Supplemental Nickel Applications and Foliar Urea Fertility on Two Warm–Season Turfgrass Species under Salinity Stress

Haibo Liu and Nick Menchyk
Clemson University

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Objectives:

1. *Assess urease activity in leaf tissue of two turfgrass species after foliar applications of urea N,*
2. *Determine the effect of supplemental Ni applications on urease activity and amino acid content,*
3. *Determine if moderate salinity reduces urease activity and N metabolism in warm–season turfgrass leaf tissue and*
4. *Establish if Ni supplementation increases foliar urea N uptake and assimilation*

Urea is a popular foliar nitrogen (N) fertilizer in turfgrass management. Before urea can be incorporated into organic N compounds it must be hydrolyzed by urease, a Nickel (Ni) dependent metalloenzyme, into ammonium and carbon dioxide. Due to the prevalence of foliar urea use in turfgrass management a nine week study repeated twice was conducted at the Clemson University greenhouse facility to examine N metabolism under foliar urea applications and Ni supplementation of two warm–season turfgrass species. ´Tif–Eagle´ ultradwarf bermudagrass [*Cynondon dactylon (L) Pers. X C. transvaalensis* Burtt– Davy] and ´Diamond´ zoysiagrass [*Zoysia matrella* (L.) Merr.] were established in solution culture consisting of two levels of salinity (0 and 5,000 ppm NaCl) and three levels of Ni as control, 200, and 400 μg Ni L^{-1}. To examine N metabolism and the influence of Ni supplementation on foliar urea

Figure 1. The greenhouse set up for the study with a hydroponic culture system of treatments of salinity and Ni at different levels. During the foliar application of N with the grass culture being removed to another container without to minimize the potential of contamination into the container´s solution.

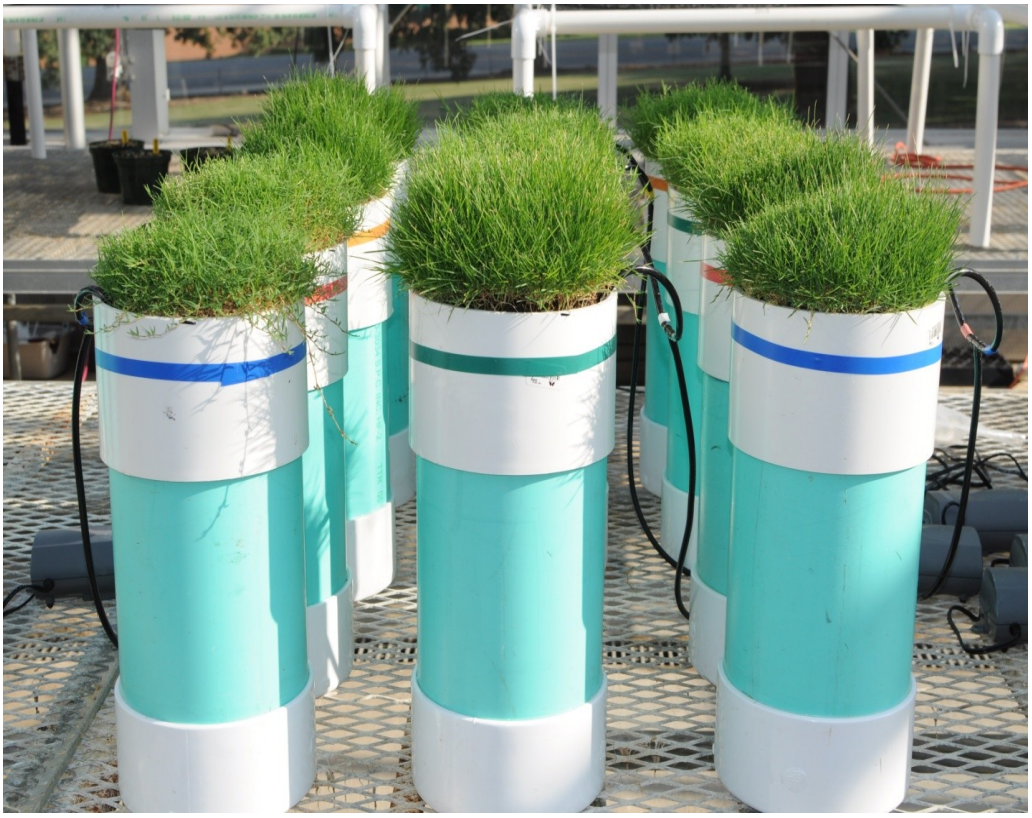

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Table 1. Amino acid content in leaf tissue of ´Diamond´ zoysiagrass and ´TifEagle´ bermudagrass as influenced by salinity regime, Ni level, and species in Clemson University Greenhouse Research Complex during 2011 at three harvest events (3, 6 and 9 weeks after initiation of treatments). Data were pooled for species, salinity regimes, and replication of two times of experiment since there were no significant interactions at α=0.05 levels.

Main effects	3 week	6 week	9 week
	——————— mg g^{-1} FW ———————		
Salinity			
Control	16.73	16.61	42.43
5,000 ppm	16.99	17.69	39.59
Ni level (mg/L)			
Control	13.40	12.27	26.55
200	17.99	19.05	48.11
400	19.19	20.14	48.36
$LSD_{0.05}$	1.56	1.94	3.86

Table 2. Urease activity in leaf tissue of ´Diamond´ zoysiagrass and ´TifEagle´ bermudagrass as influenced by salinity regime, Ni level, and species in Clemson University Greenhouse Research Complex during 2011 at three harvest events (3, 6 and 9 weeks after initiation of treatments). Data were pooled for species, salinity regimes, and replication of two times of experiment since there were no significant interactions at α=0.05 levels.

Main effects	3 week	6 week	9 week
	———— μmol NH^{4+} min^{-1} g^{-1} ————		
Salinity			
Control	486.91	587.75	533.14
5,000 ppm	448.70	639.71	534.30
Ni level (mg/L)			
Control	185.13	160.46	202.61
200	563.60	797.57	664.70
400	564.69	883.16	733.85
$LSD_{0.05}$	134.50	170.91	134.80

fertilization, turfgrass clippings were harvested three times throughout the study to measure urease activity, total amino acid content, tissue nutrient concentration, root mass and clipping yield. Supplemental Ni applications increased overall urease activity which resulted in elevated amino acid contents in leaf tissue. Although apparent increases in N metabolism and growth were exhibited under Ni supplementation, N concentration in both species decreased over the course of the study. This is the first research project examining Ni supplementation in turfgrass management. Further field research is needed to further understand the influence of supplemental Ni applications on foliar urea N fertility, micronutrient interactions, and N metabolism.

Summary Points

- Urease activity and N status in turfgrass
  - An overall decrease in N content in leaf tissue was observed over the course of the nine week study
  - This finding could be the result of utilizing urea as the sole N source which can result in reduced growth and symptoms of N starvation
- Increased urea N uptake
  - Storage and transport amino acids
- Nickel supplementation
  - Increase in dry matter production
  - Increase in urease activity and amino acid content
- Slight salinity (5,000 ppm) had no effect on urea N metabolism

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