# General Recommendations for Fertilization of Turfgrasses on Florida Soils[1]

T. W. Shaddox[2]

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 17 are known to be essential elements. Table 1 lists the 17 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.

Turfgrasses require the macronutrients nitrogen (N), phosphorus (P), and potassium (K) in greatest quantities. Calcium (Ca), magnesium (Mg), and sulfur (S) 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.

## 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 pounds 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 fertilizers. Typically, turfgrass fertilizers do not contain phosphorus, thus a typical turfgrass fertilizer might be a 15-0-15. Besides the primary elements (N, P, and K), the fertilizer may contain secondary plant foods. The nutrients labeled as secondary on the tag may include Ca, Mg, 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

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2. T. W. Shaddox, assistant professor, UF/IFAS Fort Lauderdale Research and Education Center, Ft. Lauderdale, FL 33314.

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 and 44% K2O), and slow-release N sources; ureaformaldehyde (38% N), methylene urea (40% N), isobutylidene diurea (31% N), sulfur-coated urea (36–39% N), and polymer-coated urea (40%–44% 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, a 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 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 growing at excessive rates, requiring more frequent mowing and possibly resulting in contamination of the groundwater 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 an 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 Florida 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-0-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. Apply no more than 0.25 lb of $P_2O_5$ /1000 sq ft per application and no more than 0.5 lb $P_2O_5$ /1000 sq ft per year when needed based on a recent soil test. 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 lb of actual nitrogen per 1000 sq ft of turfgrass. It is now recommended that no more than 0.7 lb of the nitrogen in the application be in soluble form. Thus, in order to make an application of 1 lb of actual nitrogen per 1000 sq ft of turfgrass you would need to use a blended fertilizer product containing no more than 70% 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 lb of N. Since 100 divided by 21 equals approximately five, 5 lb of ammonium sulfate would supply 1 lb of N. Therefore, to apply the equivalent of 0.7 lb of soluble N per 1000 sq ft of turfgrass

surface, one would need to apply 3.3 lb of ammonium sulfate.

A recent revision of the Florida Urban Turfgrass Fertilization Rule stipulates that no more than 2 lbs of N per 1000 sq ft per application may be applied in the spring and summer and no more than 1 lb of N per 1000 sq ft per application may be made during the fall. The 0.7 lbs of soluble N per application rule still applies when 2 lbs of N per 1000 sq ft are applied, thus in order to make a 2 lb N per 1000 sq ft application the fertilizer mixture must contain no more than 35% water soluble N. The other 65% of the N in the mixture must be in slow or controlled release from.

Several fertilizer materials are listed in Table 4, and the rate of application for 0.7 lb of N is already calculated. For example, if using ammonium nitrate on a turfgrass, note that the table lists the rate of application at 2.0 lb of material per 1000 sq ft to apply the equivalent of 0.7 lb of N. Therefore, if you have a 5000 sq ft lawn use 10 lb 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 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 that should produce an intermediate-quality turfgrass. The high maintenance program should produce an optimum quality turfgrass with good color and growth characteristics; and the program 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 (north Florida), apply a fertilizer such as a 15-0-15 or a 24-0-12 or some equivalent (depending on level of P and K recommended by the soil test). Maintenance of established turfgrass lawns do not typically require P fertilization, thus P is not included in a typical turfgrass fertilizer. Phosphorus should only be applied when dictated by a soil test. 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

Much confusion exists 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.

Organic N fertilizers also have advantages and disadvantages as listed in Table 3. Select an 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.

## Supplemental Iron Application

Many times turfgrasses, such as centipedegrass, bahiagrass and St. Augustinegrass, turn yellow during the summer due to lack of N fertilizer. The addition of iron (Fe) to these grasses may provide the desired dark green color, but not stimulate the excessive grass growth that may follow N fertilization. Usually, iron sulfate (2 oz per 3–5 gallons of water per 1000 sq ft) or a chelated iron source are used to provide this greening effect. Turfgrass response to granular Fe has not been document except when Fe is chelated as EDTA, DTPA, or EDDHA (Carrow et al., 2001). Iron that enters the soil solution will rapidly oxidize and become unavailable for plant uptake (Shaddox et al., 2016). Therefore, granular Fe applications are not recommend unless the Fe is chelated in one of the aforementioned forms. The effect from supplemental iron application is only temporary (approximately 2–4 weeks), therefore, repeat applications are necessary for summer-long color. The greening effect of an iron application is often only temporary and does not replace the requirement of an N fertilization in the case of an N deficient turfgrass.

On high-pH (> 7.0) soils or where high-pH water is applied, yellow leaf blades may be an indication of iron

or manganese deficiency. Application of foliar or chelated sources of these micronutrients can provide a green-up in these cases. Note that iron is not a substitute for nitrogen, which provides the building blocks for turfgrass growth and is required for turf health. While both iron and nitrogen deficiencies result in turfgrass yellowing, they are distinctly different deficiencies in plants. Applying iron does not cure yellowing due to nitrogen deficiency, and iron fertilizer is not a substitute for nitrogen fertilizer. Foliar iron fertilizers, such as iron sulfate or chelated iron solutions, help cure iron deficiencies, and nitrogen fertilizers applied according to BMPs cure nitrogen deficiencies.

## References

Carrow, R.N., D.V. Waddington and P.E. Rieke. 2001. *Turfgrass soil fertility and chemical problems: assessment and management*. Ann Arbor Press, Chelsea, Mich.

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Table 1. Essential elements required by lawngrasses (Carrow et al. 2001).

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

Table 2. Possible advantages and disadvantages of inorganic nitrogen fertilizer sources.

| Inorganic Nitrogen Sources | |
|---|---|
| **Advantages** | **Disadvantages** |
| Readily available N | May 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 |

Table 3. Possible 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 |

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

| Nitrogen Fertilizers | % N | Pounds needed to supply 0.7 lb of actual N per 1000 sq ft |
|---|---|---|
| **Soluble N Sources (Inorganic)** | | |
| Ammonium Nitrate | 33.5 | 2.0 |
| Ammonium Sulfate | 21 | 3.3 |
| Calcium Nitrate | 15.5 | 4.5 |
| Potassium Nitrate | 13-0-44 | 5.3, also 2.3 lb $K_2O$ |
| Sodium Nitrate | 16 | 4.4 |
| Nitrate of Soda-Potash | 15-0-16 | 4.6, also 0.7 lb $K_2O$ |
| Monoammonium Phosphate | 11-48-0 | 6.4, also 3.0 lb $P_2O_5$ |
| Diammonium Phosphate | 18-46-0 | 3.8, also 1.8 lb $P_2O_5$ |
| **Soluble N Sources (Organic)** | | |
| Urea | 46 | 1.5 |
| Calcium Cyanamide | 21 | 3.3 |
| **Slow-Release N Sources (Synthetic)(Can apply up to 2.0 lb N/1000 sq ft)** | | |
| Urea Formaldehyde | 38 | 5.3 |
| Methylene Urea | 40 | 5.0 |
| Isobutylidene Diurea (IBDU) | 31 | 6.4 |
| Sulfur-coated Urea | 38 | 5.3 |
| Polymer-coated Urea | 42 | 4.8 |
| **Slow-Release N Sources (Natural Organics)(Can apply up to 2.0 lb N/1000 sq ft)** | | |
| Sewage Sludge | 6-2-0 | 33 |
| Cow Manure | 2-0-0 | 100 |
| Poultry Manure | 4-0-0 | 50 |
| Cottonseed Meal | 7 | 29 |
| Alfalfa Meal | 6 | 33 |
| Blood Meal | 3-22-0 | 66 |
| Processed Tankages | 5-10 (varies) | 40 to 20 |
| Garbage Tankages | 2-3 (varies) | 100 to 66 |
| **Some Commercial Sources of Potassium and Phosphorus Fertilizers** | | |
| | | **Pounds needed to supply 1.0 lb of potash or 0.25 lb phosphate per 1000 sq ft** |
| Potassium Chloride (Muriate of Potash) | 60% $K_2O$ | 1.6 |
| Potassium Sulfate | 50% $K_2O$ | 2 |
| Potassium Nitrate | 13-0-44 | 2.2, also 0.3 lb N |
| Sulfate of Potash Magnesia | 22% $K_2O$, 11% Mg, 8% S | 4.5, also 0.5 lb Mg & S |
| Concentrated Superphosphate | 46% $P_2O_5$ | 0.5 |

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** | | | | | | | | | | | | | |
| Bahiagrass | Basic | -- | -- | -- | C | -- | -- | -- | -- | C | -- | -- | -- |
| | Moderate | -- | -- | -- | C | -- | SRN | -- | -- | C | -- | -- | -- |
| | High | -- | -- | -- | C | -- | SRN | Fe | -- | C | -- | -- | -- |
| Bermudagrass | Basic | -- | -- | -- | C | -- | SRN | -- | -- | C | -- | -- | -- |
| | Moderate | -- | -- | -- | C | -- | SRN | -- | -- | C | -- | -- | -- |
| | High | -- | -- | -- | C | | SRN | Fe | -- | C | -- | -- | -- |
| Centipedegrass | Basic | -- | -- | -- | C | -- | -- | -- | -- | -- | -- | -- | -- |
| | Moderate | -- | -- | -- | C | -- | Fe | -- | -- | -- | -- | -- | -- |
| | High | -- | -- | -- | C | -- | SRN | Fe | -- | -- | -- | -- | -- |
| St. Augustinegrass | Basic | -- | -- | -- | C | -- | Fe | -- | -- | C | -- | -- | -- |
| | Moderate | -- | -- | -- | C | -- | SRN | Fe | -- | C | -- | -- | -- |
| | High | -- | -- | -- | C | -- | SRN | Fe | -- | C | -- | -- | -- |
| Zoysiagrass | Basic | -- | -- | -- | C | -- | SRN | -- | -- | -- | -- | -- | -- |
| | Moderate | -- | -- | -- | C | -- | SRN | -- | -- | N | -- | -- | -- |
| | High | -- | -- | -- | C | -- | SRN | -- | -- | C | -- | -- | -- |
| Central Florida | | | | | | | | | | | | | |
| Bahiagrass | Basic | -- | -- | C | -- | N | -- | -- | -- | C | -- | -- | -- |
| | Moderate | -- | -- | C | -- | N | -- | Fe | -- | -- | C | -- | -- |
| | High | -- | -- | C | N | -- | SRN | -- | Fe | -- | C | -- | -- |
| Bermudagrass | Basic | -- | -- | C | -- | N | -- | SRN | -- | C | -- | -- | -- |
| | Moderate | -- | -- | C | -- | N | -- | SRN | -- | SRN | -- | C | -- |
| | High | -- | -- | C | N | SRN | -- | C | Fe | SRN | -- | C | -- |
| Centipedegrass | Basic | -- | -- | C | -- | SRN | -- | -- | -- | -- | -- | -- | -- |
| | Moderate | -- | -- | C | -- | SRN | -- | -- | Fe | -- | -- | -- | -- |
| | High | -- | -- | C | -- | SRN | -- | -- | -- | C | -- | -- | -- |
| St. Augustinegrass | Basic | -- | -- | C | -- | -- | -- | Fe | -- | C | -- | -- | -- |
| | Moderate | -- | -- | C | -- | SRN | -- | Fe | SRN | -- | C | -- | -- |
| | High | -- | C | -- | N | SRN | -- | Fe | SRN | -- | C | -- | -- |
| Zoysiagrass | Basic | -- | -- | C | -- | SRN | -- | -- | -- | -- | -- | -- | -- |
| | Moderate | -- | -- | C | -- | SRN | -- | -- | -- | -- | N | -- | -- |
| | High | -- | -- | C | -- | SRN | -- | -- | -- | -- | C | -- | -- |
| South Florida | | | | | | | | | | | | | |
| Bahiagrass | Basic | -- | C | -- | -- | -- | Fe | -- | -- | -- | C | -- | -- |
| | Moderate | -- | C | -- | N | -- | Fe | -- | -- | -- | C | -- | -- |
| | High | -- | C | -- | N | -- | SRN | -- | -- | -- | C | -- | -- |
| Bermudagrass | Basic | -- | C | -- | N | -- | SRN | -- | -- | C | -- | C | -- |
| | Moderate | -- | C | N | -- | C | -- | SRN | -- | SRN | -- | C | -- |
| | High | -- | C | N | SRN | C | SRN | Fe | -- | SRN | -- | C | -- |
| Centipedegrass | Basic | -- | -- | C | -- | -- | Fe | -- | -- | -- | C | -- | -- |
| | Moderate | -- | C | -- | SRN | -- | -- | -- | -- | -- | C | -- | -- |
| | High | -- | C | -- | SRN | -- | Fe | -- | -- | -- | C | -- | -- |

| Turfgrass | Maintenance Level | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| St. Augustinegrass | Basic | -- | -- | C | -- | SRN | -- | SRN | -- | -- | C | -- | -- |
| | Moderate | -- | C | -- | N | -- | SRN | -- | SRN | -- | -- | C | -- |
| | High | -- | C | -- | N | SRN | -- | SRN | -- | SRN | -- | C | -- |
| Zoysiagrass | Basic | -- | -- | C | -- | SRN | -- | -- | -- | -- | N | -- | -- |
| | Moderate | -- | C | -- | N | -- | SRN | -- | -- | -- | N | -- | -- |
| | High | -- | C | -- | N | SRN | -- | SRN | -- | -- | -- | C | -- |

* 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 test soil.
** 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.
C = Complete fertilizer applied at 1.0 lb N/1000 sq ft containing no more than 0.7 lb soluble N.
N = Soluble N applied at no more than 0.7 lb N/1000 sq ft.
SRN = Slow-release N applied at no more than 2.0 lb N/1000 sq ft. in the spring and summer only; no more than 1.0 lb N/1000 sq ft in the fall and winter.
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 1 lb of iron sulfate per 1000 sq ft. If the soil is calcareous, use the container label recommended rate of an iron chelate.