Perennial Ryegrass & Kentucky Bluegrass Athletic Field Response to NutriLife AF-Treated Nitrogen Fertilizer: 2012 Field Evaluation

Submitted: December 27, 2012
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Introduction:

More slow-release fertilizer products are currently available to turfgrass mangers than ever before. One of two general mechanisms to regulate nutrient availability following fertilizer application has historically been employed; degradable coatings to encapsulate immediately-available nitrogen forms (e.g. sulfur-coated urea N), or synthesis of urea and formaldehyde into polymers of various length, solubility, and stability/persistence.

Though simplistic, drawbacks to coated fertilizer technology exist. Foremost, coatings dilute nutrient content while increasing requisite material application rate. Furthermore, coatings increase prill size and likelihood of mower removal. Lastly, coating integrity can be compromised by 'rough handling' inherent to bulk fertilizer transport and application. The prospect of complementing coated fertilizers with biochemical fertilizer catalysts is interesting to professional turfgrass managers. Considering the increasing availability of such fertilizer treatments/complements, and sensational claims of fertilizer and/or nutrient use efficiency enhancement, it has become increasingly important that the performance of such fertilizer conditioners/complements/catalysts is verified by replicated and statistically-analyzed field research trials.

Experimental Objective:

To evaluate NutriLife AF (NLAF; AMS Sciences, Pilot Point, TX) treatment of granular polymer/sulfur–coated nitrogen fertilizer (24–0–4) by field measures of soil nutrient levels and turfgrass canopy color, canopy density and vigor response; 2 to 10 weeks following 0.25, 0.5, 0.75, or 1.0 lbs N per 1000 ft^2 fertilizer applications to an intensively-maintained athletic field.

Field Experimentation and Methods:

The experimental turfgrass system was a Perennial ryegrass and Kentucky bluegrass cohabited-sward within the PSU Landscape Management and Research Center (University Park, PA). In 2011, the athletic field was irrigated to prevent wilt, fertilized with 0.6-1.2 lbs urea-N and K_2O per 1000 ft^2 bi-monthly, and mowed at a 1.4" height two to three times each week. Excepting maintenance applications of fertilizer, identical management practices were conducted in 2012. Seven (7) replicated blocks of eight (8) plots were randomized in complete block design (RCBD) in late April 2012. Composite samples were collected from the 0-6" soil depth of each block and submitted to Brookside Laboratories LLC (New Knoxville, OH) for standard fertility assessment.

On 15 May 2012, a 300-gallon boom sprayer was used to treat all plots at label rates of pre-emergent herbicide (prodiamine), micronutrient fertilizer, and a non-ionic wetting agent; all in a carrier volume of 4.0 gal. / 1000 ft^2. The experimental area was then fertilized with granular K-Mag (0-0-22; 11% Mg, 22% S) at 3 lbs / 1000 ft^2, and then activated with 0.6" potable water applied via an overhead irrigation system. The following day (16 May), granular forms of either:
- 24–0–4 + NLAF (NutriLife AF; NLAF @ 1.5 gallons / ton fertilizer), or
- 24–0–4 (untreated)

polymer/sulfur–coated nitrogen fertilizer were applied at a rate of 0.25, 0.5, 0.75, or 1.0 lbs N / 1000 ft^2 to randomly-selected turfgrass plots (each 28 ft^2) within each block.

Using a dedicated 22” rotary deck-mower, clipping yields (CY) were collected 2, 4, 6, 8, and 10 weeks after treatment (WAT). Immediately following field collection of clipping yield, simultaneous measures of 660– and 850–nm reflectance from the canopy of each plot were recorded in triplicate using an ambient light-excluding FieldScout TCM–500 turfgrass chlorophyll meter (Spectrum Technologies Inc., Plainfield, IL). Reflectance data were used to calculate normalized differential vegetative indices (NDVI). On the identical frequency, a color meter (FieldScout TCM-500-RGB) collected triplicate measures of green, red, and blue canopy reflectance. Data were converted to hue, saturation, and brightness levels to determine dark green color index (DGCI; Karcher & Richardson, 2003). These NDVI and DGCI indices, dependably-reproducible measures of turfgrass canopy density and dark green color respectively (Zhu et al., 2012), are used to quantify athletic field quality response to treatments in the following results section. Clippings were dried to constant mass in 70 ^{o}C forced-air, cooled in a desiccator, and weighed to 0.1-mg resolution.

Six and ten weeks after treatment (WAT), the 0-6” soil depth of each plot was extensively sampled, air-dried, and submitted to Brookside Laboratories for standard fertility assessment. Turfgrass canopy and growth parameters were modeled by fertilizer treatment and WAT using the mixed procedure (SAS Institute, v. 8.2). Mean dependent variables significantly influenced by treatment were further evaluated using seven (7) single-degree-of-freedom contrast statements; ‘NutriLife AF vs. none’ and ‘linear, quadratic, or cubic N rate response,’ and the interaction of each with the ‘NutriLife AF vs. none’ response.

Field Results:

Turfgrass growth and canopy measures were significantly influenced by fertilizer treatment. The influence of the NutriLife AF (NLAF) biochemical catalyst on general turfgrass performance is best evaluated across the broad inference space (all N rates pooled). While mean canopy density and color (over the 70-d study) showed no significant response to NLAF treatment, an 8% relative increase in shoot growth was observed and statistically-verified (Fig. 1, top pane).

As expected, mean turfgrass growth, canopy density, and canopy color increased in direct relation to linear N rate (Fig. 2), but this response did not interact with NLAF complementation. Once turfgrass has broken dormancy, shoot growth increases area-based photosynthetic assimilation, and facilitates early season weed resistance.

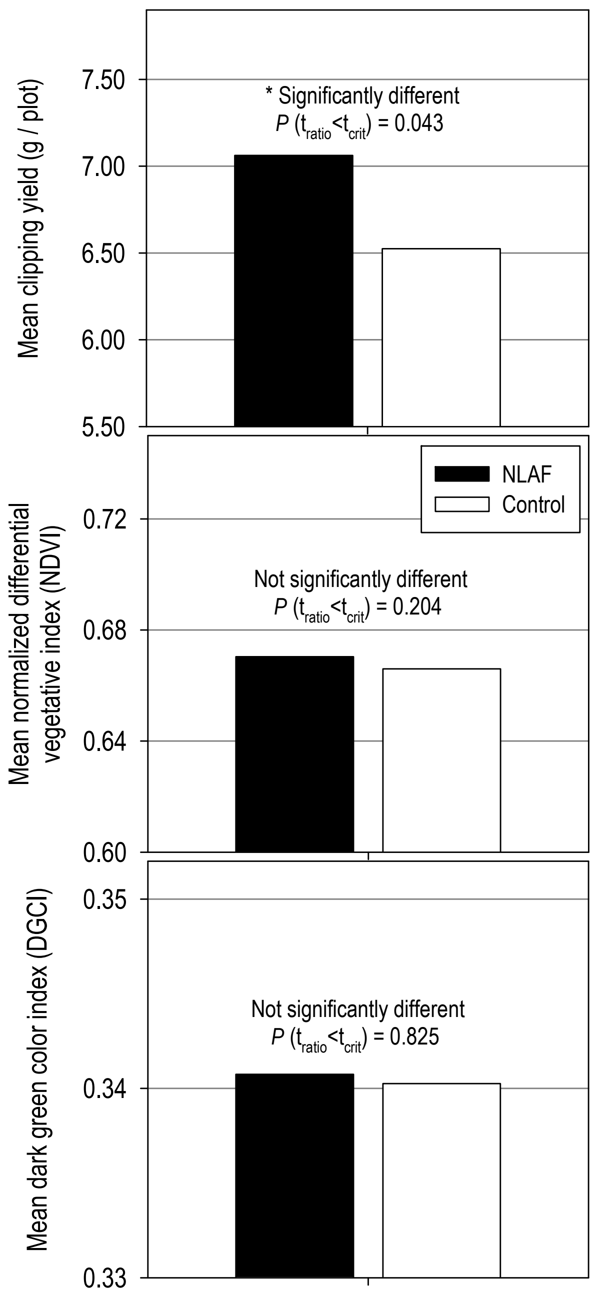


Figure 1. NutriLife AF biochemical catalyst fertilizer treatment (1.5 gal./ ton) effect on mean turfgrass clipping yield (CY), canopy density (NDVI), and dark green color (DGCI); over the 70-d field study (all fertilizer rates pooled).

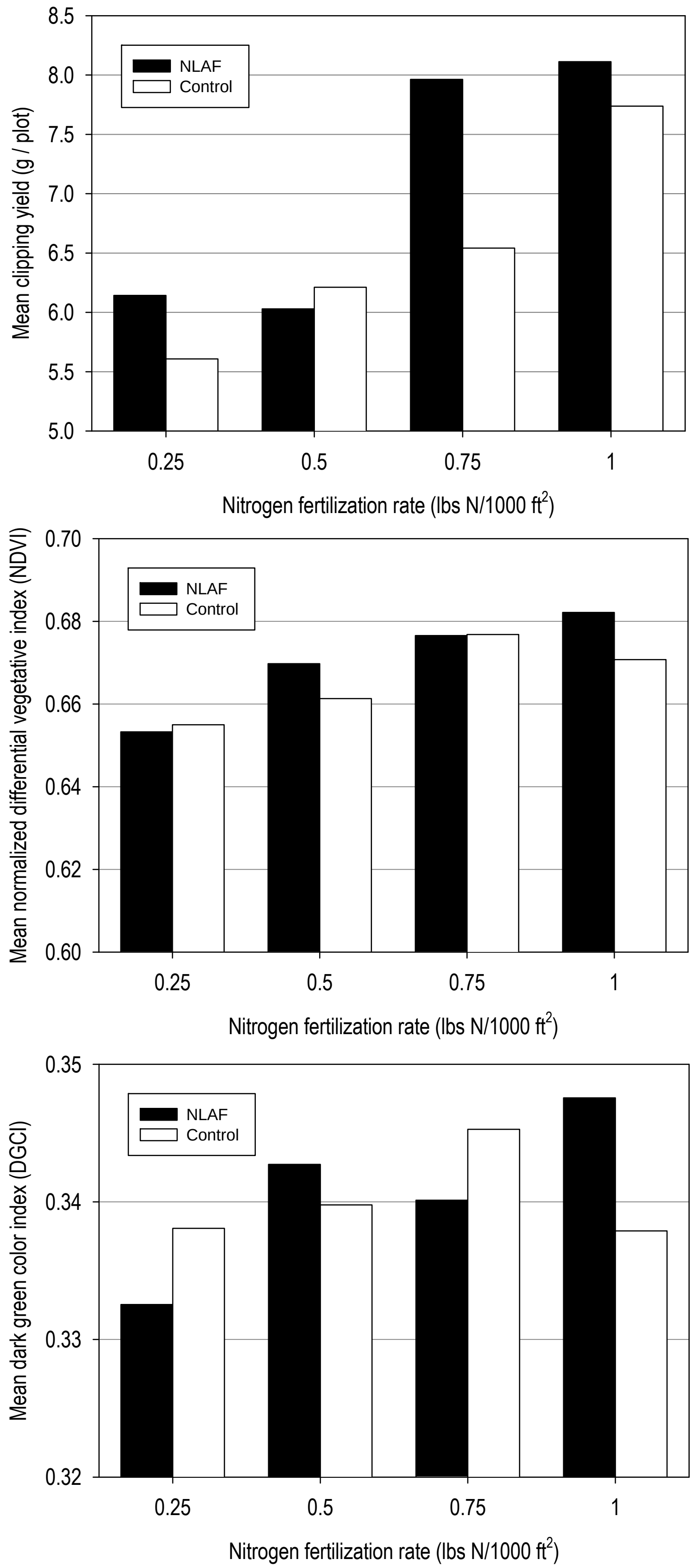


Figure 2. NutriLife AF (NLAF) influence on mean turfgrass clipping yield (CY), canopy density (NDVI), and canopy dark green color (DGCI), by fertilizer rate over the 70-day field study.

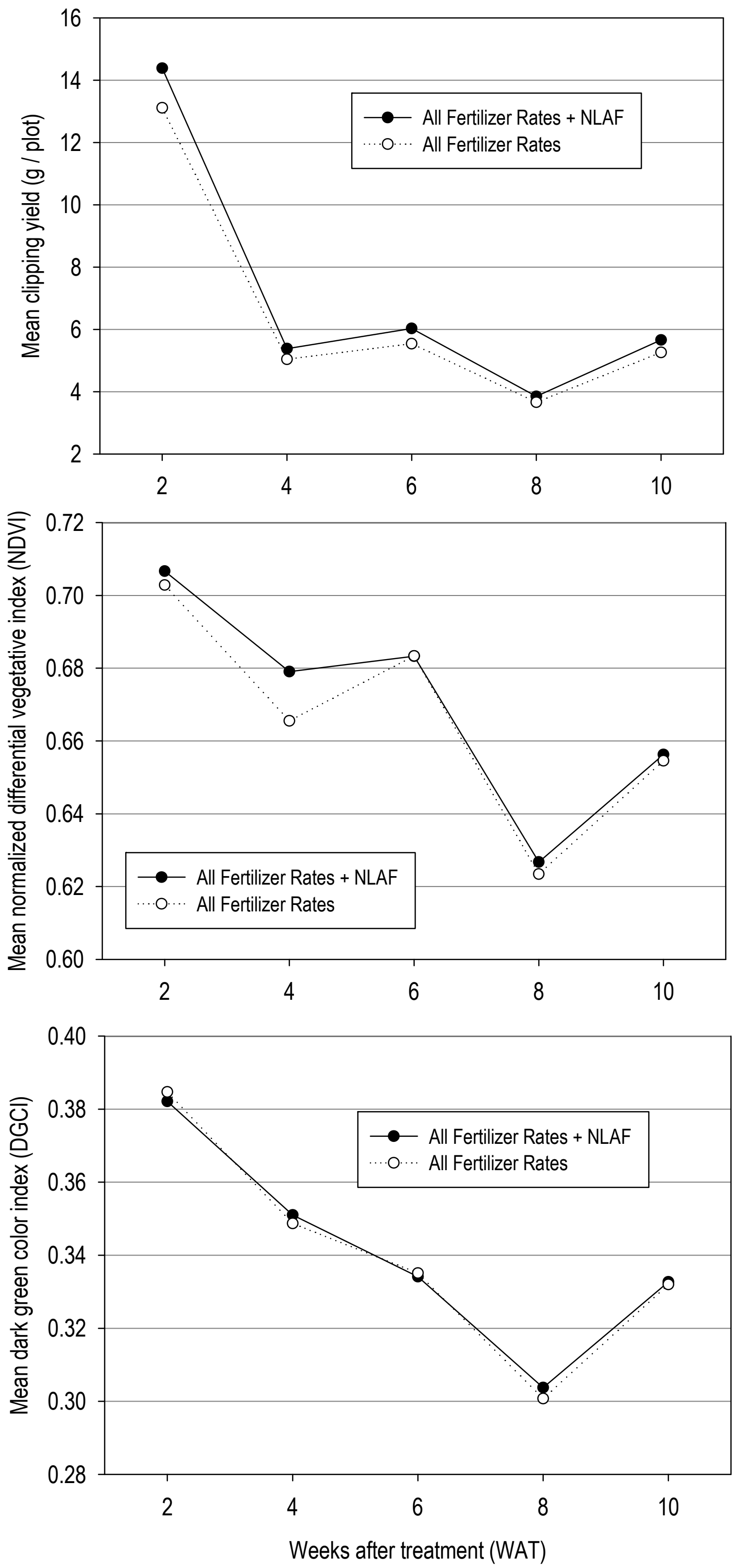


Figure 3. NutriLife AF (NLAF) influence on mean turfgrass clipping yield (CY), canopy density (NDVI), and canopy dark green color (DGCI), by WAT (all fertilizer rates pooled).

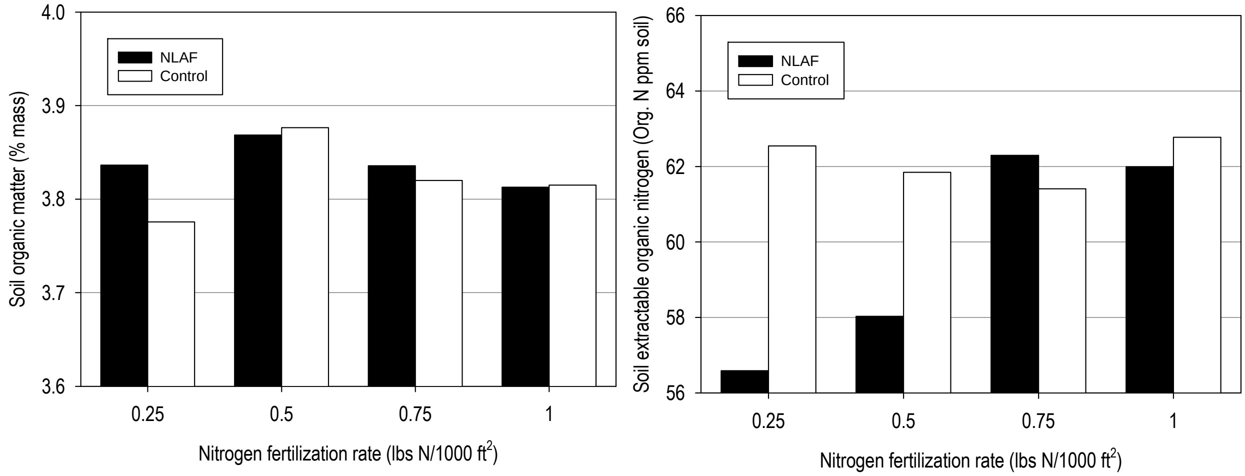


Figure 4. NutriLife AF (NLAF) influence on mean soil organic matter and extractable organic nitrogen in the 0-6" soil depth, by fertilizer rate (6 and 10 WAT measures pooled).

Growth-induced canopy thickening and enhanced aesthetic appeal are important late spring season management goals that rely on adequate nutrient availability. Turfgrass growth and canopy measures decreased with subsequent weeks after treatment (WAT), but no significant 'treatment by WAT' interaction was observed (Fig. 3).

Mean soil organic matter (OM) in the 0-6" soil depth did not significantly vary from a mean value of 3.8% dry mass (Fig. 4). Total soil organic matter levels between 2-4% are considered optimal for athletic field turfgrass systems. Mean soil organic nitrogen was extracted in levels ranging from 56 to 63 ppm soil, comprising approximately 0.1-0.2% of total soil OM (Fig. 4). Mean levels of extractable ammonium- and nitrate-nitrogen were observed within a range of 2 to 7 ppm, and concentrations of these plant-available nitrogen (N) forms were not significantly influenced by either N fertilizer rate or treatment (Fig. 5).

Mean levels of soil extractable K ranged from 235-265 ppm soil (Fig. 6), well within sufficiency levels of available nutrient (SLAN) guidelines for intensively-maintained turfgrass systems (Carrow et al., 2001; Schlossberg, 2012). Averaged over the 6 and 10 week sampling dates, soil K depletion in the 0-6" soil

Figure 5. NutriLife AF (NLAF) influence on mean soil extractable ammonium- (NH_4^+) and nitrate- (NO_3^-) nitrogen in the 0-6" soil depth, by fertilizer rate (6 and 10 WAT measures pooled).

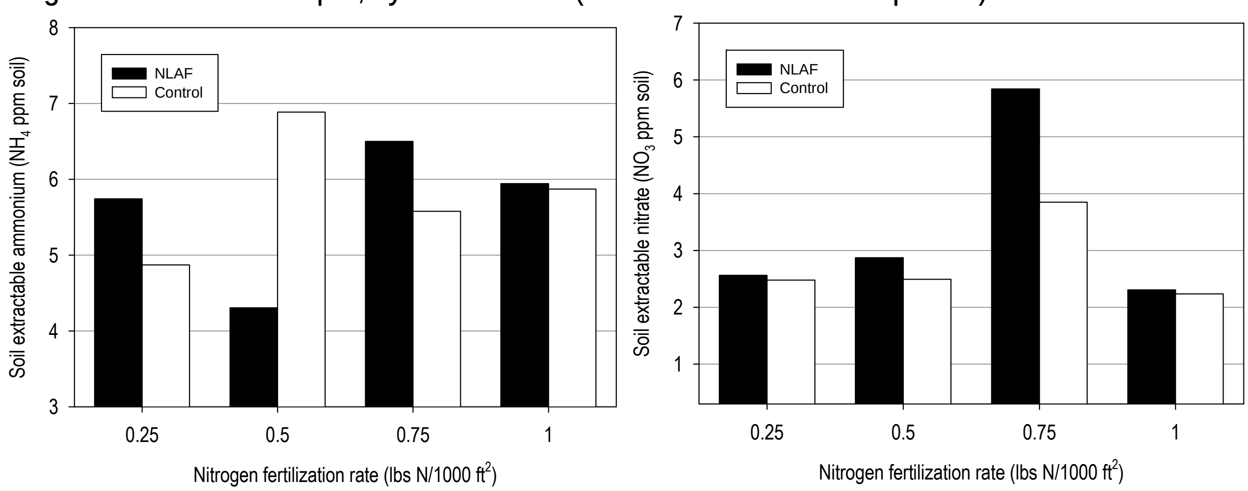
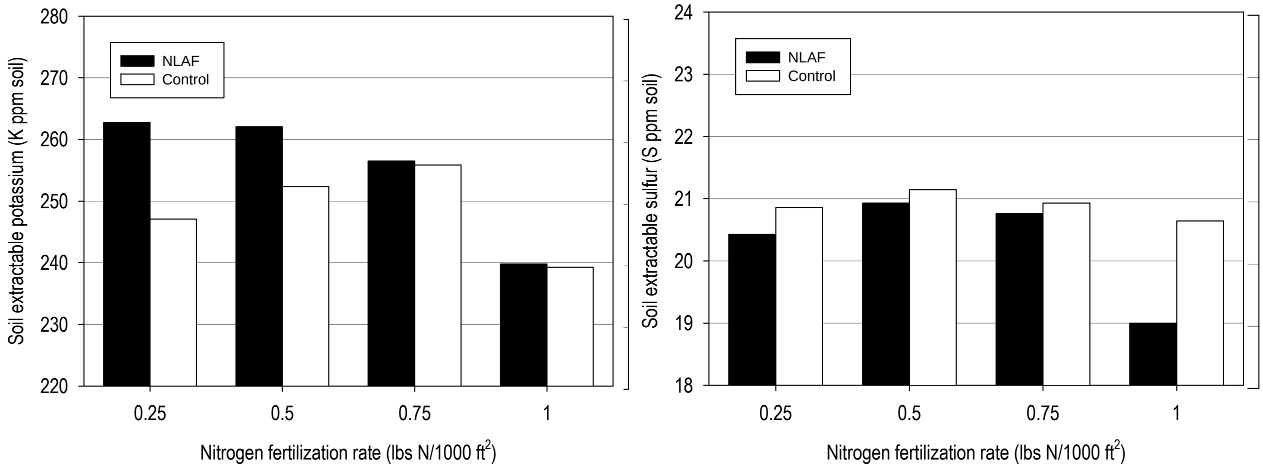


Figure 6. NutriLife AF (NLAF) influence on mean soil extractable potassium and sulfur in the 0-6” soil depth, by fertilizer rate (6 and 10 WAT measures pooled).



depth was linearly correlated to N fertilization rate; $P(t_{ratio}<t_{crit})=0.07$. Mean levels of extractable S ranged from 19-22 ppm soil, and were not significantly influenced by N fertilizer rate or treatment (Fig. 6).

While extractable sodium (Na) levels in the upper 6” ranged from 14-167 ppm soil, mean levels were confined to a range of 20-35 ppm (Fig. 7). These extractable soil Na levels are well below established salinity hazard and/or sodium toxicity thresholds of maintained turfgrass systems (Carrow et al., 2001).

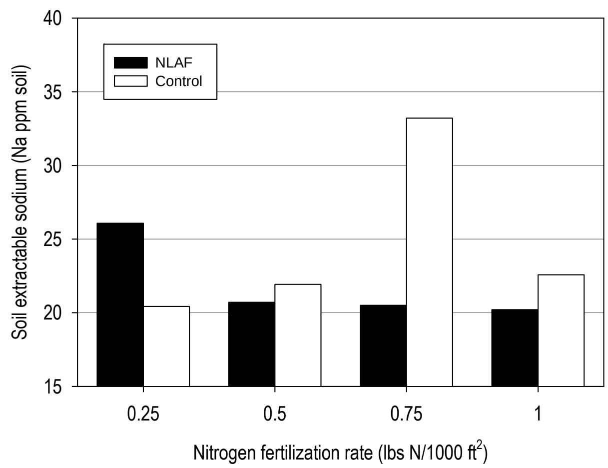


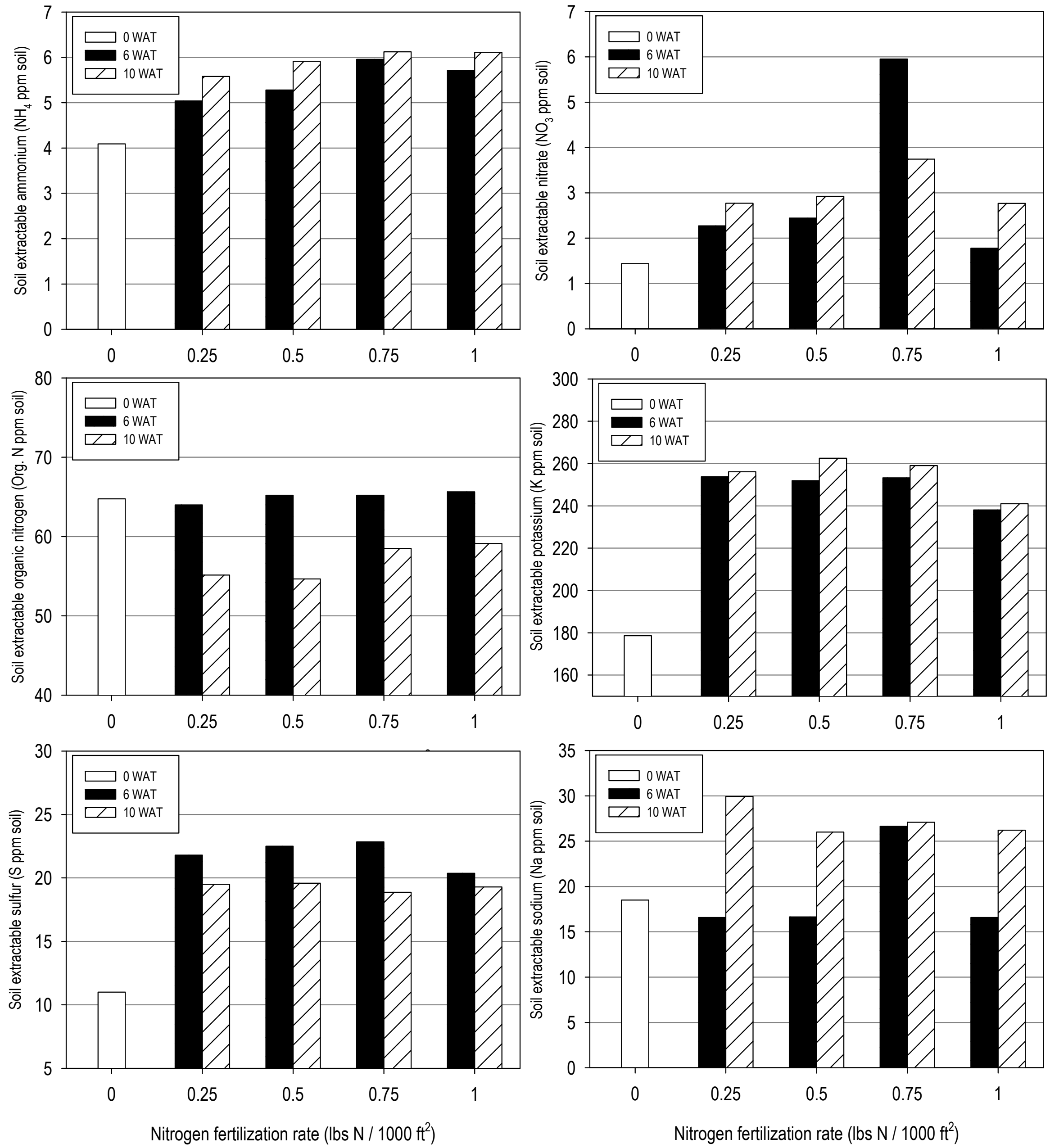
Figure 7. NutriLife AF (NLAF) influence on mean soil extractable sodium in the 0-6” soil depth, by fertilizer rate (6 and 10 WAT measures pooled).

Field Evaluation Summary:

Recent research has shown frequent and light applications of plant-available N optimize overall turfgrass health; when compared to turfgrasses receiving equal N rates in greater doses on a less frequent basis (Bowman, 2003). In conjunction with proper Kentucky bluegrass and perennial ryegrass systems culture, maintenance of N sufficiency (3.6-4.3 % leaf N) optimizes canopy density/color, leaf chlorophyll concentration, photosynthetic efficiency, and recuperative potential.

In combination with recommended rates of plant-available nitrogen (N) treatment, the data indicate NutriLife AF complementation of granular fertilizer (at 1.5 gallons per ton) resulted in an 8% relative enhancement of turfgrass growth/vigor over the 2 to 10-week period following application (Fig. 1). While greater growth/vigor enhancement may appear to result from NLAF complementation at the 0.75 lb N / 1000 ft^2 rate (Fig. 2), this specific enhancement was not statistically-significant. The data did not indicate significant influence of NutriLife AF biochemical fertilizer catalyst on other turfgrass traits measured; canopy density and color, or unmeasured; e.g., stress tolerance, nitrogen use efficiency, pest resistance, and/or root growth. Additional field testing of such biochemical fertilizer catalysts, over a wider array of climatic and edaphic conditions and in combination with additional fertilizers, is recommended. Research protocols may be expanded to multi-year evaluations that include root length measures and/or nutritional analysis of collected clippings.

Figure 8. Initial, 6, and 10 week after treatment (WAT) measures of extractable nutrient forms in the 0-6” soil depth, by nitrogen fertilizer rate (fertilizer types pooled).



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