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Comparative performance of Angus cattle and swamp buffalo fed *ad libitum* either a lucerne hay and concentrate ration or pasture hay

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ABSTRACT

Voluntary intake and liveweight gain of Angus cattle (CAP) and swamp buffalo (B) were compared on 2 feeds; *ad lib.* lucerne hay (L) + 1 kg concentrate/animal/day (LC) and *ad lib.* pasture hay (P) in a 2 x 2 Latin square designed trial. The two hays had similar ME values; L, 8.5 and P 8.7 MJ/ME/kg DM, but differed ($P<0.05$) in protein content; L, 14.6% and P 10.1%. The concentrate was 13.5 MJ ME/kg DM and 14.1% protein. Animals were fed in a feed-lot with individual pens/treatment. Intake was assessed on a group basis for all treatments and individual animal intake was assessed for the P treatments only using slow release chromium capsules. Two, 4 week experimental periods were preceded by a 2 week feed adjustment period.

Liveweight gains showed a species x fed interaction ($P<0.001$) with individual treatment gains (kg/day) of; 0.80, -0.54, -0.02, -0.09 for CLC, CP, BLC, and BP groups respectively. Cattle consumed (group assessment) more ($P<0.05$) L hay than buffalo; 127 vs 99 g DM/kg $LWT^{0.75}$. The intake of P hay was similar for each species; 102 and 100 g DM/kg $LWT^{0.75}$ for C and B respectively. The release of Cr_2O_3 from the capsules were similar for the two species (1.56 g/day). Intakes of P hay assessed by the marker technique differed ($P<0.05$); 100 and 88 g DM/kg $LWT^{0.75}$ for the CP and BP treatments respectively.

The difference in performance of the two species on P may have been the result of the marginal (for cattle) protein levels. No explanation is given for the poor performance of buffalo on the LC ration.

Keywords: Angus cattle; swamp buffalo; voluntary intake; liveweight gain.

INTRODUCTION

Buffalo (*Bubalus bubalis*) are reported to utilise fibrous feeds more efficiently than cattle for growth and milk production (Ganguli 1981). The mechanisms involved are not fully understood and the information based mainly on tropical pastures and crop by-products is conflicting. It appears buffalo have a higher intake than cattle when offered fibrous feeds due to a higher rate of rumen turnover and passage of feed (Kennedy *et al.*, 1987 (a)). Buffalo also utilise nitrogen in low protein feeds more efficiently than cattle (Homma & Ichikawa, 1984, Kennedy *et al.*, 1987b;). Preliminary studies in New Zealand (Purchas *et al.*, 1993) showed fewer large particles (>2.0 mm) in rumen digesta of buffalo compared to cattle suggesting buffalo have the capability of breaking down feeds more rapidly than cattle. This study is supportive of conclusions drawn by Kennedy *et al.* (1987a).

Swamp buffalo were introduced to New Zealand in February 1990. One of the reasons for the introduction was the possible advantage of buffalo over cattle for meat production on low quality feeds. This study is the first reported on the relative performance of buffalo and cattle on different feeds in New Zealand.

MATERIALS AND METHODS

Only 10 buffalo of similar age and sex, born and reared in New Zealand, were available for the study. The 10 rising 2 year heifers (B) were the progeny of buffalo cows, brought to New Zealand from the Northern Territory, Australia. The performance of these animals under feed-lot conditions were compared with 10 Angus cattle (C) of similar age and sex on two types of feed; *ad lib.* lucerne hay (L) + 1 kg concentrate/animal/day and *ad lib.* pasture hay (P) selected for its low leaf content and apparent poor feed quality.

The trial was run as a 2 x 2 Latin square design with 5 animals/treatment group. Each experimental period of 4 weeks was preceded by a 2 week period of adjustment to the new type of feed. A small feed-lot was available for the trial and for the trials duration all experimental animals were retained on the feed-lot with each treatment group contained on sawdust in pens of 200-250 m^2.

Measurements

At the start and end of each experimental period all trial animals were weighed following 24 hours without food. Liveweight gain (kg/animal/day) was calculated from the difference in fasted liveweight between the start and end of the experimental periods.

Feed was offered and refusals withdrawn at approximately 9.00 am each day. On 6 occasions/experimental period the daily weight of feed offered and refused was recorded. Three sub-samples of each feed type, were taken for DM determination and analysed (NIRS technique) for % DOM, % Protein and ME. From the difference in DM feed offered and

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DM feed refused/group an assessment of the total amount of feed consumed/group/day was made.

Intake of animals fed pasture hay was also assessed using slow release chromium capsules (CAPTEC) administered to all animals on the pasture hay treatments at the commencement of each experimental period. From day 6 to day 27 following insertion of capsules, faecal samples via the rectum were collected at 2-3 daily intervals.

An end-point for the release of chromium was taken as the day preceding the time when chromium levels in faeces dropped by 50%. A release rate of chromium was calculated from the specifications of the batch of capsules and DM intake calculated by the procedures proposed by Barlow *et al.* (1988).

Statistical analysis

Liveweight gain was analysed as a 2 x 2 factorial Latin square by general linear model procedures (Statistical Analysis Systems Institute, 1987) using the initial liveweight as a covariate. The chemical composition of feed and group intakes were analysed by similar procedures using the average value recorded over each experimental period.

RESULTS

Feed analysis:

The two hays used in the trial were similar (Table 1) in digestibility and ME values but differed ($P < 0.05$) in protein content. The feed value of the concentrate, a commercial formulation for dairy cows, was similar to the manufacturers specifications and higher ($P < 0.001$) in digestibility and ME than the 2 hays but similar to lucerne hay in protein content.

TABLE 1: Chemical composition of the three feeds offered to cattle and buffalo.

		% Composition			ME
		DM	DOM	Protein	(MJ/kg DM)
Lucerne Hay		85.7	58.1	14.6	8.5
Concentrate		86.7	88.2	14.1	13.5
Pasture hay		86.4	58.9	10.1	8.7
Sig.		NS	**	*	**
LSD	0.05	-	9.6	2.9	2.5
	0.01	-	17.6	-	3.5

Liveweight and liveweight gain:

Although the cattle and buffalo were of similar age, the average liveweights recorded throughout the experiment differed ($P < 0.001$). Over the experiment the average liveweight for each treatment group was; 393, 391, 333 and 329 kg/animal for the CLC, CP, BLC, and BP groups respectively.

The average liveweight gains recorded over the 2 trial periods (Table 2) show different ($P < 0.001$) effects of feed on liveweight gain for the two animal species. On the LC ration cattle gained liveweight ($P < 0.001$) whereas buffalo maintained liveweight. On the P ration both species lost liveweight but the cattle more ($P < 0.01$) than buffalo.

TABLE 2: Average liveweight gain of cattle and buffalo offered 2 types of feed.

	Treatment	LWT Gain (kg/day)
	CLC	0.80
	CP	-0.54
	BLC	-0.02
	BP	-0.09
Sig. Species x feed interation		***
LSD	0.05	0.22
	0.01	0.30

Voluntary intake:

Intake of feed/group varied little between days and between the two experimental periods. The coefficient of variation of group intakes were 4%, 3%, 6% and 5% for the CLC, CP, BLC and BP groups respectively. Intake of each treatment group expressed as kg DM/animal/day, g DM/kg LWT and g DM/kg $LWT^{0.75}$ are presented in Table 3. Both cattle and buffalo consumed all the concentrate offered (1 kg DM/animal) each day. Cattle consumed more lucerne hay than pasture hay. For buffalo, the voluntary intake of the two hays was similar and similar to the voluntary intake of P hay by cattle.

TABLE 3: Voluntary intake of cattle and buffalo calculated from the difference between feed offered and feed refused by each treatment group - calculated as kg DM/animal/day.

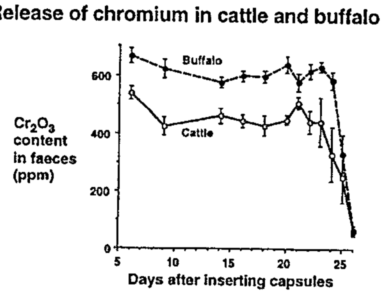
	Treatment					LSD	
Intake/animal	CLC	CP	BLC	BP	Sig.	0.05	0.01
Lucerne Hay	11.2		7.7		**		
Pasture hay		9.0		7.7	NS		
Concentrates	1.0		1.0		NS		
Total	12.2	9.0	8.7	7.7	**	1.6	2.9
Total intake/kg LWT							
g DM/kg LWT	31.0	23.0	36.1	23.4	NS		
g DM/kg $LW^{0.75}$	138.2	102.3	111.7	99.8	*	14.3	-
Hay intake/kg LWT							
g DM/kg LWT	28.5	23.0	23.1	23.4	*	3.2	-
g DM/kg $LW^{0.75}$	126.8	102.3	98.8	99.8	*	14.1	-

Indirect assessment of intake:

At the time of presentation of this paper, chromium analysis for period 1 only was available. In period 1, 1 capsule was lost from a buffalo and all capsules were retained by cattle. The average chromium levels (p.p.m. Cr_2O_3) in faeces over the 27 day monitory period for cattle and buffalo are presented in Figure 1. From these data the end-point of chromium release from the capsules for cattle and buffalo were 21.4±0.7 and 22.2±0.2 days respectively. As the difference was not significant an average time of release of 21.8 days was used for both species. From the initial weight of Cr_2O_3 in the capsules (35.8 g) the daily release rate was calculated as 1.64 g Cr_2O_3/day, which was greater than the 1.44 g/day specified by the manufacturer.

Voluntary intake of pasture hay as calculated from the chromium marker (Table 4) was similar to the intake for

FIGURE 1: Mean (SEM) concentration of chromic oxide in faeces of cattle and buffalo.



period 1 recorded from the group intake for cattle but was lower (13.4%) for buffalo. As a result when intakes were expressed per unit of metabolic body size buffalo consumed less ($P < 0.01$) P hay than cattle.

TABLE 4: Voluntary intake of pasture hay by cattle and buffalo as assessed by the chromium marker technique (period 1).

	Animal Species				
	Cattle		Buffalo		Sig.
kg DM/day	8.8	(9.0)	6.7	(7.6)	**
SE	0.2	(0.4)	0.2	(0.3)	
g DM/kg LWT	22.9		20.8		*
SE	0.6		0.6		
g DM/kg $LWT^{0.75}$	101.1		88.4		**
SE	2.2		2.5		

( ) Average intake in period 1 assessed from intakes/group

DISCUSSION

The two feeds selected for this study was on the assumption they would have differed to a greater extent than was actually found (Table 1). With the addition of only 1 kg concentrate/animal/day the ME value of the LC ration consumed by cattle and buffalo (8.9 and 9.1 MJ/kg DM for CLC and BLC respectively) differed little to pasture hay (ME, 8.7 MJ/kg DM). The feeds however differed in protein content ($P < 0.05$) and the intake of legumes is usually higher than grasses of similar digestibility (Thornton & Minson, 1973). These differences are of sufficient magnitude to justify the comparison of performance of cattle and buffalo on two feed types.

Voluntary intakes of both cattle and buffalo recorded in this study were high; 3.1% liveweight for the CLC treatment and an average of 2.4% for CP, BLC and BP treatments as assessed from group intakes and 2.3% and 2.1% for CP and BP treatments assessed by the CAPTEC method. Despite the high intakes, liveweight gains were poor except for the CLC treatment (Table 2). Charles & Johnson (1975) reported liveweight gains for buffalo steers of 0.56 and 0.64 kg/day when fed respectively on lucerne hay (crude protein 14-15%) or two thirds lucerne hay and one third concentrates. On a mainly concentrate ration Johnson & Charles (1975) reported similar liveweight gains for Angus cattle (0.72 kg/day) and buffalo (0.67 kg/day) steers. No estimate of intake was made in either of these studies. A summary of voluntary intakes of Brahman x cattle and buffalo reported by Kennedy (1990) showed that Brahman x cattle consumed on average 1.5% of liveweight and buffalo 1.6% of liveweight for a wide range of feeds; with and without NPN supplement, varying in DOM from 33-60%. However intakes of 2.0 to 2.3% of liveweight were recorded for buffalo, significantly ($P < 0.01$) higher than cattle, on a rice straw + grain + urea + protein + minerals ration.

In early studies reviewed by Ganguli (1981) and Sastry (1984) buffalo were reported to have a higher voluntary intake than cattle and utilise fibrous feeds more efficiently. Studies by Norton et al. (1979), Homma & Ichikawa (1983), Homma (1986) and Kennedy (1990) have supported that voluntary intake of buffalo may be higher for buffalo than cattle for only fibrous, poor quality feeds because of the ability of buffalo to maintain higher rumen ammonia concentrations and a more active rumen fibrolytic activity.

It could be argued the crude protein levels of pasture hay used in the reported study were low (10.1% crude protein) and marginal for the maintenance and growth of cattle (ARC, 1984). With consideration to the greater efficiency of N utilisation by buffalo, the low protein level in pasture hay could possibly explain the loss in liveweight (-0.54 kg/day) of cattle and the improved ($P < 0.001$) performance of buffalo on this feed.

The higher liveweight gain of cattle ($P < 0.001$) compared to buffalo on the LC ration was in part due to a 28% increase ($P < 0.05$) in intake of lucerne hay. No explanation for this increased intake by cattle in comparison with buffalo is possible from published information because in most trials where intake was assessed, buffalo feed intake was either similar to or greater than cattle.

CONCLUSION

On a feed marginal for protein status a marked animal species x feed type interaction was recorded. In terms of liveweight gain, Angus cattle utilised the higher protein feed (lucerne hay + concentrate, 14.6 % crude protein) better than buffalo whereas on the marginal protein feed (pasture hay, 10.1% crude protein) feed utilisation by buffalo was greater than cattle.

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