THE INFLUENCE OF RAINFALL ON THE NUTRITIVE VALUE OF A SEMI-ARID MULGA PASTURE IN SOUTH-WEST QUEENSLAND

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ABSTRACT

A study of the nutritional quality of six semi-arid pasture species, consisting of four grasses and two shrubs, showed that digestibility was significantly affected by rainfall regardless of season. Phosphorus levels after February or March were found to decline markedly even during periods of high ambient temperature and despite any subsequent rainfall indicating the need for supplementary feeding early in the year. Only one grass Thyridolepis Mitchelliana, and the two shrubs Bassia convexula and Sida sp. maintained a nutritional quality considered consistant with animal production requirements for the whole of the 21 month study period. The correlation of crude protein with dry matter digestibility for the species studied is discussed.

INTRODUCTION

Plant communities in the arid and semi-arid mulga lands of Australia are commonly associated with open range beef cattle and wool sheep production. Throughout the arid zone, these industries depend upon the growth response to rainfall of the naturally occurring grasses, shrubs and top-feed for their existence.

The chemical composition of a selection of mulga land plant species, over an 18 month period, was reported by Siebert, Newman and Nelson (1968), but no attempt was made by these authors to relate their results to rainfall.

The present study was undertaken in an attempt to ascertain the nutritional response of pasture species, which are found in these areas, to rainfall, and to indicate the necessity and timing of protein-phosphorus supplementary feeding for beef cattle.

EXPERIMENTAL

Site

The study was carried out at "Wheatleigh", a property situated near Charleville in south-west Queensland. The 12,000 ha section of the property under study was grazed by beef cattle, at 1 beast to 15-20 ha.

Pasture species

Pasture species studied were selected by the property owner from his knowledge of the area, and were assessed as those being most commonly and frequently grazed by the animals.

The four grasses and two shrubs used as monitors for the area were "Love grass" (*Eragrostis* sp.), "Mulga mitchell grass" (*Thyridolepis mitchelliana*), "Wire grass" (*Aristida jerichoensis*), "Never-fail grass" (*Eriachne helmsii*), "Buck bush" (*Bassia convexula*), and "Potato bush" (*Sida* sp.). These species were collected, with one exception, at monthly or two monthly intervals for 21 months from August 1970. The exception was Buck bush, which was not available in the study area during some of the period.

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Nutritional assessment by chemical analysis

Plant samples were hand-cut to include leaf and stem material, air dried after collection and despatched to the Arid Zone Research Institute at Alice Springs. The samples were oven-dried at 60-70°C, ground in a Kurt-Retsch mill, (0.75 mm screen) and stored in air-tight containers. The predicted dry matter digestibility (D.M.D.) was determined using the two-stage *in vitro* technique (Tilley and Terry, 1963) as modified by Newman (1972). Crude protein (C.P.) and phosphorus were determined according to A.O.A.C. (1970).

RESULTS

Rainfall was seasonal with most rain falling between September and March. The range of D.M.D., C.P. and phosphorus values recorded for each species during both summer (October to March) and winter (April to September) are shown in Table 1.

TABLE 1

Range of digestibility, protein and phosphorus values (% D.M.) of six pasture species during summer† and winter at a site in south-west Queensland

Species	Summer (Oct.-Mar.)			Winter (Apr.-Sept.)			D.M.D. v Protein
	D.M.D.	Protein	Phosphorus	D.M.D.	Protein	Phosphorus	
Love Grass (*Eragrostis* sp.)	19.9–38.2	4.0–10.4	0.03–0.12	20.2–32.3	4.1–9.9	0.02–0.05	r = 0.76***
Mulga Mitchell Grass (*T. mitchelliana*)	22.6–52.2	5.3–17.2	0.02–0.14	35.2–54.7	5.1–19.4	0.03–0.07	r = 0.37*
Wire Grass (*A. jerichoensis*)	17.5–43.8	2.3–13.8	0.02–0.15	16.6–37.8	3.0–15.9	0.02–0.05	r = 0.43**
Never-fail Grass (*E. helmsii*)	14.6–49.9	4.5–10.6	0.02–0.18	16.6–37.6	3.6–8.5	0.01–0.06	r = 0.29n.s.
Potato Bush (*Sida* sp.)	33.0–60.2	9.2–20.8	0.07–0.31	42.5–56.9	10.1–18.4	0.07–0.16	r = 0.31*
Buck bush (*B. convexula*)	22.1–52.8	10.9–19.3	0.03–0.18	38.6–50.7	10.3–15.8	0.03–0.09	r = 0.71***

† Includes 2 summers (1970/71 and 1971/72).
n.s. ($P > 0.05$), * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

There was little seasonal effect on D.M.D. and C.P. levels, but maximum levels for phosphorus were higher ($P < 0.1$) in summer.

The trends of mean measurements for the six species over a 21 month period are illustrated in Figure 1, together with rainfall and temperature data.

The pasture maintained low to medium D.M.D. and a relatively stable C.P. content throughout the period. Phosphorus levels were generally low and fluctuated on a seasonal basis.

Individually, the *Eragrostis* and *Thyridolepis* sp. both attained maximal D.M.D. and C.P. levels during periods of high temperatures following substantial rainfall. Response to rainfall after March was of less magnitude for D.M.D. than for C.P. The *T. Mitchelliana* maintained a D.M.D. generally in excess of 30% and was consistently superior to the *Eragrostis* sp. in nutritive value, although the overall correlation between D.M.D. and C.P. was lower ($r = 0.37$) than for the *Eragrostis* sp. ($r = 0.76$). Values for phosphorus were similar for the two species.

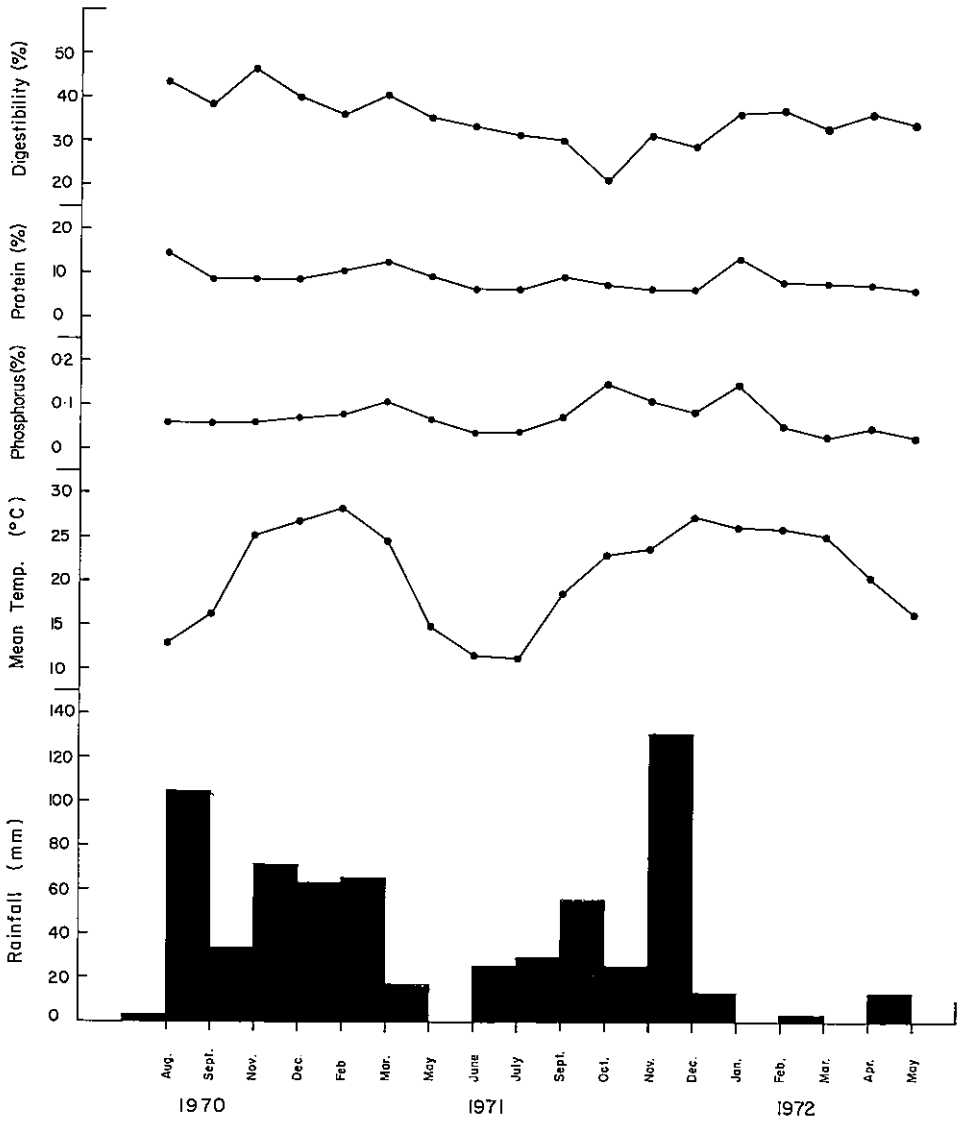

FIGURE 1

Periodic trends of mean digestibility, protein and phosphorus values for six pasture species, together with temperture and rainfall data, during a 21 month study in south-west Queensland.

A. jerichoensis and *E. helmsii* gave deeper troughs for D.M.D., with values for the *E. Helmsii* ranging from a peak of 49.9% to a low of 14.6%. C.P. levels did not reflect the wide range of D.M.D. for the *E. Helmsii* ($r = 0.29$) and seldom exceeded 10%. Response in phosphorus content to rainfall appeared more marked than for the previous two grasses, but showed a large variation within the range 0.02-0.18%.

Due to the gap in data for *Bassia convexula* a full comparison with the *Sida* sp. was not possible, but information available indicated that the species were similar in nutritional value.

D.M.D. values for the *Sida* sp. consistently exceeded 40% with C.P. levels in excess of 10%. Levels of phosphorus were well above those for the grasses. The effects of rainfall in combination with temperature were less noticeable than for the grasses.

DISCUSSION

Despite the apparent domination of mulga lands by *Acacia aneura* and other top-feed shrub species, grasses remain the most important forage species in the diet of naturally grazing cattle (Chippendale, 1968), although this may be dependant on the accessibility and density of browse species (Payne and MacFarlane, 1963).

Of the grasses examined in this study, only *T. mitchelliana* showed consistent levels of digestibility with adequate protein levels throughout the whole period. It is doubtful if the remaining grasses would be able to meet the needs of the animal even if available in considerable quantities, unless supplementary sources of nutrients were available.

Shrubs such as *Sida* and *Bassia* undoubtedly assist the situation by providing a natural source of nutrients and dry matter when selected by the grazing animal.

The common Queensland and New South Wales practice of 'pushing' and lopping of top-feed species, especially *A. aneura* (Everist, 1969), can provide valuable supplementation. Under conditions of restricted choice the intake of shrub or top-feed material and grass by sheep does not vary (Newman, 1969).

Results from this work indicated that the response to rainfall of the D.M.D. and C.P. of the pastures studied was greatest in the summer period, but statistical analysis of the data showed that rainfall always produced a highly significant response ($P < 0.001$) in D.M.D., irrespective of season. Similar observations have been noted for central Australian mulga land pastures.

The definite seasonal trends in content of phosphorus show that response to rainfall was similar to tropical pastures (Todd, 1956) and under such conditions aphosphorosis in cattle could occur if intake of protein was not maintained. This situation could occur in the area studied after depletion of reserves of the *T. Mitchelliana*, *Sida* and *Bassia* sp. In a year of low summer rainfall direct supplementation with a protein-phosphorus concentrate would need to commence no later than March in order to prevent this depletion. Such supplementation if accompanied by management practices allowing the grazing animal free access to cut and seedling *A. aneura* should ensure an adequate free choice intake of nutrients and dry matter by the animal.

The highly significant relationship between the C.P. and D.M.D. of the pasture ($r = 0.70$, $P < 0.001$) indicates that C.P. is of value as a predictor of the D.M.D. of the pasture. The significance of this relationship decreased, however, when applied to the individual components of the pasture indicating that the prediction is not necessarily specific.

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