Strategic Supplementation with a High-Quality Feed Block on Roughage Intake, Milk Yield and Composition, and Economic Return in Lactating Dairy Cows

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ABSTRACT : Twenty-four multiparous crossbred Friesian dairy cows (60-90 days in lactation) were randomly assigned into a 2×2 factorial arrangement in a randomized complete block design. Factors were two levels of concentrate supplementation (1:2, high vs 1:1.2, very high; concentrate:milk yield) and two levels of high-quality feed block (HQFB) supplementation (non vs *ad libitum* block licking). Ruzi grass (*Brachiaria ruziziensis*) was fed as a roughage throughout the 70 day feeding trial. High level of concentrate fed group resulted in higher roughage and HQFB intakes, compared with very high concentrate supplemented group. HQFB supplementation tended to increase roughage intake and significantly improved milk yield (2 kg/hd/d in high concentrate supplementation) and quality (% fat) which resulted in higher economical return. HQFB was recommended to be used as a strategic supplement in lactating dairy cows especially when fed on low-quality roughages or crop residues. (*Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 6 : 901-903*)

Key Words : Supplementation, High-Quality Feed Block, Intake, Milk Yield and Composition, Dairy Cattle, Economic Return

INTRODUCTION

Variations in both quantity and quality of feeds in different seasons significantly affect milk yield and quality, especially under the management of smallholders in the tropics (Wanapat, 1990). Moreover large amounts of, and unbalanced nutrients in concentrates used by the farmers affect milk yield and income return. High-quality feed blocks (HQFB) have been reported to be beneficial to ruminants, especially with rice straw and other low quality roughages-based diets. Supplementation with urea-molasses blocks (Srinivas et al., 1997) or HQFB (Wanapat et al., 1992, 1993, 1996) has shown a beneficial effect on growth performance and milk yield. However, supplementation with HQFB in association with varying concentrate levels in dairy cows has not been examined. The objective of this experiment was to study the effects of HQFB supplementation to lactating crossbred Friesian cows when fed concentrate and Ruzi grass (*Brachiaria ruziziensis*) on their roughage intake, weight change, milk yield and quality, and on economic return.

MATERIALS AND METHODS

Twenty-four multiparious lactating crossbred Friesian cows were randomly assigned into a 2×2 factorial arrangement in a randomized complete block design according to lactation and day-in-milk. Each animal was individually housed and allowed to be in an open field about two hours daily according to milk yield. During housing, Ruzi grass (40-70 d regrowth) was offered all the time and the intake was measured daily; concentrate was given in two equal parts daily according to milk yield (1:2 and 1:1.2 kg). Concentrate mixture was prepared using locally available ingredients (table 1).

Table 1. Ingredients and chemical composition of concentrate mixture

Items	% of fresh weight
Cassava chip	26.8
Corn	4.0
Molasses	4.5
Cottonseed meal	19.5
Kapok meal	11.0
Soybean meal	10.7
Palm kernel meal	18.3
Mineral mix.	2.7
Urea	1.5
Sulphur	1.0
	% of dry matter
DM	91.6
Ash	12.9
CP	16.0
NDF	49.1
ADF	22.2
ADL	20.8
TDN, calculated	70.0

High-quality feed block (HQFB) was prepared to contain fermentable nitrogen and by-pass protein as

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well as easily degradable energy source (table 2). All solid ingredients were mixed together and then with molasses in a 100 kg batch using a rotating cement mixer. The well mixed ingredients were pressed into blocks of about 10 kg in a hydraulic press at 3 minute per block. The HQFB were weighed once weekly to record the intake. Feeding trial lasted for 70 days during which milk yield was measured, and samples of milk and feeds were collected and taken for further chemical analyses. Each animal was weighed at the beginning and at the end of the trial.

Table 2. Ingredients of high-quality feed block (HQFB) and chemical compositions of HQFB and ruzi grass

	% of fresh weight	
Cottonseed meal	45	
Molasses	25	
Urea	8	
Rice bran	5	
Tallow	2	
Bentonite	0.5	
Sulphur	1	
Salt	1.5	
Mineral mix and binding agents	12	
	HQFB	Grass
	% of dry matter	
DM	87.7	26.0
Ash	25.3	12.2
CP	43.6	9.3
NDF	38.7	77.3
ADF	17.2	47.3
ADL	11.3	5.6

Feeds were analyzed for dry matter (DM), ash, crude protein (CP), neutral-detergent fiber (NDF), acid-detergent fiber (ADF) and acid-detergent lignin (ADL). HQFB was additionally analyzed for mineral composition. Composited milk samples (morning and afternoon) taken two times during the fourth and eighth weeks of the trial were analyzed for fat, crude protein, solids-not-fat (SNF) and lactose percentages using Milko-Scan. All data were subjected to analysis of variance using SAS (1985).

RESULTS AND DISCUSSION

The concentrate mixture contained 16% CP, 49% NDF and 70% TDN. HQFB contained 43.6% CP and a high rumen by-pass protein since cottonseed meal was used at a high level (45%) (Preston and Leng, 1987). Ruzi grass used in this trial contained lower protein (9.3% CP) and relatively high level of NDF (77.3%) which may have affected intake and milk yield. Ruzi grass was cut-carry and offered *ad libitum* to each individual cow. Intakes of the grass by cows receiving the lower level of concentrate were the higher than those on higher level (1.37 vs. 0.84% BW) (table 3). Higher level of concentrate could have affected rumen fermentation and rumen ecology, resulting in lower roughage intake. As already indicated, lower protein and higher NDF contents of Ruzi grass may also have lowered overall intake. Intake of HQFB, by licking, was higher in the lower concentrate level fed group (0.43 vs 0.16 kg/hd/d) (table 3). The cows in the HQFB supplemented group exhibited better body condition than the non-supplemented group. Weight decline of cows was significantly smaller in the HQFB supplemented group and there was an interaction between HQFB and concentrate supplementation level (table 3). HQFB appeared to provide additional nutrients, and improved productivity as shown in table 4. Significant improvements in milk yield (3.5% FCM) and fat content were found in the group supplemented with HQFB ($p<0.04$), while the content of lactose exhibited

Table 3. Effect of concentrate level and high-quality feed block (HQFB) on intakes and weight changes of dairy cows

	Conc:Milk, 1:2		Conc:Milk, 1:1.2		SEM	Significant level, p<		
	-HQFB	+HQFB	-HQFB	+HQFB		HQFB	Conc	HQFB*Conc
DM intake								
Grass, kg/d	5.26	5.48	2.87	3.44	0.18	0.29	0.000	0.64
% BW	1.38	1.36	0.74	0.94	0.04	0.25	0.000	0.16
Concentrate, kg/d	2.49	5.49	8.67	8.86	0.07	0.51	0.000	0.51
% BW	1.44	1.38	2.25	2.42	0.03	0.43	0.000	0.08
Total, kg/d	10.75	10.97	11.54	12.30	0.23	0.11	0.06	0.79
HQFB intake, kg/d	-	0.43	-	0.16	0.01	-	0.002	-
Body weight change, kg/d	- 0.64	-0.15	-0.44	-0.02	0.04	0.05	0.06	0.00

Table 4. Effect of concentrate level and high-quality feed block (HQFB) on milk yield and compositions

	Conc:Milk, 1:2		Conc:Milk, 1:1.2		SEM	Significant level, p<		
	-HQFB	+HQFB	-HQFB	+HQFB		HQFB	Conc	HQFB*Conc
Milk yield, kg/d	9.00	9.51	9.04	10.32	0.44	0.06	0.08	0.06
3.5% FCM, kg/d	9.86	11.86	10.09	10.39	1.10	0.04	0.09	0.06
Fat, %	3.85	5.02	3.64	4.49	0.43	0.04	0.42	0.22
Protein, %	2.89	2.99	3.31	3.07	0.23	0.80	0.32	0.49
Lactose, %	4.59	4.98	4.33	4.94	0.21	0.09	0.50	0.33
SNF, %	8.30	8.345	8.33	8.52	0.15	0.47	0.51	0.41
Total solids, %	12.04	13.71	11.97	13.20	0.64	0.10	0.67	0.54

an increasing trend ($p<0.10$). A greater response in milk yield was found in the group fed the lower concentrate level in which an increase of 2 kg/hd/d of 3.5% FCM was obtained. The HQFB may have provided, on a continuous basis, additional and essential nutrients needed for milk production. These enhancements were similar to those reported by Srinivas et al. (1997) and Wanapat et al. (1996).

HQFB as a strategic supplement could be used efficiently as a means to increase milk yield and milk quality especially when cows are fed on low-quality roughages with a low level of concentrate. It also increased roughage intake to help maintain normal fermentation and establish a more balanced rumen ecology, and most importantly it could provide a higher economical return to the farmers in the tropics where feeds are commonly scarce both in quantity and quality throughout the year (table 5).

Table 5. Economic analysis of high-quality feed block (HQFB) supplementation on feed utilization in dairy cows

	Conc. Suppl:Milk 1 : 2 HCSL		Conc. Suppl:Milk 1 : 1.2 VHCSL	
	-HQFB	+HQFB	-HQFB	+HQFB
Feed Cost, B				
Roughage	5.26	5.48	2.87	3.44
Concentrate	32.94	32.94	52.02	52.02
HQFB	-	8.60	-	3.20
Total	38.20	46.02	54.89	58.66
Milk yield, kg/d	9.86	11.86	10.09	10.39
Milk sale, B/hd/d	101.06	121.56	103.42	106.50
Profit, B/hd/d	62.86	75.54	48.53	47.84
B/hd/m	1885.80	2266.20	1455.90	1435.20

HCSL=high concentrate supplement level.
VHCSL=very high concentrate supplement level.
B=Baht, 40 B=1 $US.
Grass=1 B/kg, Conc.=6.10 B/kg H=high.
HQFB=20 B/kg, Milk=10.25B/kg VH=very high.

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REFERENCES

Preston, T. R. and R. A. Leng. 1987. Matching Ruminant Production Systems with Available Resources in The Tropics and Sub-Tropics. Penambul Books, Armidale, Australia.

SAS. SAS User's Guide: Statistics, Version 5 Ed. 1985. Inst., Inc. Cary, NC., USA.

Srinivas, Bandla, B. N. Gupta and B. Srinivas. 1997. Urea-molasses-mineral block licks supplementation for milk production in crossbred cows. Asian-Aus. J. of Anim. Sci. 10(1):47-53.

Wanapat, M. 1990. Nutritional Aspects of Ruminant Production in Southeast Asia With Special Reference to Thailand. Funny Press, Ltd., Bangkok, Thailand.

Wanapat, M., O. Pimpa, A. Petlum and U. Boontao. 1997. Cassava hay : A new strategic feed for ruminants during the dry season. Livestock.

Wanapat, M. and K. Sommart. 1993. Supplementation of high quality feed block (HQFB) for swamp buffalo fed rice straw based diets. Proc. The 7th World Conference on Animal Production. Edmonton, Alberta, Canada. VIII. pp. 205-206.

Wanapat, M., K. Sommart, P. Ajsuk, C. Wachirapakorn and W. Toburan. 1992. Effect of high quality feed block supplementation on intake, ruminal fermentation pattern, degradability in ruminants fed rice straw based-diets. The 30th Annual Meeting, Kasetsart University, Bangkok, Thailand.

Wanapat, M., K. Sommart, O. Pimpa and S. Boonsom. 1996. Supplementation of high quality feed pellet to increase milk productivity at small-holder farmers level. Proc. The 8th AAAP Animal Science Congrees, Japanese Society of Zootechnical Sci., Tokyo, Vol. 2:158.