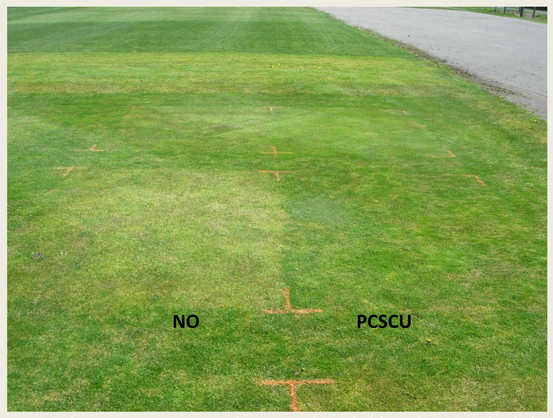
Transitioning to Natural Organic Fertilizers

Eric Miltner (miltner@wsu.edu), Gwen Stahnke, and Randi Luchterhand, Dept. of Crop and Soil Sciences, Puyallup Research and Extension Center, Washington State University, Puyallup, WA

INTRODUCTION

Availability and use of natural organic (NO) fertilizers in the turfgrass industry is increasing. These products may contain both soluble and slow-release nitrogen (N), and their N release characteristics can vary widely. Highly recalcitrant fractions of organic N may result in effective N application rates that are substantially lower than intended rates of application. Moberg et al. (1970) found that N uptake from biosolids was approximately 50% lower than from coated urea, and Hummel and Waddington (1981) found a similar difference between biosolids and isobutylidenediurea (IBDU). Carrow (1997) observed that NO fertilizers generally resulted in fewer positive measures of turf quality than slow release synthetic organic (SO) fertilizers. Miltner and Luchterhand (2009) found that first-year uptake from five NO fertilizers ranged from 65% to 94% compared to uptake from polymer coated sulfur coated urea (PCSCU). Because of the potentially limited N release of NO fertilizers, turf managers may experience unacceptable turf response as they increase NO fertilizer use. This study evaluates fertilizer management programs that compensate for limited N release of NO fertilizers while transitioning from SO to NO fertilizer use.



Turf response to natural organic (NO, left) and PCSCU (right) fertilizers two weeks after application in April.

MATERIALS AND METHODS

Three experimental sites:
•Goss Farm soil: Puyallup fine sandy loam, located at WSU Puyallup R.L. Goss Research Farm. Perennial ryegrass (Lolium perenne), mowing height 5 cm.
•Goss Farm sand: Sand-based root zone, sand conforming to USGA recommendations for particle size distribution with no organic amendment, located at WSU Puyallup R.L. Goss Research Farm. Perennial ryegrass / Poa annua mixture, mowing height 1.3 cm
•Home Course: McKenna gravelly loam (glacial till origin), golf course located in DuPont, WA, approximately 35 km west of Puyallup. Perennial ryegrass, mowing height 1.3 cm.

Experimental treatments:
•Two natural organic (NO) fertilizers and one synthetic organic (SO) fertilizer (Table 1), applied alone or in combination for a three year period (Table 2).
•Standard annual N rate: 147 kg ha^{-1} for Goss Farm soil and Home Course, applied in three equivalent applications; 245 kg ha^{-1} for Goss Farm sand, applied in five equivalent applications.
•Standard rate increased to 1.5X (221 kg N ha^{-1} or 368 kg N ha^{-1}) to compensate for limited N release from NO fertilizers.
•Transition treatments (labeled "Trans") included a combination of NO and SO fertilizers, with proportion of NO fertilizer increasing each year.

Table 1. Fertilizer products, nutrient analyses, N content descriptions, and nutrient sources.

Product name and analysis (N-P_2O_5-K_2O)	N content description	Nutrient sources
Nature Safe 8-3-5	7.2% WIN* 0.8% WSN	Hydrolyzed feather meal, meat meal, bone meal, poultry meal, blood meal, fish meal, langbeinite
SoundGro 5-4-0	3.5% WIN. 1.5% WSN	Dried biosolids
ProForma 20-5-10 PCSCU	60% of N from PCSCU	Urea, polymer coated sulfur coated urea (PCSCU), monoammonium phosphate, sulfate of potash, iron sucrate

*WIN = water insoluble nitrogen, WSN = water soluble nitrogen.

Table 2. Treatment names and fertilizer application schedules.

Treatment name	Fertilizer	Applications per Year: Home Course, Goss Farm soil Year 1*	Year 2	Year 3	Goss Farm sand Year 1	Year 2	Year 3
NS	Nature Safe	3	3	3	5	5	5
NS 1.5X	Nature Safe	3	3	3	5	5	5
NS Transition	Nature Safe	1	2	3	1	3	5
	PCSCU	2	1	0	4	2	0
SG	SoundGro	3	3	3	5	5	5
SG 1.5X	SoundGro	3	3	3	5	5	5
SG Transition	SoundGro	1	2	3	1	3	5
	PCSCU	2	1	0	4	2	0
PCSCU	PCSCU	3	3	3	5	5	5

*Year 1 = Jul '08 – Jun '09; Year 2 = Jul '09 – Jun '10; Year 3 = Jul '10 – Jun '11.

Data collection:
•Visual Quality and Color ratings (1 – 9; 1 = dead, 9 = ideal, 5 = acceptable) collected 2 and 4 weeks after fertilizer application, monthly thereafter.
•Chlorophyll Index (CI) (Spectrum Technologies CM 1000 Chlorophyll Meter) collected 2 and 4 weeks after fertilizer application, monthly thereafter.
•Quality and Color ratings were tallied for the number of ratings ≥ 5 (minimum rating for acceptable quality) then converted to percentage of ratings ≥ 5 (PQ≥5, PC≥5).
•Clipping weight and N content one month after fertilizer application.

Analysis of variance and means separation conducted using PROC GLM of SAS v. 9.2.

RESULTS AND DISCUSSION

PQ≥5 and CI are presented for Goss Farm sand and Home Course sites for years 1 and 2 (Jul '08 – Jun '10). For the Goss Farm soil site, there were no statistically significant differences. The soil is high in organic matter (~ 5%) and supplies mineralized N that helps maintain turf quality, often masking fertilizer effects.

Goss Farm sand:
•No significant differences in PQ≥5 in Year 1; NS 1.5X and SG 1.5X were numerically highest, and NS and SG were numerically lowest (Table 3). In Year 2, treatments with NS generally maintained more consistent quality than those with SG. Both 1.5X treatments had higher PQ≥5 than standard rate and Transition treatments.
•In Year 1, SG had the lowest CI and NS 1.5X was highest (Table 4). SG Trans and SG 1.5X were higher than SG, similar to PCSCU, indicating successful transitional programs in Year 1. NS 1.5X was highest in CI in Year 2. CI for all NS treatments was higher than for SG. CI for SG 1.5X was similar to PCSCU, higher than SG and SG Trans.

Table 3. Percentage of quality ratings greater than or equal to 5 (PQ ≥5) for sand-based and Home Course plots, Years 1 and 2.

Treatment	Goss Farm Sand Year 1	Year 2	Home Course Year 1	Year 2
NS 1.5X	83	95 a	70	72
NS Trans	71	75 b	77	86
NS	67	77 b	78	83
SG 1.5X	80	70 bc	87	84
SG Trans	74	45 d	83	100
SG	67	48 d	82	81
PCSCU	70	56 cd	75	78
lsd (P<0.05)*	ns	15	ns	ns

*Fisher's Protected LSD. Values within a column followed by the same letter are not significantly different.

Table 4. Chlorophyll Index (CI), averaged for study Year, for sand-based and Home Course plots, Years 1 and 2.

Treatment	Goss Farm Sand Year 1	Year 2	Home Course Year 1	Year 2
NS 1.5X	385 a	393 a	361 a	280
NS Trans	365 b	359 b	361 a	305
NS	358 b	361 b	302 cd	268
SG 1.5X	364 b	344 c	311 bcd	272
SG Trans	368 b	317 d	338 abc	260
SG	341 c	313 d	284 d	274
PCSCU	359 b	340 c	347 ab	258
lsd (P<0.05)*	13	15	40	ns

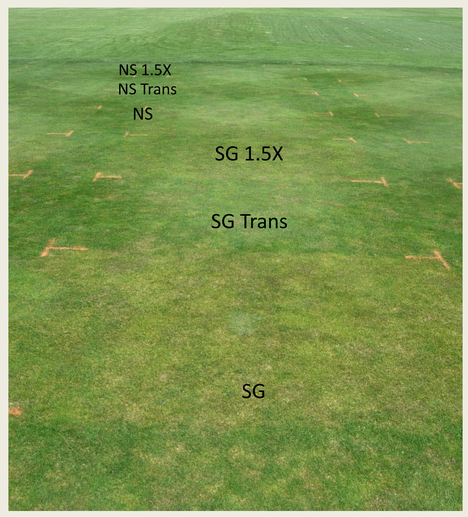
*Fisher's Protected LSD. Values within a column followed by the same letter are not significantly different.

Home Course:
•No significant differences in PQ≥5 for either year; no consistent trends were apparent (Table 3).
•SG and NS had the lowest CI in Year 1 (Table 4). Trans and 1.5X treatments maintained CI similar to PCSCU, indicating effectiveness. In Year 2, CI readings averaged ~20% lower than Year 1; there were no significant differences among treatments. Quality ratings declined in general (data not shown) and Poa annua encroachment increased dramatically. Annual N rates were probably not high enough for this gravelly soil, masking treatment effects.

Following the last fall fertilizer application (Oct for Home Course and Goss Farm soil, Nov for Goss Farm sand) treatments that received PCSCU (including Trans treatments) or NS 1.5X or SG 1.5X generally maintained better winter color (data not shown).

CONCLUSIONS

Approaches to compensate for limited N availability from NO fertilizers will vary based on fertilizer product and site. In our study, the NS treatment performed similarly to NS Trans and PCSCU. This indicates that a transition program (increased rate, or inclusion of SO fertilizer) may not be needed for this product. N availability from SoundGro is more limited. The SG treatment often resulted in the lowest ratings. Increasing the N rate by 50% (SG 1.5X) yielded results similar or superior to PCSCU. For NO fertilizers with more limited N availability (such as SoundGro), increased application rates are needed. Labels of NO fertilizers provide only cursory information about N availability. Nature Safe contains a greater proportion of WIN than SoundGro, yet appears to provide more available N. More detailed label information could provide a better indication of expected N release.



Two weeks following April fertilizer application.

REFERENCES

Carrow, R.N. 1997. Turfgrass response to slow-release nitrogen fertilizers. Agron. J. 89:491-496.

Hummel, N.W., Jr., and D.V. Waddington. 1981. Evaluation of slow-release nitrogen sources on Baron Kentucky bluegrass. Soil Sci. Soc. Am. J. 45:966-970.

Miltner, E., and R. Luchterhand. 2009. Nitrogen availability from natural organic and synthetic fertilizers. *In* Agronomy abstracts. ASA, Madison, WI.

Moberg, E.L., D.V. Waddington, and J.M Duich. 1970. Evaluation of slow-release nitrogen sources on Merion Kentucky bluegrass. Soil Sci. Soc. Amer. Proc. 34:335-339.