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A COMPARISON OF THE NUTRIENT CONCENTRATIONS AND DIGESTIBILITIES OF FOUR FLOOD PLAIN GRASSES

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Introduction

The Department had received a number of enquiries from Primary Producers on the nutrient concentrations in Amity aleman grass and how they compared with those of the other improved grasses for the floodplains.

The nutrient concentrations found in para grass (*Brachiaria mutica*), native hymenachne (*Hymenachne acutigluma*) and Olive hymenachne (*H. amplexicaulis*) had been presented in Cameron (1992).

The nutrient concentrations and nutritive value of the relatively new grass cultivar to the Northern Territory, Amity aleman grass had not been reported, and there had not been a direct comparison of the quality of these four grasses.

This study was conducted to compare the digestibility and nutrient concentrations of the four grasses.

Method

Each month, on the same day from September 1992 to January 1994, grab samples of plant tops were collected from the four grasses at Coastal Plains Research Station. The dates of collection were, where recorded, 16/9/92,

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14/10/92, 16/11/92, 19/2/93, 22/4/93, 17/6/93, 15/7/93, 18/8/93, 16/9/93, 16/11/93, 20/12/93 and 24/1/94.

The samples were collected from various paddocks including Lagoon paddock, Olympic paddock and Pig Hill paddock, depending on access during the wet season and grazing patterns during the dry season. All were from plants growing on the same soil type - the floodplain black cracking clay.

The samples were dried in a forced draft oven at 80°C for 48 hours. They were ground and samples submitted to Chemistry Section in Darwin for analyses (N, P, K, S, Ca, Mg, Cu, Zn) and to the Animal Nutrition Laboratory in Alice Springs for in-vitro digestibilities.

Results

The full results of digestibility, nitrogen, phosphorus, potassium, sulphur, calcium, magnesium, sodium, copper, zinc and dry matters are presented in Appendix 1.

The data is not complete because some samples were not collected as expected and some were lost and not submitted for analysis.

For consistency and accuracy of results for the comparison we have only considered the months where a sample was collected from all four grasses.

The grasses were ranked for each component in each month where 1 = highest value to 4 = lowest value. The ranks were totalled to give an overall rank, and a mean value was calculated for each component of nutrient concentration or nutritive value.

Table 1: Overall rank of four floodplain grasses from CPRS for nutritive component

Component	Overall Rank for each component				Number of times Ranked Highest				No. Months
	B. m	E. p	H.ac	H.am	B.m	E.p	H.ac	H.am	
Digestibility %	4	1	3	2	1	10	0	2	13
N%	4	3	2	1	0	3	4	7	13
P%	4	2	3	1	1	4	3	6	13
K%	4	2	3	1	2	4	2	11	13
S%	4	2	3	1	2	5	3	5	13
Ca%	1	2	3	4	8	7	1	0	13
Mg%	2	1	4	3	6	7	2	1	13
Na%	1	2	3	3	12	1	0	0	13
Cu ppm	1	2	3	4	7	7	2	1	13
Zn ppm	2	2	4	1	1	3	3	4	10
Dry matter %	1	3	2	4	7	1	2	0	8

The mean results for each component are presented in Table 2.

Table 2: Mean value for nutritive components for four floodplain grasses from CPRS.

Component	B. mut	E. pol	H. act	H. amp	Mean	No. months
Digestibility %	55.3	64.0	59.0	60.6	57.7	13
N%	1.7	2.0	2.2	2.4	2.1	13
P%	.18	.20	.20	.24	.21	13
K%	2.4	2.7	2.5	3.0	2.6	13
S%	.25	.37	.29	.36	.32	13
Ca%	.39	.34	.19	.15	.26	13
Mg%	.32	.32	.26	.27	.29	13
Na%	.33	.10	.02	.02	.12	13
Cu ppm	6	6	5	4	5	13
Zn ppm	27	28	26	29	28	12
Dry matter %	27.1	22.8	23.7	21.3	22.5	8
Crude protein %	10.5	12.4	14.4	15.1	13.1	13

Discussion

Comparison between the grasses

These grasses can occupy different niches on the floodplains, which makes a direct comparison difficult. Para grass is found in areas where water depth is 1 m or less, the hymenachnes areas where water depth exceeds 1 m and is up to 4 m, while Amity will grow in water from 1 to 3 m deep (Cameron and Lemcke 1996a).

Because of this, the grasses will be at slightly different development stages, particularly early in the dry season when the floodplains are drying out. Generally the grasses will be grazed in the order of para before Amity before the hymenachnes.

Based on the ranks for the components (Table 1). Amity had the highest digestibility, and para grass the lowest. For most of the major plant nutrients (N, P, K, S) the order of the levels is Olive > Amity > native hymenachne > para grass. For the other nutrients(Ca, Mg, Na and Cu), para grass and/or Amity levels exceeded those in the hymenachnes. The exception to this was for zinc, where the levels were similar.

Para grass had the highest dry matter percentage and Olive the lowest.

Looking at the actual levels in Table 2, those which appear to be significantly higher than the others are for digestibility, Amity & Olive > para grass; for N% (& CP) hymenachnes > para grass; for S % Amity and Olive > native hymenachne and para grass; for Ca % para grass and Amity > hymenachnes; for Na % para grass > Amity >> hymenachnes and for dry matter para grass > Amity and hymenachnes.

Adequacy for Animal Production

The levels of nutrients required in pastures for animal production are presented in Table 3.

Table 3: Nutrient levels[1] required in pastures for animal production by growing cattle and lactating cows.

Nutrient	Growing Steer	Lactating Cow
CP %	11.1	9.2
P %	.13	.18
K %	.50	.80
S %	.15	.15
Ca %	.19	.24
Mg%	.19	.19
Na %	.08	.08
Cuppm	6	7
Znppm	12	14

[1] From (a) Feeding standards for Australian Livestock SCA 1990

(b) Nutrient Requirements of Beef Cattle NAS 1976

* Crude Protein Content - CP = N% x 6.25

Comparing the levels in Table 3 with the mean values for the grasses in Table 2 shows the mean levels of P, K, S, Mg and Zn to be above the levels required for animal production.

The differences in the levels of these nutrients between the grasses are unlikely to affect animal production.

The mean values in the grasses which are below the animal requirements are for para grass: CP%, for native hymenachne Na% and Cu ppm; and for Olive hymenachne Na%, Ca% and Cu ppm.

An examination of the values in Appendix 1 for each month gives a clearer picture of the adequacy of the levels. The crude protein level of the para grass was low in 6 of the months and marginal in 2 others for growing steers. Low or marginal crude protein levels were also found in Amity (6 months), native hymenachne (3 months) and Olive (2 months) at the end of the wet season and during the dry season.

Calcium levels in Olive were low in 11 months for growing cattle and at all samplings for lactating cows. Calcium levels in native hymenachne were low in 8 months, in Amity in 4 months and in para in 2 months.

Sodium levels in the hymenachne were at deficient levels for all recordings. Low sodium levels were recorded in Amity in 8 months.

Copper levels were low or deficient for Olive (12 months), native hymenachne (8 months), Amity (8 months) and para (6 months).

Significance of the levels and differences

All of the samples collected were grab samples of plant tops. Grazing animals can select a better quality diet than that on offer, eating leaf and leaving lower quality stem (McCown and McLean 1983).

Vegetation on the floodplains can change markedly with changes in microtopography, primarily associated with water depth (Wilson *et al* 1990), which would allow grazing animals to graze different plants and correct imbalances or deficiencies in their diet.

Only 1 of the crude protein levels was extremely low, for para grass in July. With animals grazing on the floodplains, the lower crude proteins would probably not cause any significant problems due to diet selection.

Most of the low calcium levels in Olive were during the wet season, as were sodium levels in Amity, when grazing animals should not be on the floodplains (Cameron and Lemcke 1996b). There have been reports of low productivity in livestock grazing quick growing grasses containing less than 0.20% Ca, but grazing animals rarely suffer Ca deficiency (SCA 1990).

Sodium levels in the hymenachnes were invariably low. The supplementation of stock on the floodplains with salt blocks is one avenue to investigate if production improvements could be made with sodium supplementation.

Low copper levels were recorded during the wet season and early dry season. While copper has been suspected in some cases of poor growth of livestock on NT floodplains and the plant levels can sometimes appear to be low, the copper status of animals in the Top End appears to be adequate (Wesley-Smith and Ford 1982). Cyclic changes in animal copper reserves are normal (SCA 1990).

As a general rule, Cu is less available from lush green feed than from dry feed (SCA 1990). The concentration of Cu in pastures is a poor indication of their capacity to meet the Cu requirements of cattle as a number of other plant components including S, Mo, Zn, Fe and Ca can affect the availability of Cu to animals (SCA 1990).

Conclusions

All four grasses provide good dry season feed. While nutrient levels are good during the wet season, they should not be grazed at that time of the year.

The only nutrient deficiency which may be significant is the consistently low levels of sodium in the hymenachnes, but grazing animals on the floodplains may be able to select in their diet other plants with higher sodium levels. The low levels of other nutrients would not be a significant factor for grazing animals. Establishing mixtures of two or three of these grasses on the floodplains would be one way to level out some of the apparent deficiencies by allowing stock to select the species which satisfy their nutritional needs. Planting should be carried out primarily to suit depth of flooding.

The lower digestibility and higher dry matter percentage of the para grass indicate that it is a coarser grass than Amity and the hymenachnes.

Overall, although the differences are generally not large, the nutritive value of the 4 grasses appears to be in the order Amity > Olive > native hymenachne > para grass from highest to lowest.

Grazing animals seem to support this order, particularly in their preference of Amity over the other 3 grasses.

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Appendix 1: Digestibilities, nutrient contents and dry matter by month for 4 floodplain grasses

	1992			1993											1994
	9	10	11	1	2	3	4	5	6	7	8	9	10	11	12	1
(a) Digestibility																
B. mutica	69.4	63.4	55.3	54.3	50.3	32.6	51.8	47.3	44.4	57.1	49.8	50.8	88.4	59.4		
E. polystachya	72.4	72.9		63.2	52.8	55.3	57.3	60.4	68.2	63.0	57.6	61.5	73.9	73.7	74.4	
H. acutigluma	65.9	54.8	51.3	57.8	54.8	56.3	55.3	53.3	62.0	60.4	60.9	60.4	65.6	59.9		
H. amplexicaulis	65.4	67.6	63.4	59.7	56.3	58.3	52.8	54.3	54.6	59.5	59.0	60.0	71.3	69.2	67.8	67.1
(b) Nitrogen %																
B. mutica	1.6	1.9	2.4	3.1	1.2	1.4	4.3	1.4	2.0	0.8	1.7	2.1	1.1	1.6		
E. polystachya	3.5	1.4	2.1	2.8	1.4	2.2	1.4	1.6	2.7	1.7	1.4	1.4	1.9	1.7	2.4	2.5
H. acutigluma	3.1		3.9	3.0	2.4	2.0	1.5	1.3	2.0	1.5	2.0	2.3	2.6	2.2		
H. amplexicaulis	4.4	2.5	2.6	3.4	2.7	2.0	1.6	1.9	1.7	1.7	1.6	2.0	3.0	2.9		2.2
(c) Phosphorus %																
B. mutica	.17	.21	.21	.25	.11	.17	.14	.17	.26	.14	.23	.24	.17	.18		
E. polystachya	.28	.14	.17	.28	.14	.20	.15	.20	.19	.09	.29	.16	.29	.20	.17	.48
E. acutigluma	.23		.24	.24	.21	.20	.14	.12	.17	.11	.24	.22	.26	.18		
H. amplexicaulis	.24	.12	.20	.25	.20	.18	.19	.16	.25	.21	.20	.32	.36	.33		.23
(d) Potassium %																
B. mutica	3.5	3.9	2.6	3.0	2.3	2.3	1.7	2.0	2.4	1.1	2.4	2.8	2.2	2.2		
E. polystachya	2.9	2.7	2.9	2.4	2.6	2.4	2.0	2.2	3.0	2.8	2.5	2.9	3.7	2.0	3.6	3.4
H. acutigluma	3.4		2.2	2.5	2.4	2.1	1.7	1.5	2.5	1.9	3.0	2.8	3.6	3.0		
H. amplexicaulis	3.5	4.3	4.0	3.0	2.6	2.6	2.1	2.7	2.9	1.7	2.8	3.3	4.0	3.8		

	1992			1993												1994
	9	10	11	1	2	3	4	5	6	7	8	9	10	11	12	1
(e) Sulfur																
B. mutica	.26	.23	.23	.25	.11	.15	.21	.20	.40	.21	.35	.41	.26	.22		
E. polystachya	.57	.19	.65	.30	.19	.19	.15	.19	.56	.43	.30	.39	.68	.31	.53	.35
H. actuigluma	.45		.36	.38	.32	.25	.19	.16	.22	.20	.20	.23	.47	.36		
H. amplexicaulis	.51	.53	.53	.36	.25	.25	.25	.30	.38	.25	.35	.28	.48	.50		.35
(f) Calcium																
B. mutica	.24	.29	.32	.26	.10	.17	.41	.43	.45	.55	.63	.60	.34	.49		
E. polystachya	.38	.11	.32	.40	.18	.26	.30	.38	.45	.46	.60	.17	.38	.12	.28	.25
H. acutigluma	.22		.21	.16	.18	.17	.15	.17	.19	.22	.16	.16	.18	.29		
H. amplexicaulis	.19	.19	.28	.10	.10	.10	.10	.10	.15	.12	.19	.17	.13	.11		.10
(g) Magnesium %																
B. mutica	.26	.21	.27	.29	.13	.21	.45	.34	.29	.56	.32	.40	.28	.37		
E. polystachya	.32	.31	.32	.36	.23	.21	.24	.35	.42	.45	.38	.22	.34	.34	.29	.37
H. acutigluma	.25		.21	.16	.22	.19	.20	.22	.29	.25	.26	.41	.39	.29		
H. amplexicaulis	.28	.32	.37	.22	.15	.18	.18	.23	.33	.35	.34	.35	.28	.27		.16
(h) Sodium																
B. mutica	.34	.57	.35	.43	.18	.25	.26	.23	.33	.48	.28	.70	.23	.17		
E. polystachya	.08	.47	.03	.10	.01	.01	.01	.07	.05	.08	.24	.17	.36	.03	.01	.50
H. acutigluma	.03		.01	.03	.01	.01	.02	.01	.01	.02	.01	.04	.03	.02		
H. amplexicaulis	.01	.03	.02	.02	.02	.03	.01	.02	.03	.02	.02	.04	.01	.01		.01

	1992			1993											1994
	9	**10**	**11**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**
(i) Copper ppm																
B. mutica	8	8	7	9	5	4	4	6	4	4	6	6	4	6		
E. polystachia	16	14	7	5	4	4	3	4	10	7	2	6	11	2	8	1
H. acutigluma	12		9	7	3	2	2	2	1	1	1	1	8	11		
H. amplexicaulis	10	11	9	6	3	2	2	2	2	1	4	2	4	4	3	2
(j) Zinc ppm																
B. mutica	34	33	11	25	21	20	20	27	31	29	31	36	29	32		
E. polystachya	41	23	43	16	18	22	18	30	40	31	21	25	44	27	20	22
H. acutigluma	25			29	21	24	18	15	27	16	29	34	47			
H. amplexicaulis	47	38		17	21	25	26	23	29	26	36	32	38	42	30	26
(k) Crude protein %																
B. mutica	10.0	11.9	15.0	19.4	7.5	8.8	8.1	8.8	12.5	5.0	10.6	13.1	6.9	10.0		
E. polystachia	21.9	8.8	13.1	17.5	8.8	13.8	8.8	10.0	16.9	10.6	8.8	8.8	11.9	10.6	15.0	15.6
H. acutigluma	19.4		24.4	18.8	15.0	12.5	9.4	8.1	12.5	9.4	12.5	14.4	16.3	13.8		
H. amplexicaulis	27.5	15.6	16.3	21.3	16.9	12.5	10.0	11.9	10.6	10.6	10.0	12.5	18.8	18.1		13.8
(l) Dry matter %																
B. mutica	22.5	27.3		32.7	23.5	24.4	30.4		33.3	22.9	32.1					
E. polystachya	19.1	26.1			21.7	22.8	24.6		19.4	26.8	22.1					
H. acutigluma	18.3	21.9			22.6	23.9	25.8		21.5	28.6	27.0					
H. amplexicaulis	17.3	21.6			19.9	20.6	25.2		22.0	23.0	21.0					