BIO-ORGANIC TURFGRASS AMENDMENTS

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As economic and time investments in turfgrass management increase, the need for turf products of increasing diversity emerges. Some products might provide turf with nutritional benefit while enhancing certain soil related properties. Ringer Corporation, of Eden Prairie, MN, submitted to the Department of Crop and Soil Sciences at Michigan State University several products for evaluation. These newly marketed products, termed bio-organic turf amendments, are natural nitrogen carriers fortified with biological inoculum, principally fungi and soil bacteria. One of the functions of the inoculum is to encourage turfgrass thatch control and soil rejuvenation.

Objectives of the research were 1) to document the long term turfgrass sward response to product nitrogen release and 2) to characterize the short term turfgrass thatch response to repeated product application. Methods of investigation employed field plots and greenhouse experiments taking basic laboratory measurements on predetermined variables.

NITROGEN RESPONSE

Nitrogen response data was compiled from measurements taken from field trials begun in summer 1984. The experiment was a 3 x 3 factorial arrangement of treatments laid out on a seeded blend of Kentucky bluegrass (Poa pratensis L.) at the Hancock Turfgrass Research Center in East Lansing, MI. The experimental design was a randomized complete block having 3 replications. Plot area measured 48 square feet. Height of cut was maintained at 2.5 inches with irrigation provided to prevent wilting. The treatment consisted of Ringer's Lawn Restore (10.5% N), sulfur coated urea (32% N) and soluble urea (46% N) applied at annual rates of 2, 4 and 6 pounds of nitrogen per 1000 square feet (97.6, 195.3 and 292.9 kilograms per hectare respectively). Treatments were applied on May 15, June 15, July 15 and September 15 during 1984 and 1985. Clippings for analysis were harvested seven times in 1984 and 3 times in 1985. Variables under analysis were 1) visual turf quality ratings, where higher numbers indicate superior turf, 2) percentage turf tissue nitrogen, 3) chlorophyll A nd B content of dried clippings, and 4) clipping weights per square meter.

Significant and highly significant differences between treatment combinations on all variables were detected by analysis of variance (see Table 1). Correlation coefficients between variables were highly significant. Even though differences were evident, these investigations found that the Ringer products displayed essentially the same degree of nitrogen response as did the sulfur-coated urea product. However, the Ringer product did not perform as well as the soluble urea, which was expected. Differences in comparison to urea may be attributable to differences in nitrogen release rate and mechanism of release. Urea nitrogen release is affected by the presence of the urease enzyme and moisture conditions while the organic Ringer products are more temperature dependent, hence the rate of release of the Ringer products is somewhat slower.

FIELD THATCH RESPONSE

Thatch response data were compiled from field trials begun in October, 1984. This experiment was a 3 x 4 factorial arrangement of treatments laid out on a sodded blend of Kentucky bluegrass originally seeded on a Houghton muck soil. The sod was established several years earlier at the Hancock Turfgrass Research Center in East Lansing, MI. Thatch depth was a uniform 24 millimeters thick. Experimental design was a randomized complete block having 3 replications. Treatments were Ringer's Lawn Restore, Ringers C-50 and Ringer`s Lawn Rx applied at rates of 0, 2, 4 and 8 pounds of nitrogen per application (0, 97.6, 195.3 and 390.6 kilograms per hectare respectively). Treatments were applied initially in October 1984 and 4 times during the 1984 growing season. Such excessive rates were deemed necessary to achieve results within the one year time frame. Study site soil was a moderately alkaline, moderately compacted sandy clay loam subsoil. Height of cut was 3 inches and irrigation was supplied so that water would not be limiting. No other cultural practices were applied during the course of the experiment. Plot size was 24 square feet.

In October 1985, 6 sub-samples per plot were collected and dried to halt any further decomposer activity. Verdure was removed to the pseudothatch layer and root tissue was removed up to the first visible rhizome layer. As such the thatch boundaries were defined. Measurements taken on the samples included thickness (see Figure 1), cellulose and lignin contents, and moisture holding capacity (see Figure 3). In November 1985, 3 additional sub-samples were collected and analyzed for earthworm (Lumbricus spp.) populations (see Figure 2).

Significant and highly significant differences were detected by analysis of variance on all measurements. As rates of application increased regardless of product type, thatch thickness decreased, cellulose content decreased, lignin content increased and earthworm populations increased (with exception of thatch treated at the higher rates of C-50). (See Figures 1 and 2). Thatch treated at the higher rates of C-50 actually received higher doses of ammonium sulfate (present in the C-50) which was assumed to be irritating to the earthworm population. As thatch thickness declined, an increase in moisture holding capacity was also noted in thatch treated at the higher rates (See Figure 3). It was assumed that the decay of thatch led to a decrease in size of organic matter particles resulting in an increase in smaller pore spaces which effectively held water more tightly. And an increase in mineral soil particles brought to the surface by earthworms also likely contributed to increased water holding capacity of the thatch. It was never adequately determined whether the product was solely responsible for the observed changes in the thatch or whether the earthworms played a significant role. Most likely a combination of the effects of the earthworms, which were assumed to be attracted to the plots by the organic amendments, and nitrogen released by the products acted together producing decay.

GREENHOUSE THATCH RESPONSE

Greenhouse thatch response data were compiled from greenhouse experimentation begun in September 1984. Thatch for experimental use was obtained from the field study site previously described. Several strips of the field site were cut with a Ryan sod cutter set to a depth of 5 cm. below the bottom of the thatch and left to remain in place. This depth was chosen so that experimental units would contain turf, thatch, muck and minimal sub-soil. From these strips, circular 6 inch diameter plugs were collected and placed into 3000 cm^3 plastic containers and transported to the greenhouse. These units were incorporated into a randomized complete block design experiment having 4 replications. Experimental treatments consisted of Ringer's Lawn Restore, Ringer's Lawn Rx, Ringer's C-50, and urea (46-0-0) applied at rates of 0, 0.5 and 2.5 lbs N/M/application. Treatments were applied 15 times in 20 weeks. Treatments were arranged as a 2 factor factorial with rate of application and product type as factors. General greenhouse cultural practices were used to maintain the plugs for approximately 20 weeks. Diazinon was applied to the plugs initially to eradicate the earthworm populations. Therefore, no earthworm activity contributed to decomposition.

At the end of the 20 week period, thatch samples were measured for thickness, cellulose, lignin and percent ash on ignition. No significant differences in cellulose, lignin or percent loss on ignition were detected. However, regardless of product type, thatch thickness declined as rate of product application decreased. Without the activity of the earthworms, increasing rates of nitrogen probably enhanced thatch retention by positively affecting plant growth. The effects of the nitrogen outweighed the effects of the decomposer inoculum, and retention was encouraged. At the low rate (i.e., 0.5 lb/N/1000 square feet/application) and at the check rate (i.e., no applied product) significant thatch decomposition took place.

SUMMARY

The Ringer Corporation's bio-organic turf amendments demonstrated the capability to be effective nitrogen carriers. Turf treated with Lawn Restore showed essentially the same degree of nitrogen response as turf treated with sulfur coated urea. Lawn Restore was not as effective as soluble urea at the rates of N applied. Applications of the Ringer products effected a thatch change in both field trials and greenhouse experimentation. In the field, increasing rates of the bio-organic amendment per application resulted in significantly decreased thatch thickness and cellulose content while earthworm numbers significantly increased. It was assumed that activity of the earthworms in association with the products (possibly as a food source) enhanced the decay of thatch. When earthworms were eradicated in the greenhouse experiment, increasing rates of bio-organic and urea application resulted in thatch being retained compared to the lower rates of application. Since thatch treated at the low and check rates showed enhanced decomposition, it might be assumed that light and frequent applications may be more beneficial than infrequent, heavy applications. Indigenous decomposers are assumed to be important when given a proper environment.

It is apparent that while these studies are by no means conclusive, further work in the area of thatch decomposition is warranted to substantiate the long term effects of the amendments to turf and soil.

Table 1. Turfgrass nitrogen response variable summarization comparing the Ringer Corporation's bio-organic amendment Lawn Restore to urea and sulfur coated urea.

		NIT	CHL	CLP	VRT
		%	mg/gm	gm/m^2	
Lawn Restore	2# N/M	3.2	7.9	9.4	7.2
	4	3.4	8.3	14.1	7.6
	6	3.7	8.7	18.2	8.1
Urea	2	3.3	7.9	10.0	7.4
	4	3.7	8.9	16.1	8.3
	6	4.0	9.3	19.6	8.8
S.C.U.	2	3.2	7.8	9.3	7.3
	4	3.4	8.2	12.3	7.8
	6	3.7	8.4	17.3	8.3
LSD 0.05		0.2	0.9	4.5	0.6

NIT = percent tissue nitrogen
CHL = milligrams chlorophyll per gram dried clippings
CLP = grams dried clippings per square meter plot area
VRT = visual quality ratings (9 = highest quality)

FIG. 1. THATCH THICKNESS

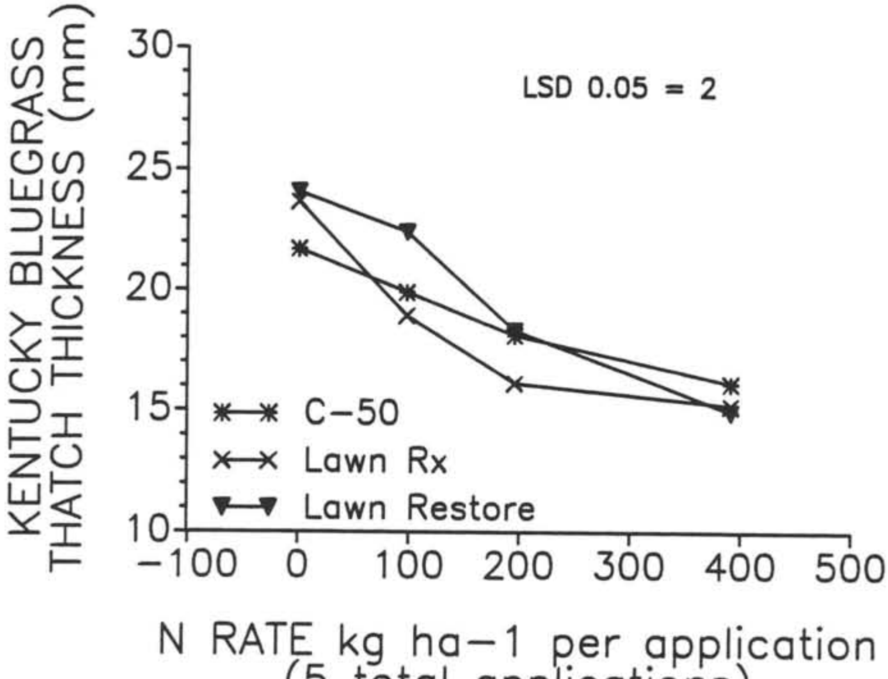

FIG. 2. THATCH WORMS

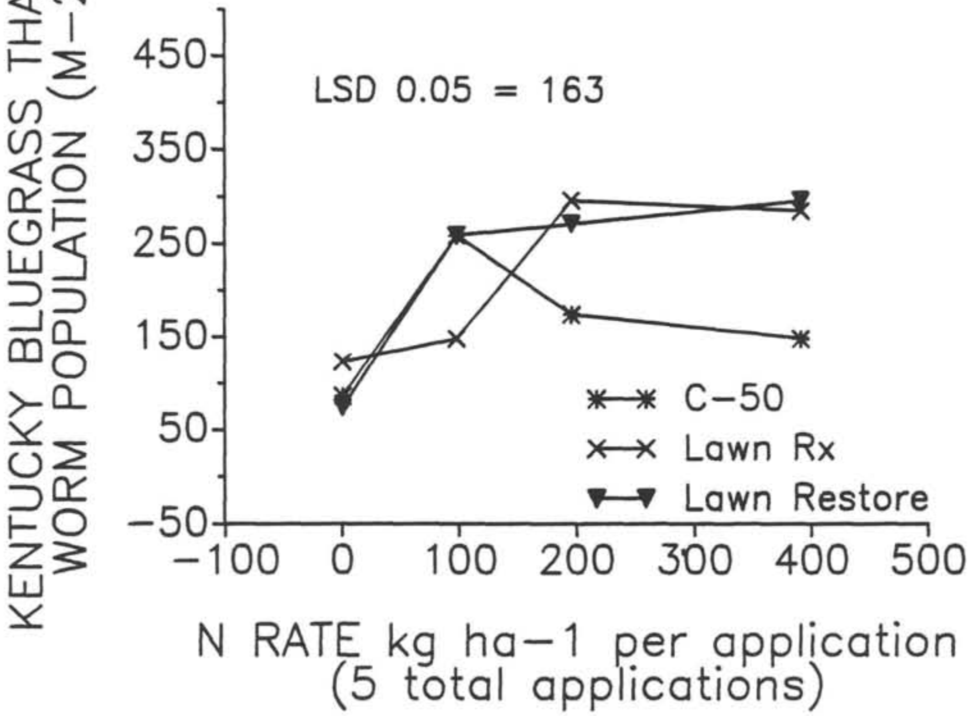

FIG. 3. WATER CONTENT