STRATEGIES TO IMPROVE BALI CATTLE IN EASTERN INDONESIA

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Feeding Strategies to Improve the Production Performance and Meat Quality of Bali Cattle (*Bos sondaicus*)

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Abstract

A range of high quality rations was fed to Bali cattle in two experiments to test the hypothesis that perceived degeneration of genetic capacity of these animals may be due to poor nutritional management. On a diet supplemented with 4 kg of high quality concentrate, animals gained up to 850 g per day compared with control animals that grew at 526 g/day on a traditional rice-bran supplement. Their feed conversion was also significantly better (6.42 vs. 9.59). In addition, in a taste panel test, the meat from the faster-growing animals achieved preference scores as high as those for imported meat and much higher than those for poorer fed, slower-growing animals. It was concluded that Bali cattle can grow well and produce good quality meat if their nutrition is managed adequately.

Introduction

WITHIN Indonesia, Bali cattle (*Bos sondaicus*) have been reported to be superior to other breeds in fertility and conception rate (Oka and Darmadja 1996) and adaption to harsh environments, and to be highly efficient in utilising low quality feed (Darmadja 1980; Darmadja and Oka 1980; Martojo 1995). However, until recently a lot of national attention has been paid to the perceived weaknesses of Bali cattle, such as slow growth rate and small body size (Sonjaya and Idris 1996), high calf mortality due to low milk production (Wirdahayati and Bamualin 1990), and poor quality or tough meat (Arka 1996). Some scientists have also proposed that this breed should be replaced or crossed with exotic breeds with faster growth rates and a higher target body size.

These workers concluded that the weaknesses of Bali cattle were genetically based. However, these opinions and suggestions come mostly from the eastern parts of Indonesia where feeding conditions, management and farmers' skills are very different from those on Bali, the original home of Bali cattle. In this island, the problems cited are not apparent and, in fact, every year a contest carried out by the Department of Animal Husbandry shows that the heaviest Bali bulls are between 800 and 850 kg. These contradictions suggest that the supposed weaknesses of Bali cattle are in fact not due to genetic factors but related to environmental, nutritional and management factors. There has undoubtedly been a decrease in the mature size of Bali cattle in other areas of Indonesia, perhaps due to negative selection for growth and size, but while this may have a genetic component it is primarily a management issue.

To support these arguments two experiments were carried out, firstly to study the performance of Bali cattle when fed good quality feed, and secondly to examine the effects of combinations of feeding strategies such as the application of non-protein nitrogen (NPN), starbio, or legume and other leaves considered to contain anti-protozoal agents or to improve the ruminant ecosystem. Meat quality was also assessed in these experiments.

Materials and Methods

Young Bali cattle steers with an average body weight of 122 kg (experiment 1) and 150 kg (experiment 2) were used for the studies.

Two experiments were carried out in a feed-lot system to study the growth, feed conversion efficiency, performance and meat quality of Bali cattle fed high quality rations. Both experiments were run at Br. Siyut, Tulikup village of Gianyar Regency, Bali, the first for 112 days and the second for 120 days.

The first experiment used a complete randomised block design in which 25 young Bali cattle steers were divided into 5 groups, then fed:

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- a control diet consisting of 70% elephant grass (*Pennisetum purpureum*) + 30% *Gliricidia* (treatment A); or
- 50% elephant grass + 30% *Gliricidia* + 20% *Hibiscus* leaves (Treatment B);
- 70% elephant grass + 15% *Gliricidia* + 15% urea molasses blocks (UMB) (treatment C); or
- 50% elephant grass + 20% *Gliricidia* + 15% *Hibiscus* leaves + 15% UMB (treatment D); or
- 40% elephant grass + 60% concentrate 20.74% Crude Protein (CP) and 77.3% Total Digestible Nutrients (TDN) (treatment E).

The second experiment, involving 12 Bali cattle steers, was a complete randomised factorial design consisting of two main and two sub-treatments. Each treatment consisted of three replicates with one steer each. The animals were randomly assigned and fed:

- elephant grass and 4 kg rice bran (13% CP and 75% TDN) (treatment RD); or
- similar to treatment RD, but with the rice bran supplemented by 0.5% starbio (treatment RDS); or
- elephant grass and 4 kg concentrate (18.34% CP and 72.5% TDN) (treatment RK); or
- similar to treatment RK but with the concentrate supplemented by 0.5% starbio (treatment RKS).

Feed and water were provided ad libitum. During both experiments, feed consumption was recorded daily and body weight was measured every second week. At the end of the experiment, the animals were slaughtered and measurements of carcass weight and of carcass components were carried out at the abattoir, where meat samples were taken. Subsequently, organoleptic tests of meat cuts were undertaken at the Bali Beach Hotel, Bali, for samples from the first experiment, and at the Bali Intercontinental Resort, Jimbaran, Bali for samples from the second experiment.

Results and Discussion

Results are summarised in Tables 1 and 2 for experiments 1 and 2 respectively.

In the first experiment, cattle fed 40% grass + 60% concentrate (treatment E) had significantly higher ($P<0.05$) body weight and body weight gains and feed conversion efficiencies that those on the four other diets. Overall, cattle fed the control diet had the smallest body weight gain and lowest feed conversion efficiency of any group. The total organoleptic acceptance score for samples from animals fed

Table 1. Experiment 1: Performance of Bali cattle fed concentrate on feedlotting system (112 days).

Treatment	Initial body weight (kg)	Final body weight (kg)	Weight gain (kg)	Daily weight gain (g)	Total feed consumption (kg dry matter)	Food conversion ratio	Meat quality score
A	122.1 ± 9.2	159.08^{a} ± 14.8	36.98	320^{b}	375.20	10.60^{a}	5.90^{a}
B	122.1 ± 8.9	165.83^{a} ± 12.3	43.73	390^{b}	456.96	11.01^{a}	7.05^{b}
C	122.1 ± 18.8	172.67^{a} ± 25.1	50.47	440^{b}	435.68	9.27^{a}	6.15^{a}
D	122.1 ± 7.39	172.3^{a} ± 2.7	50.23	450^{b}	502.88	10.14^{a}	7.80^{c}
E	122.1 ± 2.66	208.0^{b} ± 9.2	86.07	760^{a}	406.56	5.08^{b}	7.20^{bc}
Imported beef							7.20^{bc}

Values in the same column with different superscripts are significantly different ($P<0.05$). Treatment A: 70% grass + 30% *Gliricidia*; treatment B: 50% grass + 30% *Gliricidia* + 20% *Hibiscus*; treatment C: 70% + 15% *Gliricidia* + 15% UMB; treatment D: 50% grass + 20% *Gliricidia* + 15% *Hibiscus* + 15% UMB; Treatment E: 40% grass + 60% concentrate (20.74% CP, 77.3% TDN).

Table 2. Experiment 2: Performance of Bali cattle fed high quality concentrate of rice bran, with or without starbio supplement.

Treatment	Initial body weight (kg)	Final body weight (kg)	Weight gain (kg)	Daily weight gain (g)	Total feed consumption (kg DM)	FCR	Meat quality score
RD	152.7	215.81^{a}	63.13^{a}	526.08^{a}	605.99^{a}	9.59^{a}	5.87^{a}
RDS	151.3	218.71^{a}	67.66^{a}	563.83^{a}	587.37^{a}	8.68^{a}	6.16^{b}
RK	155.8	258.0^{b}	102.2^{b}	851.67^{b}	655.83^{b}	6.42^{b}	6.58^{c}
RKS	156.5	249.7^{b}	93.16^{b}	776.33^{b}	656.23^{b}	7.04^{b}	6.71^{bc}
Imported beef							7.39^{c}

Values in the same column with different superscripts are significantly different ($P<0.05$). Treatment RD: grass + 4 kg rice bran; treatment RDS: grass + 4 kg rice bran + 0.5% starbio; treatment RK: grass + 4 kg concentrate (18.34% CP, 72.5% TDN); treatment RKS: grass + 4 kg concentrate + 0.5% starbio.

treatment E was the same as that for imported meat and significantly higher ($P<0.05$) than for samples from animals on the control diet or on treatment C.

Results from the second experiment confirmed those of the first study. Steers fed elephant grass + concentrate, either with or without 0.5% starbio supplementation (treatments RK or RKS), had significantly heavier body weight and body weight gains ($P<0.05$), consumed significantly ($P<0.05$) more feed and had significantly better ($P<0.05$) feed conversion efficiencies than those fed elephant grass + rice bran with or without starbio supplementation (treatments RD or RDS).

Neither supplementation nor starbio significantly affected any of the measured parameters other than eye muscle area index, where starbio supplementation significantly ($P<0.05$) increased this parameter. Carcass weight, components of the carcass and percentage physical composition of the carcass were not significantly affected by treatments, although steers on treatment RK had a slightly higher carcass percentage and absolute carcass weight.

In this second experiment the total organoleptic acceptance score (colour, texture, flavour and taste) in meat samples from steers fed elephant grass + concentrate, either with or without starbio supplementation (treatments RK and RKS), was significantly higher ($P<0.05$) than in those fed elephant grass + rice bran with or without starbio (treatments RD or RDS). Starbio supplementation tended to improve meat quality scores but only minimally, and overall, total organoleptic scores for all treatments were marginally below those for imported meat.

Thus in these two experiments optimal performance and feed conversion efficiency of Bali steers were achieved with good quality concentrate-supplemented diets. The probiotic starbio had no effect on the parameters measured.

Thus the assumption that the growth rate of Bali cattle is low due to genetic factors is not completely true and is in need of further investigation. Evidence from this experiment is that feed quality is perhaps the most important factor in improving Bali cattle performance; management factors may also be involved. It is interesting to note that the meat quality scores of Bali cattle fed concentrate were similar to those of imported meat. Improvement in feed quality could thus also improve meat quality of Bali cattle. Another interesting point to note is that the supplementation of *Hibiscus* leaves significantly improved meat quality. However the mechanism for this is not yet understood. Is some unknown substance responsible? This is an area for further study.

The author has already emphasised (Mastika 1996, 1997) that the main problem of animal production in Indonesia in general, and in the eastern parts in particular, is insufficiency of both quality and quantity of available feed for the whole year. Also, the feeding systems for Bali cattle practised by farmers are influenced by socio-cultural factors as well as by the local environment. All these factors therefore are likely to have a profound effect on the performance of Bali cattle.

Growth, feed conversion efficiency and meat quality of Bali cattle could be enhanced by improving both feed quality and management. Growth rate examples taken from a variety of studies on feeding and management of Bali cattle are shown in Table 3.

Table 3. Summary of experiments into the growth and performance of Bali cattle.

Author	Experimental detail	Weight gain (g/head/day)
Moran (1976)	Bali cattle — feedlot: concentrate ad libitum	660
Musofie et al. (1982)	Bali cattle — feedlot: sugar cane tops + 0.45% *Leucaena* leaf DM	298
Aryawan (1989)	Bali cattle — feedlot: grass + 3 kg rice bran + 15 g starbio	543
Bamualin (1995)	Young Bali cattle — feedlot: 50% King grass + 37.5% *Sesbania* + 12.5% *putak*	510
Rika (1995)	Grazing — legume — Negara, Bali — male Bali cattle (175–200 kg): *Caliandra* pasture under coconut	108
Nitis (1996)	Bali cattle — feedlot: — very intensive (0.25 ha)	169.8
	— less intensive (0.5 ha)	151.6
Parwati et al. (1999)	Bali cattle (220–240 kg): grass + 2 kg rice bran	414
	grass + 2 kg rice bran + 5 cc bio plus	491
	grass + 2 kg rice bran + 20 g starbio	517
Mastika et al. (1996)	Bali cattle (steers) 120 kg — feedlot: 40% elephant grass + 60% concentrate (20.7% CP, 77% TDN)	760
Mastika et al. (2000)	Bali cattle (steers) 150 kg — feedlot: Elephant grass + 4 kg rice bran	526
Mastika (2001)	Elephant grass + 4 kg concentrate	851

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