Virginia Cooperative Extension

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Lawn Fertilization In Virginia

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Fertilization of lawns is essential for the production of quality turf in Virginia. However, exceeding recommended fertilizer application rates or improper application timing can negatively impact surface water and groundwater quality. A well-planned and environmentally sound turfgrass fertilization program will take into account:

1. inherent soil fertility;
2. nutrient source characteristics;
3. desired turfgrass quality or performance;
4. nutrient application rate;
5. application frequency;
6. season of application; and
7. application method.

The objective of this publication is to help Virginians effectively fertilize lawn turf in an environmentally sound manner.

Selecting a Fertilizer

Fertilizers are used to improve or maintain turfgrass quality. The value of a fertilizer depends upon the total amount of nutrients and the source of nitrogen in the fertilizer. Terms that one needs to be familiar with before selecting a fertilizer are: soil testing, fertilizer analysis, fertilizer ratio, and nitrogen availability.

The Soil Test - Soil tests taken every three or four years provide important information about the fertility of your lawn soil. The results will indicate the amounts of phosphorus, potassium, calcium, and magnesium your soil can provide to the turfgrass. It will also indicate the acidity (pH) of your soil and whether lime is needed. A soil test may indicate you do not need to apply some nutrients. A soil test report will indicate the specific amounts of lime, phosphorus, and potassium your soil needs to provide adequate nutrition for the turfgrass. The nitrogen requirements of turfgrass cannot be reliably evaluated by a soil test. Therefore, the soil test report will not contain a nitrogen recommendation. Nitrogen applications on lawns inVirginia are best made following the programs in this publication developed for cool-season grasses (Program 1 or Program 2) and warm-season grasses (Program 3 or Program 4).

Your local Virginia Cooperative Extension office can provide information on how to sample the soil and submit it to the Virginia Tech Soil Testing Lab for analysis. Information about your soil type is also available in most counties. Most Extension offices are listed in the local government section in the phone book.

Fertilizer Analysis - Fertilizers are often described by utilizing 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 to be on every fertilizer bag or container. For example, a 12-4-8 fertilizer would contain 12% nitrogen, 4% phosphate, and 8% potash on a weight basis. Complete fertilizers contain nitrogen, phosphorus, and potassium. If soil tests indicate high levels of phosphorus and potassium availability, then fertilizers supplying only nitrogen need to be applied. High-analysis fertilizers are more concentrated and therefore require less total fertilizer per application (see Table 1).

If a soil test indicates additional phosphate or potash is needed, it may be applied with a complete fertilizer or in separate applications from phosphate or potassium fertilizers. Fertilizers normally utilized to correct severe phosphorus and/or potassium deficiencies are 0-20-20, 0-28-0, 0-0-54, or 0-0-60. Never apply more than 3 lbs of 0-0-54 or 0-0-60 per 1000 sq ft to an established turf in hot weather without watering-in the material to prevent foliar burn.

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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. 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 ammonium nitrate, urea, ammonium sulfate and calcium nitrate. 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 less susceptible to leaching and are preferred on sandy soil types which tend to leach. Slowly- available sources include urea formaldehyde (UF), UF based products (methylene ureas), sulfur coated urea (SCU), 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).

Nitrogen Fertilization of Cool-Season Grasses

Program 1 - Nitrogen fertilization of cool-season grasses using predominantly quickly-available nitrogen fertilizers (less than 50% slowly-available nitrogen or WIN)

Nitrogen Application By Month

Quality Desired	Sept.	Oct.	Nov	May 15-June 15
	lbs N/1000 sq ft			
Low	0	1	0	0-1/2
Med	1	1	0	0-1/2
High	1	1	1	0-1/2

Program 2 - Nitrogen fertilization of cool-season grasses using predominantly slowly-available fertilizers (50% or more slowly-available nitrogen or WIN)

Nitrogen Application By Month

Quality Desired	Aug 15 to Sept 15	Oct 1 to Nov 1	May 15 to June 15
	lbs N/1000 sq ft		
Low	1.5	0	0
Med	1.5	1.5	0
High	1.5 to 2	1.5	0 to 1.5

Important comments about Programs 1 and 2:

1. Fine fescue perform best at 1-2 lbs of nitrogen per 1000 sq ft per year.
2. Applications in successive months should be approximately four weeks apart.
3. Natural organic and activated sewage sludge products should be applied early in the August 15 to September 15 and the October 1 to November 1 application periods to maximize their effect.
4. Up to 1 lb of nitrogen in Program 1 and up to 1.5 lb of nitrogen in Program 2 may be applied per 1000 sq ft 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.

Nitrogen Fertilization of Warm-Season Grasses

Program 3 - Nitrogen fertilization of warm-season grasses using predominantly quickly-available nitrogen fertilizers (less than 50% slowly-available nitrogen or WIN)

Nitrogen Application By Month

Quality Desired	April	May	June	July/Aug
	lbs N/1000 sq ft			
Low	1	1	0	0
Med	1	1	1	0
High	1	1	1	1

Program 4 - Nitrogen fertilization of warm-season grasses using predominantly slowly-available nitrogen fertilizers (50% or more slowly-available nitrogen or WIN)

Nitrogen Application By Month

Quality Desired	April/May	June/July
	lbs N/1000 sq ft	
Low	2.0	0
Med	1.5	1.5
High	2.0	2.0

Important comments about Programs 3 and 4:

1. If overseeded for winter color add 1/2 to 1 lb of readily available nitrogen per 1000 sq ft in Sept./Oct. and/or Nov.
2. Applications in successive months should be approximately four weeks apart.
3. Centipedegrass and mature zoysiagrass perform best at 1 to 2 lbs of nitrogen per 1000 sq ft per year.
4. Improved winterhardiness on bermudagrass will result from the application of potassium in late August or September.

For instance, a 20-10-10 fertilizer with 5% WIN has 5/20 or 1/4 of the nitrogen in the slowly-available form. If you chose a fertilizer which provides nitrogen in a slowly-available form, you should understand how to calculate WIN in order to determine which fertilizer program (see Programs 1-4 below) best fits your lawn. For example, assume that a fertilizer label provides the following information:

Guaranteed Analysis

Total Nitrogen 16%
5.6% Water Insoluble Nitrogen (WIN)
Available Phosphoric Acid (P_2O_5)..... 4%
Soluble Potash (K_2O) 8%

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

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

Therefore:

$$\frac{5.6}{16} \times 100$$

35% of the total nitrogen is WIN or slowly available and this fertilizer is most suitable for use in Program 1 or Program 3.

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 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.

Statements on a fertilizer bag such as "contains 50% organic fertilizer" do not mean the fertilizer is 50% slowly-available. Calculation of WIN as noted above or determination of the amount of another slowly-available nitrogen source is the only reliable method of determining the portion of the fertilizer that is slowly-available.

Seasons of Application – When to Apply

Proper timing of nitrogen applications is different for warm-season and cool-season turfgrasses because of their different growth cycles. Excessive spring application of nitrogen to cool-season grasses in Virginia is detrimental because it leads to excessive leaf growth at the expense of stored food reserves and root growth. This increases the injury to lawns from summer disease and drought. Late summer and early fall applications of nitrogen to bermudagrass without applying adequate phosphorus and potassium can increase winter injury. The best time to fertilize cool-season grasses in Virginia is from August 15 through November. Warm-season grasses perform best when fertilized between April 1 and August 15 in Virginia.

Nitrogen Fertilizer Programs

Programs 1-4 state when to apply nitrogen. The units used are pounds of actual nitrogen per 1000 sq ft of lawn area. Refer to Table 1 to determine the quantity needed of various fertilizers to apply the recommended N rate per 1000 sq ft.

Cool-Season Grasses – Kentucky bluegrass, tall fescue, perennial ryegrass and fine fescue (creeping red fescue, hard fescue, sheep fescue, and chewings fescue) should be fertilized using either Program 1 or Program 2. Program 1 uses predominantly quickly-available nitrogen fertilizers while Program 2 uses predominantly slowly-available nitrogen fertilizers.

Warm-Season Grasses – Bermudagrass, zoysiagrass and centipedegrass are best fertilized using either Program 3 or Program 4. Program 3 uses predominantly quickly-available nitrogen fertilizers while Program 4 uses predominantly slowly-available nitrogen fertilizers.

Factors Affecting Nutrient Management

After using your WIN calculations to choose the appropriate program of fertilization for your lawn, you should then determine the amount and frequency of fertilization that is proper. This will be influenced by the quality desired, source of nitrogen, soil type, type of turfgrass, length of growing season, traffic, shade, and whether clippings are recycled. Evaluate your lawn situation based on these factors and how each affects the amount and frequency of nitrogen application. Choose the amount and frequency that best suits your situation.

Fertilizer "Burn" - The primary advantage of slowly-available nitrogen sources is that they can be applied at higher rates, which reduces the total number of times the fertilizer must be applied. When properly applied, they also reduce the chances of foliar burning that is common with ammonium nitrate and urea. Foliar burn ing is the brownish discoloration that occurs on grass blades as a result of contact with soluble fertilizer. It can be minimized by watering the lawn immediately after fertilizing.

Soil Type - Sandy soils will generally leach more nitrogen than silt loam and clay loam soils. Therefore, more frequent nitrogen applications are often required in sandy soils when quickly-available sources of nitrogen are used. Leaching can be minimized by using slowly-available nitrogen sources, which in turn can reduce possible contribution to the problem of nitrogen-enriched water in nearby streams and lakes.

Type and Age of Turfgrass - Nitrogen application to cool-season grasses such as Kentucky bluegrass, tall fescue, perennial ryegrass, and the fine fescues (creeping red fescue, hard fescue, sheep fescue and chewings fescue) is best done in the late summer and fall period. Warm-season grasses perform best when nitrogen is applied in the mid-spring to mid-summer period. Newly established lawns or lawns lacking density or ground cover will benefit from properly timed applications of nitrogen until ground cover and density have reached a desirable level. Mature zoysiagrass, centipedegrass, and fine fescue lawns require lower levels of nitrogen than Kentucky bluegrass, tall fescue, perennial ryegrass, or bermudagrass.

Length of the Growing Season - Areas at higher elevations in western Virginia may have a three month shorter growing season than areas in southeastern Virginia. A turfgrass growing in an area with a longer growing season will require morenitrogen.

Traffic - Where heavy traffic or use is anticipated, higher rates of properly timed nitrogen can be beneficial in generating recuperative potential.

Shade - Grasses growing in heavily shaded areas require only 1/2 to 2/3 as much nitrogen as grasses growing in full sun. Shade also affects the timing of nitrogen applications. Since grass plants in shade can best use nitrogen when sunlight can reach the grass leaves, fertilizer applications should be timed after the majority of leaves have fallen from the trees in the fall. Applications made in October and November are generally most effective. In heavily shaded areas with fine fescue turf, it may be beneficial to reduce fertilization rates even further or omit applications until leaf collection is finished in the fall.

Quality Desired - Turfgrass quality is a measure of density, color, uniformity (free of weeds and off-type grasses), smoothness, growth habit, and texture. If high levels of turfgrass quality are desired, a commitment must be made to proper turfgrass species and variety selection, frequent mowing, and to slightly higher rates of nitrogen and increased application frequency. Additionally, irrigation, aeration and pesticide application may at times enhance quality.

Clipping Recycling - Significant amounts of nitrogen and potassium are returned to a lawn when clippings are returned. Recycling turfgrass clippings contributes very little to thatch, provides nutrients and organic matter and an environmentally friendly method of clipping disposal. If clippings must be collected, higher rates of nitrogen and potassium applications may be necessary.

Micronutrients - Fertilizers that contain micronutrients are most suited for application on sandy soils. Foliar spray application of iron on high quality cool-season turf during the fall, winter, and summer seasons will improve color, vigor and root growth. Three to four foliar applications of 2 ounces of iron sulphate per 1,000 sq ft during fall and winter and another three to four applications during the summer, at the same rate, will give maximum results. Iron chelates provide similar results. However, since there are a number of different iron chelates available, refer to product guidelines for their use. Application of iron in winter, if turf is brownish, may result in a gray-green appearance.

Fertilizer application equipment and methods - Nitrogen fertilizer will "green-up" a lawn. Therefore, it is important to uniformly apply nitrogen-containing fertilizers. This will eliminate streaking caused by different shades of green turf in the lawn. Proper application of nitrogen fertilizers by hand is difficult, even for a trained professional. Drop-type or rotary spreaders should be used. When using drop-type spreaders, be sure to overlap the wheel tracks, since all the fertilizer is distributed between the wheels. Drop-type spreaders are not as easy to maneuver around trees and shrubs as rotary spreaders. Rotary spreaders usually give better distribution where sharp turns are encountered because they tend to cover a broader swath and fan the fertilizer out at the edges of the swath. It is advisable to apply one half of the material in one direction and the other half in a perpendicular direction until one is experienced with a spreader. This will minimize streaking. Avoid application of any fertilizer to non-turfed areas (driveways, roads or bare soil) since it is then prone to runoff into drainage ways at which time it can enter water supplies.

How Much Fertilizer To Apply Per 1000 Square Feet?

After you have calculated WIN and selected a fertilization program, you can use Table 1 to find the correct amount of fertilizer to use on your lawn. Nitrogen recommendations are made in lbs of nitrogen per 1000 sq ft. Any fertilizer analysis can be used.

If the particular fertilizer you are using is not listed in the table, use the following calculation to determine the exact amount of fertilizer to apply per 1000 sq ft of lawn area.

$$\frac{\text{Desired lbs of nitrogen per 1000 sq ft}}{\%\text{ Nitrogen in fertilizer}} \times 100$$

= lbs of fertilizer needed per 1000 sq ft

For example, if one wants to apply 1.0 lb of nitrogen per 1000 sq ft using a 23-3-7 fertilizer:

(1.0 ÷ 23) x 100 = 4.34 lb of 23-3-7 required per 1000 sq ft

Table 1. The amounts of various types of fertilizers required to apply certain rates of nitrogen per 1000 sq ft.

Fertilizer	lbs of nitrogen desired per 1000 sq ft			
Analysis	1/2	1	1.5*	2.0*
6-2-0	8.3	16.6	25.0	33.0
10-10-10	5.0	10.0	15.0	20.0
12-4-8	4.1	8.3	12.5	17.0
16-8-8	3.1	6.2	9.4	12.0
20-0-16	2.5	5.0	7.5	10.0
23-3-7	2.1	4.3	6.5	8.6
28-0-12	1.8	3.6	5.3	7.2
31-0-0	1.6	3.2	4.8	6.4
33.5-0-0	1.5	3.0	4.5	6.0
38-0-0	1.3	2.6	3.9	5.2
46-0-0	1.1	2.2	3.2	4.4

*These amounts are only recommended for predominantly slowly-available nitrogen sources (Programs 2 and 4).

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Virginia Cooperative Extension would like to remind you that what we do to the lawn and landscape impacts local water quality and that of the Chesapeake Bay.

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