TURFGRASS SOIL MANAGEMENT RESEARCH REPORT - 1984

P.E. Rieke and S. L. McBurney
Crop and Soil Sciences, M.S.U.

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IRRIGATION AND NUTRIENT BALANCE EFFECTS ON ADELPHI KENTUCKY BLUEGRASS

The data in Table 1 give the quality ratings on these plots during the growing season. As has been reported in the past the responses to nitrogen were reduced when the plots were irrigated daily at noon. Even the untreated check plot ranked highly under regular irrigation. But higher nitrogen rates were necessary to give acceptable quality ratings when limited moisture was applied. When the entire plot area was subjected to severe moisture stress in late June-early July due to a pump failure, the plots which received the higher N rates gave the highest susceptibility to wilt. If one is growing turf on sand and/or the area is unirrigated, then lower N rates are appropriate to keep the turf less susceptible to wilt. The lower summer quality ratings would be expected on turfs treated with lower nitrogen, even though they are less susceptible to wilt.

A further observation is the lack of response to potassium on these marginally low potash soils. With the clippings returned to the plot area, this may return enough potassium to prevent serious stress induced by the low potassium level in the soil. This is a cooperative project with J. M. Vargas, Jr. and Bruce Branham.

EFFECT OF NITROGEN FERTILIZATION PROGRAM IN THE TURF QUALITY OF 3 CREEPING BENTGRASSES MAINTAINED AT PUTTING GREEN HEIGHT

After 3 years of treatments shown in Table 2, the quality ratings of Penncross and Penneagle creeping bentgrasses continue to be higher than with Emerald. At the low N rates Emerald provides a very open, poor quality turf, while the others are acceptable. At the higher rates of N all grasses become thatchy and puffy resulting in scalping.

NITROGEN FERTILITY PROGRAMS ON PENNCROSS CREEPING BENTGRASS

This cooperative study with J.M. Vargas, Jr. was established in 1982. The treatments are outlined in Table 3. Data for 1984 are given in Table 4.

The programs which provide modest N in the summer (0.5 pound N per 1000 sq. ft. per month in June, July and August with 1 pound in September and 1 in November) provide the most uniform quality turf. The total N application for the year is 3.5 pounds per 1000 sq. ft. The program which gives 4 pounds N annually with 1 pound applications in April, May and June results in ratings which are too high and would make the turf more susceptible to stresses of traffic, high temperature and moisture limitations.

WETTING AGENT STUDIES

Several wetting agents were applied to Penncross creeping bentgrass greens at the Hancock Turfgrass Research Center and on two predominantly Kentucky bluegrass fairways growing on light sandy loam soils at the Candlestone Golf Club at Belding. Appreciation is expressed to the LESCO company for financial support and Superintendent Rick Krampe for use of the fairway areas. The objective was to evaluate LESCO'S Lescowet with several other wetting agents on the prevention of localized dry spots.

Although there was imminent development of localized dry spots on the two fairways at Candlestone at the time of treatment (mid July) environmental conditions were not conducive for further development of the problem subsequent to treatment. As a result, there were no differences to record either in turf quality, wilting tendency or in soil moisture in samples taken from the fairway.

Other studies were established at the Hancock Turfgrass Research Center on Penncross creeping bentgrass greens growing on a loamy sand soil. Treatments were applied in late July and repeated as shown in the accompanying tables two weeks later in early August. Again climatic conditions were not conducive to development of the localized dry spot conditions so no differences were recorded among the various treatments in terms of localized dry spots or in wilting tendency. There was a significant response in dew control, however. The treatments were applied either to plot areas which were irrigated to replace approximately 80% of open pan evaporation or which received no irrigation except at the time of application to prevent burn. The irrigated plots received irrigation during early morning which reduced dew formation to some degree. As a result, differences were smaller than on the plots which were irrigated only on wilt. The plots which received irrigation to replace 80% of open pan evaporation (Table 5) manifested some differences among wetting agents with Lescowet and AquaGro reducing dew the most. Without the supplemental irrigation, dew formation differences were highly significant (Table 6). After 1 day only AquaGro-Dry showed no difference from the check. After 2 days, differences were still evident, but smaller in magnitude. After 5 days, only Lescowet and AquaGro gave meaningful differences. After 2 weeks, differences were very small and not meaningful.

In a second study (Table 7) similar data were obtained. Of interest were the responses to AquaGro-Dry. Although there was little response in dew control from the dry material within a day or two of treatment, after 2 weeks there were lower dew ratings compared to the check. This would be expected as the material is applied dry. It must be dissolved into applied water and then diffused into the turf. This gives a longer term release pattern, but will

not provide as much active ingredient in the turf at the time of the application, of course.

In the above study, the treatments were not watered in to determine the degree of phytotoxicity of each of the materials. Obviously this would not be a recommended practice, but this does provide some idea of the relative potential for phytotoxicity. The phytotoxicity data are given in Table 8. AquaGro and Lescowet caused the greatest phytotoxicity when not watered in. Our general recommendation is to apply wetting agents to turf which are not in a condition of moisture stress, then water in immediately. Unless absolutely necessary, it is best to never apply wetting agents when temperatures are going to be above 85, and it is best to treat in the evening. It may be necessary to irrigate the area lightly before treatment so the grass is not in a condition of wilt.

SOIL pH CONTROL

The plots treated with lime and sulfur in 1981 continue to show some changes with time. Of particular note is the increase in soil pH on the sulfur treated plots as well as on the check. Apparently the major factor is the hardness of the irrigation water applied to the turf. The pH data are in Table 9. Further, the loss in the bases, calcium and magnesium are dramatically increased from the high sulfur plots (Table 10). If the turf manager wants to achieve and keep a low pH, more frequent soil testing should be practiced to prevent a deficiency of magnesium. Also, the pH change occurs first in the surface layer and gradually moves downward. This surface acidification could lead to stress on the turf so the use of sulfur to acidify soils should be done cautiously.

PHOSPHORUS AND POTASSIUM SOIL TEST IN RESPONSE TO FERTILIZER APPLICATIONS

The effect of P_2O_5 and K_2O applications to several soils are summarized in Tables 11 and 12. As observed previously, the dune sand does not hold applied potassium (Table 11). Effective Potash application on sandy soils requires regular applications, a minimum 3 or 4 times a year. When some peat is mixed with the soil the potash holding capacity of the soil media is increased somewhat over the sand, but not as strongly as on the topsoil green (fine sandy loam).

Phosphorus is apparently leached from the dune sand as well (Table 12). After 2 years of application of P_2O_5 to this dune sand, the phosphorus soil tests are still moderately low. There was a very clear deficiency of P on the check plots throughout the year, while deficiency symptoms appeared on the 1 pound application rate per year late in the fall when soils became colder and the uptake of P was not as efficient. Soil tests on the sands should be taken more frequently than on other soils because of the low cation exchange capacity and the higher susceptibility to rapid chemical change and leaching.

Table 1. Effect of irrigation regime and nitrogen and potassium levels on turfgrass quality ratings and wilting susceptibility of Adelphi Kentucky bluegrass. Hancock Turfgrass Research Center. Fertilizer applications made May 11, June 16, August 9 and September 14, 1984. Averages for 3 replications.

Irrigation regime	N Rate	K_2O Rate	Wilt*	Quality Rating (9=best)		
	lbs/1000 sq ft		July 2	June 13	July 15	Aug 25
Daily	2	0	1.0 j[z]	6.2 ce	7.3 cf[#]	7.0 bd
80% Pan	2	0	2.0 i	4.0 kn	5.5 jm	3.8 ik
None	2	0	3.7 de	3.3 mp	4.7 np	2.8 jm
Daily	4	0	1.0 j	6.7 ac	8.0 ac	7.5 ac
80% Pan	4	0	3.7 de	5.2 fi	6.5 fh	5.0 fh
None	4	0	4.7 b	3.8 lo	4.7 np	3.5 il
Daily	6	0	1.0 j	7.3 ab	8.5 a	7.8 a
80% Pan	6	0	2.7 gh	6.0 cf	7.0 dg	5.8 cf
None	6	0	5.7 a	4.8 gk	6.2 gi	4.8 fi
Daily	2	1	1.0 j	6.0 cf	7.0 dg	6.8 be
80% Pan	2	1	2.7 gh	4.2 jm	4.8 mo	3.8 ik
None	2	1	3.0 fg	2.8 pq	3.5 r	2.5 lm
Daily	4	1	1.0 j	6.2 ce	7.5 ce	7.2 ac
80% Pan	4	1	2.7 gh	4.8 gk	5.3 kn	4.8 fi
None	4	1	2.3 hi	3.7 lp	4.2 or	3.3 jl
Daily	6	1	1.0 j	7.5 a	8.5 a	8.0 a
80% Pan	6	1	3.3 ed	5.7 dg	6.8 eh	5.5 df
None	6	1	3.7 de	4.8 gk	5.7 il	4.5 gj
Daily	2	2	1.0 j	6.5 bd	7.3 cf	7.2 ac
80% Pan	2	2	1.0 j	3.8 lo	4.5 nq	3.5 il
None	2	2	2.7 gh	3.0 oq	3.7 qr	2.7 km
Daily	4	2	1.0 j	6.5 db	7.3 cf	7.0 bd
80% Pan	4	2	2.7 gh	4.8 gk	5.8 hl	4.3 hj
None	4	2	3.3 ef	4.3 il	5.5 jm	4.0 hk
Daily	6	2	1.0 j	7.4 ab	8.0 ac	7.5 ac
80% Pan	6	2	2.7 gh	5.5 eh	7.2 cf	5.2 eh
None	6	2	5.7 a	5.2 fi	6.8 eh	4.5 gj
Daily	2	4	1.0 j	6.2 ce	7.3 bd	7.3 ac
80% Pan	2	4	2.7 gh	4.6 hl	5.8 hl	4.2 hj
None	2	4	4.7 b	2.8 pq	4.7 np	2.5 lm
Daily	4	4	1.0 j	6.5 bd	7.8 bd	7.0 bd
80% Pan	4	4	2.0 i	4.8 gk	6.0 hj	4.5 gj
None	4	4	3.3 ef	4.2 jm	5.5 jm	4.2 hj

Daily	6	4	1.0 j	7.2 ab	8.2 ab	7.8 ab
80% Pan	6	4	4.0 cd	5.3 eh	6.8 eh	5.3 eg
None	6	4	4.3 bc	5.2 fi	6.0 hj	4.8 fi
Daily	0	0	1.0 j	6.0 cf	7.3 cf	6.8 be
80% Pan	0	0	2.3 hi	3.2 np	4.2 or	2.8 jm
None	0	0	4.3 bc	2.2 cf	4.0 pr	1.8 m
Daily	4	1	1.0 j	6.5 bd	7.8 bd	7.0 bd
80% Pan	4	1	4.7 b	5.2 fi	6.3 fi	4.8 fi
None	4	1	4.7 b	4.0 kn	5.3 kn	3.0 ik
Daily	4	2	1.0 j	6.5 bd	7.8 bd	7.2 ac
80% Pan	4	2	3.3 ef	5.0 gj	5.8 hl	4.7 hi
None	4	2	3.7 de	3.8 lo	4.7 np	3.5 il

* Wilt rating based on 1 = no wilt; 5 = severe wilt.
# Rating taken 1 week after a 1 inch rain
z Means in columns followed by the same letter are not significantly different from each other at the 5% level using DMRT.

Table 2. Effect of N fertilization program on turfgrass quality ratings of Emerald, Penneagle and Penncross creeping bentgrasses maintained under putting green conditions. Nitrogen applications are made in May, June, July, August and September except as noted. Averages of 3 replications.

Treatment, lbs/1000 yr		Turfgrass quality rating (9 = greenest)			
N	Carrier	May 16	June 5	August 2	Sept 20
Emerald					
1	Urea	3.3 k[x]	3.5 j	2.5 n	3.1 k
2	Urea	3.7 jk	4.6 hi	3.1 mn	3.8 jk
3	Urea	4.2 hj	4.5 i	4.6 jk	5.1 hi
4	Urea	4.4 fj	5.1 ei	5.2 ij	5.5 fh
6	Urea	5.0 di	6.2 bd	6.3 dg	6.6 ce
8	Urea	5.3 cf	6.6 ac	6.6 ce	7.1 bd
4[y]	Urea	6.1 ac	5.7 dg	5.5 gi	5.9 eh
4[y]	Milorganite	5.7 bd	5.5 dg	5.4 hi	5.3 gh
4[y]	Am. Nit.	4.3 gj	5.1 ei	5.3 hj	5.9 eh
Penneagle					
1	Urea	4.1 ik	4.8 gi	3.7 lm	4.1 j
2	Urea	4.3 gj	5.4 dh	4.4 kl	5.4 gh
3	Urea	4.7 ei	5.4 dh	5.7 fi	6.1 dg
4	Urea	4.7 ei	5.6 dg	6.1 dh	6.5 ce
6	Urea	5.2 cg	6.6 ac	6.9 bd	7.4 ac
8	Urea	5.4 ce	6.9 ab	7.4 ab	8.3 a
4[y]	Urea	6.4 ab	6.0 ce	6.3 dg	7.1 bd
4[y]	Milorganite	6.0 ac	5.9 ce	6.3 dg	6.5 ce
4[y]	Am. Nit.	4.7 ei	5.5 dg	6.5 cf	7.0 bd
Penncross					
1	Urea	4.3 gi	4.9 fi	4.2 kl	4.3 ij
2	Urea	4.6 ei	5.3 di	4.6 jk	5.3 gh
3	Urea	5.1 dh	5.6 dg	5.6 gi	6.4 cf
4	Urea	5.2 eg	5.8 cf	6.0 ei	6.5 ce
6	Urea	5.3 cf	6.9 ab	7.2 ac	7.6 ab
8	Urea	5.7 bd	7.3 a	7.8 a	8.3 a
4[y]	Urea	6.6 a	6.2 bd	6.3 dg	7.3 bc
4[y]	Milorganite	6.1 ac	6.1 bd	6.5 cf	6.6 ce
4[y]	Am. Nit.	5.3 cf	5.9 ce	6.3 dg	7.1 bd

[x]Means in columns followed by the same letter are not significantly different from each other at the 5% level using Duncan's Multiple Range Test.

[y]Nitrogen program includes 1 pound N per 1000 sq. ft applied on November 5.

Table 3. Treatments applied in Penncross bentgrass nitrogen carrier fertility study at the Hancock Turfgrass Research Center. Treatments initiated in 1982. Plot size is 6 feet by 6 feet. Four replications.

Treatment		Month of application						
No.	N carrier	Nov	Apr	May	June	July	Aug	Sept
		--------Pounds N per 1000 sq. ft.---------						
1	IBDU (coarse)	1.0	---	---	0.5	0.5	0.5	1.0
2	Sulfur coated urea	1.0	---	---	0.5	0.5	0.5	1.0
3	Powder blue	0.5	---	---	0.25	0.25	0.25	0.5
	Urea	0.5	---	---	0.25	0.25	0.25	0.5
4	Powder blue	---	---	0.5	0.75	---	---	1.0
	Urea	---	---	0.5	0.5	---	---	1.0
5	Urea	1.0	---	---	0.5	0.5	0.5	1.0
6	Check[y]	---	---	---	---	---	---	---
7	Urea	---	1.0	---	---	---	---	1.0
8	Urea	---	1.0	1.0	1.0	---	---	1.0
9	Urea	---	2.0	2.0	2.0	---	---	2.0
10	IBDU (coarse)	---	1.0	1.0	1.0	---	---	1.0
11	Sulfur coated urea	---	1.0	1.0	1.0	---	---	1.0
12	Powder blue	---	0.5	0.5	0.75	---	---	1.0
	Urea	---	0.5	0.5	0.5	---	---	1.0
13	Urea	---	1.0	1.0	---	---	1.0	1.0
14	Ammonium nitrate	1.0	---	---	0.5	0.5	0.5	1.0
15	Ammonium nitrate	---	1.0	1.0	1.0	---	---	1.0
16	Milorganite	1.0	---	---	0.5	0.5	0.5	1.0
17	Milorganite	---	1.0	1.0	1.0	---	---	1.0
18	Oxamide	1.0	---	---	0.5	0.5	0.5	1.0
19	Oxamide	---	1.0	1.0	1.0	---	---	1.0

[y]Check plots received 1 pound N per 1000 square feet as urea in July and September.

Table 4. Effect of nitrogen carriers on quality of a Penncross creeping bentgrass green at the Hancock Turfgrass Center. Averages for four replications.

Treatment[y]		Turfgrass Quality Rating (9 = best)				
No.	Carrier	April 16	June 5	July 2	Aug. 1	Sept. 20
1	IBDU	5.3 bc[x]	6.3 be	6.4 bd	5.9 bd	6.2 cg
2	S.C. urea	4.7 c	5.2 eg	5.3 eh	5.4 cd	6.1 cg
3	P.B. + Urea	5.1 c	5.5 df	5.6 cg	5.3 cd	5.7 dg
4	P.B. + Urea	4.5 cd	5.7 cf	5.8 cg	5.5 bd	6.5 ce
5	Urea	4.7 c	5.2 eg	5.4 dh	5.4 ed	6.3 cf
6	Check	2.5 c	3.6 h	4.1 i	3.8 e	4.5 h
7	Urea	3.5 dc	4.6 fh	4.4 hi	4.1 e	5.2 gh
8	Urea	6.3 b	7.1 b	7.4 ab	6.5 ac	7.6 b
9	Urea	7.5 a	8.5 a	8.3 a	7.4 a	8.5 a
10	IBDU	5.0 c	6.2 be	6.4 bd	5.8 bd	6.2 cg
11	S.C. Urea	4.6 cd	5.7 cf	6.4 bd	6.1 bd	6.7 bd
12	P.B. + urea	5.5 bc	6.1 be	6.2 cf	5.7 bd	6.3 cf
13	Urea	5.2 bc	6.9 bc	6.3 ce	5.6 bd	6.9 bc
14	Am. Nitrate	6.3 b	6.0 be	5.9 cg	6.0 bd	7.1 bc
15	Am. Nitrate	5.6 bc	6.7 bd	7.4 ab	6.7 ab	6.6 cd
16	Milorganite	4.5 cd	5.0 eg	5.2 fg	5.5 bd	6.9 bc
17	Milorganite	3.0 e	5.6 df	6.5 bc	6.1 bd	6.2 cg
18	Oxamide	3.3 e	4.7 fh	5.1 gh	5.2 d	5.5 eg
19	Oxamide	3.0 e	4.0 gh	5.7 cg	5.5 bd	5.4 fh

[x]Means in columns followed by the same letter are not significantly different from each other at the 5% level using Duncan's Multiple Range Test.

[y]For treatment details, see Table 3.