

Performance of Kacang Goats fed with Complete WaferedForage based on I Palm Plantation Waste

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Performance of Kacang Goats fed with Complete Wafered Forage based on I Palm Plantation Waste

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Abstract

Background and Objective: Palm oil plantations have a great potential in underpinning the development of animal industry in South Kalimantan through supplying feeds for ruminants. This research was aimed at utilising oil palm plantation by-products to improve production performance of Kacang goats in South Kalimantan using complete wafered roughages (CWR) based on oil palm plantation by products. **Materials and Methods:** Sixteen 11 month-old male Kacang goats weighing 12 ± 1.2 kg were allocated to four different feed formulations with four replications, namely 1) Control feed consisting of 60% pasture grass + 40% legume (PTA), 2) 50% CWR + 50% PTA (PT1) 3) 75% CWR + 25% PTA (PT2) 4) 100% CWR (PT3). The experimental measurements were dry matter intake (DMI), dry matter digestibility (DMD), live weight gain (LWG), and feed efficiency. The data were statistically analysed by one-way ANOVA. **Results:** Compared to those fed with other dietary treatments, Kacang goats offered 75% CWR on the feed PT2 have higher DMI (521.7 g/day; $P < 0.05$), crude protein (CP) consumption (68.4 g/day; $P < 0.05$), DMD (64.7%; $P < 0.05$), and protein digestibility (72.4%; $P < 0.05$). As a result, PT2 feed formulation has significantly increased LWG of Kacang goats by 95.5 g/day ($P < 0.05$) and improved feed efficiency by 0.12. **Conclusion:** Complete wafered roughages can be used as a feed for Kacang goat at a level of 75% on the ration.

Keywords : complete wafered roughages, digestibility, goats, oil palm fronds,

Introduction

The rapid expansion of palm oil plantation has resulted a large amount of waste products either from the plantation area or palm oil mill. The main by-products of palm oil industry are empty fruit bunches (EFB), oil palm fronds (OPF), oil palm trunks (OPT), palm kernel cake (PKC), palm press fibre (PPF), palm oil mill effluent (POME), and shell (Alimon & Zahari, 2012) In South Kalimantan, however, these by products have not been utilised optimally for animal feeds due to technical issues such as limited access to obtain the by-products and lack of technology to treat them as feeds for livestock.

Palm kernel cake is the most potential material to be used as a feed for ruminants owing to high crude protein (CP) content compared to other by products ranging from 16 to 17% (Carrion *et al.*, 2011). Because the content of crude fibre is ~16%, therefore, the use of PKC in the feed of ruminant should be accompanied by other feed supplements. Moreover, PKC can be added in the ration by up to 30% without hindering performance of ruminants (Batubara *et al.*, 2005). Following this, OPF which consists of leaves, midribs, and stems (petiole) could also be utilised as a potential source of energy for ruminant as it generates a huge amount of biomass which is about 82.5 kg/tree annually (Wan Zahari *et al.*, 2003). After being segregated from OPF, Biyatmoko (2013) reported that a palm oil tree yielded ~3.3 kg of fresh leaves with 35% dry matter (DM) content. Apart from its abundant availability, Rusli *et al.* (2016) reported that palm leaf contains 11.2% CP, 46% cellulose, 26.3% lignin, 69.3% NDF, and < 50% *in vitro* digestibility. Therefore, pre-treatments to palm oil by products are inevitable prior to offering to ruminants in order to improve digestibility and palatability.

A complete wafered roughage (CWR) technology has two main benefits *viz.*, easy to be stored and perishable (Suzawa, 1978). Moreover, Retnaniet *al.* (2010) accentuated that nutrient content of wafered roughages is more complete than those without any treatment.

Moreover, the compact form of wafered roughages results in the efficient use of storage space.

The main objective of this study was to scrutinise the effectiveness of utilising oil palm by-products to improve the performance of Kacang goats using complete wafered roughages (CWR) based on oil palm plantation products.

5 Materials and Methods

The experiment was conducted at the animal house Islamic University of Kalimantan (UNISKA), Animal Nutrition laboratory Lambung Mangkurat University (ULM), Feed Technology Laboratory Bogor Agricultural University (IPB), Biotechnology Laboratory IPB, and BALITNAK Ciawi Laboratory Bogor. Palm oil fronds were emanated from oil palm plantation, Gunung Kupang, South Kalimantan.

Animals and Diets

Sixteen 11 months-old male Kacang goat weighing 12 ± 1.2 kg were housed at individual metabolic pens during 40 days and consisted of four periods of experimentation. The goats were then allocated to four different feed treatments: 1) control feed consisting of 60% pasture grass + 40% legume (PTA), 2) 25% pasture grass + 25% legume + 50% complete forage wafered (PT1), 3) 12.5% pasture grass + 12.5% legume + 75% complete forage wafered (PT2), and 4) 100% complete forage wafered (PT3). Prior to the experiment, the goat had been drenched by Kalbazenat a dose of 0.01% LW and treated by vitamins at a dose of 250 mg/head. Treated feeds were fed to goats twice a day at 08.00 and 15.00. Nutrient composition of each treatment is elaborated in Table 1 and 2.

Procedure of Complete Wafered Roughage Production

After being separated from oil palm fronds, the stem was peeled and chopped using chopper until it was smooth as fibre. Following this, the chopped stem was dried under the sun or drier for 5 – 8 hours until the moisture content was 15 – 17%. Palm kernel cake, rice bran, cassava meal, molasses, and urea were further mixed with the dry chopped stem. In order to generate complete wafered roughages, the mixed feedstuff was inserted into wafered machine to be pressed, heated, and formed at a temperature of 100°C for 10 minutes. Finally, the wafered roughages were cooled down at a room temperature. The dimension of CWR is 20x20x1.5cm and the average weight is approximately 400g.

Table 1. Nutrient composition of grass, legume, and complete forage wafered

Nutrient Content (%)	Grass (G)	Legume (L)	Complete Wafered Roughage (CWR)
Dry matter	20.12	27.86	86.54
Crude protein	9.21	18.43	12.64
Crude fibre	25.12	23.20	24.67
Ether Extract	2.85	0.12	3.14
Nitrogen Free Extractives	54.86	42.65	44.03
TDN	51.86	52.72	61.42
NDF	63.00	58.93	43.99
ADF	45.25	38.28	37.23
Ca	0.54	0.32	1.32

P	0.72	0.64	0.86
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TDN = Total Digestible Nutrient, NDF = Neutral Detergent Fiber, ADF = acid detergent fiber, Ca = calcium, P = Phosphor

Table 2. Nutrient analysis and feed composition of experimental diets offered to Kacang goat

Nutrient Content (%)	Ration Formulation			
	PTA	PT1	PT2	PT3
	60%G + 40%L	25%G+25%L+50%C	12.5%G+12.5%L+75%C	100%C
Dry Matter	70.68	71.53	70.26	86.54
Crude Protein	12.24	13.12	13.62	12.64
Ether Extract	3.00	3.88	4.98	3.14
Crude Fibre	25.76	23.82	24.74	24.67
TDN	58.21	59.87	60.12	61.42
NDF	57.85	54.32	56.62	43.99
ADF	39.54	32.75	42.76	37.23
Ca	1.05	1.39	1.45	1.32
P	0.68	0.72	0.78	0.86

PTA = control feed consisting of 60% pasture grass + 40% legume, PT1 = 25% pasture grass + 25% legume + 50% complete forage wafered, PT2 = 12.5% pasture grass + 12.5% legume + 75% complete forage wafered, and PT3 = 100% complete forage wafered, TDN = Total Digestible Nutrient, NDF = Neutral Detergent Fiber, ADF = acid detergent fiber.

Data Collection and Faecal Analysis

Faecal and urine collections were conducted daily within seven days after all treatments and other measurements had been undertaken completely. Faecal and refusals were collected every morning before the feed was given. Approximately 10% of the samples were composited on the plastic bag and refrigerated before being analysed in the laboratory.

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Experimental Design

The completely randomise design was used with four treatments and four replications. The goat performance [DMI, digestibility, live weight gain (LWG), and feed efficiency] were statistically assessed by one-way ANOVA using IBM® SPSS version 22. The difference between means was analysed using Duncan's multiple-range test to compare means within the fixed factors. The significant level was set at $P < 0.05$.

Results

Feed Intake

Kacang goats given control feed (60% grass + 40% legume) ingested the least fodder and that were treated with 50% and 75% CWR. Inclusion of CWR by up to 75% in the diet increased DMI of goats significantly ($P < 0.05$). However, providing 100% CWR to the goats deteriorated DMI by 35.3 g/day ($P < 0.05$) (Table 3). Moreover, either 50% or 75% inclusion of CWR in the diet did not give a striking impact on DMI of Kacang goat ($P > 0.05$).

On a dry matter basis, the average CP intake (CPI) of Kacang goat was 64.5 g/day. There was a significant increase ($P < 0.01$) in CPI of goats with the increase in the level of CWR in the ration by up to 75%. However, the CPI was markedly declined by 8.3% when CWR was offered as the only feed for Kacang goats ($P < 0.05$). The CPI of Kacang goat is presented in Table 3.

Table 3. Feed intake of Kacang goat across feed treatments

Intake	Treatments				SEM
	PTA	PT1	PT2	PT3	
Dry matter (g/day)	474.63 ^a	497.36 ^b	521.74 ^b	486.42 ^a	20.08
Crude protein (g/day)	62.21 ^a	64.41 ^b	68.45 ^b	62.78 ^a	2.82
Crude fibre (g/day)	113.50	126.86	120.76	112.64	6.69
Ether extract (g/day)	33.62	48.54	50.14	35.65	8.56
N Free extractives (g/day)	246.54	252.98	264.12	240.76	10.01
TDN (g/day)	282.74	324.24	345.85	298.13	27.94
NDF (g/day)	250.52	274.65	308.75	283.76	24.06
ADF (g/day)	172.34	184.60	245.84	215.25	32.94

PTA = control feed consisting of 60% pasture grass + 40% legume, PT1 = 25% pasture grass + 25% legume + 50% complete forage wafered, PT2= 12.5% pasture grass + 12.5% legume + 75% complete forage wafered, and PT3 = 100% complete forage wafered. TDN = Total Digestible Nutrient, NDF = Neutral Detergent Fiber, ADF = acid detergent fiber, Means within a row with no common superscript differ significantly ($P < 0.05$).

Feed Digestibility

Dry matter digestibility (DMD) of feed was significantly influenced by the presence of CWR on the ration of Kacang goat. Enhancing level of CWR on the ration from 0 – 75% had significantly altered DMD by 2.6% ($P < 0.05$). However, there was a 2.5% decrease in DMD of feed ($P < 0.05$) when 100% CWR was solely used as a feed for the goat (Table 4). The DMD of feed did not differ by the inclusion of CWR at a level of 0, 50, and 100% (Table 4).

Table 4. Feed digestibility of Kacang goat fed complete forage wafered

Digestibility	Treatments				SEM
	PTA	PT1	PT2	PT3	
Dry matter (%)	62.11 ^a	63.94 ^a	64.72 ^b	62.23 ^a	1.47
Crude protein (%)	68.02 ^a	69.98 ^a	72.45 ^b	69.24 ^a	1.87
Crude fibre (%)	61.45	60.32	62.89	61.45	1.05
Ether extract (%)	34.12 ^a	45.41 ^a	66.54 ^b	65.75 ^b	15.92
N Free extractives (%)	65.64	66.34	67.52	65.54	0.91
NDF (%)	39.54 ^a	50.42 ^b	48.48 ^b	56.73 ^c	7.10
ADF (%)	42.78 ^a	49.46 ^b	46.18 ^a	53.62 ^b	4.63

PTA = control feed consisting of 60% pasture grass + 40% legume, PT1 = 25% pasture grass + 25% legume + 50% complete forage wafered, PT2= 12.5% pasture grass + 12.5% legume + 75% complete forage wafered, and PT3 = 100% complete forage wafered. TDN = Total Digestible Nutrient, NDF = Neutral Detergent Fiber, ADF = acid detergent fiber.

Live Weight Gain and Feed Efficiency

During 40 days of experimental study, LW of Kacang goats increased from 12.85 to 15.98 kg. On average, LWG of Kacang goat in this experiment was 78.75 g/day. The incremental level of CWR at the levels of 75 and 100% on the ration had successfully enhanced LWG significantly ($P < 0.05$). However, both treatments did not markedly differ in altering LWG of goats. Accordingly, there was no significant impact of adding 50% CWR on LWG of Kacang goats ($P > 0.05$) (Table 5). Furthermore, inclusion of 75% CWR had the most efficient feed utilisation by Kacang goats.

Table 5. The effects of complete wafered roughages on live weight gain (LWG) and feed efficiency of Kacang goat

Variables	Treatments				SEM
	PTA	PT1	PT2	PT3	
Initial body weight (kg)	12.5	13.0	12.9	13.0	0.26
Final body weight (kg)	15.0	16.1	16.5	16.3	0.67
Live weight gain (total) (kg)	2.5 ^a	3.1 ^a	3.9 ^b	3.3 ^b	0.58
Live weight gain (average) (g/day)	62.5 ^a	77.5 ^a	92.5 ^b	82.5 ^b	9.63
Feed efficiency	0.08	0.09	0.12	0.09	0.02

PTA = control feed consisting of 60% pasture grass + 40% legume, PT1 = 25% pasture grass + 25% legume + 50% complete forage wafered, PT2= 12.5% pasture grass + 12.5% legume + 75% complete forage wafered, and PT3 = 100% complete forage wafered. Means within a row with no common superscript differ significantly ($P < 0.05$)

Discussion

Dietary intake of goat in this experiment has fulfilled the standard requirement for basal metabolic rate (BMR) which was between 2.6 – 3.5% LW. According to NRC (2006), BMR of goat requires 2.4 – 2.8% LW of DMI. In this trial, inclusion of CWR at a level of 75% resulted in the highest DMI (521.7 g/day) and 100% CWR was the least feed consumed by the goat (474.6 g/day). This results was likely due to increasing level of fine particles in the ration of goats. Poppi *et al.* (1980) reported that the particles greater than 1.18mm are difficult to flow from rumen to abomasum. Rostini *et al.*, (2014) reviewed that wafered dried forages shrivelled the particle size which leads to an increase in voluntary feed intake (VFI) of beef cattle. Likewise, Kawamoto *et al.* (2001) pointed out that a decrease in particle size of the oil palm fronds enhances the amount of particles flow from the rumen and hence increases VFI.

Utilising complete wafered roughages as a sole feed for goat reduced DMI significantly. According to Eriksson *et al.* (1968), a ration of entirely wafered roughages could potentially reduce the motility of reticulo-rumen and cause a loss of appetite. Therefore, 100% CWR in this experiment deteriorated DMI and DMD. Wilkins *et al.* (1972) stated that finer particle size accelerates the passage rate in the alimentary tract and hence diminish DMD. Hence, it can be inferred that 75% wafered oil palm leaves in this trial creates the optimum particle size to be digested by rumen microbiota of Kacang goats. Dahlan *et al.* (2000) reported 80% and 63% OPF in the ration of goats improve digestible DMI significantly. Reduced DMI and DMD at a level of 100% of CWR at the ration was likely due to insufficient amount of CP and energy. Therefore it is pivotal to provide concentrate and other supplementary feeds along with CWR in the ration of goat for fulfilling protein and energy requirements.

The significant effects of high levels of CWR (75% and 100%) on LWG of goats occurred because both treatments had higher nutrient content particularly CP and TDN than did other feed formulations. This is because CWR contains palm kernel cake, rice bran, molasses, cassava meal and urea. McDonald *et al.* (2011) explained that those feedstuffs are the great sources of carbohydrate, protein and nitrogen. In this trial, Kacang goats fed 75% CWR were also the most efficient feed utilisers. Reynolds *et al.* (2011) stated that high contingency of ruminant on forages as the main sources of energy has reduced feed efficiency. Thus, low forage proportion on the ration can be associated with high feed efficiency.

Conclusion

The utilisation of complete wafered roughage based on palm oil leaves as a feed of Kacang goat is potential due to its benefit to improve DMI, DMD, LWG and feed efficiency. However, the use of CWR in the ration of Kacang goat should be along with forages and other supplementary feeds to fulfil protein and energy requirements. Hence, it can be suggested that 75% is the optimum level of CWR on the ration of Kacang goat.

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References

- Alimon, A. R., & Wan Zahari, W. M. (2012). Recent advances in utilization of oil palm by-products as animal feed. In E. Wina, L. H. Prasetyo, I. Inounu, A. Priyanti, A. Anggraeni, D. Yulistiani, & Z. Asnan (Eds), *International Conference on Livestock Production and Veterinary Technology 2012* (pp. 211-219).
- Batubara, L. P., Krisnan, R., Ginting, S. P., & Sianipar, J. (2005). The Utilization of Palm Kernel Cake and Solid Ex-Decanter as an Additional Feed on Growth of Goats. *Seminar Nasional Teknologi Peternakan dan Veteriner 2005* (pp. 611-616).
- Biyatmoko, D. (2013). Response of increased nutrients of fermented palm fronds inoculated by different inoculants. *Ziraa'ah*, 36(1), 20-24.
- Carrión, S., De Blas, J. C., Méndez, J., Caídas, A., & García-Rebollar, P. (2011). Nutritive value of palm kernel meal in diets for growing rabbits. *Animal Feed Science and Technology*, 165(1), 79-84.
- Dahlan, I., Islam, M., & Rajion, M. A. (2000). Nutrient intake and digestibility of fresh, ensiled and pelleted oil palm (*Elaeis guineensis*) frond by goats. *Asian-Australasian Journal of Animal Sciences*, 13(10), 1407-1413.
- Eriksson, S., Jönsson, G., Persson, S. J., & Wallin, O. (1968). The influence of pelleted and wafered roughage on the rumen digestion, the milk fat content, and the health of cows. *Acta Agriculturae Scandinavica*, 18(3), 168-176.
- Kawamoto, H., Mohamed, W. Z., Shukur, N. I. M., Ali, M. S. M., Ismail, Y., & Oshio, S. (2001). Palatability, digestibility and voluntary intake of processed oil palm fronds in cattle. *Japan Agricultural Research Quarterly (JARQ)*, 35(3), 195-200.
- McDonald, P., Edwards, R. A., Greenhalgh, J. F. D., Morgan, C. A., Sinclair, L. A., & Wilkinson, R. G. (2011). *Animal Nutrition*. 7th. Essex, UK: Pearson Education.
- Poppi, D. P., Norton, B. W., Minson, D. J., & Hendricksen, R. E. (1980). The validity of the critical size theory for particles leaving the rumen. *The Journal of Agricultural Science*, 94(02), 275-280.
- Retnani, Y., Syananta, F. P., Herawati, L., Widiarti, W., & Saenab, A. (2010). Physical characteristic and palatability of market vegetable waste wafer for sheep. *Animal Production*, 12(1), 29-33.

- Reynolds, C.K., Crompton, L.A., & Mills, J.A.N. (2011). Improving the efficiency of energy utilization in cattle. *Animal Production Science*, 51, 6-12.
- Rostini Rostini T, Abdullah L, Wiryawan KG, Karti PDMH. 2014. Utilization of Swamp forages from South Kalimantan on Local Goat Performances. *Media Peternakan* . 37(1): 50-55
- Rusli, N. D., Mat, K., Harun, H. C., Mohamed, W. Z., Kasim, A., Saad, M. Z., & Hassim, H. A. (2016). Assessing the potential of oil palm frond juice as animal feed supplements by determining its nutrients, lignocellulosic and sugar contents. In *1st International Conference on Tropical Animal Science and Production (TASP 2016): Integrated Approach in Advanced Animal Science and Innovation Technology (Volume II)*(pp.277-282).
- Stell, R.G.D. & Torrie, J.H.(1981). *Principles and Procedures of Statistics:A Biometrical Approach*(2nd Edition). Tokyo, Japan: McGraw-Hill Book Company Inc.
- Suzawa, K. (1978). Roughage wafering techniques in Japan. *Japan Agricultural Research Quarterly (JARQ)*, 12(1), 17-21.
- Taylor, J. C. (1970). Dried forages and beef production. *Grass and Forage Science*, 25(2), 180-190.
- Wan Zahari, W. M., Hassan, O. A., Wong, H. K., & Liang, J. B. (2003). Utilization of oil palm frond-based diets for beef and dairy production in Malaysia. *Asian Australasian Journal of Animal Sciences*, 16(4), 625-634.

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