



Effects of Several Pre-plant Nutrient Programs on the Establishment and Nutrient Content of Creeping Bentgrass

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Summary. Establishment of creeping bentgrass (*Agrostis stolonifera* L.) is often a slow process in sand-based putting greens due to the poor nutrient- and water-holding characteristics of the medium. A study was designed to test the effects of several pre-plant, organic soil amendments on establishment of creeping bentgrass in a sand-based putting green in Johnson, Ark. The treatments included a standard pre-plant treatment (Milorganite at 146 kg N ha⁻¹ (3.0 lb N / 1000 ft²) + methylene urea at 146 kg N ha⁻¹ (3.0 lb N / 1000 ft²) and three treatments containing a new, proprietary material called Architect's Blend, which is designed to provide all of the nutrients necessary to establish bentgrass in sand with a single application. Architect's Blend was applied at either 7320 kg ha⁻¹ (150 lb 1000 ft²) or 3660 kg ha⁻¹ (75 lb 1000 ft²). A final treatment included Architect's Blend at 3660 kg ha⁻¹ (75 lb 1000 ft²) + methylene urea at 146 kg N ha⁻¹ (3.0 lb N / 1000 ft²). Data on establishment rates were collected weekly. Root and shoot growth and shoot tissue nutrient analysis were determined at 6 and 8 weeks after planting. The high rate of Architect's Blend (Arch. 150) produced faster grow-in than any of the other treatments, resulting in a 2-week increase in complete coverage. Treatments had minimal effects on shoot or root growth or tissue nutrient levels.

Rapid establishment of creeping bentgrass greens is desirable to hasten the opening of new golf courses and renovation projects. A number of products, generally classified as soil additives or bio-stimulants, are currently being used to speed-up this process. New formulations are being developed that allow a manager to incorporate all of the necessary nutrients into a single composite product for ease of application. The following study was designed to compare a new pre-plant amendment called Architect's Blend to traditional pre-plant amendments such as Milorganite (Milorganite, Inc., Milwaukee, WI).

Materials and methods

A sand-based putting green was constructed at Clear Creek Golf Club in Johnson, Ark., during the summer of 2003. The green was comprised of a 12-inch deep, 85% sand and 15% Dakota Peat mix rootzone over 4 inches of crushed limestone aggregate. All materials were tested for physical properties and selected based on USGA recommendations (Anonymous, 1993).

Just prior to seeding the green, four amendment treatments were incorporated into the sand rootzone. The treatments were as follows: 1) Architect's Blend at 7320 kg ha⁻¹ (150 lb 1000 ft²), 2) Architect's Blend at 3660 kg ha⁻¹ (75 lb 1000 ft²) + methylene urea (MU, 40-0-0) at 146 kg N ha⁻¹ (3.0 lb N / 1000 ft²) and 4) greens-grade Milorganite (6-2-0) at 146 kg N ha⁻¹ (3.0 lb N / 1000 ft²) + MU at 146 kg N ha⁻¹ (3.0 lb N / 1000 ft²). Treatments 1, 3 and 4 provided a total N level of 292 kg N ha⁻¹ (6.0 lb N 1000 ft²), while treatment 2 provided a total N level of 146 kg N ha⁻¹ (3.0 lb N 1000 ft²). The materials were incorporated into the top 5.0 cm of the existing soil mix. Plot size for the individual treatments was 1.82 x 9.14 m (6 x 30 ft) and the experimental design was a randomized complete block design with 4 replications. The entire green was seeded on 15 Sep. 2003 with a blend of 'A4' / 'G6' creeping bentgrass at a rate of 61 kg pure-live-seed (PLS) ha⁻¹ (1.25 lb PLS 1000 ft²).

Mowing was commenced at 4 weeks after seeding and was initially set to a height of 0.64 cm (0.25 inch). Fertilization of the entire green also started on this date and consisted of bi-weekly application of a foliar fertilization program (Emerald Isle, True Foliar, Ann Arbor, MI) that delivered a complete fertilizer at the rate of 4.44 kg N ha⁻¹ (0.091 lb N / 1000 ft²), 1.56 kg P ha⁻¹ (0.032 lb P 1000ft²), and 3.46 kg K ha⁻¹ (0.071 lb K 1000ft²) every 2 weeks.

Turfgrass establishment rates were monitored weekly during the grow-in using digital image analysis (Richardson et al., 2001). At 6 and 8 weeks after planting (WAP), two soil cores (2.54 x 30 cm) were removed from each plot and the sand was washed from the roots for a determination of maximum root length and root weight. Also at 6 and 8 WAP, a single pass was made through each plot with a mower to determine shoot growth. A sub-sample was taken from the clipping harvest, dried in a forced air oven at 60°C for 48 h and ground to pass a 1-mm screen. Leaf tissues were analyzed using inductively coupled plasma (ICP) emission spectroscopy (Donahue and Aho, 1992) for all nutrients except N, which was analyzed by combustion analysis (Campbell, 1992).

Results and discussion

A uniform stand of creeping bentgrass was attained across the entire experimental area. Turfgrass cover ratings were similar for the four treatments through the first 4 weeks of the trial (Figure 1), but began to separate at the 36 and 48 days after planting treatments. On those dates, the Arch.-150 treatment resulted in more turfgrass cover than any of the other treatments. There were statistical differences in turfgrass cover among all treatments, with ranking being Arch.-150 > Milorganite + MU > Arch. 75 + MU > Arch. 75 (Figure 1). The differences between the top three treatments and the Arch. 75 are not surprising, as they have twice as much available N as the Arch. 75. However, the differences between the top three treatments indicate that actual fertility may not be as important as the form of fertility. A Milorganite pre-

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plant application, such as the one tested in this trial, has been commonly used in this type of seeding for many years (McCarty, 2001). However, the Arch.-150 treatment out-performed this treatment, even with the same amount of actual nutrients. Milorganite is an activated sewage sludge product that is pelletized for application, while the Architect's blend is a proprietary formulation of bio-stimulants and plant and seaplant meals.

One of the most important aspects of turfgrass establishment is the number of days required to reach full coverage. For each treatment, the number of days required to reach both 80% and 100% coverage was calculated. The Arch.-150 treatment required significantly fewer days than any other treatment to reach both 80% and 100% coverage (Table 1). The Arch.-150 treatment reached 100% coverage approximately 2 weeks prior to any other treatment. This would be a significant advantage for golf course superintendents during construction or renovation, as this time saved in establishment would allow the course to open sooner.

Data on root and shoot growth was inconclusive, as the differences between treatments were small and variable (Table 2). At 8 WAP, there was a slight reduction in root wt. in the Arch.-75 + MU treatment compared to other treatments. Also, there was a significant reduction in shoot wt. of the Arch.-75 treatment at 8 WAP (Table 2). There were no significant differences observed for other treatments and variables.

There were significant treatment effects on nutrient content at both the 6 and 8 WAP sampling dates (Table 3). At 6 WAP, N, P, K, Ca, Mg, and S were all affected by pre-plant treatments, with the major difference being observed between the Arch.-75 treatment and all other treatments. This is not surprising, as this treatment received half the amount of total fertility as the other treatments. The differences between other treatments was small and not significant for most parameters tested. At 8 WAP, the differences due to treatment were even less pronounced and there was no treatment effect on N or K (Table 3).

Conclusions

The results of this study demonstrate that pre-plant organic matter treatments can have a significant impact on bentgrass establishment in high sand content putting greens. The proprietary product, Architect's Blend, produced the most favorable results when used at the high rates. Assuming it is cost-competitive, this product should benefit golf course superintendents, as excellent grow-in results can be attained using a single, composite material.

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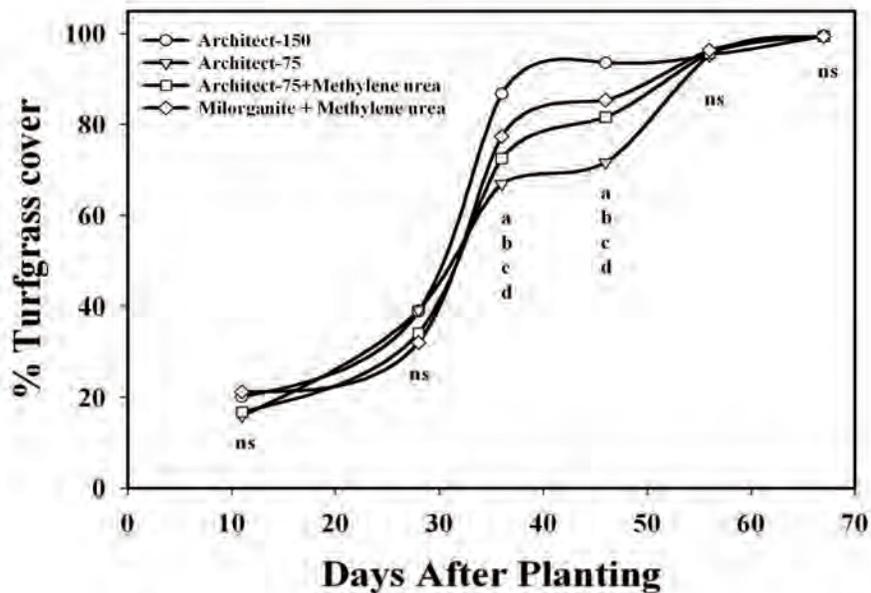


Fig. 1. Establishment of creeping bentgrass, as affected by four pre-plant soil amendments. Letters indicate a significant difference ($P=0.05$) between treatments at each evaluation date. ns - no significant difference between treatments at that date.

Table 1. Days for creeping bentgrass to reach either 80% or 100% coverage, as affected by various pre-plant fertilizer treatments.

Treatment	80% Cover	100% Cover
	----- days to reach -----	
Arch.150	34 d [†]	40 b
Arch.75	50 a	56 a
Arch. 75 + methylene urea	43 b	56 a
Milorganite + methylene urea	37 c	55 a

[†] - different letters indicate a significant difference (P=0.05) between treatments for that level of turfgrass coverage.

Table 2. Effects of various pre-plant fertilizer treatments on shoot and root characteristics of creeping bentgrass.

Treatment	Root length (cm)		Root Wt. (g)		Shoot Wt. (g m ⁻²)	
	6 WAP [†]	8 WAP	6 WAP	8 WAP	6 WAP	8 WAP
Arch.150	18.60	19.00	4.60	4.60	1.30	2.00
Arch.75	17.90	19.50	4.80	4.20	1.28	1.26
Arch.75 + methylene urea	19.20	16.60	3.60	3.60	1.14	2.32
Milorganite + methylene urea	19.90	18.00	4.00	4.60	1.20	1.94
LSD (0.05)	NS [‡]	NS	NS	0.30	NS	0.58

[†] - WAP - weeks after planting

[‡] - NS - not significantly different at the P = 0.05 level of probability

Table 3. Tissue analysis of creeping bentgrass, as affected by various pre-plant fertilizer treatments. Samples were collected at 6 and 8 weeks after planting.

Treatment	N	P	K	Ca	Mg	S
	----- % dry wt. -----					
	<u>6 weeks after planting</u>					
Arch.150	2.9	0.36	1.17	0.43	0.20	0.36
Arch.75	1.5	0.19	0.75	0.22	0.13	0.23
Arch. 75 + methylene urea	2.2	0.26	1.05	0.32	0.18	0.31
Milorganite + methylene urea	2.3	0.28	0.97	0.27	0.19	0.27
LSD (P=0.05)	0.6	0.07	0.23	0.09	0.04	0.08
	<u>8 weeks after planting</u>					
Arch.150	4.7	0.62	2.47	0.36	0.25	0.44
Arch.75	4.1	0.54	2.19	0.29	0.23	0.37
Arch. 75 + methylene urea	4.6	0.52	2.24	0.29	0.23	0.38
Milorganite + methylene urea	4.8	0.61	2.44	0.33	0.27	0.39
LSD (P=0.05)	NS [†]	0.05	NS	0.04	0.02	0.03

[†] NS - not significant at the P = 0.05 level of probability