Compost Type Affects Bermudagrass (*Cynodon dactylon* (L.) Pers.) Invasion

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ABSTRACT

A study was conducted on the Texas A&M-Commerce campus in Commerce, TX to evaluate the rate of bermudagrass reestablishment following incorporation of 4 different compost blends. Five beds were created by mechanically removing bermudagrass from an area approximately 60 cm (24") wide and 300 cm (120") long. All beds were tilled to a depth of 15 cm (6"). Compost was added at the following rates: 1) poultry litter compost (PLC) @ 10 tons / ac, 2) yard waste compost (YWC) @ 20 tons / ac, 3) dairy compost (DC) @ 10 tons / ac, or 4) a mix of dairy and poultry litter compost @ 10 tons / ac. The remaining bed had no compost added and was used as a control. EC and pH did not differ between compost types, but N was slightly higher in PLC. Compost type had a strong effect on bermudagrass invasion. By day 30, PLC and YWC had significantly more coverage than other treatments. The PLC plots covered significantly faster, achieving 100% coverage by day 60. All compost plots reached at least 90% coverage by day 90. Coverage was significantly slower in the control plot, with full coverage not achieved until day 120.

KEYWORDS: Poultry litter, Dairy compost, Yard waste compost

INTRODUCTION

Bermudagrass (*Cynodon dactylon* (L.) Pers.) is an important, but invasive, grassy weed throughout the southern U.S. Its aggressive, stoloniferous and rhizomatous nature allows it to rapidly invade, especially in areas with adequate moisture (Knoop, 1986). It was likely introduced in 1751 from Africa (Cudney et al., 2007), and by 1807 was listed as one of the principle grasses in the southern states (Duble, 2006). Because bermudagrass is one of the most common lawn grasses in the southern U.S., its control and elimination from landscape beds is a major concern for many gardeners (Chalmers et al., 2006; Cudney et al., 2005).

Hybrid bermudagrass responds readily to increasing rates of N regardless of inorganic or organic N source (Evers, 1998; Osborne et al., 1999). This yield response to N is generally linear up to about 560 kg N/ha and then becomes quadratic (Robinson, 1996). Due to the genetic diversity, common bermudagrass forage yield and growth may or may not be similar to hybrid bermudagrass (Alabama Cooperative Extension Service, 1996). In years of average precipitation, N and P uptake from organic wastes has been shown to be similar across bermudagrass types (Brink et al., 2003) but not in dry years (Brink et al., 2004). The effects of poultry litter are generally greater than other organic fertilizers, as over 50% of the N is found as ammonia based uric acid (Guerra-Rodriguez et al., 2001; Mitchell and Donald, 1995).

Numerous studies have demonstrated the benefits of compost as an organic fertilizer and bed amendment, beginning with Sir Albert Howard's *The Soil and Health: A Study of Organic Agriculture* in 1945 (Beck, 1997). The addition of composts generally results in many improvements to the soil including, but not limited to: 1) increased macro and micronutrient availability, 2) increased water retention and porosity, and 3) improved soil structure (Fitzpatrick et al., 2005; Beck, 1997). Studies on turfgrasses, including bermudagrass, St. Augustine grass, Kentucky bluegrass, and tall fescue, have all found composts to be an effective alternative to inorganic fertilizer sources (Wright et al., 2007; Sloan et al., 2006; Linde and Hepner, 2005). Dairy manure compost, in particular, proved to be very effective at providing sufficient fertility to landscape beds and bermudagrass turf plots (Sloan et al., 2006).

Because the addition of compost to landscape beds and gardens can make these areas more prone to bermudagrass invasion, this study was conducted to evaluate what might be observed in a new or updated home landscape. The purpose of this study was to ascertain the potential invasiveness of bermudagrass in newly amended compost beds using various compost sources: poultry litter, yard waste, and dairy composts.

MATERIALS AND METHODS

At the onset of the study, five beds, in each of 3 blocks, were created by mechanically removing all vegetation from an area 1.2 m (4') x 6.1 m (20'). Beds were tilled to a depth of 15 cm (6"), and any vegetative remains were removed and discarded. Compost was randomly added from one of four blends: 1) poultry litter compost (PLC), 2) yard waste compost (YWC), 3) dairy compost (DC), and 4) a 1:1 mixture of PLC and DC. PLC, DC, and MC received application rates of 1.78 kg / m^2 (10 tons / acre). YWC was known to have lower nitrogen levels (Table 1) and was applied at 3.56 kg / m^2 (20 tons / acre). Composts were applied at average moisture content between 25 and 30%. The fifth bed was not amended with compost and used as a control. All composts were analyzed for NO_3^- levels prior to incorporation, using the cadmium reduction method (Table 1). In terms of actual N applied, PLC was the highest at 0.052 kg N / m^2 (4.72 lbs. N / 1,000 ft^2) and DC was the lowest at 0.036 kg N / m^2 (3.25 lbs N / 1,000 ft^2). YWC and MC were applied at a rate of 0.039 kg N / m^2 (3.58 lbs N / 1,000 ft^2). No mulch was applied to the planting area. Plots were analyzed prior to initiation of the study for electrical conductivity (EC) and pH (Table 1).

Four, one-meter long transects were taken within each plot every thirty days. Ten points (10 cm apart) were used to score for hits. Presence of a bermudagrass plant was considered a hit. Zero (0) hits per transect indicated no bermudagrass coverage. Ten (10) hits indicated one hundred percent coverage. Data collection continued until all beds reached 100% coverage.

Experimental design was a randomized complete block design, with each transect an experimental unit and four transects per treatment. Square root arc-sin transformations were made prior to statistical analysis. Statistical analysis was conducted using Proc ANOVA of SAS (Statistical Analysis Software, Cary, NC). Means were separated using Duncan's Multiple Range test. Data were back-transformed for presentation purposes.

RESULTS AND DISCUSSION

Chemical analyses of plots and composts showed only minor variation among the treated beds. Nitrogen levels were slightly higher in PLC at 2.9% and lowest in the YWC at 1.1% (Table 1). EC again was slightly higher in the PLC, consistent with salt and fertility levels found in other studies.

Table 1. Initial chemical analysis of landscape soils amended with various compost materials in treatment plots.

Compost Blend	Compost %N	Soil pH	Soil EC (ųS/cm)
Control (None)	N/A	7.12	152
Yard Waste Compost (YWC)	1.1	7.15	141
Poultry Litter Compost (PLC)	2.9	7.05	164
Dairy Compost (DC)	2.0	7.12	136
Mixed Compost (MC)	2.2	7.02	134

At day 30, PLC and YWC had significantly higher bermudagrass invasion than other treatments with roughly 70% coverage in all treatment plots (Table 2). Dairy compost had greater bermudagrass invasion than the control with approximately 40% coverage. Bermudagrass invasion in MC was not significantly greater than the control by day 30. It is interesting to note that bermudagrass invasion in YWC was significantly higher than MC at day 30; given that N application rates were identical, suggesting differences in N availability between the composts.

Table 2. Bermudagrass invasion scores in landscape beds amended with various compost types. Each point represents 10% coverage.

Compost Blend	Day 30	Day 60	Day 90	Day 120
Control (C)	3.3a	6.7a	8.3a	10.0a
Dairy Compost (DC)	4.7b	8.0b	9.0b	10.0a
Mixed Compost (MC)	4.3ab	7.7b	9.3b	10.0a
Poultry Litter Compost (PLC)	7.7c	10.0c	10.0c	10.0a
Yard Waste Compost (YWC)	6.7c	8.3b	10.0c	10.0a

By day 60, the PLC plots were 100% covered, significantly faster than any other treatment (Table 2). This can be explained by the slightly higher N concentration in the compost. Coverage in the control group was significantly lower than other treatments with approximately 67% coverage. DC, MC, and YWC treatments had approximately 80% coverage.

By day 90, all treatments had reached at least 83% coverage (Table 2). The control treatment remained significantly lower than other treatments. YWC matched PLC at 100% coverage. Bermudagrass in MC and DC treatments exceeded 90% coverage. Full coverage in all treatments was reached at day 120 of the study.

CONCLUSIONS

The type of compost can affect the invasion of bermudagrass, as the choice of compost can affect the amount and availability of soil N. In this study, the compost selection significantly affected the rate at which bermudagrass invaded, with poultry litter, a compost known for N supplied by uric acid (Guerra-Rodriquez et al., 2001) providing an immediate response, while dairy composts, that are subject to potentially high levels of N mineralization (Shi et al., 2004), were invaded slowly. Because bermudagrass responds quickly to nitrogen increases, it is likely to invade adjacent gardens as incorporated composts increase soil fertility. This further emphasizes the need for weed control measures in newly amended soils.

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