GETTING THE MOST OUT OF UREA

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Urea is a very popular turf fertilizer. The reasons for this are low cost and high water solubility. Urea, with a unit nitrogen cost ranging from one-fourth to one-third that of slow release nitrogen fertilizers, is definitely a low budget material. Solutions of urea have a near-neutral pH and are compatible with most pesticides and micronutrient sources. Urea is also the material of choice for blending with slow release nitrogen fertilizers to provide them with quick response capability.

Despite all of the apparent advantages of urea as a turf fertilizer, some turf managers are reluctant to use it and others are dissatisfied with turfgrass responses when urea is applied. Reluctance to use urea, particularly in the prilled form, generally stems from fear of burn or overstimulation of turfgrass growth. Disappointments with the product range from slower response than anticipated to response of short duration. All of these concerns reflect lack of familiarity with urea, the chemical reactions it undergoes when applied to turf and the potential consequences of these reactions.

Urea is an organic compound. When added to water, it dissolves by separating into individual molecules. Nitrogen in these molecules cannot be directly utilized by plants. The urea molecules must first undergo hydrolysis, a chemical reaction involving the urea, the enzyme known as urease and water. The products of this reaction are ammonium and carbonate ions. It is only after hydrolysis occurs and the nitrogen in urea is released in the form of ammonium ions that turfgrass use of the nutrient becomes possible. This is true regardless of whether urea is soil applied as prills or foliarly applied as a urea solution.

The production of carbonate ions during urea hydrolysis is unavoidable and a cause of problems that can occur when using urea on turf. The carbonate ions react with water to produce bicarbonate and hydroxyl ions. The latter cause the pH of the solution at the reaction site to increase, sometimes to a level where ammonium ions begin to convert to ammonia gas. If the amounts of ammonia generated are substantial and the gas is free to escape into the atmosphere, one of two or both events will occur; there is significant loss of fertilizer nitrogen and the ammonia liberated may be sufficient to burn the turfgrass.

Getting the most out of urea first requires an awareness of what controls its rate of hydrolysis. The key factors are air temperature and moist soil and plant surfaces. Level of urease activity is generally of secondary importance because turfgrass shoots and thatch typically have urease activity levels 20 to 30 times greater than the underlying soil. As such, urease activity rarely limits the rate of urea hydrolysis in turf.

Temperatures of 50° F or less slow urea hydrolysis to the extent that color response of turfgrass may not occur until 10 to 14 days after soil application. This is one potential cause of slower than anticipated response of turfgrass to urea and is why our European colleagues often refer to urea as an intermediate rather than a fast release turf fertilizer. As temperatures climb above 50° F, urease hydrolysis rates rapidly increase and peak at about 90° F. Therefore, volatilization loss of nitrogen from urea increases steadily in the temperature range of 50 to 90° F.

How much urea-nitrogen volatilizes at a given temperature depends on the rate of urea application and other ambient conditions following application. When temperatures favor rapid urea hydrolysis, nitrogen loss is directly proportional to the amount of urea applied. The ambient conditions conducive to volatilization loss from urea are moist turfgrass, thatch or soil surfaces at the time of application and rapid drying shortly thereafter.

When urea is applied at air temperatures ranging between 50 and 90° F and the turfgrass response is less than expected and of short duration, volatilization loss of urea-nitrogen is the most likely reason. This of course, assumes that soil levels of other required nutrients and moisture supply are adequate for normal turfgrass growth.

Management-wise there are several things that can be done to minimize volatilization loss of nitrogen from urea applications. Contrary to popular opinion, foliar rather than soil application of urea does not reduce nitrogen loss. Rather, research has shown that when urea is foliarly and soil applied at the same rate, loss from foliar applications is two to three times greater than from soil applications.

When urea is soil-applied in the form of prills, the most effective means for reducing nitrogen volatilization loss is to irrigate shortly after application. As little as 0.2 inches of water can reduce nitrogen losses to one percent or less under most circumstances. More water is required if the turf is thatchy. "Shortly after urea application" means irrigation within 24 hours or less. The higher the air temperature when the urea is applied, the quicker the irrigation should begin. At 75° F, volatilization cannot be detected for the first 10 to 12 hours after urea application. At 85° F to 90° F, volatilization begins in as little as four hours after the urea is applied.

Reduction of nitrogen loss from prilled urea can also be achieved by reducing the rate of application as air temperatures increase. My experiences last summer showed that in the temperature range of 50 to 60° F, no burning of turf occurs at urea rates as high as 1.2 lb N/1000 ft². However, at about 80° F the safe upper rate limit drops to 0.8 lbN and at 90° F is approximately 0.4 lbN.

Control of nitrogen volatilization from foliar applications of urea is, in some ways, more complex than with soil applications of urea prills. The reason is that irrigation shortly after application reduces foliar absorption of the urea to 5 percent or less, which, according to our research, is insufficient to induce a perceptible color improvement in the turfgrass. The best management strategy for foliarly applied urea is late afternoon or early evening application followed by irrigation the next day before the turfgrass dries off. Hydrolysis of foliarly applied urea begins within one hour after application and peaks six to 12 hours later. Drying of the foli-

age after this period of time has been shown to result in loss of as much as 23 percent of the nitrogen applied.

Finally, overstimulation of turfgrass with urea is usually a rate of application problem. Unlike with slow release nitrogen fertilizers, all the urea-nitrogen is available to the turfgrass once hydrolysis has taken place. Lighter and more frequent applications of urea are required. My experience is that prilled urea must be applied at least once a month to maintain good color in closely mown, highly maintained turf. For less intensively maintained turf, such as home lawns and athletic fields, good color can be achieved with urea; application intervals of six to eight weeks are recommended. The actual length of the interval is determined by turfgrass growth rates.

1988 WTA FIELD DAY

The 1988 Wisconsin Turfgrass Association Field Day will be held on August 23 at the Yahara Hills Golf Course in Madison. Again, the event has a distinct WGCSA flavor. WGCSA members Tom Harrison and Tom Schwab are chairmen for this sixth annual education and equipment program. WGCSA members Irv Graf, Ron Schara and Don Steinmetz are hosting the occasion on their 36 hole City of Madison golf couse, as they will for 1989 and 1990.

Watch your mail for registration details.

1988 SYMPOSIUM DATES SET

Jim Spindler has announced a slight change in tradition for the Wisconsin Golf Turf Symposium for 1988. The days this year will by **Tuesday** and **Wednesday,** October 25th and 26th. Set those dates aside and mark your calendar today!

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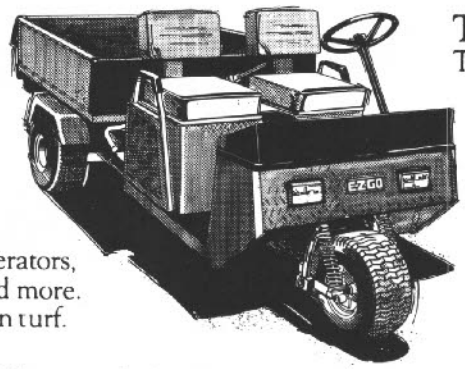

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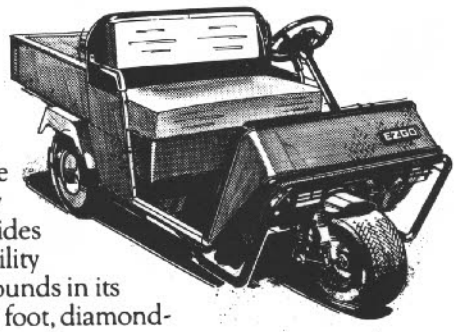

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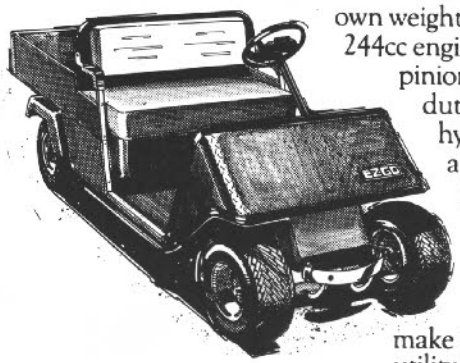

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