Seasonal variation in chemical composition and dry matter digestibility of *Digitaria decumbens* and *Cynodon dactylon* in admixtures with *Desmodium intortum*

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SUMMARY

An investigation was conducted to determine the seasonal variation in chemical composition and *in vitro* dry matter digestibility of tropical pastures consisting of *Digitaria decumbens* (Pangola grass) and *Cynodon dactylon* (Star grass) with or without *Desmodium intortum* (Greenleaf desmodium). The effect of season on chemical composition and *in vitro* dry matter digestibility was not significant. There was no significant difference in percentage crude protein content between the individual mixed or pure treatments. The mixed treatments had, however, higher mean crude protein values than the corresponding pure treatments ($P < 0{\cdot}01$). For soluble carbohydrates, Pangola grass whether pure or when mixed had higher values than Star grass, whether pure or when mixed. For *in vitro* dry matter digestibility, differences between the treatments were not significant.

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RÉSUMÉ

ANTWI, M. K. : *Variations saisonnières dans la composition chimique et la digestibilité de la matière sèche, de* Digitaria decumbens *et de* Cynodon dactylon, *pures ou en mélange avec* Desmodium intortum.

Des recherches ont été entreprises pour déterminer les variations saisonnières dans la composition chimique et la digestibilité *in vitro* de la matière sèche, du foin de pâtures tropicales, de 4 sortes de parcelles ensemencées en *Digitaria decumbens*, (Herbe Pangola), *Cynodon dactylon* (Herbe étoilée), chacune cultivée à l'état pur ou en mélange avec *Desmodium intortum* (*Desmodium* à feuilles vertes). La saison de la récolte n'a pas eu d'effet notable sur la composition chimique, ni sur la digestibilité *in vitro* de la matière sèche. Il n'a pas été observé non plus de différence appréciable dans la teneur en proteine brute des deux parcelles mixtes (*Digitaria* + *Desmodium* et *Cynodon* + *Desmodium*); pas non plus de différence de cette sorte entre les deux parcelles à graminées pures (*Digitaria* et *Cynodon*). Cependant, les deux parcelles mixtes avaient de plus hautes valeurs en proteine brute que les deux parcelles de graminées pures ($P < 0{,}01$). En ce qui concerne les hydrates de carbone solubles, le *Digitaria*, pur ou mélangé de *Desmodium* avait une plus haute teneur que le *Cynodon* pur ou mélangé. Pour la digestibilité *in vitro* de la matière sèche, les différences entre les parcelles n'ont pas été appréciables.

Introduction

Pasture quality is best expressed in terms of energy. Blaxter (1956) has discussed methods for determining net energy value and pointed out the difficulties involved. The simplest, and at the present time, the most satisfactory measure of pasture quality is its apparent digestibility, which is a function of feed intake and faecal output, and can be expressed as percentage digestibility of dry or organic matter or energy. Moir (1961) and Minson & Milford (1966) found a correlation between digestibility of organic matter and dry matter, and digestible energy. Milford & Minson (1966) also showed that there was a good correlation between energy digestibility and net energy for both maintenance and production of milk, meat and wool.

Application of the concept of digestibility

becomes limiting in breeding and selection programmes or glasshouse type of experiments where the quantity of herbage available is inadequate for direct estimation. The two-stage *in vitro* rumen fermentation described by Tilley & Terry (1963) has been an accepted laboratory method for pasture quality estimation. The criterion of *in vitro* rumen fermentation used in various methods is represented by the disappearance of dry matter, organic matter or of energy. Tilley & Terry (1963) have shown that the two-stage *in vitro* rumen fermentation of forage crops produced the same digestibility values as those obtained by direct methods. Raymond (1969) indicated that even though the two-stage *in vitro* technique appears to give a better prediction of *in vivo* forage digestibility than chemical methods, it will also appear that without additional chemical information, *in vitro* technique can only describe, rather than explain, the differences in digestibility observed among different forage samples. This suggests that *in vitro* and chemical techniques should be considered as complimentary, rather than competitive, methods of forage evaluation, the *in vitro* techniques being used to establish that forages differ in digestibility, and the chemical techniques to study the probable reasons for these differences.

This study was initiated to find out the nutritional significance of *Digitaria decumbens* and *Cynodon dactylon* with or without *Desmodium intortum* and the effects of the season.

Materials and methods

The experiment, which was conducted over two grazing seasons at the University of Queensland farm at Redland Bay, was laid out on one hectare land in four randomized blocks of four plots each to which were assigned the following treatments: *Cynodon dactylon* (Star grass), *Digitaria decumbens* (Pangola grass), *Cynodon dactylon/Desmodium intortum* (Greenleaf desmodium) and *Digitaria decumbens/Desmodium intortum*. The swards were cut to ground level just before sampling on 1 Oct 67 and fertilized by split application with molybdenized superphosphate and nitrogen (grass plots only) at the rate of 450 kg/ha. The plots were irrigated and thereafter irrigated once a week.

Samples for the estimation of chemical composition and *in vitro* dry matter digestibility were obtained from the regrowth cut weekly per block by clipping to ground level with hand shears for the next 32 weeks. Three randomly placed quadrats measuring 1·0 m × 1·0 m were cut from each plot. Sampling time was between 1530 and 1630 hours. The samples cut were dried overnight at 100°C. The dried samples were milled and bottled for the determination of percentage crude protein, soluble carbohydrate and *in vitro* dry matter digestibility.

Nitrogen content of the herbage was determined by the Kjeldahl digestion procedure, the percentage soluble carbohydrate in the herbage dry matter was determined by the phenol-sulphuric acid colorimetric method of Dubois *et al.* (1956) and the *in vitro* rumen fermentation technique employed was that of Tilley & Terry (1963) as modified by Rogers & Whitmore (1966).

Results and discussion

Seasonal effects on crude protein percentage were not significant. The combined value of the two seasons are shown in Table 1.

Differences in crude protein contents of the Star grass and Pangola grass were not significant. There was also no significant difference between the individual mixed treatment, that is, Star grass/Greenleaf desmodium and Pangola grass/Greenleaf desmodium. The mixed treatments, however, had significantly higher mean crude protein values than the corresponding pure treatments ($P < 0{\cdot}01$) (Table 1). Legumes, in general, have higher crude protein content than grasses, and the significantly higher values of the mixed treatments can, therefore, be attributed to the inclusion of Greenleaf desmodium in the mixed treatments.

The crude protein contents of the various treatments reported in this investigation are comparable to published work in the tropics and sub-tropics. Burton, Jackson & Hart (1963) found the crude protein content of Star grass, a 3-year average, to be 8·4–18·5%. Evans (1969) obtained a mean annual content of 12·34% with a range of 8·06% (450 kg N/ha) to 19·56% (900 kg N/ha) for Pangola grass.

Milford & Minson (1965) have established a close linear relationship of digestible crude protein with crude protein percentage, and suggested that crude protein content of more than 7% was favourable for animal production in the

TABLE 1

Crude Protein Soluble Carbohydrate and in vitro *Herbage Dry Matter Digestibility* (%) *of Hand-Clipped Samples*

Treatment parameter	*Star grass*	*Pangola grass*	*Star grass/ Greenleaf desmodium*	*Pangola grass/ Greenleaf desmodium*	*Tukey Q value*	
					$P=0\cdot05$	$P=0\cdot01$
Crude protein	11·3 (5·4–16·7)	10·1 (5·0–16·5)	15·7 (13·1–18·9)	12·4 (11·4–15·2)	2·8	3·4
Soluble carbohydrate	2·3 (1·5–3·4)	3·8 (2·3–5·6)	1·9 (1·0–2·6)	2·9 (1·3–3·7)	0·5	0·6
Digestibility	47·4 (41·9–56·0)	51·1 (39·0–59·9)	50·9 (44·8–54·3)	51·6 (46·6–55·9)	4·2	5·2

Ranges where necessary are given in brackets

tropics. It is, therefore, evident from the crude protein data of this investigation that Pangola grass and Star grass whether pure or when in admixture with Greenleaf desmodium will be suitable for animal production in the tropics.

The pure grass treatments had higher concentrations of soluble sugars than the corresponding mixed treatments with the Pangola treatment showing a significant level ($P<0\cdot01$). The Pangola treatment had a significantly higher concentration than the Star grass and Star grass/Greenleaf desmodium treatments ($P<0\cdot01$). The Pangola grass/Greenleaf desmodium treatment also had a significantly higher concentration of soluble sugars than the Star grass/Greenleaf desmodium treatment. Soluble carbohydrate values obtained in this investigation are less than the values obtained by Hunter, McIntyre & McIlroy (1970) from some tropical pasture plants (leave plus stems) at two stages of growth. They found the levels of soluble sugars to be higher in the second stage of growth when the plants were in their floral development. It is, however, of some interest to note that floral and seed developments were not allowed to take their natural course as the pastures were under constant defoliation.

Nonetheless, the significantly high concentration in Pangola grass confirms the work of Humphreys (1969) who has reported that Pangola grass has an unusually high content of soluble sugars.

Seasonal effects on *in vitro* dry matter digestibility percentage were not significant. There was also no significant difference between the treatments in *in vitro* dry matter digestibility percentage (Table 1). Dry matter digestibility values ranging from 34% to over 70% for tropical pasture have been reported by many workers. Burton, Jackson & Hart (1963) have reported values ranging from 43·2% to 65·2% for Star grass. Minson & Milford (1966) found the mean dry matter digestibility for Pangola grass to be 57·7% with a range of 40·7 to 69·8%. Milford (1960) working with 17 different sub-tropical grasses has reported that except in very young grass, dry matter digestibility values of tropical grasses never exceed 60% and they mostly fluctuate between 40 and 50% although higher and lower values were obtained. The mean dry matter digestibility values obtained in this investigation thus compare favourably with the literature cited above.

Conclusion

The nutritional significance of *Digitaria decumbens* and *Cynodon dactylon* with and without *Desmodium intortum* has been investigated. The results have shown that the tropical pasture species studied could be incorporated in animal production programmes in the tropics because of their relatively high percentage crude protein and dry matter digestibility values.

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