"Give It What It Needs"

'Nitrogen Sources for Turf' by Dr. James A. Murphy and Pedro Perdomo[1]

A sound nitrogen fertility program is needed to maintain the desired quality and function of a turf. Of all the cultural inputs, nitrogen is preceded only by water in the amount required by the turf. Not only is the amount of nitrogen applied important, but the timing of the application is also critical. A well-timed nitrogen fertilization may help alleviate damage from diseases such as dollar spot or red thread. Pythium blight and brown patch, however, may be stimulated by the application of nitrogen during hot, humid weather. Research continues to show that nitrogen source and form can play a significant role in the management of stresses afflicting turf. Understanding how nitrogen sources influence the amount and timing of nitrogen release is crucial to the development of a sound fertility program.

Quickly and Slowly Available Nitrogen Sources

Two broad classes of nitrogen fertilizer are the quickly available and the slowly available nitrogen sources. Quickly available nitrogen sources fit into three categories: inorganic salts, urea, and ureaformaldehyde products. These water soluble forms of nitrogen are taken up rapidly by a healthy and vigorously growing turf. Inorganic salts are materials such as ammonium sulfate, ammonium nitrate, ammonium phosphates, calcium nitrate, and potassium nitrate. Urea is a compound containing organic nitrogen. Methylol-ureas are short-chain precursors to methylene ureas and are formed by the combination of urea and formaldehyde. Although methylol-ureas are included among the quickly available nitrogen sources, they are not as readily available as urea.

Compared to the quickly available nitrogen sources, slowly available sources have lower water solubility, a lower salt index, and when applied, result in a slower initial turf green-up with a longer duration. Slow green-up and longer color retention of turf occur when using slowly available nitrogen sources because the plant available nitrogen is released over a longer period of time. When using slowly available nitrogen sources, consider the physical and/or biological processes involved in releasing plant available nitrogen to the turf. It is important to understand these processes so that the growth responses expected from a nitrogen fertilizer are realistic.

Slowly available nitrogen fertilizers are formulated as either water insoluble nitrogen compounds or as encapsulated, water soluble nitrogen sources. Water insoluble organic nitrogen fertilizers can be derived from either natural organic or synthetic organic materials.

Natural Organic Nitrogen Sources

Prior to 1950, natural organic materials were the only form of slow release nitrogen fertilizers available for use on turf and other agricultural crops. Materials such as animal manures, bone meal, dried blood, waste from the food industry, activated sewage sludge, soybean meal, and cotton seed meal are used as components of natural organic fertilizers. Each component has a distinct rate of nitrogen release due to differences in the complexity of organic nitrogen containing compounds within each material.

Non-leguminous plants, such as turfgrasses, can only utilize the mineral forms of nitrogen, which are nitrate- and ammonium-nitrogen. Natural organic nitrogen sources must be mineralized, or converted from an organic nitrogen compound to a mineral form of nitrogen, before plants can utilize the nitrogen contained in these sources. To mineralize natural organic fertilizers, soil microbial activity is required. Factors such as pH, temperature, and moisture influence the activity of soil microorganisms. A soil pH between 6 and 7 is generally considered optimal for the mineralization of organic fertilizers by microorganisms. Microbial activity is reduced when cold soil temperatures predominate. The application of organic nitrogen fertilizer during the cool weather of early spring and late fall, therefore, will not result in a rapid green-up response. Deficient and excessive soil moisture will also inhibit microbial activity. Soil moisture levels at field capacity and slightly below are considered ideal for microbial activity.

Synthetic Organic Fertilizers

Ureaformaldehyde reaction products and IBDU are two widely-used synthetic organic nitrogen sources. Methylene ureas (also known as UF or ureaform) are formed by the reaction of formaldehyde with urea. Methylene urea polymers formed by this process can be short- or long-chain compounds. The length or size of these polymers influences the speed with which the nitrogen is supplied to the turf. Larger size polymers release plant available nitrogen more slowly than small size polymers. Methylene ureas require microbial activity to release mineral nitrogen (mineralization); therefore, the growth response will be limited when microbial activity is low. Nitrogen release from methylene urea is slowed during the cool weather of spring and fall. Low soil pH and moisture content may also reduce the effectiveness of methylene urea fertilizers.▲

Isobutylidene diurea (IBDU) is another synthetic organic fertilizer, and it is formed by the reaction of urea with isobulybuteraldahyde under pressure and heat. In contrast to methylene urea, nitrogen release from IBDU is independent of

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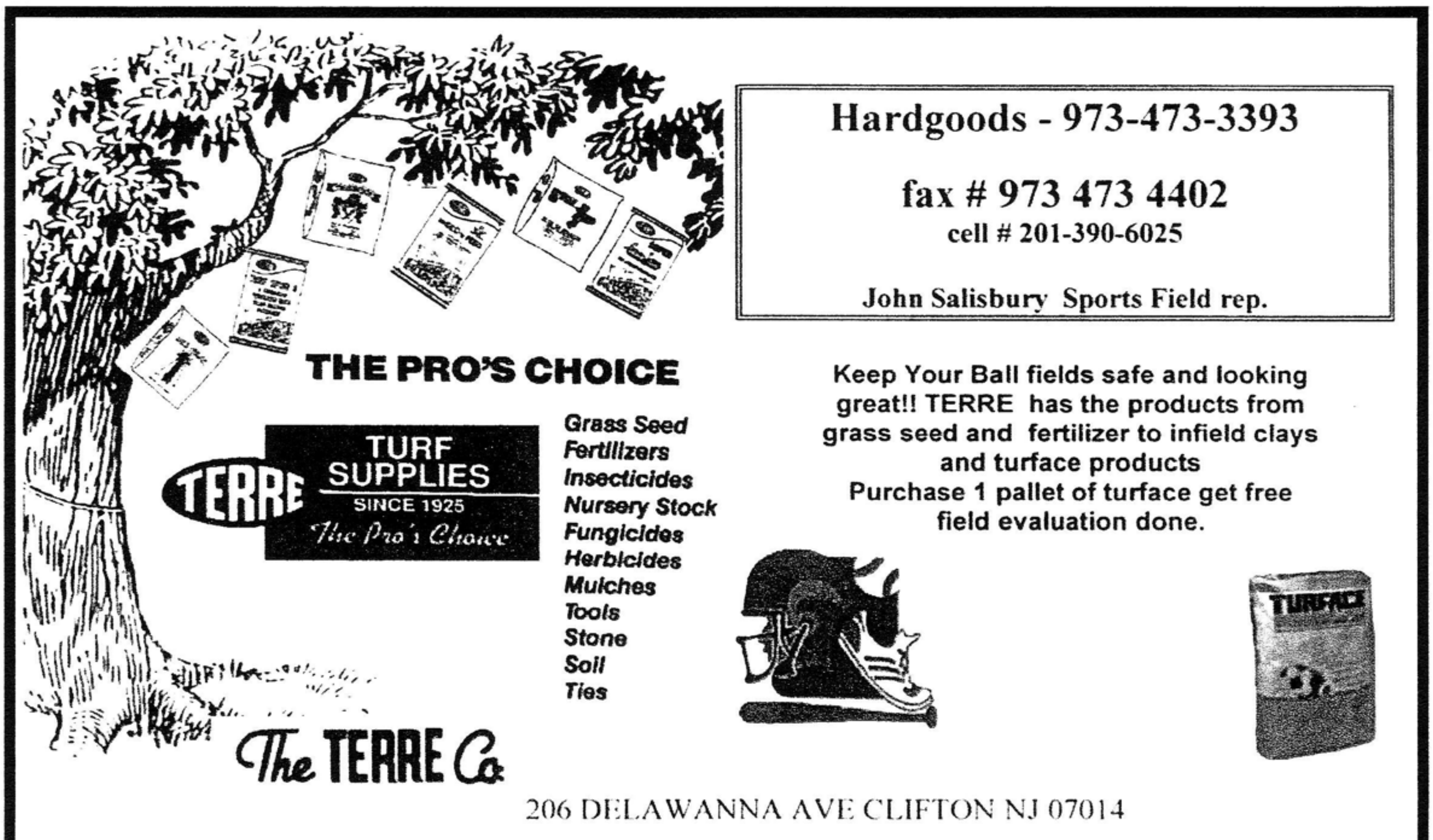
microbial activity; however, its release is influenced by temperature, moisture, particle size, and soil pH. Moisture and particle size are typically the dominating factors influencing nitrogen release from IBDU because nitrogen release is the result of hydrolysis of IBDU to urea. Wetter soil conditions and a finer fertilizer particle size increase the release rate of plant available nitrogen from IBDU. Thatchy turfs often respond more slowly to IBDU than turfs with little thatch. Thatch inhibits IBDU granules from reaching the soil surface where the granules are more easily hydrated and dissolved. Good low temperature response from IBDU can be expected because the release of nitrogen is independent of microbial activity. Release of nitrogen from IBDU can be inhibited as soil pH approaches and exceeds 7.

Coated Nitrogen Sources

Coated nitrogen sources consist of a water soluble nitrogen source, such as urea, encapsulated within a coating that is impermeable or semi-permeable to water. The coating inhibits wetting of the water soluble urea, delaying the release of nitrogen. The two principal types of coated fertilizer are sulfur-coated and resin-coated fertilizers. Resin-coated materials are also referred to as plastic- or polymer-coated products.

Sulfur-coated urea (SCU) relies on a sulfur coating around a prill of urea to create a barrier to water. Water must penetrate the sulfur coat through pinholes or cracks in the coating before the urea prill can be dissolved. Once dissolved, urea will either diffuse out through pinholes, or will more rapidly leak out through the larger cracks in the sulfur coating. Conditioners and sealants are commonly used on sulfur-coated material to minimize the effects of cracks on nitrogen release.

The process of nitrogen release from resin-coated urea is different than that of sulfur-coated urea. The resin-coated fertilizer pellet swells upon diffusion of water across the resin coat and into the pellet. Dissolved urea then diffuses back out through the resin coating, or the swelling pressure causes the pellet to crack open and release urea. Resin-coated materials have fewer flaws compared to the numerous cracks found in sulfur-coated products. The greater integrity of resin-coated materials provides a more predictable nitrogen release. Urea release from resin-coated urea is affected by the coating thickness, prill size, soil temperature, and moisture. A thicker resin coating and larger prill size will decrease the rate of nitrogen release, thus slowing nitrogen availability. Temperature increases the release of nitrogen from resin-coated products because the rate of diffusion increases with temperature. Moisture is needed for diffusion to proceed; dry conditions following fertilization, therefore, will delay the release of nitrogen from a resin-coated urea. Resin-coated ureas are typically blended with uncoated urea to improve initial green-up and growth responses. Cont. next page.



Recently, materials combining sulfur-coating and resin-coating technology have been marketed. The resin coating of this sulfur/resin-coated material is much thinner than a typical resin-coated urea and acts primarily as a sealant over the sulfur coat. The resin sealant reduces the rapid release of urea that can occur when cracks or flaws are present in the sulfur coat.

Nitrification and Urease Inhibitors

Nitrification and urease inhibitors modify nitrogen transformation processes in the soil and are intended to maintain nitrogen in a form that minimizes leaching and volatilization losses, thus improving the efficiency of nitrogen fertilizers. Nitrification inhibitors inhibit the conversion of ammonium-nitrogen in the soil to nitrate-nitrogen. This is useful because nitrate-nitrogen is susceptible to leaching, whereas ammonium-nitrogen is retained by the soil. Two products that inhibit nitrification, N-Serve (nitrapyrin) and DCD (dicyandiamide), have been studied on turf. N-Serve has not been effective on turf systems most likely because the compound is highly volatile. Although DCD is a low volatility nitrification inhibitor, most research indicates that its effectiveness on turf is also limited.

Following application, urea should be carried into the soil by thorough irrigation or by rainfall. Otherwise, surface-applied urea will hydrolyze and release ammonia to the atmosphere. Research has shown that up to half of surface-applied urea can be lost in this manner. Initial research has shown that urease inhibitors can be effective in reducing this type of nitrogen loss. Phenylphosphorodiamidate (PPD) and N-butyl phosphorothiaic triamid (NBPT) are two urease inhibitors shown to be effective in reducing ammonia volatilization losses from urea fertilizer.▲

DID YOU KNOW? Rutgers is *"plotting"* to develop higher quality turf. Check out the turf research plots. Come see the finest programs in the nation. Visit Rutgers Landscape Research Turf Field Day on July 31st. It's not only for Landscapers. Sports Field Managers can enhance their knowledge too. SEE CALENDAR on page 8.

Always Consider the Environment

by Jim Hermann

As students of the turf industry we try to read as many articles as we can find on the subject of turf management. We use the information we receive from these articles to help formulate the management programs we implement on the fields we maintain. These articles often times include topics such as aeration technique, selection of topdressing materials, yearly maintenance programs, athletic field renovation etc.

When you evaluate an article, always make sure you are considering the similarities and differences in the ***environment*** of the field you are reading about and the ***environment*** of your own field.

I trust that many of you have found yourselves in the following situation. You are trying to decide how to deal with a problem on your field. Not having had personal experience with this particular problem, you base your decision on an article that was written about a similar situation, or so it would seem.

Let's assume your soccer field is constructed on heavy textured native soil. The chemical soil analysis has determined that you have an acceptable Ph of 6.5 along with adequate amounts of available Phosphorous and Potassium.

It's September and the soccer league is tearing your field up and you're in a quandary over what to do first. You go to your mailbox and what do you find but the new issue of Sports Turf. By sheer coincidence the main article is written about how some facilities management company maintains a world-class soccer field. After you finish reading the article, you commit to a fertilizer program consisting of 8 lbs. of Nitrogen a year along with an obscene amount of Potassium and Phosphorous and micronutrients you never heard of before. In addition to this you purchase a trailer load of sand from the local supply house to use as a topdressing material. What's wrong with this picture?

The field you are reading about is more than likely constructed on a sand based root zone. Water is most certainly supplied by an automatic irrigation system. It is more than likely mowed every other day with a reel mower. It has a slit drainage system and employs a maintenance crew the size of a small town. Cont. next page