The Evaluation of Natural Source Fertilizers on Kentucky Bluegrass Turf

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Summary

Three natural nitrogen source products were evaluated for their overall effectiveness as turf fertilizer for use on Kentucky bluegrass. Old Mill Alfalfa Green, corn gluten meal and soybean meal were compared with an industry standard product, Milorganite. The treated plots were rated weekly for overall turfgrass quality and clipping yield.

All three of the natural nitrogen source products tested maintained the overall turf quality of the Kentucky bluegrass. Six ratings out of the ten revealed that the overall turf quality of the fertilized plots was significantly better than the turf quality of the unfertilized control. There was no significant difference in turf quality between the fertilized plots.

Data collected from measuring the clipping weights indicates that although there were differences in the weekly clipping production between the treatments, the only significant difference in clipping weight was between the unfertilized control and the fertilized treatments.

This test would indicate that the three natural products, Olds Mill Alfalfa Green, corn gluten and soybean meal were equal in performance to the industry standard, Milorganite.

Introduction

Over the years many natural products have been tested for use as a nitrogen source for turfgrass. Some of these products have performed quite effectively in comparison to other organic fertilizers, but few have ever developed into an industry standard. In this study, the turf response to three natural nitrogen sources was investigated.

Milorganite, considered an industry standard for organic fertilizers, was used as the treated control for this experiment. Derived from microbes used to remove nutrients from wastewater, Milorganite is an exceptional quality biosolid fertilizer with an analysis of 6-2-0 and is widely accepted as a non burning slow release nitrogen fertilizer well suited to turfgrass applications.

Old Mill Alfalfa Green dehydrated alfalfa pellets, is sold as an agricultural based soil amendment. It is developed from dehydrated alfalfa foliage and is compressed into long thin pellets. The pellets contain 18% crude protein which converts into a nitrogen fertilizer source with an analysis of 2.5-0-2.5.

TurfMaize Pro, produced from corn gluten meal, is an agricultural by-product created from the production of corn starch and corn syrup. It is a very high in crude protein which readily converts into a very rich nitrogen fertilizer source with an analysis of 10-0-0.

Unifeed soybean meal, sold primarily as a feed supplement, is the material remaining after extracting most of the oil from whole soybeans. With a 46% crude protein content this raw material converts into a nitrogen fertilizer source with an analysis of 7.5-0-0.

In previous trials the natural weed suppressant properties of both corn gluten meal and soybean meal was explored. The intent of this study was to investigate the potential of both materials as a natural fertilizer.

Methodology

In this study three natural products were compared with an industry standard product, Milorganite, and an untreated control. The trial was established at the Prairie Turfgrass Research Centre located at Olds College, Olds, Alberta. Test plots that measured 1x 4 metres were laid out on a uniform stand of established Kentucky bluegrass. Each treatment was replicated four times within a randomized complete block design (RCBD) Table1.

Table 1- Product list and nitrogen source information for natural source fertilizers, 2005.

Products	Analysis	Nitrogen Source	Formulation
Old Mill Alfalfa Green	2.5-0.2-2.5	Dehydrated alfalfa	Extruded pellet
Turf Maize Pro Corn gluten	10-0-0	Corn gluten meal	Extruded pellet
Unifeed Soybean meal	7.5-0-0	Dehulled soybean meal	Ground flakes
Treated Control: Milorganite	6-2-0 w 4% Fe	Composted sewage sludge	Micro granules SGN 90
Untreated Control: No fertilizer			

The Kentucky bluegrass test site was fertilized six weeks prior to the initiation of the study with a synthetic product (Contec 23-3-11) at the rate of 0.5kg N/100m^2. The natural nitrogen source products were applied as mid-season fertilizer treatment and their performance was monitored over the last ten weeks of the season.

In order to more effectively compare the potential of each product as a nitrogen source the treatment application rates were based on providing 0.4kg N/ 100m^2 rather than the manufacturer's recommended rate. To avoid application problems and assure a precise distribution, the products were individually weighed into plot sized lots and applied by hand using a simple shaker bottle. Each plot received two applications of product over the duration of the trial. The first application was applied July 19th and the second application followed four weeks later.

Once a week the plots were visually evaluated to assess the impact of the treatments on the turf's overall appearance. Following National Turfgrass Evaluation Program (NTEP) protocols, three turf quality factors: colour, density and area coverage were assessed.

The colour rating subjectively evaluated the uniformity and intensity of the colour displayed by the turf. A 1 to 9 scale was used to rate each plot. Treatments which stimulated a uniform dark green colour received scores ranging from 6 for an acceptable colour to 9 for turf with outstanding colour. Treatments that negatively impacted the turf and caused a brown or a burned appearance were scored significantly lower.

Density, the second quality factor rated, was subjectively evaluated for the impact of the fertilizers on shoot and tiller production. The 1 to 9 scale was again used to rate each plot. Treatments which produced a tight knit turf surface received scores ranging from 6 for an acceptable density to 9 for superior density. Treatments associated with a weak or thin turf stand were scored lower.

The final quality factor, area cover, was used to subjectively evaluate the vigor of turf. Once again a 1 to 9 scale was used to rate each plot. Treatments which stimulated a thick competitive turf cover received scores ranging from 6 for an acceptable area cover to 9 for a superior area cover. Treatments producing a weak turf, affected by weed encroachment and/or the presence of bare patches, were scored lower.

To compare the effect of the treatments on the overall turf quality, the average of the combined colour, density and area cover scores for each plot was calculated and statistically analyzed.

In addition to the subjective turf quality ratings, turf clipping weights were collected on a weekly basis from each of the plots. To determine the clipping weight of each treatment, the turf clippings were oven dried at 70^0C for forty-eight hours in order to extract the moisture from the clippings. The dried samples were later weighed and the values recorded.

Results

Turfgrass Colour Ratings

Over the ten week test period, all the fertilized plots generally scored higher for turf colour than the unfertilized control. On four of ten rating dates the turf colour of the fertilized plots was significantly better than the colour displayed by the unfertilized control (Table 2). Colour ratings were acceptable or slightly less than acceptable throughout the study. Although the Milorganite treated plots consistently scored high, there was no significant difference in colour between the Milorganite and the other fertilizers.

Table 2 - Turf colour for various natural source fertilizers, 2005.

Treatment	July 26th	Aug 2nd	Aug 9th	Aug 16th	Aug 25th	Aug 30th	Sept 6th	Sept 13th	Sept 20th	Sept 27th
	1 – 9 scale									
Alfalfa pellets	6.0a	6.0a	5.8a	5.8a	5.5a	5.8a	5.8a	5.5a	6.0a	5.8a
Corn gluten pellets	6.0a	6.0a	5.8a	5.8a	5.8a	6.0a	5.5a	5.8a	5.8a	5.8a
Soybean meal	6.0a	6.0a	5.8a	5.8a	5.5a	5.8a	5.8a	5.5a	6.0a	5.8a
Milorganite	6.0a	6.0a	5.8a	5.8a	5.8a	6.0a	6.0a	6.0a	6.0a	6.0a
Unfertilized control	6.0a	6.0a	5.3b	5.3b	5.3a	5.3a	5.3a	5.0a	5.0b	5.0b
$LSD_{0.05}$	N/S	N/S	0.4	0.4	N/S	N/S	N/S	N/S	0.3	0.5

* Values that have the same letter as a suffix are not significant from each other.

Turfgrass Density Ratings

In general, the density of the turf was scored as acceptable on the NTEP rating scale (Table 3). The density produced by each of the products was better than the untreated control, but it was generally not significant. Only once over the course of the trial was the turf density of the fertilized treatments significantly better than the density of the unfertilized control. Even though the Milorganite consistently scored higher for turf density, the differences were not significant.

Table 3 - Turf density for various natural source fertilizers, 2005.

Treatment	July 26th	Aug 2nd	Aug 9th	Aug 16th	Aug 25th	Aug 30th	Sept 6th	Sept 13th	Sept 20th	Sept 27th
	1 – 9 scale									
Alfalfa pellets	6.0a	6.8a	6.5a	6.8a	6.3a	6.5a	6.8a	6.5a	6.5a	6.0a
Corn gluten pellets	5.8a	6.5a	6.8a	6.8a	6.0a	6.3a	7.0a	6.5a	6.5a	6.0a
Soybean meal	5.8a	6.3a	6.5a	6.5a	6.5a	6.8a	6.8a	6.5a	6.8a	6.0a
Milorganite	6.0a	6.8a	6.8a	6.8a	6.5a	6.8a	7.0a	7.0a	6.8a	6.0a
Unfertilized control	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0b	6.0a	6.0a	6.0a
$LSD_{0.05}$	N/S	N/S	N/S	N/S	N/S	N/S	0.4	N/S	N/S	N/S

* Values that have the same letter as a suffix are not significant from each other.

Turfgrass Area Cover Ratings

Over the short ten week trial no significant changes in the turf area cover was observed. Under the NTEP system the area cover of this turf was acceptable for most of the products tested on each of the rating dates (Table 4).

Table 4 - Turf area cover for various natural source fertilizers, 2005.

Treatment	July 26th	Aug 2nd	Aug 9th	Aug 16th	Aug 25th	Aug 30th	Sept 6th	Sept 13th	Sept 20th	Sept 27th
	1 – 9 scale									
Alfalfa pellets	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a
Corn gluten pellets	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a
Soybean meal	5.8a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a
Milorganite	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a
Unfertilized control	6.0a	6.0a	6.0a	6.0a	6.0a	6.0a	5.8a	5.8a	5.8a	5.8a
$LSD_{0.05}$	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S

* Values that have the same letter as a suffix are not significant from each other.

Overall Turf Quality Score

When the combined average of the three quality factors was generated the impact of the fertilized treatments became more significant. Six ratings out of the ten revealed that the overall turf quality of the fertilized plots was significantly better than the turf quality for the unfertilized control (Table 5). There was no significant difference in turf quality between the fertilized treatments.

Table 5 - Overall turf quality ratings for various natural source fertilizers, 2005.

Treatment	July 26th	Aug 2nd	Aug 9th	Aug 16th	Aug 25th	Aug 30th	Sept 6th	Sept 13th	Sept 20th	Sept 27th
Alfalfa pellets	6.0a	6.2a	6.1a	6.2a	5.9a	6.0a	6.2a	6.1a	6.2a	5.9a
Corn gluten pellets	5.9a	6.2a	6.2a	6.2a	5.9a	6.0a	6.2a	6.1a	6.1a	5.9a
Soybean meal	5.9a	6.1a	6.1a	6.1a	6.0a	6.1a	6.2a	6.0a	6.2a	5.9a
Milorganite	6.0a	6.2a	6.2a	6.2a	6.1a	6.1a	6.3a	6.3a	6.2a	6.0a
Unfertilized control	6.0a	6.0a	5.8b	5.8b	5.8a	5.8a	5.7b	5.6 b	5.6b	5.7b
$LSD_{0.05}$	N/S	N/S	0.2	0.2	N/S	N/S	0.2	0.3	0.2	0.1

* Values that have the same letter as a suffix are not significant from each other.

Clipping Weights

Seven ratings out of the nine rating dates revealed a significant difference in clipping weight production between the treatments and the unfertilized control (Table 6). On two of the rating dates alfalfa pellets and corn gluten pellets produced greater clipping dry weights than the soybean meal or the Milorganite.

Although the treatments were not significantly different, the alfalfa pellets stimulated the turf to produce the largest quantity of clippings, while the Milorganite generated the least amount of clippings of all the fertilizer treatments (Table 6).

Although there were differences in the weekly production of clipping dry weights between the treatments, the total clipping dry weight data indicates that there was only a significant difference between the unfertilized control and the fertilized treatments (Table 6).

Table 6 - Clipping dry weight yields for various natural source fertilizers, 2005.

Treatment	Aug 2nd	Aug 9th	Aug 16th	Aug 25th	Aug 30th	Sept 6th	Sept 13th	Sept 20th	Sept 27th	Total Yield
	g/m^2									
Alfalfa pellets	11.2a	13.4a	8.5ab	13.5ab	12.8a	11.3a	10.0a	6.2a	2.6a	89.4a
Corn gluten pellets	10.9a	12.5a	8.7a	15.3a	14.2a	10.3a	9.4ab	6.0a	2.1ab	89.1a
Soybean meal	10.9a	10.6a	5.9c	11.9b	12.0a	10.2a	9.0ab	5.3ab	2.0abc	77.6a
Milorganite	8.8a	10.1a	6.3bc	11.2bc	12.2a	8.5a	7.6abc	5.2ab	1.6abc	71.3a
Unfertilized control	8.0a	7.5a	4.7c	8.9 c	6.4b	5.1b	5.0c	3.6c	1.0c	50.1b
$LSD_{0.05}$	N/S	N/S	2.3	2.7	4.8	3.0	2.7	1.5	1.1	19.8

* Values that have the same letter as a suffix are not significant from each other.

Figure 1

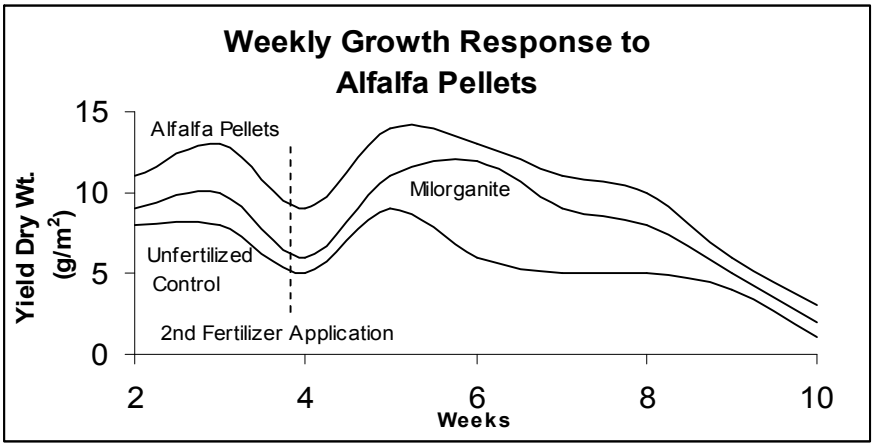


Figure 2

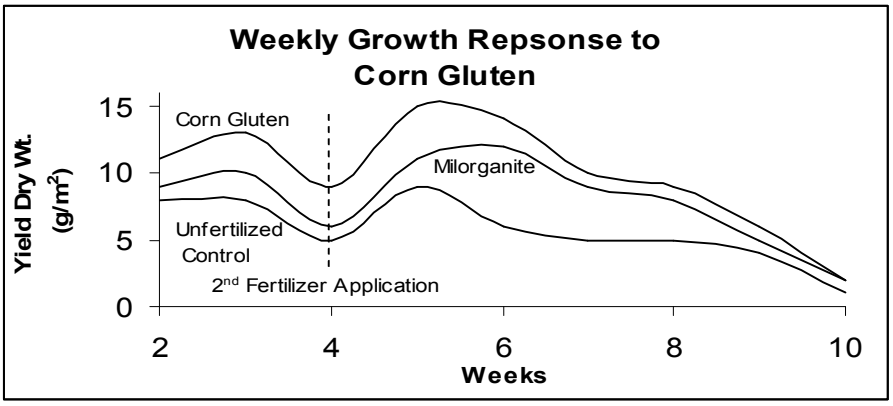
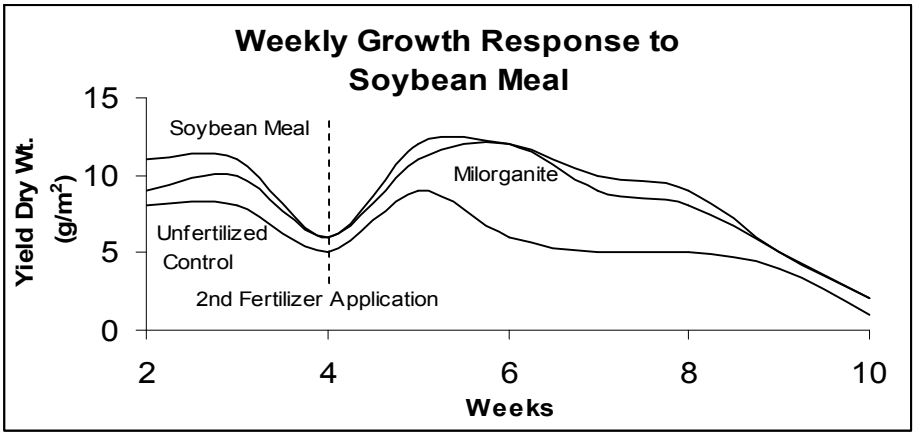


Figure 3



Discussion

Nitrogen release is thought to be the greatest factor in producing a growth response. Nitrogen sources that are efficiently taken up by the plant will produce superior ratings on most occasions.

Natural nitrogen sources are generally characterized as being slow release, long residual fertilizers. They tend to more temperature sensitive than synthetic fertilizers. At cooler temperatures the nitrification process slows down and the amount of nitrogen available to the turf declines, thus affecting the overall performance of the turf. This loss of turf performance is a major concern when managing turf in a region with a moderate to cool temperature growing season.

Unlike synthetic fertilizers, the nitrogen in natural materials must be mineralized by soil microorganisms into a nitrate or an exchangeable ammonium form before it can be utilized by the turf. Unfortunately not all of the mineralized nitrogen is available to the turf. Soil organisms, in order to grow, also utilize nitrogen and will compete with the turf for available nitrogen. It is not until the nitrogen needs of the microorganisms are met and additional nitrogen becomes available will the turf benefit. Under favorable temperature and moisture conditions the decomposition of nitrogen-rich natural materials may result in the immediate release of plant available nitrogen similar to the nitrogen release of a synthetic nitrogen product.

Here is a brief summary on the performance of each of the natural nitrogen sources tested:

Milorganite

As expected, the Milorganite treatment stimulated a slow regulated growth response from the turf. The high level of iron within the product proved advantageous in enhancing the dark green turf colour. The Milorganite effectively maintained an acceptable level of turf quality over the ten week period.

Dehydrated alfalfa pellets

Despite requiring several days to completely dissolve and disappear from the turf surface, the alfalfa pellets produced a greater growth response from the turf than either of the two control treatments (Figure 1).

Although the intensity of the turf colour was lower than the treated control, the alfalfa pellets did effectively maintain an acceptable level of turf quality over the ten week period (Table 5).

Corn gluten meal
With an analysis of 10-0-0, the TurfMaize pellets effectively stimulated greater clipping production from the turf than either of the two control treatments (Figure 2).

Although the intensity of the turf colour was lower than the treated control, the TurfMaize pellets did produce an acceptable level of turf quality over the ten week period (Table 5).

Soybean meal
Although, the soybean meal did stimulate a growth response from the turf similar to that of the treated control (Figure 3), the lack of a strong turf colour was evident on several occasions over the ten week period (Table 2).