TURF PROGRAM ADVANTAGES OF SLOW-RELEASE FERTILIZERS

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Slow-release nitrogen sources have much to offer today's professional turfgrass manager. Even though they generally cost more per lb. of nitrogen than fast-release sources, they offer several advantages which contribute to their increasing popularity. When compared with fast-release sources, the slow-release sources of nitrogen provide the following advantages:

1. Reduced labor costs associated with fertilization, since the number of applications is generally reduced.
2. Reduced nitrogen leaching
3. Reduced risk of foliar burn or root plasmolysis
4. A more even supply of nitrogen is provided to the plant, avoiding the excess-deficiency syndrome associated with totally soluble nitrogen sources.

Today's professional turfgrass manager needs to be aware of the major factors which affect release rates of the more popular synthetic organic slow-release nitrogen sources: Isobutylidene Diurea (IBDU) Urea formaldehyde (UF), and sulfur-coated ureas (SCU).

IBDU

This product is available in several formulations providing a wide range of nitrogen release rates and N:P:K ratios. The basic slow-release nitrogen source is Isobutylidene Diurea (IBDU) which breaks down to isobutyraldehyde and urea in the soil. The isobutyraldehyde is of no value to the plant and is thought to volatilize. The urea eventually is converted to ammonium (NH_4^+) and with the help of microorganisms, finally changes to the most plant utilizable form -nitrate (NO_3^-). Particle size, soil moisture, soil pH and soil temperature affect the rate at which IBDU nitrogen is released to the plant.

Particle Size — IBDU is available in a coarse (.7 to 2.5 mm) and fine (.5 to 1.0 mm) particle size. The fine material releases nitrogen faster than the coarse. In a wet soil (50% moisture) at 80°F the fine material has been shown to release approximately 25% more nitrogen than the coarse material two months after application.

Soil Moisture — Water availability increases the breakdown rate of IBDU to urea. In experiments using fine IBDU and soils maintained at 80°F, wet soils (50% moisture) released approximately 56% more nitrogen in a 2 month period than dry soils (20% moisture).

Soil pH — IBDU's rate of nitrogen release will speed up in very acid soils (Ph $<$ 5.0) and slow up in alkaline soils (Ph $>$ 8.0). The availability of nitrogen from IBDU at alkaline pH's around 8.0 is somewhat depressed.

Soil Temperature — The temperature effect is minor when compared with other slow-release materials which depend upon microbial activity. However, in controlled studies fine IBDU applied on soil maintained at 80°F released approximately 37% more nitrogen in 2 months than fine IBDU applied to a soil maintained at 40°F. The soil in these studies was maintained at moderate soil moisture levels (35% moisture).

UF

Urea formaldehyde or ureaform (UF) is a generic name for several methylene urea formulations that are made from chemically condensing urea with formaldehyde. As the ratio of urea to formaldehyde increases the length of the methylene urea compounds formed, decrease. The shorter the methylene urea compound, the faster the urea is released for plant utilization. Nitroform is a common urea formaldehyde that has a urea: formaldehyde ratio of 1.3 to 1. It provides about 1/3 of its nitrogen as water soluble nitrogen and 2/3 as water insoluble nitrogen which becomes available to the plant predominantly as a function of microbiological activity. O. M. Scott utilizes urea formaldehyde solutions in the production of some of their products. These have a higher urea: to formaldehyde ratio and therefore are shorter chained methylene urea compounds that generally release a greater proportion of the applied nitrogen quicker than traditional urea formaldehyde materials. Because of this release pattern, they tend to provide less residual nitrogen than Nitroform when equally compared.

Since microbiological activity influences the rate of release of the urea formaldehyde products, any factor that increases microbiological activity will increase the release rate of the water insoluble nitrogen from UF. Therefore temperature, soil pH, aeration, soil texture and many other factors have been noted to affect UF release rates. Soil temperatures below 55°F generally decrease microbiological activity enough to significantly slow UF breakdown. Acid soil pH's and poor aeration will also slow breakdown of UF, through their negative effect upon microbiological activity.

SCU

Sulfur-coated urea (SCU) is a slow release nitrogen source made by coating hot (140°F) urea with molten (300°F) sulfur. The prill is then sealed with a polyethylene oil or a microcrystalline wax and conditioned with diatomaceous earth or some other suitable material. A 36% nitrogen SCU product will also contain 16% sulfur and about 5% conditioner + sealant. The nitrogen in these products is released through membrane rupture or diffusion of solutes through pores or imperfections in the coating. Solubility is varied by varying coating thickness or sealant weight. Nitrogen release rates in these products are characterized by determining the amount of nitrogen released in 7 days in water at 100°F. Therefore SCU-30 means the product releases 30% of its nitrogen under the conditions prescribed above. Therefore, an SCU-30 will theoretically release 1½ times as much nitrogen as an SCU-20 under the same conditions. These dissolution values are a measure of the relative number of imperfectly coated granules. Therefore, controlled release of nitrogen occurs from many granules providing nitrogen at different times rather than all granules slowly releasing nitrogen at the same time.

Continues on page 46

Slow-Release *from page 43*

Many factors affect the release rate of nitrogen from sulfur-coated urea. Soil temperature, soil moisture, fertilizer placement and root action appear to be the most important.

Soil Temperature — Warm soils will accelerate release of N from SCU. Breakdown of the coating by microbial decomposition of the sealant or oxidation of the sulfur does speed up nitrogen release.

Soil Moisture — Soil moisture stress has been shown to *increase* the rate SCU breakdown. Dry soils (10% moisture) have been shown to release SCU nitrogen faster than moist (20% moisture) soils.

Fertilizer Placement — Surface applications have provided faster SCU dissolution than soil mixed applications. It is thought that the fluctuating soil temperature and moisture conditions on the surface of the soil increase dissolution.

Root activity — Root activity is thought to accelerate SCU dissolution. SCU release rates have been observed to be much slower on fallow soils than in soil containing actively growing plants.

There is evidence that from 5 to 30% of the applied nitrogen in SCU products may not dissolve during the season of application. Since membrane rupture significantly affects nitrogen release in this product, methods of application which crush granules could alter the release rate. Variable and somewhat unpredictable release rates on golf greens (close mowed turf) have led us to the position of currently not recommending coarse particle size SCU products on golf greens.

All three slow-release nitrogen products mentioned above have a place in turf management. It is important that the professional turf manager be aware of how these products might most effectively be used to enhance the quality of turf in his operation. **WTT**