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EFFECT OF THE USE OF COOKING PRODUCT OF THE STEM CONTENT OF GEBANG (CORYPHA UTAN LAMK.) PLANT WITH UREA ON THE GROWTH OF BALI CATTLE

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ABSTRACT

The purpose of this study was to evaluate the impact of the use of slow release urea products from the cooking result of gebang starch (putak) with urea in concentrate feed as feed supplements on the growth of Bali cattle. Sixteen male Bali cows (body weight of 192.71 ± 19.17 kg) used in a completely randomized design 4 x 4. Livestock were randomly allocated to get one of the treatments of the use of purea (cooking of putak meal with 6% urea) in concentrate feed, namely T₀: putak meal mixed with urea (the amount of putak meal 60% in concentrate, the amount of urea 3% from putak meal), T₁: purea 20%, T₂: purea 40%, T₃: purea 60%. King grass is used as basal feed in comparison with a 60: 40 concentrate. The research results showed the consumption of dry matter, organic matter, crude protein, crude fiber and total digestible nutrients did not differ due to the use of purea, but the digestibility of dry matter, organic matter, crude protein and crude fiber, weight gain, and efficiency of feed use differ among the treatments. The use of purea to 40% level in concentrate feed is better in increasing the growth compared to the use of urea mixture with putak meal without cooking. The use of purea does not cause cattle to experience health problems or poisoning.

KEY WORDS

Efficiency of feed use, economic value, synchronization, slow release urea.

Bali cattle is reliable livestock commodity on dry land with dry climate in the province of East Nusa Tenggara, Indonesia; but its growth is limited because it is not supported by the availability of sufficient feed in terms of quality and quantity. In the dry season, the dominant feed consumed by Bali cows is natural grass with very low quality (CP 2-4%) and cell wall content can reach 80% (Fattah, 1998). This condition is very unlikely to support the fulfillment of the basic needs of ruminant cattle (Chanjula and Ngampongsai, 2008), even livestock can experience 20% loss of life weight due to low feed consumption (Bamualim, 1991). Wirdahayati and Bamualim (1990) reported that during the dry season calves less than one year old lost weight at 0.15-0.22 kg/head/day and young steers 0.34-0.35 kg/head/day and late in the dry season mature bulls and cows might experience even more severe weight loss (0.42-0.52 kg/head/day).

The use of NPN, such as urea as feed supplement can increase the consumption and digestibility of feed as well as the performance of livestock that consume low-quality forage and most importantly it costs less than using natural protein. Urea can also be used as an effective alternative to replace soybean meal based supplements and produces more N than pure protein sources per unit of N (Mentz *et al.*, 2015; Gardinal *et al.*, 2016). Cattle that consume high amounts of forage will generally meet their nitrogen needs with urea supplementation (Gardinal *et al.*, 2016). Although many studies have shown that the performance of urea supplements is usually lower than the natural food, with the increasing price of feed protein, urea has become a cost-effective protein substitute (Cui *et al.*, 2015). However, the use of urea in cattle feed is less efficient because the speed of dissolution in the rumen and the use of ammonia becomes less perfect by rumen microbes, with the occurred of accumulation and absorption of ammonia so that a lot of ammonia is excreted in urine (Highstreet *et al.*, 2010).

The use of the the stem contents (pith) of gebang (*Corypha utan* Lamk.) Plant as a source of carbohydrates (starch) which cooked with urea can increase synchronization of the release of ammonia and energy to produce microbial protein synthesis. According to Jittakot (1999), during the cooking process at high temperature and pressure, starch will mix with urea and gelatinized, forming a homogeneous mass and will decomposed slowly in the rumen, releasing urea gradually and hence the ammonia supply and energy occur simultaneously for the synthesis of microbial protein. Rodrigues (2003) states, if there is no synchronization between ammonia and carbohydrates in the rumen there can be a loss of nitrogen up to 40%. In general, the product developed is called slow release urea (SRU), and has been studied as an alternative to reduce the high urea solubility in the rumen, high excretion through the kidneys and ammonia poisoning from urea. (Wanapat, 2000; Goncalves *et al.*, 2015). Similarly, Inostroza *et al.* (2009) suggested that slow release urea products can be useful in reducing poisoning, increasing the acceptability of supplements and the use of urea as well as improving ruminant performance. Galo *et al.* (2003) and Xin *et al.* (2010) reported that slow release urea in dairy cattle feed could increase the total consumption and digestibility of dry matter and crude protein of feed. Likewise Siciliano-Jones and Downer (2005) states that slow release urea can replace a number of soybean meal proteins to meet the needs of easily degraded protein in the rumen and lead to additional space in the rumen which available for the provision of dry matter of forage and grains. Even according to Calomeni *et al.* (2015) slow-release urea from polymer coating, hydrolyzed into ammonia slower than urea and can be used more efficiently by rumen microorganisms and improves livestock production performance. Bali cattle is very well adapted to the poor nutritional conditions of the environment so that with the supplementation of feed using materials available around the environment is expected could increase the growth.

The purpose of this study was to evaluate the impact of the use of slow-release urea products from the cooking of gebang starch with urea as a feed supplement on the growth of Bali cattle.

MATERIALS AND METHODS OF RESEARCH

The study was conducted in a cattle shed owned by the Regional Technical Implementation Unit/Unit Pelaksana Teknis Daerah (UPTD) of Cattle Farming from The Animal Husbandry Office of the Province of East Nusa Tenggara, in Lili, Kupang Regency.

A total of sixteen male Bali cows aged 1.5-2 years with a body weight of 192.71 ± 19.17 kg used as experimental animal. Feed is arranged in the ratio of forage: concentrate (60: 40). The forage used is king grass (*Penisetum purpurephoides*), while the concentrate consists of: fish meal, ground corn, rice bran, palm kernel cake, coconut cake and mineral mixture, flour of gebang stem content known as "putak", urea as well as the cooking product of the contents of the gebang stem with urea which is named "**purea**". Purea is made by mixing urea with putak meal (the amount of urea is 6% of the total Dry Matter of putak meal) then put in a HDPE heat resistant plastic bag with brand BELL ISO-9000 No. 005 / 223-1998 and cooked in an autoclave at 135°C with a pressure of 186 kPa, cooking time 60 minutes. The moisture content of material 60 %. Feed compiled iso protein to meet the needs of 13% crude protein (NRC, 2000). All feed ingredients are analyzed before the field research conducted. Drinking water is given *ad libitum*.

This study used a Completely Randomized Design with 4 treatments that were repeated 4 times. The treatment applied was the provision of concentrate as supplement feed with purea level in concentrate feed as follows, T_0 = putak meal mixed with urea (the amount of putak meal 60% from the concentrate, the amount of urea 3% from putak meal) as control, T_1 = purea 20% in concentrate feed, T_2 = purea 40% in the concentrate feed, and T_3 = purea 60% in the concentrate feed.

Measurement of feed consumption is done every day for 60 days by weighing the feed provision and the rest every day. The rest of the forage collected 100 grams per day during the study. Cow feces were collected in the last week of observation. At the end of the

observation time the feed and faecal samples composited and taken 100 grams to be analyzed for the content of dry matter (DM), organic matter (OM), crude protein (CP), and crude fiber (CF) according to the proximate analysis method (AOAC, 2000).

Response variables measured included consumption and digestibility of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), body weight gain, and feed efficiency. Digestion of feed nutrients, measured the amount of feed nutrients consumed minus the nutrients released through feces divided by the amount of nutrients consumed multiplied by 100%. Body weight gain, obtained by dividing the final body weight of the cattle minus the initial body weight divided by the time of observation. Efficiency of feed use, measured the amount of feed consumed for each body weight gain.

All research data were tabulated and then analyzed statistically using analysis of variance according to the experimental design used and followed by Duncan's multiple range test using the general linear procedure (GLM) of Statistical Analysis System (SAS, 2000). All data in the table are presented as a mean value and standard deviation (mean value $\pm$ standard deviation).

RESULTS AND DISCUSSION

The composition of the feed ingredients and the chemical composition of treatment feed are shown in Table 1. The composition of the research feed ingredients varies according to the increase in the percentage of purea in the feed. Nutrient composition of feed from each treatment in the same range to support the fulfillment of needs for cattle growth.

Table 1 – The composition of the ingredients of the research ration

n/n	T ₀	T ₁	T ₂	T ₃
Feed ingredients,				
King grass	60	60	60	60
Fish meal	2.5	5.6	4.5	2.5
Palm kernel cake	0.12	6.5	4.5	6.25
Coconut meal	12.46	3.5	5.5	6.5
Rice bran	0.1	6.4	7.5	0.5
ground corn	0.1	10	2.0	0.25
Putak	24	0	0	0
Urea	0.72	0	0	0
Purea	0	8	16	24
Total	100	100	100	100
Chemical Composition, %				
Dry matter	44.20	44.73	43.56	42.05
Organic matter	87.96	87.75	87.98	88.70
Crude protein	13.09	13.22	13.49	13.30
Crude fiber	22.60	24.17	24.30	23.58
Crude fat	5.42	4.52	4.67	4.09
BETN	43.70	39.27	38.74	40.37
TDN	61.27	60.94	61.09	61.31

The data in Table 2 shows the response of Bali cattle on the use of purea in concentrate rations showed no effect ($P > 0.05$) on feed consumption (DM, OM, CP and CF) of Bali cattle. The use of purea as a supplement in Bali cattle feed is no different from the use of urea-putak mixture without cooking. The use of purea, which contains 6% urea can be tolerated by Bali cattle with the same consumption as 3% urea mixed with putak without cooking. According to Golombeski *et al.* (2006), the addition of slow release urea products causes N to be released more slowly in the rumen, retains slow release properties for a long time of provision and provides the same performance as urea supplements without the potentially harmful effects associated with urea. The use of slow release urea in feed can maintain feed consumption in accordance with the level of production achieved with rations containing urea in beef cattle (Sinclair *et al.*, 2001). The use of purea up to the level of 40% in concentrate feed increases consumption and the use above that level decreases

consumption. The results of this study are the same as those reported by Paengkoum and Bunnakit (2009) in Thai and Brahman crossbred cattle which given a gelatinization supplement of a mixture of cassava pulp with urea as a substitute for soybean meal in concentrate feed, get an increase in feed consumption to the level of use of 40% but statistically not different. The research results of Alves *et al.* (2014a) found that the substitution of urea with slow release urea did not change the consumption of sheep rations.

According to Goncalves *et al.* (2015) the use of slow release urea up to the level of 40% in concentrate feed in a total mixture of rations with low-quality forage can maintain feed consumption in accordance with the level of production achieved for beef cattle in rations containing urea. Mastika (2003) in a study on Bali cattle which given concentrate on a feedlotting system for 112 days obtained feed consumption of $78.83 \text{ g/kg BW}^{0.75} - 106.25 \text{ g/kg BW}^{0.75}$. The high feed consumption in the study compared to this study, because the research time is longer than the study conducted (60 days). The use of urea with putak without cooking (T_0) as a supplement results in low feed consumption. Xin *et al.* (2010) reported that the consumption of cow dry ingredients which given urea coated with polyurethane was the same as those given soybean meal. Consumption of OM, CP and CF increases with increasing levels of purea use on the level of 40% in concentrate feed.

The drymatter digestibility of the feed of Bali cattle that got 40% purea was significantly higher ($P < 0.05$) than those that got 60% purea and those which got the urea-putak mixture without cooking, whereas in cows that received 20% purea there was no difference. The same phenomenon occurs in Organic matter digestibility. T_2 treatment was higher than T_3 and T_0 but with T_1 was not different in the digestibility of DM and OM. CP T_2 digestibility (T_2) is not different from T_0 . Digestibility of CF did not differ among treatments. Increase in feed consumption causes increase in digestion, causing rumen emptying faster. The results of this study are the same as reported by Geron *et al.* (2016) that the use of 1.2% slow release urea in sheep ration did not change the consumption of nutrients and rumen parameters.

Table 2 – The response of research cattle on the response variable

n/n	T_0	T_1	T_2	T_3	SEM
Feed consumption, g/kg BW ^{0.75}					
DM of King grass	45.67±3.60	48.54±2.06	50.61±1.08	46.76±4.78	1.08
DM of Concentrate	32.36±2.94	31.53±2.11	30.51±1.05	31.15±3.04	0.38
Total DM	78.03±6.10	80.07±3.79	81.07±1.58	77.92±7.27	0.78
DM of King grass	39.09±3.08	41.55±1.76	43.28±0.89	40.03±4.09	0.92
OM of Concentrate	30.16±2.74	28.69±1.92	27.92±0.96	29.08±2.84	0.47
Total OM	69.25±5.42	70.24±3.35	71.20±1.40	69.11±6.43	0.49
CP of King grass	4.61±0.36	4.90±0.21	5.11±0.11	4.72±0.48	0.11
CP of Concentrate	7.07±0.64	6.96±0.47	6.90±0.24	6.89±0.67	0.04
Total CP	11.68±50.94	11.86±0.94	12.01±0.27	11.61±1.07	0.09
CF of King grass	15.09±1.19	16.04±0.68	16.70±0.34	15.45±1.58	0.35
CF of Concentrate	2.31±0.21	3.44±0.23	3.43±0.12	2.94±0.29	0.27
Total CF	17.40±1.35 ^b	19.48±0.85 ^a	20.14±0.38 ^a	18.39±1.0 ^{ab}	0.60
Feed digestibility, %					
Dry Matter	60.53±5.10 ^b	62.73±3.13 ^{ab}	66.79±0.34 ^a	59.66±1.34 ^b	1.59
Organic matter	62.05±4.91 ^b	64.17±3.04 ^{ab}	68.12±0.39 ^a	61.35±1.21 ^b	1.52
Crude protein	79.84±2.25 ^{ab}	78.62±0.94 ^b	82.32±0.52 ^a	75.43±2.92 ^c	1.43
Crude fiber	27.35±15.84 ^b	38.75±8.91 ^a	42.89±5.62 ^a	25.23±4.45 ^{ab}	4.30
Initial body weight, kg	193.40±25.12	190.55±19.14	192.55±12.47	194.33±28.82	0.81
Final body weight, kg	207.63±27.35	211.70±16.04	224.28±8.40	206.33±28.77	4.09
Body Weight Gain, kg	0.24±0.16 ^b	0.36±0.13 ^{ab}	0.53±0.14 ^a	0.24±0.05 ^b	0.07
Efficiency of feed use	0.06±0.04 ^b	0.08±0.03 ^{ab}	0.12±0.03 ^a	0.06±0.01 ^b	0.01

^{abc} Averages in the same row with the different superscript differences at $P < 0.05$; SEM = Standart Error of the Mean.

Feed digestibility (DM, OM, CP and CF) is in line with feed consumption where Bali cows which given 40% purea in concentrate feed produce higher digestibility among the treatments. Contribution of purea as a slow release urea product in feed can meet the needs of microbes that characterized by increase in nutrient digestibility and increase in rate of passing feed in the rumen. The higher the digestibility value of feed in the provision of purea,

the higher the nutrients absorbed by livestock for their growth needs. Geron *et al.* (2016) concluded that the use of 0.66% slow release urea in sheep feed produces the best digestibility of crude protein. Consumption of digested nutrients among the treatments did not differ ($P > 0.05$) which indicated the use of purea had no effect on energy consumption; however there is a tendency for an increase in consumption to a level of 40% purea compared to when using an urea-putak mixture without cooking. Almost the same results as reported by Castaneda-Serrano *et al.* (2013) that the use of slow release urea replaces conventional urea in beef cattle rations does not change the consumption and total digestibility of nutrients.

Body weight gain of Bali cattle that received purea in concentrate feed showed a significant difference ($P < 0.05$) while the efficiency of feed use was not significant ($P > 0.05$) its effect. Body weight gain of Bali cattle that received a mixture of urea-putak without cooking experienced a ADG of 0.24 kg/h/d (T_0) and increase to 0.36 kg/h/d on the provision of purea 20% (T_1) in concentrate feed and 0.52 kg/h/d on the provision of purea 40% (T_2). In the provision of 60% purea in the feed concentrate (T_3) the body weight gain decreased to 0.24 kg/h/d equal to T_0 . An increase in ADG with the use of purea up to the level of 40% shows the existence of efficient use of urea through synchronization of carbohydrate fermentation originating from putak with the rate of release of ammonia from urea. The treatment of T_2 is different from T_0 and T_3 but with T_1 it is not different. ADG between T_2 and T_1 is relatively the same because the consumption and digestibility of the two treatments is relatively similar so that the supply of nutrients for the growth is also relatively the same. The research results of Ahmed *et al.* (2017) concluded that supplementation of slow release urea (Optigen®) with corn silage was effective in increasing sheep body weight gain. The results of this study are higher than those obtained by Nanda *et al.* (2014) in Bali cows which were given a supplement of palm kernel cake and palm fronds (0.30 – 0.42 kg/h/d).

The use of slow release urea as ration supplement also results in an increase in milk production as reported by Xin *et al.* (2010) occurs an increase in milk production in dairy cows around 2.0 kg/h/d. The Body Weight Gain of Bali cattle in this study is still the same as that obtained by Mastika *et al.* (2000) who provide various supplements to improve body weight gain of Bali cow namely 510 - 526 g/h/d.

The efficiency of feed use is an illustration of how much feed consumed by cows can produce the body weight gain. The use of purea in concentrate feed results in different feed efficiency ($P < 0.05$) in Bali cattle. There is a tendency the increasing levels of purea in concentrate feed, the value of the efficiency of feed use increases. The highest value of the efficiency of feed use achieved by T_2 followed by T_1 , T_0 and T_3 . An increase in feed efficiency will cause a decrease in costs and the efficiency of all production systems become better (Nkrumah *et al.*, 2006). The result of this study is in accordance with Tedeschi *et al.* (2002) and Kardaya *et al.* (2018) that the best feed conversion is obtained when growing cows are given slow release urea compared if given conventional urea in natural rations that contain high forage.

CONCLUSION

The use of purea in concentrate feed as a supplement produces benefits for the productivity of Bali cattle through the increase in growth namely consumption, digestibility, Body Weight Gain, and efficiency of feed use. The results of this study indicate that purea should be used in 40% concentrate feed in Bali cattle feed, especially if given king grass as its basal feed. Urea can be utilized in Bali cattle feed up to 6% with the use of purea.

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