Evaluation of Various Slow-release Nitrogen Sources for Growth and Establishment of *Poa pratensis* L. on Sand-based Systems

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Introduction
Slow release fertilizers were initially developed to provide a more consistent release of nitrogen over a longer period. This reduces the number of applications per year and allows for higher rates of product to be applied in a single application. Because slow release fertilizers release smaller amounts of nutrient over longer periods of time, they have not been considered as a primary choice for rapid establishment of turfgrass. Establishing grass on sand based systems is problematic because nitrogen is easily leached from the system and soluble N sources often need application every 7 days to grow-in these sand-based fields. The goal of this project is to determine if various slow release N sources affect the rate of turfgrass establishment. It is also not clear if high rates of slow release N sources can be mixed into the sand media to improve turf establishment.

Materials and Methods
Six nitrogen sources were evaluated: Nitroform (38-0-0), Nutralene (40-0-0), Organiform (30-0-0), Sulfur coated urea (SCU), Urea, and Milorganite. Local mason sand that meets USGA specification was used as the growing media. The sand materials were packed into a 3-inch diameter PVC pipe lined with 2.7-inch diameter clear plastic tubing. The plastic liner was removed for the measurement of roots and replaced in the PVC tubes. The PVC pipe was capped at the bottom and the plastic tube tied off at the bottom with fine holes punched to facilitate drainage. The root zone depth was 14 inches and the holding tube was 15 inches. Each fertilizer, except urea, was mixed into the top 2 inches of the root zone media at rate of 2 and 4 lbs of N per 1000ft^2, respectively. Urea treatment was applied at the surface of the media at 0.16 and 0.33 lbs of N per 1000 ft^{2,} weekly giving a total of 2 and 4 lbs of N per 1000 ft^2 during the 12 week study period, respectively. The root zone media was either seeded or sodded with 'Limousine' Kentucky bluegrass and watered to field capacity on November 20, 2001. The study was conducted in the research greenhouse at the ISU Horticulture Department, Ames, IA. Turf color, root length and clipping yield was recorded every week and root dry weight was estimated by washing sand from the roots and oven drying the roots at the termination of the study. The experimental design was a randomized complete block design with three replications. The data were analyzed using the t-test procedures, and the mean separation was performed by standard error of differences (SED) method of the Statistical Analysis System (SAS, 1987).

Results
There was an interaction between N source and establishment type and between N rate and establishment type for total clipping yield (Table 1). Urea applied to the seeded pots produced 109-230% more clipping dry weight than other N sources applied to the seeded pots. However, Milorganite applied to the sodded pots created 26-55% more clipping dry weight than other N sources (Table 2). A significant interaction existed between N sources and establishment type for root dry weight and root length at the end of the study (Table 1). Milorganite applied to the seeded pots produced 9% more root length than organifrom applied to the seeded pots, although there was no difference between urea and milorganite. Urea produced 13-22% more root length than other N sources. Milorganite formed 25-45% more root dry weight than urea applied to the seeded pots (Table 2). However, no difference for root dry weight was found between milorganite and urea in the sodded pots. There were differences for turf color between treatments in the seeded pots and in the sodded pots, even though no difference was found between rates in the sodded pots. This was not changed until 12 WAP.

Picture 1. Root mass produced by Milorganite and urea

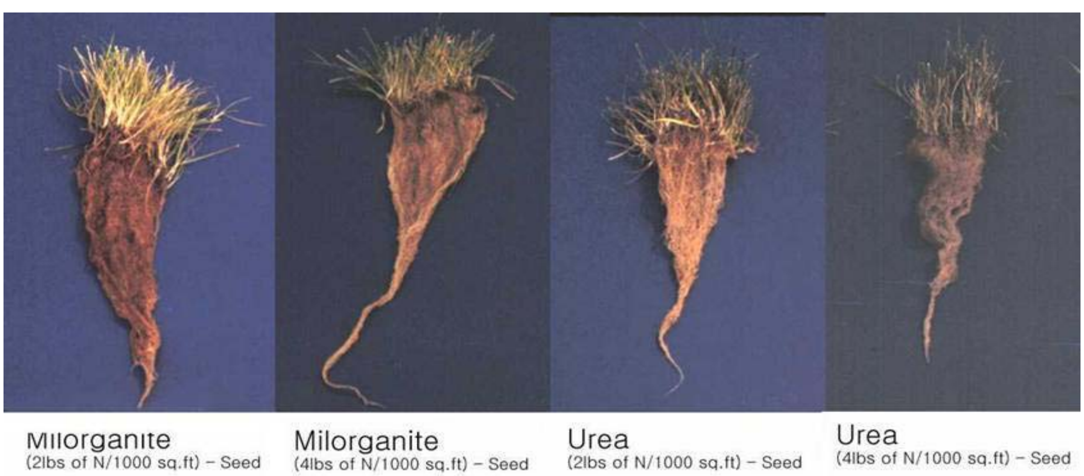

Table 1. Summary of analysis of variance from 2001 greenhouse study on the evaluation of 6 nitrogen sources for establishment and growth of 'Limousine' *Poa pratensis* L. on sand-based systems.

Source of variance	df	Total clipping yield	Root length at the end of the study	Turf color at the end of the study	Root dry weight
Nitrogen Sources (NSO)	5	**	NS	**	NS
Nitrogen Rate (RATE)	1	*	NS	**	NS
Establishment Type (TYPE)	1	**	**	**	NS
NSO*RATE	5	NS	NS	NS	NS
NSO*TYPE	5	**	*	NS	*
RATE*TYPE	1	*	NS	*	NS
NSO*RATE*TYPE	5	NS	NS	NS	NS

*, ** Significant at the $\alpha = 0.05$ and 0.01 probability level, respectively. NS = not significant.

Table 2. Mean root length and root dry weight of 'Limousine' *Poa pratensis* L. with factors N sources and type of establishment averaged over replications and both levels of N rates at the end of the study.

	Total clipping dry weight ($g \cdot m^{-2}$)		Root length (cm) at the end of the study		Root dry weight ($g \cdot m^{-2}$)	
	Seed	**Sod**	**Seed**	**Sod**	**Seed**	**Sod**
Nitroform	125.05 [z]	428.41	19.58	23.00	13.40	13.76
Nutralene	114.21	520.05	19.92	23.42	15.64	14.50
Organiform	105.18	485.74	18.80	22.92	14.17	16.53
SCU	166.13	470.39	20.27	21.28	13.29	17.32
Milorganite	147.17	665.47	20.45	20.88	20.99	12.11
Urea	347.60	529.97	19.77	26.80	11.55	11.60
SED[y]	57.16		1.49		2.48	

[Z] Each mean was calculated from 6 observations (three replications * two N rate levels).
[y] Standard error of difference.

Figure 1. Mean turf color per unit surface area of 'Limousine' *Poa pratensis* L. by N rate and type of establishment. Each mean was calculated from 18 observations (three replications * 6 N sources). The vertical bar represents the standard error of difference (SED). WAP means week after planting.