RESPONSES TO DRY SEASON SUPPLEMENTATION BY DAIRY COWS ON THE HIGHLAND ZONES OF MADAGASCAR

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Abstract

RESPONSES TO DRY SEASON SUPPLEMENTATION BY DAIRY COWS ON THE HIGHLAND ZONES OF MADAGASCAR.

Three feeding trials were conducted to evaluate the effect of different feed supplements on the productivity of dairy cows. The trials were conducted in 49 farms located in the Highland zones of Madagascar and comprised of 143 crossbred cows. Milk yield was recorded daily and live weight was measured at the beginning and end of each experiment. Progesterone concentration was measured in milk samples taken regularly for investigating post partum ovarian function. Milk production estimates were evaluated through regression analysis. The daily consumption of 0.6 kg urea-molasses minerals blocks (UMMB) resulted in an additional 30 to 55% milk production during the dry season. The nature of the supplemental feeds had no major effect on the onset of ovarian activity, which ranged from 28 to 95 days after calving. An economic analysis showed that the use of UMMB in addition to the usual concentrates was profitable to the dairy farmers.

1. INTRODUCTION

Dairy farming is a major agricultural activity providing additional income to farmers in the Malagasy highlands. There is also an increasing demand for milk as a result of urbanization and increasing population growth. Small scale rice-dairy farming is the predominant production system in the highlands of Madagascar [1].

Among the many problems faced by these dairy farms, scarcity of feed ingredients and their high prices are considered to be of major importance. In the conditions of the Highland Zones of Madagascar the increasing pressure on land to grow food crops and the ever expanding human population has resulted in a reduction in grazing land. Therefore, there is a need for smallholder farmers to be aware of the most efficient combination of roughages and concentrates for year round production.

This paper reports experiments in which dairy cows were given different feeds in order to increase milk performance, improve body condition score, evaluate the impact on postpartum cyclicity and evaluate the economic implications of supplementation.

2. MATERIALS AND METHODS

Three experiments were conducted on 49 farms during the dry seasons of 1997, 1998 and 2000. These farms are located in the peri urban zones of Antananarivo (latitude 18°55' S, longitude 47°3' E, altitude 1381 m) and Antsirabe (latitude 19°52' S, longitude 47°01' E, altitude l506 m). In these regions the climate alternates between a warm rainy season (November to May) and a cool dry season (June to October). Rainfall is unimodal, with a mean annual rainfall averaging 1360 mm and 1432 mm in Antananarivo and Antsirabe respectively.

Experiment I was carried out from July to November 1997 in the peri-urban zones of Antananarivo and Antsirabe. A total of 76 cows received one of the 3 supplement feeds already being used by the farmers: concentrates, groundnut seedcake, or fodder radish *(Rapharus sativa).* Cows were included in the experiment as soon as they had calved and the experiment continued for 10 weeks. The supplement level varied from 3–5 kg/cow per day for the concentrates, 1–4 kg groundnut seed cake and 10–15 kg of cultivated fresh fodder radish/cow per day. Most of the cows were stallfed and received a combination of hay and fresh forages as their basic diet.

Experiments 2 and 3 were conducted during dry seasons in 1998 and 2000 in the periurban zones of Antananarivo. Concentrates are mainly home made by participant farmers. Cows were supplemented with concentrates alone (2–6 kg/day) or a combination of concentrates (2–4 kg/day) and a compound of mixture of urea, molasses and minerals as a block (UMMB) [2, 3]. The latter was incorporated at the rate of 0.6 kg/cow per day. The UMMB consisted of 42% of molasses, 9% urea, 5% salt, 15% cement and 29% rice bran. Each block weighed approximately 1.2 kg. This was easy to transport and within the farmer's purchasing power.

Cows were milked by hand twice daily: in the early morning and in the evening. Milk yields were recorded daily by the farmers themselves and the data were collected every 1 or 2 weeks. The live weight (measured by using an electronic scale; True-Test, New-Zealand) and body condition score (BCS: 1–5 scale) were assessed before the distribution of the supplements and at the final visit to the experimental cows.

Milk samples were taken weekly from day 25 post partum until the animals were observed to be cycling or until day 120 postpartum. Progesterone concentrations were measured by radioimmunoassay (RIA) technique using a kit provided by the joint FAO/IAEA Division (Vienna, Austria). A cow was considered to be cycling when progesterone concentrations were equal or more than 1 ng/ml in two or three consecutive samplings.

Data were analysed by analysis of variance and regression equations (Microsoft Excel) were used to determine the rate of decline in milk production to modelize and predict the production in cases where the groups to be compared had the same initial level of production. (Jayasuriya 1999, personal communication). Benefit:cost ratio was calculated to assess the economical profitability of supplementation [4].

3. RESULTS

The crude protein (CP) and crude fibre (CF) content of feeds used in the experiments are shown in Table I. During the experimental period, no cows suffered of any major disease.

3.1. Milk production and live weight gain

3.1.1. Experiment 1

For each cow, experiment lasted from July to November 1997. The results presented in Table II show two different cow populations. Cows from Antsirabe have a higher production as they are a high-grade crossbred derived from the Norwegian Red breed, and those raised in Antananarivo are a mixture of different crosses from French Friesian and Normande breeds.

At Antananarivo, supplementation seemed to have no significant impact on milk production. At Antsirabe, the rate of decline in milk production was higher for cows fed the concentrates than for those on fodder radish. Assuming that the curves have the same origin the milk production from the radish group was 6% higher than for the cows receiving only concentrates.

3.1.2. Experiment 2

The experiment was conducted using two different production systems. An institutional farm was used as a control group where only concentrate (4–6 kg/cow per day) was used as the supplement. The UMMB was distributed in small farms and each cow received daily 0.6 kg of UMMB, in addition to 2–5 kg/cow per day of concentrate.

The two groups were different in term of production. But when comparing the rate of decline in milk production (Figure 1), the best-fit curves were polynomial (Table II). Assuming that the initial production is the same for the two populations, the results show that cows receiving concentrates and UMMB give 53.5% more milk than those fed on concentrate alone (Table III)

TABLE I. THE CHEMICAL COMPOSITION OF FEEDS GIVEN TO EXPERIMENTAL ANIMALS

Type of feed	DM	CP	CF
		(% DM)	
Natural pasture (dry season)	56.8	7.1	31.5
Oats	22.2	12.4	30.6
Fodder radish	7.7	20.1	15.1
Concentrates	90.7	12.8	6.3
Groundnut seedcake	90.1	44.8	7.4
Urea-Molasses-Block	85.2	40.8	5.2

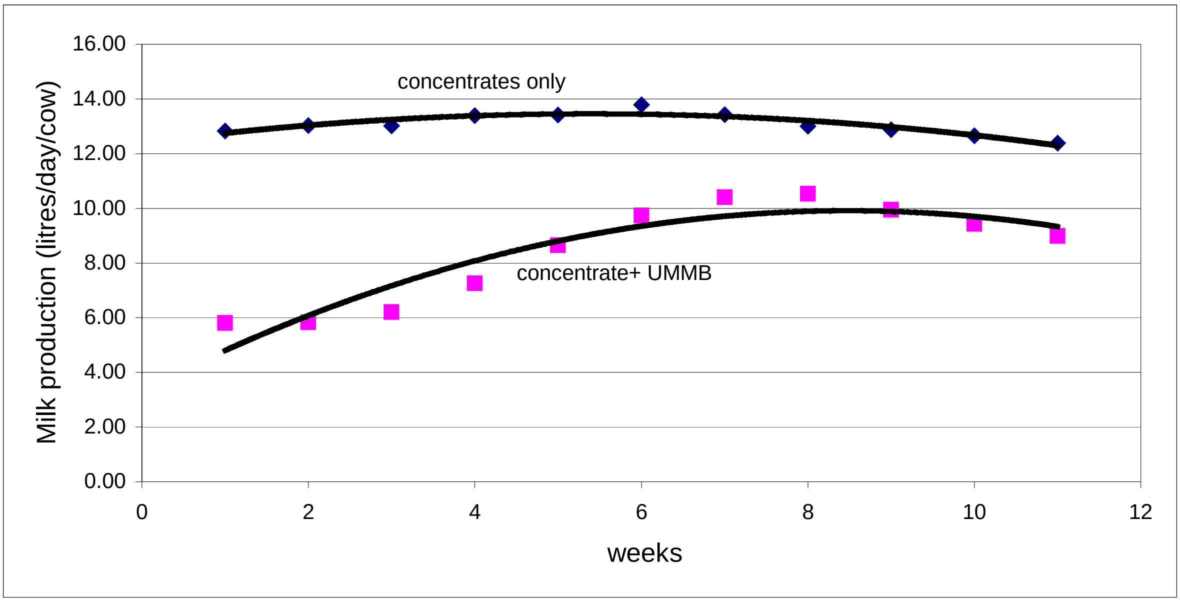

FIG. 1. Milk production of cows receiving only concentrates or a combination of concentrates and UMMB for 11 weeks during the dry season at Antananarivo (Experiment 2).

TABLE II. EFFECT OF SUPPLEMENTATION ON LIVE WEIGHT, LIVE WEIGHT GAIN AND MILK PRODUCTION

Experiment, Location, Supplement & Feed used	Number of cows	Mean body weight (kg)	Body weight gain (kg)	Mean daily milk production (litres)	Regression equations related to milk production	R^2
Experiment I (Antsirabe and Antananarivo)						
Antsirabe						
Fodder radish	10	469.0 ± 38.2	10.5 ± 7.9	20.3 ± 4.4	Y = — 0.0181X + 20.4	0.33
Concentrate	22	432.2 ± 40.4	8.0 ± 8.4	14.6 ± 4.0	Y = — 0.2359X + 17.7	0.85
Antananarivo						
Concentrate	20	429.0 ± 42.3	2.8 ± 3.8	9.7 ± 2.4	Y = — 0.1103X + 10.3	0.72
Groundnut cake	24	406.5 ± 48.9	4.1 ± 5.3	7.2 ± 5.1	Y = — 0.1713X + 8.13	0.94
Experiment II (Two production systems)						
Control Group (Concentrate only)	22	410	-	13 ± 5.3	$Y=-0.0351X^2 + 0.38X + 11.0.8$	0.85
Supplemented Group (Concentrate + UMMB)	22	387	-	8 ± 3.4	$Y=-0.0913X^2 + 1.54X + 3.34$	0.88
Experiment III (Peri-urban zones of Antananarivo)						
Concentrate	9	375	20.0	9.65 ± 2.79	$Y= -0.0235X^2- 0.0476X + 12.55$	0.94
Concentrate + UMMB	14	396	23.0	10.82 ± 4.14	$Y= -0.0189X^2+ 0.2081X + 10.90$	0.90

Y = litres/day; X = weeks

TABLE III. MILK PRODUCTION ESTIMATED FROM REGRESSION CURVES, ASSUMING REGRESSION CURVES HAVE THE SAME ORIGIN

Supplement feed	Milk Prediction curves	Predicted milk production (litres)	Increase (%)
Experiment II (Experimental period of 11 weeks)			
Concentrate alone	$Y=-0.0351x^2 + 0.3783x + 11.8$	638.5	
Concentrate + UMMB	$Y=-0.0913x^2 + 1.5485x + 7.0$	980.0	53.5
Experiment III (Experimental period of 17 weeks)			
Concentrate alone	$Y=-0.0235x^2 + 0.0476x + 11$	1041	
Concentrates + UMMB	$Y=-0.0189x^2 + 0.208lx + 11$	1373	32

Y = litres/day; X = weeks

3.1.3. Experiment 3

This trial was also conducted in the peri-urban zones of Antananarivo. The main difference when compared to Experiment 2 was that both groups were from smallholder farms. Results presented in the Table II shows that the rate of decline in milk production (Figure 2) was higher with the group receiving concentrates only. Assuming that the daily initial production was 11 litres, the prediction curve estimates that total milk production during the 17 weeks would have been 1373 and 1041 litres for the cows given concentrate + UMMB and concentrate only, respectively (Table III). The UMMB supplementation resulted in a mean gain of 2.8 litres of extra milk per day.

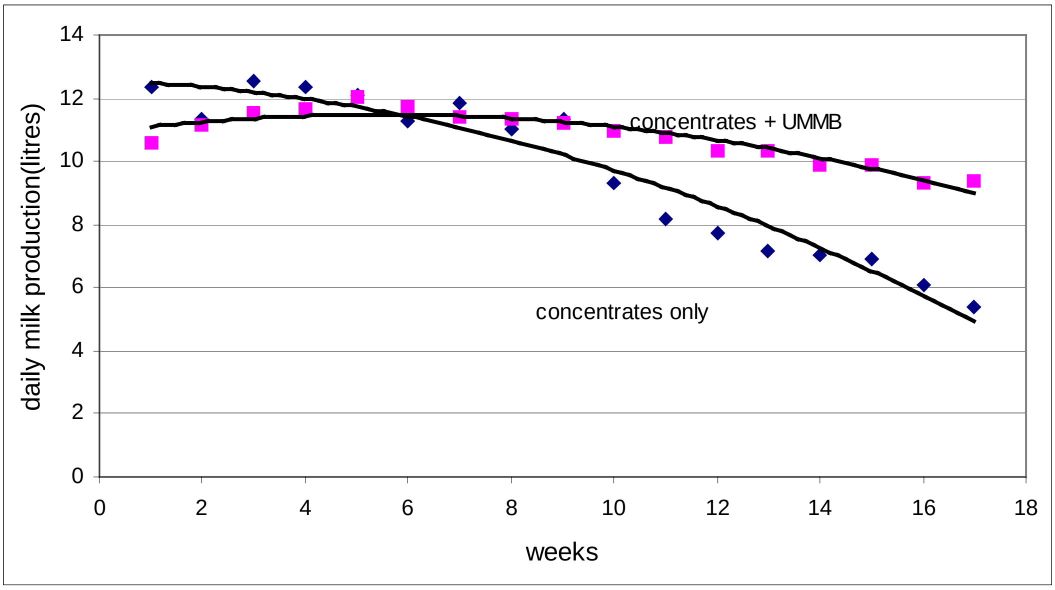

FIG. 2. Milk production of cows receiving only concentrates or a combination of concentrates and UMMB for 17 weeks during the dry season at Antananarivo (Experiment 3).

3.2. Post partum ovarian function

Both Experiment II and III results showed that there was no significant difference between the different types of supplements on the time taken for the manifestation of first oestrus from the time of calving. This interval ranged from 28 to 95 days.

3.3. Economical analysis

Benefit:cost analysis was used to evaluate the profitability of supplementing dairy cows in the smallholder farms. Considering the present cost of feed and the market price of milk, UMMB supplementation appears to be both economical and cost effective (Table IV).

TABLE IV. INFLUENCE OF TYPE OF SUPPLEMENT ON THE BENEFIT:COST RATIO AND THE BENEFIT (US $) PER LITRE OF MILK SOLD

	Concentrate alone		Concentrate + UMMB	
	Expt. 2	Expt. 3	Expt. 2	Expt. 3
Benefit:Cost ratio	2.07	2.20	5.00	4.4
Benefit/litre of milk sold (US$)	0.30	0.30	0.37	0.36

4. DISCUSSION

Constraints which limit the productivity of dairy cows under tropical conditions are multi-factorial [5, 6]. On-farm experiments presented in this paper show positive effects of supplementation on milk production.

In the first trial, there were more than 40 cows initially identified in the radish group. But 34 weeks later the radish supplement was no longer available. Cultivating and distributing fodder radish during the dry season may be a promising way of increasing the quality of dairy cow rations. The limiting factor is the availability of land for cultivating this forage in sufficient quantity for use during the dry season.

The other supplements are available all year round but they are more expensive. It is worth noting that feeding of concentrates, groundnut and cotton seed cakes are readily adopted by farmers who are principally limited either by their purchasing power, or by the availability of land for cultivating fodder radish.

In terms of production, supplementary feeding increases milk production by up to 55%. Regression analysis indicated that lower the initial milk production, the greater is the effect of supplementation. This study also showed that during the dry season, crude protein levels in pasture may fall below the 60 g/kg DM required for grazing animals, for meeting their maintenance requirement [7]. In this context, the supply of concentrates and particularly UMMB could be a very effective way of maintaining milk production especially during the dry season [8, 9].

The measurement of milk progesterone provides a better understanding of the onset of the ovarian activity. The observed mean calving to first ovulation interval showed a normal ovulatory oestrus within 60 days. However, most farmers prefer to wait for 90 days or more to carry out the first service, which is mostly by natural mating. This is a major reason why the mean calving interval of Madagasy cattle is around 418 days (n=200) [10], although the most economical inter-calving interval would be 12–13 months [12].

Strategic supplementation is already well proven and practiced by many farmers, but the extension services need to place more emphasis on the observation of post partum oestrus. These data and those which are continued to be recorded are important and they will be combined with the results of various surveys conducted in the Highland Zones of Madagascar within an integrated approach and for developing in the near future a decision support model that can be used by extension services and policy makers.

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