

Application of complete feed formulated from agriculture by products with undegraded protein supplementation on beef cattle productivity¹

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ABSTRACT: Complete feed formulated from agriculture by-products (corn cob, rice bran, cassava pomace, molasses, kapok seed, copra and soybean meal) containing 12% of crude protein and 64 % of TDN was pelleted before being applied to beef cattle raised in livestock farmer's group. Ten males Ongole crossbred cattle of 1.5 to 2.5 years old weighing 259.7 ± 27.0 kg were randomly divided into two groups. First group as the control received *ad libitum* local feed (mixed from rice straw, elephant grass, peanut haulm, cane top and native grass), supplemented with 4kg of rice bran/head/day. Second group received complete feed (2.6% of body weight) and 5g undegraded protein /kg^{0.75}. Undegraded protein was prepared from soybean meal protected using 1% formaldehyde (w/v). After 4 weeks of adaptation, gain weight and feed consumption were collected for 13 weeks. The cattle were slaughtered to evaluate carcass percentage and meat bone ratio. Income over feed cost was calculated by the difference between daily feed cost and gain weight price. The result showed that crude protein, dry and organic matter consumption of control group: 1.35kg, 10.96kg, and 8.25kg/head respectively were higher ($P < 0.05$) than those the group received complete feed (respectively 1.09kg, 7.9kg and 7.4kg/head). The average daily gain and carcass percentage of control group (0.573kg and 44.15%) was lower ($P < 0.05$) than that the complete feed group (0.868kg and 49.98%). Feed conversion ratio (FCR) in complete feed groups (9.17) was significantly better ($P < 0.05$) than the control group (20.41). However, there was no significance different between the both group on meat bone ratio (4.62 and 5.34 for the control and the complete feed group). Income over feed cost was 80,131.0 and 230,297.3 IDR/day/head for the control and treatment of complete feed group respectively. It can be concluded that application of complete feed formulated from agriculture by-product supplemented with undegraded protein improved beef cattle productivity.

Key word: complete feed, agriculture by-products, undegraded protein supplementation, beef cattle productivity, livestock farmer's group

INTRODUCTION

Ruminants productivity, in the tropical region like in Indonesia was influenced by the fibrous feed supply mainly fluctuation of forages production during the dry season. The problems above needed to be solved by utilization of agricultural crop residues like rice straw, corn stalk, sugarcane top (Haryanto, 2009), as well as agricultural processing by product such as bagasse, coffee pulp, and corn cobs which were the excellent sources of fibrous feed for ruminants. These fibrous feeds were available during the dry season however their nutrients content were low. The supplementation of feed protein and energy sources and proper feed formulations were required to obtain a better utilization of the fibrous feed.

Complete feed is a nutritionally adequate feed mixed from forages and concentrates prepared to meet nutrients requirement of animal in certain physiological state (maintenance, growing, and lactating) (Hartadi et al. 1980). Complete feed was composed from mixture of various feed ingredients that usually have been ground or milled before mixing. Pelleting reduces the volume of

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storage and dustiness, increases feed intake, prevents animals from sorting ingredients, but requires an addition appreciable cost of 10% approximately (Cheeke, 2005).

Complete feed was suitable to be applied because most of the cattle raiser in Indonesia was traditional farmers who did not understand to prepare a good rations and to solve globally problems of insufficient forage during the dry season. Preparation of complete feed by considering the protein and energy level, the type of carbohydrate and supplementation undegraded protein, was expected to be able to increase efficiency of feed utilization and cattle productivity (Widyobroto, et al, 1999 and Utomo, 2005).

The new system for estimating the requirement of ruminants dietary protein involve degradable protein in the rumen which is used by the micro-organism to produce microbial protein and undegraded dietary protein which is digested in small intestine and used by animal itself (Orskov and Robinson, 1981, and Kamalak et al, 2005). Furthermore Kamalak et al, 2005 reported that to protect dietary protein from microbial degradation in the rumen, heat and formaldehyde treatment could be applied to make more protein or amino acid available for the host animal but it might reduce synthesis of microbial protein. Soybean meal is a concentrate feed of protein source contained high quality protein, but in ruminant feed, the majority (80-90%) of crude protein was degraded in the rumen (Widyobroto, et al., 1998). Treatment of soybean meal with 1% of formaldehyde decreased significantly protein degradability (14.81%) in the rumen (Widyobroto *et al.*, 1997). Chemical treatments (lignosulfonate and formaldehyde) for protecting soybean meal are cheaper and easier method and better than heat treatments method (Borucki-Castro *et al.*, 2007). The advantage of chemical method does not involve browning reaction which reduce amino acids intestinal availabilities (iso-leusine, leusine phenylalanine dan valine).

The study was conducted in animal farmer's group of cattle to determine the effect of application of complete feed in the form of pellet supplemented by undegraded protein on feed intake, gain weight, carcass percentage, meat bone ratio and economic evaluation aspect.

MATERIALS AND METHODS

This study was conducted in a grouping cattle house of village livestock farmer's group. Ten males of Ongole crossbred cattle of 1.5 to 2.5 years old, weighing of 259.7 ± 27.0 kg raised in 5 grouping cattle house by 5 members of farmer's groups, were randomly divided into two groups. Each member of livestock farmer's group raised 2 heads of cattle (as control and treatment). First group as the control received *ad libitum* local feed (mixed from rice straw, elephant grass, peanut haulm, cane top and native grass) supplemented with 4kg of rice bran/head/day. The local feed distributed to the cattle were the feeds that found and usually used by the farmer in site activities and available during the study. Second group as the treatment received complete feed in form of pellet (2.6% of body weight) with a supplementation of 5g undegraded protein /kg^{0.75}. Undegraded protein was prepared from soybean meal protected using 1% formaldehyde (w/v). Pellet of complete feed was formulated from agriculture by-products (corn cob, rice bran, cassava pomace, molasses, kapok seed, copra and soybean meal) containing 12% of crude protein and 64 % of TDN (Table 1) to meet the needs of beef cattle with the estimation of average daily weight gain from 0.5 to 0.8 kg.

Feeds were distributed twice a day in the morning from 07:00 to 08:00 a.m. and afternoon from 04:00 to 05:00 p.m. After 4 weeks of adaptation, gain weight and feed consumption were collected for 13 weeks. Animal weighing was carried out every two weeks in the morning before feeding. Feeds consumption were measured during 10 days consecutives. There were three times measurements of feed consumption during the study: at the beginning (first week), middle (seventh week) and the end of the study (twelve weeks). Feed and refusal feed were weighed, sampled and dried in oven 50°C for three days then ground with a 0.2 mm sieve and analyzed for dry and organic matter and crude protein (AOAC, 1975).

At the end of this study, the cattle were slaughtered to evaluate carcass percentage (ratio of carcass weight after slaughtering and body weight before being slaughtered in percent) and meat bone ratio (ratio of meat and bone weight after its separation) (Soeparno, 1998). Income over feed cost is an economic evaluation aspect that was calculated by the difference between feed cost and the price of weight gain in Indonesian rupiah (IDR). Data from the study consisted of feed intake, average daily

weight gain, carcass percentage and meat bone ratio, were compared between the control and the treatment with Student's T-test analysis (Steel and Torrie, 1981).

RESULTS AND DISCUSSION

Nutrients Consumption

Dry matter intake of treatment group received a complete feed with supplementation of soybean meal treated with formaldehyde (undegraded protein=UDP) of 7.90 kg was lower ($P < 0.05$) compared to control groups of 10.96 kg/head/day (Table 2).

Feed consumption in the treatment group was lower due to limited quantities of feed distribution, whereas in the control group feed was given unlimited quantity (ad libitum) especially forages. The farmer distributed ad libitum forage, because the forage was free that came from agricultural crop residues. These crop residues if not be eaten by the animal its will be mixed with cattle manure (feces and urine) in the cattle house and becoming a good quality compost for their agriculture field. The ad libitum distribution of forage increased feed intake. The point of view of the feed intake, the quantity of feed consumed (3.33% of body weight) in control group has met dry matter requirement. Kearn (1982) reported that dry matter requirement of beef cattle in developing countries varied from 2.0 to 3.0% of body weight, as well as reported by the NRC, (1976) and INRA (1988). Organic matter intake of treatment group received complete feed supplemented with undegraded protein (7.40 kg) was lower ($P < 0.05$) than animals in control group (8.25 kg/head/day). Total organic matter intake described the quantity of energy intake by ruminants (Tillman et al, 1998). Crude protein intake of treatment group received complete feed supplemented with undegraded protein (1.03 kg) was also lower ($P < 0.05$) than animals in control group (1.35 kg/head/days). This was due to the higher quantity of dry matter intake in control group compared to the treatment groups received pellets of complete feed. On the other hand, analysis of protein content of feed intake in the treatment group (13.04%) was only slightly higher than the control group (12.32%). This sufficient protein content in the diet of control group supported by the presence of peanut haulm containing high crude protein from 15.1 to 27.34% (Hartadi et al, 1980, Usman, 1999 and Holil, 2003) and fine rice bran.

Body Weight Gain

At the beginning of the study, farmers in the village did not believe at all that distribution of complete feed without others additional feed, was able to meet the animal requirement for fattening because the complete feed was only given about 8 kg approximately/head/day. The farmers were commonly granted to distribute their own ration composed of fine rice bran and ad libitum forages (native grass, elephant grass, peanut haulm, etc) so that cattle in better body condition were selected to be the control group. The average of initial body weight of cattle in control group 276.8 ± 17.92 (shown in Figure 1.) was bigger than that in treatment group 242.6 ± 24.29 kg.

In the Figure 1. showed that the rate of weight gain of cattle received treatment feed with UDP supplementation up to week 13 still increased constantly, while the control feed started to be slowly at week 8. This result mentioned that nutrient (protein) sources of control feed coming from fine rice bran and peanut haulm was not able to maintain a constant rate of weight gain after week 8. Nutrient requirements increase simultaneously with increasing of body weight, however fine rice bran as additional feed was limited only 4 kg/head/day and its protein content limited 9.9-11.55% as well (Hartadi et al, 1980, and Holil, 2003). In contrast, the treatment group received more nutritious supplementation coming from 5g undegraded protein /kg^{0.75} (300g/head/day in average equal of 120g crude protein) could maintain the increasing rate of weight gain up to week 13.

The result of the study showed that average daily gain measured for 13 weeks (Table 3.) of cattle in treatment group received complete feed supplemented with UDP was 0,868 kg higher ($P < 0,05$) compared to cattle on control group 0,573kg/head/day. Even though, cattle in treatment group consumed only 1.03 kg protein lower than control group (1.35 kg/head/days), but protein quality of supplemented feed (UDP) in treatment group (soybean meal) was higher than control group (fine rice brand). The result proved that treatment group received UDP supplementation made from soybean

meal protected using 1% of formaldehyde would be able to be utilized and digested directly in the intestine of ruminants. Widyobroto et al (1997) mentioned that high protein quality of soy bean meal comes from high protein content and amino acids compositions, however 60-80% of its high quality protein is degraded and used by the microbes in the rumen. After protection as UDP using 1% of formaldehyde, up to 96% of soybean meal protein was digested in the intestine. The better utilization of feed in the treatment group was also showed by the lower feed conversion 9.17 vs 20.41 in the control group (Table 3).

Table 1. Feed ingredients of complete feed in form of pellet

No	Ingredients	Composition (%)	Crude protein (%)	TDN (%)
1	Corn cob	34,95	1,40	13,63
2	Rice bran	10,75	1,48	7,30
3	Cassava pomace	15,15	0,39	12,65
4	Milled dried cassava	21,00	0,69	18,90
5	Kapook seed meal	2,50	0,79	1,85
6	Soy bean meal	6,45	3,10	5,03
7	Copra meal	4,00	0,65	2,19
8	Molasses	3,00	0,17	1,64
9	Urea	1,20	3,42	-
10	Mineral Mix	0,30	-	-
11	Salt	0,40	-	-
12	Binder	0,30	0,01	0,27
Total		100,00	12,10	63,46

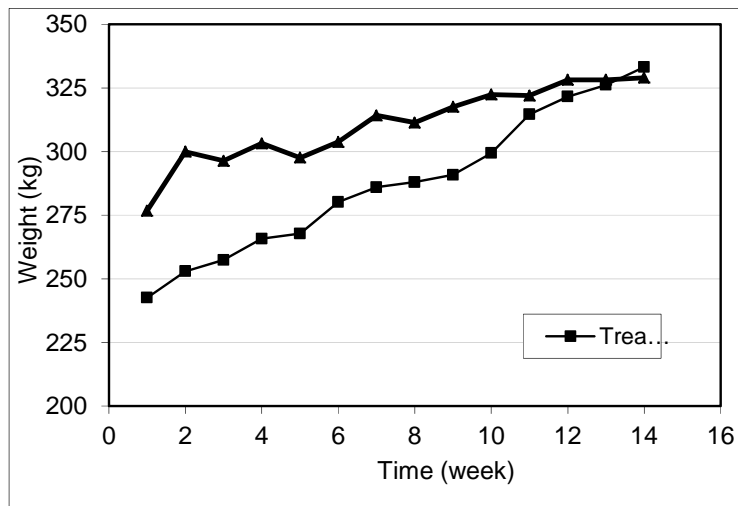


Figure 1. Evolution of animal body weight received complete feed supplemented with undegraded protein as treatment and local feed as control during the study of 13 weeks

After 13 weeks of study, cattle in the both groups were slaughtered. Carcass percentage (Table 3.) of cattle in treatment group received complete feed supplemented UDP (49.98%) was higher ($P < 0.05$) than cattle on control group (44.15%). The lower carcass percentage in control group was resulted by gastro-intestinal tract content in particular reticulo-rumen capacity higher than that was in treatment group. Transit time of feed particle in treatment group received limited quantity of complete feed in form pellet was lower/faster that caused capacity of gastro-intestinal tract was lower. Transit time of particle in form pellet was lower than that in chopped wheat straw (Suhartanto, 1992). Average daily gain and body condition of cattle received treatment feed were better (more fat) compared to control feed, resulted in meat proportion 5.34 vs 4.62 for treatment and control group respectively and to be higher in treatment group.

The economic evaluation by income over feed cost analysis showed that treatment and control

group was 230,297.3 and 80,131.0 (IDR/head) respectively. The margin earned by the farmers in treatment group was higher than in control group. This result proved that during the dry season complete feed in form of pellet supplemented with undegraded protein can be used to solve economically the problem of feed supply for fattening beef cattle. Application of complete feed in form of pellet was easier to be done, the farmers only distributed feed 2.6% of body weight and ad libitum water (4.5kg in the morning and 4.5 kg in the afternoon for cattle 300kg of weight). Using conventional feed (forages and concentrate supplementation) the farmers had to prepared (chopped) in higher quantity of forages (at least to 30 kg) and mixed feed supplementation (4 kg of fine rice bran) with water, so that this method needed much more labor. In conventional or control method of fattening beef cattle, one farmer raised usually from 10 to 15 heads if available forages and concentrate was in stock, but only up to 5 heads per farmer if he had to look for forages. However, in treatment group one farmer was able to raised more than 25 heads per farmer. Therefore cost of labor in treatment group was lower than control.

Table 2. Nutrient intake of complete feed supplemented with undegraded protein (CF+UDP) as treatment and local feed as control

Nutrients intake	Treatment CF+UDP	Local feed as control
Dry matter, kg/head/d	7.90±0.17	10.96±0.65 ^{*)}
Organic matter, kg/head/d	7.40±0.16	8.25±0.48 ^{*)}
Crude protein, kg/head/d	1.03±0.19	1.35±0.25 ^{*)}

^{*)} Means with superscript indicated significant differences (P < 0.05)

Tabel 3. Average daily gain, feed conversion and carcass percentage of cattle fed with complete feed supplemented with undegraded protein (CF+UDP) as treatment and local feed as control

Items	Treatment CF+UDP	Local feed as control
Average daily gain, kg	0.87±0.09	0.57±0.17 ^{*)}
Feed conversion, kg feed/kg gain	9.17±0.84	20.41±5.42 ^{*)}
Carcass percentage, %	49.98±2.70	44.15±2.21 ^{*)}
Meat bone ratio, w/w	5.34±0.81	4.62±0.57 ^{ns)}
Income over feed cost ratio, IDR/head	230,297.3	80,131.0

^{*)} Means with superscript indicated significant differences (P < 0.05), ^{ns)} non significant

CONCLUSIONS

From this study can be concluded that complete feed composed from agriculture crop residues and processing by-product in form of pellet supplemented with soybean meal treated using 1% of formaldehyde can be applied for fattening beef cattle in villages livestock farmer's group with better productivity such as on feed conversion, gain weight, carcass percentage, and meat bone ratio, and more profitable economically as well. Complete feed in form of pellet is easier to be applied by the farmer and more cattle can be raised by the farmer if this form of feed is available.

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