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EFFECT OF FERTILIZER SOURCE ON NITRATE LEACHING AND TURFGRASS QUALITY

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Abstract. **Due to increasing concern over potential pollution of Florida's water resources from fertilization of home lawns, state wide research is being conducted to verify different aspects of turfgrass Best Management Practices. The objectives of this study are to evaluate differences in plant visual quality and growth responses, and fertilizer leaching between turfgrass and landscape plants in response to different fertilizer formulations. The experiment was conducted in a climate controlled greenhouse at the G. C. Horn Turfgrass Field Laboratory at the University of Florida in Gainesville. 'Floratam' St. Augustinegrass (*Stenotaphrum secundatum* [Walt.] Kuntze.) was compared to a mix of ornamentals including Canna (*Canna generalis*), Nandina (*Nandina domestica*), Ligustrum (*Ligustrum japonicum*) and Allamanda (*Allamanda* spp). All plants were grown in 303 L plastic pots in an Arredondo fine sand. There were three fertilizer treatments (16-2-7 quick-release (e.g., 16-4-8), 15-0-12 quick-release (e.g., 15-0-15), 8-2-10 slow-release (e.g., 8-4-12) applied at 4.9 g nitrogen per m² every other month. Water was applied to meet the evapotranspiration and turfgrass tubs were mowed weekly. Experimental design was a randomized complete block design with four replications. Leachate was collected at three intervals following fertilizer application and analyzed for nitrate nitrogen and phosphate content. Visual quality ratings and time domain reflectometry (TDR) data were collected weekly and multispectral reflectance (MSR) readings were taken every other week. Preliminary data indicated that turf is more responsive to fertilizer treatment than ornamentals. Best turfgrass reactions were in response to quick release treatments in the first two weeks following fertilizer application.**

Best management practices (BMP's) are currently being developed for commercial and residential lawns and landscapes in Florida, however there is a lack of information regarding many issues. One of the most popular turfgrasses for home lawns in Florida is St. Augustine grass; a warm season grass that requires moderate fertility (Cisar et al., 1992). While some data exist on fertility needs of St. Augustine grass, little is known about effects of turfgrass fertility regimes on other landscape plants.

Nitrogen (N) is the nutrient applied to turfgrass in the greatest quantity and frequency (Cisar et al., 1992). The fate of fertilizer N applied to residential landscapes involves gaseous loss to the atmosphere through volatilization and denitrification, plant uptake, soil storage, run off, and leaching. A number of authors have examined N leaching from turfgrass systems, which can lead to water contamination from home lawn fertilization (Cisar et al., 1992; Morton et al., 1988; Petrovic, 1990; Starr and Deroo, 1981).

Improper fertilization rates can greatly affect both growth and quality of plants as well as water quality due to potential nutrient leaching. Petrovic et al. (1990) observed that up to 47% of applied N leached when applied as urea to Kentucky bluegrass grown on a sandy loam soil with no irrigation.

Materials and Methods

The experiment was performed in a climate-controlled greenhouse at the G. C. Horn Memorial Turfgrass Field Laboratory at the University of Florida, Gainesville. 'Floratam' St.

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Table 1. Leachate collection schedule in a fertilizer cycle.

Week	Events	Day
0	Fertilizer application	1
1		8
2	First leachate collection	15
3		22
4	Second leachate collection	30
5		37
6		45
7		52
8	Third leachate collection	60

Augustinegrass (*Stenotaphrum secundatum* [Walt.] Kuntze.) and a combination of four common Florida ornamentals, *Canna generalis* 'Brandywine', *Ligustrum japonicum* 'Lake Tresca', *Nandina domestica* 'Harbor Dwarf' and *Allamanda cathartica*, were chosen as plant material. All plant material was planted in 303 L tubs in Arredondo sand with a pH of 6.5. Three fertilizer treatments were used: quick release fertilizer (QRF) at 16-2-7 (e.g., 16-4-8) and 15-0-12 (e.g., 15-0-15) and a specialized slow release palm fertilizer (SRF) 8-2-10 (e.g., 8-4-12). Fertilizer was applied at 2 month intervals at a rate of 4.9 g of N per m^2 to both turf and ornamentals. In this 2 month period (Fertilizer cycle), leachate was collected at 2, 4, and 8 weeks after fertilizer application (Table 1). To collect leachate, a hole was drilled on one side of the tub. Leachate drained through a pipe attached to the tub into a dark 19 L plastic bucket. Leachate volume was measured and a 20-mL sample was sent to the Analytical Research Laboratory (ARL), Gainesville for analysis. Leachate was analyzed for nitrate nitrogen, ammonium nitrogen and phosphate. Water was applied to meet evapotranspiration and turfgrass tubs were mowed weekly to maintain a height of 9 cm. Clippings were removed. Visual quality ratings and time domain reflectometry (TDR) data were collected weekly and multispectral reflectance (MSR) readings were taken every other week. Light intensity and temperature data were also taken weekly.

The experimental design was a randomized complete block model. Data were analyzed with proc anova to determine differences in response to treatments at the 5% significance level and with Fisher's LSD to compare means.

Results and Discussion

Plant Quality. Turfgrass quality was measured through visual quality analysis and MSR. During the first 2 weeks following fertilizer application, QRF applications had significantly higher quality than SRF applications (Figs. 1 and 2). Turf quality did not differ between QRF throughout the fertilizer cycle. There were no differences between any of the fertilizer treatments from week 3 to week 8 following fertilization.

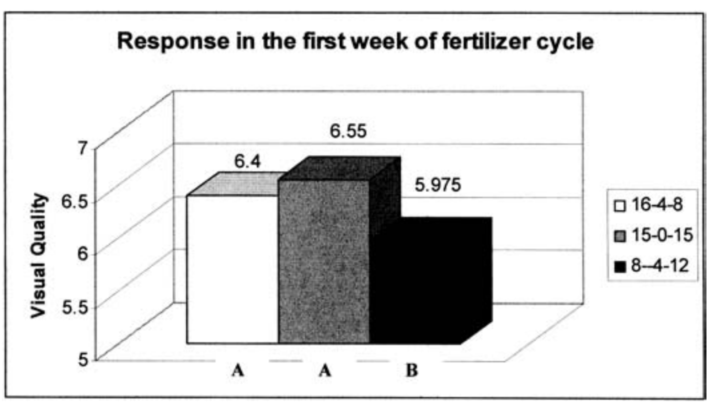

Fig. 1. Response of turfgrass in the first week of fertilizer cycle.

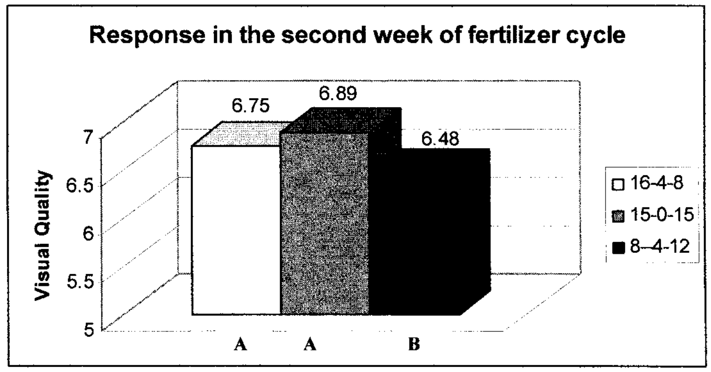

Fig. 2. Response of turfgrass in the second week of fertilizer cycle.

Both quick release fertilizers initially released nitrogen at a faster rate, which enabled turf to take up more nitrogen. This resulted in better turf vigor and quality in the first 2 weeks. Lack of differences in visual quality by week three was most likely due to reduction of nitrogen release from QRF and increased release of nitrogen from SRF.

MSR results also supported findings of visual quality analysis. In the first and second treatment cycles, reflectance measured at wavelength 550 showed that 15-0-12 treated turf was statistically better than SRF in the first 2 weeks of the cycle ($P = 0.08$ and 0.07, respectively). Measurement of thatch volume also showed significant difference between fertilizer treatments. There was less thatch build up in SRF treated turf than in QRF treated turf (Table 2).

In contrast to turf, ornamental combination pots did not show differences to different fertilizer treatments during the establishment period. There were no significant differences between fertilizer treatments at any period of time during fertilizer cycles.

Nitrogen Leaching. Leachate samples from initial fertilizer cycles were analyzed at the ARL in Gainesville. There were significant differences in percentage of nitrate leached between turf and ornamentals. More nitrate was leached from ornamentals than from turf (Fig. 3). Ammonium leaching was also lower from turf, but it was not statistically different from ornamentals.

In turf, the amount of nitrate leached from different fertilizers was also significantly different. The highest amount of nitrate leached from QRF 15-0-12 and the lowest amount of nitrate leached from the SRF (Fig. 4). QRF 16-2-7 and SRF both leached more nitrate from ornamentals than turf (Figs.

Table 2. Comparison of thatch volume.

Fertilizer	Type	Mean thatch volume (g·cm^2)
15-0-12 (e.g., 15-0-15)	QRF	0.150 a[z]
16-2-7 (e.g., 16-4-8)	QRF	0.126 b
8-2-10 (e.g., 8-4-12)	SRF	0.108 c
Anova		$P = 0.0011$
R^2		0.92

[z]Means followed by the same letter do not differ significantly at the 0.05 probability level.

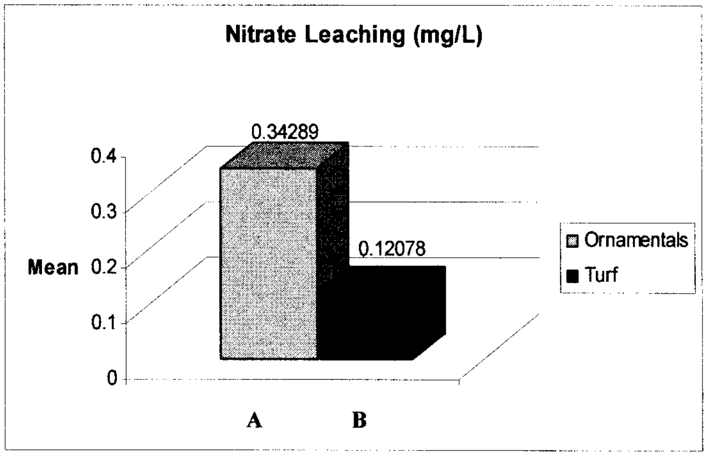

Fig. 3. Comparison of nitrate leaching between turf and ornamentals.

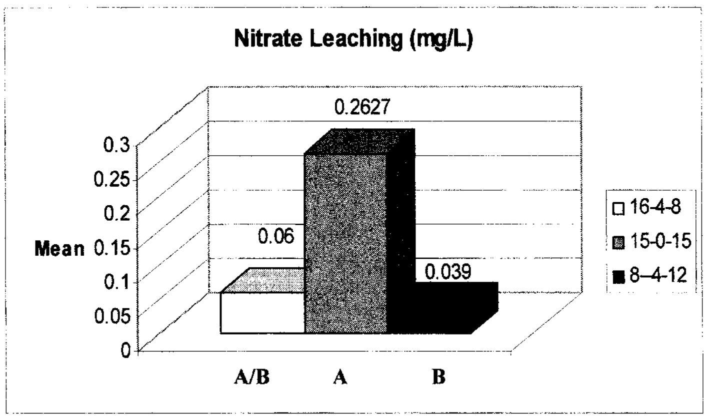

Fig. 4. Nitrate leaching from different fertilizers in turf.

5 and 6), while there were no differences in nitrate leaching between plant treatments in QRF 15-0-12.

This study is not yet completed and results presented here are based on analysis of preliminary data. Further research is needed to gain better knowledge of the best management practices that can help in proper nutrient management of residential areas. An ideal urban landscape model should be developed employing BMP's for best utilization of resources in an environmentally sound fashion.

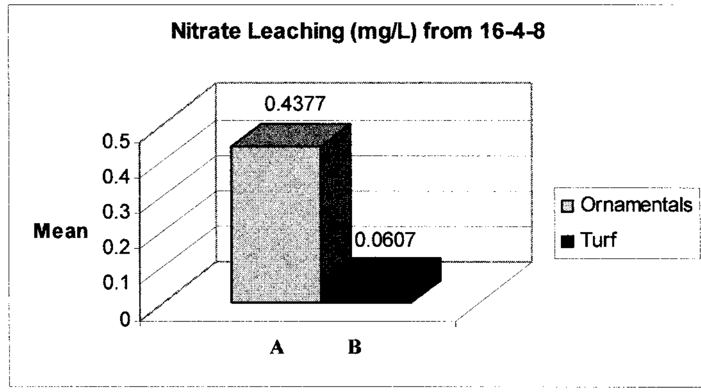

Fig. 5. Nitrate leaching from 16-2-7 (e.g., 16-4-8).

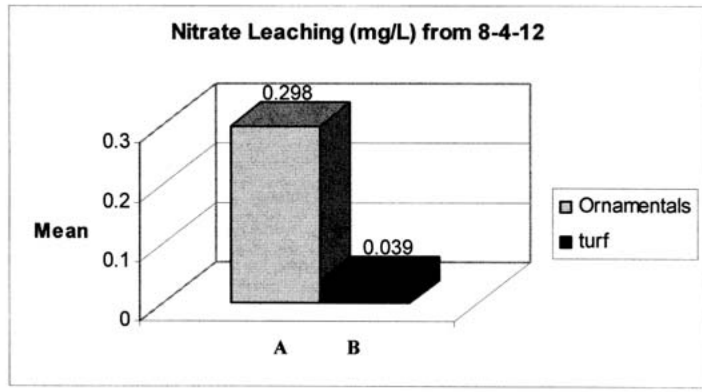

Fig. 6. Nitrate leaching from 8-2-10 (e.g., 8-4-12).

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