THE USE OF OIL PALM FRONDS AS AN ENERGY SOURCE FOR PREGNANT BALI COW RATION AND ITS EFFECT ON THE COW'S PERFORMANCES

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ABSTRACT

One of the inhibitors to develop cattle in Indonesia is the limitation of forage as the main ration for ruminants, especially cattle. One of them, which can be a substitute for forage, is oil palm fronds (OPF); the real number is abundant and available. This study aims to examine the use of OPF as the main energy source in Bali cows rations and its effect on the cow's performance. Twenty pregnant Bali cows were fed consist of OPF as an energy source, mixed with Pueraria javanica (PJ) and Palm Kernel Meal (PKM) as a source of protein (OPF group ration, with 13.89% Crude Protein, 73.52% Total Digestible Nutrients), compared to cows group given only cut and carry grasses as a Control (9.02% CP, 50.92%TDN). The results showed that the consumption and digestibility of DM, CP, and TDN significantly more in the OPF group (P <0.05). There were no differences in body condition score (BCS) and calf vigor score, but differences in calf birth weight (18.13 vs. 15.07 kg)(P<0.05) and an acceleration in postpartum estrous (54.6 days vs. 69.9 days). It concluded that oil palm fronds could be used as the main energy sources for pregnant Bali cow's ration. There was better cow's performance compared to cows fed with cut and carry grasses.

Key words: Oil palm fronds, Energy source, Performance of Bali cows

INTRODUCTION

One of the inhibitors to develop cattle in Indonesia is the limitation of forage as the main ration for ruminants, especially cattle. One of the potencies that have not been exploited is oil palm fronds from the palm trees after fresh fruit bunches harvested (Sunarko, 2009). Each hectare of the plantation can be produced as many as 486 tons of dry fronds and 17.1 tons of dry palm leaves/year (Sianipar et al., 2003). Mathius (2008) states that one hectare of oil palm is planted with an average of 130 trees, producing 22 fronds/tree/year with a weight of 7 kg per frond. The biomass content of fresh palm fronds is 6,292 kg, with 26.07% dry matter (DM) content, so produced 1,640 kg DM (Umar, 2009). Nutrient composition of palm fronds were crude protein 2.23%, crude fat 3.04%, crude fiber 47.00%, ash 3.96%, TDN 51.39%, neutral detergent fiber (NDF) 76.09%, acid detergent fiber (ADF) 57.58%, cellulose 43%, hemicellulose 18.51% (Suryani et al., 2016). Palm fronds are good when used as a primary feed source of energy because of their nutrition compositions.

The yield from oil palm plantations that can use as a protein source is the legume Pueraria *javanica*. Pueraria is a ground cover crop in oil palm plantations because it is known to be tolerant of low and high light intensity. The productivity of 10 tons of dry matter per ha (at full light intensity) and its palatability was good for cattle feed (Valentim and Andrade 2005). Pueraria is shade tolerant, still has high dry matter production at 50% shade (Ali et al., 2010), has crude protein (CP) 16.3 - 20.5%, CP digestibility 61 - 80%, and TDN 54.3 - 68.7% (Legel, 1990). The palm oil industry's by-product, which has very high nutritional value, is a palm kernel meal. Palm kernel meal has DM content of 89.0%, CP 15.3, CF 2.9%, crude fiber 14.3%, ash 4.1%, TDN 75.0%, NDF 66.7%, ADF) 46.1%, cellulose 43% and hemicellulose 18.51% (Mustafa, 1987).

Pregnant cows need more and continue nutrients, for the fetus grows well, the dam has a good body condition score during pregnancy, the calving process is normal, and estrous after calving returns quickly. In Indonesia's current conditions, most of the beef cows kept by smallholder farmers used to be fed with cut and carry grass; during the dry season, the number decreases. Efforts should be sought for good and available rations throughout the year. One option is the use of oil palm by-products.

The study was conducted to examine palm fronds' use as an essential ration energy source in pregnant Bali cows rations mix with Pueraria javanica and palm kernel meal. The research is expected to be a consideration in cattle farming, especially for the Bali cows business.

MATERIALS AND METODS

Location

The research was conducted in Kotawaringin Barat district, Central Kalimantan Province, a relatively large area of oil palm plantations. The research location is located on the equator between 1 ° 19 'to 3 ° 36' south latitude, 110 ° 25 'to 112 ° 50' east longitude. The climate of West Kotawaringin Regency is generally tropical, which is influenced by the dry season and the rainy season. The highest rainfall occurred in March, namely 423.8 mm, with 210 rainy days in 2015 and April being the month with the rainiest days, 27 days. The maximum temperature ranges from 33.4 ° C-36.4 ° C, and the minimum temperature is between 20.0 ° C-22.4 ° C with an average humidity between 89.4-90.4% and maximum wind speed 22 knots.

Materials

The cattle sample used in the study were 20 pregnant Bali cows with an average of 5-6 months divided into two treatments. Control Group (C group, n = 10, an average body weight of 240.3 kg) and OPF group (treatment group, n = 10, an average weight of 235.9 kg).
OPF feed ingredients come from oil palm plantations:those were palm fronds, Pueraria javanica, and palm kernel meal. Control group, fed with cut and carry grass obtained from around the farmer's house.
In vivo research was carried out in cattle sheds belonging to cattle farmer groups in oil palm plantations in Kotawaringin Barat, Central Kalimantan for six months, proximate analysis of feed and feces done at the Animal Feed Technology Laboratory, Faculty of Animal Science UGM, fiber analysis at the Forage Laboratory Animal and Pasture, Faculty of Animal Science UGM.

Methods

Twenty pregnant Bali cows were fed 2.6% of body weight (DM based) (Kearl, 1982) for seven months (until the calving and then estrous again after calving) with a period of adaptation to feed for two weeks. During adaptation, the animals were given a multivitamin by injection dose of 10 cc/head. There are two groups of animals, P1 as a control group, and P2 was treatment group given complete feed ration made from a mixture of Pueraria (35%), palm fronds (25%) and palm kernel meal (40%) in the form of mash (fresh chopped).

Figue 1. Pregnant Bali cows, the location of the research, and preparation of oil palm fronds

For cows in the OPF group, the ration was given two times a day, morning and evening; water was given ad libitum; while for cows in the control group, it was given cut and carry grass from the natural pasture as usual according to the habits of the farmers. The nutrient composition of the complete feed ration using in the study presented in Table 1.

Table 1. Nutrients compotition of complete feed ration for the cows (%)

Nutrients	Control group	OPF group	Nutrient requirement of pregnant cows[2]
Dry matter[1]	21.44	35.22	86
Organic matter[1]	86.07	94.07	-
Crude protein [1]	9.13	13.89	14
Total Digestible Nutrients [2]	50.92	73.52	65
Crude fiber [1]	29.15	20.27	6
Nitrogen free extract [1]	41.65	51.08	
Neutral Detergent Fibre[3]	73.22	67.02	
Acid Detergent Fibre[3]	53.60	44.54	

[1]Proximate analysis at the Faculty of Animal Sciece UGM.

[2] Kearl (1982),
[3] Inter-university central laboratory UGM

The collection of feces is carried out two weeks approaching calving, for consecutive ten days. After collected, weighed, a sample of 1 kg feces was taken, sprayed with a 10% formalin solution to avoid fecal decomposition and loss of fecal N. Furthermore, sun drying, and then taken to the laboratory for proximate analysis.
Data on feed consumption, feed residue, and feces production were used to calculate the amount of digested nutrients.
The parameters of Bali cow performances that measured were body condition score (BCS)(Teleni et al., 1993, Baliarti, 1999), changes in body weight of the dam, calving score (Breedplan, 2014), birth weight of the calves, calf vigor score (Baliarti, 1999) and estrous returned after calving.

Data analysis
Data on consumption, digestibility, and performance parameters were analyzed using the t-test (Steel and Torrie, 1989) using the help of the SPSS ver. 22.

RESULT AND DISSUSION

Table 2. Nutrients composition of Pueraria *javanica*, palm fronds, and palm kernel meal (% DM)

Nutrients	Palm fronds	Pueraria	Palm kernel meal
Dry matter[1]	23.38	27.41	91.88
Ash[1]	2.91	7.05	6.56
Crude protein [1]	1.96	18.10	15.77
Crude fiber [1]	47.14	40.83	24.46
Fat[1]	0.64	1.82	6.45
Nitrogen free extract[1]	47.35	32.20	46.76
Total Digestible Nutrients [1]	47.33	59.29	67.44
Neutral Detergent Fibre[2]	74.56	53.35	74.32
Acid Detergent Fiber[2]	51.43	29.48	53.21

[1)]Proximate analysisi at Fac. Of Animal Science UGM
[3)] Inter-university central laboratory UGM

Table 3. *In vitro* DM and OM digestibility of Palm oil fronds, Pueraria javanica, and Palm kernel meal (%)

	Dry matter digestibility	Organic matter digestibility
Palm fronds	20,45±2,75	22,65±2,72
Pueraria javanica	50,26±2,96	52,46±5,76
Bungkil inti sawit	61,84±14,26	64,12±14,59

Table 4. Nutrient consumption of the Bali cows

Nutrients consumption	Control group	OPF group
Dry matter (kg)	4,45[a] ±0,44	5,69[b] ±1,00
Dry matter (%)	1,86[a] ±0,11	2,41[b] ±0,06
Organic matter (kg)	3,83[a] ±0,38	5,34[b] ±0,94
Crude protein (g)	406[a] ±40,3	789[b] ±138
Total Digistibel Nutrients (kg)	2,26[a] ±0,22	4,18[b] ±0,73
Crude fiber (kg)	1,30[a] ±0,13	1,15 0,67
Neutral Detergent Fibre (kg)	3,26[a] ±0,32	3,81[b] ±0,67
Acid Detergent Fibre (kg)	2,38[a] ±0,24	2,53[a] ±0,44

[ab]Different superskrip at the same line mean significant differences (P<0,05)

The consumption was different (P <0.05) on DM, OM, CP, TDN, CF, and NDF, while ADF consumption has no difference. In the control group, pregnant cows weighing 240.3 kg required DM 6.25 kg, CP 550 g, and TDN 3.27 kg while in OPF group with a bodyweight of 235.9 kg required DM 6.13 kg, CP 540 g and TDN 3.21 kg (Kearl, 1982). The results of DM consumption were fulfilled by 71.2% in P1, 92.7% in P2.

Table 5. Nutrients consumption (g/kg$^{0.75}$) based on metabolic body weight

	Control group	OPF group
Dry matter	73,0^{a} ±3,51	94,1^{b} ±5,35
Organic matter	62,8^{a} ±3,02	88,5^{b} ±5,03
Crude protein	6,7^{a} ±0,32	13,1^{b} ±0,74
Total Digistibel Nutrients	37,2^{a} ±1,78	69,2^{b} ±3,94
Crude fiber	21,3^{a} ±1,02	19,1^{b} ±1,09
Neutral Detergent Fibre	53,5^{a} ±2,57	63,1^{b} ±3,59
Acid Detergent Fibre	39,1^{a} ±1,88	41,9^{b} ±2,38

^{ab}Different superskrip at the same line mean significant differences (P<0,05)

Table 6. In vivo digestibility of nutrients (%)

	Control group	OPF group
Dry matter	60,00^{a} ±2,03	58,69 ^{a} ±4,51
Organic matter	60,63^{a} ±2,68	67,86^{b} ±3,49
Crude protein	56,29 ±3,28	60,65 ±2,08
Total Digistibel Nutrients	49,81^{a} ±2,37	77,18^{b} ±4,19
Crude fiber	53,27^{a} ±4,75	59,05^{a} ±8,68
Neutral Detergent Fibre	62,15^{ab}±2,63	57,93^{a} ±6,12
Acid Detergent Fibre	63,22^{a} ±2,83	49,81^{b} ±9,91

^{ab}Different superskrip at the same line mean significant differences (P<0,05)

Table 7. Performance production and reproduction of the cows

	Control group	OPF group
N	10	10
BCS start	3.40±0.52	3.50±0.53
BCS final	4.10±0.32	4.20±0.42
Initial bodyweight (kg)	240.26±30.16	235.90±37.96
Final bodyweight (kg)	262.17±31.16	265.70±36.08
ADG (kg)	0.23^{a}±0.05	0.27^{ab}±0.03
Lama bunting (hr)	283.20±6.16	282.50±5.46
Birth weight (kg)	15.07^{a}±0.68	18.13^{b}±1.59
Male calves (ekor)	5	4
Female calves (ekor)	5	6
Calving score	1.0^{a}±0.0	1.0^{a}±0.0
Calf Vigor Score	1	1
Estrous returned after calving (days)	69.9^{a}±16.1	54.6^{b}±7.03

^{ab}Different superskrip at the same line mean significant differences (P<0,05)

The results of observations on the Body Condition Score (BCS) of Bali cows at the beginning of the study (age 5 - 6 months of gestation) were not different. The BCS score used a value of 1 - 5 (Teleni et al., 1993). The average BCS in Control group was around 3.4, which means that the condition was slightly fat, for OPF group was 3.5 means that the condition of the cows was almost the same. Putro (2009) states that the optimum BCS value for cow reproduction or early pregnancy was between 3.0 - 3.5 (scale 1 - 5). The final BCS before calving also did not difference; the average was 4.1 for Control and 4.2 for OPF group. Berry et al. (2007) stated that the ideal BCS for cows at calving is 4 (BCS scale 1 to 5). BCS that was too large meant that fat cows, or BCS that was too small or thin cows, will reduce the secretion of FSH and LH, thereby increasing cystic ovaries because the ovaries were unable to ovulate (Pryce et al., 2001), reducing signs of estrous (Putro, 2007), reduces fertility and increases difficulty during calving (Heinrichs and Ishler, 2008). In cows whose body was too fat, temporary infertility can occur (Toelihere, 1985).

There was a difference in weight changes for Bali cows until calving due to higher consumption and nutrient digestibility. The increase in weight gain was also in line with the final BCS. The results of Utomo and Widjaja (2007) research that Bali cows were seven months pregnant with elephant grass feed and 1.5% palm sludge (solid) in Central Kalimantan, showing ADG of 0.25 kg/head/day.

The birth weight (BW)of the calves was different between groups (P <0.05). The increase in birth weight was 20.31% in OPF group compared to Control. Feed consumption that causes higher birth weight, such as: consumption (kg/head/day): DM 5.69-5.95; CP 0.72-0.79 and TDN 4.18-4.39, nutrient digestibility: DM 58.69-68.88%, CP 59.11-60.65% and TDN 77.18-78.98% . This BW was almost the same as Imran's (2013) studed, which provided 30% supplementation of Turi leaves in Bali cows at the end of

pregnancy in Lombok with an average BW of 18 kg. The same BW was also found in the research of Suyasa and Sugama (2011) that given flushing feed in the form of 1% rice bran, 1% coffee bran, and probiotics in Bali island. Pane (1990) reported that cows raised in dry areas with limited forage such as NTT and NTB had an average calf BW of only 12 and 13 kg/head. Panjaitan et al. (2003) in Sumbawa reported it was around 14.2 kg.

The calving score was not different (P> 0.05); everything was normal. The calf vigor score was also good. The average calf born takes 30-50 minutes to wake up and to milk their dam. Return estrous after calving or postpartum estrous (PPE) was different (P <0.05); PPE was 54.6 days (41 - 65 days) on OPF group, and the longest is 69.9 days (51 -109 days) for Control group. There was a PPE acceleration of 15.3 days..

CONCLUSION

It concluded that oil palm fronds could be used as energy sources for pregnat Bali cows, showed better performances compared to cows in the smallholder farms with cut and carry grass.

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