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Hydretain® Application for Enhanced Nutrient Uptake by Cool-Season Turfgrass

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Introduction

Previous research has demonstrated increased vegetative growth of cool-season turfgrass treated with Hydretain® at labelled rates versus untreated controls. Presumably, turfgrasses treated with Hydretain that respond with increased vegetative growth would contain a greater amount of assimilated nutrients relative to slower growing controls. While numerous reports describe the positive vegetative response of turfgrasses to Hydretain application, none have reported data directly confirming a link between this response and increased nutrient uptake. This research was undertaken to explore fertilizer uptake efficiency of turfgrass treated with and without Hydretain.

Materials and Methods

Turf-type perennial ryegrass (*Lolium perenne* L. 'Paragon') seed was obtained from Midwest Grass & Forage (Macomb, IL). Ryegrass was seeded at a rate of 4 lbs. pure live seed per 1000 ft^2 in two-gallon plastic nursery containers filled with soilless media (Pro-Mix BioPlus; Quakertown, PA). Seeds were then gently incorporated by hand-mixing into the surface 1/4-inch of the media, pots were placed on benches in the WIU greenhouse facility, and subsequently irrigated as necessary to ensure optimal seed germination and subsequent turfgrass establishment. Turfgrasses were considered established when vegetation reached 2 ½ inches in height.

After turfgrass establishment, fertility applications were made to all pots, supplied in solution prepared from a soluble, complete fertilizer (20-20-20; Scott's Company) dosed at a rate of 1.0 lb. actual N/1000 ft^2. Hydretain treatments ('Hydretain' if applied; 'Control' if not), were made at the standard label rate of 9.0 fl. oz. /1000 ft^2. In order to limit possible nutrient losses, each container was fitted with an impermeable polymer dish placed underneath it. Immediately after treatments were applied, all pots were irrigated to incorporate treatments into the root-zone. From this point, maintenance irrigation was applied at 24-hour intervals, and application volumes were carefully monitored so that each container was irrigated to saturation. Irrigation was slowly applied so as to limit surface runoff or bottom drainage. Turfgrass was maintained at a cutting height of 2 ½ inches via weekly clipping with scissors. At each clipping event, clippings were collected, placed into individually-labelled paper bags and dried in a forced-air drying oven for 24 hours. After drying, mass was recorded, and samples were combined per treatment per replication, stored until the end of the trial, and sent for total-N analysis at the University of Illinois (R. Mulvaney, PhD; Urbana, IL), and then to Southeastern Agricultural Labs (Barney, GA) for characterization of P, K, Ca, Mg, S, Zn, Mn, Cu, and Fe.

Statistical analysis was accomplished with SAS software version 9.2.3 (SAS Institute Inc., Cary, NC) using the MIXED procedure with mean separation of treatments achieved using the PDIFF option. Significance was determined at an α-level of 0.10. The experimental design used for the study was a randomized complete block with four replications.

Results & Discussion

Dry Matter Yield

As shown in Table 1, there were differences in clipping production as measured by dry matter yield at two of four weekly harvests during the trial. These differences occurred for the first and second harvest dates, where Hydretain treated turf produced 16 and 21 percent more clippings than controls. Taking into account overall vegetative production, Hydretain treated turf outgrew controls by 31 percent, exhibiting a significantly higher mean yield of 5.5 g versus 4.2 g for controls.

Nutrient Recovery in Vegetative Tissue

As shown in Table 2., differences in vegetative elemental composition of turfgrass used in the study were detected for nine (N, P, K, S, Ca, Mg, B, Mn, Cu) of the eleven elements sampled. In every instance where differences were significant, Hydretain treated plants exhibited greater recoveries of assayed elements relative to controls. For example, Hydretain treatment of turf increased macronutrient recoveries in leaf tissue relative to controls by 45, 47, and 54 percent for N, P, and K, respectively. A similar trend was found for the secondary nutrients of Ca, Mg, and S, where Hydretain treatment increased recovery of these elements by 41, 48, and 56 percent, respectively. Similar to the findings for primary and secondary nutrients, some micronutrients were found in greater amount in Hydretain treated than control plants. In this regard, Hydretain treatment increased tissue levels of B, Mn, and Cu, by 31, 41, and 43 percent, respectively. Recovery in turf leaves of Fe and Zn were not influenced by Hydretain application.

The enhanced uptake of essential plant nutrients by turfgrass resulting from Hydretain treatment as reported here likely arises from a complex interplay of factors inherent to turfgrass systems. Possibly, enhanced nutrient uptake provided by Hydretain application may arise through augmented root function, stabilized fertilizer solubility or form, or altered colloid chemistry. Regardless of the mechanism, this research suggests that Hydretain may provide an environmental benefit to turfgrass managers by limiting nutrient losses from fertilized turfgrasses through enhanced fertilizer uptake efficiency.

Conclusions

Under the conditions reported here, this research provides evidence that Hydretain may be utilized to enhance fertilizer uptake of N, P, K, Ca, Mg, S, B, Mn, and Cu by a cool-season turfgrass. These findings suggest that turfgrass managers applying Hydretain may be able to reduce the environmental impact of fertilization by enhancing turfgrass root, soil, and fertilizer dynamics resulting in improved fertilizer uptake efficiency. Depending on site-specific conditions, turf managers may be able to reduce overall fertilizer rates by taking advantage of the results demonstrated by this research. Turfgrass managers should be aware of benefits that Hydretain application may confer to their operation when cultivating fertilized turf to lower the environmental impact of doing so.

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Tables

Table 1. Dry matter yield of turfgrass

	Mean Clipping Yield (g)				
	--------------------------Date-----------------------				
Treatment	4/25/2020	5/2/2020	5/16/2020	5/25/2020	Total
Control	0.5b*	1.8b	1.0a	0.9a	4.2b
Hydretain	0.6a	2.1a	1.4a	1.3a	5.4a
P-value**	0.0918	0.0854	NS***	NS	0.0560

*Within data columns, variables with the same letter designation are not statistically different.
**Significance was determined using a *P*-value α-level of 0.10
***NS = not significant

Table 2. Mean Total Recovery of Selected Elements in Vegetative Tissue

	Mean Total Recovery of Selected Elements in Vegetative Tissue (mg)										
Treatment	Nitrogen	Phosphorus	Potassium	Sulfur	Calcium	Magnesium	Boron	Zinc	Manganese	Copper	Iron
Control	156.15b*	21.49b	130.58b	16.27b	18.07b	11.76b	0.13b	0.28a	1.21b	0.07b	0.61a
Hydretain	226.91a	30.95a	200.85a	25.36a	25.50a	17.41a	0.17a	0.43a	1.71a	0.10a	0.84a
P-value**	0.0493	0.0989	0.0727	0.0973	0.0733	0.0708	0.0575	NS***	0.0357	0.0697	NS

*Within data columns, variables with the same letter designation are not statistically different.
**Significance was determined using a *P*-value α-level of 0.10
***NS = not significant