Late-fall Nitrogen Applications: Not as Important as You Think!

By Dan Lloyd and Doug Soldat, *Department. of Soil Science, University of Wisconsin-Madison*

Many superintendents place a large emphasis on fall N fertility often citing benefits such as increased root development, faster recovery from aerification, preservation of fall color, increased reserve carbohydrate storage, and hastened spring green up and recovery from winter damage. The basis of these proclaimed benefits is based on the observation that shoot growth tapers off in mid to late-October in Wisconsin while soil temperatures remain warm enough to sustain root activity. Conventional wisdom is that N uptake and photosynthesis continue and the byproducts (assimilated N, photosynthates) will be partitioned into root and rhizome development instead of being used for shoot growth as it would during the spring and summer. While this investment in infrastructure would be a very logical response for the plant, there is surprisingly little research that actually supports this notion. In fact, research generally links N uptake to growth and for many plants, a sharp decrease in N uptake has been observed when temperatures inhibit shoot growth. Limited research available on turfgrass has shown a few extra weeks of color response suggesting some amount of N taken up, although root growth, carbohydrate storage, and year round benefits have not been shown. Research is lacking directly measuring plant uptake and utilization, as well as evaluating environmental differences including soil type, plant species, and application timings. For a comprehensive scientific review of the work that has been done (or to cure your chronic insomnia), you can check the literature review section of my Master's thesis.

Because of the lack of good supporting data for one of the most important fertilizer timings, our research objectives were to evaluate beneficial claims associated with fall N fertilization. We hope that our findings will spark renewed interested in the conventional wisdom of fall fertilization and eventually lead to improved N fertilizer recommendations. This research was conducted between 2007 and 2009 and involved a greenhouse experiment and an ongoing a field study conducted in Madison, WI and St. Paul, MN.

In the greenhouse experiment, plant species (Kentucky bluegrass, creeping bentgrass, and annual bluegrass) were grown to maturity and transferred to a growth chamber set to the temperatures and day lengths characteristic of September 15th, October 15th, or November 15th for Madison, WI. Nitrogen was applied to these grasses at 0, 0.5, 1, or 2 lbs N/M. We found that the N uptake responses were fairly similar[1] among species, but very different among temperatures (Figure 1). Ten days after N was applied, uptake averaged 64, 47, and 26% of fertilizer applied in September, October, and November treatments across species. In field conditions, these numbers were even lower probably due to rainfall and other environmental factors. Root growth was not stimulated and was actually inhibited by the high application rates in September. Spring green up was greatest for October applications and

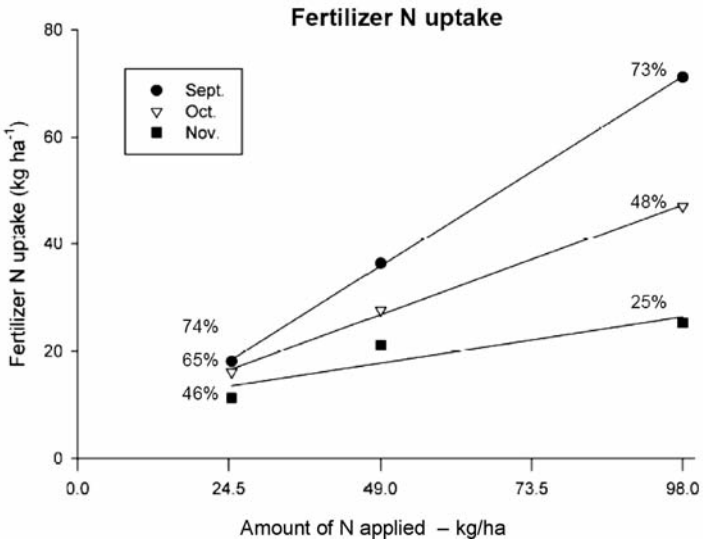

Figure 1. The amount of N taken up by the grass as a function of application rate and temperature. An application of 1 lb N/M is equivalent to 49 kg/ha. Note the inefficiency of high application rates in cool temperatures. The percent of N taken up is shown on the figure next to the data points. In summary, the best fall fertilizer plan is to continue your spoon feeding program into late fall, or apply a predominately slow-release fertilizer at a high rate in September. This research study found few, if any benefits to heavy applications of N in the late season in Wisconsin and Minnesota.

[1] **Interestingly, the annual bluegrass had a greater nitrogen uptake potential than Kentucky bluegrass or creeping bentgrass in cool temperatures. That means fertilizing heavier in cooler temperatures may favor annual bluegrass, or it may lead to more succulent growth of that species and therefore increased winter damage.**

there was no difference between the 0.5 lb and the 1.0 lb/M rate. November applications did not respond at all in the sand based root zone but did green up nicely in the silt loam soil, suggesting fertilizer loss through leaching from November treatments on sand. While we will continue to investigate the effects of fall applications of fertilizer to putting greens and other types of turf, the following conclusions can be made:

- Don't expect miracles from fall-applied N. Color will improve slightly in fall and spring but the N will not increase root production, photosynthesis, or make any lasting impact on quality. The same spring and fall color responses can probably be achieved through much smaller applications than are currently being applied by most managers.
- Avoid high application rates in fall, as the turf is only able to absorb small amounts of N during this time. Some N will be lost over winter and early spring, and the remaining N will stimulate a flush of shoot growth in the spring at the expense of root development. We watched this happen in the field in Madison and St. Paul.
- Based on our research findings, the best strategy for golf courses that currently practice spoon feeding is to maintain the spoon feeding program into mid-October.
- For taller cut turf, or turf that is fertilized with granular fertilizers, managers should avoid applying more than 0.5 lbs N/M past mid-October. Prior to this time, applications up to 1.0 lbs N/M continue to be suitable, especially if slow-release N is included.

(Note: We are proud to announce that Dan Lloyd completed his Master's Degree in August and has moved on to the University of Missouri where he will be a turfgrass research technician for Dr. Xi Xiong. His literature review and full research reports are in fact very interesting and worth a read if you find yourself in disbelief right now. To get a copy or for other questions concerning this article feel free to contact Doug Soldat at djsoldat@wisc.edu, office phone: 608-263-3631.)