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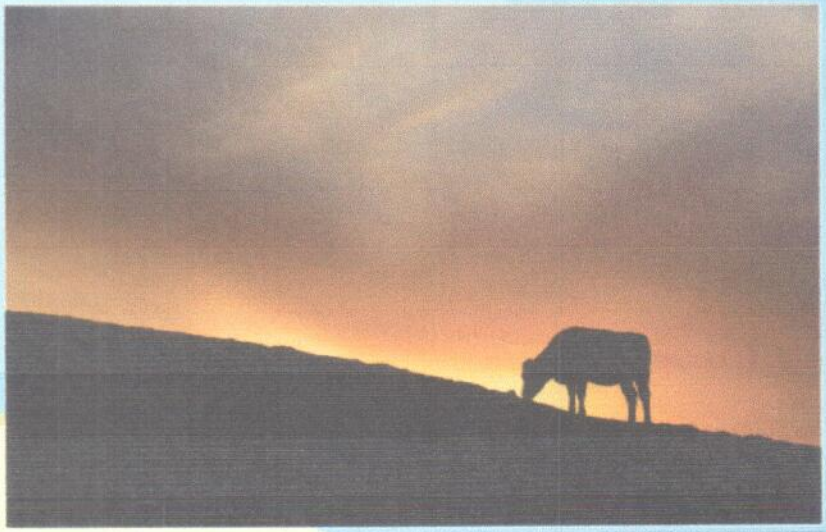

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Optimizing Rice Straw Utilization for Bali Cattle Fattening as Adaptation Strategy to Climate Change for Smallholder Farmers in Lombok Indonesia

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Introduction

The fluctuated feed resources availability becoming main cause of liveweight fluctuation of beef cattle in West Nusa Tenggara province. This was also worsened by the climate change that caused uncertainty of dry and wet season and also prolonged draught. To overcome this it was necessary to find the alternative feed source that available in abundance, easy to collect and cheap. This alternative feed is rice straw which is abundance in number, highly available but less use by farmer. Gumilar (2010) stated that each hectare land produced between 12 to 15 tonnes of rice straw in one harvest, but 70-80% of this rice straw was merely burned straight after harvest. On the other hand, this rice straw have potential to be used as cattle feed since it contains high organic matter and could be digested by cattle.

Improvement of nutrient quality and digestibility of rice straw could be achieved through certain physical treatment and fermentation. Winarno (2010) stated substrates that undergo fermentation usually contain higher nutrition value compared to its origin caused by microorganisms activities that able to break the complex components so it was easier to digested and also provide more nutrients. There are many fungus isolated from soil such as *Trichoderma viride, Pleuratus sp, Phanerachaete chrysosporium,* and *Fusarium sp.* These microorganisms are able to degraded cellulose and lignin that originally from nature (Malekzadeh *et al.*, 1993). Previous research by Sutaryono and Ali (2007) showed that the used of local microorganisms on rice straw fermentation could reduced the NDF, ADF, cellulose and lignin content of rice straw.

It is expected that the impact of the rice straw use as a base of complete feed for cattle will increase the scale of breeding and fattening activities by smallholders and at the same time also as an adaptation strategy to overcome climate change so the cattle population keep increasing.

Materials and Methods

The ground rice straw was fermented with *Trichoderma viride* a particularly fungus which were cultured in petridish. Rice straw in 100 kgs was sprayed with 400 mls of starter solution (the mixture of 2.5 kg urea, 2.5 kg molasses, 2.5 litres of prepared *T. viride* which was diluted in 20 litres aquadest). The rice straw then were put in the bunker and sealed with hard plastic. Furthermore the fermented rice straw was mixed with concentrate to make complete feed with varies composition as follows: Formula 1 (80% rice straw + 20% concentrate); Formula 2 (60% rice straw + 40% concentrate); Formula 3 (40% rice straw + 60% conscntrate); dan Formula 4 (20% rice straw + 80% concentrate). Meanwhile the concentrate was composed of rice bran (63.5%), ground corn (30%), fish meal (5%) and urea (1.5%). This rice straw base complete feeds were then fed to young Bali bull for 4 months. Several parameters were observed such as feed quality, average daily gain, meat physical and chemical characteristics.

Results and discussion

The fermentation of rice straw with *Trichoderma viride* with addition of urea and molasses reduced the neutral detergent fibre (NDF) and acids detergent fibre (ADF) content of rice straw as shown in Figure 1.

Higher NDF and ADF content of feed showed that the feed quality is not good. With lower fiber content of fermented rice straw indicated that the fermentation process could increase the rice straw nutrients. The increase of digestibility of rice straw after fermentation was also reported by Han *et al.*, (1978). Feed consumption tended to increase inline with the adaptation of cattle on the ration of the rice straw base complete feed provided to the cattle. The complete feed which consist of 80% rice straw and 20% concentrate (Formula 1) and 60% rice straw % and 40% concentrate (Formula 2) showed the higher consumption compared to those two other formulas with higher concentrate content (Formula 3 and 4). This result suggests the good palatability of rice straw base complete feed. Hence, the rice straw base complete feed could be developed as quality feed resource for cattle.

Although complete feed Formula 3 and 4 contain higher concentrates, the palatability of complete feed Formula 1 and 2 were better. So eventhough the quality of Formula 1 and 2 was lower compared to those of Formula 3 and

4, the nutrient content of Formula 1 and 2 still in the significant level to increase the Bali cattle productivity and provide reliable average daily gain (Figure 2).

Although the growth rate of Bali cattle fed with complete feed Formula 1, 2 and 3 all showed significant good result, the best gain was showed by complete feed Formula 1 with average daily gain of 0.63 kg/day. This result similar to average daily gain of cattle reported by Thalib (2008) with average daily gain varies between 0.3 - 0.75 kg/day.

Average carcass showed the positif correlation between liveweight and carcass weight. Average carcass weight was 46.30% of liveweight, meanwhile the meat percentage of carcass was 70.80% and leg plumpness was 85.29%. All values were the normal value of percentage could be achieved from livestock carcass. Hence, the use of rice straw base complete feed could provide good growth for cattle and maintain cattle condition although without using grasses as cattle feed.

Although there was decrease of meat pH from fresh meat to 4 hours after slaughtering (pH ultimate), the pH value of meat in this research was in the normal range of meat pH value (Table 3). Postmortem decrease of meat pH was affected by postmortem glikolysis rate and meat postmortem glikogen reserve, in which the normal value of meat pH ultimate was 5.40-5.80 (Silva *et al*., 1999). The pH value is the factor influence the physical characteristic of meat such as colour, water holding capacity, tenderness and cooking loss.

Meat tenderness was achieved by measuring the the total *breaking value* of meat, the lower the breaking value the more tender the meat (Tambunan, 2010). Factors affected the meat tenderness have relationship with the meat composition itself, such as meat cross linkage, meat fibres, marbling of the meat and meat rigor mortis that happened after cattle slaughtered. The meat collagen and age of cattle also influenced the meat tenderness caused by cross linkage of meat fibre individually increased accordingly to the cattle age (Swatland, 1984). Based on Warner Bratzer category, the top side of Bali cattle meat fed with rice straw based complete feed fall into tender category (4.51 kg/cm^2) while the tenderness of rump falls in slightly tender category (6.41 kg/cm^2; Suryati dan Arif, 2005).

Cooking loss value of top side meat was 13.68% was lower than normal value which was varied between 15.00-40.00%. Meat with lower cooking loss indicates higher quality compare to meat with higher cooking loss value, because with lower cooking loss the meat will have lesser nutrition loss during cooking process. The cooking loss value in this research was lower compared to cooking loss value reported by Bolink *et al* (1999) for youg Limousine beef with cooking loss value of 31.2 + 0.6%. The difference in cooking loss value may be caused by differences in duration and temperature of cooking of the research. This inline with statement made by Suparno (2005) that cooking loss was influenced by temperature and duration of cooking. The higher the temperature of cooking the higher the loss of meat juice until it achieved the constant level.

The proximate analysis value of rump and top side was similar and all values were at the normal ranges (Table 4). The water content and crude protein content was close to the value those reported by Arka (1990) which found the water content of 73.63% and crude protein content of 20.91% in meat of young Bali cattle at 2-3 years old. Hence, base on this result it is clear that the quality and chemical characteristic of meat produced by feeding cattle with rice base complete feed were in good quality.

Conclusions

Based on the results found in this research it was concluded that:

Rice straw ferementation with *Trichoderma viride* isolate plus urea and molasses improved the quality of rice straw as cattle feed which was shown by decrease in NDF and ADF content.Rice starw base complete feed Formula 1 (80% fermented rice straw + 20% concentrates) provide the highest average daily gain of cattle at 0.63 kg/ dayPhysical and chemical characteristics of meat from cattle fed with rice straw based complete feed were comparable to meat of cattle raised traditionally by smallholder farmers.Rice straw base complete feed could be used as basic feed for Bali cattle raising and as a climate change adaptation strategy for smallholder farmer

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KEYWORD : Bali cattle, Rice straw fermentation, Complete feed, Meat quality

Table 1. Proximate analysis of rice straw base complete feed.

Content	Rice straw base complete feed			
	Formula1	Formula2	Formula3	Formula 4
Dry matter (%)	100.00	100.00	100.00	100.00
Ash (%)	23.62	19.01	14.87	12.18
Crude fibre (%)	22.52	17.97	14.16	11.66
Crude protein (%)	10.76	12.24	14.16	14.67

Table 3. Physical characteristics of Bali cattle meat

	pH (fresh)	pH ultimate (after 4 hrs)	Water Holding Capacity (%)	Tenderness (kg/cm^2)	Cooking Loss (%)
Rump	5.63 ± 0.10	5.26 ± 0.19	235.79 ± 4.69	6.14 ± 0.53	21.39 ± 2.41
Top side	5.35 ± 0.09	5.30 ± 0.05	238.13 ± 12.18	4.51 ± 0.25	13.68 ± 0.75

Table 4. Proximate analisys and Fatty acids content of Bali cattle meat

	Water content (%)	Ash (%)	Crude Protein (%)	Crude Fat (%)	Fatty acids (mix; w/w)
Rump	77.38 ± 0.20	1.10 ± 0.06	22.29 ± 0.53	15.0 ± 0.14	40.0
Top side	76.87 ± 0.22	1.04 ± 0.07	22.90 ± 0.05	14.0 ± 0.01	

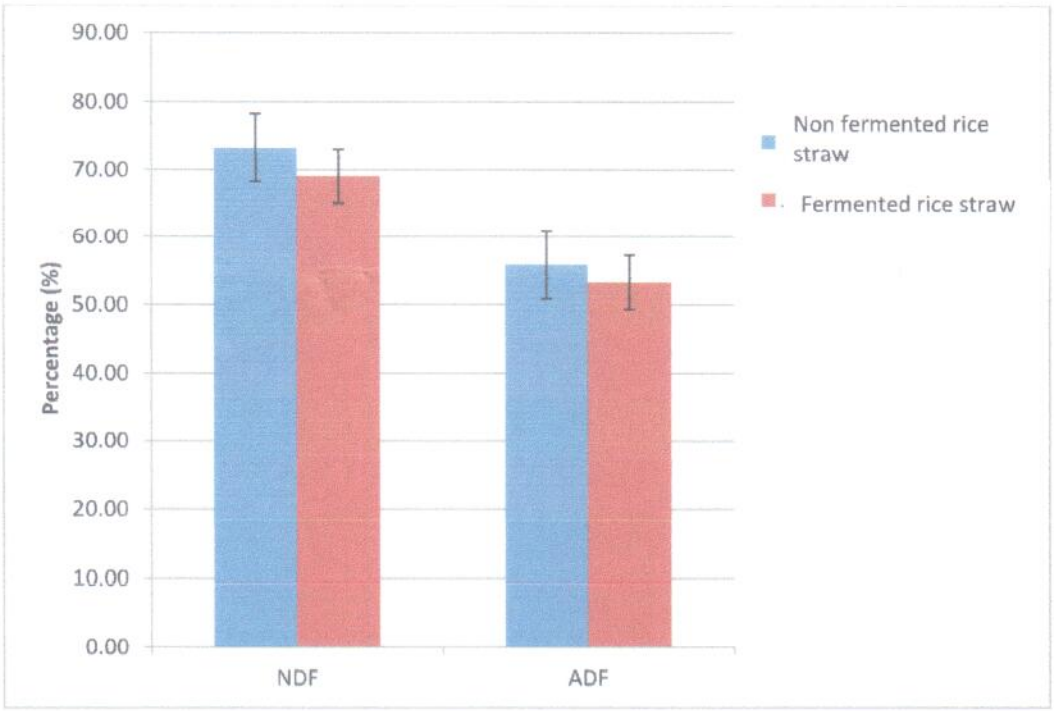

Figure 1. NDF and ADF of non fermented and fermented rice straw

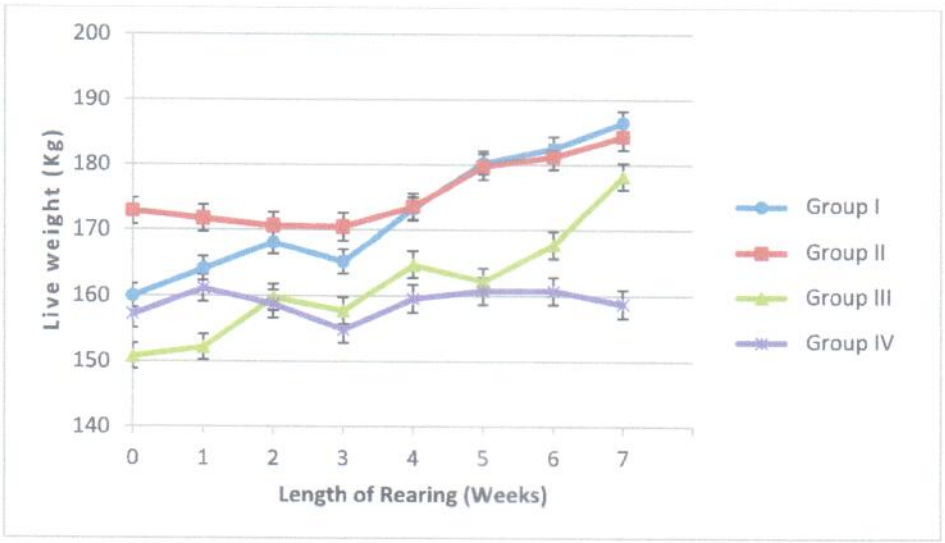

Figure 2. The liveweight development of Bali cattle fed with rice straw base complete feed with different composition of rice straw and concentrate. Group I fed with 80% rice straw+20% concentrate, Group II fed with 60% rice straw+40% concentrate, Group III fed with 40% rice straw+60% concentrate, and Group IV fed with 20% rice straw+80% concentrate.

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