

## Weaning and Supplementation Increase Liveweight Gain of Bali (*Bos javanicus*) Cattle of Small-holder Farmers in Central Lombok, Indonesia

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**Abstract.** One of the constraints for improving productivity of Bali cattle in west Nusa Tenggara Province is the low growth rate of weaned calves. Results of on-station experiments showed that *Sesbania grandiflora* (sesbania) supplementation can significantly increase live weight gain of weaned calves. The objective of this experiment was to investigate whether sesbania supplementation can increase live weight gain of weaned calves and improve farmer income. This experiment was carried out in Tandek, Labulia Village (treatment village) and in Kelebu and Sukaraja villages (control villages) central Lombok District from April to October 2008. A total of 21 calves (9 males and 12 females) aged 237±7 days with initial live weight of 122.3±4.5 kg were monitored in Kelebu and Sukaraja villages (control villages). During the same period, 25 calves (13 males and 12 females) aged 237±6 days with initial weight of 108.8±4.1 kg were monitored in Tandek Village (treatment village) and fed fresh sesbania at 1% dry matter of live weight. To ensure that sesbania was fed at the recommended level, regular weighing of sesbania offered by each farmer was conducted 2-3 times per week. All calves were weighed every month to determine live weight gain. Farmers from the control villages and other villages were invited to a field day conducted in the treatment village at the end of the experiment. The results showed that sesbania supplementation significantly increased live weight gain (0.36±0.01 kg/day for calves in the treatment village compared to 0.22±0.01 kg/day for those in the control villages), increased body condition and health of the calves and improved farmer income. Weaning management and supplementation with sesbania was very easy to implement so most of the farmers participated in this study stated that they were willing to continue this feeding management.

**Keywords:** Bali calves, growth, early weaning, *Sesbania grandiflora*, Lombok

**Abstrak.** Salah satu permasalahan untuk meningkatkan produktivitas sapi Bali di NTB adalah rendahnya tingkat pertumbuhan pedet lepas sapih. Hasil kajian di pusat penelitian menunjukkan bahwa suplementasi dengan pakan lokal seperti daun turi terbukti dapat meningkatkan pertambahan bobot badan pedet lepas sapih secara nyata. Penelitian ini bertujuan untuk menguji apakah suplementasi dengan daun turi pada peternakan skala kecil dapat mempercepat pertumbuhan pedet lepas sapih dan meningkatkan pendapatan peternak. Penelitian dilakukan di Dusun Tandek, desa Labulia Lombok Tengah (lokasi intervensi) dan di Desa Kelebu dan Sukaraja Kecamatan Praya Tengah (lokasi kontrol), Kabupaten Lombok Tengah mulai bulan April sampai Oktober 2008. Sejumlah 21 ekor pedet (9 jantan dan 12 betina) yang berumur 237±7 hari dengan bobot badan awal 122,3±4,5 kg diamati di Desa Kelebu dan Sukaraja (lokasi kontrol). Pada saat yang sama, 25 ekor pedet (13 jantan dan 12 betina) berumur 237±6 hari dengan bobot badan awal 108,8±4,1 kg diamati di Tandek (lokasi intervensi) dan diberikan pakan tambahan berupa daun turi (sekitar 1% BK dari bobot badannya). Untuk memastikan jumlah daun turi diberikan sesuai dengan rekomendasi, dilakukan penimbangan daun turi yang diberikan secara acak dua sampai 3 kali seminggu. Penimbangan bobot badan dilakukan setiap bulan dan pada akhir penelitian dilakukan temu lapang dengan mengundang peternak dari lokasi kontrol dan lokasi lainnya di Lombok Tengah. Hasil penelitian menunjukkan bahwa penyapihan dan suplementasi daun turi secara nyata meningkatkan pertambahan bobot badan lepas sapih (0,36±0,01 kg/hari pada kelompok intervensi dibandingkan dengan 0,22±0,01 kg/hari pada lokasi kontrol), meningkatkan kondisi dan kesehatan pedet dan meningkatkan keuntungan peternak. Manajemen

penyapihan dan suplementasi dengan daun turi sangat mudah dilakukan sehingga sebagian besar peternak yang berpartisipasi dalam temu lapang menyatakan bersedia menerapkannya.

**Kata kunci :** Sapi Bali, pertumbuhan, penyapihan, *Sesbania grandiflora*, Lombok

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## Introduction

Bali cattle are the main cattle species in Central Lombok, West Nusa Tenggara province, Indonesia (8°N to 9°S and 115° to 119°E). In Central Lombok each farm is approximately 0.2 ha in area with small-holder farmers typically planting 2 rice crops followed by a single cash crop of soybean, peanut or maize each year, with an average 2 Bali cattle per household.

The main constraints of Bali cattle productivity in Central Lombok are low calving rate, high mortality (especially calf mortality) and low liveweight gain. To overcome these constraints, an integrated village management system (IVMS) consisting of seasonal natural mating, managed weaning and strategic supplementation was implemented and significantly increased calving rate, reduced mortality and improved weaning liveweight of Bali cattle in Central Lombok, West Nusa Tenggara (Panjaitan et al., 2008). The IVMS has successfully been scaled out to 36 villages in Central Lombok (Dahlanuddin et al., 2011) and incorporated into the provincial government plan to improve Bali cattle productivity in West Nusa Tenggara. One of the expected outcomes of the large scale implementation of the IVMS will be a significant increase in the number of Bali calves weaned by small-holder farmers.

The growth of Bali cattle has been reviewed by Marsetyo et al. (2008) with growth rates ranging from 0 to 0.85 kg/d reported, depending on age of animal, quality of diet offered and management system employed. Few experiments

have been conducted with weaned Bali cattle, six to 12 months of age, and none within the small-holder cattle production system of Central Lombok. Experiments conducted with this class of Bali cattle on research stations indicated that the maximum growth rate is approximately 0.65 kg/d with a high crude protein, maize grain/soybean meal based diet (Poppi and Quigley, 2009). These feeds are not used by small-holder farmers due to the high cost, availability of ingredients and technical expertise required in formulation and preparation, so local feeds that increase the growth of this class of animal are required. *Sesbania* (*Sesbania grandiflora*) is readily available to small-holder farmers in Central Lombok and can be grown on the bunds of rice paddy fields, and as such is easily integrated into the small-holder farming systems in this area (Dahlanuddin et al., 2005). Research conducted on-station suggested that supplementation of Bali calves fed native grass with sesbania had a higher average daily gain than calves fed native grass alone (Poppi and Quigley, 2009).

The current experiment introduced weaning and supplementation of weaned calves in Central Lombok and measured the liveweight gain of calves, the economic benefits to farmers and the farmers perceptions to the weaning and feeding strategy implemented.

## Materials and Methods

An on-farm evaluation of a feeding strategy to increase liveweight gain of weaned Bali calves

was conducted in villages in Central Lombok, Indonesia. Kelebu and Sukaraja villages were allocated as control villages, while Tandek was allocated as the intervention village. The treatment and control villages were approximately 7 km apart, with Tandek typically experiencing a higher rainfall (1500-2500 mm/year) compared with Kelebu and Sukaraja villages (1000-1750 mm/year). The study was conducted between April and October, 2008.

Kelebu and Sukaraja villages (control). Bali calves (n=9 males and n=12 females), aged approximately nine months ( $237 \pm 7$  days) and  $122.3 \pm 4.5$  kg liveweight were given an individual identification number. These cattle were maintained under normal feeding management practices, consisting of native grass and gliricidia. Cattle were typically maintained in a communal kandang overnight before moving to the farmer's individual kandang or tethered on bunds or roadsides, during the day. Calf liveweight was recorded once each month over a six month period and average daily liveweight gain was determined.

Tandek village (treatment). Weaned Bali calves (n=13 males and n=12 females), aged approximately nine months ( $237 \pm 6$  days) and  $108.8 \pm 4.1$  kg liveweight were given an individual identification. Those animals not already weaned were removed from their mothers for an initial separation period of at least three weeks. Farmers collected a daily allocation of sesbania from their own plots each morning and offered the equivalent of 10 g sesbania DM/kg W.d to each calf prior to their usual feeding management. The amount of sesbania was randomly checked several times each week throughout the experiment and was adjusted at each monthly weighing. Cattle were typically maintained in a communal kandang overnight before moving to the farmer's individual kandang

or tethered on bunds or roadsides during the day. Calf liveweight was recorded once each month over a six month period and average daily liveweight gain was determined.

The economic evaluation of the sesbania supplementation strategy was based on the assumptions cattle live weight was valued at 35,000 rupiah/kg (the approximate price of breeding stocks), and that the price of sesbania was fixed at 350 rupiah/kg on an as fed basis; the typical basal forages in these villages were valued at 250 rupiah/kg on an as fed basis, and has been described previously by Priyanti et al. (2010). At the conclusion of the six month monitoring period a field day was held at Tandek and a total of 60 farmers from Kelebu, Sukaraja, Sukaraja, Ubung, Gontoran, Jelantik and Mengelok in Central Lombok were surveyed.

Liveweight gain over the six month monitoring period was determined by regression of change in liveweight over time. Data was analysed using the General Linear Model procedure in SAS (SAS Institute v9.2) which included treatment and sex, and their interaction, as fixed effects. When there was no significant interaction between treatment and sex this term was removed from the model.

## Results and Discussion

### Results

Weaned Bali calves which received sesbania supplementation, in Tandek village, grew significantly faster ( $0.36 \pm 0.01$  kg/day) than calves maintained under traditional management systems ( $0.22 \pm 0.01$  kg/day) ( $P < 0.05$ ) over the six month monitoring period. There was a tendency towards a significant interaction between sex and treatment ( $P = 0.051$ ) for average daily liveweight gain, with male weaners ( $0.38 \pm 0.02$  kg/d) growing faster than female weaners ( $0.32 \pm 0.02$  kg/d) supplemented with sesbania but no

difference between male ( $0.20 \pm 0.02$  kg/d) and female ( $0.22 \pm 0.02$  kg/d) control calves. Bali cattle supplemented with sesbania gained  $65.0 \pm 2.4$  kg liveweight over the six month monitoring period, which was significantly greater than Bali cattle maintained under the existing management system ( $40.0 \pm 2.7$  kg;  $P < 0.05$ ) (Figure 1). There tended to be a significant interaction between sex and treatment ( $P = 0.062$ ) on change in liveweight over the six month monitoring period, with males gaining more liveweight than females when weaned and supplemented with sesbania but no differences were evident between the male and female control calves (Figure 1). Economic analysis indicated that the supplementation of Bali calves with sesbania would result in a profit of 3600 rupiah/head.d greater than when calves were managed under the existing management system (Priyanti et al., 2010).

Of the 20 farmers surveyed upon completion of the experiment 19 indicated that they would

adopt the weaning and supplementation strategy implemented at Tandek. The farmers perceptions of the benefits of the weaning and supplementation strategies were that cattle fed sesbania had higher growth rates than other cattle, sesbania provides a good diet combination and that sesbania is a low cost feed that is available locally. The one farmer that indicated the weaning and supplementation strategies would not be adopted, indicated that this was due to lack of sesbania supply and no land to plant sesbania.

### Discussion

Weaned Bali calves supplemented with sesbania gained 0.14 kg/d more liveweight than unweaned Bali cattle that were maintained under traditional feeding management systems in Central Lombok. A similar response to copra meal combined with rice bran was reported by Damry et al. (2009) with a similar class of cattle in Central Sulawesi. Sesbania has a high crude

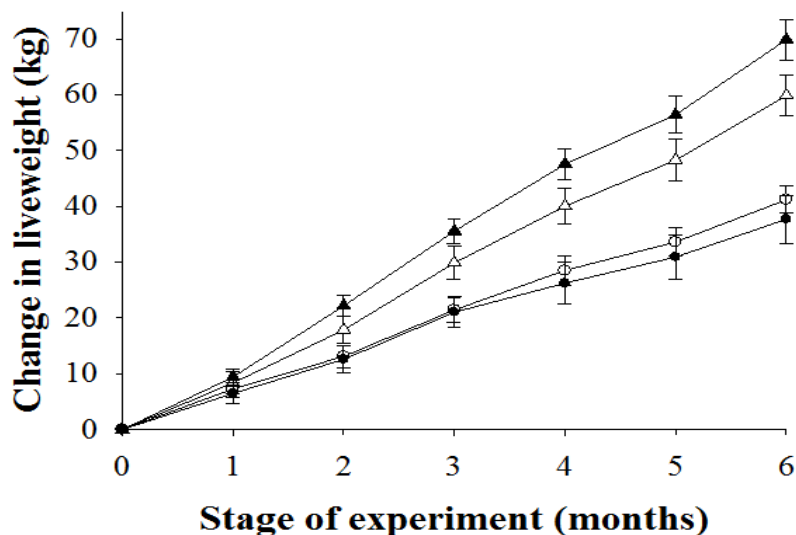


Figure 1. Change in liveweight of Bali cattle maintained under the traditional management system (Control; ● male and ○ female) or weaned at nine months of age and fed sesbania (10 g DM/kg W.d) (Treatment; ▲ male and △ female ) in villages in Central Lombok, Indonesia

protein content (>200 g CP/kg DM) and the results of the present work and the work of Damry et al. (2009) demonstrate a response to additional protein in the diet for weaned Bali cattle. Poppi and Quigley (2009) demonstrated the response in liveweight gain of six to 12 month old Bali cattle to dietary protein content and suggested that these animals have a high requirement for protein (~180 g CP/kg DM) to maximise liveweight gain (0.65 kg/d). It is likely that the supply of additional protein from sesbania also would have increased total dietary intake above unsupplemented control animals, and the liveweight response evident in this experiment may be related to higher protein and metabolizable energy intake.

Liveweight gain of unweaned Bali calves maintained under traditional feeding management in the present study was comparable to that reported by Damry et al. (2009) over six months in Central Sulawesi and for weaned Bali calves fed native grass in on-station experiments (Poppi and Quigley, 2009) which ranged from 0 to 0.2 kg/d. Liveweight gain of Bali cattle fed native grass can be as low as 0 kg/d during the dry season under cut and carry systems (Dalgleish et al., 2010) or as high as 0.33 kg/d when grazing within coconut plantations with a good annual rainfall distribution (Copland, 1974). While liveweight gain of Bali cattle has been reported to be above 0.5 kg/d (Mastika, 2000; Moran, 1985; Siregar and Talib, 1992) and as high as 0.85 kg/d (Mastika, 2001), these are often when concentrates are included in the diet. The use of concentrates and other processed supplements are unlikely to be adopted by small-holder farmers due to cost, availability or complicated processing requirements. Feeding tree legumes, such as sesbania, as the sole component of the diet may result in a greater

liveweight gain response than when it is offered as a supplement (Poppi and Quigley, 2009), however it is unlikely to be sustainable. If tree legumes are fed as the sole component of the diet for an extended period of time the on-farm supply will be more rapidly depleted compared to feeding as a proportion of the diet, where a smaller amount of material is required. This is particularly important during the dry season, where a source of high protein supplement may be required to maintain growth rates when other feed resources are scarce. Sesbania is well suited to the small farm size and intensive cropping activity of small-holder farmers in Central Lombok, it requires no productive land for establishment (when planted on rice paddy field bunds), is adapted to the climatic conditions, is easily managed by farmers, provides year round feed supply and an additional source of income for farmers from the trunk when harvested after approximately three years.

In the current experiment there was a difference in liveweight gain between weaned male and female cattle supplemented with Sesbania, which was not evident for unweaned calves maintained under traditionally feeding systems. This is in contrast to Damry et al. (2009) who reported no difference in liveweight gain between male and female Bali cattle between six and 12 months of age, regardless of management practice. The difference in liveweight gain of the two sexes between supplemented and control calves in the present experiment and the discrepancy between the current experiment and the work of Damry et al. (2009) may be due to the age and liveweight of the animals. In the current experiment, the difference between male and female cattle supplemented with sesbania was only evident at the end of the monitoring period, when animals were greater than 170 kg

liveweight and 15 months of age, whereas control animals were approximately 160 kg liveweight. The cattle monitored by Damry et al. (2009) were only 12 months of age at the end of the experiment. Previous work has demonstrated that growth rates of male and female Bali cattle fed a sesbania based diet were similar prior to puberty but different after puberty (Quigley, unpublished). The weaned, supplemented Bali cattle in the current experiment were growing more rapidly and in better body condition than the control animals or the animals in the work of Damry et al. (2010).

The good results from this simple management and feeding strategy can be easily adopted by small-holder farmers and therefore should be scaled out to a wider area and number of households. The field day conducted at the end of the study was a very relevant extension strategy to improve awareness, motivation and skills of farmers in the control villages and other villages in Central Lombok. Results of the perception survey provided good feedback on the advantages and possible constraints to adoption of the weaning and supplementation strategy.

The current experiment demonstrates the advantages of supplementation of weaned Bali calves within a village based system. However, the primary objective of implementing weaning as a management tool is to manage the body condition of the cow. While the impact of weaning on the body condition of cows was not measured in the present experiment, it is likely that weaning would also result in improved body condition in cows and a greater likelihood of re-conception sooner after the subsequent calving.

## Conclusions

The management strategy of weaning and supplementing Bali calves with sesbania in

villages in Central Lombok will firstly increase the liveweight gain of weaned calves, and secondly increase the body condition score of reproducing cows, improving reproductive performance. This strategy is easily implemented by small-holder farmers and is likely to improve cattle production and increase the household income of small-holder farmers operating under similar conditions in Indonesia.

## Acknowledgements

We gratefully acknowledge the Australian Centre for International Agricultural Research for funding this work and the farmers in Central Lombok for their co-operation in this experiment.

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