THE NEED FOR MICRONUTRIENTS IN PUTTING GREEN ROOTZONE MIXES

By Bret M. Lynch

Editor's Note: *Bret Lynch is a May 1994 graduate of the University of Wisconsin Turf and Grounds Management Program. While in school, he worked at the Cherokee and Bishop's Bay country clubs. He has accepted employment as Spray Technician at the Pinehurst Resort and Country Club and is looking forward to helping prepare the number 2 course for the US Senior Open Tournament in June. Dr. Wayne R. Kussow was his advisor and supervised this project.*

Micronutrient deficiencies in turfgrasses grown in Wisconsin are vary rare. Yet, fertilizer companies offer fertilizers with micronutrients and sell micronutrient packages for use in all stages of turfgrass development. The incorporation of a micronutrient package into sand putting green mixes has become a fairly standard practice.

The objectives of this study were to determine if this is really necessary, if there is a bentgrass growth response, the nutrient or nutrients responsible, and if the growth response depends on the type of organic amendment used.

EXPERIMENTAL METHODS

Six organic amendments were used to prepare 80:20 (v/v) rootzone mixes. The amendments and their total sulfur and micronutrient contents are shown in Table 1. Four pots were prepared with each mix; two received a micronutrient package and two did not. The micronutrient package added was Scott's Trace Element Package (STEP). STEP was added at the recommended rate of 0.62 lb/cu. yd. of rootzone mix. This provides approximately 15.8 ppm Ca, 5.8 ppm Mg, 28.5 ppm S, 1.3 ppm Cu, 23.4 ppm Fe, 6.8 ppm Mn, 0.07 ppm Mo, and 3.4 ppm Zn in the rootzone mix.

The pots were seeded to 'Penncross' creeping bentgrass at a 3.0 lb/M rate after adding 1.0 lb N/M as 19-25-5 starter fertilizer. Starting 2 weeks after seeding, the pots were clipped every 4 to 6 days at 0.5 inch for 4 weeks. The clippings were oven-dried, weighed and ground for chemical analysis. The last four successive cuttings were combined to provide the amount of tissue needed for analysis by the State Soil and Plant Analysis Laboratory.

OBSERVATIONS

Bentgrass growth response to the micronutrient package became evident approximately 2 weeks after emergence. However, at no time during the study were there any decided differences in visual appearances of the bentgrass growing in pots receiving STEP and those which did not.

Increases in total clipping weights attributable to the application of STEP ranged from -3% for the fermented rice hulls to +52% for the Wisconsin peat (Table 2). Overall, application of STEP increased the bentgrass clipping weights by 38%.

Clipping weights from the pots not treated with STEP were correlated with the analyses of the organic amendments to see if there was any possible influence of organic amendment S or micronutrient content on bentgrass growth. The only significant relationship found was for boron. The evidence was that the 10.9 ppm boron in the Dakota reed sedge had an adverse effect on bentgrass growth (Fig. 1).

Concentrations of S and micronutrients found in the creeping bentgrass clippings are presented in Table 3. The

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FIGURE 1

Influence of the boron in six rootzone organic amendments the clipping weight of creeping bentgrass during establishment.

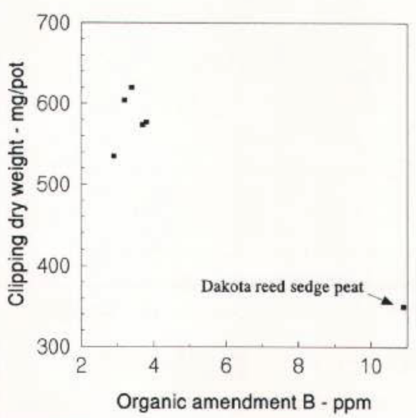

FIGURE 2

Relationship between creeping bentgrass clipping sulfur concentrations and dry weights.

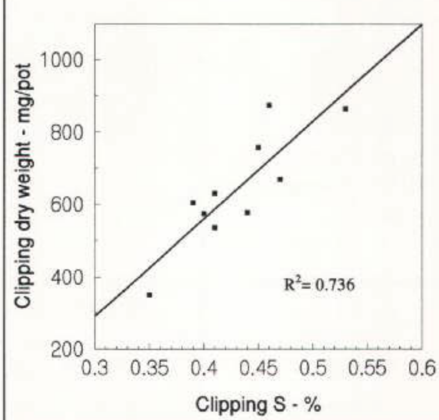

FIGURE 3

Relationship between creeping bentgrass clipping manganese concentrations and dry weights.

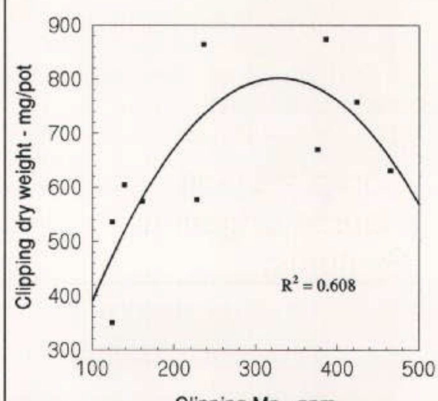

TABLE 1. Total sulfur and micronutrient concentrations in rootzone amendments.

Amendment	Nutrient concentration S	B	Cu	Fe	Mn	Zn
	ppm					
Canadian peat	959	3.2	7.0	346	19.3	7.8
Michigan peat	938	2.9	8.5	945	18.1	17.0
Wisconsin peat	1085	3.7	10.3	2010	83.3	25.5
Reed sedge peat	2890	10.9	9.8	3790	69.0	10.4
Fermented rice hulls	376	3.4	9.1	83	149.0	17.3
Humate	4850	3.8	24.1	5590	26.1	7.0

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interpretative standards available for turfgrass tissue concentrations of essential plant nutrients indicate the following:

Sulfur concentrations were all sufficient whether STEP was added or not and STEP brought all S concentrations to the upper limit of the sufficiency range.

Boron concentrations were sufficient for all treatments even though STEP does not contain this micronutrient.

Copper levels were at the upper end of the sufficiency range (20 ppm) in all treatments.

Iron concentrations were consistently at the upper end of the sufficiency range (100 ppm) when STEP was not applied. This concentration of Fe was exceeded when STEP was applied to the Michigan and Wisconsin peat treatments. However, application of STEP did not significantly increase clipping Fe concentrations.

Manganese concentrations in the absence of STEP were sufficient or exceed the upper limit of 150 ppm. With the addition of STEP, tissue Mn levels exceed the 150 ppm concentration by 57 to 210%.

Zinc concentrations were all sufficient without the addition of STEP; five of the six organic amendment treatments exceed the sufficiency range when STEP was added.

The clipping weights of the creeping bentgrass were regressed on tissue concentrations of S and the micronutrients to see which of these nutrients appeared to be responsible for the observed increases in growth observed when STEP was applied. Since there was no growth response to STEP in the fermented rice hulls treatment, data from this treatment were not included in the regression analysis.

TABLE 2. Creeping bentgrass growth response to STEP applied to rootzone mixes with different organic amendments.

Organic amendment	Bentgrass clippings weight* -STEP	+STEP	Change
	mg/pot		%
Canadian peat	604	758	+25
Michigan peat	535	670	+25
Wisconsin peat	574	874	+52
Reed sedge peat	350	631	+80
Fermented rice hulls	620	602	-3
Humate	577	864	+50

Duncan's LSD (p=0.05)
Among amendments = 76 mg
Among STEP treatments = 93 mg

* Sum of four mowings.

The regression analyses, which examine the strength of the relationship between clipping weight and nutrient concentration, revealed that only the tissue concentrations of S and Mn were significantly related to bentgrass growth. The relationship was particularly strong for sulfur (Fig. 2). In fact, the R2 value obtained indicates that nearly 74% of the observed variation in clipping weights could be attributed to differences in tissue concentrations of S. The higher the tissue concentration of S, the higher the bentgrass clipping weight, even though tissue S concentrations in all treatments were sufficient without the addition of STEP.

The relationship between clipping weights and tissue Mn concentrations was very different from that for S. Indications were that in four of the ten treatments Mn actually depressed bentgrass growth (Fig. 3). The optimum clipping Mn concentration was around 350 ppm. Hence, this may be the point where Mn toxicity begins to occur in 'Penncross' creeping bentgrass. This concentration of Mn occurred when STEP was applied to the all but the fermented rice hull and humate treatments.

Multiple regression, in which the additive influences of S and Mn tissue concentrations on clipping weights were examined, showed that the two nutrients accounted for 80% of the variation in clipping weights. But clearly, the primary factor involved was clipping S concentration.

CONCLUSIONS

This greenhouse study indicates that, while addition of sulfur and micronutrients to sand putting green rootzone mixes can significantly increase creeping bentgrass growth rates during establishment, indiscriminant use of a micronutrient package is not warranted and can actually elevate the levels of some nutrients to toxic levels. For the six organic amendments studied, addition of sulfur alone would likely have been more beneficial overall than application of the micronutrient package. Further research is needed to devise the means and standards necessary to judge in advance which nutrients other than N, P, and K need to be added during the blending of sand-based putting green rootzone mixes.

TABLE 3. Sulfur and micronutrient concentrations in clippings from creeping bentgrass grown in 80:20 rootzone mixes with and without STEP.

Rootzone mix amendment	STEP added?	S	B	Cu	Fe	Mn	Zn
Canadian peat	No	0.39	15	60	91	139	52
	Yes	0.45	15	57	116	424	120
Michigan peat	No	0.41	12	30	177	124	48
	Yes	0.47	15	41	134	376	98
Wisconsin peat	No	0.40	13	31	143	161	45
	Yes	0.46	14	41	132	386	101
Reed sedge peat	No	0.35	17	27	106	124	43
	Yes	0.41	18	35	122	465	121
Fermented rice hulls	No	0.38	13	38	87	88	46
	Yes	0.46	14	81	88	344	106
Humate	No	0.44	9	21	97	228	29
	Yes	0.53	11	26	91	236	54
Duncan's LSD (p=0.05)							
Among amendments		0.01	NS*	11	20	36	10
Among STEP treatments		0.04	NS	6	NS	18	6

* NS = not significant.