

General Recommendations for Fertilization of Turfgrasses on Florida Soils ¹

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In many neighborhoods, people envy the individual with the most beautiful lawn and think they cannot grow a lawn of equal quality. That is not necessarily true. A well-maintained lawn only requires some knowledge about fertilization, watering, pest control and mowing. This publication provides basic information about fertilization. By far, the best approach to a proper fertilization program is to start with a soil test, but, if a soil test is not available, these guidelines can be used for a general turfgrass fertilization program.

Essential Elements

All plants require certain chemical elements for proper growth and appearance. Of these nutrients, at least 16 are known to be essential elements. Table 1 lists the 16 known elements and the sources from which plants obtain them. All essential elements except carbon, hydrogen, and oxygen are obtained from the soil and absorbed by plant roots. If inadequate nutrients are available in the soil, turfgrass growth and quality may be limited. However, essential elements can be added to a soil through fertilizer applications.

Table 1. Essential elements required by lawngrasses.

From Air/Water	----- From Soil -----	
	Macronutrients	Micronutrients
Carbon	Nitrogen	Iron
Hydrogen	Calcium	Copper
Oxygen	Phosphorus	Manganese
	Magnesium	Molybdenum
	Potassium	Zinc
	Sulfur	Boron
		Chlorine

Turfgrasses require the macronutrients nitrogen (N), phosphorus (P), and potassium (K) in greatest quantities. Calcium, magnesium, and sulfur are required in smaller quantities. The micronutrients iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), chlorine (Cl), molybdenum (Mo), and boron (B) are required in very minute quantities. Micronutrients are as essential as the macronutrients, but are required in much smaller amounts.

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Types of Fertilizers

Fertilizers are identified by analysis and/or brand name. Many common commercial fertilizers are known by their grade, such as 16-4-8, 10-10-10, or 6-6-6. A complete fertilizer contains N, P and K. The numbers indicate the percentage of each of these nutrients. A 16-4-8 fertilizer, for example, contains 16% Total Nitrogen, 4% Available Phosphorus expressed as P_2O_5 and 8% Soluble Potash expressed as K_2O . Thus a 100-pound bag of 16-4-8 would contain 16 pounds of total N, 4 pounds of available phosphate, and 8 pound of potash. These three constituents, N, P, and K, are called the primary plant foods; if all three are present, the fertilizer is referred to as a complete fertilizer. Complete fertilizers, such as 16-4-8, 12-4-8, 10-10-10, and 6-6-6, are commonly used in turfgrass fertilization. Besides the primary elements (N, P and K) the fertilizer may contain secondary plant foods. The secondaries may include Ca, Mg, sulfur (S), Mn, Zn, Cu, Fe and Mo.

Both primary and secondary elements, if present, are listed on the fertilizer label. The label also tells the materials from which the fertilizer has been made. This information appears below the “derived from” statement. An example of a mixed fertilizer containing several different sources of N is shown in Figure 1.

Lawn (Turf-Type) Fertilizer 16-4-8 Guaranteed Analysis	
Total Nitrogen	16%
Ammoniacal Nitrogen	8.50%
Nitrate Nitrogen	2.00%
Water Soluble Organic Nitrogen	0.90%
Water Insoluble Nitrogen	4.60%
Available Phosphoric Acid (P_2O_5)	4%
Soluble Potash (K_2O)	8%

Figure 1. Example of a fertilizer label.

In addition to complete fertilizers, some materials are used almost exclusively to supply N to turfgrasses for rapid growth and dark green color. These materials include soluble forms of N ; ammonium nitrate (34% N), ammonium sulfate (21% N), urea (46% N), calcium nitrate (15.5% N), potassium nitrate (13% N & 44% K_2O) and slow-release N sources; Ureaformaldehyde (38% N),

Isobutylidene diurea (31% N), Sulfur-coated urea (36-39% N), Nutralene (40% N), and Polyon (40-43% N). Turfgrasses commonly require higher rates and more frequent applications of N source fertilizers than other nutrient sources. In most cases, slow-release N sources can be used to reduce the potential for leaching losses of applied N. In order to obtain the desired growth and color response in most cases, a 70/30 mixture of soluble and slow-release N sources is recommended for use on turfgrasses. It should be pointed out that turfgrasses are one of the most N absorbing efficient ground covers that one can use. When fertilized at the recommended rate and frequency, N leaches very sparingly, if at all, from the turfgrass system. Poor quality, slow-growing and improperly fertilized turfgrasses actually leach much more N than do turfgrasses growing at optimum levels. A quality turfgrass furnishes a complete and uniform cover of the soil surface. The highest quality turfgrass is not necessarily the darkest green or most rapidly growing turfgrass, but the turfgrass that has acceptable color and density without excessive growth. Excess N application can lead to a dark green turfgrass that is growing at excessive rates which will require more frequent mowing and possibly result in contamination of the ground water with nitrate nitrogen.

For Florida turfgrasses, the best yearly fertilization program usually includes a combination of one or two applications of multiple nutrient fertilizations and several supplemental applications of a N fertilizer. Nitrogen fertilization is often based on the desired growth rate and type of turfgrass being grown. Due to past fertilization and the inherent nature of some placeStateFlorida soils, P fertilization is not always required. One should depend on a recent soil test to determine if P is required for optimum turfgrass growth. If your soil test indicates an adequate level of extractable soil P, choose a fertilizer blend that does not contain P as one of the supplied nutrients. That blend would be represented by an X-O-X, such as 15-0-15. Excess P application can result in enrichment of the P status of run-off or leachate waters, and in the eutrophication of adjacent water bodies. Second only to N in total fertilization requirement is K. Potassium influences root growth and water and stress tolerance relationships in turfgrasses and should be maintained

at adequate levels for optimum growth. In most turfgrass growth systems, the potassium fertilization program should be based on a recent soil test. Potassium is highly mobile in most of Florida's sandy soils, but an annual soil test is adequate for determining the K fertilization requirement of most turfgrasses grown in the State.

Fertilizer Application

Most fertilizers are applied at a rate determined by the type and amount of nitrogen present in the material. Nitrogen is the nutrient most used by a turfgrass and often the material that burns the turfgrass if applied at excessive rates.

In the past, it was customary to recommend the application of 1 pound of actual nitrogen per 1000 square feet of turfgrass. In light of potential environmental concerns it is now recommended that no more than one half (0.5) pound of the nitrogen in the application be in the soluble form. Thus in order to make an application of 1 pound of actual nitrogen per 1000 square feet of turfgrass you would need to use a blended fertilizer product containing no more than 50% of the total N in soluble form with the rest of the nitrogen originating from a slow-release N source. The pounds of actual N in every fertilizer can be determined by dividing the percent N listed on the label into 100. For example, if applying soluble N from ammonium sulfate, divide 21% (the N content of ammonium sulfate) into 100 to find the number of pounds of ammonium sulfate that will supply 1 pound of N. Since 100 divided by 21 equals approximately five, five pounds of ammonium sulfate would supply one pound of N. Therefore, to apply the equivalent of 0.5 pounds of soluble N per 1000 square feet of turfgrass surface, one would need to apply 2.5 pounds of ammonium sulfate.

Several fertilizer materials are listed in Table 4, and the rate of application for 0.5 pounds of N is already calculated. For example, if using ammonium nitrate on a turfgrass, note that the table lists the rate of application at 1.5 pounds of material per 1000 square feet to apply the equivalent of 0.5 pounds of N. Therefore, if you have a 5000 square foot lawn use 7.5 pounds of ammonium nitrate.

When a soil test of a turfgrass area is not available, Table 5 can be used as a guide for turfgrass fertilization programs at three levels of maintenance for each type of turfgrass for three regions of the state. Note that most programs use a combination of complete fertilizers and nitrogen fertilizers applied during different times of the year. Recall that the complete fertilizer should only be used when the soil test calls for both P and K. When P is not required apply only those nutrients which are recommended by the soil test report.

One program is a basic, or low-maintenance, recommendation that will produce only a minimum quality turfgrass. The second program is a moderate maintenance program which should produce an intermediate-quality turfgrass. The high maintenance program should produce an optimum quality turfgrass with good color and growth characteristics, and should not result in nitrogen leaching losses if the recommendations are followed. The best schedule is the one that produces the quality of turfgrass the individual desires.

To use Table 5, find the particular turfgrass and part of the state that applies to you, then apply the fertilizer indicated during the month(s) recommended. For rates of various materials, refer to Table 4. For example, to obtain a high quality Centipedegrass lawn in Gainesville (central Florida), apply a complete fertilizer (C) like a 16-4-8, 10-10-10, or 6-6-6 (depending on whether or not P and K are recommended by the soil test) in March and September, then apply a slow-release N material like sulfur-coated urea or Milorganite in May. Rates for individual N fertilizer materials are given in Table 4, and the rate for a complete fertilizer is shown at the bottom of the fertilization chart (Table 5).

Organic vs Inorganic Fertilizers

There is much confusion over whether to use organic or inorganic fertilizers on turfgrasses. Both types have advantages and disadvantages; however, the type of fertilizer makes no difference to the turfgrass. Grasses absorb N as nitrate- or ammoniacal-N. Organic N is not used directly by the plant but must first be converted to one of the above chemical forms by soil microorganisms before being taken up by the plant.

The advantages and disadvantages of organic or chemical fertilizers relate to the consumer, not the turfgrass. Inorganic N fertilizers have advantages and disadvantages as listed in Table 2.

Table 2. Advantages and disadvantages of inorganic nitrogen fertilizer sources.

Inorganic Nitrogen Sources	
Advantages	Disadvantages
Readily available N	Leach readily
Low cost per pound of N	Danger of fertilizer burn
Easily controlled N levels	High salinity potential
Little problem of residual N	Must be applied frequently at low rates

Organic N fertilizers also have advantages and disadvantages that are listed in Table 3. Select a N source after considering the pros and cons of the various forms. A mixture of the two will most likely result in the best response.

Table 3. Advantages and disadvantages of organic nitrogen fertilizer sources.

Organic Nitrogen Sources	
Advantages	Disadvantages
Slow-release of N	May be very expensive per pound of N
Less subject to leaching loss	Not released at adequate rate during cool season
Small danger of turfgrass burn	Application response may be slow
May be applied infrequently at high rates	May contain weed seeds that contaminate turfgrass

growth which follows N fertilization. Usually, iron sulfate (2 ounces per 3 to 5 gallons of water per 1000 square feet) or a chelated iron source are used to provide this greening effect. The effect from supplemental iron application is only temporary (approximately 2 to 4 weeks), therefore, repeat applications are necessary for summer-long color.

Precautions

All soluble fertilizers may burn the turfgrass if improperly applied. To avoid burn, never apply fertilizer at greater than the recommended rate of 0.5 pounds of soluble N per 1000 square foot per application. If only slow-release N materials are used up to 3 pounds of N can be applied in a single application. Apply P and K only when required based on a recent soil test and do not exceed the recommended rate of application, especially for P. Always apply fertilizers when the turfgrass leaves are dry and water thoroughly after application. Apply enough water to dissolve the fertilizer and move it below the surface. This can generally be accomplished by applying between 1/4 and 1/2 inch of water through the irrigation system which can usually be accomplished by running a typical turfgrass irrigation system for 15 to 20 minutes. Excess irrigation may leach the soluble N below the root zone so great care should be taken not to water too little or too much.

Supplemental Iron Application

Many times turfgrasses, such as Centipedegrass, Bahiagrass and St. Augustinegrass, turn yellow during the summer due to lack of N fertilizer. However, fertilization with N in the summer is not always desirable since this often encourages disease and insect problems. Many times the addition of iron (Fe) to these grasses provides the desirable dark green color, but does not stimulate excessive grass

Table 4. A guide to rate of fertilizer material to use on Florida turfgrass.

Nitrogen Fertilizers	%N	Pounds needed to supply 0.5 pounds of actual N per 1000 sq ft
Soluble N Sources (Inorganic)		
Ammonium Nitrate	33.5	1.5
Ammonium Sulfate	20	2.5
Calcium Nitrate	15.5	3.2
Potassium Nitrate	13-0-44	3.8 also 1.7 lbs K_2O
Sodium Nitrate	16	3.1
Nitrate of Soda-Potash	15-0-16	3.3 also 0.5 lbs K_2O
Monoammonium Phosphate	11-48-0	4.5 also 2.2 lbs P_2O_5
Diammonium Phosphate	18-46-0	2.8 also 1.3 lbs P_2O_5
Soluble N Sources (Organic)		
Urea	45	1.1
Calcium Cyanamide	21	2.4
Slow-Release N Sources (Synthetic)		
Ureaform/Nitroform	38	1.3
Nutralene	40	1.25
Isobutylidene diurea (IBDU)	31	1.6
Sulfur-coated Urea	38	1.3
Polyon	42	1.2
Slow-Release N Sources (Natural Organics)		
Sewage Sludge	6-2-0	8.3 also 0.2 lbs P_2O_5
Cow Manure	2-0-0	25
Poultry Manure	4-0-0	12.5
Cottonseed Meal	7	7.1
Alfalfa Meal	6	8.3
Blood Meal	3-22-0	16 also 3.7 lbs P_2O_5
Processed Tankages	5-10 (varies)	10 to 5
Garbage Tankages	2-3 (varies)	20 to 15
Some Commercial Sources of Potassium and Phosphorus Fertilizers		
		Pounds needed to supply 0.5 lbs of actual Potash or Phosphate per 1000 sq ft
Potassium Chloride (Muriate of Potash)	60% K_2O	0.83
Potassium Sulfate	50% K_2O	1
Potassium Nitrate	13-0-44	1.1 also 0.1 lbs N
Sulfate of Potash Magnesia	22% K_2O , 11% Mg, 8% S	2.2 also 0.2 lbs Mg & S
Concentrated Superphosphate	46% P_2O_5	1

Table 5. Fertilization guide for turfgrasses maintained without the benefit of a soil test.*

Turfgrass	Maintenance Level	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Florida**													
Bahia grass	Basic	--	--	C	--	--	--	--	--	C	--	--	--
	Moderate	--	--	C	--	SRN	--	--	--	C	--	--	--
	High	--	--	C	--	SRN	--	Fe	--	C	--	--	--
Bermuda grass	Basic	--	--	C	--	SRN	--	--	--	C	--	--	--
	Moderate	--	--	C	--	SRN	--	SRN	--	C	--	--	--
	High	--	--	C	SRN	C	--	SRN	Fe	C	--	--	--
Centipede grass	Basic	--	--	--	C	--	--	--	--	--	--	--	--
	Moderate	--	--	--	C	Fe	--	--	--	--	--	--	--
	High	--	--	--	C	SRN	--	Fe	--	--	--	--	--
St. Augustine grass	Basic	--	--	C	--	--	Fe	--	--	C	--	--	--
	Moderate	--	--	C	--	SRN	--	Fe	--	C	--	--	--
	High	--	--	C	--	SRN	Fe	SRN	--	C	--	--	--
Zoysiagrass	Basic	--	--	C	--	SRN	--	--	--	C	--	--	--
	Moderate	--	--	C	--	SRN	--	SRN	--	C	--	--	--
	High	--	--	C	N	SRN	--	SRN	--	C	--	--	--
Central Florida													
Bahia grass	Basic	--	--	C	--	N	--	--	--	C	--	--	--
	Moderate	--	--	C	--	N	--	Fe	--	--	C	--	--
	High	--	--	C	N	--	SRN	--	Fe	--	C	--	--
Bermuda grass	Basic	--	--	C	--	N	--	SRN	--	C	--	--	--
	Moderate	--	--	C	--	N	--	SRN	--	SRN	--	C	--
	High	--	--	C	N	SRN	--	C	Fe	SRN	--	C	--
Centipede grass	Basic	--	--	C	--	SRN	--	--	--	--	--	--	--
	Moderate	--	--	C	--	SRN	--	--	Fe	--	--	--	--
	High	--	--	C	--	SRN	--	--	--	C	--	--	--

Table 5. Fertilization guide for turfgrasses maintained without the benefit of a soil test.*

Turfgrass	Maintenance Level	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
St. Augustine-grass	Basic	--	--	C	--	--	--	Fe	--	C	--	--	--
	Moderate	--	--	C	--	SRN	--	Fe	SRN	--	C	--	--
	High	--	C	--	N	SRN	--	Fe	SRN	--	C	--	--
Zoysiagrass	Basic	--	--	C	--	SRN	--	--	--	C	--	--	--
	Moderate	--	--	C	--	SRN	--	--	SRN	--	--	C	--
	High	--	C	--	N	SRN	--	SRN	--	N	--	C	--
South Florida													
Bahia-grass	Basic	--	C	--	--	--	Fe	--	--	--	C	--	--
	Moderate	--	C	--	N	--	Fe	--	--	--	C	--	--
	High	--	C	--	N	--	SRN	--	--	--	C	--	--
Bermuda-grass	Basic	--	C	--	N	--	SRN	--	--	C	--	C	--
	Moderate	--	C	N	--	C	--	SRN	--	SRN	--	C	--
	High	--	C	N	SRN	C	SRN	Fe	--	SRN	--	C	--
Centipede-grass	Basic	--	--	C	--	--	Fe	--	--	--	C	--	--
	Moderate	--	C	--	SRN	--	--	--	--	--	C	--	--
	High	--	C	--	SRN	--	Fe	--	--	--	C	--	--
St. Augustine-grass	Basic	--	--	C	--	SRN	--	SRN	--	--	C	--	--
	Moderate	--	C	--	N	--	SRN	--	SRN	--	--	C	--
	High	--	C	--	N	SRN	--	SRN	--	SRN	--	C	--
Zoysiagrass	Basic	--	--	C	--	SRN	--	SRN	--	--	C	--	--
	Moderate	--	C	--	N	--	SRN	--	SRN	--	--	C	--
	High	--	C	--	N	SRN	--	SRN	--	SRN	--	C	--

Table 5. Fertilization guide for turfgrasses maintained without the benefit of a soil test.*

Turfgrass	Maintenance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Level													
<p>* This guide is for turfgrass fertilization under circumstances where a soil test does not exist. In order to properly apply the rate of P and K required, a soil test is required. It is recommended to always soil test.</p> <p>** The arbitrary dividing line between north and central Florida is a straight east-west line from coast to coast through Ocala, and the dividing line between central and south Florida is a line from coast to coast through Tampa and Vero Beach.</p> <p>C = Complete fertilizer applied at 1.0 lbs N/1000 sq ft containing 50% soluble and 50% slow-release N.</p> <p>N = Soluble N applied at 0.5 lbs N/1000 sq ft.</p> <p>SRN = Slow-release N applied at 1.0 lbs N/1000 sq ft.</p> <p>Fe = Apply Fe to provide dark green color without stimulating excessive growth. For foliar application use ferrous sulfate (2 oz /3-5 gal water/1000 sq ft). If the Fe is applied to an acidic soil, use one pound of iron sulfate per 1000 square feet. If the soil is calcareous, use the container label recommended rate of an iron chelate.</p>													