New England Regional Turfgrass Foundation

Final Technical Report

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Project Title: Using the Solvita® Soil CO_2-Burst and Soil Labile Amino Nitrogen Test Kits to Categorize Turfgrass Site Responsiveness to Nitrogen Fertilization

Methods:
In September of 2007, an organic composted fertilizer (Suståne 5-2-4, all natural fine grade) was incorporated to a depth of 6 inches in each 3.5 × 3.5 ft plots at two adjacent sites at 23 different rates ranging from 0 to 8.2 lbs. available N per $1000ft^2$ per year. After compost incorporation, one site was seeded to tall fescue (*Festuca arundinacea* cvs. Shortstop II, Dynasty, Crossfire II), and the other was seeded to Kentucky bluegrass (*Poa pratensis* cv. America). The experiments were set out as randomized complete block designs with three replicates. In November of 2008, 2009, 2010, 2012, 2013, and 2014, plots were solid-tined aerified and compost was applied again to the same plots using the same rates, and brushed into the aerification holes. Additional treatments in each year include urea in split applications (May, June, Sept., Oct.) for a total amount of 1, 2, 3, and 4 lbs. N per $1000ft^2$ per year. The synthetic urea treatments were included so that response of the compost treatments could be matched to that of the synthetic N rate. Urea plots also received 2 lbs. per $1000ft^2$ per year of K_2O and P_2O_5 at the first urea application in the form of potassium sulfate and triple super phosphate. In early May before urea application, soil samples were collected from each plot to a depth of 4-inches below the thatch layer, air-dried, then sieved to pass a 2-mm screen. These samples were analyzed with the Solvita® Soil CO_2-Burst and SLAN test kits for concentrations of CO_2-C and NH_3-N, respectively. At approximately every two weeks during the growing season, turf color quality was measured using Spectrum CM1000 Chlorophyll and TCM500 NDVI Turf Color meters (Spectrum Technologies, Inc., Aurora, IL). Turf growth (yield of clippings) was collected monthly. Clipping samples were analyzed for concentrations of total N. Total N uptake in the clippings was determined by multiplying the clipping yields by the total N concentrations. Logistic curves of binary responses for the probabilities of organic fertilizer plot NDVI, CM1000, clippings yields, clippings total N concentration, and clipping total N uptake values equaling or exceeding the mean responses obtained from the 3 and 4 lbs. per $1000ft^2$ per year urea treatments (which would typically be the maximum recommended rates of N for lawns in our climate) in relation to Solvita® CO2-Burst CO_2-C and SLAN NH_3-N concentrations were determined with linear binary logistic regression.

Results:
Relationships between concentrations of CO2-Burst CO_2-C and SLAN NH_3-N concentrations and relative response of NDVI, CM1000, clipping yields, clippings total N concentration, and clippings total N uptake pooled across eight years are shown in Figs. 1 and 2.

Probability curves for the mean values of relative NDVI, CM1000, clipping yields, clippings total N concentration, and clippings total N uptake across eight years indicated that when mean SLAN NH_3-N concentrations were ≤ 101 and ≤ 119 ppm, there was a low probability ($P \leq 0.33$) of response equal to or exceeding that of the 3 and 4 lbs. per $1000ft^2$ per year from urea for Kentucky bluegrass and tall fescue, respectively (Fig. 3 and Table 1). When mean NH_3-N concentrations were >101 to 180 ppm for Kentucky bluegrass and > 119 to 160 ppm for tall fescue, there was a moderate probability (P > 0.33 to 0.67) of equaling or exceeding the response obtained from the 3 and 4 lbs. per 1000ft^2 per year from urea treatments. When mean NH_3-N concentrations were ≥ 265 ppm for Kentucky bluegrass and ≥ 206 ppm for tall fescue, there was a high probability (P ≥ 0.90) of equaling or exceeding the response obtained from the 3 and 4 lbs. per 1000ft^2 per year from urea treatments. When both species were combined, there was a low probability (P ≤ 0.33) of response equal to or exceeding that of the 3 and 4 lbs. per 1000ft^2 per year from urea when mean SLAN NH_3-N concentrations were ≤ 116 ppm. When mean NH_3-N concentrations were >116 to 165 ppm, there was a moderate probability (P > 0.33 to 0.67) of equaling or exceeding the response obtained from the 3 and 4 lbs. per 1000ft^2 per year from urea treatments. When mean NH_3-N concentrations were ≥ 217 ppm, there was a high probability (P ≥ 0.90) of equaling or exceeding the response obtained from the 3 and 4 lbs. per 1000ft^2 per year from urea treatments.

Conclusions:

The Solvita® Soil Labile Amino Nitrogen (SLAN) test kit shows promise as predictor of Kentucky bluegrass and tall fescue lawn response to N fertilization with a single spring soil sample. Identifying the potential response to N fertilization should help better guide N fertilization rates. The Solvita® SLAN test kit should help turfgrass managers categorize their turf areas as to probability of response to N fertilization.

More years of data are required before any definitive conclusions are reached for the Solvita® Soil CO_2-Burst test kit as a predictor of turfgrass response.

Tentative Guidelines for Using the Results of the Solvita® SLAN test kit for High-Cut Cool-Season Turfgrass:

- < 120 ppm: High probability of response to N fertilization; probably needs full currently recommended rate.
- 120 to 170 ppm: Moderate probability of response to N fertilization; probably needs less than currently recommended full rate (maybe half?).
- > 200 ppm: Low probability of response to N fertilization; maybe best to monitor conditions and delay application; if one does apply, use low rate and monitor response before another application.

Acknowledgements:

I appreciate the funding provided by the New England Regional Turfgrass Foundation.

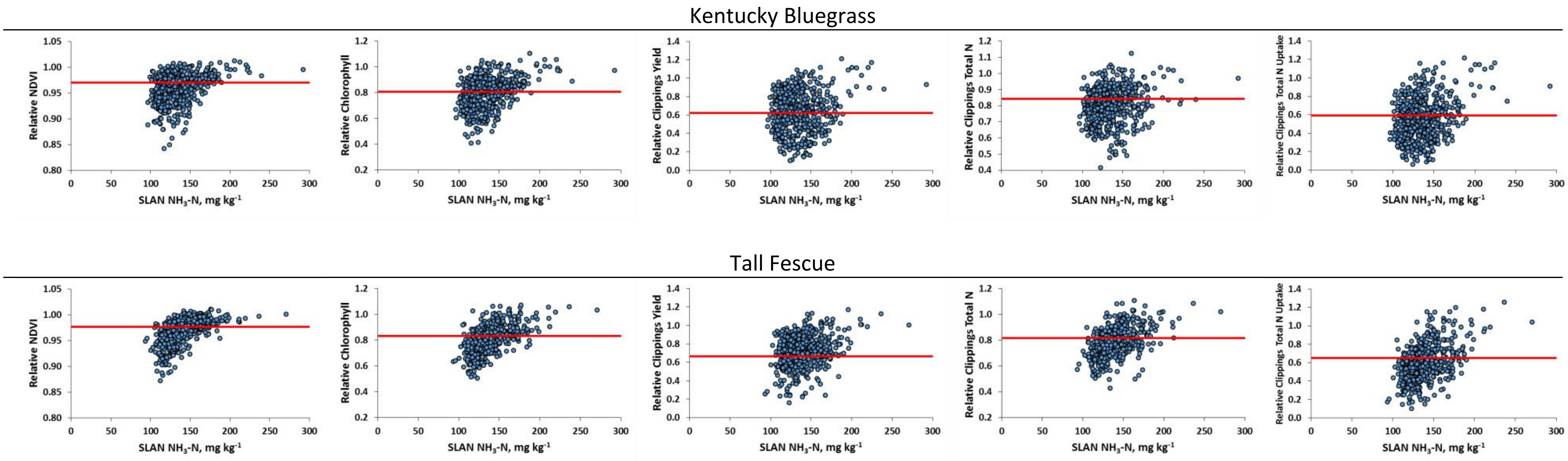


Figure 1. Relationships between concentrations of SLAN NH_3-N concentrations and relative response of NDVI, CM1000, clipping yields, clippings total N concentration, and clippings total N uptake pooled across eight years (2008-2015) for Kentucky bluegrass (top panels) and tall fescue (bottom panels).

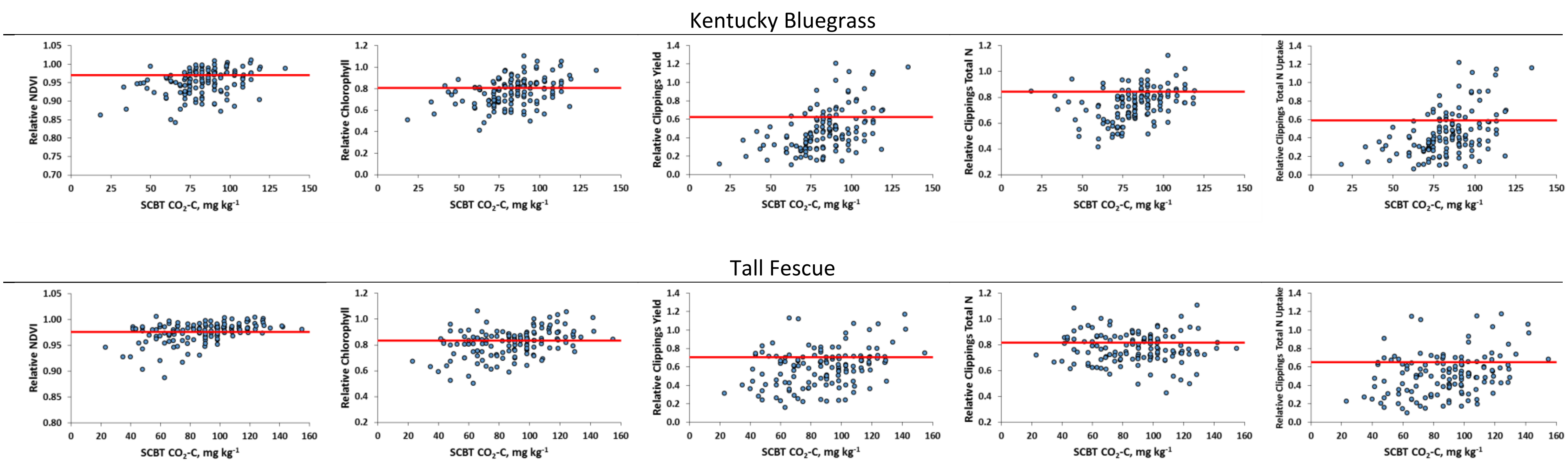
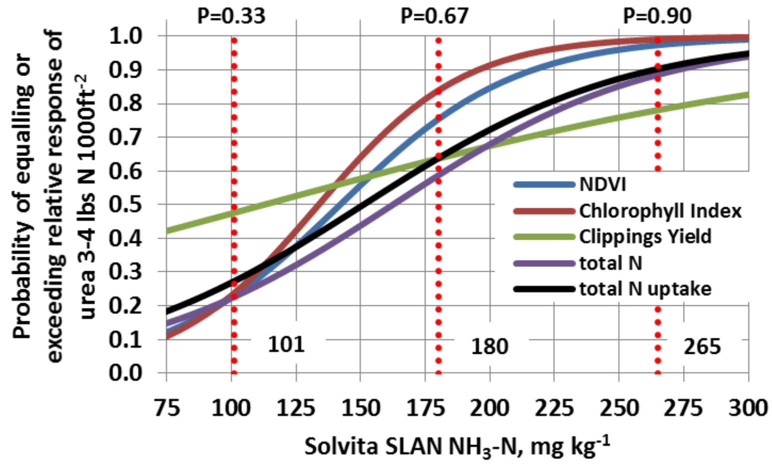
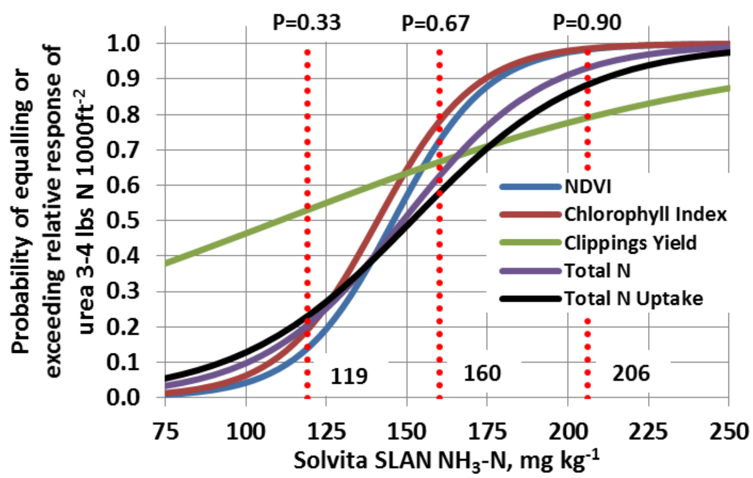


Figure 1. Relationships between concentrations of CO2-Burst CO_2-C concentrations and relative response of NDVI, CM1000, clipping yields, clippings total N concentration, and clippings total N uptake pooled across two years (2014-2015) for Kentucky bluegrass (top panels) and tall fescue (bottom panels).

Kentucky Bluegrass



Tall Fescue



Kentucky Bluegrass + Tall Fescue

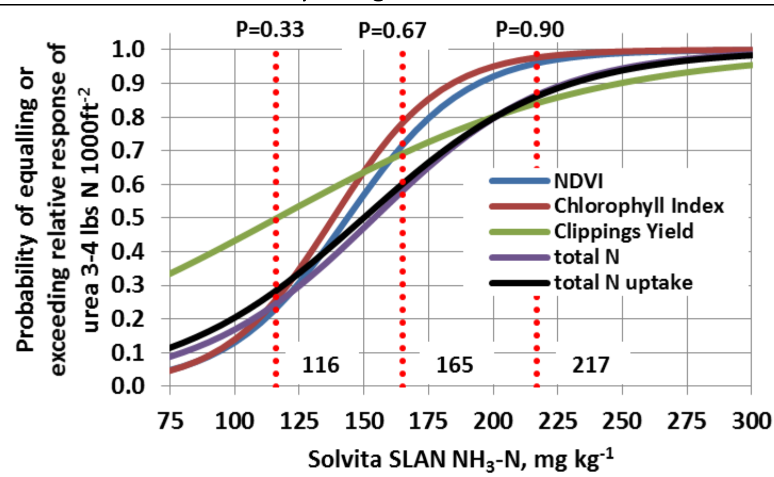


Figure 3. Probability curves of equaling or exceeding the mean relative NDVI, CM1000, clippings yields, clippings total N concentration, and clippings total N uptake values of that obtained from the mean response of urea at the 3 and 4 lbs. N per 1000ft^2 per year rates in relation to Solvita® SLAN NH_3-N concentrations across eight years (2008-2015).

Table 1. Concentrations of Solvita SLAN NH_3-N at selected probabilities of equaling or exceeding the response of 3-4 lbs. N per 1000ft^2 per year using urea for relative NDVI, Chlorophyll Index (CM1000), clippings yield (ClipYield), clippings total N concentration, and clippings total N uptake (NUP) pooled across 2008-2015.

SLAN NH_3-N concentrations, ppm

	Kentucky bluegrass						Tall fescue						Both species					
P	NDVI	CM1000	ClipYield	Total N	Total NUP	Mean	NDVI	CM1000	ClipYield	Total N	Total NUP	Mean	NDVI	CM1000	ClipYield	Total N	Total NUP	Mean
0.33	119	114	29	128	116	101	136	130	60	134	133	119	128	124	75	130	124	116
0.67	166	153	196	197	186	180	156	151	160	164	170	160	159	153	158	177	175	165
0.90	217	195	376	272	263	265	178	174	268	197	210	206	194	184	249	228	230	217