Proc. Aust. Soc. Anim. Prod. 1994 Vol. 20

EFFECT OF SLAKED LIME AND RUMENSIN ON INTAKE AND RUMEN PH WHEN WHEAT IS RAPIDLY INTRODUCED TO ANGORA GOATS

B.A. McGREGOR, K.L. BUTLER and A.M. HOWSE

Victorian Institute of Animal Science, Dept of Agriculture, Wcrribee, Vic. 3030

SUMMARY

The effect of slaked lime and Rumensin on the intake of wheat and on rumen pH of adult Angora does following the rapid introduction of whole grain wheat was investigated in 2 experiments. Does (mean ± sd, liveweight 40 ± 3.7 kg) were allocated to 7 treatments and housed indoors in individual pens and fed whole wheat or lupin grain. Wheat was treated with 3 levels of slaked lime (0, 2 and 4%) and 2 levels of Rumensin (sodium monensin; 0 and 17 ppm). Lupin grain was fed as a starch free control diet. The inclusion of slaked lime in whole wheat diets increased rumen pH when compared to diets without slaked lime. The inclusion of Rumensin in whole wheat fed to goats at intakes of 300-500 g/day appeared unnecessary as the rumen pH was no higher than that provided by slaked lime, and resulted in less stable feed intake. The rapid introduction of 500 g/day of wheat to individually fed Angora goats occurred without mortality. The results suggest that wheat treated with slaked lime can be rapidly introduced to goats during drought, inclement weather following shearing, in flood, or on admission to feedlots.
Keywords: slaked lime, Rumensin, grain diets, management, goats.

INTRODUCTION

Cereal grains are used as energy supplements in southern and Western Australia during short term seasonal droughts (summer and autumn in mediterranean climates), long term droughts of 6-18 months and for supplementary feeding of pregnant and lactating sheep and goats. Recommendations for the feeding of cereal grains to sheep include gradual introduction (50 g/head.day) and slow increases in quantity (50 g/head increases every second day) to avoid the onset of acidosis, the likelihood of reduced voluntary food intake, and the potential death of animals in severe cases of acidosis. Our experiences during the 1981-83 drought, when we fed whole wheat to flocks of Angora goats, indicated that the behaviour (dominance) of some goats contributed to acidosis. Attempts to feed less frequently than once per day were not successful, with some goats gorging wheat. This caused subsequent acidosis resulting in death (B.A. McGregor, unpublished data). There are occasions when rapid introduction to high energy cereal grains may be required, such as at the commencement of feedlotting and during adverse weather following shearing and flooding. Methods to reduce the risks of acidosis and facilitate the rapid adaption to these grains need development.

Wentzel (1982) has described the use of caustic soda treated maize for supplementary feeding of small livestock and proposed the use of sodium monensin to modify the process of rumen fermentation and limit rumen acidification. Wentzel (1987) advised the use of calcium hydroxide treated maize for supplementary feeding cold stressed goats and for drought feeding small livestock. Owing to the brownish appearance of the end product, South African Angora goat and sheep farmers call such treated maize "chocolate mealies" and commonly use it for energy supplementation.

There is little detailed information on the benefits of using calcium hydroxide when feeding wheat to Angora goats. The work reported in this paper investigated the effect of adding slaked lime (calcium hydroxide) and Rumensin (sodium monensin) to a whole wheat grain diet that was rapidly introduced to Angora goats, on their voluntary intake of grain and their rumen pH.

MATERIALS AND METHODS

In 1991, a flock of 90 adult Angora does were grazed on pasture at Werribee and offered whole barley grain from January to April. Four non-eaters of grain were eliminated. From June to August the remaining does were offered lucerne-lupin (50:50) pellets. Goats were removed from pasture, fasted for 24 hours and then housed indoors. Each pen (1.6 m x 1.6 m) had slatted floors, a metal feeder and fresh water. One hour after penning the goats were fed treated whole grain wheat or lupins. Feed refusals were measured each day. Diets were mixed using a paddle mixer in batches containing 20 kg of grain. In addition, all diets contained molasses (1.9%). Two experiments were undertaken in September-October. The designs were 3 x 2 factorials plus added control, in randomised blocks. Individual goat pens were the experimental unit, and blocking was carried out on liveweight, previous grain intake (experiment 2 only) and pen location. Treatment factors were:

three levels of slaked lime (0, 2 and 4%; Limil, David Mitchell Estates Ltd, 90% $Ca(OH)_2$) treated wheat,
two levels of sodium monensin (0 and 17 ppm; Rumensin, Elanco Products Co, AF1404) treated wheat, and
whole grain lupin (*Lupinus angustifolius* was used as a starch free control diet).

Experiment 1

Diets were fed at 300 g/day for 5 days (rapid introduction). Rumen samples were taken by stomach tube and rumen pH determined immediately on days 1, 2 and 5 at 3, 6 and 24 hours after feeding. Rumen samples were not taken from animals consuming less than 100 g/day (non-eaters) on day 1. The experiment had 8 replicates and the initial liveweight (mean ± sd) was 40 ± 3.7 kg.

Experiment 2

Diets were fed at 500 g/day for only 4 days (rapid introduction). Rumen samples were taken on days 1 and 3 at 3, 6 and 24 hours after feeding and also on day 2 at 24 hours after feeding. After day 1 rumen samples were not taken from animals that consumed less than 160 g on day 1 (non-eaters). The experiment had 6 replicates and the initial liveweight (mean ± sd) was 39 ± 4.5 kg.

Statistical and chemical analysis

Randomised block analysis of variance was used to determine levels of feed intake achieved and unbalanced intra-block analysis of variance was used to estimate treatment effects on rumen pH and feed intake with non-eaters excluded. In the analyses a direct comparison of lupins (LG), wheat (W) and wheat plus additive (W+) was made. The effects of additive (slaked lime (SL) and Rumensin (R)) were then examined within W+. Samples of feed were analysed for crude protein (CP), acid detergent fibre (ADF), dry matter digestibility (DDM) and estimated metabolizable energy (ME) by near infra-red spectrophotometry (Miskelly *et al. 1984).*

RESULTS

Ration

The mean chemical composition (% w/w) of the wheat treated with molasses was CP 11.0, ADF 3.8, DDM 85.4 and ME 12.5 MJ/kg dry matter.

Health

No health problems were observed, no animals had diarrhoea, and no deaths occurred. The range in rumen pH of non-eaters on day 1 of experiment 2 was 6.6-7.6.

Table 1. The mean food intake, effect of non-eaters on food intake and rumen pH of Angora goats (n =56) fed 300 g/day of whole lupins or whole wheat (W) fed with either 0, 2 or 4% slaked lime (SL), with or without sodium monensin (17 ppm, R)

Treatment	Intake (g/day)		Rumen pH[B]				
	All	NEE[A]	D1+6	D2+24[A]	D5+3[A]	D5+6[A]	D5+24[A]
Wheat	215	300	7.16	6.45	5.91	5.63	5.96
W + 2%SL	270	285	6.82	6.21	6.10	6.04	5.91
W + 4%SL	210	295	7.05	6.72	6.40	6.41	6.44
W + R	210	245	6.96	6.24	6.16	6.26	6.05
W + R + 2%SL	180	295	7.09	6.75	6.16	5.95	6.59
W + R + 4%SL	130	280	7.00	6.46	6.43	6.35	6.14
Lupins	145	240	7.23	6.60	6.41	6.53	6.67
SED range	52	26-44	0.28	0.13-0.20	0.12-0.20	0.16-0.27	0.13-0.23

[A]All non-eaters excluded from data set. Estimates calculated using unbalanced analysis of variance.
[B]Day of experiment + hours after feeding.

Experiment 1

Intake The presence of 3 or 4 non-eaters in R and LG treatments reduced total feed intake below that of treatments without R ($P < 0.05$, Table 1). Individual day analyses showed that the effects became more pronounced with time.

Rumen pH Treatment had little effect on rumen pH during days 1 and 2. On day 1, at 6 **hours after** feeding pH of LG was greater than all wheat fed treatments (7.23 vs 7.01, sed = 0.105, $P < 0.05$, Table 1) and 24 hours after feeding on day 1, pH ranged from 5.95-7.71. On day 2, 24 hours after feeding, pH ranged from 5.59-7.10 and pH of LG, W+4%SL and W+R+2%SL was greater than W+2%SL and W+R ($P < 0.05$, Table 1). Treatment differences were detected at 3, 6 and 24 hours after feeding on day 5 (Table 1), with LG having a higher mean pH than W (6.55 vs 5.86, sed = 0.088, $P < 0.001$). On day 5, the mean effect of SL was to significantly increased pH (W and W+R = 5.99 vs W+2%SL and W+R+2%SL = 6.16, and W+4%SL and W+R+4%SL = 6.39, sed = 0.072, $P < 0.001$).

Experiment 2

Intake Nine non-eaters were present on day 1 (2 in LG and W+R+2%SL and 1 in each other treatment). When non-eaters on day 1 were excluded, no significant differences ($P > 0.2$) were observed in intake (Table 2).

Rumen pH *No* effects of treatment ($P > 0.1$) on rumen pH were detected on day 1 (range 5.61-6.93). Prior to feeding on day 3, SL significantly increased pH compared to W (6.29 vs 6.00, sed = 0.120, $P < 0.05$) and SL also significantly increased pH at 3 and 6 hours after feeding on day 3 ($P < 0.01$). Throughout day 3 LG had a higher pH than the mean of the W+ treatments ($P < 0.01$) which in turn had a higher pH than W ($P < 0.05$, Table 2). However the pH of W was not significantly different to that of W+R and W+R+4%SL (Table 2). Range in pH on day 3 was 5.25-6.76.

Table 2. The mean food intake, effect of non-eaters on food intake and rumen pH of Angora goats (n = 42) fed 500 g/day of whole lupins or whole wheat (W) fed with either 0, 2 or 4% slaked lime (SL), with or without sodium monensin (17 ppm, R)

Treatment	Intake (g/day)		Rumen pH[B]				
	All	NEE[A]	D1+6	D2+24[A]	D3+3[A]	D3+6[A]	D3+24[A]
Wheat	395	465	6.81	6.03	5.80	5.68	5.59
W + 2%SL	420	420	7.09	5.82	6.12	6.13	5.86
W + 4%SL	420	485	7.05	6.39	6.26	6.18	6.03
W + R	375	430	6.98	5.96	6.02	6.00	6.03
W + R + 2%SL	300	475	7.01	6.31	6.28	6.31	6.10
W + R + 4%SL	415	415	7.09	6.18	6.18	5.83	5.77
Lupins	245	400	6.88	6.32	6.50	6.19	6.26
SED range	94	140-193	0.15	0.19-0.22	0.15-0.17	0.17-0.19	0.19-0.22

[A]All non-eaters excluded from data set. Estimates calculated using unbalanced analysis of variance.
[B]Day of experiment + hours after feeding.

DISCUSSION

Inclusion of slaked lime to whole grain wheat diets resulted in increased rumen pH compared to diets without slaked lime. The size of the effect increased with time. It is likely that, if greater amounts of treated whole grain wheat were fed, greater benefits in rumen pH would be detected closer to introduction. Results from Experiment 2 indicated that individually fed goats can be rapidly introduced to 500 g/day of whole grain wheat, without mortalities. After non-eaters were removed there was no effect of treatment upon intake but there were 10-20% non-eaters. In group feeding situations gorging is likely to occur, especially since a substantial proportion of animals (10-20%) were non-eaters. Thus the increase in rumen pH with the addition of 2% slaked lime could well prevent acidosis and even death.

We thus suggest that in group feeding situations that wheat should be treated with 2% slaked lime.

Addition of Rumensin with lime provided no additional benefits in rumen pH over that provided by slaked lime but resulted in less stable feed intake in Experiment 1. Feeding of Rumensin to goats fed whole grain wheat at intakes of 300-500 g/day appears unnecessary.

The feeding of lupins to goats without experience of lupin grain resulted in a high incidence of non-eaters and in these circumstances the feeding of wheat for rapid intake of energy appeared more desirable than rapid introduction of lupins.

This research along with associated studies with sheep under conditions of feedlotting for the live sheep trade (Butler *et al.* 1992) have shown substantial benefits from the inclusion of slaked lime in cereal diets. These findings and the existing use of slaked lime on corn by South African goat and sheep farmers indicates that this technique should be applied when rapid introduction of cereal grain is required. Wentzel (1987) indicates that feeding of 900-1200 g of chocolate mealies (2 feeds/week) does provide good results in practice. He advises that ammonium chloride (0.5%) should be added to the grain to prevent formation of urinary calculi in males if fed more than 500 g/day of treated grain.

In conclusion, the addition of slaked lime to high energy cereal diets fed to goats should provide management and health benefits when such diets are rapidly introduced.

ACKNOWLEDGMENTS

This work was financially supported by the Ricegrowers' Co-operative Ltd and the Rural Industries Rural Development Corporation (DAV14). Advice of Dr M.J. Watson and assistance of Mr B. Scott and Mr B. Hester is acknowledged.

REFERENCES

BUTLER, K.L., WATSON, M.J. and VERSTEGEN, H.W.A. (1992). *Proc. Aust. Soc. Anim. Prod.* **19:** 297-9.

MISKELLY, D., LAW, D.P. and CLUCAS, T. (1984). "NIR 84" (Royal Australian Chemical Institute: Melbourne).

WENTZEL, D. *(1982). Angora Goat and Mohair J.* **23(1):**17-21.

WENTZEL, D. (1987). "Angora Goat Farming" (Grootfontein College of Agriculture: Republic of South Africa).