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Performance of Dairy Cows to Urea Supplementation With or Without Fish Meal under Grazing Management in the Coconut Triangle of Sri Lanka

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ABSTRACT. On-farm research was conducted to identify a low cost supplement that would improve milk production in lactating Sahiwal cows maintained under grazing conditions in the coconut triangle by evaluating the response to urea molasses based diets. Eighteen multiparous Sahiwal dairy cows were allotted at calving to three groups balanced by milk yield of previous lactation. Control group (F_0) received the conventional concentrate mixture formulated at the farm to feed the entire milking herd. Other groups (F_1 and F_2) received concentrate mixtures in which 40 g urea kg^{-1} concentrate and 40 g urea + 30 g fish meal kg^{-1} concentrate, respectively, were used to substitute 50% and 75% of coconut poonac in conventional mixture. All the cows were offered with free grazing and milked twice a day. Concentrate was provided during milking. Concentrate intake was recorded and proximate composition of representative samples was determined. During the first 200 days of lactation 24 h milk yield of individual cows was recorded weekly. Milk samples were used to determine the fat content. Concentrate intake of the cows in group F_1 (50% of coconut poonac was substituted urea) was significantly lower ($p<0.05$) than that of control (F_0) but higher than F_2 (75% of coconut poonac was substituted with urea+ fish meal). Actual milk yield and 4% fat corrected milk yield were significantly higher in cows of the group F_1 when compared to those in F_2 or control (F_0). The difference in milk yield between cows in group F_2 and F_0 was not significant. Milk yield of cows per kilogram of concentrate was lower in the control group when compared those in F_1 and F_2. Substitution of 50% of coconut poonac with urea reduced the cost of concentrate per kilogram of milk by 47% ($p<0.05$). The results indicate that 50% substitution of coconut poonac with urea in the conventional concentrate reduces the cost of concentrate and increases milk yield and persistency in lactation among Sahiwal cows maintained under grazing conditions in the coconut triangle.

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INTRODUCTION

The cost of production of milk in Sri Lanka has escalated during the past decade mainly due to high prices of inputs, particularly of coconut oil meal and formulated cattle feeds. Production of coconut poonac fluctuates during the year depending on rainfall. During the dry periods, the demand created by monogastric animals results in severe shortage of concentrate feeds for ruminants. To tide over this situation, annually Sri Lanka has to import animal feeds and feed ingredients. Since the price of concentrate feeds, produced from conventional feed ingredients, is very high, cost efficiency has become a major concern among small holder dairy farmers.

Urea molasses based feeds have been tested and successfully used in many countries (Taiwo *et al.*, 1992). Essentially, urea molasses supplementation aims to improve straw and basal feed utilization using minimum quantity of supplement. This could be one of the economical alternatives to curb the cost of production of milk.

However, information relating to the response of high yielding dairy cattle to urea molasses supplementation is scanty. The aim of this study was to evaluate urea molasses based diets to identify a low cost supplement that would improve milk production in cows maintained under grazing conditions in the coconut triangle of Sri Lanka.

MATERIALS AND METHODS

On–farm research was conducted at Marandawila National Livestock Development Board farm located in the Kurunegala district of the coconut triangle of Sri Lanka. Eighteen multiparous Sahiwal dairy cows were allotted at calving to three groups balanced by milk yield of previous lactation and parity. All the cows were in the same herd before the commencement of experimental period to ensure uniform feeding and management. One group (F_0) received the conventional concentrate mixture formulated in the farm to feed the entire milking herd. Another group (F_1) received a concentrate mixture in which 40 g urea per kg concentrate was used to substitute 50% of coconut poonac in the conventional mixture. The third group (F_2) received a concentrate mixture in which 40 g urea + 30 g fish meal per kg concentrate was used to substitute 75% of coconut poonac in the conventional mixture. Molasses, mineral mixture and salt were added at fixed levels to all three formulations while the level of rice bran was altered to balance the mixture. Detail formulation of the test feeds is presented in Table 1. Cows were fed individually with concentrate mixture, *ad libitum*, during milking at 0530 h and 1500 h daily. Amounts of feed offered and refused were recorded. Throughout the experiment the cows were maintained under extensive system of management allowing to graze on *Brachiaria brizantha* grass grown under coconut. Cows were paddocked and taken to milking parlour for milking, twice daily. After each milking, cows were allowed to graze until next milking.

Table 1. Composition of test feeds.

Items	F_0 (g kg^{-1})	F_1 (g kg^{-1})	F_2 (g kg^{-1})
Ingredients			
Molasses	375.0	375.0	375.0
Urea	-	40.0	40.0
Rice bran	375.0	435.0	455.0
Salt	30.0	30.0	30.0
Mineral Mixture	20.0	20.0	20.0
Coconut oil meal	200.0	100.0	50.0
Fish meal	-	-	30.0
Proximate composition			
Dry matter	857.3	862.4	861.3
* Crude protein	108.3	206.3	219.4
* Crude fibre	70.8	65.4	61.2
* Ether extract	61.3	54.4	58.5
* Total ash	164.8	168.6	172.3

* Presented on dry matter basis

All the feeds were analysed for dry matter (DM), crude fibre (CF), crude protein (CP), ether extract (EE) and total ash (TA) contents according to the standard procedures (AOAC, 1990). During the first 200 days of lactation 24 h milk yield of individual animal was recorded weekly. The fat content of milk was determined every other week using Gerber method.

Cost of each formulation was estimated based on the market price of ingredients. Amount and cost of concentrate required to produce a kilogram of milk from each formula were also calculated.

Data were statistically analysed using ANOVA. Mean separation was done by using Duncan's multiple range test (Snedecor and Cochran, 1968).

RESULTS AND DISCUSSION

Concentrate intake

Mean concentrate intake per cow during 200 days of lactation is presented in Table 2. Concentrate intake was highest ($p<0.05$) in the cows in control group (F_0) while F_1 group (50% coconut poonac substituted with urea) showed significantly higher intake than F_2 group (75% of coconut poonac was substituted with urea+fish meal). Concentrate was offered from individual feeders during milking and the intake was controlled by the duration of milking. However, visual observation revealed that the cows offered the diet containing high level of coconut poonac (control, F_0) consumed readily while the rest which received low level of poonac consumed reluctantly, suggesting that F_1 and F_2 formulae were less palatable. The intake of supplementary diets increased with increasing level of coconut poonac. This is possibly due to enhanced palatability with increasing levels of coconut poonac in the diet.

Daily intake of N from concentrate is presented in Table 2. There was a significant difference in N intake by cows fed with different concentrates. The cows in the F_1 group showed the highest and in the control (F_0) showed the lowest concentrate N intake per day. The N intake of cows in the F_2 group was lower than that of F_1, but higher than the control. Nitrogen intake is a product of the nitrogen content and the concentrate intake. Diets F_1 and F_2 had urea as a source of N that increased the N content of the mixture while control diet contained coconut poonac as the major N source. The poor intake of the diet which included urea+fish meal to substitute 75% of coconut poonac (F_2), in spite of its high nitrogen content, has resulted in lower daily N intake.

Table 2. Concentrate intake, milk yield, fat content and fat corrected milk yield of cows, during the first 200 days of lactation.

Attributes	F_0	F_1	F_2	± SEM
Intake				
Concentrate (kg)	552.3^a	392.7^b	314.7^c	46.07
Concentrate N (g cow^{-1} d^{-1})	40.8^c	55.8^a	47.4^b	5.0
Milk yield (kg)	1008^b	1413^a	989^b	149.33
Fat content (%)	4.52	4.59	4.56	0.0625
4% FCMY (kg)	1135^b	1610^a	1119^b	163.91

Within each row, values followed by the same superscript is not significantly different (p=0.05) ; FCMY- Fat corrected milk yield; SEM standard error of the mean.

Milk yield and composition

Mean actual milk yields, fat content and 4% fat corrected milk yields are presented in Table 2. There was a considerable difference in actual milk yield and 4% fat corrected milk yield but the difference in fat content was not significant. Increasing the crude protein content or inclusion of undegradable dietary protein (UDP) did not affect the fat content in milk in this experiment. Similar results have been reported (Klusmeyer *et al.* (1990).

Milk yields and 4% fat corrected milk yields were significantly higher in group fed with the diet F_1 when compared to that of the group fed with diet F_2 and control. The difference in milk yield between the cows in control and fed with diet F_2 were not significant. Any increase in N intake by the ruminant increases the production of ammonia in the rumen that could be utilized for growth and multiplication of the rumen microorganisms (Mathur *et al.*, 1994). Increased microbial activity in the rumen accelerates fibre digestion, which results in increased grass intake. The higher intake of nitrogen by the cows fed F_1 may have increased the availability of nutrients through increased intake of grass. Increased influx of nutrients may be attributed for higher milk production. Several previous research findings also have indicated such improvement in milk production in response to feeding of non protein nitrogen (NPN) such as urea (Ghebrehiwet *et al.*, 1994).

In agreement with Ellison *et al.* (1997), production of milk was not affected by the inclusion of UDP in the diet in this experiment. However, earlier work has indicated that addition of fish meal to corn silage diets treated with urea resulted in a significant increase in milk production (Erfle *et al.*, 1983).

The lack of improvement in milk yield in response to true protein supplementation suggested that duodenal N supply was not effectively improved by addition of fish meal with UDP. Oldham (1994) showed that a supply of UDP becomes necessary when the milk yield of a cow exceeds 20 kg day^{-1}. The cows in this experiment never exceeded a daily milk yield of 20 kg and hence may not have responded to UDP.

Figure 1 illustrates the mean monthly 4% fat corrected milk yield of cows receiving different supplementary diets. Cows fed with the conventional concentrate (F_0) and with a diet F_2 (75% of coconut poonac was substituted with urea+fish meal) reached peak milk yield at 2 month postpartum while those fed with diet F_1 (50% of coconut poonac substituted with urea) attained peak yield at 3 months. Cows of F_1 group tended to have more persistent milk yield those in F_0 and F_2. Lack of galactopoietic response by cows fed with fish meal in the later part of lactation in the present study agrees with the findings of Wohlt *et al.* (1991).

Cows in the control group did not reach a significant peak in their lactation, suggesting that these cows may be operating below their potential. Nitrogen supplied by the conventional concentrate (F_0) may be inadequate to provide favourable rumen environment to enhance digestion. This may have resulted in a lower metabolizable energy and protein supply for milk production.

Economics of feeding

The data on the economics of feeding are given in Table 3. The cost of concentrate feed supplements was lowest in F_1. Substitution of expensive coconut poonac by urea and rice bran contributed for the reduced cost. Even though, the level of substitution was high in F_2, cost also remained high

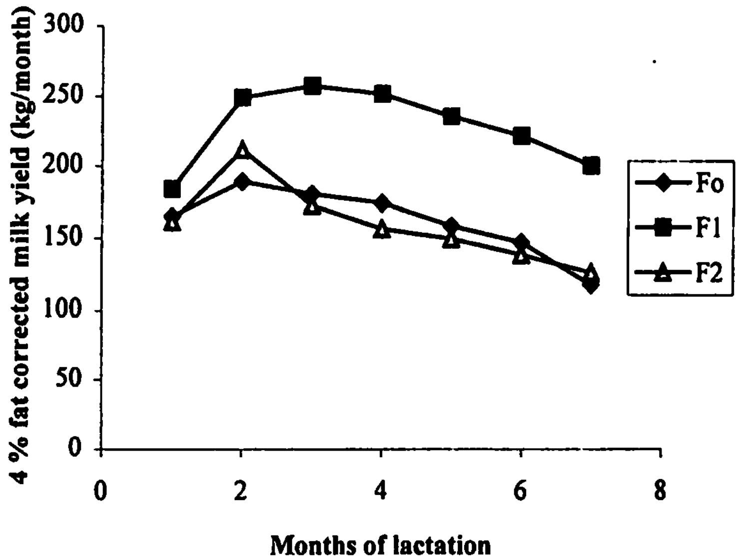

Figure 1. Mean monthly 4% fat corrected milk yields of cows.

Table 3. Economics of feeding of lactating cows under extensive system of management.

Attributes	F_0	F_1	F_2	± SEM
Cost of concentrate (Rs. kg^{-1})	5.22	4.81	5.53	
Milk yield per kg concentrate (kg)	1.88^b	3.69^a	3.14^a	0.626
Cost of concentrate per kg milk (Rs.)	2.93^a	1.38^c	1.89^b	0.381
Cost of feeding concentrate (Rs. cow^{-1} d^{-1})	14.4^a	9.43^b	8.70^b	1.158

Within each row, means followed by the same letter are not significantly different (p=0.05).

because fish meal is more expensive than other feed ingredients. The objective of testing this expensive formulation was to examine the response to feeding of UDP.

Milk yield per kilogram of concentrate was lower in cows fed with the conventional concentrate (control) compared with groups fed with diets F_1 or F_2. The difference of milk yield between cows fed with F_1 and F_2 was not significant (Table 3). This may be attributable for higher feed intake and lower milk yield of the cows in the control group. Even though the milk yield of cows fed with the diet F_2 (75% of coconut poonac substituted with urea+fish meal) was low, the lowered intake contributed for higher milk yield per unit of concentrate.

Cost of concentrate per kilogram of milk was significantly lower in the group fed with the diet F_1 and highest in the group fed with the conventional concentrate (control). Cost of the diet F_2 was significantly lower than that of control but higher than the diet F_1 ($p<0.05$). The lack of or poor response to UDP supplementation by low yielding cows resulted in higher cost per kg milk produced by this group contrary to the expectations.

CONCLUSIONS

The results suggest that substituting 50% of coconut poonac in the conventional concentrate mixture improves N intake, milk yield and persistency, and lowers the cost of milk production and cost of concentrate required per kg milk produced by 47%. Thus, the conventional concentrate mixture can be improved and the expenditure can be curtailed by incorporating urea to substitute 50% of the coconut poonac in the mixture offered to lactating cows in the coconut triangle area.

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