quirements and optimum timing of application. The inability to correctly identify turfgrass species can lead to misapplications of nitrogen. What follows are numerous pest and environmental stress problems. The most common example would be differences in optimum timing of application for warm- versus cool-season grass species. Late spring through early fall is generally optimum for the former; late summer and fall generally being ideal for the latter.

Ideal rates of application vary tremendously among the species, even within the cool- and warm-season grass species. Thus, the first factor that must be considered in developing any program is the predominant (or desired) turfgrass species.

In a mixture of species, you can shift populations over a period of years towards a desired species simply by manipulating the nitrogen program.

Application rates

Over the years, standardized nitrogen application rates have become widespread for the different turfgrass species. They are commonly used without much thought. These standardized rates are an averaging of rates found to produce acceptable turf over a wide range of conditions.

For the good turfgrass manager however, these rates only provide a rough guideline. They must be adjusted, sometimes dramatically, for local conditions.

For example, turf grown on excessively sandy soils, particularly those that recieve heavy irrigation, may need more nitrogen than the standardized rates. Turf stands which are heavily used and need greater than normal recuperative rates, such as athletic fields, may also need more nitrogen. However, where limited budgets may restrict mowing to infrequent intervals, reduced nitrogen rates would be advisable to prevent too much tissue removal and potential turf scalping.

Application timing

Perhaps no greater mistake is made by homeowners than nitrogen applications during the wrong time of year. Unfortunately, this type of mistake is not limited to homeowners. It is commonly made by turfgrass professionals as well, often due to the economics and demands of business rather than to a lack of agronomic knowledge. The results in either case can be devastating.

A common example of the economics versus agronomics problem occurs in the spring fertilization of cool-season grasses in the transition zone. Spring applications in excess of 1 pound of nitrogen per 1,000 square feet can cause disease and summer stress problems in many situations. But the demand for increased dark green color (particularly in comparison to their neighbors) often leads to excessively high nitrogen rates for this time of the year. Turf loss or failures later in the year are often the result of this problem (although the reduced quality is usually blamed on other factors).

As the above example suggests, the problems of timing of application are usually related to the rate. Whereas small applications of nitrogen (1/8 to 1/4 pound per 1,000 square feet) usually cause no problem and are generally

Other factors to consider when selecting a nitrogen source

When choosing a nitrogen source, it is important to contact local turfgrass researchers and extension specialists. They can help determine which nitrogen sources have performed best in your geographic location. However, you must not only consider cost and general performance.

Although several different nitrogen sources may produce excellent results, the application program (timing of application, number of applications, etc.) to produce favorable results can vary dramatically for these nitrogen sources both within a region and among regions throughout the country. Consider the following:

Soil Type. The soil upon which turf is growing can substanially alter the nitrogen program needed to produce acceptable turf. Soil influences the breakdown rate of fertilizers, the leaching rate of nitrogen, and the growth rate of turfgrass and thus its annual nitrogen requirement.

The most obvious example is a soil containing substanial amounts of sand. The soil's retentive capacity for nitrogen is reduced and the leaching rate of nitrogen is increased. Thus, the annual nitrogen requirement is usually higher on these sites. More frequent applications at lower rates per application must be used to meet the needs and conditions on these soils.

Management practices. General management practices should be considered as affecting the optimum nitrogen program for the site.

Heavy irrigation will usually require that somewhat higher annual nitrogen rates be used due to leaching losses and higher turfgrass growth rates. When turfgrass clippings are removed, you are in effect also removing nitrogen from the site. Thus, annual nitrogen rates in the long term will need to be somewhat higher. Also, if pesticide applications are not available for a site or you are trying to minimize their use, it is important to adjust your nitrogen program, particularly timing of application. This will minimize potential disease and weed problems that regularly occur or can be expected to occur.

Special Problems. A good turfgrass manager will anticipate problems and will record problems that tend to reappear on a site on a regular basis. He then should adjust the nitrogen program accordingly to minimize these problems.

Diseases are typical of these recurring type problems. For example, if serious snow mold problems regularly occur on a turfgrass stand being maintained, late fall applications of nitrogen should probably be avoided, even though these applications are generally considered beneficial in most situations.

Another example is brown patch problems that recur every year on tall fescue or perennial ryegrass. Late spring applications of more than 1/2 lb. of nitrogen per 1,000 ft. should be avoided to help reduce the severity of disease incidence.

—*Tom Turner, Ph.D.* □