Building A Successful Fertilizer Program

By John Wildmon

Building a fertilizer program involves answering two basic questions: How much fertilizer do I apply and at what intervals? Although the questions are simple enough, the answers are somewhat more complex and must take into account a number of factors that influence the plant's nutritional needs.

A yearly fertilizer program is a necessary planning tool and can be created by utilizing information about the climate in a particular area. However, any scheduled fertilization should remain flexible enough to change when weather and other variables affect the needs of the turfgrass. In other words, the best fertilizer program also includes an ongoing process of monitoring and adjusting for changing plant needs.

Selecting specific fertilization dates and amounts must take into account factors such as climate, species of turfgrass, soil type, level of use of the turfgrass, expected quality, and release characteristics of the fertilizer. Successful monitoring requires that the turf manager be familiar with the release characteristics of the fertilizer, know where to look for the response, and be familiar with nutrient deficiency symptoms. Soil testing and tissue analysis are also useful tools.

Fertilizer needs increase as growth rate increases. Climate and species interact to determine turfgrass growth rates. Cool season grasses grow fastest in the spring and fall and need heavy fertilization in these seasons. Summer brings partial dormancy and heavy fertilization should be avoided. Warm season grasses, however, grow fastest in the summer and may require two or more fertilizer applications during that period. Most managers also fertilize in early spring after the last frost, both on cool and warm season grasses to help break winter dormancy and aid in recovery from winter damage. Additionally, late fall fertilization is gaining popularity as a means of improving winter hardiness and aiding in spring recovery.

Turfgrass species vary considerably in the quantity of fertilizer they require. High-fertility species such as bermudagrass and creeping bentgrass might require as much as one pound of nitrogen per 1,000 square feet per growing month, in high-maintenance conditions. Low-fertility species such as tall fescue or bahiagrass may require as little as 0.2 pound of nitrogen per 1,000 square feet. Keep in mind any fertilization guideline may need adjusting for specific conditions.

Guidelines for N Rates

lbs N/1000 ft sq per growing month	Species	
0.5 to 1.2	bermudagrass St. Augustinegrass	creeping bentgrass colonial bentgrass
0.3 to 0.6	zoysiagrass centipedegrass	Ky. bluegrass perennial ryegrass
0.2 to 0.4	bahiagrass carpetgrass	tall fescuegrass fine fescuegrass

Turfgrass requirements for other nutrients will be related to nitrogen rate and soil conditions. In general, rates for potassium should be approximately equal to nitrogen, while phosphorus, magnesium, and sulfur should be applied at one-quarter to one-half the nitrogen rate. Annual or semi-annual applications of micronutrients, especially in iron and manganese, will typically avoid micronutrient problems. However, some situations such as high pH soils, cold soils, or overseeding may require frequent foliar applications and/or the use of chelates. Care should be taken to avoid over-application of micronutrients, since many of them are toxic at higher concentrations.

Soil type has a dramatic effect on fertilizer rate and frequency of application. Finer-textured soils such as clays and loams have higher cation exchange capacities (CEC), consequently, they require less frequent fertilization. Conversely, coarse textured soils such as sands have low CECs and require more frequent fertilization.

Soil type may interact with other factors to affect fertilizer programs. For example, sands are much more susceptible to leaching during periods of heavy rainfall than loams or clays. Sands are frequently used for sports turf applications, such as USGA sand-spec greens and Prescription Athletic Turf (PAT) systems because of their drainage characteristics and compaction resistance. Fertility requirements for such areas will be considerably higher than adjacent turfgrasses growing on finer textured soils.

Sports turf also tends to be unique because of the high use and exceptional quality which are typically required. Excessive wear and the need for speedy recovery may necessitate additional fertilizer applications. Sports turf managers often face situations that involve high-fertility grass species, which are grown on low CEC soils, receive heavy or excessive use, and are expected to be high-quality and dense. This often involves the use of slow-release fertilizers. Fertilizer scheduling must account for the release characteristics of these products.

Time Frame

Fertilizer materials can be divided into two groups: quick-release materials (i.e. water soluble), and slow-release materials. Quick-release materials will provide an immediate response, but generally last only four to eight weeks. Slow-release materials typically will not give an acceptable initial response; however, they will begin releasing in three to six weeks and last 12 to 16 weeks. The time frame for fertilizer responses will be shortened by conditions of heavy growth, high temperature, heavy rainfall, and leachable soils. Knowledge of the release characteristics for various fertilizer materials is essential for evaluating plant responses to fertilizer.

Release Catagory for Selected Fertilizers

Quick Release Sources	Slow Release Sources
ammonium nitrate	urea formaldehyde
ammonium sulfate	IBDU
DAP, MAP	sulfur coated materials
potassium nitrate	PVC & resin coated materials
urea	sewage sludge

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Fertilizer Program

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It is also necessary to know where to look for the response if you are going to accurately evaluate a fertility program. For example, if you applied phosphorus and waited for a color response, you would probably be disappointed. Several parameters such as color, shoot growth, root growth, tolerance to various environmental stresses, recuperative capacity, and disease resistance are affected by plant nutrition. Generally, turfgrasses will respond to increasing quantities of nutrient up to a point of sufficiency. Increasing applications of a nutrient beyond the sufficiency point will not give any additional positive plant response and may actually be detrimental.

A large part of managing turf nutrition is obtaining the equipment that is accurate and efficient.

Expected Response to Selected Nutrients

	Parameter			
	Color	Shoot growth	Rooting	Stress Tolerance
nitrogen	+	+/-	+/-	-
phosphorus			+	+
potassium	+		+	+/-
magnesium	+	+		
iron	+		+	+

+ parameter increases with increasing quantities up to the sufficiency point
- parameter decreases with increasing quantities beyond the sufficiency point
+/- parameter increases with increasing quantities up to the sufficiency point then decreases beyond the sufficiency point

Selecting specific fertilization dates and amounts must take into account factors such as climate, species of turfgrass, soil type, level of use of the turfgrass, expected quality, and release characteristics of the fertilizer.

Plants that are well below the sufficiency level in terms of nutrition for one or more elements will typically exhibit deficiency symptoms. These visible symptoms can be useful in diagnosing fertility problems. However, care must be taken to correctly identify what caused the deficiency. Even with adequate nutrient levels in the soil other root problems, such as diseases, compacted or saturated conditions, nematodes, and more, can reduce nutrient uptake and cause deficiency symptoms to occur.

Soil testing has been around for approximately 50 years, yet little correlation data is available concerning turfgrass fertility. This makes predicting specific fertilizer quantities from soil test results a dubious practice at best. However, soil test results can be valuable for monitoring fertility trends such as gradual build-up or loss of a particular element. Be sure to stick with same lab. Changing labs may result in a different extractant being used in the test leading to results that have no relative value when compared to previous test results. Soil test results are probably most useful when used in conjunction with tissue analysis.

Nutrient Deficiency Symptoms

nitrogen	Turfgrass initially exhibits light green color and reduced growth, left untreated progresses to a general chlorosis of the older leaves first, followed by severe stunting, thinning and general chlorosis of all leaves
potassium	Turfgrass initially exhibits less wilt resistance and some chlorosis may occur, left untreated progresses to reddish scorch of leaf margins and tip, leaf necrosis, turfgrass may take on a stemy appearance
phosphorus	Turfgrass initially appears darker green and slightly stunted, left untreated older leaves take on purple color gradually progressing to newer leaves
Magnesium	Turfgrass initially exhibits lighter green color and some growth reductions, left untreated warm season grasses develop general chlorosis of the older leaves first and some stunting. Cool season grasses will develop cherry red color in older leaves, color may be general and/or blotchy
iron & manganese	Turfgrass develops interveinal chlorosis of the new leaves first, progressing to older leaves and general chlorosis, some stunting occurs

Tissue analysis is a relatively recent tool available to the turfgrass manager. Interpretation of tissue analysis data is becoming more refined every year. Tissue analysis can be an excellent management tool and may also be a very useful diagnostic tool. Nutrient levels need to be within a fairly narrow range in the new leaves or deficiencies or toxicities can occur. Using tissue analysis to monitor fertility is similar to the use of deficiency symptoms in one respect — it only reveals tissue levels of elements. It does not tell you how the plant got that way. Various problems in the root zone will affect nutrient uptake. Consequently, deficiencies in the tissue may only be a symptom of some other problem in the root zone, not low fertility.

General Sufficiency Ranges in Turfgrass Tissue**

% dry weight new leaves	
nitrogen	3.5-5.0
phosphorus	0.3-0.6
potassium	2.0-4.0
ppm new leaves	
iron	50-300
manganese	25-250

** more precise values for your area and conditions may be available through local extension agent or university

A successful fertilizer program will make other aspects of turfgrass management easier. Remember to keep your fertilization schedule flexible to account for changing conditions. Monitor turfgrass on a regular basis and make appropriate adjustments in your program. Lack of response to applied fertilizer or deficiency in the tissue may only be symptoms of other problems in the root zone. ❑

Editor's Note: John Wildmon is an instructor at Lake City Community College in Lake City, FL. This is his second article for sportsTURF.