Milk Production and Milk Income over Feed Cost of Dairy Cow Fed Fermented Cassava, Tabut Block, and Concentrate Containing *Curcuma xanthorhiza* and Yeast

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ABSTRACT

The objective of this research was to evaluate four diets that were applied in lactating dairy cows. The diests were forage and rice bran (RB), forage and a combination of fermented cassava (1.7kg/d) and *C. xanthorhiza* liquid (0.7kg/d) (FCC), forage and Tabut block (6 blocks/d) (TB), and forage and lactating concentrate (2kg/d) containing *C. xanthorhiza* and yeast (LC). The last three treatments containing yeast or fermented cassava and *C. xanthorhiza* were based on the results of previous researches. These treatments were provided accordingly in Latin Square 4 x 4 arrangements in four lactating dairy cows during four- 10 days/period. Results showed that dry matter intakes were low in averages of RB (14.34 kg/d) and TB (15.45 kg/d) diets. However, the milk yields were slightly higher in the RB (5.53 kg/d), while in TB diet was low (5.0 kg/d). Milk fat (4.08 %) and milk protein (4.36%) were found high in TB diet. Economically, feed cost of RB and TB diets were low. Since the milk production of the RB diet was high, therefor its milk revenue (Rp. 38,710/d) and milk income over feed cost or MIOFC (Rp. 22,710/d) were high with low feed cost (Rp. 16,000/d). Among the last three diets, the TB diet showed low total feed cost (Rp. 18,564/d) and slightly high MIOFC (Rp. 16,436/d). In can be concluded that diet containing forage and and Tabut block was considered optimal in terms of milk production, milk quality and MIOFC.

Key words: Curcuma, milk, MIOFC, Tabut, yeast

INTRODUCTION

Milk production nationwide is still under the number of demand. Therefore it requires an effort such as through manipulation of feed in a good amount of quantity with proper quality in reasonable price to improve milk yield of dairy cow and manage a profitable dairy farming. Some previous results showed that fermented cassava with Curcuma increased milk yield about 8-10 times higher in lactating Bali cow (Sulistyowati, 1999); Tabut block in higher quantity (0 to 450 g) improved milk yield in dairy cow (Sulistyowati and Erwanto, 2009); a combination of 1% yeast and 2% *Curcuma xanthorrhiza* was optimal in lactating dairy cow (Sulistyowati *et al.*, 2010); and a mixture of 0.5% yeast and 2% *Curcuma xanthorrhiza* was optimal in concentrate of late lactating dairy goat (Sulistyowati *et al.*, 2014).

As feed cost and milk price could be fluctuated across the time, milk income over feed cost (MIOFC) is an important indicator to access the profitability of a dairy farm operation. However, Buza *et al*. (2014) stated that depressing feed cost was not always increasing income over feed cost (IOFC); it is rather than improving proper formula of ration would determine milk yield that in turn could increase IOFC. The IOFC was considered a proper indicator to access dairy farm profitability as stated by Wolf (2010).

MATERIALS AND METHOD

Preparation of Diets and Location

Four types of diet were prepared, RB: rice bran and forage, FCC: fermented cassava and forage, TB: Tabut block and forage, and LC: Lactating concentrate and forage. The Block and concentrate were prepared according the formula presented in Table 1.

Table 1. Composition of Tabut block and Lactating concentrate

Ingredients	Tabut Block * (%)	Lactating ** Concentrate (%)
Fermented cassava	40	-
Cassava flour	3.5	15
Rice bran	25	25
Ground corn	15	20
Soybean meal	-	15
Tapioka flour	3.5	15
Palm oil	-	4
Urea	3	-
CaCO3	3	1
NaCl	3	1
TSP	1	-
Mineral mix	1.5	1
Yeast	-	1
Curcuma xanthorrhiza liquid	1.5	2
Total	100	100

Source: *Modification of Sulistyowati and Erwanto (2009); ** Modification of Sulistyowat *et al.* (2010); Tabut Blok (300 g/block).

Tabut block was sized 300 g/block and given as much as 6 blocks/cow/day or 1.8 kg/d; the LC was provided as much as 2 kg/cow/day. The FCC contained of 1.7 kg fermented cassava and 0.35 kg Curcuma extract per cow per day as modified from Sulistyowati (1999). Rice bran was prepared 5 kg/cow/day. Forages containing of a combination of 40% King grass (*Pennisetum purpureum*) and 60% corn stover that were provided all together about 40 kg/d. Yeast was prepared as mentioned in previous research reported by Sulistyowati et al. (2014). Other ingredients were provided in local feed shop in Curup, Rejang Lebong, Bengkulu.

Feeding trials were conducted in Sepakat II farm in desa Mojorejo village, kecamatan Sindang Kelingi, kabupaten Rejang Lebong, Bengkulu province, Indonesia. This area is in the upland of about 1200m asl, with average temperature of around 19- 20^0C.

Statistical analysis and Variables Measurement

Experimental design used was Latin Square 4 x 4, with Anova and any further significant analysis using Duncan's Multiple Range Test (DMRT) according to Lentner and Bishop (1986). Four treatments were RB, FCC, TB, and LC, four- 2 week periods with one week preliminary time. Four lactating dairy cows were used in this feed trials.

Variables, feed intake, dry matter intake, water intake, milk production and feed orts were measured daily in the mornings. Milk compositions were sampled at the last 4 days of each period and analyzed for fat and protein contents. Economic analysis consisted of feed cost of each diet, milk revenue (milk yield x milk price), and milk income over feed cost (milk revenue- feed cost), all is stated in Rupiah per day (Rp./d).

RESULTS AND DISCUSSION

Performance of milk production and composition

Milk production and milk composition of dairy cows fed fermented cassava and curcuma, Tabut block, and lactating concentrate are presented in Table 3.

Table 2. Milk production and composition, dry matter intake and water intake averages of dairy cows fed fermented cassava and curcuma, Tabut block, and lactating concentrate

Item	RB	FCC	TB	LC
Milk production, kg/d	5.53	5.23	5.00	5.15
Milk fat, %	2.79	2.67	4.08	3.42
Milk protein, %	4.06	3.71	4.36	4.14
Forage intake, kg/d	37.85	38.36	38.16	38.64
Concentrate intake, kg/d	5.00	2.40	1.80	2.00
Dry matter intake, kg/d	14.34	16.59	15.45	16.28
Water intake, kg/d	17.09	17.60	16.80	16.78

Notes: RB: forage + rice bran; FCC: forage + fermented cassava and curcuma; TB: forage + Tabut block, and LC: forage + lactating concentrate; no significant effects were found ($P>0.05$).

Tabut block and Lactating concentrate had similar ingredients, yet, with different types and composition. In the block (TB), there was using fermented cassava and Curcuma fluid; while in Lactating concentrate (LC), it included cassava flour, yeast, and Curcuma flour. In fermented cassava and Curcuma (FCC), it contained both cassava that was fermented with yeast, and the inclusion of Curcuma fluid. Therefore, these three diets were formulated to contain Cassava, yeast, and *Curcuma xanthorrhiza* in different types and levels with an objective to improve milk production in dairy cow.

Intakes of forage and concentrate will determine milk production. Fresh forage intakes were about the same, around 37- 38 kg/d; while concentrate intakes were different according to the designated treatment. Dry matter intake (DMI) of diets with FCC and LC were relatively remained the same, yet in averages were a little higher than those of diets with RB and TB. These dry matter intakes were above the required one for dairy cow with 400 kg body weight (BW) and 10 kg/d milk yield that is about 2.7% of BW, equaled to 10.8 kg (NRC, 1989). Diet with rice bran was slightly higher; while FCC seemed better than TB and LC. Milk yield of TB treatment was quantitatively being the lowest, as it was in coherence that Tabut block was given only 1.8 kg/d, the lowest concentrate among other diets. In the other hand, in RB diet, rice bran was given as much as 5 kg/d.

Milk production in all diets were unaffected significantly (P>0.05) by treatments. Even though, RB diet contained the highest concentrate, in this case was 5kg/d rice bran (roughly about 2-3 times higher in weight compared to other treatments), its milk production was quantitatively only 0.53 kg/d higher compared to that of in TB. These results may have been due to the fact that the feeding management in this farm prior to this feeding trial was not maintained properly that all four dairy cows did not perform physiologically as supposed to be.

Milk composition of fat (4.08%) and protein (4.36%) showed that diet with Tabut block were high in averages than other diets. This research supported the results of Tabut supplementation that that and the higher blocks given (0 to 450g/d), the higher the fat composition found in milk of dairy cow (Sulistyowati and Erwanto, 2009). This suggested that the ingredients of Tabut block, especially fermented cassava and urea synergically affected rumen metabolism in modifying protein and fat synthesis in milk. Milk proteins in this research were found higher than milk protein suggested in National Standard of Indonesia that is SNI 3141.1 (BSN, 2011) with the minimum of 2,8%. On the other hand, milk fats in RB and FCC diets were found low (<3%), which was considered under the standard of SNI 3141.1 that was supposed at least 3% (BSN, 2011).

Water intake was required for milk production. Predicted free water intake (FWI) is formulated as: 14.4 + 1.28 x milk yield, kg/d + 0.32 x DM diet,% (Dahlborn *et al.*, 1998). Water intakes in this result were l6- 17 kg/d which was under the amount required for lactating dairy cow. These water intakes were reasonable as the milk production were low as well. It can be seen in water intake of TB and LC were quantitatively low as their milk yields were also being the lowest. Drinking water in lactating dairy cows was reported as ranging 15.6- 126.4 kg/d with mean the rate of 63.4 kg/d as with milk production of about 4.6- 55.9 kg/d and mean rate of 23.5 kg/d; while forage consumption were 15- 95 kg/d as reported by Appuhamy *et al.* (2014). The results of our present study confirmed that ratio of milk yield/ water intake were about 0.29- 0.32 that is lower than that reported one, was about 0.44; while forage consumption was about lower than the mean rate of 49 kg/d. Therefore, all of these conditions were contributing to the low milk production of this study.

Economic Analysis

Analyis of economic consisting of total feed cost, milk revenue, and milk income over feed cost (MIOFC) are presented in Table 3.

Table 3. Milk income over feed cost (MIOFC) of milk production of dairy cows fed fermented cassava and curcuma, Tabut block, and lactating concentrate

Item	RB	FCC	TB	LC
Total feed cost, Rp/d	16,000	23,602	18,564	19,688
Milk revenue, Rp/d	38,710	36,610	35,000	36,050
MIOFC, Rp/d	22,710	13,008	16,436	16,362

Notes: RB: forage + rice bran; FCC: forage + fermented cassava and curcuma; TB: forage + Tabut block, and LC: forage + lactating concentrate

Since feed cost is easily changing, it will affect expenses for feed in dairy farm. In turn the quality and quantity of the feed will determine milk production. Forage and concentrate prices mostly will be taken into account when formulating ration. However, optimal formula will usually

produce good amount of milk yield that will give better milk revenue, in turn it increases milk income over feed cost (MIOFC). Buza *et al*. (2014) reported that reasonable forage price and feed purchase will give higher income over feed cost (IOFC).

Our results showed that RB diet had lowest feed cost, while its milk yield was the highest, therefore, its milk revenue then its MIOFC (Rp. 22,710) was being the highest among other diets. It was different from TB diet, even though it produced the lowest milk yield, it gave higher MIOFC (Rp. 16,436) compared to FCC and LC that had the highest feed cost.

It is approved that optimal formulation of diet is very important since it will determine optimal milk production with reasonable feed cost that in turn will determine good amount of milk income over feed cost. As with our result, diet containing rice bran and forage or diet containing Tabut block and forage was considered better.

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