New Approaches to Nitrogen Fertilization of Turfgrass

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Nitrogen fertilization is a cultural practice essential in maintaining high quality turfgrass areas. Nitrogen nutrition is directly related to turfgrass color, shoot and root growth, shoot density, disease susceptibility, and drought tolerance. Because of nitrogen's vital role in plant nutrition, methods of improving application efficiency in traditional crops has been studied extensively. Greater yields have been achieved with many crop species as the result of incorporating nitrogen fertilizer into the soil. Traditionally, there has been no equipment available to the turf manager to incorporate nitrogen fertilizer into the soil without causing considerable surface disruption and it has therefore been applied almost exclusively to the turfgrass surface.

High pressure water injection was introduced early this decade as a method of cultivating turfgrass areas while causing minimal surface disruption. The Toro HydroJect®, the original water injection cultivation unit, utilizes 5000 psi water bursts to cultivate soils to depths reaching 4 to 6 inches. This technology has created the possibility of incorporating nitrogen into turfgrass soils by injecting soluble fertilizer.

Preliminary studies conducted at Michigan State University concluded that injecting nitrogen with the HydroJect increased clipping yields, produced darker colored turf, increased nitrogen content is leaf tissues, and decreased moisture stress symptoms when compared to surface applications of nitrogen. It was not possible to determine whether these benefits of injecting nitrogen were the result of placing nitrogen deeper in the soil profile, the result of creating aeration channels with the high pressure water jets, or a combination of deeper nitrogen placement and aeration channels.

Two research projects were initiated this year at the Hancock Turfgrass Research Center to study the mechanisms involved with the beneficial turfgrass responses related to nitrogen injection. The objective of Study #1 is to examine the interaction between deep nitrogen placement and aeration channels created by the HydroJect. The objective of Study #2 is to examine the differences in nitrogen uptake between surface and subsurface applications with regard to amount and duration of fertilizer nitrogen incorporated into turfgrass tissues.

STUDY #1. "Nitrogen Application Depth and Water Injection Cultivation"

This study was initiated on May 2, 1997. Two rates of nitrogen were applied using four types of management practices (see study outline below). As of August 28, 1997, four treatment applications have been made. Treatments are applied monthly and will run through October. A double rate dormant application will be made in November. Turfgrass evaluations to be made throughout this study include: clipping yields (weekly), color ratings (weekly), quality ratings (weekly), soil moisture content (during periods of turf dry down), and root mass (semi annually).

Early results from this study have shown, as expected, that the 1 lb. rate of nitrogen per 1000 ft^2 produced greater clipping yields, color ratings, and quality ratings than the 0.5 lb. rate. Within a week of the initial treatment applications, there were no differences among management practices in turfgrass evaluations. However, since two weeks following initial treatment applications, nitrogen injected with both the #53 and #56 nozzles have consistently had significantly greater clipping yields, color ratings, and quality ratings than surface applications (this was true for both rates of nitrogen). The experimental area has gone through one dry down period since the initiation of the study. Soil moisture values were significantly higher for turf injected with nitrogen than turf

receiving surface applications. Water injection cultivation also increased soil moisture values within surface application treatments.

STUDY OUTLINE

〈 Factor A - Management Practices

1. Surface application of N with no water injection cultivation.
2. Surface application of N plus water injection cultivation.
3. Subsurface injection of N with #56 nozzle (2 to 4" injection depth).
4. Subsurface injection of N with #53 nozzle (4 to 6" injection depth).

Factor B - N Rate

5. 0.5 # N per 1000 ft^2 per application.
6. 1.0 # N per 1000 ft^2 per application.

〈 Treatment Summary

1.	N applied on surface with no WIC	0.5 # N per 1000 ft^2 per application
2.	N applied on surface with no WIC	1.0 # N per 1000 ft^2 per application
3.	N applied on surface plus WIC	0.5 # N per 1000 ft^2 per application
4.	N applied on surface plus WIC	1.0 # N per 1000 ft^2 per application
5.	N injected with #56 nozzle	0.5 # N per 1000 ft^2 per application
6.	N injected with #56 nozzle	1.0 # N per 1000 ft^2 per application
7.	N injected with #53 nozzle	0.5 # N per 1000 ft^2 per application
8.	N injected with #53 nozzle	1.0 # N per 1000 ft^2 per application

〈 Plot Plan: North ↑

5	8	2	3	7	1	6	4
2	4	1	2	1	4	3	7
6	5	5	8	2	8	5	8
3	1	7	3	7	4	6	6

STUDY #2: "Injection and Surface Application of Labeled Nitrogen"

This study was initiated on August 5, 1997. The study consists of two treatments; 1 lb. nitrogen per 1000 ft^2 either injected of surface applied. The nitrogen source used in this experiment contains excessive amounts of ^{15}N (heavy nitrogen atoms) that can be identified using laboratory equipment. Turfgrass cores will be taken at 1, 3, 7, 14, 21, and 35 days following treatment. These cores will be sectioned into green tissue, thatch, soil at 0 to 4 inches, roots at 0 to 4 inches, soil at 4 to 8 inches, and roots and 4 to 8 inches. Analyzing these core sections for ^{15}N content will illustrate how application method affects nitrogen fertilizer cycling through soil and turfgrass tissues.