The nutritive value of medic pods following treatment with sodium hydroxide or supplementation with molasses

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Summary. The effects of treating mature Paraggio barrel medic pods harvested after a poor growing season, with water, sodium hydroxide and molasses were investigated. Treating with water and NaOH resulted in substantial decreases in the voluntary intake whereas supplementation with molasses increased pod intake by more than 100% from 327 g/sheep/d to 694 g/sheep/d. The intake responses could not be explained by differences in either rumen degradability nor rumen p1-1. Although molasses improved intake of the pods the intake was still inferior to that achieved in a previous study with Paraggio medic pods harvested after a good growing season.

Introduction

In southern Australian farming systems mature pods of annual medic, *Medicago* spp. are often present in large quantities over the summer months and constitute a valuable source of nutrients at a time when dry pasture residues are declining in quantity and quality. Mature medic pods are rich in protein but poor in digestible energy because of a high indigestible fibre content. The digestibility and voluntary intake of various high-fibre feeds has been improved by physical, chemical and supplementation methods (3. 6). However, there is no information about the application of these methods for improving the nutritive value of annual medic pods. Most fibrous feeds are deficient in nitrogen, however nitrogen concentration in medic pods exceeds that necessary for maintenance and even production requirements of sheep (2). Therefore, chemical treatment or supplementation of medic pods with energy sources should give better results than for other fibrous feeds such as cereal straws. These treatments might also be useful in overcoming a previously-observed intake problem with *Medicago truncatula* cv. Paraggio pods when compared with other cultivars (9). In that experiment voluntary intake of Paraggio pods was only 30% of that of *Medicago truncatula* cv. Parabinga and *Medicago scutellata* cv. Sava.

The reason for undertaking this experiment was to test suggestions from previous experiments (9, 10) that low intake of Paraggio pods may be attributed to surface contamination by fungal residues or the presence of some antinutritional substance and to examine the effects of supplementation and chemical treatment on the nutritive value of mature medic pods.

Methods

A flock of 20 adult Merino wethers were allocated by restricted randomization based on body weight (61?3kg) to 5 treatments. Sheep were kept in individual pens in the Waite Agricultural Research Institute animal house. The sheep were drenched for worms prior to the experiment. Drinking water, common salt and minerals were freely available at all times. In a preliminary period of ten days the sheep adjusted to the diets, pens and indoor conditions. Voluntary intake of untreated and treated pods was measured in the main feeding period of 10 days. The sheep were weighed after an overnight fast at the commencement of the experiment and every ten days thereafter. The treatments used in the experiment were: (a) Untreated; Paraggio barrel medic pods harvested following a poor growing season. (b) Washed; pods soaked in tap water for 30 minutes (ratio of water : pods was 8: I), washed under running water for 5 minutes, transferred to a basket and the free liquid allowed to drain for 2 hours. (c) Water-sprayed; pods sprayed with tap water at the level of 400 g per kg pods while mixing. (d) Molasses-treated; pods sprayed with a cane molasses/water mixture (1:2.5) at the rate of 15% (w/w). (e) NaOH-treated; pods were sprayed with a 10% solution of sodium hydroxide. Treatment b was selected to remove surface contamination by fungi or soil. Molasses was added (treatment d) in order to improve palatability. Treatment e was chosen to verify that treatment of Paraggio pods with sodium hydroxide can improve their intake by hydrolysing the fibrous hull and removing possible antinutritional residues from the surface of pods. Treatment c was selected as a control for treatment e. All pods were from the same source. Pods were prepared daily on the afternoon of the day before feeding and given as a sole ration at 0900 hrs. At

the time of offering the pods to the sheep the dry matter contents were approximately the same and not less than 50%. The 5 feeds were sampled daily and samples dried at 60 C to determine dry matter contertt. Dry samples were bulked for proximate analysis. Ash content was determined by combustion at 550 C for 5 hours, total nitrogen by the Kjeltec Auto System, ether extract by Soxhlet extraction (4) and crude fibre by AOAC (I). The diets were fed *ad-libitum* with an allowance of approximately 10% in excess of that consumed. All feed residues were collected daily, weighed and dried for dry matter determination.

All sheep were bled from the jugular vein at the beginning and the end of the main feeding period. Blood samples were taken daily 3 hrs after the morning feeding and centrifuged. Plasma was frozen and later analysed for urea-N. Rumen fluid samples were collected concurrently with the blood collection via a stomach tube and rumen fluid pH determined.

Four Merino wethers each fitted with a permanent rumen cannula were used for an *in sacco* study to determine rumen degradability of untreated and treated pods. The sheep were fed at a level slightly above maintenance using oaten chaff and commercial sheep pellets (8). Five nylon bags (12x8 cm) containing 3-5 g of ground pods (I mm) from each of the five treatments were incubated in the rumen of each sheep for 24 h. On removal, bags were washed thoroughly under running water (about 5 minutes), until the rinsing water was colourless. The bags and residues were dried to constant weight. Another set of 5 bags was washed under running tap water and dried to constant weight to determine the content of soluble dry matter and fine particles for each treatment.

Results and discussion

Chemical composition and voluntary intake data are shown in Table I. No consistent differences in chemical composition occurred between untreated and treated pods. Differences which were observed were attributed to the characteristics of the treatments; for example, NaOH-treatment resulted in lower content of crude fibre and higher ash concentration because of high amount of sodium. This is in agreement with the report by Felix *ei al. (5)* who observed that soya-beans straw treated with NaOH and $Ca(OH)_2$ had higher ash concentrations than control and $NH_4$01-I treated soya-beans. There was a highly significant difference ($P<0.001$) between voluntary dry matter and organic matter intakes of untreated and treated Paraggio pods. NaOH-treatment, water spraying and washing severely reduced pod intake. The probable explanation for the common adverse effects of these treatments is that they all reduced palatability. Mixing the pods with 15% molasses more than doubled voluntary intake to a level which was similar to intakes recorded for other cultivars in a previous study (9).

Table 1. Chemical composition and voluntary intakes of untreated and treated whole, mature Paraggio barrel medic pods.

Treatment	Chemical composition (%)[a]					Voluntary intake (g/sheep/d)[b]	
	Ash	CF	CP	EE	NFE	DM	OM
Untreated	6.2	33.5	20.2	4.9	35.2	327	307
Washed	5.6	35.0	19.4	3.6	36.4	66	62
Water-sprayed	6.4	30.0	20.5	4.3	38.8	173	162
Molasses-treated	7.0	29.7	18.8	3.4	41.1	694	645
NaOH-treated	10.2	28.0	18.4	4.0	39.4	77	69
l.s.d. (P=0.01)						191	177

[a] CF= Crude fibre, CP= Crude protein, EE= Ether extract, NFE= Nitrogen-free extract.
[b] DM= Dry matter, OM= Organic matter.

The relatively low intakes of both the treated and untreated pods led to weight losses of all treatments as follows: 8.3, 10.0, 9.5, 3.6 and 11.0 kg for treatments a to e respectively over a 20 day period. To maintain body weigh sheep need to consume about 900 g dry matter per day of a feed with the

digestibility coefficient of 55-60% (11). This intake was not achieved in this study. In relation to this it should be noted that in a previous study (9) the *in vivo* digestibility of untreated Paraggio pods was only 33% and it is therefore not surprising that the intake of these pods was less than that required for maintenance.

Rumen pH values of all treatments (Table 2) were similar 3 hours after feeding on both day I and day 10 indicating that fermentation patterns were similar for all treatments and not likely to be responsible for differences in intake. On both sampling occasions there was a trend for plasma urea-N values (Table 2) for sheep given molasses-treated pods to be higher than those for the other treatments. This was probably due to the better physiological status of these sheep due to higher intake of readily available energy (molasses). On the contrary, the plasma urea-N concentration of NaOH-treated pods was lower than for the untreated pods. The plasma urea-N values on day 10 indicated that those treatments which depressed voluntary intake also resulted in lower plasma urea-N levels.

Table 2. Rumen pH and plasma urea-N concentration (mg/L) in wethers given untreated and treated whole Paraggio pods.

Treatment	pH		Plasma urea-N	
	Day 1	Day 10	Day 1	Day 10
Untreated	5.59 ± 0 03	5.96 ± 0.28	84 ± 4	99 ± 3
Washed	5.56 ± 0.05	6.06 ± 0.14	103 ± 9	71 ± 10
Water-sprayed	5.56 ± 0.04	5.95 ± 0.10	108 ± 14	69 ± 15
Molasses-treated	5.63 ± 0.02	5.77 ± 0.06	116 ± 17	107 ± 24
NaOH-treated	5.60 ± 0.40	6.26 ± 0.31	81 ± 12	46 ± 12

Results of the *in sacco* study are summarised in Fig. 1. Treatment with NaOH significantly ($P<0.05$) increased the dry matter disappearance of Paraggio pods. The total dry matter disappearance of the molasses-treated pods was also high, but this may be attributed mainly to the high digestibility of the added molasses.

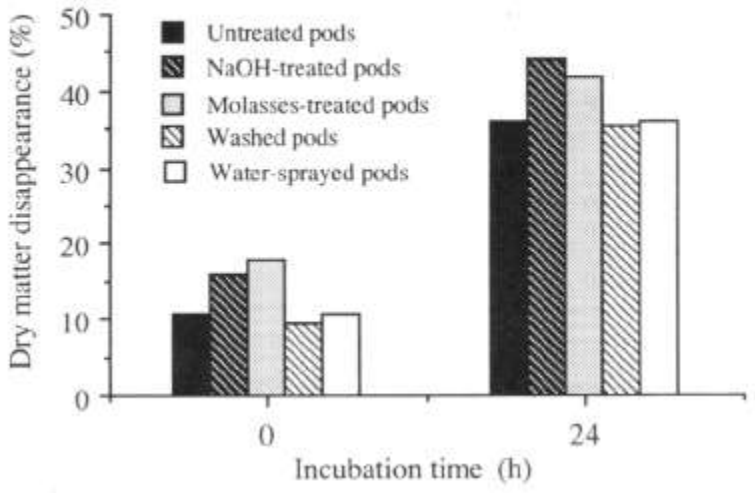

Figure 1. Dry matter disappearance of untreated and treated whole Paraggio medic pods

The reason for the lower intake of Paraggio pods harvested from a poor growing season is not immediately clear from this study. However, where intake is a problem it has been shown that a significant improvement can be achieved by the addition of molasses. However, even this approch does not result in intakes comparable with Paraggio pods harvested following a good growing season (10).

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