2 or 4-1-3 are commonly recommended. Due to focused efforts to improve water quality in the Mid-Atlantic, there are now many phosphorus-free fertilizers (e.g. 4-0-2 ratio) that are commonly called “maintenance” fertilizers, with their intent being to get the homeowner to use soil test results rather than always applying phosphorus, even if it is not needed. Turf maintenance fertilizers vary in nitrogen content and may contain a portion of the nitrogen as water-insoluble or slowly available nitrogen.

Nitrogen Availability

The source of nitrogen in fertilizers influences nitrogen availability and turf response. There are two categories of nitrogen sources: quickly available and

slowly available. Quickly available materials are water-soluble, can be readily utilized by the plant, are susceptible to leaching and have a relatively short period of response. Quickly available sources include urea, ammonium sulfate, and calcium nitrate. Fertility guidelines from Virginia Tech and the Virginia Department of Conservation and Recreation now recommend that no more than 0.7 lb of quickly available nitrogen be applied per active growing month. Slowly available nitrogen sources release their nitrogen over extended periods of time and are applied less frequently and at somewhat higher rates than the quickly available nitrogen sources. Slowly available sources are defined as those with 15% or more slowly available or water insoluble nitrogen as detailed in the fertilizer's guaranteed analysis on the label. Slowly available sources are less susceptible to leaching and are preferred on sandy soil types, which tend to leach. They can be applied at levels up to 0.9 lb N per 1000 square feet per active growing month. Slowly available sources include urea formaldehyde (UF), UF based products (methylene ureas), sulfur coated urea (SCU) and polymer coated urea (PCU) and their combinations, isobutylidene diurea (IBDU), natural organics (bone meal, fish meal, dried blood, and animal manures), and activated sewage sludge.

If a fertilizer contains a slow-release nitrogen source, it will be listed on the label. For UF based fertilizers the portion of the nitrogen that is slowly available is listed on the fertilizer bag as Water Insoluble Nitrogen (WIN). For instance, a 20-10-10 fertilizer with 5 percent WIN has 5/20 or 1/4 of the nitrogen in the slowly available form. If you choose a fertilizer that provides nitrogen in a slowly available form, you should understand how to calculate WIN in order to determine which fertilizer program (see Table 1) best fits your lawn. For example, assume that a fertilizer label provides the following information:

Guaranteed Analysis

Total Nitrogen 16%.....16%
 5.6% Water Insoluble Nitrogen (WIN)
 Available Phosphoric Acid (P₂O₅)4%
 Soluble Potash (K₂O).....8%

To find the % nitrogen that is WIN, use the following calculation:

$$\frac{\% \text{ WIN}}{\% \text{ Total Nitrogen}} \times 100 = \% \text{ of total nitrogen that is WIN or slowly available}$$

Therefore:

$$\frac{5.6}{16} \times 100 = 35\% \text{ of the total nitrogen is WIN or slowly available and this fertilizer is most suitable for use in Program 2}$$

If WIN is not listed on the fertilizer label, one should assume it is all water-soluble or quickly available nitrogen, unless the fertilizer label indicates it contains sulfur-coated urea. Sulfur-coated or polymer-coated urea fertilizers do provide slowly available nitrogen, but the fertilizer label does not list it as WIN. If the fertilizer contains sulfur-coated urea, include that portion as water-insoluble nitrogen when determining the amount of nitrogen that is slowly available.

Table 1. Example Fertilization Program for cool-season grasses:

Program 1 - Nitrogen application by month using predominantly quickly available nitrogen fertilizers (less than 15 percent slowly available nitrogen or WIN)

Quality Desired	Sept.	Oct.	Nov.	May 15 - June 15
----- lbs. N/1,000 sq. ft. -----				
Low	0	0.7	0	0 - 0.7
Medium	0.7	0.7	0	0 - 0.7
High	0.7	0.7	0.7	0 - 0.7

Program 2 - Nitrogen application by month using predominantly slowly available nitrogen fertilizers (15 percent or more slowly available nitrogen or WIN)

Quality Desired	Aug. 15 - Sept. 15	Oct. 1 - Nov. 1	May 15 - June 15
----- lbs. N/1,000 sq. ft. -----			
Low	0.9	0	0
Medium	0.9	0	0 - 0.9
High	0.9	0.9	0 - 0.9

Important Comments about Programs 1 and 2:

1. Fine fescues perform best at 1 to 2 pounds of nitrogen per 1,000 square feet per year.

- Applications in successive months should be approximately 4 weeks apart.
- Up to 0.7 pound of nitrogen in Program 1 and up to 0.9 pound of nitrogen in Program 2 may be applied per 1,000 square feet in the May 15 to June 15 period if nitrogen was not applied the previous fall or to help a new lawn get better established.

Fertilizer Programs

When to fertilize depends on the type of grass. This Note is for cool-season grasses, such as Kentucky Bluegrass, Tall Fescue, Creeping Red Fescue and Perennial Ryegrass. (Use Note 18 for warm-season grasses such as bermudagrass or zoysiagrass.) Refer to VCE publication CSES-135P Lawn Fertilization in Virginia and/or the Virginia Nutrient Management Standards and Criteria (<https://www.dcr.virginia.gov/document/standardsandcriteria.pdf>) for specifics on fertilizer selections, application timing, and program development for the different grasses grown in Virginia.

Lawn Establishment

Go directly to Table 2 and select an appropriate fertilizer from the recommendation on the Soil Test Report. Use the rate under the 1.0 pound of nitrogen column and incorporate the fertilizer into the soil (along with lime, if needed) to a depth of 4 to 6 inches. After the turf has been established (6 to 8 weeks), follow one of the maintenance fertilization programs described below.

Lawn Maintenance

If lawn soil tests are low or medium for phosphorus or potassium, a complete fertilizer will be recommended to correct a potential deficiency of either of these plant nutrients. Follow the soil test recommendations for these nutrients and then sample soils again in 3 years to determine if a different fertilizer should be used. If the lawn soil test indicates high or very high levels of phosphorus and potassium availability, then fertilizers supplying mainly or only nitrogen need be applied.

The programs listed in Table 1 give flexibility in deciding the types of fertilizer to best meet your needs. Program 1 utilizes fertilizers that contain predominately readily available nitrogen (i.e., less than 15 percent of the nitrogen is slowly available – listed as WIN on the fertilizer bag). Program 2 utilizes fertilizers that contain predominately slowly available nitrogen (i.e., more than 15 percent of the nitrogen is slowly available or WIN).

If used properly, either program will result in quality turf. Choose the program best suited to your needs and the available fertilizer supply in your area.

Table 2 contains information on the amounts of various types of fertilizers to apply for certain rates of nitrogen per 1,000 square feet. After you decide what kind of fertilizer you want to use, determine the amount at which it should be applied using Table 2.

TABLE 2. The amounts of various types of fertilizers to apply certain rates of nitrogen (N) per 1,000 square feet

Fertilizer Analysis	Approximate Ratio	lb. of N desired/1,000 sq. ft.		
		0.5	0.7	0.9
lbs. fertilizer per 1,000 sq. ft.				
5-10-5	1-2-1	10.0	14.0	NA†
5-10-10	1-2-2	10.0	14.0	NA
6-2-0‡	3-1-0	8.3	11.7	16.1
10-10-10	1-1-1	5.0	7	NA
12-4-8	3-1-2	4.2	5.8	NA
16-8-8	2-1-1	3.1	4.4	NA
16-4-8	4-1-2	3.1	4.4	NA
20-0-16	4-0-3	2.5	3.5	NA

Fertilizer Analysis	Approximate Ratio	lb. of N desired/1,000 sq. ft.		
		0.5	0.7	0.9
23-3-7	8-1-2	2.2	3.0	NA
28-0-12	7-0-3	1.8	2.5	NA
31-0-0‡	1-0-0	1.6	2.3	3.0
38-0-0‡	1-0-0	1.3	1.8	2.3
42-0-0‡	1-0-0	1.2	1.7	2.1
46-0-0	1-0-0	1.1	1.5	NA

†NA = not applicable. Nitrogen levels from predominantly water-soluble sources should never exceed .07 pound N/1,000 square feet in a single application per active growing month.

‡Sources containing 15 percent or greater water insoluble N (WIN) can be applied up to 0.9 pound N/1,000 square feet in a single application.

If the particular fertilizer you are using is not listed in Table 2, use the following calculation to determine the exact amount of fertilizer to apply per 1,000 square feet of lawn area.

$$\frac{\text{Desired lbs of nitrogen per 1000 sq. ft.}}{\% \text{ Nitrogen in fertilizer}} \times 100 = \text{lbs. of fertilizer needed per 1,000 sq. ft.}$$

For example, if one wants to apply 0.7 pound of nitrogen per 1,000 square feet using a 23-3-7 fertilizer:

$$\frac{0.7}{23} \times 100 = 3 \text{ lb. of 23-3-7 is required per 1,000 sq. ft.}$$

Important Application Practices to Protect Water Resources

- Never exceed 0.7 lb of water-soluble nitrogen in any single application.
- Apply phosphorus only when a soil test determines that it is needed.
- Do not apply fertilizers to hard or paved surfaces (driveways, sidewalks, etc.) and sweep or blow any products that end up on hardscapes back into the turfgrass canopy.

Additional Information

For more information, contact your local Virginia Cooperative Extension office or go to www.ext.vt.edu.

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