Fertilization Practices and Quality Turf

Twenty-one day root growth of Kentucky bluegrass sod transplanted in window boxes in April 1 from a late fall-winter nitrogen fertilization experiment. Nitrogen (ammonium nitrate) amounts applied from left to right: 1, none; 2, one pound of N/1000 sq. ft. in October, December, and February; 3, two pounds of N/1000 sq. ft. in October, November, December, January, and February.

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Plants need 16 other elements in addition to carbon, hydrogen and oxygen, which are supplied by air and water. The other necessary elements are: nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, copper, zinc, boron, molybdenum, sodium, chlorine, silica, and vanadium. The first six (nitrogen, phosphorus, potassium, calcium, magnesium and sulphur) are needed by the plant in relatively large amounts and are referred to as macro-nutrients.

Micro-nutrient turfgrass deficiencies (i.e., the last 10 elements mentioned) are not now considered the cause of the majority of nutritional problems. Generally, sufficient micro-nutrients are supplied to the turf from rain, irrigation water, fertilizer carriers, lime and natural weathering of the soil. However, in some areas micro-nutrient deficiencies are being reported, and many fertilizer companies now supply speciality fertilizers containing micro-nutrients.

Since the majority of turf nutritional deficiencies are associated with the major elements, it is wise to insure that adequate and proper major elements are available to the grass plant. The word *proper* should be emphasized here. Although the grasses tolerate "imbalance" of the elements, the grasses function and produce better turf with properly balanced nutrients. Also the nutrition availability and season interaction must be considered for proper fertilization.

Soil Tests

Two methods that aid in determining nutrient status for plant growth are soil tests and tissue analysis. The soil test is most widely used. Generally the soil testing service provides the pH status and calcium, magnesium, phosphorus, and potassium content of the soil. From the information along with the knowledge of the soil type, species of grass and turf usage, a fertilizer recommendation can be made.

Although grass species differ in their tolerance to acidity, all grasses do best at about a pH of 6.5. Soils receiving more than 20 inches annual rainfall generally become acid; therefore, lime is used to correct acidity.

Liming

Three factors to consider in determining the amount of lime to be applied to turf are: 1) kind of lime to be used; 2) type of soil; and 3) the soil pH. The neutralizing power of lime is based on its calcium or magnesium content. Seventy-five pounds of hydrated lime and 56 pounds of burned lime have the same neutralizing power as 100 pounds of pure limestone. Burned lime is seldom used because of its caustic properties. A dolomitic limestone ground so that at least one-half passes a 100 mesh screen and all pass a 10 mesh screen is preferred because it will provide calcium as well as magnesium.

As a general rule of thumb, it takes about 100 pounds of finely ground limestone per 1,000 square feet to raise one pH unit of a loam soil. Clay soil types will take about one quarter more, and sandy soil one quarter less.

Phosphorus and Potassium

Soil tests show that mature turf soil tends to build up in phosphorus and decline in potassium. The opposite is true of newly established turf. This is because phosphorus is readily fixed in the soil and potassium is soluble and leaches especially in light or sandy soils such as the modified topsoil of greens. A wise turf manager uses a soil test to diagnose and properly supply phosphorus and potash. Medium to high levels of phosphorus and potash should be maintained. Late summer or early fall is the best time to take the soil samples.

Nitrogen

Soil tests for nitrogen are not satisfactory for making turf fertilizer recommendations. Rather, nitrogen recommended fertilization rates and schedules are based on field experiments. Nitrogen recommendations are based on the following:

1. Type of nitrogen source to be used.
2. Type of grass to be used.
3. Anticipated usage of the turf.

Nitrogen sources can be classified into four groups:

1. **The inorganic quickly available.** Usually the least expensive. Soluble but caustic. Must be applied frequently at low rates and often must be watered in to prevent burn.

2. **The organics.** Expensive, but slowly available and not caustic. Higher rates than the quickly available may be applied at one time.

3. **The ureaformaldehydes.** Also expensive, very slowly available, not caustic, but dependent upon microbial activity and warm temperature for the N to become available to the plant. These materials provide only small amounts of nitrogen to the plant during the winter and need to be supplemented on greens.

4. **Synthetics.** Many new types of nitrogen sources are being tested. They have different modes of nitrogen release. Most fall between the availability of the quickly available and the ureaformaldehydes.

No source of nitrogen is better than the other if managed properly. Many turf managers use a combination of several sources.

Recommended yearly rates of nitrogen vary from two pounds for general utility turf to as much as 12 pounds on high quality putting green turf. It is not the intent that fertilizer recommendations for all types of turf be given in this paper. (Consultations with the local agricultural agent, the state agricultural experiment station or USGA Green Section representative are suggested for this information.)

Different Grasses — Different Management

Timing of nitrogen applications vary with the species. Warm and cool season grass species differ in their season growth habits. Therefore, it seems reasonable that growth stimulation due to fertilization should also differ for the two types of grasses.

Cool season grasses naturally increase in food reserves (carbohydrates) during fall and winter. During the flush growth of spring these food reserves are utilized to a large extent. It's not until the next fall that food reserves can be built back up again. Consequently, not much stored energy can produce summer growth.

Root growth follows the food reserve cycle. That is, most root development occurs during the winter and early spring.

Our recent data show that, under Virginia conditions, supplying adequate nitrogen nutrition to the cool season grass during periods of natural carbohydrate build-up enhances the plants' appearance and vigor.

Nitrogen applications made during the fall and winter increase carbohydrates, create green color and produce more roots. This vigor is carried through the summer.

Nitrogen applications made immediately prior to or during the spring flush growth stimulate excess top growth, reduce carbohydrates and root development. If nitrogen is needed, it is best to wait until the spring flush growth has ceased.

Heavy summer applications of nitrogen cause loss of carbohydrates and reduce the turf vigor and should be avoided.

Warm season grasses also benefit when nitrogen fertilization is applied concurrently with the natural carbohydrate development. The warm season grasses differ from the cool season grasses in that they develop their carbohydrates during the summer months. Recent work in North Carolina indicates that relatively high fall nitrogen rates can be beneficial to bermudagrass if phosphorus and potash rates are also high.

Our observations in Virginia show that heavy nitrogen fertilization of overseeded cool season grasses growing on dormant bermudagrass does not reduce the vigor of the bermudagrass the following spring.