# PRELIMINARY INVESTIGATIONS INTO MOLASSES AND SULPHUR SUPPLEMENTATION OF SHEEP FED MULGA (Acacia aneura)

W.A. HOEY*#, B.W. NORTON†, and K.W. ENTWISTLE*Δ

## Summary

Individually penned wethers supplemented with 50 gm DM molasses consumed more mulga than unsupplemented controls. An identical response was observed when the 50 gm DM molasses was replaced by its ash content. A lower response in intake was observed when sheep were fed the sulphur contained in 50 gm DM molasses, as sodium sulphate. A comparison of a number of sulphur sources fed on an equal sulphur basis revealed that sheep supplemented with calcium sulphate consumed significantly more mulga than those fed methionine, sodium sulphate or elemental sulphur, but all intakes with these supplements were significantly lower than that of the group supplemented with 50 gm DM molasses.

## I. INTRODUCTION

Mulga (Acacia aneura F. Muell.) is widely distributed throughout inland Australia where it provides a valuable fodder for both sheep and cattle, particularly during drought (Everist 1949). Nichols (1938) fed fresh mulga ad lib. to penned sheep resulting in liveweight gain. However, Harvey (1952), Rohan-Jones et al. (1972), Norton et al. (1972) and McMeniman (1975) stressed that mulga is basically a maintenance fodder.

Improvements in reproductive, wool growth and liveweight status of ewes browsing mulga (McMeniman and Little 1974) and in intake and liveweight gain (McMeniman 1975) plus wool growth (Entwistle andBaird1975) in penned wethers fed mulga have been recorded by feeding molasses (M) and phosphorus (P). The largest percentage response to molasses over the range 50-200 g occurred at the 50 g level.

Experiments were undertaken to determine (1) whether an intake response occurs at a level of M less than 50g, and (2) the component(s) of M responsible for this increase in mulga consumption.

## II. MATERIALS AND METHODS

### (a) Animals

Twenty one Merino cross wethers aged 2-3 years and weighing 28.5 ± 0.53∇ kg were used in Experiments l-4. In Expt. 5, 20 two-tooth Merino wethers weighing 26.6 ± 0.26 kg were used. In all experiments, sheep were kept in individual pens. All sheep were given a parenteral vitamin A, D and E supplement (to provide 500,000 I.U. vitamin A, 75,000 I.U. vitamin $D_3$ and 50 I.U. vitamin E) prior to Expt. 1, and drenched monthly with Thibenzole.

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*Animal Research Institute, Yeerongpilly, Brisbane, Qld. 4105.
†Faculty of Agriculture, University of Queensland, St. Lucia, Brisbane, Qld. 4067.
#Present Address: Dept. of Agronomy, Waite Agricultural Research Institute, Glen Osmond, South Australia 5064.
ΔPresent Address: Dept. of Tropical Veterinary Science, James Cook University, Qld. 4811.
∇Given as mean ± standard error.

## (b) Diet

The mulga was collected from the Charleville area of Queensland and transported to the Animal Research Institute, Brisbane where it was kept in polythene bags and stored at -20°C until needed. Sufficient material was thawed daily for feeding. Expt. 5 was conducted at the Charleville Pastoral Laboratory, consequently the mulga was harvested and fed fresh daily. All sheep were fed mulga ad lib. at all times, and drenched daily with 2g P as $NaH_2PO_4$. The crude protein and mineral analyses of M and mulga are presented in Table 1.

TABLE 1

Crude protein and mineral content of composite M and mulga samples (D.M.)

| | Crude Protein | P% | Ca% | Mg% | K% | S% | Cu ppm | Mn ppm | Na ppm | Zn ppm | Fe ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M (a) | 5.2 | 0.15 | 1.37 | 0.85 | 5.6 | 0.77 | 7.7 | 99 | 2456 | 31 | 371 |
| M (b) | 4.9 | 0.09 | 1.26 | 0.53 | 4.1 | 0.54 | 2.2 | 84 | 2009 | 33 | 483 |
| Mulga (a) | 12.5 | 0.08 | 1.06 | 0.17 | 0.9 | 0.15 | 6.0 | 967 | 43 | 17 | 114 |
| Mulga (b) | 11.0 | 0.12 | 1.10 | 0.17 | 0.8 | 0.14 | 9.3 | 892 | 43 | 17 | 79 |

(a) Composite samples from the experiment of Entwistle and Baird (1975).
(b) Composite samples from this series of experiments.

## (c) Design and Treatments

TABLE 2

Treatments and sheep numbers used in Expts. 1-5

| | Daily Treatments | No. of sheep$^{\phi}$ | Duration(d) |
|---|---|---|---|
| Expt. 1 | Control, M25g$^{\dagger}$, M50g | 15 | 28 |
| Expt. 2 | Control, M50g, Ash$^{\dagger\dagger}$, Sucrose$^{\dagger\dagger}$, Ash+Sucrose$^{\dagger\dagger}$ | 15 | 28 |
| Expt. 3 | Control, Cu, Zn, Mn, Fe, Na, Ca, Mg, K, S as $Na_2SO_4$ added in sequence$^{\dagger\dagger}$ | 6 | 10$^{\#}$ |
| Expt. 4 | Control, M50g, Ash$^{\dagger\dagger}$, $Na_2SO_4$* | 12 | 28 |
| Expt. 5 | M50g, $Na_2SO_4$*, $CaSO_4$*, Methionine*, Elemental S* | 20 | 28 |

$\phi$ Equal numbers per group.
$\dagger$ M levels in this paper refer to dry matter (D.M.) basis.
$\dagger\dagger$ Equivalent to the amount contained in 50g M.
* Equivalent to the amount of sulphur contained in 50 g M.
# Treatment periods were reduced to 10d as any intake response should have been evident before that time.

The M, which was offered separately, was consumed within 5 min. Other supplements were mixed with distilled water and given via a stomach tube. Faeces were collected during the last week of Expts. 1, 2and4.

In Expts. 1 and 5 sheep were allocated to treatments at random.' In Expts. 2 and 4 animals were also allocated with regard to previous treatment. In Expt. 3 six similar sheep were used and paired in order to test the effect of minerals added in sequence on their mulga consumptibn. For 4 weeks prior to Expt. 1 sheep were accustomed to the basal diet of mulga and phosphate drench. Between Expts. 1 and 2 and Expts. 2 and 4, the sheep were fed the basal diet for 3 weeks during which their intakes returned to a common level.

## (d) Measurements

(i) 'Daily ad lib. intake of mulga, dry matter digestibility (DMD) of the diets, and liveweight changes in Expt. 1.

(ii) In vitro rumen activity of four sheep 'from each of the Control and M50 groups in Expt. 1, using the method of Tilley and Terry (1963). Milled pangola grass (Digitaria decumbens) was the common'substrate. These results were subjected to analyses of variance.

### (e) Chemical Analyses

Calcium (Ca), magnesium (Mg), copper (Cu), manganese (Mn), zinc (Zn) and iron (fe) were determined by atomic absorption spectroscopy. Sodium (Na) and potassium (K) were estimated by flame photometry. P was determined using a colorimetric method based on the reduction of phosphomolybdate, and nitrogen (N) was determined by the Kjeldahl technique.

## III. RESULTS

TABLE 3

Mean daily mulga and supplement intakes (g D.M.)

| | Control | M25g | M50g | Ash | Sucrose | Ash+Sucrose | L.S.D.(5%) |
|---|---|---|---|---|---|---|---|
| Expt. 1 | 615 | 797 | 865 | - | - | - | 90 |
| Expt. 2 | 440 | | 618 | 616 | 379 | 580 | 180 |

In Expt. 3 the mean daily intake of the controls and the group receiving all of the minerals except sulphur was 519 ± 34.5g. By adding $Na_2SO_4$ to the latter supplement or feeding it alone, increased intake ($0.10 > P > 0.05$) to 636 ± 24.0g.

TABLE 4

Mean daily mulga and supplement intakes (g D.M.)

| | Control | M50g | Ash | $Na_2SO_4$ | S | $CaSO_4$ | Methionine | L.S.D.(5%) |
|---|---|---|---|---|---|---|---|---|
| Expt. 4 | 398 | 587 | 579 | 493 | | | | 111 |
| Expt 5 | | 419 | | 261 | 222 | 371 | 257 | 98 |

The M25 supplement induced 73% of the intake response to the M50 supplement. In Expts. 2 and 4, the ash and M50 treatments produced identical responses indicating that the mineral component of molasses was responsible for the increased mulga intake. Although Expts. 3 and 4 indicated an apparent response ($0.10 > P > 0.05$) to $Na_2SO_4$, it was still less ($0.10 > P > 0.05$, Expt. 4; $P < 0.05$, Expt. 5) than the response to the M50 supplement. In Expt. 5, CaS04 also significantly increased intake ($P < 0.05$) over the $Na_2SO_4$ and remaining sulphur supplements. There were no treatment effectson D.M.D. in any of the experiments. During the acclimatisation period, all sheep lost 4.4 ± 0.72 kg. At the end of Expt. 1 the mean liveweight of the treatment groups was significantly higher than that of the controls, 28.5 ± 0.46 > 25.1 ± 0.81 ($P < 0.05$). The rumen fluid from the 50gM treatment digested the pangola grass to a significantly greater extent than that from the controls (D.M.D.% 54 ± 5.4 > 37 ± 7.0 ($P < 0.05$)).

## IV. DISCUSSION

The apparent intake responses to a sulphur supplement in Expts. 3 and 4 were unexpected as the N:S ratio of mulga is below 13.5:1 and therefore should be adequate for optimum utilization of dietary nitrogen (Bird 1972). The sulphur, which is probably present in the sulphur containing amino acids, could either be relatively inaccessible because of the low digestibility of the feedstuff or bound by the tannins present in mulga. Preliminary analyses have revealed 5-7% tannic acid equivalent in mulga (R.J.W. Gartner - pers. comm.), which would appear sufficient to reduce the catabolism of dietary protein in the rumen (McLeod 1974).

From the Results of Expts. 4 and 5 it appears that the response is not solely due to sulphur but also perhaps to calcium. However a recent experiment (unpublished data) conducted at Charleville demonstrated no differences between molasses and some of the other sulphur sources tested in Expt. 5. The reasons for this apparent discrepancy have yet to be elucidated.

The increased intake which occurred without any changes in D.M.D. implies that the response was mediated by other factors which influence rate of removal of organic matter from the rumen (Weston 1967). The increased microfloral activity observed in the in vitro digestions may indicate that the rate of digestion of the feedstuff had been improved.

Future experiments will be concerned with determining the effects of climatic and plant factors on the magnitude of the response in both sheep and cattle.

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