

Seedling Establishment of Three Primary Cool-Season Turfgrass Species as Affected by Four Urea-based Nitrogen Fertilizer Products.

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Objective:

To determine the effects of four urea-based fertilizers and two nitrogen application rates for the establishment of summer seeded creeping bentgrass, turf-type tall fescue and Kentucky bluegrass.

Experimental Procedures:

This field study was conducted at the W.H. Daniel Turfgrass Research and Diagnostic Center in West Lafayette, IN on a new research area that had previously received little fertilizer or regular turfgrass maintenance (soil pH=7.2, percent O.M. = 6.9, available P and K = 200 + and 542 ppm respectively). Prior to seeding the area was treated with a non-selective herbicide and the soil was prepared using standard soil tillage equipment and the surface smoothed and firmed prior to seeding. Creeping bentgrass 'L-93', a three-way Kentucky bluegrass blend containing 'Midnight, Unique, and Denim' and a three-way turf-type tall fescue blend containing 'Mustang III, Cayenne and Dynasty' were each seeded into blocks approximately 25 x 40 ft at 1.0, 2.0 and 7.0 lbs. of seed per 1000 ft² respectively on 24 July, 2004. The seed was lightly raked into the soil to promote seed soil contact. Once seed and initial fertilizer nitrogen (N) treatments were applied, each species was individually covered with a spun-bonded geotextile cover to conserve moisture, enhance seedling establishment and prevent potential seed movement. Throughout germination and establishment the study area was regularly irrigated via an overhead irrigation system to keep the soil moist and promote maximum seedling growth. The covers were removed on 30 July for the creeping bentgrass and turf-type tall fescue and 2 Aug. for Kentucky bluegrass. Within each species the urea-based fertilizer treatments were applied to plots measuring 5 x 5 ft with 6 inch borders between plots. The studies contained four replications arranged in a randomized complete block design. The dates, application rates and timings of all treatments are footnoted in the data tables.

The following data was recorded throughout establishment, percentage turfgrass cover, rated on a linear 0 to 100 % scale where 0 = bare ground and 100 = entire plot area covered. Dry matter yield was determined at the conclusion of the study, 22 Sept., for turf-type tall fescue and Kentucky bluegrass by harvesting the clippings within the entire plot area to a mowing height of 2 inches using a rotary bagging mower. Fresh clippings were immediately placed into a forced air drying oven, dried for one week and weighed. Dry matter yield for creeping bentgrass was not determined because the canopy had a wavy appearance and a uniform harvest at 2.0 inches could not be accomplished with the equipment available.

Results:

During the summer establishment, all three turfgrass species established rapidly (Tables 1-3). Although this study was not designed to make comparisons between each species, by the first rating date, 9 Aug., the unfertilized plots of creeping bentgrass and turf-type tall fescue had established faster than Kentucky bluegrass having reached 35, 40 and 13 % cover for creeping bentgrass, turf-type tall fescue and Kentucky bluegrass respectively. These results were expected since it is widely known that Kentucky bluegrass seed germinates slower than the other two species.

The urea fertilizer source effects were variable throughout the data collection period for each species. By 9 Aug., however, the treatment N effects compared to the unfertilized plots were becoming evident for turf-type tall fescue and creeping bentgrass. The only difference for Kentucky bluegrass on this date was for UMaxx applied at 1.5 lb. N at seeding. There were very few noticeable effects between the urea sources for creeping bentgrass establishment rate, and all plots receiving N were superior to the unfertilized control (Table 1). By 19 Aug., all plots

receiving N had achieved cover values of nearly 75 %, compared to 57 % for the unfertilized plots. By the following rating date, 23 Aug., all fertilized plots had reached nearly 90% cover compared to 75 % for the untreated. On 26 Aug., UFlexx at the 1.5 lb N application at seeding had lower coverage, 91 %, compared to UFlexx, UMaxx, and urea plots receiving the 1.0 + 1.0 lb. N, which had 97, 98, and 97 % cover respectively. UFlexx at 1.5 lb still had superior cover to the unfertilized which had 78 %. For the remainder of the study, only small, 1-2 %, differences were noted between some treatments. These differences are probably not practically important since most plots had achieved $\geq 94\%$ coverage.

For the turf-type tall fescue blend on the first rating date, 9 Aug., both UMaxx treatments and the sulfur coated urea (SCU) treatments had superior coverage $\geq 52\%$ cover compared to the unfertilized plots, 40 % (Table 2). By the next rating date, 16 Aug., all urea-N treatments were superior ranging from 67 to 85 % cover, compared to 51 % for the unfertilized. On 19 Aug. both the UMaxx and UFlexx treatments at 1.5 lb N at seeding had more cover than urea alone at 1.0 lb. N. These treatments, however, were not different than the 2.0 lb. N SCU treatment. For the next two rating dates treatment effects were variable but on 30 Aug. both the 1.5 lb. N UMaxx and UFlexx treatments had poorer coverage than the plots receiving two 1.0 lb. N applications of UMaxx or UFlexx. By 2 Sept., the 1.5 lb. N from UFlexx had lower cover than the corresponding UFlexx plots receiving 1.0 + 1.0 lb. N. These results, however, are probably not practically important since the difference between these treatments was only 5 % coverage and all N fertilized plots had $\geq 93\%$ coverage.

For Kentucky bluegrass only UMaxx at 1.5 lb. N at seeding was different from the unfertilized on 9 Aug., which had 27 % cover versus 13 %. On 19 Aug. UFlexx at 1.5 lb. N was the only treatment that was superior to the unfertilized and UFlexx at 1.5 lb. N was also superior to UFlexx plots at 1.0 lb. N at seeding. On 23 Aug. all plots had achieved $> 50\%$ cover and UMaxx at 1.5 lb. N was superior to the 1.0 lb. of urea alone 68 % versus 55 % cover. By 26 Aug. all fertilized plots had achieved $\geq 82\%$ cover but only UFlexx at 1.5 lb. was superior to the unfertilized at 73 % coverage. On 30 Aug., one week after the sequential 1.0 lb. N treatments were applied the benefits of two 1.0 lb. N applications of UMaxx were detected since the plots receiving the additional 1.0 lb. N from UMaxx had greater coverage 97 %, versus 89 %. Three days later, however, this difference was not evident. By 2 Sept., there was a significant difference between the two 1.0 lb. N applications of either UFlexx or UMaxx over SCU with 99 and 98 % respectively compared to 90 % for the SCU treated plots. On the last coverage rating date, 7 Sept., all treatments except UMaxx at 1.5 lb. N were superior to the unfertilized but differences between these plots and fertilized were only 3-5 %.

Dry matter yield was measured for turf-type tall fescue and Kentucky bluegrass only (Table 4). For turf-type tall fescue the most clippings were produced in plots receiving two 1.0 lb. N applications of either UMaxx or UFlexx and the least amount of clippings were produced by UMaxx and UFlexx at the single 1.5 lb. N application and the unfertilized control. The two 1.0 lb. N applications of UFlexx was not different from the single 2.0 lb. N application of SCU at seeding and SCU was not different from two 1.0 lb. N applications of urea. For the Kentucky bluegrass, plots receiving two 1.0 lb. N applications of UMaxx, UFlexx or urea produced the most dry matter. The UFlexx and urea plots, however, were not different from the other treatments or the unfertilized control.

In summary, no single treatment performed consistently across all three turfgrass species. Creeping bentgrass seemed least sensitive to N applications during establishment, Kentucky bluegrass intermediate, and turf-type tall fescue most responsive. In general, where rapid turf cover is desired without excessive dry matter production or the requirement for multiple N applications the 1.5 lb N rate of UMaxx, UFlexx, or the 2.0 lb. N SCU at seeding seems most effective. This practice would require the least labor inputs with regard to repeat fertilizer

application and potentially initial mowing requirement while still achieving rapid and/or satisfactory ground cover.

Acknowledgements

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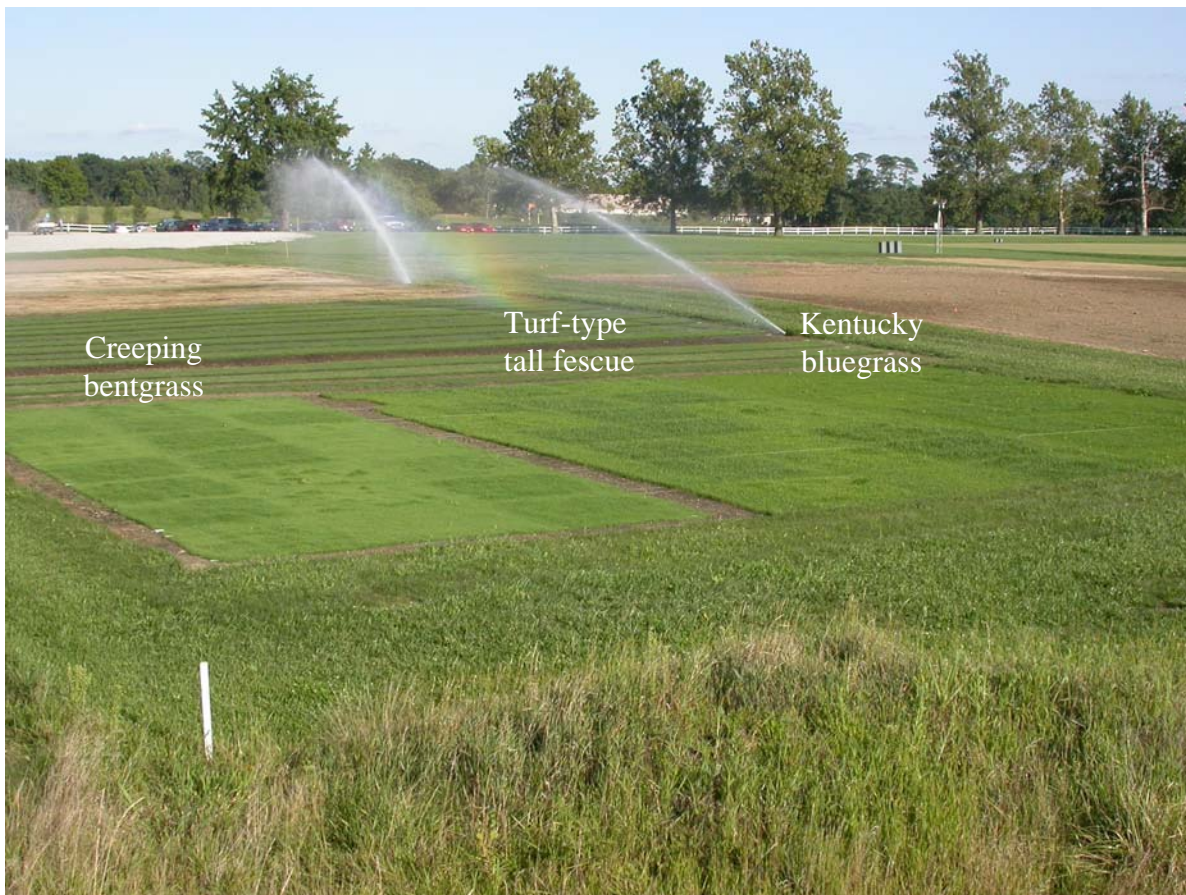


Figure 1. Establishment of three primary cool-season turfgrass species as affected by four urea-based fertilizers. Plots were seeded and initial fertilizer application occurred on 24 July, 2004. Photo was taken on 30 Aug, 2004.

Table 1. Creeping bentgrass seedling establishment as affected by four urea-based nitrogen sources, Purdue University, 2004.

Treatment ^a	Nitrogen application rate	9 Aug.	16 Aug.	19 Aug.	23 Aug.	26 Aug.	30 Aug.	2 Sept.	7 Sept.
	lbs./ 1000 ft ²	-----% ^b -----							
UFlexx (46-0-0)	1.5	60 a ^d	77 a	86 a	92 a	91 b	98 a	98 abc	99 ab
UMaxx (47-0-0)	1.5	62 a	78 a	87 a	90 a	94 ab	98 a	97 cd	99 ab
UFlexx (46-0-0) ^c	1.0 + 1.0	58 a	65 a	73 ab	90 a	97 a	99 a	100 a	100 a
UMaxx (47-0-0)	1.0 + 1.0	55 a	72 a	75 a	90 a	98 a	99 a	99 ab	100 a
Urea (46-0-0)	1.0 + 1.0	52 a	67 a	79 a	88 ab	97 a	99 a	100 a	100 a
SCU (31-0-0)	2.0	50 a	78 a	87 a	92 a	92 ab	98 a	98 abc	99 ab
Untreated	---	35 b	45 b	57 b	75 b	78 c	94 b	95 d	98 b

^a Creeping bentgrass 'L-93' was seeded and initial nitrogen applied on 24 July, 2004. Plots were covered with a spunbonded geotextile cover and regularly irrigated via an overhead sprinkler system to promote seedling emergence and establishment.

^b Percentage turf cover was rated visually on a linear 0 to 100 scale where 0 equals bare soil and 100 is complete turf cover.

^c Sequential nitrogen applied on 23 August, 2004.

^d Means in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 2. Turf-type tall fescue seedling establishment as affected by four urea-based nitrogen sources, Purdue University, 2004.

Treatment ^a	Nitrogen application rate	9 Aug.	16 Aug.	19 Aug.	23 Aug.	26 Aug.	30 Aug.	2 Sept.	7 Sept.
	lbs./ 1000 ft ²	-----% ^b -----							
UFlexx (46-0-0)	1.5	50 abc d	78 ab	83 ab	83 a	87 bc	95 bc	93 bc	96 b
UMaxx (47-0-0)	1.5	55 a	77 ab	85 ab	88 a	92 ab	95 bc	95 ab	97 ab
UFlexx (46-0-0) ^c	1.0 + 1.0	50 abc	67 b	78 bc	85 a	92 ab	98 a	98 a	98 a
UMaxx (47-0-0)	1.0 + 1.0	52 ab	78 ab	78 bc	88 a	94 a	98 a	98 a	98 a
Urea (46-0-0)	1.0 + 1.0	42 bc	72 ab	74 cd	83 a	88 abc	97 abc	98 a	98 a
SCU (31-0-0)	2.0	55 a	85 a	88 a	89 a	93 ab	98 ab	97 a	98 a
Untreated	---	40 c	51 c	65 d	70 b	83 c	91 d	90 c	95 b

^a Turf-type tall fescue blend was seeded and initial nitrogen applied on 24 July, 2004. Plots were covered with a spunbonded geotextile cover and regularly irrigated via an overhead sprinkler system to promote seedling emergence and establishment.

^b Percentage turf cover was rated visually on a linear 0 to 100 scale where 0 equals bare soil and 100 is complete turf cover.

^c Sequential nitrogen applied on 23 August, 2004.

^d Means in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 3. Kentucky bluegrass seedling establishment as affected by four urea-based nitrogen sources, Purdue University, 2004.

Treatment ^a	Nitrogen application rate	9 Aug.	16 Aug.	19 Aug.	23 Aug.	26 Aug.	30 Aug.	2 Sept.	7 Sept.
	lbs./ 1000 ft ²	----- % ^b -----							
UFlexx (46-0-0)	1.5	20 ab d	45 a	60 a	65 ab	85 a	92 ab	95 ab	97 a
UMaxx (47-0-0)	1.5	27 a	45 a	53 ab	68 a	83 ab	89 bc	94 abc	96 ab
UFlexx (46-0-0) ^c	1.0 + 1.0	21 ab	33 a	45 b	63 abc	82 ab	98 a	99 a	99 a
UMaxx (47-0-0)	1.0 + 1.0	22 ab	42 a	47 ab	60 abc	83 ab	97 a	98 a	98 a
Urea (46-0-0)	1.0 + 1.0	19 ab	35 a	48 ab	55 bc	84 ab	96 ab	95 ab	98 a
SCU (31-0-0)	2.0	22 ab	42 a	50 ab	67 a	83 ab	89 bc	90 bc	97 a
Untreated	---	13 b	33 a	43 b	53 c	73 b	80 b	86 c	94 b

^a Kentucky bluegrass blend was seeded and initial nitrogen applied on 24 July, 2004. Plots were covered with a spunbonded geotextile cover and regularly irrigated via an overhead sprinkler system to promote seedling emergence and establishment.

^b Percentage turf cover was rated visually on a linear 0 to 100 scale where 0 equals bare soil and 100 is complete turf cover.

^c Sequential nitrogen applied on 23 August, 2004.

^d Means in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 4. Turf-type tall fescue and Kentucky bluegrass dry matter yields as affected by four urea-based nitrogen sources, Purdue University, 2004.

Treatment ^a	Nitrogen application rate lbs./ 1000 ft ²	Dry matter yield	
		Turf-type tall fescue	Kentucky bluegrass
		----- (grams per plot) ^b -----	
UFlexx (46-0-0)	1.5	43.0 d ^d	32.1 b
UMaxx (47-0-0)	1.5	48.1 d	19.9 b
UFlexx (46-0-0)c	1.0 + 1.0	200.0 ab	72.9 ab
UMaxx (47-0-0)	1.0 + 1.0	241.0 a	127.8 a
Urea (46-0-0)	1.0 + 1.0	135.1 c	60.5 ab
SCU (31-0-0)	2.0	149.7 bc	40.0 b
Untreated	---	9.8 d	14.6 b

^a Tall fescue and Kentucky bluegrass were seeded and initial nitrogen applied on 24 July, 2004, covered with spunbonded geotextile cover and irrigated to promote seedling emergence and establishment.

^b Dry matter yields are the mass of oven-dry clippings accumulated from seeding until harvest on 22 Sept. 2004 averaged for four replications of 5 x 5 ft plots.

^c Sequential nitrogen treatments were applied on 23 August, 2004.

^d Means in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).