In a warm, moist environment, NH_4^+ is quickly microbiologically oxidized to NO_3-(Schmidt, 1982), rendering the N in a form subject to denitrification. While some denitrification may be a chemical process, the most common pathway is microorganism use of NO_3- as an e- acceptor within 0_2-deficient soil microsites (Firestone, 1982). The dominant products resulting are the gases N_20 and N_2. The obvious means for reduction of denitrification is inhibition of the microorganisms responsible for oxidation of NH_4^+. Several such chemical inhibitors have been identified, one of which is dicyandiamide (DD) (Mengel and Kirkby, 1987).

The purpose of the research was to determine how and to what degree impregnation of urea with NBTP and DD alters the efficacy of urea as a turfgrass fertilizer. To achieve this purpose a greenhouse study was conducted where the extent of which NBTP and DD influence volatilization and denitrification losses of urea-N were documented. The objectives of the study were:

1. To obtain evidence that NBTP reduces ammonia volatilization from urea applied on turfgrass;
2. To obtain evidence that DD reduces denitrification loss of N from turf;
3. To observe the comparative effects of NBTP and DD treatment of urea on turfgrass color, clipping nutrient content, and root mass.

METHODS

The experimental units consisted of Penncross creeping bentgrass and Manhattan III perennial ryegrass grown in silt loam soil maintained at field moisture capacity by the weighing method. The bentgrass and ryegrass were clipped weekly at 0.5 inch and 2.0 inches, respectively. The fertilizers tested in the experiment were urea, UMAXX (urea treated with NBTP and DD), Nutralene, and SCU. A control (no N) treatment was also included. The treatments were replicated four times. The fertilizers were applied at the rate of 1.0 lb N/M.

Twenty-four hours after applying the N, sorption pads containing a glycerol and phosphoric acid solution were suspended over the pots to trap any NH_3 that was volatilized. The pads remained in place for 24 hours. The nitrogen trapped in the pads was extracted and quantified.

Three weeks into the experiment, nitrification data were collected by measuring the amount of soil $N0_3$- and NH_4^+ before and 2 days after over-watering the pots (125% field capacity) to create conditions favorable to nitrification.

Each week color ratings were made, and clippings were collected, weighed, and analyzed for %N. At the end of the study, roots from each treatment were weighed.

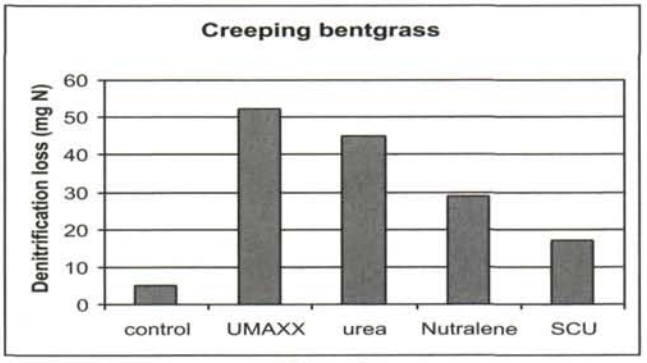


Figure 3

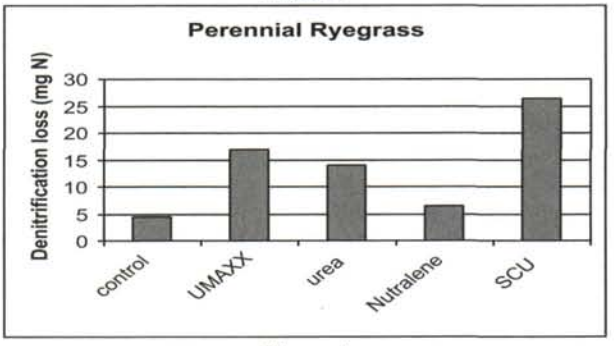


Figure 4

RESULTS

Ammonia Volatilization Loss

UMAXX showed significantly lower N volatilization rates than Nutralene, SCU and Urea on creeping bentgrass (Fig. 1) and was not significantly different from the control treatment (no N applied). On perennial ryegrass UMAXX showed significantly lower volatilization rates than the urea treatments (Fig. 2).

Denitrification Loss of Nitrogen

The denitrification data were somewhat sporadic. Creeping bentgrass fertilized with the NBTP and DD impregnated UMAXX had three times more N denitrified than did the SCU treatment. The UMAXX treatment, however, was found to be not statistically different than the urea treatments in regard to denitrification losses (Fig. 3).

When applied to ryegrass, the UMAXX treatment showed 36% less N denitrification than SCU, and the N loss was not statistically different from the urea treatment (Fig. 4). Among the four fertilizers, denitrification loss of N was least for the Nutralene treatment, suggesting that much of the N in the Nutralene was still in the form of methylene urea.

Effects on Turfgrass Color

UMAXX showed color ratings very similar to the other fertilizer treatments on both bentgrass (Fig. 5) and ryegrass (Fig. 6) over the 8-week study. Very little variation was found between treatments.

Effects on Fertilizer N Uptake

At the time this report was prepared, fertilizer N uptake data were available only for the first 4 weeks of the study. On bentgrass, fertilizer N uptake was significantly higher from UMAXX than the urea and SCU treatments during week 1 (Fig. 7). During week 2, UMAXX showed significantly higher N uptake from fertilizer than SCU. During weeks 3 and 4, UMAXX showed significantly higher N uptake from fertilizer than urea.

On ryegrass, fertilizer N uptake was significantly higher from UMAXX than the SCU treatment during week 1 (Fig.8). During week 2, the UMAXX treatment had significantly higher fertilizer N uptake than from urea or Nutralene. UMAXX was not significantly different from the urea, SCU, or Nutralene treatments during week 3. Fertilizer N uptake from UMAXX was significantly higher than from Nutralene during week 4.

Effects on Root Mass

The root mass of the UMAXX treatment was not significantly different from the urea and SCU treatments for either bentgrass (Fig. 9) or ryegrass (Fig. 10). As expected, the control pots had the highest root mass per pot. This is because nitrogen stimulates shoot growth at the expense of root growth.

Data on turfgrass clipping concentrations of nutrients other than N were not available at the time of preparation of this report.

CONCLUSIONS

The denitrification data failed to show anything that would lead me to believe that DD significantly inhibited nitrification. The failure of DD to be an effective nitrification

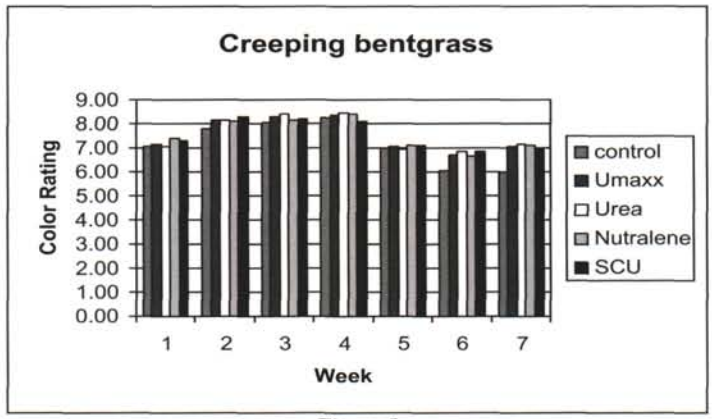
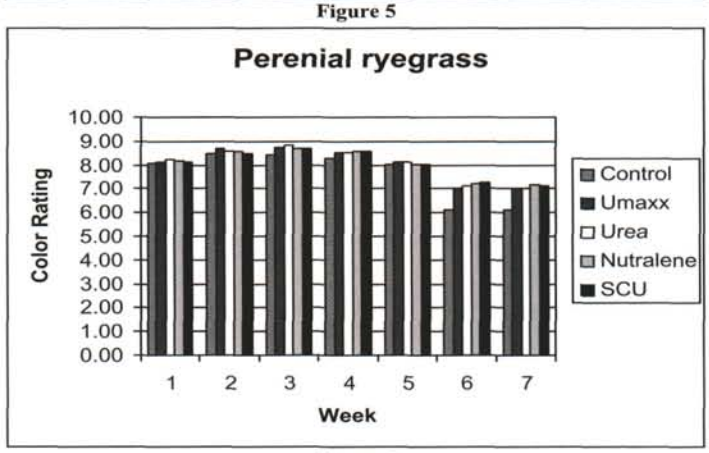


Figure 5



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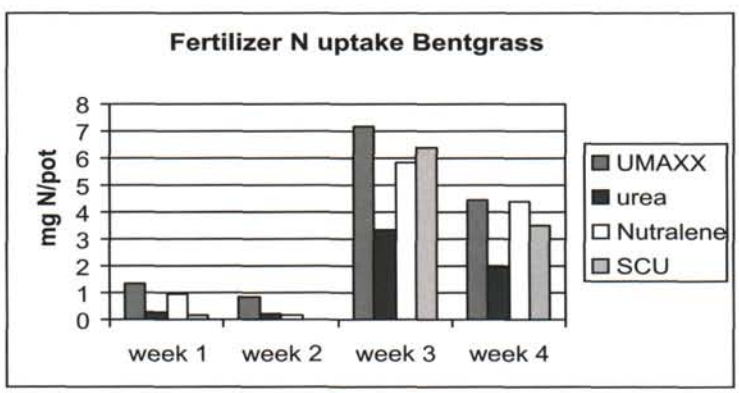

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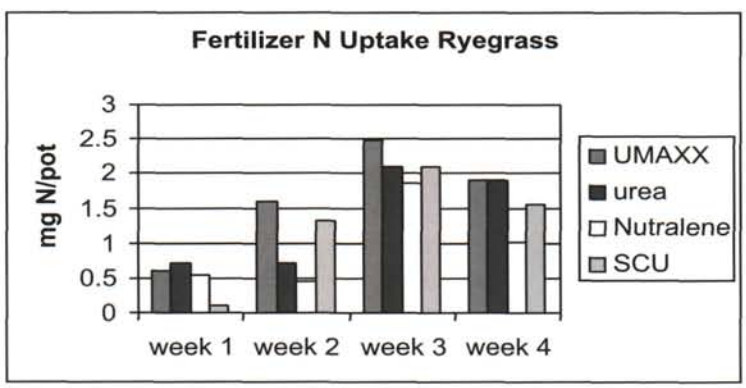

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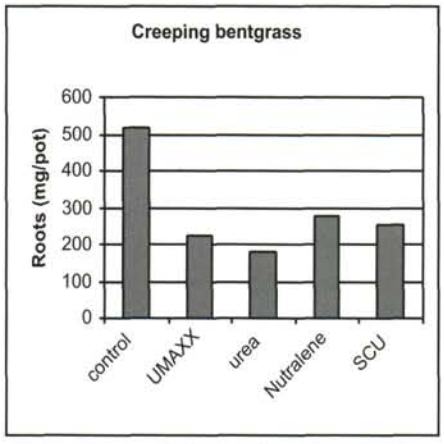

Figure 9

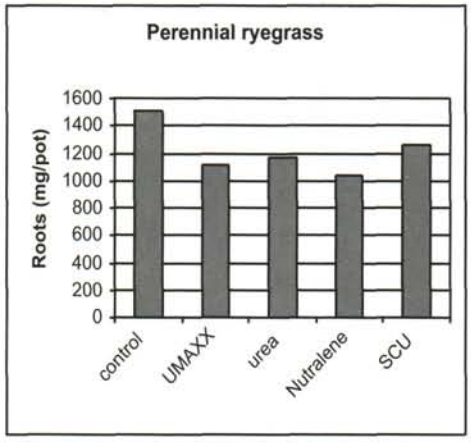

Figure 10

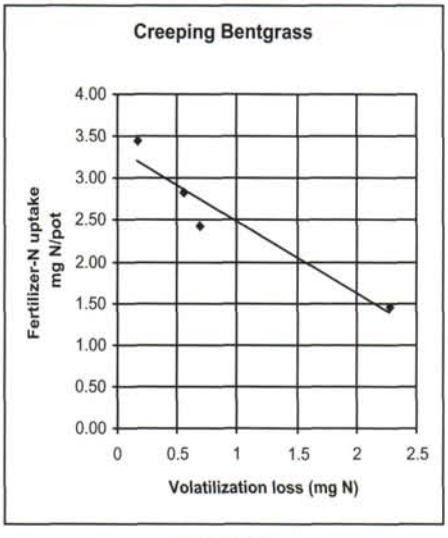

Figure 11

inhibitor is not surprising. Spangenberger et al. (1986) evaluated a 3.2% DD + $(NH_4)_2SO_4$ combination and a 4.6% DD + urea combination, and compared them to $(NH_4)_2SO_4$ and urea alone. While some color and yield differences were observed, they concluded that there was little advantage to including DD in the formulation. Mosdell et al. (1986) made similar comparisons with the same conclusions.

NBTP proved to be effective at reducing N loss due to ammonia volatilization. Volatilization N losses of N from urea applied to bentgrass and ryegrass were over 2 to 13 times greater than the volatilization N loss from UMAXX . The increase in N volatilization of the UMAXX treatment from the bentgrass as compared to the ryegrass could be attributed to particle size differences between the two treatments. The UMAXX applied to the bentgrass had a SGN of 150, while that applied to the ryegrass had a SGN of 237.

There was a strong correlation between N volatilization and fertilizer-N uptake (Fig. 11). This was especially evident in the bentgrass treatments, where UMAXX showed the lowest volatilization loss. The treatments with the highest N volatilization had the lowest fertilizer-N uptake. By reducing N volatilization through the action of NBPT, the efficiency of UMAXX was increased, perhaps to the extent that its rate of application could be less than urea but produce the same level of turfgrass response.

Treatment of urea with DD and NBTP did not seem to have any significant effects on turfgrass color or root mass as compared with the other treatments. This may have been the result of application of the fertilizers at the rate of 1.0 lb N/M. A lower rate of N application would likely have resulted in greater differences among the fertilizer treatments.

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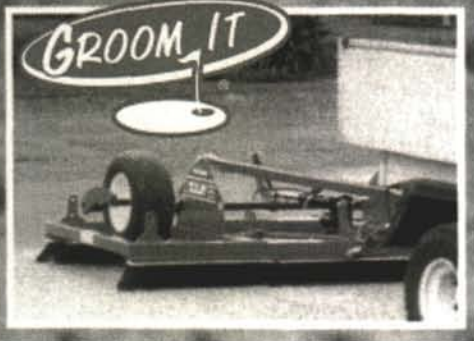

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Douglas Soldat is a May graduate of the University of Wisconsin-Madison Turf and Grounds Management Program. He has returned to Northmoor Country Club in Lake Forest, IL for the summer. In September, he will begin his graduate studies in Madison as the first recipient of the Wisconsin Turfgrass Association Wayne R. Kussow Distinguished Graduate Fellowship.

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Admissions and Confessions

By Pat Norton, *Golf Course Superintendent, Nettle Creek Country Club*

We are guilty. We plead guilty to all charges against us. Alleged, unsubstantiated, or borderline ridiculous... all charges against us are true. Anything that anybody has said about or against us... whether to our faces or behind our backs... is totally and unforgiveably true!

We confess to all of our wrongdoings and will accept any penance or penalty that is imposed upon us by a jury of our more perfect peers. We desire to cleanse our hearts, minds, and souls by admitting in public... here in this column... to some of our many and numerous professional sins over the years.

We all have our secrets in this line of work, I think. Haven't we all screwed up, spaced out, pulled a boner, or simply screwed the pooch... probably many times over?? Yes... I have!! Yes... you have, too!! Admit it, big man. You're worthless and weak... just like everybody else!! You are not perfect, nor am I.

The humorous part of it all is that nobody ever seems to want to admit or confess to their mistakes! When that sales rep walks in or in talking to a fellow superintendent, club owner, or green chairman... do we ever willlingly admit to or confess to a huge mistake? Heck no... it becomes our little secret!! I will privately gnash my teeth, kick myself, or bang my head on the concrete... but I'll be dipped if I'll ever admit to anybody that I've made a mistake.

Does this sound familiar to you? If so, join me as we review a career full of missteps, mistakes, and Nixonian coverups! Don't deny yourself the chance to mentally come along on this cathartic journey through 20 years of golf course stumblings and bumblings... as one guy opens himself up and admits and confesses to a few poor decisions along the way.

Our spokesman is... a humble, everyday mouthpiece who is truly representative of all that is truly good, yet entirely average in the world of golf course management. If you can't identify with our hero and see yourself making at least a few of these rookie or veteran mistakes... you are only kidding yourself! Everybody makes mistakes... it's just that some make more than others!!!

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So let's review the early years...

1) Do not spray fungicide tank mix 'A' over the top of fairway fungicide research plots 'B-G' when left in quasi-charge for the weekend. Dr. Worf seemed to understand that I was just a dumb college kid... Miller, however, was not quite so understanding!

2) Do not forget to watch out for fast approaching thunderstorms when night watering. It's a pretty scary thing to have a dozen or more sprinklers to disconnect... when suddenly your hair stands on end... and your attention is riveted on that huge bolt of lightning that illuminates the course like a stadium!

3) Never try to impress your girlfriend too much! Pouring a 'hot' water soluble fertilizer mixture directly over her landlord's annual flowers will usually result in direct phytotoxicity and lots of embarrassment for the fledgling horticulturalist!

4) Always remember to invite true friends to weddings... I'll never quite forgive myself for forgetting to invite Kay Morganthaler... among others... to our wedding. That's right, macho men. Take the time to review and think about those important occasions in your life... do not dump on your fiancee and force her to make practically all of the arrangements!

5) Do not drink heavily during university registration week parties. It may lead to extreme sickness, intense hangovers, and major heckling from the crew... I do believe that I was once poured out of a car as I arrived late for work on a Sunday AM!! In hindsight... it is still a most pleasant and humorous memory!

6) Do not drink heavily during your bachelor's party... unless you're better able to hold your liquor than the average guy! This average guy ended up trying to crawl into the Weber grill... while exclaiming... "this thing is great, guys... what is it???"

7) By approx. age 40... stop the drinking... heavily or otherwise!!! Nowadays about two bottles of beer act upon me like nature's best laxative... and isn't it difficult enough rising super early on weekends without having to deal with any ethyl alcohol in the system??? Learn your lesson, man...

8) Make sure... above all else... that your rough is mowed and dandelions are under control before hosting an event... like the 1983 NEWGA Spring Clinic. As a rookie superintendent... I'm quite sure that I truly impressed Stan Zontek, Rod Johnson, and many others... with my horrible golf game and horribly conditioned golf course. I still remember Zontek saying that my tee shot was 'out in

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