Fertilizing Economically

Soil condition, environmental conditions, management program and turfgrass requirements are as important as cost per unit of fertilizer.

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When discussing the economics of a fertilizer program, we usually spend most of our time talking about cost per unit of fertilizer. While this is an important point, there are several other factors which affect the economics of your fertilizer program. Factors such as soil condition, environmental conditions, management program, turfgrass requirement, etc., will all have a large effect on how efficiently your fertilizer is being used. This is one of the major points I would like to cover — getting the most efficient use of the fertilizer applied. Learning to combine the best buy cost wise along with maximum efficiency is what every turf manager should strive for.

The chemical, physical, and available nutrient level of the soil in which the turfgrass is grown will have a large effect on your fertilizer program. Of the soil chemical factors, soil pH (soil reaction) will play a big role in how efficiently the applied fertilizer is being used by the plants. Soil pH is a term used to express the acidity or alkalinity of the soil. A pH of 7.0 is considered neutral, while anything below 7.0 acid and anything above 7.0 alkaline. Soil pH is expressed in logarithms. What this means is that a pH of 6.0 is ten times as acid as a pH of 7.0 and pH of 5.0 is one hundred times as acid as a pH of 7.0. This is why it is so important that the pH is not allowed to become highly acidic. At this point, it takes considerably more time and limestone to neutralize the soil. (Amount of lime applied to adjust pH should always be based on results of soil tests. Most states have facilities for conducting these tests.)

Acidic or alkaline soil conditions affect nutrient uptake in many ways. Under acidic soil conditions, much of the phosphorus in the soil is unavailable for plant use. The phosphorus ion forms highly insoluble complexes with iron and aluminum ion which cannot be absorbed by the plant. Root growth, especially root hairs, is greatly limited under acidic conditions. This reduces the amount of roots for nutrient uptake. Acid soils leads to thatch build-up. Activity of microorganisms which break down thatch is reduced under acid soil conditions.

Under both alkaline and acid soil conditions, the activity of soil microorganisms which are involved in nitrification, ammonification, nitrogen fixation, and other nutrient transformations are reduced. This includes release of nitrogen from ureaformaldehyde as well as the organic complexes in the soil.

A good means of illustrating the effect of soil pH on fertilizer efficiency is the following example: At a pH of 5.0, 33% of N-P-K in a complete fertilizer is not available for plant use. At a cost of $180 per ton for the complete fertilizer, 33% of the money spent or $59 per ton is wasted. By simply maintaining the soil pH at correct level, this waste can be greatly reduced.

Physical condition of the soil will also have an effect on nutrient absorption by the turfgrass. Root growth is restricted under soil compaction. Some nutrients, especially phosphorus, are very immobile in the soil. Roots have to intercept these ions and with restricted root growth, chances of intercepting a phosphorus ions is reduced.

Waterlogged and/or compacted soils reduce plant respiration. Nutrient uptake is an energy process and plant respiration is necessary to produce the energy required for nutrient uptake. Therefore, under waterlogged or compacted soil conditions, efficiency of fertilizer use is reduced because of restricted root growth and reduced plant respiration. Provision for proper soil drainage and good cultivation practices (aerification) can thus help to increase efficient use of applied fertilizer.

Another means for more efficient use of fertilizers is by selecting the proper fertilizer analysis for your area. The fertility level for N-P-K will vary for different soils. Research has found that more turfgrass plants used on golf courses grow best at N-P-K ratio of 3-1-2 to 4-1-2. Application of supplemental nutrients should be based on supplying this ratio to the plants. Also, if soil tests indicate high to very high

levels of phosphorus and potassium on those areas where clippings are not removed, then nitrogen only may be applied. Thus by determining soil fertility level through soil tests, a turf manager may be able to save money on purchase of his fertilizers. All fertility programs should be based on results of soil tests. The difference in cost for supplying 4.0 lbs. per 1,000 sq. ft. on fairways for 18 hole golf course using ammonium nitrate vs. 18-18-18 at present prices is approximately $1,300. If soil levels of phosphorus and potassium are high, this money could be saved or diverted to another project.

A turf manager should be aware of the different types of fertilizer carriers available and how they work. This is especially true for the three nitrogen carriers. These carriers work differently and to obtain the most efficient use of them, a turf manager must be aware of their characteristics.

First class of nitrogen carrier is the inorganic nitrogen carriers. Two examples of this type of fertilizer are ammonium nitrate and ammonium sulfate.

Important characteristics of this type nitrogen carrier are: (a) high water solubility, (b) rapid response, (c) high foliar burn potential, (d) short response, and (e) less cost per unit N.

Application of large amounts of these fertilizers should be avoided on soils high in sand content. This could lead to a high degree of leaching. However, under most fairway conditions, loss of nitrogen due to leaching is reduced considerably. Also, application of these fertilizers should be avoided when leaves are wet or on hot humid days. These fertilizers should always be watered in thoroughly after application to reduce the chance of foliar burn.

Due to the short response period, lighter and more frequent applications of these fertilizers will be required. While labor costs will be higher for these type nitrogen fertilizers (more applications), the lower cost per unit N will more than offset this difference. The difference between ureaformaldehyde vs. ammonium nitrate at 4.0 lbs. per 1,000 sq. ft. on bermudagrass fairways for 18 hole golf course is approximately $3,000. Research has shown that with proper application of ammonium nitrate the same quality turf can be grown with the synthetic organic or natural organic fertilizers.

The second source of nitrogen carriers used on turf is the natural organic nitrogen carriers. Activated sewage sludge is an example of this type of carrier. Some of its characteristics are: (a) dependence on soil temperature, (b) low water solubility, (c) medium release, and (d) higher cost per unit of N.

These fertilizers need a soil temperature above 55° for soil microorganism activity to break down organic complex and release the nitrogen. In early spring when Bermudagrass needs nitrogen for early growth, release of nitrogen from these fertilizers is very slow due to reduced microorganism activity in the soil. These soil microorganism are most active at 90°.

With the low water solubility and reduced foliar burn potential, larger amounts of fertilizer can be applied per application. The response period for these fertilizers is intermediate between the inorganic carriers and the synthetic organic carriers. However, under high soil temperatures, nitrogen can be released at a fairly high rate by some of the natural organic carriers. Over application of these materials in summer months could lead to excess growth problems.

The third class of nitrogen carriers used on turf is the synthetic organic nitrogen carriers. There are basically two kinds: (a) primarily water-soluble, and (b) primarily water-insoluble. An example of water soluble synthetic organic nitrogen carrier is urea. This carrier reacts much like the synthetic inorganic nitrogen carrier. Ureaformaldehyde and IBDU are examples of the primarily water insoluble carrier. These compounds are considered slow release nitrogen sources.

Fertilizers containing ureaformaldehyde and IBDU are what we often refer to as specialized fertilizers for use in high maintenance turf. These fertilizers were developed after many years of research and offer several advantages. Some of these advantages are: (a) reduced risk of foliar burn, (b) better spreadability, (c) less fire hazard, and (d) longer residual response. While the cost per unit N is much higher for these fertilizers, advantages listed above must be taken into consideration when selecting a fertilizer.

Release of nitrogen from IBDU and ureaformaldehyde is different and the turf manager should be aware of this difference. Ureaformaldehyde is dependent upon soil microorganism activity for release of nitrogen while IBDU is dependent upon a water hydrolysis reaction and is not as dependent upon soil temperature. This means that IBDU will be released in cold as well as warm temperatures while ureaformaldehyde will only be released during warm weather, soil temperature above 55°.

Another important characteristic for the ureaformaldehyde's is that the effective use of these fertilizers is dependent upon the buildup of relatively large reserves of insoluble nitrogen in the soil. To get maximum use of these fertilizers may require several years of application.

Selecting the proper fertilizer for use will depend on several factors. Turfgrass quality desired, environmental conditons, cost, cultural practices, and growth rate desired will all influence the turf manager's choice. He must be aware of the different characteristics for fertilizer carriers in order to obtain maximum efficiency from his applications. In most cases, more than one type of nitrogen carrier is used. Maximum fertilizer efficiency will depend on using the proper fertilizer carrier, at the correct rate, and when needed by the plants. As one can visualize, this is not an easy task.

Listed below are three important factors for providing a sound, economical fertilizer program:

(1) Provision of good chemical and soil conditions for proper nutrient uptake by plants.
(2) Awareness of the different fertilizer carriers and how to use them properly.
(3) Applying supplemental fertilizer at the correct ratio, rate and time. □