

## QUALITY ASSESSMENT OF THE FODDER LEGUME *CASSIA ROTUNDIFOLIA*

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### ABSTRACT

*The nutritive value of hays made from Cassia rotundifolia cv. Wynn and Medicago sativa cv. Trifecta (lucerne) was compared in 2 experiments. In the first experiment, 16 adult wether sheep were fed (ad libitum) either cassia hay or lucerne for 35 days. Digestibilities of dry matter and nitrogen in the cassia were 55 and 66% respectively. Both values were significantly ( $P < 0.05$ ) less than the corresponding values for lucerne hay (65 and 81% respectively). Sheep fed cassia hay exhibited significantly lower ( $P < 0.05$ ) nitrogen retention than animals offered lucerne hay (5.4 versus 24.6 g N/d).*

*In a second experiment, microbial protein production in the rumen was measured using abomasally fistulated sheep fed the 2 hays. The mean efficiencies of microbial protein production were 166 g and 223 g protein/kg organic matter fermented in the rumen for sheep fed cassia and lucerne hays respectively.*

*It is concluded that cassia hay cut at a mature stage of growth has the expected nutritive value and voluntary intake based on its chemical composition and appears to be free of noxious compounds.*

### RESUMEN

*El valor nutritivo de los henos hechos de Cassia rotundifolia cv. Wynn y Medicago sativa cv. Trifecta (lucerne) fué comparada en 2 experimentos. En el primer experimento 16 carneros adultos castrados fueron alimentados (ad libitum) por 35 días con heno de cassia o de lucerne. Las digestibilidades de materia seca y nitrógeno en la cassia fue de 55 y 66% respectivamente. Ambos valores fueron significativamente ( $P < 0.05$ ) menores que los valores correspondientes para el heno de lucerne (6.5 y 8.1% respectivamente). Los animales alimentados con heno de cassia mostraron significativamente ( $P < 0.05$ ) menos retención de nitrógeno que los que recibieron heno de lucerne (5.4 versus 24.6g N/d).*

*En un segundo experimento, la producción de proteína microbiana en el rumen se midió usando carneros fistulados alimentados con dos tipos de heno. Las eficiencias promedio de la producción microbiana de proteína fueron de 166 g y 223 g proteína/kg de materia orgánica fermentada en el rumen de los animales alimentados con henos de cassia y de lucerne, respectivamente.*

*Se concluye que el heno de cassia cortado en una etapa madura de crecimiento tiene el valor nutritivo esperado y consumo voluntario de acuerdo con su composición química y parece estar libre de compuestos nocivos.*

### INTRODUCTION

*Cassia rotundifolia cv. Wynn is a recently introduced pasture legume undergoing agronomic evaluation in Northern Australia (Oram 1984). It is a short-lived perennial whose growth habit varies with stand density and grazing pressure, but recent field observations (I. J. Partridge, pers. comm.) have indicated that the plant is not readily eaten by cattle in summer. No information appears to have been published on the chemical composition, intake and nutritive value of this forage plant although toxicity screening trials with rats have indicated that cv. Wynn produced greater liveweight gain than lucerne. (Strickland *et al.* 1986).*

*This paper describes 2 studies using cassia hay. In the first, feed intakes, digestibilities and nitrogen balance were measured in sheep. In a second experiment,*

rumen microbial protein production was determined. Lucerne (*Medicago sativa* cv. Trifecta) hay was fed as a control in both experiments.

## MATERIALS AND METHODS

### *Feeds*

Hay was made from a pure but mature stand of cassia grown at Woolooga near Gympie, Queensland, after the harvest of seed by header. Lucerne was grown at Lawes, Queensland and cut for hay at the half bud stage of growth. Both legume hays were chaffed to approximately 2-3 cm in length and a representative sample taken for chemical analysis.

### *Experiment 1*

In this study the voluntary intake, digestibility of the dry matter (DM), organic matter (OM) and nitrogen (N) were determined together with the nitrogen retention. Sixteen wether sheep (Border Leicester cross) of 35 kg mean weight were treated with the anthelmintic Mebendazole (Merck Sharp and Dhome Pty. Ltd.) and held in individual metabolism cages. Eight animals were offered *ad libitum* the cassia hay and eight the lucerne hay for 35 days. At 9.00 a.m. each day the sheep were offered 20% more air dry forage than was eaten the previous day. During the final 7 days, intake was accurately measured and faecal and urinary output collected. Urine was collected in 20 ml of concentrated HCl. Each day a 10% aliquot of urine and faeces from each animal was stored at  $-10^{\circ}\text{C}$  and these were bulked for each animal over the 7 days. Liveweights were measured at the beginning and end of the 5-week feeding period.

At the end of the trial, rumen liquor samples (10 ml) were withdrawn by stomach tube from each animal 3 hours after the morning feed, acidified with an equal volume of 0.3 M HCl and stored at  $5^{\circ}\text{C}$  prior to the determination of ammonia.

### *Experiment 2*

The production of microbial protein in the rumen was determined for the 2 forages in a crossover design experiment. Four mature wether sheep (35 kg liveweight), cannulated in the rumen and abomasum were maintained in individual metabolism cages and fed *ad libitum* for 28 days on pangola (*Digitaria decumbens*) hay plus a daily supplement of 100 g of sunflower meal. The sheep were then offered the cassia and lucerne hay for a further 26 days at the rate of 1 kg/head/day. The forages were fed at hourly intervals, using overhead automatic feeders (Minson and Cowper 1966). During the last 5 days, each sheep was infused intraruminally with a solution containing Sodium  $^{35}\text{S}$ ulphate (8.5 MBq) and  $^{51}\text{Cr}$ romium-EDTA (3.7 mBq) at a constant rate (250 ml/day) using a peristaltic pump. During the infusion periods, the intake of hay was recorded daily and any uneaten feed collected and bulked over the 5 days prior to analysis.

Abomasal digesta samples (approximately 200 ml) from each animal were collected 4 times daily on days 4 and 5 of the infusion. The 8 samples for each animal were divided into 3 equal portions. One portion was separated into filtrand and filtrate as described by Faichney (1980). Another portion was separated by centrifugation to produce a microbial fraction (Elliott and Armstrong 1982) which was frozen and subsequently freeze dried. The third portion was freeze dried without separation. The sheep were then offered the alternate legume hay and the infusion and sampling procedures repeated after 21 days.

### *Analysis*

Samples of feeds, feed refusals and faeces were dried in a force draught oven at  $60^{\circ}\text{C}$ . Determination of nitrogen content was by the Kjeldahl procedure. Lignin and acid detergent fibre (ADF) content of the feed samples and abomasal digesta was determined by the technique of Goering and Van Soest (1970). Organic matter

content of feed, feed refusals, faecal and abomasal digesta was determined by ashing at 550°C for 6 h.

<sup>51</sup>Chromium-EDTA in the infusate and in samples of abomasal digesta was counted in a Hewlett Packard Gamma counter. Flow rates of abomasal digesta were calculated by the method of Faichney (1980) with the exception that lignin (quantitatively recovered in faeces) replaced Ruthenium as the solid phase marker. The proportion of cystine of microbial origin in abomasal digesta was estimated using the technique described by Elliott and Armstrong (1982).

Significant differences between feeds in Experiment 1 were determined by t test analysis and by analysis of variance in Experiment 2.

## RESULTS

### *Chemical composition*

Lucerne hay had a higher nitrogen and lower ADF and lignin content than the cassia hay which was harvested at a later stage of growth (Table 1).

TABLE 1

<i>Composition, mean voluntary intakes and digestibility of 2 legume hays and nitrogen retention by sheep.</i>			
Parameter	Cassia hay	Lucerne hay	LSD (P < 0.05)
Feed composition (% DM)			
Acid detergent fibre	41.7	35.9	—
Lignin	10.9	8.4	—
Nitrogen	2.2	4.0	—
Voluntary intakes			
DM (kg/d)	1.09	1.40	0.16
N (g/d)	24.0	56.0	5.5
<i>In vivo</i> digestibility (%)			
DM	55.5	65.0	3.3
N	66.6	81.1	4.5
Predicted N digestibility <sup>1</sup>	66.4	79.0	—
Nitrogen retention (g/d)	5.4	24.6	3.0

<sup>1</sup>From regression equation of Milford and Minson (1965).

### *Voluntary intakes and digestibilities*

Sheep readily accepted the cassia hay from the first day it was offered but dry matter intake was 22% lower than with lucerne hay. The digestibility of the dry matter in the cassia hay was 55%, which was 10 percentage units lower than for lucerne.

### *Nitrogen status*

All sheep fed the cassia hay exhibited positive N balance. The mean retention of 5.4 g N/day was significantly less ( $P < 0.01$ ) than that of sheep fed lucerne hay (24.6 g N/day) and this was reflected in superior liveweight gains by the lucerne-fed animals (165 g/head/day vs. 95 g/head/d for the sheep fed cassia hay). Nitrogen digestibility by the sheep fed cassia hay was significantly lower than for the lucerne. This difference appeared to be associated with the lower nitrogen content of the cassia. The N digestibilities of the 2 forages were close to those predicted from a published relationship (Table 1) between digestible crude protein and crude protein content of tropical feed (Milford and Minson 1965).

The rumen ammonia concentration in sheep fed cassia hay was 140 mg NH<sub>3</sub>-N/L compared with 210 mg NH<sub>3</sub>-N/L when sheep were fed lucerne. The proportions of microbial N in abomasal digesta of sheep fed cassia and lucerne hay (Table 2) were very similar and correspond to values previously reported by Mathers and Miller (1981) for lucerne hay. The efficiency of microbial protein synthesis in the rumen of sheep fed the cassia hay was significantly less than that of sheep fed lucerne (Table 2).

TABLE 2  
*Microbial protein production in the rumens of sheep fed the legume hays.*

Parameter	Cassia hay	Lucerne hay	LSD (P < 0.05)
Intake of OM (g/24h)	726	725	NS
Flow of nutrients from stomach (g/24h):			
Organic matter	427	408	NS
Total nitrogen	18.6	30.7	9.4
Microbial Nitrogen	12.0	20.5	3.2
Proportion of nitrogen in abomasal contents of microbial origin	0.65	0.67	NS
Efficiency of microbial protein synthesis:			
g CP/kg organic matter apparently digested	250	407	103.1
g CP/kg organic matter actually digested	166	233	33.0

## DISCUSSION

Many species of *Cassia* are toxic (Bailey 1985), but *Cassia rotundifolia* did not appear to contain any deleterious compounds. The sheep ate well throughout the study with voluntary intakes close to that predicted for material with a high fibre content and low digestibility. This normal intake is in contrast to field observations of stock which avoided eating the cassia, a difference possibly associated with the loss during haymaking of volatile compounds disliked by the grazing cattle. Both the close agreement between measured and predicted N digestibilities and the high rumen ammonia concentration in the sheep fed cassia hay indicated that protein degradation in cassia was normal. This shows that polyphenolic tannins or similar compounds, which restrict degradation of proteins in other legumes (Barry and Blaney 1987) were absent from cassia. The yield of microbial protein from cassia (250 g CP/kg organic matter apparently digested in the rumen) is very similar to the value predicted for legume forages using the equation proposed by ARC (1984), but lower than was found in lucerne.

It is concluded that cassia hay cut at a mature stage of growth has the expected nutritive value and voluntary intake based on its chemical composition and appears to be free of noxious compounds.

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