Effects of Dairy Manure Compost and Supplemental Fertilizer on Forage Yield and Nutrient Value of Coastal Bermudagrass

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ABSTRACT

Research was conducted to compare the effects of composted dairy manure and raw dairy manure alone, or in combination with supplemental inorganic fertilizer, on Coastal bermudagrass (Cynodon dactylon [L.] Pers.) yield and quality. Composted dairy manure was surface applied at rates of 94 (29 Mg ha⁻¹), 188 (57 Mg ha⁻¹), and 282 (85 Mg ha⁻¹) DM ha⁻¹, and raw dairy manure was surface applied at a rate of 54 (132 kg DM ha⁻¹) to established bermudagrass. Selected control plots received supplemental inorganic N at rates of 88, 112 and 140 kg N ha⁻¹ cutting⁻¹; 112 kg P₂O₅ ha⁻¹ yr⁻¹ and 112 kg K₂O ha⁻¹ cutting⁻¹ for the first season and the second half of the second season; and were not receiving any of the compost or fertilizer. Initial compost, manure and inorganic fertilizer treatments were surface applied by hand at spring green-up with subsequent harvests 3 and 4. Even with supplemental N, the low rate of compost (C₁, 14 Mg ha⁻¹) produced significantly lower yields than the other compost and manure treatments. The highest overall yield was achieved with a combination of compost and the need for supplemental fertilizer so that compost use may be both economical and environmentally sound.

RESULTS and DISCUSSION

There was a year by treatment interaction for forage yield. Where treatment by harvest interactions were observed, means within a harvest were analyzed. Without supplemental inorganic fertilizer, dairy manure compost applied at rates of 29 (C2) and 57 Mg ha⁻¹ produced cumulative forage yields significantly greater than the untreated check in both years (Table 2). However, inorganic fertilizer (IF) produced cumulative forage yields greater than the untreated check in both years. In contrast, Egbdal and Power (1998b) reported corn grain yields from annual or bermudagrass or compost applications were similar to the untreated check. Cumulative yields from IF treatment was ranged from 7,138 to 11,342 kg DM ha⁻¹ and were not different from the dairy manure treatments (C₁ and C₃) in either year. Inorganic fertilizer was significantly greater than compost treatments for all harvests in both years (Table 2).

Table 1. Treatment summary.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Material</th>
<th>Rate (Mg ha⁻¹)</th>
<th>N (kg N ha⁻¹ cutting⁻¹)</th>
<th>P (kg P₂O₅ ha⁻¹ yr⁻¹)</th>
<th>K (kg K₂O ha⁻¹ cutting⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost (C1)</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Compost (C2)</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>112</td>
<td>112</td>
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<tr>
<td>Compost (C3)</td>
<td>57</td>
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<td>0</td>
<td>112</td>
<td>112</td>
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<tr>
<td>Raw manure (M)</td>
<td>54</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inorganic fertilizer (IF)</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

There was a N rate by compost or manure rate interaction on forage yield. Where treatment by harvest interactions were observed, means within a harvest were analyzed. Without supplemental inorganic fertilizer, dairy manure compost applied at rates of 29 (C2) and 57 Mg ha⁻¹ produced cumulative forage yields significantly greater than the untreated check in both years (Table 2). However, inorganic fertilizer (IF) produced cumulative forage yields greater than the untreated check in both years. In contrast, Egbdal and Power (1998b) reported corn grain yields from annual or bermudagrass or compost applications were similar to the untreated check. Cumulative yields from IF treatment was ranged from 7,138 to 11,342 kg DM ha⁻¹ and were not different from the dairy manure treatments (C₁ and C₃) in either year. Inorganic fertilizer was significantly greater than compost treatments for all harvests in both years (Table 2).

Compost and manure treatments produced a significantly higher tissue N concentration than the untreated check and less N leaching than IF treatment in both years (Table 3). The high rate of compost resulted in significantly lower tissue N concentrations than the untreated check, but no statistical difference was observed between the low and medium rates of compost treatments. The highest tissue N concentrations were observed with IF treatment in both years (Table 3). The high rate of compost resulted in significantly lower tissue N concentrations than the untreated check, but no statistical difference was observed between the low and medium rates of compost treatments. The highest tissue N concentrations were observed with IF treatment in both years (Table 3).

There was a N rate by compost or manure rate interaction on tissue P concentration. Where treatment by harvest interactions were observed, means within a harvest were analyzed. Without supplemental inorganic fertilizer, dairy manure compost applied at rates of 29 (C2) and 57 Mg ha⁻¹ produced cumulative forage yields significantly greater than the untreated check in both years (Table 2). However, inorganic fertilizer (IF) produced cumulative forage yields greater than the untreated check in both years. In contrast, Egbdal and Power (1998b) reported corn grain yields from annual or bermudagrass or compost applications were similar to the untreated check. Cumulative yields from IF treatment was ranged from 7,138 to 11,342 kg DM ha⁻¹ and were not different from the dairy manure treatments (C₁ and C₃) in either year. Inorganic fertilizer was significantly greater than compost treatments for all harvests in both years (Table 2).

Tissue N concentrations tended to increase with increasing rates of supplemental N applied to compost or manure. However, when compost or manure did not appear to be as efficient as it was from plots receiving only inorganic fertilizer. Significant yield differences between compost and manure treatments observed in this study were attributed to increased N uptake. The general trend observed was that applications of supplemental N increased tissue N concentrations, but the response was not linear. The highest tissue N concentrations were observed with IF treatment in both years (Table 3). Tissue N concentrations tended to increase with increasing rates of supplemental N applied to compost or manure. However, when compost or manure did not appear to be as efficient as it was from plots receiving only inorganic fertilizer. Significant yield differences between compost and manure treatments observed in this study were attributed to increased N uptake. The general trend observed was that applications of supplemental N increased tissue N concentrations, but the response was not linear. The highest tissue N concentrations were observed with IF treatment in both years (Table 3).

CONCLUSIONS

Raw and composted manures generally act as slow release nutrient sources which can improve nutrient stability in the event of significant rainfall, but also may affect their ability to support rapidly growing, warm season crops. Forage yields produced by compost (29 and 57 Mg ha⁻¹) and raw dairy manure (24 Mg ha⁻¹) were significantly greater than the untreated check, but less than IF in both years. Supplemental inorganic fertilizer rates as low as 56 kg N ha⁻¹ cutting⁻¹ applied to compost and manure treatments produced cumulative yields greater than those observed with IF treatments for all harvests. Increasing supplemental N fertilizer rates to 84 or 112 kg N ha⁻¹ cutting⁻¹ produced forage yields in compost and manure plots that were equal to or greater than those observed with IF treatments. When IF treatments were applied at 112 kg N ha⁻¹ cutting⁻¹, the treated treatments produced yields comparable to those achieved using inorganic fertilizer alone.

REFERENCES

