The Performance of Beef Cattle Fed by Complete Feed

by Limbang K Nuswantoro

The Performance of Beef Cattle Fed by Complete Feed

Sunarso [*1], L.K. Nuswantara [*1], A.Setiadi[*1], Budiyono[#2]

[1]sunarso_undip@yahoo.com

[* 1]Faculty of Animal Agriculture, Diponegoro University
[#2]Chemical Engineering Dept, Diponegoro University
Tembalang Campus, Semarang, 50275, Central Java-Indonesia

***Abstract*— For Complete feed a diet were formulated mixed roughage and concentrate in one diet. CF in the study utilizes the agricultural land and crop estate by products. The aims of the study to determine the effect of the CF diets on the performance, to determine the efficiency of the diet use economic evaluation. 20 Simmental crossbreed young bulls (initial body weight = 375,10 ± 24,05) were housed in separate pens with space 2 m^2. The completely random design (CRD) was used in the study. Complete feed were formulated in five treatments, T_0 (control) 9.78%CP, 60%TDN; T_1 (11%CP, 60%TDN); T_2 (12%CP, 63%TDN); T_3 (13%CP, 60%TDN); T_4 (14%CP, 60%TDN). Dry matter (DM), Organic matter (OM), Crude protein (CP), Total Digestible Nutrient (TDN) intake and digestibility to examine effects of complete feed on rumen degradability. Average daily gain (ADG) were used to examine the effect of complete feed on performance of bulls. Urea and glucose bloods were used to determine on hematologist. The statistical analysis indicated that DM, OM, CP, and TDN intakes and were not significant (P>0.05). Average daily gain of bulls fed by T_2 (1.54) was the highest (P<0.05). FCR of T_2 (7.33) was the lowest than that in other treatments. The income of the bulls fed by T_2 assumed others factors constant was IDR 16,629.74. Implementation of complete feed (CP 12%, TDN 63%) could increase the performance of cattle.**

***Index Term*-- ADG, Complete Feed, CP, TDN, Income.**

I. INTRODUCTION

Feed availability as quality, quantity, or continuity is important factor to support development of animal production system (Santoso and Hariadi, 2009). Further they stated in the tropical country such as Indonesia, grass production is much during wet season but very limited in dry season. Development feedstuff from agricultural land and crops by product is one of way to solve the problem. Central Java, one of the second largest cattle producers in Indonesia has the complex problem to provide feed availability especially during dry season. At present, In Central Java, many of the arable land would convert to housing and industry. This condition indicates the development of complete feed by utilization of agricultural land and crop estate by products is needed to develop the cattle in the province. In the future, Yan et al., (2007) reported feeding technology with mitigation strategies to reduce N excretion in beef cattle is also needed.

CF is the combination of concentrate and roughage in one diet. Utilization of agricultural and crop estate is one of way to provide feed for developing cattle in Central Java. Tamminga (1996) stated that every ruminant need carbohydrates, proteins, and lipids to maintain microbial rumen and produce products (meat, milk). In practices, diet usually is offered to cattle separate between roughage and concentrate. Complete feed technology were developed use agricultural land and crop estate by products such as rice straw, cotton seed meal, coconut pod. Previously many researcher conducted study in application of high concentrate in the diet (Benefield et al. 2006; Devant et al. 2000; Devant et al. 2001; Cozzi and Gottardo, 2004; Legleiter et al. 2005; Ostergaard et al. 1996), but they fed cattle roughage separate from concentrate.

At present, the productivity of cattle raised by farmers in Central Java was low, the reached ADG by farmers in Central Java was 0.52 kg/d. Sunarso (2007) introduced the technology complete feed without grass anymore, so farmers could raised cattle without think about grass planting. Complete feed technology was implemented to cattle farmers, which aimed to increase the productivity of cattle, fitted with their genetic ability. Devant et al. (2001) reported that no effect on animal performance or duodenal flow of microbial protein, when CP content in the concentrate was reduced to 14 %. Galyean (1996) reported cattle diet usually were formulated percentage of CP (DM basis) in the finishing diet ranged from 12.5% to 14.4%. The objectives of the study to examine effects of complete feed diets on the performance young bulls and then to determine the efficiency of the diets use economic evaluation.

II. MATERIALS AND METHODS

20 Simmental Crossbreed young bulls (initial body weight = 375.10 ± 24.05 kg (CV = 6.41%) were assigned to four balanced groups reared in separate pens with space of 2 m^2 per head, completely random design (CRD) was used in the study. The research is divided in two periods, 10 d for adaptation period and 56 d for collection period. CF were formulated in 5 treatments, T_0 (9 % CP, 60% TDN); T_1 (11 % CP, 60% TDN), T_2 (12% CP, 60% TDN), T_3 (13% CP, 60%TDN), and T_4 (14% CP, 60% TDN). The composition of feedstuff every diet is shown in Table I.

TABLE I
COMPOSITION OF CF

Feedstuff	T_0	T_1	T_2	T_3	T_4
	%				
Fermented rice straw	40	40.0	40.0	40.0	40.0
Corn Gluten feed	20	10.0	10.0	10.0	10.0
Cassava	10	30.0	27.0	21.0	20.0
Rice bran	20	6.7	6.2	9.3	5.8
Cottonseed meal	5	1.0	3.0	4.5	8.0
Coffee leather meal	-	1.5	1.0	1.0	1.0
Crude Palm Oil	-	0.1	0.1	0.1	0.1
Coconut meal	5	10.0	12.0	13.4	14.4
Urea	-	0.5	0.5	0.5	0.5
Mineral mix	5	0.1	0.1	0.1	0.1
Salt (NaCl)	-	0.1	0.1	0.1	0.1
Total	100	100.0	100.0	100.0	100.0

A. *In vitro analysis*

In vitro analysis followed Tilley and Terry method (Tillman *et al.*, 1998). NH_3 concentration was measured used micro diffusion Conway. Total protein was measured used Kjeldahl method.

B. *In vivo analysis*

The study used 20 simmental crossbreed young bulls with the live body weight 375,10 ± 24,05 kg (CV = 6,41%). The bulls were housed in separate pens with space of 2 m^2 per head. Moreover, to mitigate worms, vermiprazol 10% were offered to every bull with dose 40 ml/head. Daily feed consumption of CF was measured on Dry matter (DM). The amount of CF offered and refused was recorded daily. The feed refused for 1-week collection were composited and analyzed to determine the DM, OM, CP, and TDN contents. Bulls weighted every week to determine the Average daily gain (ADG). Berthelot method were used to measure the blood urea, and Spectofotometer with wavelength 546 nm were used to determine the blood glucose (Dawiesah, 1989).

C. *Statistical Analysis*

Analysis of Variance (ANOVA) were used to determine the effect of the complete feed on growth performance, DMI, OMI, hematologis status of the bulls. Differences among treatment means were determined using DMRT (Duncan multiple range test). All of these paramaters were statistically processed within SAS program.

III. RESULTS AND DISCUSSIONS

As shown in table I, the formulation of complete feed (T1-T4) followed NRC (1996). The CP content subtantially differ from that the control (T0). T4 had the highest CP content (13.61%) while T0 was computed to be the lowest (9.46%). TDN content of the diets subtantially is greater than control (T_0). The increasing of the CP concentration in diet could increase availability of Nitrogen in the rumen, The nitrogen used for rumen microbial synthesis. The composition of diets were formulated, supported Dicke in Galyean (1996) that stated diet contained CP ranged 12.5 to 13% could increase the ADG of the cattle.

TABLE II
CHEMICAL COMPOSITION OF DIETS (%)

Nutrient Composition	T_0 (control)	T_1	T_2	T_3	T_4
	………… % ……………				
DM,%	88.76	89.92	89.24	89.67	89.52
Crude protein,%	9.46	11.54	12.01	12.95	13.61
Crude fiber,%	29.42	24.41	26.67	23.21	25.63
EE,%	0.58	2.67	2.57	3.29	3.23
Ash,%	12.44	10.16	9.72	10.53	9.46
TDN,%	56.04	62.81	60.90	64.59	62.67

DM: dry matter; OM : organic matter; CP:Crude Protein; CF: Crude Fiber; EE: Ether extract; TDN : Total Digestible Nutrient

As shown in Table III, apparent DM and OM intakes did not differ ($P>0.05$) among the treatments. VFA production were similar among the treatments, eventhough VFA production in T_2 was the highest (113.33). NH_3 production were differ among treatments. NH_3 production of T_0 (Control) was the highest (6.60 mM), There was strong correlation between NH_3 production and N excreta. Kirchgessner et al in Castillo et al. (2001) stated Nitrogen consumed in excess of animal requirement is excreted in feces and urine, contributing to environmental pollution. The result found T_4 was the highest protein digestibility compare with other treatments.

TABLE III
IN VITRO, DIGESTIBILITY AND FERMENTABILTY

Items	T_0	T_1	T_2	T_3	T_4
DM intake (%)	53.80	50.36	49.44	52.58	50.96
OM intake (%)	60.31	62.39	56.99	58.05	62.16
VFA's (mM)	100	9333	113.33	105	100
NH_3 (mM)	6.60^a	6.05^b	5.23^c	4.68^d	5.50^c
Protein digestibility (%)	83.86^b	86.84^b	87.44^b	87.72^a	92.27^a

DM: dry matter; OM : organic matter; VFA: Volly fatty acids

Results of the study showed OM digestibility would always greater than the DM digestibility, this result were good, caused the high OM digestibility would more potencial to produce energy in the body, particularly to support metabolism process in the body. The OM digestibility ranged from 57% to 62%. Good quality of OM digestibility could produces VFA in the rumen and then could support uminal protein microbial.

Average of NH_3 production from T_0, T_1, T_2, T_3 dan T_4 respectively were 6.60 ; 6.05 ; 5.23 ; 4.68 dan 5.50 mM. The result supported by Sutardi *et al.*(1983) that average rumen NH_3 concentration ranged from 3.57 to 7.14 mM.

This concentration is enough to adequate the optimum microbial synthesis. The availability of NH_3 in the rumen is needed by rumen microbial in protein metabolism. NH_3 concentration which higher than 7.14 mM would negative correlated with productivity and efficiency of N utilization, while if the NH_3 is less than 3.57 mM would influence the efficiency of productivity and efficiency N utilization.

Results showed Ammona production and VFA were obtained still in the optimum value, VFA production CF ranged from 80 to 108 mM and ammonia production ranged from 4.68 to 6.60 mM. The results supported by (Sutardi *et al*., 1983) that explained that rumen NH_3 concentration ranged from 3.57 to 7.14 mM and VFA concentration ranged from 80 to 160 mM enough to support the optimum microbial sintesis in the rumen. Total Protein depended on VFA and NH_3 productions. Microbial protein synthesis supported by availability of ammonia as N sources, VFA as energy sources, and C chain for rumen microbial (Tamminga, 1996; Williams and Jenkins, 2003; Rodriguez et al. 2007). *in vitro analysis* showed VFA and NH_3 productions in all treatmets in normal values so the amount of VFA and NH_3 could support rumen microbial synthesis in the rumen.

Blood glucose before and after treatments was not differ significantly, but the blood glucose after treatments tended was higher than before treatments is shown in Table IV.

TABLE IV
BLOOD GLUCOSE LEVEL BULLS FED BY CF

Blood Glucose level	Treatments				
	T_0	T_1	T_2	T_3	T_4
	.... mg/dL				
Before	44.02	56.60	54.80	47.03	47.02
After	77.02	66.50	83.60	72.27	69.00

Fraser *et al*. (1986) noted blood glucose for dairy cattle ranged from 40 to 60 mg/dL. The blood glucose were higher than standard after treatments, caused, complete feed would produce the VFA particularly propionate acid in greater number. A propionate acid is glycogenic properties will be changed to glucose. Devant et al. (2000) explained that propionate acid in the rumen have highly correlated with crude protein (CP) content in the diets, e.g. sorghum, grains. Diet which contained grain could produce propionate acid, usually propionate acid is greater than acetic acid, and then propionate acid will be absorbed from rumen and will be transported to liver and will be changed as glucose.

Average blood urea before and after treatments showed in table 5. The blood urea was not differing significantly (P>0.05), but urea blood after treatments were less than before treatments. Duncan and Prasse (1977) in Fraser et al. (1986) explained that urea blood in dairy cattle approximately between 10-20 mg/dl. Urea blood before treatment was higher than that in standard. The blood urea of T_0, T_1, and T_2 after treatments in normal value. Blood urea of T_3 and T_4 were higher than that in standard. The blood urea before treatments was not differing significantly. After Treatments, The blood urea in T_3 and T_4 were differ than that in T_0, T_1, and T_2 (Table 5)

TABLE V
BLOOD UREA OF BULLS

Urea Blood level	Treatments				
	T_0	T_1	T_2	T_3	T_4
	.... mg/dL				
Before	50.06	49.37	50.69	39.03	52.59
After	19.00^a	16.04^a	15.60^a	27.00^b	31.10^b

TABLE VI
IN VIVO ANALYSIS BULLS FED BY CF

Treatments	T_0	T_1	T_2	T_3	T_4
DM intake (kg/head/d)	11.73	10.56	11.25	11.07	9.06
CP Intake ((kg/head/d)	1.17	1.21	1.35	1.40	1.23
TDN intake (kg/head/d)	6.47	6.38	7.01	6.88	5.42
DM digestibility	59.96	66.75	64.55	66.27	67.77
OM digestibility	65.18	71.56	69.45	71.12	71.87
CP digestibility	58.31	66.08	64.69	67.34	69.13
ADG (kg/d)	0.96^a	1.38^b	1.54^b	1.49^b	1.08^a
FCR (kg/head/d)	12.79	8.06	7.33	7.53	9.21
Feed cost (IDR)	8,192.8	10,349.3	11,090.3	11,154.3	9,659.8
Revenue (IDR)	17,28	24,84	27,720	26,820	19,49
Income (IDR)	9,087.8	14,490.7	16,629.7	15,665.7	9,780

FCR: Feed Conversion Ratio

As shown in Table VI, DM, CP, TDN intakes did not differ (P>0.05) among treatments. Increasing CP level in the diets had no effect on DM, CP, and TDN intakes. The results similar with the study of Devant et al. (2000) who examined effects protein concentration and degradability growing heifers fed high concentrates diets and concluded that DM and OM intakes unaffected by increasing level of CP.

Apparent DM, OM, and CP digestibility did not differ among the treatments (P>0.05). It does mean increasing level of CP did not affect DM, OM and CP digestibility. Relationship of CP and ADG is shown in Fig. 1. Findings the result increasing CP level until 12% could increase the ADG of the bulls. Similar with Galyean (1996), the diet contained 12.5% CP could maximize the ADG of cattle. FCR of T_2 was the lowest value (7.33). This value indicated that CF with 12% CP and 63% TDN was the most efficient diet compare with other CF diets.

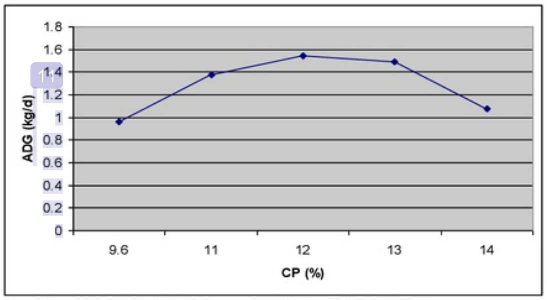

Fig. 1. Relationship between CP (%) and ADG (kg/d)

Economic evaluation showed diet T_2 generated the higher income than that in other treatments. T_2 enable generated income IDR 16,629.74/d with assumption other factors constant. Hence, base on techno-econo analysis T_2 (diet contained 12%CP, and 63%TDN) was the best diet in this research.

IV. CONCLUSIONS

The effect of the complete feed (T_1,T_2, T_3, and T_4) on the performance of the bulls was greater than that in control (T_0). Findings of the results T_2, which contained with 12% of CP content and 63% TDN, performed the best result in this study. Further research is needed to discuss the effect of the high concentrate level on N excretion.

REFERENCES

[1]. Benefield, B.C., M. Liniero., R. Ipharraguerre and J.H. Clark. 2006. Nutridensecorn grain and corn silage for dairy cows. J.Dairy Sci (89):1571-1579
[2]. Castillo, A.R., E.Kebreab., D.E. Beever., J.H. Barbi., J.D. Sutton., H.C. Kirby., and J. France. 2001. The effect of protein supplementation on nitrogen utilization in lactating dairy cows grass silage diets. J. Anim. Sci.2001 (79):247-253
[3]. Cozzi, G., F. Gottardo. 2005. Feeding behaviour and diet selection of finishing limousine bulls under intensive rearing system. Applied Anim. Bahav. Science. (91) 181-192
[4]. Dawiesah I., S. 1989. Penentuan Nutrient dalam Jaringan dan Plasma Tubuh. Pusat antar Universitas Pangan dan Gizi Universitas Gadjah Mada Yogyakarta.
[5]. Devant, M., A. Ferret., S. Cassamiglia., R. Casals., and J. Gasa. 2001. Effect of protein concentration and degradability on performance, ruminal fermentation, and nitrogen metabolism in rapidly growing heifers fed high concentrate diets from 100 to 230 kg body weight. J. Anim Sci. 2000.78:1667-1676
[6]. Devant, M., A. Ferret., S. Cassamiglia., R. Casals., and J. Gasa. 2001. Effect of nitrogen in high-concentrate, low-protein beef cattle diets on microbial fermentation studied in vivo and in vitro. J. Anim Sci. 2001.79:1944-1953
[7]. Fraser, C.M., A. Mays, H.E. Amstutz, J. Archibald, J. Armour, D.C. Blood, P.M. Newberne dan G.H. Snoeyenbos. 1986. The Merck Veterinary Manual : A Handbook of Diagnosis, Therapy, and Disease Prevention and Control for The Veterinarian. 6th Ed. Merck and Co. Inc Rahway, New York.
[8]. Galyean, M.L. 1996. Protein Levels in Beef Cattle Finishing Diets: Industry Application, University Research, and System results. J. Anim.Sci (74):2860-2870.
[9]. Legleiter, L.R., A.M. Mueller and S. Kerley. 2005. Level of supplemental protein does not influence the ruminally undegradable protein value. J. Anim. Sci. 2005 (83):863-870.
[10]. NRC (National Research Council). 1996. Netrient Requirements of Beef Cattle. Update 2000. Seventh Revised Edition, 1996. National Academy Press.Washington, D.C.
[11]. Ostergaard, S., J.T. Sorensen., J.Hindhede., A.R. Kristensen. 1996. Technical and economic effect of feeding one vs multiple total mixed rations estimated by stochastic simulation under different dairy herd and management characteristics. Livestock Production Science. (45) 23-33
[12]. Rodriguez., J. Gonzales., M.R. Alvir and Caballero. 2007. Effects of feed intake on situ rumen microbial contamination and degradation of feeds. Livestock Science (23): 15-30
[13]. Santoso, B and B.T. Hariadi. 2009. Evaluation of nutritive value and invitro methane production of feedstuffs from agricultural and food industry by-products. JIITA (34): 1989-1995
[14]. Sunarso. 2007. Strategi dan Model Komersialisasi Usaha Sapi Potong dalam Konsep Zero Waste di Kabupaten Blora. Unpublished Research Report.
[15]. Sutardi, T., N.A. Sigit dan T. Toharmat. 1983. Standarisasi Mutu Protein Bahan Makanan Ternak Ruminansia Berdasarkan Parameter Metabolismenya oleh Mikrobia Rumen. Proyek Pengembangan Ilmu dan Teknologi Dirjen Pendidikan Tinggi, Jakarta (Laporan Penelitian).
[16]. Tamminga, S. 1996. A Review on environmental impacts of nutritional strategies in ruminants. J. Anim. Sci (74):3112-3214
[17]. Tillman, A.D., H. Hartadi, S. Prawirokusumo, S. Reksohadiprojo dan S. Lebdosukoyo.1998. Ilmu Makan Ternak Dasar. Gadjahmada University Press, Yogyakarta.
[18]. Williams, C.B and T.G. Jenkins. 2003. A dynamic model of metabolizable energy utilization in growing and mature cattle.II. metabolizable energy utilization for gain. J. Anim. Sci.2003 (81):1382-1389
[19]. Yan, T., J.P. Frost., T.W.J. Keady., R.E. Agnew and C.S. Mayne. 2007. Prediction of nitrogen excretion in feces and urine of beef cattle offered diets containing grass silage. J. Anim.Sci (85): 1982-1989

IJENS

The Performance of Beef Cattle Fed by Complete Feed

ORIGINALITY REPORT

15%	13%	8%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	krishikosh.egranth.ac.in Internet Source	4%
2	jas.fass.org Internet Source	1%
3	curis.ku.dk Internet Source	1%
4	e-sciencecentral.org Internet Source	1%
5	M Devant, A Ferret, S Calsamiglia, R Casals, J Gasa. "Effect of nitrogen source in high-concentrate, low-protein beef cattle diets on microbial fermentation studied in vivo and in vitro.", Journal of Animal Science, 2001 Publication	1%
6	Yustina Yuni Suran, Dzaky Haidar Ali, Nu`man Firdaus, Rochijan .. "Milk Production and Composition of Etawah Crossbred, Sapera and Saperong Dairy Goats in Yogyakarta, Indonesia", International Journal of Dairy	1%

	Science, 2018 Publication	
7	docplayer.net Internet Source	1%
8	www.asas.org Internet Source	1%
9	www.bsas.org.uk Internet Source	1%
10	Cozzi, G.. "Feeding behaviour and diet selection of finishing Limousin bulls under intensive rearing system", Applied Animal Behaviour Science, 200506 Publication	1%
11	www.prairieswine.com Internet Source	1%
12	sutir.sut.ac.th:8080 Internet Source	<1%
13	www.i-scholar.in Internet Source	<1%
14	F. Gottardo, R. Ricci, S. Preciso, L. Ravarotto, G. Cozzi. "Effect of the manger space on welfare and meat quality of beef cattle", Livestock Production Science, 2004 Publication	<1%
15	paduaresearch.cab.unipd.it	

Internet Source

<1%

16 helvia.uco.es
Internet Source

<1%

17 animalsciencepublications.org
Internet Source

<1%

18 Estimation of Microbial Protein Supply in Ruminants Using Urinary Purine Derivatives, 2004.
Publication

<1%

19 www.asft.ttu.edu
Internet Source

<1%

20 ibic.lib.ku.ac.th
Internet Source

<1%

21 T. Yan, J. P. Frost, T. W. J. Keady, R. E. Agnew, C. S. Mayne. "Prediction of nitrogen excretion in feces and urine of beef cattle offered diets containing grass silage", Journal of Animal Science, 2007
Publication

<1%

22 Solanas, E.. "Effects of cereals and/or protein supplement extrusion on diet utilisation and performance of intensively reared cattle", Livestock Science, 200809
Publication

<1%

23	Li, D.. "Effect of diet composition on digestion and rumen fermentation parameters in sheep and cashmere goats", Animal Feed Science and Technology, 20081015 Publication	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

The Performance of Beef Cattle Fed by Complete Feed

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4