Nitrogen Fertilization Effects on Three Lawn Species in Indiana

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Objectives

- Determine environmentally responsible N fertility programs that maximize turfgrass quality and agronomic benefits while minimizing N fertilizer inputs.
- To reevaluate Purdue's current nitrogen (N) fertilizer recommendations as well as investigate alternative N rates and application timings for cool-season turfgrass species used in home lawns.

Rationale

Excessive fertilizer applied to the soil has the potential to leach through the soil profile and lead to the contamination of our groundwater. Nitrogen is a dynamic nutrient and undergoes numerous transformations and movement within the turf system (Petrovic, 1990). Nitrogen enters the system primarily as fertilizer, and exists via gaseous loss, leaching, clipping removal, and under some conditions, surface runoff (Bowman, Cherney, and Rufty, 2002). Losses of Nitrate-N to groundwater increases the likelihood of exceeding the Nitrate-N drinking water standard of 10 mgL-1 set by the EPA for human safety (Erickson, Cisar, Vollin, and Snyder, 2001). Nitrate leaching from fertilizers applied to turfgrass sites has been proposed as a major source of nitrate contamination of groundwaters in suburban areas where turfgrass is a major land use.

Procedures

This field study is currently being conducted at the W. H. Daniel Turfgrass Research and Diagnostic Center, West Lafayette, IN. Plots (5 ft x 5 ft) were seeded in May, 2003 with three cool-season turfgrass species: Kentucky bluegrass, perennial ryegrass, and turf-type tall fescue. Fertilizer applications began in September 2003 and will continue for two years. Eight nitrogen fertilizer programs were applied varying in total N and time of application. Sulfur coated urea (slow-release) and urea (fast release) are the two sources of nitrogen being used in this study depending on season. Plots are maintained at 2.5 inches with a rotary mower.

Table 1. Eight nitrogen fertilizer programs for cool-season turfgrass lawn species.

Treatment	September	October	November	April	May	July	Total N	Relative annual N rate
1	1.0	0.0	0.0	0.0	0.0	0.0	**1.0**	**low**
2	1.0	0.0	1.5	0.0	0.0	0.0	**2.5**	**med**
3	1.0	0.0	1.5	0.0	0.75	0.75	**4.0**	**high**
4	1.0	1.0	1.0	0.5	0.5	0.0	**4.0**	**high**
5	1.0	1.0	0.0	0.0	0.5	0.0	**2.5**	**med**
6	0.0	0.0	1.5	0.0	0.0	0.0	**1.5**	**low**
7	0.0	0.0	0.0	1.0	0.75	0.75	**2.5**	**med**
8	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	
N Source	**SCU/Urea**	**Urea**	**Urea**	**SCU/Urea**	**SCU/Urea**	**SCU**		

Clippings are harvested weekly, dried at 82°C, and then weighed to determine dry matter yields. A clipping sub-sample from each week's harvest is analyzed for leaf tissue N content using the LECO CHN-2000 analyzer. Visual turfgrass quality ratings and disease incidence/severity ratings are taken weekly. Canopy greenness is also being quantified using a hand-held chlorophyll meter (FieldScout CM-1000, Spectrum Technologies Inc.).

Potential leaching of N is monitored by soil samples taken each December at three depths (0-6, 6-12, and 12-18 inches). These samples are oven-dried, and then ground to obtain inorganic soil N using a KCl extraction. Soil solution samples are being collected from each experimental plot using suction cup lysimeters located 18 inches below the soil surface (Figures A-C). Samples are collected one week before N application, then three and ten days following. These samples are analyzed using the Lachat for ammonia (NH^{+3}) and nitrate (NO^{-3}) concentrations.

Figures A-C. Lysimeters were installed at 18 inches below the soil surface using a guide and a soil probe.

Results to Date

All three turfgrasses followed seasonal shoot growth patterns for cool season turfgrasses having higher dry matter yields during the spring and early fall (Figure 1). There was a greater increase in dry matter for the medium to high N programs for turf-type tall fescue and perennial ryegrass (Figure 1). Leaf tissue N content ranged from 2-4 % for all three turfgrasses, those plots that received greater amounts of N fertilizer had higher % N in their leaf tissue. Increased N fertilizer application enhanced turf color as well as turfgrass quality ratings. There were greater amounts of nitrate found in soil solution during November and the first of April (Figure 2). There were also greater amounts of nitrate found in soil solution three to seven days after fertilizer application (Figure 2).

References

Bowman, D. C., C. T. Cherney, and T. W. Rufty, Jr. 2002. Fate and transport of nitrogen applied to six warm-season turfgrasses. Crop Sci. 42:833-841.

Erickson, J. E., J. L. Cisar, J.C Volin, and G. H. Snyder. 2001. Comparing nitrogen runoff and leaching between newly established St. Augustine turf and an alternative residential landscape. Crop Sci. 41:1889-1895.

Petrovic, A. M. 1990. The fate of nitrogenous fertilizers applied to turfgrass. J. Environ. Qual. 19:1-14.

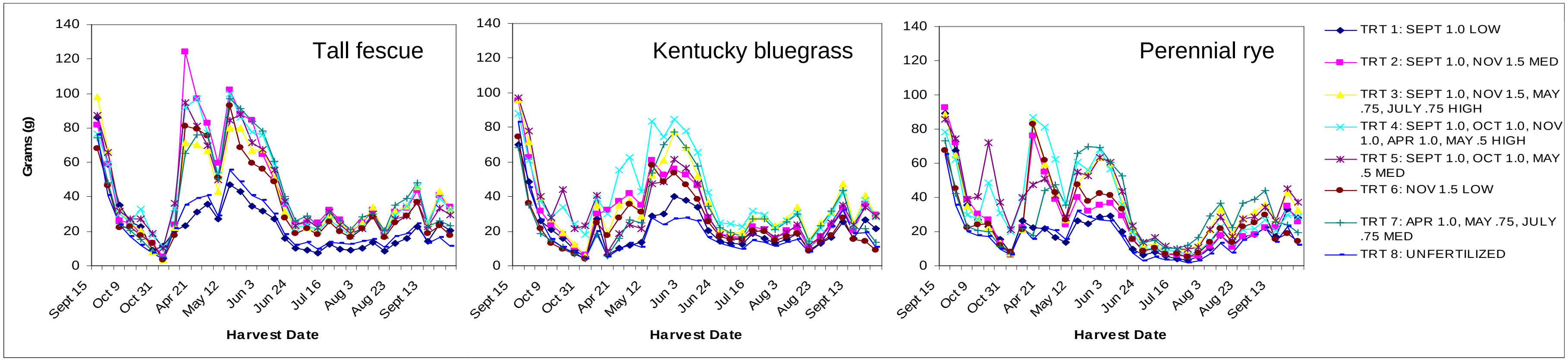

Figure 1. Dry matter yields from September15, 2003 to September 28, 2004 for turf-type tall fescue, Kentucky bluegrass and perennial ryegrass.

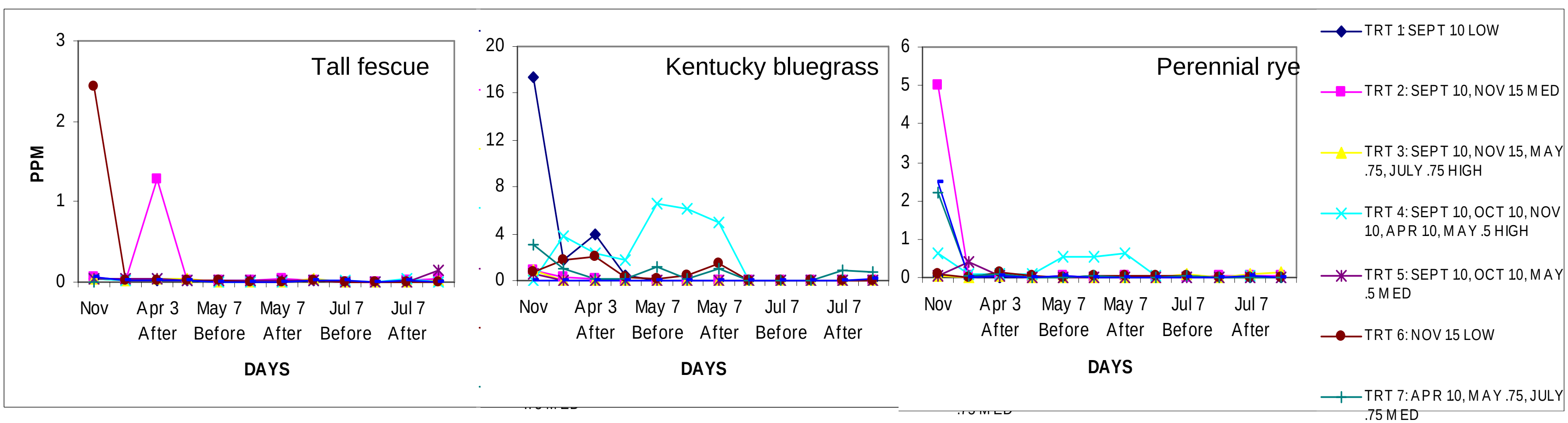

Figure 2. Amount of nitrate (NO^-_3) found in soil solution for turf-type tall fescue, Kentucky Bluegrass, and perennial ryegrass.