Enteric methane production from cattle fed on three tropical grasses in East Africa

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Introduction

• Livestock production is an important source of livelihood and nutrition to the vulnerable communities in the tropics, with more than 80% of subsistence farmers in Africa owning livestock (FAO, 2009).

• Ruminant production in Sub-Saharan Africa (SSA) is dominated by small and medium scale farmers – owning up to 70% of the cattle in the region.

• Low animal productivity – mainly as a result of low quantity and quality of feed.
introduction

- Planted grasses form the main feed resource for cattle among smallholder farmers under crop-livestock systems in humid zones
- Changing climatic conditions and emerging diseases are negatively affecting productivity of commonly grown grasses (Napier and Rhodes var.)
- Led to Introduction of new/improved species that tolerate drought and diseases.
- For greenhouse gas reporting, many SSA countries – IPCC Tier 1- high uncertainty level
Aim of the present work

- To study the nutritive value of cultivated grasses in Kenya (inconclusive data available);
- To measure enteric methane emission from cattle fed planted grasses using methane respiration chambers – accurate in situ method - gold standard
Materials and methods

Animal feeding experiment;

• Animals: Growing Boran steers (n=18, live weight (LW): 216 ± 6 kg)
• Diets: Freshly cut *Pennisetum purpureum* var. Kakamega 1 (Napier), *Chloris gayana* var. Boma (Rhodes) or *Brachiaria brizantha* var. Xaraes (Brachiaria)
Materials and methods

- Two feeding periods each running for 70 days.
- Parameters measured:
  - Voluntary nutrient intake,
  - Apparent total tract digestibility,
  - LW gain and,
  - Enteric methane production (respiration chambers)
Results_ Chemical composition and intake

Table 1: Dry matter (DM), Organic matter (OM), crude protein (CP), Neutral and acid detergent fibre (NDF and ADF), and gross energy of Napier, Rhodes and Brachiaria grasses

<table>
<thead>
<tr>
<th>Diet</th>
<th>DM (g/kg)</th>
<th>OM (g/kg)</th>
<th>CP (g/kg)</th>
<th>NDF (g/kg)</th>
<th>ADF (g/kg)</th>
<th>GE (Mj/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Napier</td>
<td>230±8</td>
<td>885±4</td>
<td>83±4</td>
<td>668±6</td>
<td>370±5</td>
<td>16.8±0.06</td>
</tr>
<tr>
<td>Rhodes</td>
<td>278±10</td>
<td>893±4</td>
<td>77±5</td>
<td>695±7</td>
<td>386±5</td>
<td>17.0±0.09</td>
</tr>
<tr>
<td>Brachiaria</td>
<td>256±8</td>
<td>885±4</td>
<td>83±4</td>
<td>668±6</td>
<td>370±5</td>
<td>16.8±0.06</td>
</tr>
</tbody>
</table>

• No difference on DM intake among the 3 treatments $P = 0.37$
Results _ Digestibility, weight gain and methane production

Table 2: Organic matter digestibility (DOM), average daily weight gain (ADG), methane yield (MY) (g/kg intake) and methane conversion rate (Ym) of Boran steers ($n=18$; Avg. 216 kg) fed on freshly cut Napier, Rhodes and Brachiaria grasses

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rhodes</th>
<th>Napier</th>
<th>Brachiaria</th>
<th>SEM</th>
<th>P value</th>
<th>IPCC (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOM%</td>
<td>57.1</td>
<td>64.0</td>
<td>61.0</td>
<td>1.37</td>
<td>0.0076</td>
<td></td>
</tr>
<tr>
<td>ADG (g/day)</td>
<td>403</td>
<td>449</td>
<td>468</td>
<td>36.3</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>MY (g/kg DM)</td>
<td>26.7</td>
<td>28.5</td>
<td>27.5</td>
<td>0.77</td>
<td>0.26</td>
<td>23.3</td>
</tr>
<tr>
<td>Ym (% of GEI)</td>
<td>8.73</td>
<td>9.87</td>
<td>9.03</td>
<td>0.252</td>
<td>0.0127</td>
<td>7.0</td>
</tr>
</tbody>
</table>

GEI: gross energy intake; SEM: standard error of mean; IPCC: Intergovernmental Panel on Climate Change

IPCC (2019)
Conclusion

• Our findings suggest that East African cattle could be having higher emissions (MY and Ym) than currently estimated by IPCC 2019 (non-dairy cows on high forage diet) – need for more similar studies
• Improved Brachiaria grass species may only benefit livestock production if management and nutrient input match the species potential - need to integrate better fodder management – Native soils are known to be low in nitrogen
Opportunities going forward;

• Need more on enteric methane emissions from Boran cattle in East Africa

• Grass legume integration/ compatibility studies to improve the nitrogen status grass quality
Thank you for your audience

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