SLOW RELEASE NITROGEN FERTILIZER AND ITS IMPACT ON SUSTAINABLE TURF GRASS GROWTH

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Abstract

The methodology of this project aims at developing an efficient, yet effective, means of providing various nitrogen (N) fertilizer sources to turf grass with the ultimate goal of maintaining sufficient biomass production while minimizing the use of excess fertilizer that may eventually end up contaminating our groundwater and waterways. Nitrogen is the nutrient required in the largest quantity by plants, and also poses the greatest threat when nutrient leaching and water contamination are considered. For this experiment, Bermuda grass and Tall Fescue turf plots are treated with either: quick release N fertilizer, slow release N fertilizer, or a control (no fertilizer). Data collected from each plot consists of dry weight biomass yield, turf quality rating (based on % cover, color and vigor of each plot), as well as analysis of water samples collected from no tension lysimeters located below the turf's root zone. Analysis of biomass and water samples will help in determining the Nitrogen Use Efficiency (NUE) of the turf, as well as the leaching potential of each nitrogen fertilizer source. Turf quality ratings will judge the all important aesthetic quality. The data reflects that slow release N fertilizer had the most positive impact in reducing overall biomass production, reducing N leaching below the root zone, and improving the turf color throughout the growing season compared to quick release fertilizer (urea) and the control.

Introduction

Sod farms, golf courses and recreational turf managers rely heavily on pesticides and traditional fertilizers to keep turf and landscapes functional and aesthetically pleasing (Starrett and Christians, 1995). In 1999, Illinois end users maintained 1.544 million acres of turf grass (Campbell, 2001). The main fertilizer used is nitrogen (N), followed by phosphorus (P), potassium (K), and iron (Fe). Golf courses are a good example. In 1999, there were 717 golf courses in Illinois, which ranked No. 8 in the number of golf courses nationwide. For an 18-hole golf course, the average land area ranges from 120 to 200 acres. According to a survey conducted by Schrickel (Overbeck, 2000), the annual average fertilizer use per course in the USA was 22 tons. Under normal management in southern Illinois, N application on golf green is about 5 to 6 times (per unit area per year) higher than in corn production. Therefore, the potential of contamination of water sources from golf courses and residential lawn areas is much higher than that from agricultural fields in certain areas.

The fate of applied N fertilizer on lawns depends very much upon the type of grass planted, soil properties, climatic conditions of the region, and management practice in the field. The most feasible factor to be changed in order to reduce fertilizer loss is selection of the type of fertilizer. The best type of fertilizer to use is still under debate. Traditional quick release N fertilizers have shown poor environmental performance (Easton and Petrovic 2004). There is limited research about other sources of N that may enhance N uptake, such as slow release nitrogen fertilizers (SRF). There is some evidence that organic materials might better enhance N release. This research intends to evaluate two inorganic N sources; urea and a polymer coated urea (SRF)

Research Objectives

The objectives of this study are:

1. To evaluate two inorganic nitrogen sources, quick release and slow release, for turf management in order to maximize turf grass quality.
2. To investigate the nitrogen use efficiency and leaching potential of nitrates from the nitrogen sources.

Research Procedures or Strategy for achieving the objective(s)

A three-year field study of selected organic and inorganic sources on turf grass will be conducted at the Horticultural Research Center (HRC) at SIU-Carbondale. Two grasses, Bermuda grass (*Cynodon* spp.) and tall fescue (*Festuca*, spp.) were utilized for this study. These grasses are the most commonly used in home lawn, athletic field, and recreation areas in Illinois. Bermuda grass is a warm-season grass and tall fescue is a cold season grass. The experiment was conducted on an existing plot installed in 1999 at HRC. The experiment was carried out under a randomized complete block design with four treatments and four replications per treatment. The treatments will include the application of (1) no fertilizer (as control), (2) quick release N fertilizer, Urea (3) slow-release N fertilizer, and polymer coated urea. All the treatments were balanced out with macronutrients and micronutrients, to ensure that nitrogen is the only source of variation. The plot sizes for each replication was 2 x 4 m. The amount of N fertilization in those grasses will follow the guideline recommendation by Beard (2002).

Turf quality ratings and clipping yield were collected. Turf quality was evaluated monthly by color measurements using optical sensors that can read visible color and near infrared light reflected by the turf grass. This data was used to determine a normalized difference vegetative index (NDVI). This index was used as an indication of turf quality. Clipping dry weight will be collected based on growth performance in the spring, summer, and fall for the assessment of the turf growth. A chemical analysis will follow, where plant total N (Carlson, et al. 1990) and plant N uptake, determined by total plant N divided by dry plant biomass, will be evaluated. Water samples from the no tension lysimeters was collected weekly and analyzed for N-nitrate (Wendt, K. 1999). The data collected was examined separately and subjected to analysis of variance using the GLM procedure of SAS (SAS Inst., Cary, N.C.).

Summary

Bermuda grass: Urea had the largest early-season impact on biomass production, out-producing slow release fertilizer by as much as 23%. Urea produced this growth effect until late in the season when its effects diminished rapidly. The slow release fertilizer (SRF) was the most consistent fertilizer in relation to biomass production, and late in the season out-produced the urea treatment by as much as 22.8%. For turf grass, large biomass production is not

recommended, due to the increased maintenance required due to rapid turf growth. For the Grass Index ratings in Bermuda grass, SRF produced slightly higher grass Index (G.I.) and NDVI ratings than urea throughout the entire season.

In Tall Fescue, Urea produced the highest early season biomass yields, out-producing slow-release fertilizer (SRF) by as much as 32% early on in the season. Mid-season, SRF and Urea began alternating with one another as the top biomass producers among treatments. Urea's effects on biomass production diminished later in the season, eventually falling to the rank of lowest biomass producing fertilizer source in the mid-late season. SRF out-produced Urea in biomass production by as much as 17% late in the season. As for turf quality, readings showed that SRF had the most significant early season effects on Grass Index ratings, with ratings as much as 4.7% higher than those of urea. As the season progressed, the effects of both SRF and urea on the grass index and NDVI ratings diminished, leaving SRF with only slightly higher (1.7%) late-season G.I. ratings than urea. Urea experienced a similar effect to that of SRF with grass ratings dropping throughout the season, but not as drastically as was the case with urea.

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