Turfgrass Response To Controlled-Release Urea Fertilizers

By John L. Cisar, Ph.D.
University of Florida

Nitrogen (N) is the nutrient element required in greatest quantity by warm-season turfgrasses. Turfgrass managers often prefer to use soluble N sources on turfgrasses due to their relatively low cost, their rapid response, and with some sources, soil acidifying effect.

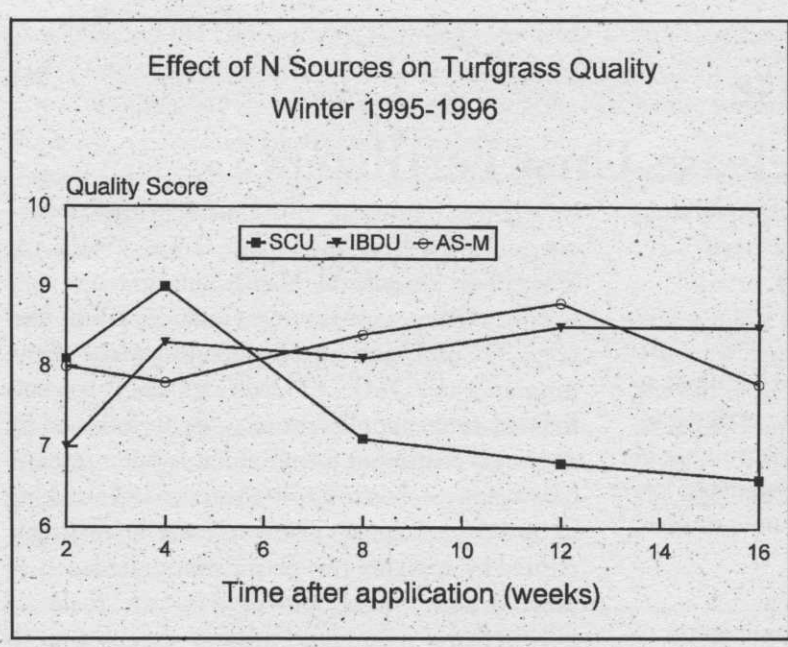
On highly permeable, sandy soils, applications of large amounts of soluble N can result in appreciable N leaching and reduced N utilization by turfgrass. Sandy soils, along with irrigation and clipping removal, make it difficult to provide the grass with an even supply of N. Slow- and controlled-release N sources have been shown to provide a longer lasting, more uniform supply of fertilizer N. In addition, these materials reduce nitrate leaching under adverse climate and soil conditions and offer benefits such as minimum burn potential, reduced application frequency, and lower labor costs.

Water-soluble urea can be coated to provide a controlled-release N which can extend the duration of turfgrass response. The first coated-urea material, sulfur-coated urea (SCU), has become a standard in the turfgrass industry. Developed by the Tennessee Valley Authority in the 1960s, the SCU production process consists of coating urea prills with layers of sulfur, wax, and conditioner. Nitrogen release occurs by water penetration through micropores and imperfections in the sulfur coating and microbial degradation of the wax layer. Unreleased N from a certain percentage of heavily-coated prills (coined "lock-off"), has been a concern with users of SCU.

Recent technological advances in polymer chemistry have led to a number of new controlled-release ureas (CRU). SCU can be coated with a thin layer of polymer (e.g., available as PolyS and Tricote) to to control N dissolution more uniformly. Other new sources include saran film (e.g., V-Cote), and an ethylene-propylene diene monomer (EPDM). EPDM (e.g., ESN) is a sulfonated-rubber applied from a solvent followed by a mineral coating to form a durable outer layer. A fourth approach is to apply a reactive layer coating to urea (e.g., Polyon). The reactive layer coating is created by applying two plastic monomer layers to urea which then polymerize to form a polyurethane membrane around the urea prill. Water penetration through this coating and the subsequent release of soluble N is governed by diffusion across the semi-permeable polymer membrane.

The objective of this study was to determine the effect of new controlled-release sources on turfgrass growth and quality as compared to standard soluble and slow-release N forms. Twelve controlled-release ureas and a coarse (0.7-2.5 mm diameter) IBDU were evaluated in each of two experiments. For the first experiment, these N fertilizers were applied on November 13, 1995 and for the second experiment on May 24, 1996 to provide either 1.5 or 3 lbs. N per 1,000 sq. ft. to established "Tifgreen" bermudagrass plots. Soluble N as ammonium sulfate (AS) was applied at the same rate to other plots. A second set of plots received AS each month at 1 lb. N per 1,000 sq. ft. In addition, three IMC Vigoro products (V-Cote and two experimental products coded S-1 and S-3) were applied as split 50/50 CRU/AS at the above rates to determine the effectiveness of blended, controlled and soluble N sources. The plots were arranged as a randomized complete-block design on a Hallandale fine sand soil at the Ft. Lauderdale Research and Education Center, University of Florida.

The plots were also fertilized at the beginning of each experiment with phosphorus (P) and potassium (K) at a rate of 0.5 and 1.5 lbs. per 1,000 sq.



The figure on the left illustrates the typical quality response obtained from standard controlled-release N sources, SCU and IBDU, as compared to AS applied monthly. Note the expected more rapid but shorter duration quality response from SCU compared to the slower and longer turfgrass response from coarse IBDU. The turfgrass quality response was consistent with the observed N release rate from prills placed in the field.

This example reflects the typical patterns observed for CRU sources. In general, sources releasing N over a longer duration did not always promote as high initial turf quality as did sources with shorter expected duration. However, manufacturers often supplement controlled-release N with soluble N to compensate for this lag in N response, and we too observed greater initial turf responses with the 50/50 (IMC Vigoro products/AS) blended experimental products.

ft., respectively. The area was mowed as needed at a 0.5-inch height. Irrigation maintained adequate soil moisture for turfgrass growth. Turfgrass quality ratings were determined and turfgrass clippings were harvested beginning two weeks after N application. Nitrogen release from controlled-release urea prills placed in the field was also determined.

N Release and Quality Response

Ideally, controlled-release N fertilizers should provide acceptable turfgrass quality responses similar to those obtained from frequent "spoon feeding" applications of soluble N fertilizers. In addition, the materials should release predictably, so that a turfgrass manager can time applications efficiently at rates sufficient to achieve suitable quality and growth responses.

All of the controlled-release N sources generally provided acceptable turfgrass quality and clipping yields consistent with their estimated release duration under both winter and summer conditions of sub-tropical South Florida. Furthermore, these products generally provided turfgrass quality and growth that was equal to or better than that achieved from the application of soluble N. However, no single source consistently out-performed other sources.

Based on the results of this study, turfgrass managers in Florida and elsewhere have numerous controlled-release N options from which to choose. Among the many criteria for selecting a N source, turfgrass managers could base their decisions on material and labor costs, convenience of application, safety, and duration of N release.

John L. Cisar, Ph.D., is an associate professor of turfgrass management and water, FLREC, University of Florida, 3205 SW College Ave, Ft. Lauderdale, FL 33314. He received his Ph.D. in Biological Sciences from the University of Rhode Island, M.S. from Cornell University and B.A. from Rutgers University. Cisar has been with the UF since his appointment in 1986. He is active in turfgrass research, extension, and resident instruction at the University. His current activities include efficient agrichemical resource utilization, water conservation and protection of water quality in turfgrass systems.

Table 1. Controlled-release urea sources evaluated.

Designation	Description/ Estimated Release	% N	Manufacturer
S-1 (expmtl.)	Saran-coated/ 3-4 months	43	IMC Vigoro, Winter Haven, FL
V-Cote	Saran-coated/ 2-3 months	44	IMC Vigoro, Winter Haven, FL
S-3 (expmtl.)	Saran-coated/ 2-3 months	44.5	IMC Vigoro, Winter Haven, FL
Polyon 42	Reactive-layer coated/3-4 months	42	Pursell, Sylacauga, AL
Polyon 43	Reactive-layer coated/2-3 months	43	Pursell, Sylacauga, AL
Polyon 44	Reactive-layer coated/2-3 months	44	Pursell, Sylacauga, AL
S-4 (expmtl.)	Saran-coated/ 3-4 months	44	IMC Vigoro, Winter Haven, FL
PolyS	Polymer + Sulfur-coated 2-3 months	40	Scotts, Marysville, OH
TriKote	Polymer + Sulfur-coated 2-3 months	44	Pursell,Sylacauga,AL
SCU	Sulfur-coated 2-3 months	39	
ESN 2003	Sulfonated rubber-coated/ 2-3 months	40	Veridian, Redwater, Alberta, CAN
ESN 2004	Sulfonated rubber-coated/ 3-4months	40	Veridian, Alberta, CAN
IBDU	Isobutylidene diurea 3-4 months	31	
Ammon. Sulfate	Soluble	21	

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