

TECHNO-ECONOMIC UTILIZATION COMPLETE FEED FOR BEEF CATTLE DEVELOPMENT IN INDONESIA

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Submitted 29 March 2023; Approved 6 June 2023

ABSTRACT

Complete feed is very crucial for cattle development in Indonesia. This study analyzed the technical and economical use of complete feed from agricultural waste to developing beef cattle in Indonesia. Agricultural waste is arranged into a complete feed based on crude protein and total digestible nutrients. Experimental research and survey research was used in the study. Experimental research used five feeds, namely T0 (feed usually given by farmers), T1 (12% CP, 60 TDN), T2 (12% CP, 63% TDN), T3 (12% CP, 66% TDN), T4 (12% CP, 69% TDN). The technical parameters observed were dry matter digestibility, organic matter digestibility, rumen VFA, and rumen NH₃. Data analysis uses Analysis of Variance (ANOVA), and if there is a difference, it is continued with the Duncan Multiple Range Test (DMRT). The economic analysis is revenue, feed costs, and income over feed cost (IOFC). Survey research was conducted on ten beef cattle farmers to analyze the differences between farmers who used complete feed and those who did not. The results showed a difference between complete feed T1-T4 and feed T0 (control). The T3 feed (12% CP, 66% TDN) yielded the best results. Farmers who use complete feed show higher yields compared to farmers who do not use complete feed. Fattening beef cattle with a total of 10 heads with a rearing period of 90 days produced was Rp 9,100,000 with an R/C ratio was 1.05. The conclusion from this study is that using complete feed from agricultural waste can increase the income of beef cattle farmers. This complete feed can be recommended for developing beef cattle in Indonesia.

Keywords: *agricultural waste, beef cattle, complete feed, economical analysis, technical analysis*

BACKGROUND

Beef cattle are one of the most popular livestock commodities in Indonesia. The per capita demand for beef cattle has risen in recent years. The demand of beef cattle increase from 0.11 kg per capita per year to 0.14 kg in 2021 (Setiadi et al. 2021). Beef cattle have long been common livestock in Indonesia. Farmers who raise beef cattle normally have two to three heads of cattle. Feed supply generally determines the profitability of livestock business, including beef cattle. Agricultural/plantation waste, agricultural, industrial waste, forage cultivation, and grazing are potential sources of ruminant feed, although land use competition often hinders the latter. As a result, it is essential to take advantage of two additional feed sources that have consistent supply, high quality, and a reasonable price. Feed are aspect with the highest cost of the beef cattle fattening Techno-Economic Utilization Complete Feed for Beef Cattle (Nuswantara et al., 2023)

process, accounting for approximately 70% of overall costs. Seeking alternate feeds that are widely available and do not compete with human needs is one way to cut manufacturing costs.

The development of beef cattle in Indonesia is strongly influenced by three factors: feeding, breeding, and management. Feed is an essential factor; the provision of forage and concentrate feed which is still separated, is an obstacle, so now what is called a complete feed is developing. Complete feed is prepared from agricultural waste that has not been used optimally.

Several studies have used agricultural waste to produce beef cattle (Muzaki et al. 2020., Nuswantara et al. 2020; Nuswantara et al., 2022). The results showed that using agricultural waste in the form of coconut fiber could replace rice straw with better results than using rice straw. The use of rice straw waste as cattle feed does not harm livestock (Anderson et al., 1977; Doolatabada. 2020; Cherdthong et al. 2021 and Tayengwaa et al., 2020). Research conducted by He et al. (2018) showed that using wheat straw in cattle resulted in an increase in ADG from cattle. This research is supported by Purbowati et al. (2004), who showed that agricultural waste can be used to fatten beef cattle.

Good feed is one indicator of successful livestock development in Indonesia. Setiadi et al. (2021) showed that a complete feed, both in quantity and quality, can improve the performance of beef cattle. Muzaki et al. (2020) stated that using agricultural waste, such as coconut fiber, in fattening cattle can reduce feed costs by 15-20%. Development of beef cattle in Indonesia must be done to reduce dependence on beef imports from other countries such as India, Brazil, and the United States. Based on this background, this study aims to analyze the technical and economical use of complete feed in beef cattle.

RESEARCH METHODS

The research aim was to determine the effect of feeding on the technical and economic performance of beef cattle. Experimental research was conducted for 100 days using 16 Simmental cows for T1-T4. as for T0 using feed given by farmers. The technical analysis carried out were: dry matter digestibility analysis, organic matter digestibility, rumen VFA and rumen NH₃, the economic analysis carried out was the calculation of income, feed costs and Income over feed cost (IOFC). Economic analysis of cattle fattening for 90 days was carried out to analyze the income earned by beef cattle farmers.

The survey was conducted on ten farmers in Bringin District, Semarang Regency, sampling to obtain data on using complete feed at the farmer level. Site selection is based on population and development potential of beef cattle in Semarang. The DMD value which was not significantly different was thought to be caused by the nutritional content of the rations, especially the dry matter (BK). The content of BK ration based on laboratory analysis in the control treatment (T0) was 56.81%, while the BK complete feed was almost the same, namely T1 was 89.20%, T2 was 88.55%, T3 was 90.37, and T4 was 90. 12%. The content of the ration DM shows the amount of nutrients digested in the rumen, the relatively the same ration DM content indicates that the amount of nutrients digested in the rumen is the same so it will produce the same KcBK. Another factor that is thought to be the cause of the KcBK values that are not different is the crude protein in the ration. Protein content based on laboratory analysis in the treatment of T0 was 8.75%, T1 was 10.56%, T2 was 11.90%, T3 was 11.65% and T4 was 10.55%. Protein in the rumen will be degraded to produce ammonia which will be used for microbial growth. Microbes will produce enzymes to digest feed in the rumen. Almost

the same protein content of the feed will provide the same ammonia for rumen microbes so it is suspected that the growth and ability to produce microbial enzymes will also be the same, causing the digestibility of the dry matter of the feed to be no different.

The crude fiber content of the rations which were almost the same was thought to affect the KcBK value which was not significantly different. Crude fiber is a nutrient that is difficult to degrade in the rumen. The content of crude fiber in the rations will reduce the digestibility of dry matter in all treatments. Crude fiber content based on laboratory analysis at T0 was 19.28%, T1 was 23.20%, T2 was 20.71%, T3 was 24.75%, and T4 was 22.48%. Furthermore, to determine the difference in the use of complete feed and the feed commonly used by beef cattle farmers at that location using the t-test.

Table 1. Feed Ingredient Used in the Study

No	Feed Ingredient	To (%)	T1 (%)	T2 (%)	T3 (%)	T4 (%)
1	Palm oil meal		5 - 10	5 - 10	5 - 10	10 - 15
2	Corn		5 - 10	5 - 10	5 - 10	10 - 15
3	Pile		15 - 20	15 - 25	20 - 25	20 - 25
4	Rice bran		15 - 20	10 - 15	5 - 10	5 - 10
5	Kapok bean skin	Farmer Feed	10 - 15	10 - 15	10 - 15	10 - 15
6	Coffee skin		20 - 25	10 - 20	10 - 15	5 - 10
7	Coconut oil		0,1 - 1	0,5 - 1	0,5 - 1	0,5 - 1
8	Coconut meal		5 - 10	5 - 10	5 - 10	10 - 15
9	CaCO ₃		0,5 - 1	0,5 - 1	0,5 - 1	0,5 - 1
10	Salt		0,5 - 1	0,5 - 1	0,5 - 1	0,1 - 0,5
11	Mollases		5 - 10	5 - 10	5 - 10	10 - 15
12	Urea		0,5 - 1	0,5 - 1	0,1 - 0,5	0,1 - 0,5
	Crude protein content (%)	-	12	12	12	12
	Total digestible nutrient (TDN)		60	63	66	69

The complete feed was computed based on: AOAC (2005) and Hartadi et al. (1993)

RESULT AND DISCUSSION

As shown in Table 2, Dry matter digestibility, organic matter digestibility, VFA's Rumens, and NH₃ were not significantly different between treatments. DMD, OMD, VFA and NH₃ indicate the utilization and fermentability of the ration in the rumen. Rations with a high level of degradation will have a high level of fermentability. This is indicated by data on the results of nutrient degradation, both protein and carbohydrates, in the form of VFA and NH₃. High fermentability and degradability of rations will result in high digestibility and utilization rates of rations, thereby increasing productivity which will ultimately affect income levels. This study's results follow research (Hoerbe et al., 2020; Kulkarni et al. 1999; Mor et al. 2018; Muensri et al. 2011; and Netto et al. 2004).

Table 2. Digestibility and Fermentability Complete Feed

Digestibility/ Fermentability	Treatments				
	T0	T1	T2	T3	T4
Dry matter digestibility (%)	60.66	68.53	69.83	67.17	67.14
Organic matter digestibility (%)	61.25	76.32	74.56	62.16	66.18
VFA's Rumen (mM)	173.00	147.00	187.00	157.00	163.00
NH ₃ Rumen (mM)	4.43	4.53	3.10	3.10	3.20

Different superscripts on the same line indicate significant differences (P<0.05)

In this study, there was no significant difference between treatments which indicated that complete feed was safe to use as feed for beef cattle. The same level of fermentability and digestibility in different rations indicates that the rations are prepared with almost the same levels or nutrient values, because they are prepared based on different protein iso and energy. Giving rations with different energy has not been able to increase the level of digestibility and fermentability. This is due to the fact that the same protein level with different energy is thought to have not been able to increase the rumen microorganism population, so that the degradation and fermentation processes of the rations did not differ among treatments. Several studies using complete feed (Schalm, 1975; Thanh, 2012; Wannapat et al., 2009 Ware and Zin, 2005) showed no significant differences between treatments in digestibility and fermentability.

As shown in table 3 there was no significant difference between the dry matter consumption between the treatments; this was because the complete feed used in the study was prepared with the same protein content. One of the factors that influence ration consumption is the nutrient content of the feed, one of which is the protein content of the ration. The same ration protein content will produce relatively the same concentration of NH₃, so that the N precursor for microbial protein synthesis is also relatively the same. The process of microbial protein synthesis is a process of reproduction and multiplication of rumen microbes. this affects the process of feed fermentability, length of stay in the digestive tract and level of ration consumption.

Table 3. Performances of Beef Cattle Fed Complete Feed

Performances	Treatments				
	T0	T1	T2	T3	T4
Dry matter consumption (Kg/head/day)	11.25	8.56	6.89	8.48	8.01
Dry matter consumption (kg/BW ^{0.75})	0.166	0.093	0.076	0.092	0.082
Dry matter consumption (% BW)	3.87	2.09	1.7	2.04	1.79
Average daily gain (kg)	0.54 ^a	1.39 ^b	1.3 ^b	1.51 ^c	1.04 ^d
Feed conversion ratio (FCR)	25.94 ^a	6.87 ^b	5.85 ^b	7.64 ^b	12.49 ^c

Body weight: BW, Different superscripts on the same line indicate significant differences (P<0.05)

The results of this study are consistent with the study of Nuswantara et al. (2022), which showed no significant difference in dry matter consumption in beef cattle fed complete feed containing coconut coir. ADG of beef cattle fed T3 showed the highest yield. The lowest FCR in beef cattle fed T2. The study also was supported by Wannapat et al. (2009) and Ware and Zinn (2005), which found that utilization of complete feed for beef cattle fattening improves the FCR and ADG.

As shown in Table 4, the revenue obtained from using the complete feed in beef cattle fed complete feed (T1-T4) is better than the control (T0). The treatment ration is better than the farmer ration because the treatment ration has taken into account the nutrient requirements for livestock with the same protein level and different energy levels, so that it has a different nutrient content from the farmer ration. This condition indicates technically efficient if farmer using complete feed.. The complete feed can be processed inside the cow's body into the meat. The IOFC of cows fed T3 had the highest IOFC.

Table 4. Income Over Feed Cost (IOFC) Beef Cattle Fed Complete Feed

Items	Treatments				
	T0	T1	T2	T3	T4
Revenue (Rp/live weight/day)	24,300	62,550	58,500	67,950	46,800
Feeding cost (Rp/head/day)	18,000	34,000	32,000	36,000	32,500
Income over Feed Cost (Rp/live weight/day)	6,300	28,550	26,500	31,950	14,300

As shown in table 5, the ADG, revenue, and IOFC of beef cattle fed complete feed were higher than beef cattle not given complete feed. This result shows that the complete feed can increase the growth of ADG, revenue, and IOFC. This research also shows a positive correlation between ADG and IOFC. The higher the ADG achieved by beef cattle with complete feed, the greater the IOFC. Most of the farmers surveyed still use different forage and concentrate feed; this causes the digestibility process to be not optimal, also supported by the poor quality of the feed. The implication of this research is that the utilization of complete feed can be used as an alternative feeding technique to increase livestock productivity, besides that it can also be used as an alternative to feeding during the dry season where the availability of forage is very less.

Table 5. t-test Performances Beef Cattle Farmers

Items	Use Complete Feed	Not Use The Complete Feed
Average daily gain (ADG) (kg/head)	1.51	0.54
Revenue	67,950	24,300
Feeding cost	36,000	18,000
IOFC	31,950	6,300

As shown in Table 6. Economic analysis of beef cattle fattening was feasible. The cage investment and facility were Rp 40,000,000. The total production cost was Rp 164,150,000. Revenue was Rp 173,250,000. The income was 9,100,000, and the R/C ratio was 1.05. Based on the results in Table 4-6 of the economic analysis, complete feed formulated from agricultural waste increased the income of beef cattle farmers. A good complete feed can support the development of beef cattle in Indonesia.

Table 6. Economic Analysis of Beef Cattle Fattening (10 heads) for 90 days

No	Items	Number (Rp)
1	Cage investment and facility	40,000,000
2	Production cost	
	Cost of buying young cattle	118,750,000
	Cage and facility depreciation	3,000,000
	Feeding cost	32,400,000
	Worker salary	9,000,000
	Another cost	1,000,000
	Total production cost	164,150,000
3	Revenue	173,250,000
4	Income	9,100,000
5	R/C ratio	1.05

Development of beef cattle in Indonesia is urgently needed with the use of complete feed with agricultural waste with a minimum number of 10 cows. It can increase income for beef cattle farmers. The condition of beef cattle production in Indonesia is generally raised by people's farms by providing forage feed and sometimes combined with concentrate feed, resulting in low productivity. This is because the provision of feed for livestock has not paid attention to aspects of quality and quantity as well as the adequacy of nutrients for livestock. The use of complete feed technology has taken into account aspects of availability, adequacy of nutrients for livestock and continuity can be maintained because it is composed of concentrated feed and/or by agricultural products and the agricultural industry.

CONCLUSION AND SUGGESTION

The results showed that complete feed, which was processed from agricultural waste, was proven to improve beef cattle's performance. Technically and economically, the complete feed can provide a higher ADG than the feed usually given by farmers. Complete feed with a protein content of 12% and a TDN of 66% can increase the income of beef cattle farmers. Fattening beef cattle with a total of 10 heads which are reared for 90 days, generates an income of Rp 9,100,000 with an R/C ratio of 1.05. Based on this, complete feed produced from agricultural waste can be used to develop beef cattle in Indonesia.

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