Development of Leucaena Mimosine-Degrading Bacteria in the Rumen of Sheep in Myanmar

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Development of leucaena mimosine-degrading bacteria in the rumen of sheep in Myanmar

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Introduction

Myanmar has an agricultural base, and about 70% of people reside in rural areas. They depend for survival on agriculture and small-scale crop production, with ruminant livestock consuming fibrous agricultural residues. For optimal ruminant production, concentrates are needed as supplements to these residues. As concentrates are expensive, researchers are testing alternative protein sources like legumes, including foliage from leguminous trees such as leucaena (*Leucaena leucocephala*). Leucaena is the most widely used leguminous tree as a ruminant feed because it is rich in protein (~ 22%) and contains easily digestible fibre (23% neutral detergent fibre, 16.6% acid detergent fibre; Ni Ni Maw 2004). Khin Htay Myint (2005) noted that 25% of leucaena in the ration tended to increase nitrogen retention without decreasing dry matter and organic matter digestibilities. However, leucaena leaves contain a toxic non-protein amino acid, called mimosine. Research workers have endeavoured to reduce mimosine toxicity in animals fed leucaena in Myanmar (Aung Aung 2007, Wink Phyo Thu 2010) and one avenue of research was the development of mimosine-degrading bacteria in the rumen of sheep fed leucaena. In this paper we describe an experiment tracing the development of mimosine-degrading bacteria in the rumen of sheep.

Materials and Methods

The experiment was carried out using 9 male sheep aged 6-8 months and weighing 11-18 kg. The animals were divided into 3 groups and fed the following 3 diets: rice straw + mixed concentrate (G1); rice straw + mixed concentrate + 50% leucaena leaves (G2); and rice straw + mixed concentrate + gradually increased amount of leucaena leaves from 10% to 50% level (4 days for each level) (G3). Body temperatures of sheep were measured daily when the animals were checked for clinical signs and symptoms of mimosine toxicity. Mimosine concentration in urine was determined at the end of the experiment.

Results

Results of clinical examinations and urinary mimosine concentrations of sheep after feeding 50% leucaena leaf are shown in Table 1. Animals from all groups had the same average body temperature (37.5 ºC). Clinical signs appeared 4 days after feeding 50% leucaena in the total diet for animals in G2. The most prominent signs were hair loss, dullness and decrease in feed intake. However, no clinical signs of leucaena mimosine toxicosis were observed in animals from G3 throughout the experimental period, although urinary mimosine levels in this group were high.

Table 1. Clinical examination of sheep with and without leucaena in the diet.

Group	Clinical signs			
	Body temperature	Loss of weight	Hair loss	Urinary mimosine (mg)
1	37.5 °C	Nil	Nil	0
2	37.5 °C	Slightly	Present	0.006
3	37.5 °C	Nil	Nil	0.16

Group 1: rice straw + mixed concentrate; Group 2: rice straw + mixed concentrate + 50% leucaena; Group 3: rice straw + mixed concentrate + gradually increased amount of leucaena from 10% to 50% level (4 days for each level).

Discussion

The loss of hair by animals from the group fed 50% leucaena after 4 days from the start of feeding is similar to the reports of Hegarty *et al.* (1964). Toxic symptoms in cattle were reported by other research workers (Jones and Hegarty 1984). The failure of toxicity to alter body temperature of the sheep agrees with the experiment of Jones *et al.* (1978), where rectal temperature of all cattle showing toxic symptoms was normal. However, in the experiment of Hegarty *et al.* (1964), the body temperature of sheep was 105 °F (40.6 °C) after 4 days of infusion of mimosine and higher than that of sheep from this experiment. The absence of toxic symptoms when the animals were fed on gradually increased amount of leucaena leaves was unexpected as mimosine levels in urine of this group were high. Molecular identification of bacterial strains from rumen liquor will be performed to check the possibility that mimosine-degrading strains were present. Subsequently, rumen liquor from the sheep which developed the ability to degrade mimosine will be transferred to other ruminants to encourage more extensive use of leucaena in Myanmar.

Conclusion

This study has shown that gradual introduction of leucaena leaf into the diet of sheep can prevent the appearance of symptoms of mimosine toxicity in the sheep. This suggests that rumen microflora have adapted to the changes in dietary composition through the slow introduction of leucaena. This has far-reaching implications for how leucaena can be used in the diets of animals, especially in cut-and-carry systems.

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