AGR-212

University of Kentucky
College of Agriculture, Food and Environment
Cooperative Extension Service

Fertilizing Your Lawn

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Lawns require fertilizer to remain healthy. Proper fertilization practices will lead to a thick, dark green, uniform lawn that is competitive against weed and disease invasions. The nutrients contained in fertilizers are necessary to support many processes occurring within the plants. If any essential nutrient is limiting, the plants will not perform at their highest level.

What your Lawn Needs

Soils and soil fertility levels vary across Kentucky. Nutrients that may be naturally abundant in the central region of the state may be limiting in Eastern or Western Kentucky. Soils under lawns have often been modified by the removal of topsoil or the addition of fill during construction, so even knowing the natural fertility of the area may be of little value. The only way to specifically know the fertility needs of your lawn is to perform a soil test. A basic soil test is very inexpensive and will provide you information about certain nutrient levels and the pH of the soil. This information is critical to determine which fertilizer you should purchase, how much to apply, and whether lime needs to be applied.

Getting the Soil Tested

Soil sampling is easily accomplished with some very simple tools. All that is required to take a soil sample is a clean bucket and either a soil probe, a shovel, or a trowel. Many county extension offices have soil probes available for use. Take soil from 10 to 15 random spots throughout the lawn. The goal in collecting soil is to get a comprehensive sample, which represents the entire lawn. Be sure to test flower beds or areas of known soil variations separately as to not skew the test results. Take samples to a depth of 1 to 2 inches (4-6 inches on newly tilled soils) and remove the plant material. Break the samples up in the bucket and thoroughly mix the soil together. Your county extension office will supply you with bags free of charge in which to place the soil. You can then return the samples to the extension office and the results will be returned to you within a few weeks. Soil tests should be taken every three to 5 years on established lawns and may be taken at any point during the year. For recommendations, see AGR-214: *Liming Kentucky Lawns.*

Table 1. The sixteen essential elements needed for plant growth.

Macronutrients	Micronutrients
Carbon (C)	Zinc (Zn)
Hydrogen (H)	Iron (Fe)
Oxygen (O)	Copper (Cu)
Nitrogen (N)	Manganese (Mn)
Potassium (K)	Chlorine (Cl)
Phosphorous (P)	Molybdenum (Mo)
Sulfur (S)	Boron (B)
Calcium (Ca)	
Magnesium (Mg)	

The Essential Elements

The basic composition for any grass plant is 85 percent water, 8 percent to 13 percent carbon, and 2 percent to 7 percent other essential elements. There are sixteen elements that are considered essential for plant growth (Table 1). Plants must have all of these essential elements in their proper proportions to grow and remain healthy.

Carbon, hydrogen and oxygen are obtained by the plant from air and water. These elements are building blocks for making sugars during photosynthesis. The remaining nutrients are taken up from the soil and are required in many different pathways and products in plants. Macronutrients are found in higher concentrations within the plant than micronutrients. However, this does not mean that micronutrients are not important. Deficiencies of any nutrients will result in less than optimal plant growth. Macronutrients may be further broken down into primary and secondary macronutrients. The primary macronutrients include nitrogen, phosphorus, and potassium. These are considered primary due to the larger quantities required by plants. These nutrients can often be deficient in the soil resulting in the need to fertilize. Whereas, the secondary macronutrients, as well as micronutrients, are needed in lesser amounts by plants, so natural soil levels are often adequate and these nutrients are not always necessary.

Buying Fertilizer

Once you know what nutrients your lawn needs, how do you know which fertilizer to buy? The analysis on the fertilizer bag tells you the percent nitrogen (N), phosphate (P_2O_5) and potash (K_2O) in the fertilizer, in that order. For example, a fertilizer with a 32-0-4 analysis contains 32 percent N, 0 percent available P_2O_5, and 4 percent soluble K_2O (Figure 1). The fertilizer label will often break the N sources into slow release (water-insoluble nitrogen, WIN), and quick release (water-soluble nitrogen—often includes ammoniacal or urea) sources. Slow release nitrogen sources will only release a small amount of fertilizer at a time. The benefits of slow release fertilizers include less nitrogen losses from leaching and volatilization, reduced burn potential on the turf, and

32-0-4

Guaranteed Analysis

Total Nitrogen	32.0%
5.4% Ammoniacal Nitrogen	
19.8 % Urea Nitrogen	
6.3% Other Water Soluble Nitrogen	
0.5% Water Insoluble Nitrogen	
Soluble Potash (K_2O)	4.0%
Total Calcium (Ca)	1.6%
Combined Sulfur (S)	7.0%
Iron (Fe)	2.0%

Derived From: Methylene Urea, Urea, Pottassium Sulfate, Ammonium Sulfate, Iron Sucrate.

Figure 1. An example fertilizer label.

fewer applications required to maintain soil fertility. However, the amount of the slow-release nitrogen is usually a quarter to half of the total amount of nitrogen in the bag. So although slow-release nitrogen makes applications safer, such a small amount would not provide noticeable availability of nitrogen over the long term. Most specialty fertilizers can be applied and measured exactly the same as you would a farm fertilizer. The same is true with specialty organic fertilizers, with the exception that they would need to be applied earlier in the fall as warm conditions are required for release of these materials. Most of these fertilizers have a low percentage of nitrogen or are fortified with urea, a quick-release source of nitrogen. Fertilizers with greater than 50 percent WIN (water insoluble nitrogen) can be considered true slow release sources. These sources can be applied at slightly higher rates than soluble fertilizers. There will not be a rapid greening of the lawn with these products as is common with quick release fertilizers. Cost will be 3 to 5 times higher per pound of nutrients for slow release fertilizers.

The recommended rates of nutrients can be applied with single nutrient fertilizers containing only nitrogen (e.g., urea 46-0-0), only phosphate (e.g., triple superphosphate 0-46-0), or only potash (e.g., muriate of potash 0-0-60). Or, you can use a complete fertilizer such as 10-10-10, 19-19-19, 10-20-10, etc. Complete fertilizers allow the job to be finished with fewer passes, but rarely have nutrients in the ratios needed for a specific situation. Recent summaries of Kentucky soil test results have revealed that more than 50 percent of homeowner turf soil samples test high or above for phosphorus and potassium. If the soil test results reveal that phosphorus and potassium are adequate, there is no need to apply more of these nutrients. Over-applying or misapplying phosphorus can lead to surface water contamination. Most phosphorus contamination occurs due to runoff, therefore you should always be diligent to avoid throwing fertilizers on hard surfaces such as sidewalks.

Specialty vs. Farm Fertilizer Products

Lawns can be fertilized with specialty turf fertilizers (normally available at local garden centers) or with many farm fertilizers. The main advantages to the specialty fertilizers are:

- Normally good nutrient ratios for turf (turfgrasses often require a ratio of 4:1:2 N:P:K).
- Uniform and small particle size.
- Low burn potential.
- Calibration and application rate information for applying to small areas printed on the bag.

Most farm fertilizers do not have these advantages, but farm fertilizers are usually three to five time less expensive.

Farm fertilizers such as urea and 10-10-10 must be used with caution. Because of their potential to burn foliage, you should not apply them during extremely hot weather or when moisture is on the grass leaves. However, if these fertilizers are applied during cooler times of the year, burn is seldom a concern. It is critical that correct rates of farm fertilizers are applied to avoid burning.

When to Fertilize

Without question, the best time to fertilize cool-season lawns (Kentucky bluegrass, tall fescue, perennial ryegrass, fine fescue) in Kentucky is during the autumn. These grasses all grow optimally during cooler weather and can best utilize nutrients at this time of year. The turf develops a better root system, becomes very dense, and has much better late fall and early spring color if nitrogen is applied in the fall.

During mild winters, good color may be maintained all winter following a fall application of nitrogen. By eliminating or minimizing spring fertilization you:

- Prevent the heavy flush of growth that occurs with spring fertilization.
- Reduce frequency of mowing during spring.
- Develop a better root system and promote better drought tolerance in summer.
- Reduce disease.
- Develop a more heat-tolerant, weed-free turf.

If the window to apply nitrogen in the fall is missed, an application during the following spring will improve greenup. Even if some fall nitrogen was applied, applying a half rate of nitrogen in late May or early June in years with heavy spring rainfall may help improve or maintain color.

If color is not a major concern, it is best to not fertilize in the spring because crabgrass, goosegrass, dallisgrass, bermudagrass, etc. respond to the nitrogen much more than do cool-season grasses. If you increase nitrogen fertilization of cool-season grasses in spring and summer, the need for irrigation, thatch control, and chemicals for weed control also increases. A lush summer lawn may not be worth these potential problems.

Weed and feed products (fertilizers and herbicides in the same product) are usually not recommended as the optimum time to use a herbicide for controlling weeds, may not match up to the optimum time or applying fertilizer. For instance, grassy weeds such as crabgrass and goosegrass are normally controlled with a pre-emergent application applied in April. If a weed and feed product is used to apply the herbicide, the fertilizer applied can lead to the problems mentioned above.

Late spring into summer is the best time to fertilize warm-season grasses such as bermudagrass and zoysiagrass, since they perform best during hot summer months.

The number of times you should apply nitrogen depends upon the lawn quality you desire. Low and medium maintenance levels are best for general lawns that get little or no summer irrigation—this includes most Kentucky home lawns. High maintenance levels usually require some irrigation, high mowing frequency, and often more pest control. Timing of fertilizer applications for various maintenance levels are shown in Table 2.

Table 2. Timing and amounts of nitrogen applications for various levels of maintenance on cool-season lawns.

Maintenance Level	September	October	November	December	Late May/ early June
	Pounds N/1,000 sq ft				
Low*	--	1	--	--	--
Medium†	--	1	1	--	--
High‡	--	1	1	1	0-0.5
Very high	1	1	1	1	0-0.5

* Mainly non-irrigated, non-trafficked, large acreage lawns, church or schoolyards, etc.
† Mainly includes commercial lawns, apartments, home lawns, and high traffic areas. Requires no irrigation except during severe heat and drought.
‡ Mainly for formal lawns, requiring maximum uniformity and color. Irrigation is required during summer for this level of nitrogen. Will require frequent and consistent mowing, even into winter months if growth continues. Never let a lawn go into winter higher than 2.5 to 3 inches tall.

Table 3. Examples of fertilizers and rates needed to provide 1 pound of nitrogen per 1,000 square feet of lawn.

Farm Fertilizer	Pounds Product Needed/1,000 ft²
Urea (46-0-0)	2.2
10-10-10	10
19-19-19	5.3
Specialty Fertilizer*	
25-5-10	4
29-3-4	3.5
32-4-8	3.1

* Specialty fertilizers generally contain high nitrogen and low phosphate. They also contain a portion of slow-release nitrogen.

How Much Fertilizer Should I Apply?

The soil test measures several important elements, however, it does not adequately measure nitrogen. Nitrogen changes forms in the soil very rapidly so it is difficult to predict its availability to plants with a soil test. Turf growth is highly dependent on nitrogen fertilization, but applying nitrogen at the wrong time or in heavy amounts may severely damage your lawn. A general recommendation is to apply 1 pound actual nitrogen per 1,000 square feet at any given application (Table 3).

The examples listed in Table 3 show many fertilizers that can be used to maintain turf. Because the fertilizer analysis tag indicates only the percent of nutrients, you must calculate the pounds of nutrients in a bag.

For example, a 50-pound bag of 10-6-4 contains:

5 pounds (50 x 0.10 = 5) of actual nitrogen (N).

3 pounds (50 x 0.06 = 3) of phosphate (P_2O_5).

2 pounds (50 x 0.04 = 2) of potash (K_2O).

The rest of the material in the bag [50 - (5+3+2)] = 40 (i.e., 40 pounds) is called the carrier which does not contribute to the nutrient needs of plants.

Another example: to apply 1 pound N per 1,000 square feet (using the same 10-6-4 fertilizer), you would need to apply 10 pounds of the 10-6-4 fertilizer per 1,000 square feet.

1 pound N ÷ 10% N

= 1 pound N ÷ 0.10

= 10 pounds of 10-6-4 fertilizer.

Ten pounds of 10-6-4 per 1,000 square feet would also supply 0.6 pounds of P_2O_5 (phosphate) and 0.4 pounds of K_2O (potash).

Phosphorus and potassium rates will be dictated by the soil test report. As was stated above, if levels of these two nutrients are already sufficient, additional amounts should not be applied to the lawn. If clippings are recycled and not removed, almost no additional phosphate or potash will ever be needed. However, grasses have a yearly nitrogen requirement to keep the lawn healthy and thick. Although these rates can vary based on soil types and environmental conditions, the rates listed in Table 4 can be used as guidelines.

Table 4. Recommended fertilizer rates for various lawn grasses in Kentucky.

	Pounds N/1,000 sq ft/year†	Fertilizer Timing
Cool-season grasses		
Fine fescues*	1-2	Autumn
Kentucky bluegrass	2-4	Autumn
Perennial ryegrass	2-4	Autumn
Tall fescue	2-4	Autumn
Warm-season grasses		
Bermudagrass	3-4	Summer
Zoysiagrass	1-2	Summer

* Includes sheep, hard, and red fescues.
† See Table 2 for fertilizer amount and timing recommendations based on low, medium, and high maintenance lawns. The low numbers in the above table would be considered part of the low maintenance regime, while the high numbers are associated with the high maintenance regime.

Applying Lime

Soil pH should ideally be in a range of 6.0 to 6.5. If the pH gets much higher or lower than this range, various macro- and micronutrients can become tied up in the soil and will be unavailable to plants. The only way to know whether lime should be applied or not, is to have the soil tested. The soil test results will give specific recommendations on how much lime is needed in the soil. Often as much as 100 to 200 pounds of lime will be required per 1,000 square feet of lawn. However, it is usually suggested that only 50-100 pounds be applied in a single application. If more than 100 pounds per 1,000 square feet is required, the rest of the recommended lime can be applied three to six months after the initial application. For more information on lime see **AGR-214, Liming Kentucky Lawns.**

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