NATURAL DECLINE IN THE QUALITY OF CLOVERS AND GRASSES ON THE SOUTH COAST OF WESTERN AUSTRALIA

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SUMMARY

The natural decline in digestibility, protein and essential macro-element contents of clovers and grasses were measured at three ungrazed sites on the south coast of Western Australia between October and April. *In vitro* dry matter digestibilities declined from over 70 per cent in October to less than 55 per cent in January. Crude protein content declined; values for clover were always substantially greater than for grasses. Phosphorus, sulphur and potassium contents of clovers and grasses declined over time, with phosphorus and sulphur levels in grasses being low enough to depress utilization in late January and February.

INTRODUCTION

The quality of dry pasture limits its utilization by livestock during the summer/autumn in the Mediterranean climates of southern and south western Australia (Purser 1981). In late spring when plants mature and *senesce* digestibility declines very rapidly. Also there are marked declines in the concentrations of nitrogen and some essential minerals when the pasture available in winter or early spring is compared with the dry residues present, in November and March.

Decline in the quality of pasture available to grazing animals through the summer/autumn may be due to natural decline (effects of weathering and microbial or insect action) to consumption by stock of higher quality components *or* to greater losses of high compared with low quality components through trampling. The work reported here was conducted to describe the natural decline in quality of clover and grasses on the south coast of Western Australia.

MATERIALS AND METHODS

Samples of ungrazed clover and grasses were collected at two sites (land 2) on a farm at South Stirlings (average rainfall 530 mm). Site 1 was a gravelly soil while Site 2 was a sandy soil with pasture responsing to sulphur fertilizer, Site 3 was at North Albany (average rainfall 810 mm) on a sandy soil and was also responsive to sulphur. At all sites plant samples were collected from eight plots used in fertilizer trials. Four of the plots were fertilized in late April and August with phosphorus (P, 20 kg/ha), potassium (K, 100 kg/ha), sulphur (S, 50 kg/ha) and a trace element mix. The other plots received no sulphur, with the other elements given as above.

At sites 1 and 2, samples were taken by cutting clover or grass plants at ground level on seven occasions (October 25, November 9, December 1, January 5 and 31, February 28 and April 6). At site 3 no samples were taken in October or April. Clover began to dry off at sites 1 and 3 on December 1 and was completely dry by January 5, while at site 2 the clovers were still slightly green in early January. *In* April, new growth covered most of the dry residues and small amounts of this may have contaminated the dry material taken for analysis. Major rainfall events (> 5mm < 35 mm in two days) occurred early in November, in early, mid and late January and in mid and late February-at all sites,

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The samples were analyzed for solubility using a pepsin/cellulase assay (Aufrere and Michalet-Doreau 1988) and this value was adjusted to an estimated *in vivo* dry matter digestibility (DMD) value using standard feeds which had been fed to wethers at maintenance. Nitrogen content was determined by the Kjeldahl procedure and crude protein (CP) calculated. P and K were determined on a four channel autoanalyzer system, using modifications of Technicon procedures (Anon. 1977). After digestion with sulphuric acid and hydrogen peroxide (Yuen and Pollard 1954), P was determined colorimetrically by the molybdovanadate method, and K by flame photometry. Calcium (Ca), magnesium (Mg) and S were determined by ICP-AES after digestion with nitric/perchloric acids (McQuaker *et al.* 1979).

Analysis of variance was used to test for effects of site, time of sampling, plant species, fertilizer treatment and interactions between time of sampling and plant species.

RESULTS

There were differences ($P<0.01$ to $P<0.001$) between sites in DMD (Fig. 1), and in CP (Fig. 2), P (Fig. 3), S (Fig. 4), K (Fig. 5) and Mg (Fig. 7) contents, but they were not great. In all figures the results for Site 1 at any sampling date are presented prior to those for Sites 2 and 3, respectively. Fertilizer treatment had no effect on DMD, P, K, or Ca (Fig. 6) content, but did increase CP ($P<0.05$), S ($P<0.001$) and Mg ($P<0.05$) concentrations, although the effects were small.

Dry matter digestibility declined ($P<0.001$) with time (from > 70% in October to <55% in January), and although different ($P<0.001$) between clover and grasses this was mainly at the early sampling dates. Within sites there were interactions ($P<0.05$ to $P<0.001$) between time of sampling and plant species.

There were differences ($P<0.001$) between crude protein contents at different times of sampling, and clover always contained more than grasses. Phosphorus, S, K and Mg concentrations differed ($P<0.001$) between times of sampling and plant species with interactions ($P<0.01$ to $P<0.001$) occurring for P, S and Mg. Calcium concentration differed ($P<0.01$) between times of sampling, increasing slightly whereas other elements tended to decline with time. Clovers always contained more ($P<0.001$) Ca than grasses.

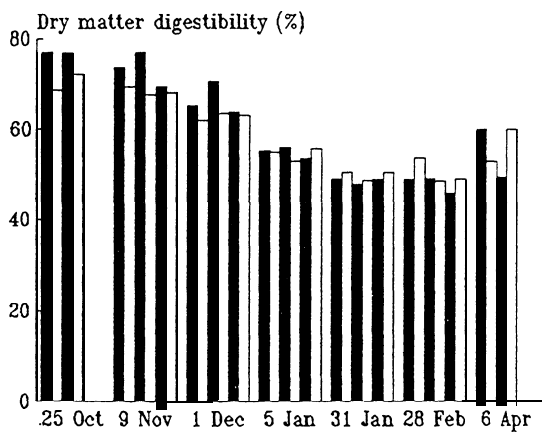

Fig. 1. Dry matter digestibility of clover (full) and grasses (open) at three sites

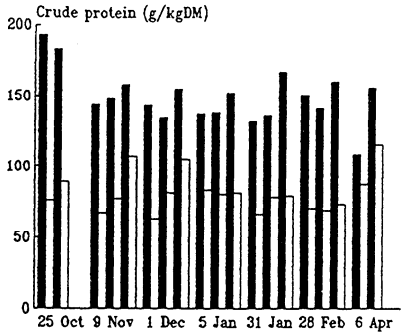

Fig. 2. **Crude protein content of clover (full) and grasses (open) at three sites**

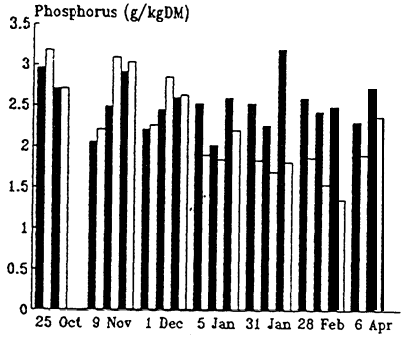

Fig. 3. **Phosphorus content of clover (full) and grasses (open) at three sites**

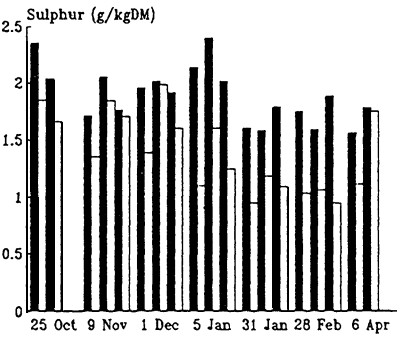

Fig. 4. **Sulphur content of clover (full) and grasses (open) at three sites**

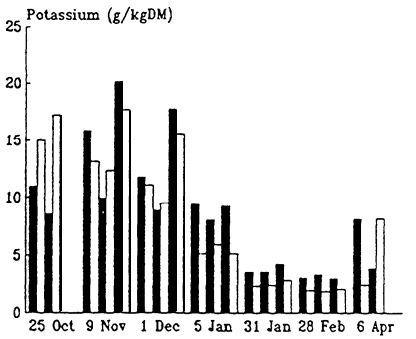

Fig. 5. **Potassium content of clover (full) and grasses (open) at three sites**

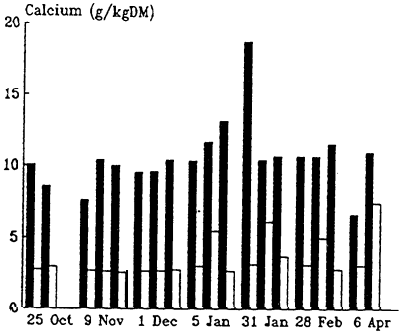

Fig. 6. Calcium content of clover (full) and grasses (open) at three sites

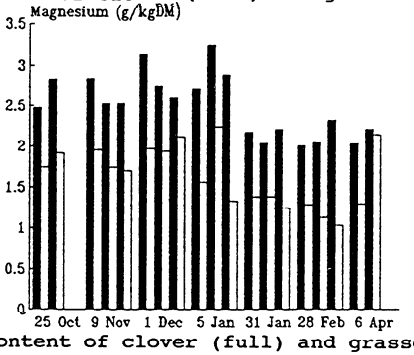

Fig. 7. Magnesium content of clover (full) and grasses (open) at three sites

DISCUSSION

Digestibility of ungrazed clovers and grasses declined to less than 55 per cent by early January, indicating that they would be unlikely to meet the maintenance energy requirements of sheep. The CP content of grasses was 80 g/kg DM or 'less from late October to February and this level might be expected to limit their intake and digestion by sheep. However, CP levels in clovers were unlikely to impose such limitations, provided the protein was available to ruminal micro-organisms. The concentrations of S and P in grasses declined to less than 1.2 and 1.7 g/kg DM, respectively, levels which again might limit their utilization. Clovers generally contained adequate levels of these elements. Concentrations of K fell from 15 to 3 g/kg DM between November and March, and these values are similar to those reported by Purser (1981). Finally, it is probable that the decline in quality described would be much greater under grazing due to the selective ingestion of pasture components of higher quality and trampling.

ACKNOWLEDGEMENTS

The assistance of R. Love and S. Smith, Western Australian Department of Agriculture with collection of samples and P. Coates Chemistry Centre *of* Western Australia, with mineral assays is greatly appreciated.

REFERENCES

ANON. (1977). Technicon Industrial Systems, Tarrytown, N.Y., USA.

AUFRERE, J. and MICHALET-DOREAU, B. (1988). Animal Feed Science Technol. — 20:203.

McQUAKER, N.R., BROWN, D.G. and KLUCKNER, P.D. (1979). Anal. Chem. 51:1082.

PURSER, D.B. (1981). In "World Animal Science, B1 Grazing Animals", p. 178, editor F.H.W. Morley. (Elsevier: Amsterdam).

YUEN, S.H. and POLLARD, A.G. (1954). J. Sci. Food Agric. 5:364.