Sports Turf Manager
FOR BETTER, SAFER SPORTS TURF. AUTUMN 2011. VOL. 24. NO. 3.

Fertilizer Technology: Understanding Slow Release Nitrogen

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The introduction of synthetic fertilizers such as urea revolutionized turfgrass management. Finally there was an efficient, inexpensive nitrogen source to increase fertility and therefore growth and vigour of turfgrass stands. The issue with readily available fertilizers is that they need to be applied every three weeks to have a steady growth pattern. This is usually not feasible considering the labour costs involved in application. The solution is to use a slow release fertilizer that provides a steady release of nitrogen available to the plant throughout the season. In order to most effectively use slow release fertilizers, turfgrass managers must understand the factors that affect the release of nitrogen from the product.

STA FIELD DAY HIGHLIGHT

Lyons (far left) presented in both Moncton & Oakville.

Slow release fertilizers can be categorized in many ways. In this article they are categorized by the factor that predominantly affects the release, either water or temperature. In order for release to occur with any of these fertilizers, both factors have an effect, but one is always more important than the other. Fertilizers that release based on water availability will release more with increased moisture. If you have a wet summer, release will be faster and you will get more growth and most likely have to reapply sooner than during a dry summer. Conversely, temperature-based release products need some moisture but adding more moisture does not speed the release. Rather, a cooler summer will have slower release than a hot summer. This means that a cool summer may lack in fertility while a hot summer may have increased growth and the need to reapply sooner.

Generally, temperatures are more predictable than rainfall, so fertilizers with temperature-based release can be more predictable and often more expensive. That being said, understanding the release and incorporating some flexibility into your management strategy can allow a sports field manager to maximize the efficient delivery of nitrogen to create the optimum growth for his or her operation.

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WATER-BASED RELEASE

Sulfer Coated Urea (SCU)

SCU is a prill of urea that is coated with sulfur. The sulfur protects the urea from immediately dissolving when it comes in contact with water. The sulfur must first dissolve before the water can dissolve the urea inside. The release of SCU is often referred to as catastrophic release because once the integrity of the coating is compromised, the urea immediately becomes readily available.

Above. Over-application of sulfur coated urea (SCU) fertilizer that resulted in burn. Although the fertilizer contained SCU a significant portion of the nitrogen in the bag was straight urea.

Sulfur coated urea releases primarily as a function of available water; the more water present, the faster the sulfur will be dissolved allowing its release. Temperature is also a factor as things dissolve slower at colder temperatures, but water remains the most important environmental factor affecting the release. Manufacturing and handling of the product also affects its release, as do other factors such as thickness and uniformity of the coating. Thicker coatings will release more slowly. In addition, the integrity of the prill is essential. During shipping and handling, any cracks will render the coating worthless and all of the urea readily available. Mowers can also cause damage to the prill resulting in faster release. Sulfur coated urea costs more than straight urea per unit nitrogen and ranges in price greatly depend on quality and trucking fees. As far as slow release technologies are concerned however, it is one of the least expensive.

Isobutylidene-diurea (IBDU)

IBDU is urea that is reacted with carbon to form a short carbon chain attached to the urea molecule. This molecule breaks down slowly in the presence of water releasing the nitrogen in the form of urea. The release is primarily water dependent although it does slow a little at lower temperatures. The best analogy for its release is that like a bar of soap, it slowly rubs off over time. The water slowly releases the urea through hydrolysis (the splitting with water). This release mechanism means that the smaller the prill or particle, the faster the release. In this case you may get four weeks of release from a small prill and larger prills can get up to 6-8 weeks of release. Straight IBDU has an analysis of 31-0-0 and IBDU is 85-90% slowly available nitrogen, the rest being urea.

TEMPERATURE-BASED RELEASE

Polymer Coated Urea (PCU)

PCU is a prill of urea that is coated in polymers (plastic). These polymers create a barrier that slows the water from reaching the urea inside the prill and the dissolved urea from escaping. Unlike SCU, the coating remains intact and the release is dependent on the diffusion of the urea through microscopic fissures (channels) in the coating. This release mechanism makes the release very dependent on temperature because with warmer temperatures diffusion occurs at a faster rate. Water must be present but the amount of water is not as important as temperature. One drawback of this technology is that the prill, while it may eventually break down in the soil, remains after the urea has dissolved. Large amounts of nitrogen can be applied at once but if the operator overlaps improperly, it can result in an entire season of having excessive nitrogen striped down the field. In addition, timing of applications may need to be changed based on the temperature of the season. A cold spring may require a delay in the early summer application while a warm spring may require an earlier application than originally planned.

Methylene Urea

Methylene urea is urea that is reacted with carbon to form intermediate and long carbon chains. Microbes degrade the carbon chains to release the nitrogen. The length of the carbon chain determines the length of time it takes to release the urea. Different methylene urea products can have the same amount of slow release nitrogen but their release times will vary based on the length of the carbon chains. Release characteristics of methylene urea can vary greatly from product to product. The reason temperature mediates release is because microbial activity is regulated by temperature.

Formaldehyde Urea

This is similar to methylene urea but the chains are even longer and they can last much longer in the soil. Microbial activity affects the release, therefore temperature is the most important factor in determining the release characteristics. With both methylene and formaldehyde urea it is important to note that smaller prill sizes will break down quicker due to more surface area available for microbial action but it is less important than with the IB ureas.

Summary

Proper nitrogen fertility is important to maintain sufficient growth throughout the playing season without creating excessive growth. Understanding the benefits and limitations of fertilizer technologies will help maximize resources within a sports field management operation. In the end, the technology is only as good as the people who implement the programs.

FIELD DAY HIGHLIGHT

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