The utilization of *Arachis pintoi* and *Gliricidia sepium* as protein-sources substitute for dairy cattle

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**Abstract.** Dairy cattle need high nutrient contents in their ration, especially in the first lactation period. Farmer prefers to feed the cattle with cheap and low quality concentrate to decrease the feed cost. This condition leads to low milk production. This research aimed to observe the effect of substitution of legume which contains high protein to improve the cheap low-quality concentrate. This research uses twenty-four dairy cattle (8.5 months-pregnancy; average body weight (BW) 359.29±35.63Kg), which were randomly divided into 3 groups of dietary treatments. The treatment were Concentrate I (100% concentrate); Concentrate II (85% Concentrate+15% *Gliricidia sepium*); Concentrate III (Concentrate 85% + 15% *Arachis pintoi*). The observation was done during 16 weeks of feeding trial. The parameters observed were feed intake and digestibility, milk production, and feed conversion ratio (FCR). Milk production measured during 3 months-lactation periods. The result shows that concentrate substitution by using 15% *Gliricidia sepium* or *Arachis pintoi* didn’t affect feed intake (11.017-11.388kg DM/head/day), digestibility (56.70-58.32%), FCR(1.138-1.214 kg DM/L), and total milk production in first 3 months-lactation period (859.07-887.59 L/head). This research concludes concentrate can be replaced up to 15% by *Gliricidia sp* or *Arachis Pintoi* to improve quality without affect livestock performs, but decrease feed cost.

1. **Introduction**

Traditional dairy cattle farming has a role as a primary income source for farmer in Indonesia since long time ago, but still can’t increase farmer’s prosperity. It happens caused by internal factor that could be controlled and fixed by farmer, such as managing production to produce great milk, and external factors that can’t be controlled by the farmer, such as milk and concentrate price. Milk price depends on fat content of milk and milk quality influenced by feed quality. Therefore, milk quality could be controlled through feed management. High-quality concentrate leads to high-quality milk, but also will increase production cost. Increasing profit can be achieved through modified and provide cheap-high quality concentrate.

Nutrient deficiency in the first lactation period commonly happens due to high nutrient requirement for parturition and produce milk, which cannot be full filled. Unbalanced nutrient requirement and nutrient available in the cheap-low quality concentrate causes demobilization some nutrients from the body and leads to decrease milk production and increase calving interval [1]. Sufficient nutrients supply in the last months of parturition and the first lactation period could lead to high milk production [2].
Concentrate feeding to dairy cattle aimed to fulfill nutrients required by dairy cattle fed forage only. High nutrient concentrate will reflect on the high price of the concentrate. The Farmer prefers to feed the livestock used the cheap-low quality concentrate to decrease feed cost. Gamal (*Gliricidia sepium*) used as protein source for ruminant improved performances of livestock [3-4]. Mixture feeding of three legumes, gamal, kialiandra (*Calliandra calothyrsus*), and lamtoro (*Leucaena leucocephala*), in the last 2 months of parturition improved reproduction health after giving birth [5-6]. These showed that improving feed quality for dairy cattle in the last parturition period could lead to energy reserved in the body. It has reported that feeding 20% of dried Kaliandra leaf improved 4% FCM milk production of Frisian Holstein in lactation period [7].

One of the popular grazing type legumes is *Arachis* (*Arachis pintoi*), that can grow better in dried stress land, grazing area with high pressure on land cover, and insect’s invasion, with high leaf production 17.5-42.5 ton/ha/year [8], high protein contents (20.81-23.50%). Adding *Arachis* into ration for beef cattle increase dry matter and NDF digestibility [9]. Meanwhile, a mixture of *Arachis* with *Brachiaria decumbens* in the ration for Jersey leads to increase milk production and quality [10].

*Arachis* fed to the dairy cattle continuously by cut and carry system reported has high palatability. Whereas, there’s no information about dairy cattle performances fed this legume during parturition and lactation period [11]. This research aimed to observe the effect of substitution of cheap-low quality concentrate by using legume (*Arachis* and Gamal) in dairy cattle performances.

2. Material and methods

2.1. Material

Twenty four of 8.5 months-pregnant dairy cows with average BW 359.29±35.63 kg were kept in individual pens then divided into three dietary treatment groups following a randomized block design (RBD) based on body weight. The treatment rations evaluated consisted of King grass: tofu waste: and three different concentrates. The concentrates were made up from some feed materials, with the composition of each concentrate is shown in Table 1. *Gliricidia* and *Arachis* were used to replace part of pollard, soybean meal and rice bran. *Gliricidia* leaves were harvested at about 60 days of regrowth from the area of Indonesian Research Institute for Animal Production (IRIAP). The *Arachis pintoi* leaves were harvested from the land area at Balai Besar Perbibitan Ternak Unggul dan Hijauan Pakan Ternak (BPTU-HMT) Baturaden. The leaves were sundried for about 1 day following with an oven dried at 60° C for 48 hours, ground through 3 mm of screen sieve and stored before used. Fresh King grass, harvested at 40-50 days of regrowth, were chopped (3-5 cm) daily and offered to the animals in fresh form. Fresh tofu waste was obtained daily from tofu home industries located around the IRIAP.

2.2. Methods

2.2.1. General. The experimental rations were arranged to fill the protein (12%) and TDN (64%) required by 8 - 9 months pregnant dairy cows. The crude protein and gross energy content of grass, tofu waste and concentrate I, II and III used in the experiment were 6.09% and 3741 call/kg; 23.82% and 4010 call/kg; 18.41% and 3685 call/kg; 18.26% and 3665 call/kg; 18.89% and 3705 call/kg, respectively. There were three experiment rations, Rations A consisted of grass, tofu waste and concentrate I; Rations B consisted of grass, tofu waste and concentrate II; Rations C consisted of grass, tofu waste and concentrate III. The ratio of each were 48%:8%:44% for grass:tofu waste:concentrate. The experiment was conducted over a period of 18 weeks (2 weeks of adaptation period to the experimental rations and 16 weeks of the measurement period). The daily rations were offered in two equal portions, one at 08:00 h and the other at 16:00 h. Drinking water was freely available to the animals during the experiment. The trial was conducted to observe feed intake and digestibility, milk production, body weight of the dairy cattle and birth weight of calves. The daily feed intake calculated from the differences between feed offered and residue. The feed digestibility measure for 7 days by using collecting method in the third month of the lactation period. Cows’ body
weight were weighed at first and second months after giving birth. Calves’ Body weight measured early after birth. Milk production in the morning and afternoon were measured for 3 months.

2.2.2. Statistic. Experiment was carried out using a randomized block design (RBD) based on body weight with 8 replicates per treatment group. Data collected were analyzed using SPSS version 20. The difference in mean values that occurred was compared using the Duncan test.

3. Results and discussion
The average of feed intake varied between 2.9-3.5% of body weight. The average daily feed intake of dairy cattle are showed in Table 2. The inclusion of 15% *Grilicidia sp* or *Arachis pintoi* in the concentrate II and III as presented in rations B and C (Table 1) resulted in iso protein and energy conditions. These two legumes could replace soybean meal, rice bran and pollard as protein and energy sources in the concentrate without affecting the consumption of dry matter, crude protein and energy. As shown in Table 2 that the three rations were consumed in the similar amount by the animals. They were also have similar digestibility value, then they also had impact on similar feed efficiency.

| Materials                  | Concentrate |
|----------------------------|-------------|
|                            | I           | II          | III          |
| Palm kernel cake (%)       | 30          | 30          | 30           |
| DGDS (%)                   | 12          | 12          | 12           |
| Pollard (%)                | 20          | 12          | 14           |
| Soybean meal (%)           | 10          | 5           | 5            |
| Grounded *Gliricidia* leaves (%) | 0       | 15          | 0            |
| Grounded *Arachis* leaves (%) | 0         | 0           | 15           |
| Rice bran (%)              | 16          | 15          | 12           |
| Soysouce waste (%)         | 10          | 9           | 10           |
| Mineral Mix (%)            | 1           | 1           | 1            |
| Salt (%)                   | 1           | 1           | 1            |
| Content of CP (%)          | 18.41       | 18.26       | 18.89        |
| Content of Energy (cal/kg) | 3,685       | 3,665       | 3,705        |

Table 2. Dry matter, protein, and energy intake; dry matter and organic matter digestibility of the three different rations by dairy cattle during the experimental period

| Parameters               | Ration A               | Ration B               | Ration C               |
|-------------------------|------------------------|------------------------|------------------------|
| Dry matter (kg/day)     | 11.388±115             | 11.165±403             | 11.017±273             |
| Crude Protein (g/day)   | 1.507±0.02             | 1.485±0.03             | 1.488±0.03             |
| Energy (Kcal/day)       | 42,506±834             | 41,563±1,507           | 41,195±1,021           |
| Digestibility (%)       |                        |                        |                         |
| Dry matter              | 58.32±0.76             | 56.70±1.89             | 58.19±1.56             |
| Organic matter          | 59.20±0.77             | 58.12±1.93             | 59.47±1.56             |

Inclusion of these two legumes in pregnant dairy cows resulted in an upward trend in the main body weight and birth weight of calve. Cow’s body weight measured three times during the experiment showed that cows fed ration A gain their weight by 5 kg (from 348 kg to 353 kg) during two months of period. While cows fed rations B and C gain for about 17 kg and 12 kg for the same of
period. These results indicated that with similar intake of protein and energy, the cows fed concentrate containing Gliricidia and Arachis gain more than cows fed concentrate without addition of the two legumes. Similar results also indicated that calves resulted from cows fed ration A has less birth weight (35 kg) compared to those calves born from cow fed rations B (37.7 kg) and C (37 kg).

Table 3. Milk production in the first three months of the lactation period

| Parameters                        | Ration A           | Ration B           | Ration C           |
|-----------------------------------|--------------------|--------------------|--------------------|
| Total Milk Production (L/head/month) | 328.53±56.26       | 328.75±49.36       | 342.87±10.68       |
| First month of lactation          | 313.48±45.12       | 292.64±56.37       | 291.92±29.75       |
| Second month of lactation         | 245.58±20.28       | 237.68±50.87       | 251.73±20.37       |
| Third month of lactation          | 887.59±40.55       | 859.07±52.20       | 886.52±20.27       |
| Total during 3 months             | 10.95 ±1.87        | 10.96±1.04         | 11.43±0.35         |
| Daily Milk Production (L/head/day) | 10.11±1.46         | 9.44±1.82          | 9.42±0.96          |
| First month of lactation          | 8.19±0.67          | 7.92±1.69          | 8.39±0.68          |
| Second month of lactation         | 1.11±1.70          | 1.10±1.70          | 1.11±1.70          |
| Third month of lactation          | 1.10±1.70          | 1.10±1.70          | 1.10±1.70          |

There were no significant different on daily milk production among the three treatments. This indicated that inclusion of the two legumes to substitute soybean meal, pollard and rice bran might improve N availability for production activities. In addition [4] also showed N retention values reaching 21% if sheep were fed using Gliricidia. An adequate N retention value in Gliricidia is also suspected to be able to produce milk production values that are similar with the controls. Research on the use of 50% Gliricidia silage in sheep also provides good results on increasing the final body weight of livestock due to improved feed nutrition [12]. Results of experiment indicated similar average feed conversion ratios for the three groups being 1.182; 1.214 and 1.138 kg DM of the ration/L of the milk.

4. Conclusion

This research concludes that as much as 15% concentrate should be replaced use Gliricidia sp or Arachis Pintoi to improve the cheap-low quality concentrate without affect livestock performs and leads to decrease the feed cost.

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