

A thesis submitted to the University of New England for the degree of Master of Rural Science.

by

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PREFACE

The studies presented in this thesis were completed by the author whilst a post-graduate student in the Department of Animal Science, The Faculty of Science, The University of New England, Armidale, N.S.W., Australia. Any assistance received is acknowledged in the text or in the list of acknowledgements. All references acknowledged are included in the bibliography. The work is otherwise original.

I certify that the substance of this thesis has not already been submitted for any degree and is not being currently submitted for any other degree.

I certify that to the best of my knowledge any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.



ASRIL AUGUST, 1996

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Alhamdulillahirabbilalamin

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SUMMARY

The experiments reported in this thesis were conducted to study sources of protein, which are available in developing countries, as supplements for ruminants fed low quality fibrous diets. Supplementation with dietary protein or non-protein nitrogen (urea) is usually suggested as a means to increase production of animals fed a low quality diet. The provision of rumen undegradable protein is suggested to supply dietary amino acids to ruminant.

In the study presented here, urea and by-pass protein sources (cottonseed meal, sunflower meal, palm kernel cake, and copra meal) were used in combination as supplements for sheep fed a low quality fibrous diet. In the first experiment, the efficiency of utilization of these protein-rich supplements was compared in sheep given a low quality fibrous diet. In the second experiment, the accuracy of a technique for estimation of intake of the supplements was determined using lithium chloride as a marker. Supplementary feeding of grazing sheep during winter/spring in The Northern Tablelands of New South Wales is necessary to maintain or to support animal production. A third experiment was carried out in grazing sheep to investigate the effect of supplementary feeding during a period of low pasture growth in winter/spring in The Northern Tablelands of New South Wales. The lithium chloride technique was used to measure the intake of supplements by grazing sheep.

The first experiment was conducted in penned animals using a complete randomized 5 x 5 design. All animals were fed with the same amount of nitrogen (about 18.4 g/h/d) in different sources of crude protein (urea-treated oaten chaff, cottonseed meal, sunflower meal, palm kernel cake, and copra meal). Sheep given urea-treated oaten chaff tended to have a higher rate of liveweight gain (11 \pm 6.6 g/h/d for 36 d) than that sheep given other diets. Sheep on cottonseed meal and sunflower meal lost weight (-16 \pm 5.7 and -9 \pm 4.8 g/h/d for 36 d respectively). Supplementation of urea-treated oaten chaff with bypass protein likely increased wool production.

In the second experiment, lithium chloride was successfully used to measure intake of supplement. The result showed a small error in estimation of intake of supplement (< 10 %) when all the supplement given was eaten. The use of lithium

chloride as a marker did not appear to affect intake when the dose of LiCl with the supplement was less than 50 mg/kg liveweight per d.

Supplementation of grazing ewes with 190 g lupin/h/d and 200 g barley plus virginiamycin + 1 % urea/h/d increased liveweight and wool fibre diameter. Supplementation with lupins tented to increase of liveweight. The change in average fibre diameter was smaller in unsupplemented sheep $(0.14 \pm 0.15 \,\mu\text{m})$. The sheep supplemented with lupins had the highest variation of change of mean fibre diameter $(1.03 \pm 0.41 \,\mu\text{m})$. The sheep supplemented with barley plus virginiamycin +1 % urea produced a coarser wool fibre than those fed lupins.

Intake of supplements by individual sheep appeared to change as time progressed as the animals became familiar with the feed and feeding environment and as competition for feed intensified. The variation of intake of supplement was higher in lupins than in barley. This may indicate that sheep prefer lupins over barley.

Further studies however are required to investigate the utilization of some sources of by-pass protein, e.g. copra meal or palm kernel cake, for ruminants. The balance of energy and nutrients and the efficiency of utilization of these sources by ruminants still require further study.

It is concluded that many sources of by-pass protein from agro-industrial byproducts are potential supplements for ruminants. The lithium chloride technique is very useful in estimating intake of supplement, particularly by grazing sheep. The addition of urea and virginiamycin to barley both increased its feeding value in this study.