Background

Interactions between rumen microbes and the ruminant host are mediated in part by chemical constituents of the host diet.

Understanding how phytochemicals affect ruminant-microbe interactions may result in the use of novel forages to improve productivity and reduce production of the greenhouse gas methane.

Prairie acacia (PA) is a rangeland forage legume that produces a moderate amount of biologically active proanthocyanidins.

Objectives

1. Evaluate the dose-response effect of replacing alfalfa hay with PA at levels of 0, 25, 50 and 100% on ruminal CH₄ suppression.

2. Identify the subunit composition of PA proanthocyanidins and elucidate the structure-activity relationship between PA proanthocyanidins and ruminal CH₄ suppression.

Materials & Methods

Acacia angustissima var. hirta

In vitro Gas Production

Results

Dose-response effect of PA on CH₄

<table>
<thead>
<tr>
<th>Acacia levels, %</th>
<th>Methane, g/kg FOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>a</td>
</tr>
<tr>
<td>25</td>
<td>b</td>
</tr>
<tr>
<td>50</td>
<td>c</td>
</tr>
<tr>
<td>100</td>
<td>d</td>
</tr>
</tbody>
</table>

Thiolysis Products

Before rxn

After rxn

Mass-Spec of Bu-HCl Products

Structural Features

Conclusions

1. There is a negative linear relationship between PA inclusion in the diet and in vitro ruminal CH₄.

2. PA produces 5-deoxy proanthocyanidins.

3. 5-deoxy proanthocyanidins demonstrate reduced interflavan reactivity and increased resistance to degradation, which may lead to prolonged activity in the ruminant gastrointestinal tract and inhibition of CH₄ producing microbes.