Bali Heifers Performance on Cassava Leaves, Palm Oil Sludge and Yeast Supplementation in a Ration Based on Kumpai Grass (Hymenachne amplexicaulis (Rudge) Nees)

by Riswandi Riswandi

Submission date: 03-Sep-2020 10:39AM (UTC+0700)

Submission ID: 1378672434

File name: AAVS_8_8_813-818_publish_juli_2020.pdf (376.01K)

Word count: 4706

Character count: 23997

OPEN ACCESS
Advances in Animal and Veterinary Sciences

Research Article

Bali Heifers Performance on Cassava Leaves, Palm Oil Sludge and Yeast Supplementation in a Ration Based on Kumpai Grass (*Hymenachne amplexicaulis (Rudge) Nees*)

RISWANDI*, BASUNI HAMZAH, AGUS WIJAYA, ARFAN ABRAR

Sriwijaya University, Indonesia.

Abstract | Utilization of potential swamp forages, by-product of the palm oil industry, and cassava is a strategy in the improvement of cattle feed. The purpose of this study was to evaluate the effect of cassava leaves, palm oil sludge, and yeast supplementation on a ration based on Kumpai grass (*Hymenachne amplexicaulis* (*Rudge*) *Nees*) on the performance of Bali heifers. Twelve Bali heifers were allocated into two groups. First group was fed with control diet consisting of 70% Kumpai grass + 30% concentrate (R0) while second group (R1) was fed a diet consisting of 55% Kumpai grass + 15% concentrate + 15% palm oil sludge (POS) + 15% cassava leaves + 5 g yeast (*Saccharomyces cerevisiae*)/head/d. The variables measured in this study were intake, digestibility of dry matter, organic matter, crude protein, neutral detergent fiber, acid detergent fiber, average daily gain, feed conversion ratio, and farmer income. Data were analyzed by independent t-test. The results showed that the supplemented diet had a significant performance by improving the intake of dry matter, organic matter, and crude protein. Moreover, it also followed by increasing the digestibility of dry matter, organic matter, crude protein, neutral detergent fiber, and acid detergent fiber, average daily gain, feed conversion ratio, and farmer income. Supplementation of palm oil sludge, cassava leaves, and yeast in the Kumpai grass-based ration significantly increased the performance of Bali heifers. Heifers fed the supplements gave a higher income than those without supplements.

Keywords | Bali heifers, Digestibility, Daily gain, Non-tidal swamp, Performance

Received | February 24, 2020; **Accepted** | June 28, 2020; **Published** | July 15, 2020
***Correspondence** | Riswandi, Sriwijaya University, Indonesia; Email: riswandi_dya@yahoo.com
Citation | Riswandi, Hamzah B, Wijaya A, Abrar A (2020). Bali heifers performance on cassava leaves, palm oil sludge and yeast supplementation in a ration based on kumpai grass (*Hymenachne amplexicaulis* (*Rudge*) *Nees*). Adv. Anim. Vet. Sci. 8(8): 813-818.
DOI | http://dx.doi.org/10.17582/journal.aavs/2020/8.8.813.818
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

INTRODUCTION

In the non-tidal swamp of South Sumatra, the forage supply mainly depends on aquatic vegetations, one of them is Kumpai grass (*Hymenachne amplexicaulis* (*Rudge*) *Nees*). However, the utilization of Kumpai grass is limited by the high fiber fraction that may reduce intake and digestibility when fed alone in the diet (Ali et al., 2013; Rostini et al., 2014).

The high price of concentrate was the main reason for the low frequency of cattle supplementation by smallholder farmers (Hernaman et al., 2018; Mumba et al., 2018). Concerning the price of commercial concentrate, the locally-available concentrate may increase cattle performances and farmer income. Palm oil sludge (POS) is one of the agro-industrial by-products from palm oil processing at a low price and available for small scale farming. The supplementation of POS has a potency for increasing intake and cattle performance due to a higher content of water-soluble carbohydrates and a source of unsaturated fatty acids (Hayyan et al., 2010) that might reduce methane gas production (Machmüller et al., 2000; Vlaeminck et al., 2006). An often-used approach for boosting cattle production in humid tropical areas was cassava leaves since a higher crude protein (CP) content, especially branched amino acids. Furthermore, The addition of branched amino acids in the ration was able to increase the growth of cellulolytic bacteria. It could be reflected by increasing the digestibility of dry matter (DM), organic matter (OM) and neutral detergent fiber (NDF) (Puastuti et al., 2017; Tedeschi et al., 2015).

Supplementation of yeast (*Saccharomyces cerevisiae*) increased the population of cellulolytic bacteria and reduced the accumulation of lactic acid and oxygen concentration in the rumen and thus increased the use of starch in the ration (Kumar et al., 2013; Pinloche et al., 2013). Other studies proved that yeast supplementation increased the digestibility of DM, OM, CP, and fiber fraction and microbial efficiency (Ali et al., 2015; Tang et al., 2008). The purpose of this study was to evaluate the effect of the locally-available supplementations on Bali heifer's performances.

MATERIALS AND METHODS

Location and duration

This research was conducted in the village of Tanjung Seteko, Ogan Ilir district, South Sumatra province of Indonesia, Rubber and oil palm plantations are dominantly cultivated in this area and serves a potential source of feed for beef cattle originating from the plantations by-products. The study was conducted for four months.

Experimental design and animals

Twelve Bali heifers aged one year with an initial body weight of 151±12.3 kg (mean±standard deviation) were randomly allocated into two experimental treatments. The animals were placed in individual pens (1.6 m x 2.5 m).

The trial was conducted for seven weeks and consisted of two weeks of preliminary period, four weeks of the adaptation period, and one week of digestibility measurement when feed intake and fecal excretion were quantified. Live weight was measured weekly before morning feeding.

Feeding

The experimental treatments comprised of two diets. The first group was the control diet (R0) consisting of Kumpai grass and concentrate (70:30, DM basis), the second group (R1) consisted of Kumpai grass, cassava leaves, POS (Palm oil sludge), and concentrate (55:15:15:15) and 5 g yeast/head/day (Table 2). The ration was prepared according to NRC (2001) for small breed cattle with estimated DM intake of 3% body weight.

Kumpai grass and cassava leaves were collected in the evening and then chaffed to ±10 cm. Palm oil sludge was obtained from a palm oil processing while Yeast (Yea-sac) was obtained from Livestock Research Center at Ciawi, Bogor. Feeding was started at 8.00 AM. First, the concentrate (yeast) and POS were offered while grass and cassava leaves were offered at 10:00 AM and 4:00 PM. Animals had free access to drinking water and Salt-mineral lick.

Table 1: The chemical composition of diets (% dry matter).

Nutrient	Kumpai grass	Cassava leaves	Palm oil sludge	Con-centrate
Dry matter	91.86	88.75	90.76	80.59
Organic matter	88.52	78.96	83.23	63.21
Crude protein	8.43	20.34	18.85	15.62
Crude fiber	32.85	23.64	13.54	11.24
Ether extract	4.64	7.92	18.93	6.99
Neutral detergent fiber	58.43	30.58	46.37	37.71
Acid detergent fiber	46.35	22,34	35.32	21.66
Hemicellulose	12.08	8.24	11.14	16.05
Cellulose	26,64	16.72	27.21	15.86
Lignin	13,51	4.62	7.25	3.52
Oleate	0.05	0.13	42.18	1.42
Linoleic	0.22	0.38	11.24	1.58
Valine	0.03	0.63	0.39	0.43
Leucine	0.07	0.75	0.48	0.37
Isoleucine	0.12	0.67	0.43	0.28

Note: Data were analyzed by Laboratory of Nutrition and Feed Science, Faculty of Agriculture, University of Sriwijaya.

Table 2: Ingredients and chemical compositions of the experimental diets (% dry matter).

Ingredients	Treatment	
	R0	R1
Kumpai grass (%)	70	55
Cassava leaves (%)	0	15
Palm oil sludge (%)	0	15
Concentrate (%)	30	15
Yeast (g/head/d)	0	5
Total	100	100
Dry matter	88.48	89.54
Organic matter	80.87	82.47
Crude protein (%)	11.29	13.41
Crude fiber (%)	28.37	25.33
Ether extract (%)	5.79	7.93
Neutral detergent fiber (%)	52.21	49.35
Acid detergent fiber (%)	39.94	36.65
Hemicellulose (%)	13.27	12.05
Cellulose (%)	23.41	23.62
Lignin (%)	10.51	9.23
Oleate (%)	0.46	6.59
Linoleic (%)	0.63	2.10
Valine (%)	0.15	0.23
Leucine (%)	0.16	0.28
Isoleucine (%)	0.08	0.27

Note: Data were analyzed by Laboratory of Nutrition and Feed Science, Faculty of Agriculture, University of Sriwijaya.

QUANTIFICATION OF FEED INTAKE AND FECES EXCRETION

Samples of 100 g of fresh material (FM) consisting of Kumpai grass, cassava leaves, POS, and concentrates were daily collected during the week of digestibility measurement. After that, to determine the diet-digestibility, the feed offered and refusal were weighed and recorded per animal per day. No concentrate refusal was found. The samples were dried at 65 °C for 72 hours and then pooled at the end of each trial week in order to obtain 100 g of dried sample.

Determination of daily fecal excretion was carried by removing the feces each time the animals defecated from the clean floor throughout the digestion week. For each heifer and every 24 hours (8:00 AM), all fesses were collected into a 10-l bucket and weighed. After that, the fesses were mixed by hand, and a sample of 300 g FM was dried in an aluminum foil tray at 65 ° C for 72 hours and re-weighed. At the end of the trial, all dry samples were grounded to pass a 1-mm mesh. Subsamples of 100 g of dried feces were stored for analysis.

CHEMICAL ANALYSIS OF SAMPLES

Samples from Kumpai grass, cassava leaves, POS and concentrates as well as fecal samples were analyzed for DM and ash (AOAC, 2005), neutral detergent fiber (NDF), and acid detergent fiber (ADF) (Van Soest et al., 1991). The concentration of N was determined by the Kjeldahl procedure (AOAC, 2005) using the distillation unit Tecator 1028 (Tecator GmbH; Hagen, Germany). All analyzes were carried out in duplicate, and the analyzes were repeated when the results differed by more than 5%.

DATA ANALYSIS

Digestibility value was obtained by reducing the intake of the dietary nutrient with nutrients in the feces and then divided by the intake of dietary nutrition. The feed conversion ratio was calculated by dividing the DM intake by live weight gain. Income over feed cost was calculated based on the differences between the selling price of the Bali heifers gain and feed costs in the unit of Indonesian rupiah (IDR). Differences in observed parameters between groups of treatments were analyzed by the t-test (SPSS 13.0 program).

RESULTS AND DISCUSSION

The results showed that the supplemented R1 ration increased intake ($P<0.05$) of DM, OM, and CP, whereas NDF and ADF were not significantly. increased intake for DM 13.07%, OM 21.34%, and CP 102.1% (Table 3). Furthermore, it also followed by increasing the digestibility of DM (16.21%), OM (18.66%), CP (24.12%), NDF (8.81%), and ADF (13.30%) compared without supplement ($P<0.05$) (Table 4).

Table 3: Intake (kg/d) of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), and acid detergent fiber (ADF) by Bali heifers at control (R0) and supplemented diet (R1).

Parameter	R0	R1	SEM	P
DM	6.12 ^{a}	6.92 ^{b}	0.23	0.043
OM	5.06 ^{a}	6.14 ^{b}	0.26	0.007
CP	0.47 ^{a}	0.95 ^{b}	0.12	0.010
NDF	3.14	2.84	0.15	0.380
ADF	2.26	2.13	0.11	0.600

Different superscripts in the same row show significant different ($P<0.05$). R0= 85% Kumpai grass + 15% concentrate (control); R1= 55% Kumpai grass + 15% concentrate + 15% cassava leaves + 15% palm oil sludge + 5 g yeast/head/d; SEM: standard error of the mean.

Table 4: Apparent digestibility (%) of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), and acid detergent fiber (ADF) by Bali heifers at control (R0) and supplemented diet (R1).

Parameter	R0	R1	SEM	P
DM	55.5 ^{a}	64.5 ^{b}	0.33	0.004
OM	58.4 ^{a}	69.3 ^{b}	0.12	0.001
CP	59.7 ^{a}	74.1 ^{b}	0.11	0.004
NDF	61.3 ^{a}	66.7 ^{b}	0.15	0.008
ADF	57.9 ^{a}	65.6 ^{b}	0.11	0.012

Different superscripts in the same row show significant different ($P<0.05$). R0= 85% Kumpai grass + 15% concentrate (control); R1= 55% Kumpai grass + 15% concentrate + 15% cassava leaves + 15% palm oil sludge + 5 g yeast/head/d; SEM: standard error of the mean.

The difference value of DM intake was caused by the nutrients, especially protein and energy feed (McDonald et al., 2010). The higher intake might relate to the lower content of NDF and higher CP in the supplemented diet, which is consistent with Cunningham et al. (2005) that the lower NDF content, the higher the feed intakes. Coleman and Moore (2003) stated that regulation of intake was an interaction between the characteristics of feed and the animal where mainly depend on rumen capacity and passage rate (McDonald et al., 2010). Increased DM, OM, and CP in the R1 were due by cassava leaves to have high CP content and also by POS as a source of fatty acids so that it will contribute to the preference level (palatability) cattle on feed intake. The same result was reported by Sanh et al. (2002) stated that the palatability and digestibility of nutrients feed were related to the CP content. According to NRC (2001), generally, the additional calcium salts of fatty acids in dairy cows can reduce the consumption of

DM. It is assumed that yeast supplementation modified the condition of the rumen, so the effects of unsaturated fatty acids on the DM intake could be suppressed.

The higher digestibility values might vary due to the lower fiber fraction of NDF and ADF and the higher CP contents of supplemented ration (Table 4). This result is due to the potential work of the carbon framework from sources of POS and N cassava leaves. It increases microbial growth in the rumen so that the microbial population will increase and continue to increase ration degradation in the rumen. Branched chain amino acids of cassava leaves (Table 1) might contribute to the higher NDF, and ADF digestibility since these amino acids are sources of carbon framework for rumen microbial growth (Puastuti et al., 2017; Tedeschi et al., 2015; Zhang et al., 2011). Increased protein supplementation has a positive correlation effect on CP digestibility with increased digestibility of DM and OM (Figueiras et al., 2016). The supplementation of cassava leaves (for branch chain amino acid (BCAA) source) and organic minerals in palm oil-based waste ration can increase the digestibility value of DM, OM, and Average daily gain (ADG) (Adhianto et al., 2018).

Souze et al. (2010) and Larazzarini et al. (2016) reported that nutrient supplementation both energy and protein together could be optimized for microbial growth in order to use fibrous feed and will increase the value of intake and digestibility. Moreover, it will increase nutrients for the formation of body tissues. Badarina et al. (2017) showed that the feeding of POS and some local fermented feed ingredients up to 10 kg/d increased the DM intake by 5.78 kg and digestibility of the ration by 73.14%. These results might also relate to the improvement of digestibility by yeast supplementation in the R1 ration (Ali et al., 2015; Tang et al., 2008). Supplementation of yeast increased the population of cellulolytic bacteria and reduced the accumulation of lactic acid and oxygen concentration in the rumen and thus increased the use of starch in the ration (Kumar et al., 2013; Pinloche et al., 2013).

The results showed that the mean of ADG of the heifers on the supplemented diet (R1) was higher ($P<0.05$) than that on the control diet (R0). As a result, the supplemented diet had a better FCR compared to the control diet (Table 5). Bali heifers fed POS, cassava leaves, and yeast supplementation gave 489% higher IOFC values than those fed Kumpai grass and concentrated (Table 6).

A bodyweight gain of cattle is strongly associated with nutrition in the feed and the feed digestibility level. Rations have a high nutrient content, and good palatability level can quickly increase body weight gain of cattle for fattening (Purwanti et al., 2014). According to NRC (2001), body weight gain is influenced by several factors such as total protein obtained each day, type of animal, age, state of genetic, environmental conditions, the condition of each individual, and the treatment of management.

Table 5: Average daily gain (ADG, kg/d) and feed conversion ratio (FCR) by Bali heifers at control (R0) and supplemented diet (R1).

Variable	R0	R1	SEM	P
ADG	0.32 [a]	0.56 [b]	0.07	0.04
FCR	23.2 [a]	13.3 [b]	1.20	0.035

Different superscripts in the same row show significant different ($P<0.05$). R0= 85% Kumpai grass + 15% concentrate (control); R1= 55% Kumpai grass + 15% concentrate + 15% cassava leaves + 15% palm oil sludge + 5 g yeast/head/d; SEM: standard error of the mean.

Table 6: Income Over Feed Cost (IOFC) (IDR/animal/d) and Revenue Cost (R-C) ratio in the Bali heifers at control (R0) and supplemented diet (R1).

Variabel	R0	R1	SEM	P
Price of ADG *	14,250.- [a]	25,250.- [b]	2,935.-	0.04
Feed costs **	12,142.- [a]	12,827.- [a]	559.6.-	0.6
IOFC	2,108.- [a]	12,423.- [b]	2,741.-	0.032
R-C ratio	1.16 [a]	1.98 [b]	0.15	0.046

Note: Different superscripts in the same row show a significant difference ($P<0.05$). R0 = 70% Kumpai grass + 30% concentrate (control); R1= 55% Kumpai grass + 15% concentrate + 15% cassava leaves + 15% palm oil sludge + 5 g yeast/head/d; SEM: standard error of the mean.

*: The price of animal = IDR 45, 000.-/kg of live weight); **: The price of Kumpai grass= IDR 1,000. - /kg; cassava leaves IDR 1,500. - /kg; Palm oil sludge IDR 1,500. - /kg; concentrate of IDR 3,500. - /kg, Yeast IDR 300,000. - /kg.

The increase of ADG is caused by an increase in the consumption and nutrient digestibility of the treatment ration. The result of the present study is in line with Riswandi et al. (2015) that the supplementation of Lamtoro leaves (*Leucaena leucocephala* (Lam.) de Wit) in the fermented Kumpai grass-based diet, which the results showed a higher ADG of Bali bulls than those on fermented Kumpai grass alone. The addition of yeast as a feed supplement in the diet has the potential to improve the rumen ecosystem, thus contributing to improved rumen microbial population. The increase in the digestibility and feed intake will increase nutrients to the body's tissue (Tripathi and Karim, 2010).

The conversion rate is the ratio between the amount of DM intake and animal body weight gain (Katongole et al., 2009). The value of feed conversion is highly dependent on the digestibility and nutrient metabolism in the body. Feed consumed will be used for basic living and production. Feed conversion value depends on the quality of feed, the higher nutrient contained, the better the resulting feed conversion (Nusi et al., 2011).

The IOFC of this study was IDR 12,264. - /animal/d with palm oil by-products on beef ration (Zakiatulyaqin et al., 2017), while Jefri et al. (2013) stated that livestock business using palm oil by-products was profitable with an R-C ratio more than 1.00.

CONCLUSIONS

Supplementation of palm oil sludge, cassava leaves, and yeast in the Kumpai grass-based ration significantly increased production of Bali heifers as shown by higher nutrients intake and digestibility and average daily gain. Heifers fed the supplements gave a higher income than those without supplements.

ACKNOWLEDGMENT

The researcher would like to thank Sriwijaya University for providing research funding through a competitive flagship scheme.

AUTHORS CONTRIBUTION

Riswandi, Basuni Hamzah, Agus Wijaya, and Arfan Abrar contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

REFERENCES

- Adhianto K, Muhtarudin, Liman, Haryanto A (2018). Improvement nutrient digestibility and production performance of cattle through restricted amino acid and organic minerals addition on fermented palm oil waste-based feed. Bull. Anim. Sci., 42(1): 45-49. https://doi.org/10.21059/buletinpeternak.v42i1.24158
- Ali AIM, Sandi S, Muhakka, Riswandi, Budianta, D (2013). The Grazing of Pampangan Buffaloes at Non Tidal Swamp in South Sumatra of Indonesia. APCBEE Procedia ICAAA 2013: July 27-28, Moscow, Russia. https://www.researchgate.net › publication › 280
- Ali AIM, Sandi S, Riswandi, Imsya A, Prabowo A, Rofiq N (2015). Evaluation of yeast supplementation with urea-molasses in rice straw-based diets on in vitro ruminant fermentation. Pak. J. Nutr., 14(2): 988-993. https://scialert.net/abstract/?doi=pjn.2015.988.993
- AOAC (2005). Offical methods of analysis. 18th ed. Association of Official Analytical Chemists, USA.
- Badarina I, Jarmuji, Gultom DP (2017). Kecernaan ransum sapi Bali dengan konsentrat fermentasi berbasis lumpur sawit dan bahan pakan local. J. Agrointek, 11(2): 63-67. https://journal.trunojoyo.ac.id › https://doi.org/10.21107/agrointek.v11i2.3173
- Coleman SW, Moore JE (2003). Feed quality and animal performance. Field Crops Res. 84(1): 17-29. https://www.researchgate.net › publication › 223, https://doi.org/10.1016/S0378-4290(03)00138-2
- Cunningham M, Latour MA, Acker D (2005). Animal Science and Industry. 7th Ed. Pearson Prentice Hall, Upper Saddle River, New Jersey.
- Figueiras JF, Detmann E, Franco, MO, Batista ED (2016). Effects of supplements with different protein contents on nutritional performance of grazing cattle during the rainy season. Asian-Australas. J. Anim. Sci., 29(12): 1710-1718. https://www.ncbi.nlm.nih.gov › pubmed, https://doi.org/10.5713/ajas.16.0125
- Hayyan A, Alam MZ, Mirghani MES, Kabbashi NA, Hakimi MNIN, Siran YM, Tahiruddin S (2010). Production of biodiesel from sludge palm oil by esterification process. J. Energy Power Eng. 4(1): 12-17. https://pdfs.semanticscholar.org
- Hernaman I, Budiman A, Tarmidi AR (2018). Perbaikan mutu ransum sapi potong melalui pemberian konsentrat berbasis pakan lokal di Purwakarta. J. Aplikasi Ipteks untuk Masyarakat. 7(1): 1 – 5. https://doi.org/10.24198/dharmakarya.v7i1.10279
- Jefri D, Daulay AH, Wahyuni TH (2013). Analisis usaha pemanfaatan daun kelapa sawit fermentasi dengan Aspergillus niger dan limbah pabrik kelapa sawit terhadap performans sapi Bali jantan. Jurnal Peternakan Integratif, 2(1): 22-30. https://jurnal.usu.ac.id › index.php › jpi › article
- Katongole CB, EN, Sabiiti FB, Bareeba I, Ledin (2009). The performance of growing indigenous goats fed a diet based on urban market crop wastes. Trop. Anim. Health Prod. 41: 329-336. https://doi.org/10.1007/s11250-008-9193-7
- Kumar DS, Prasad Ch S, Prasad RMV (2013). Effect of yeast culture (*Saccharomyces cerevisiae*) on ruminal microbial population in buffalo bulls. Buffalo Bull. 32: 116-119.
- Lazzarini I, Detmann E, Sebastião de Campos VF, Paulino MF, Erick DB, Luana M, de Almeida R, William LS dos R, Marcia de OF (2016). Nutritional performance of cattle grazing during the rainy season with nitrogen and starch supplementation. Asian Australas. J. Anim. Sci. 29(8): 1120-1128. https://doi.org/10.5713/ajas.15.0514
- Machmüller ADA, Ossowski, Kreuzer M (2000). Comparative evaluation of the effects of coconut oil, oilseeds, and crystalline fat on methane release, digestion, and energy balance in lambs. Anim. Feed Sci. Technol., 85(1–2): 41–60. https://www.researchgate.net › publication › 248, https://doi.org/10.1016/S0377-8401(00)00126-7
- McDonald P, Edwards RA, Greenhalagh JFD, Morgan CA, Sinclair LA, Wilkinson RG (2010). Animal Nutrition. Seventh, Ed., New York. C.A., Morgan, J.F.D., Greenhalgh, L.A., Sinclair and R.G., Wilkinson, Inc.
- Mumba C, Hasler B, Muma JB, Munyeme M, Sitali DC, Skjerve E, Rich KM (2018). Practices of traditional beef farmers in their production and marketing of cattle in Zambia. Trop. Anim. Health Prod. 50: 49-62. https://www.researchgate.net › publication › 320, https://doi.org/10.1007/s11250-017-1399-0
- NRC (2001). Nutrient Requirements of Beef Cattle. Washington, DC (US): seventh updated ed. Natl. Acad. Press.
- Nusi M, Utomo R, Soeparno (2011). Pengaruh penggunaan

tongkol jagung dalam *complete feed* dan suplementasi *undegraded protein* terhadap pertambahan bobot badan dan kualitas daging pada sapi peranakan ongole. Buletin Peternakan. 35(3): 1-9. https://doi.org/10.21059/buletinpeternak.v35i3.1090

- Pinloche E, McEwan, Marden JP, Bayourthe C, Auclair E, Newbold CJ (2013). The effects of a probiotic yeast on the bacterial diversity and population structure in the rumen of cattle. PLoS One. 8 (6): 78-24. https://journals.plos.org › plosone, https://doi.org/10.1371/journal.pone.0067824
- Puastuti W, Yulistiani D, Handiwirawan E (2017). Supplementation of molasses and branched chain amino Acids to increase in vitro digestibility of ammoniated corn cob in ruminants feed. JIVT. 22 (4):179-187. J. Ilmu Ternak dan Vet. https://doi.org/10.14334/jitv.v22i4.1664
- Purwanti D, Suryahadi D, Evvyernie (2014). Performa sapi potong sebagai respon dari suplementasi probiotik padat dan cair. Buletin Makanan Ternak. 101(1): 13 - 24
- Riswandi, Ali AIM, Muhakka, Syaifuddin Y, Akbar I (2015). Nutrient digestibility and productivity of Bali cattle fed fermented *Hymenachne amplexiacalis* based rations supplemented *Leucaena leucocephala*. J. Media Peternakan. 38(3): 156-182. https://pdfs.semanticscholar.org, https://doi.org/10.5398/medpet.2015.38.3.156
- Rostini T, Abdullah L, Wiryawan KG, Kartic, PDMH (2014). Utilization of swamp forages from South Kalimantan on local Goat performances. J. Media Peternakan, 37(1): 50-56. https://doi.org/10.5398/medpet.2014.37.1.50
- Sanh MV, H Wiktorson, LVLy (2002). Effects of natural grass forage to concentrate ratio and feeding principles on milk production and performance of cross bred lactating cows. J. Anim. Sci. 15: 650-657. https://doi.org/10.5713/ajas.2002.650
- Souza MA, Detmann E, Paulino MF (2010). Intake, digestibility and rumen dynamics of neutral detergent fibre in cattle fed low-quality tropical forage and supplemented with nitrogen and/or starch. Trop. Anim. Health Prod. 42: 1299-1310. https://doi.org/10.1007/s11250-010-9566-6
- Tang SX, Tayo GO, Tan ZL, Sun H, Shen LX, Zhou CS, Xiao WJ, Ren GP, Han XF, Shen SB (2008). Effects of yeast culture and fibrolytic enzyme supplementation on in vitro fermentation characteristics of low - quality cereal straws. J. Anim. Sci., 86: 1164 –1172. https://www.researchgate.net › publication › 564_, https://doi.org/10.2527/jas.2007-0438
- Tedeschi LO, Fox DG, Fonseca MA, Francis L, Cavalcanti L (2015). Models of protein and amino acid requirements for cattle: Invited Rivi. R. Bras. Zootec. 44: 109-132. https://doi.org/10.1590/S1806-92902015000300005
- Tripathi MK, Karim SA (2010). Effect of individual and mixed live yeast culture feeding on growth performance, nutrient utilization and microbial crude protein synthesis in lambs. Anim. Feed Sci. Technol. 155(2-4): 163-171. https://doi.org/10.1016/j.anifeedsci.2009.11.007
- Van Soest PJ, Robertson JB, Lewis BA (1991). Methode for dietary fiber neutral detergent fiber and nonstrarch polysaccharides in relation to animal nutrittion. J. Dairy Sci. 74(10): 3583-3597. https://www.sciencedirect.com › article, https://doi.org/10.3168/jds.S0022-0302(91)78551-2
- Vlaeminck B, Fievez V, Tamminga S, Dewhurst RJ, Van Vuuren A, De rabander D, Demeyer D (2006). Milk odd- and branched-chain fatty acids in relation to the rumen fermentation pattern. J. Dairy Sci. 89: 3954–3964. https://www.ncbi.nlm.nih.gov, https://doi.org/10.3168/jds.S0022-0302(06)72437-7
- Zakiatulyaqin, Suswanto I, Lestari RB, Setiawan D, Munir AMS (2017). Income over feed cost dan R-C ratio usaha ternak sapi melalui pemanfaatan limbah kelapa sawit. Jurnal Ilmiah Peternakan Terpadu. 5(1): 18-22. https://media.neliti.com, https://doi.org/10.23960/jipt.v5i1.p18-22
- Zhang HL, Chen Y, Xiao Li Xu, HL, Yang YX (2011). Effects of Branched-chain Amino Acids on *In vitro* Ruminal Fermentation of Wheat Straw. Asian-Australas J. Anim Sci. 26(4): 523–528. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4093378/, https://doi.org/10.5713/ajas.2012.12539

Bali Heifers Performance on Cassava Leaves, Palm Oil Sludge and Yeast Supplementation in a Ration Based on Kumpai Grass (Hymenachne amplexicaulis (Rudge) Nees)

ORIGINALITY REPORT

17%	14%	14%	10%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Mansoura University Student Paper	3%
2	journal.ipb.ac.id Internet Source	2%
3	www.tandfonline.com Internet Source	1%
4	www.fmvz.unesp.br Internet Source	1%
5	medpub.litbang.pertanian.go.id Internet Source	1%
6	www.e-sciencecentral.org Internet Source	1%
7	eprints.undip.ac.id Internet Source	1%
8	krishikosh.egranth.ac.in Internet Source	1%

9	koreascience.or.kr Internet Source	1 %
10	researcherslinks.com Internet Source	1 %
11	Renata Miltko, J. Agnieszka Rozbicka-Wieczorek, Edyta Więsyk, Marian Czauderna. "The Influence of Different Chemical Forms of Selenium Added to the Diet Including Carnosic Acid, Fish Oil and Rapeseed Oil on the Formation of Volatile Fatty Acids and Methane in the Rumen, and Fatty Acid Profiles in the Rumen Content and Muscles of Lambs", Acta Veterinaria, 2016 Publication	1 %
12	Sayed , Haiam A. | El-Maghraby , M. M.. "Effect of Dietary Roughage to Concentrate Ratios with Sunflower Oil Supplement on Digestibility, Rumen Fermentation, Milk Production and Milk Fatty Acid Profile of Dairy Goats = تأثير نسبة العلف المركز إلى العلف الخشن، مع وجود زيت عباد الشمس في العليقة، على معاملات الهضم، تخمرات الكرش، إنتاج اللبن وتركيبه والمحتوى من الأحماض الدهنية للماعز الحلابة", Egyptian Journal of Sheep and Goat Sciences, 2017 Publication	1 %
13	Submitted to Sriwijaya University Student Paper	1 %

14	www.cambridge.org Internet Source	1%
15	Submitted to University of Queensland Student Paper	1%
16	repository.lppm.unila.ac.id Internet Source	1%
17	www.mdpi.com Internet Source	1%
18	M Rahmat, B T Premono, N A Ulya, E A Waluyo, A Sumadi, F Azwar, A Kurniawan, Muhakka. "Management of swamp buffalo farms in forest areas to preserve forest ecosystem and sustainability of community livelihoods", IOP Conference Series: Earth and Environmental Science, 2019 Publication	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	Off		