PERFORMANCE OF DAIRY CATTLE UNDER TWO DIFFERENT FEEDING SYSTEMS, AS PRACTICED IN KIAMBU AND NYANDARUA DISTRICTS OF CENTRAL KENYA

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Abstract

PERFORMANCE OF DAIRY CATTLE UNDER TWO DIFFERENT FEEDING SYSTEMS, AS PRACTICED IN KIAMBU AND NYANDARUA DISTRICTS OF CENTRAL KENYA.

A study was carried out in Central Kenya to compare the performance of dairy cattle under two different feeding systems, stall feeding in Kiambu and grazing in Nyandarua. A total of 23 dairy farmers were randomly selected, 11 from the Kiambu district with a total of 61 cows and 12 from Nyandarua district with a total of 102 cows. Data on milk production and reproduction was collected over a period of two years.

Stall-fed cattle showed a significantly higher milk yield ($P < 0.05$) than the grazed animals over a 10 month lactation period (3,150 vs 2,299 kg/lactation). In both feeding systems Ayshires performed better than the other breeds. The cross-bred animals compared well with pure-breds in the grazing system. Lactation yield increased with parity for the stall-fed animals while for grazed animals, milk yield declined from the 5th parity onwards. The calving intervals were long for both feeding systems (437 vs 513 days, stall-fed vs grazed, respectively). Services per conception were significantly lower ($P < 0.05$) for stall-fed (1.85 vs 2.36) compared to grazed animals. Calving season did not have any significant effect on milk yield in both feeding systems but animals calving during the wet season, on average, had a slightly higher milk yield. Lactation curves for animals in both feeding systems did not show a distinct peak. Body weight and body condition score varied with the stage of lactation.

1. INTRODUCTION

Small scale dairy farmers own 80% of dairy cows in Kenya [1]. Lactation yields of these animals are low compared to large scale farmers. Inappropriate feeding has been cited as one of the major limiting factors to increased productivity. The feeds are either poor in quality and/or insufficient in quantity [2]. Fertility is also poor resulting in decreased herd productivity as indicated by long calving intervals (568-681 days) [3].

Two distinct feeding systems exist in smallholder dairy farms in Kenya. In high potential areas, where there is a scarcity of land, farmers opt for stall feeding where forage (mainly Napier grass) is grown and brought to the animals. In addition, there is heavy input of off-farm feeds like commercial concentrates. In areas where land holdings are large, animals are grazed and receive supplementary feeding (e.g. home grown fodder or commercial concentrates) during milking.

In both feeding systems, despite genetic improvement through the use of artificial insemination, milk yields are low compared to commercial farms in the same localities. Reproductive performance is also poor.

Therefore, nutritional intervention is necessary if productivity of these animals is to be improved. To enable the design of nutritional packages which are both cost effective and sustainable, it is necessary to collect baseline information on available feed resources, milk production and reproductive performance of the existing production systems.

This study was designed to collect baseline data (Phase I) on the performance of dairy animals in the two feeding systems i.e. stall-fed and pasture-grazed. Phase II of the study involved designing strategic feed supplementation packages to improve both individual cow and herd productivity. The results presented in this paper are the baseline data (Phase I) on animal performance in these two feeding systems.

2. MATERIALS AND METHODS

2.1. Study area

The study was carried out in Kiambu (Githunguri division) and Nyandarua (South Kinangop division) districts of central Kenya. These two districts have a combined population of more than 400,000 cows. They fall under agro-ecological zone 1 and 2. The average annual rainfall in the study area in Kiambu district is between 1,200 and 1,400mm and is bimodal in nature. In Nyandarua district the average annual rainfall is between 950 and 1,200mm.

2.2. Selection of Farms

With the help of government livestock extension staff, 14 farms were randomly selected in each of the two study areas. Some of the farmers refused to cooperate early in the project and therefore, were dropped leaving 11 farmers (61 milking animals) in Kiambu district and 12 farmers (102 milking animals) in Nyandarua district.

2.3. Data collection

By means of a questionnaire, farm characteristics (e.g. farm size, number of cows, other livestock, feeds grown on the farm, feeds purchased etc.) as well as the history of cows reared (age, breed, parity, date of last calving, date of last heat etc.) were recorded. All milking animals were examined to ascertain their body condition score (BCS) on a scale of 1-5, [4] and reproductive status (by rectal palpation). Body weights were estimated with a weigh band.

To estimate milk yields, farmers were provided with graduated cups and pre-prepared record sheets. Yield was recorded fortnightly and this data was used to estimate the lactation yield. Occurrence of calving, heats, inseminations and diseases were also recorded.

Milk for progesterone assay was collected weekly 30 days after calving until confirmed pregnant by rectal palpation. The farmers were visited monthly when body weights, BCS, pregnancy diagnosis and feed availability were recorded.

3. RESULTS

A summary of the characteristics of the farms selected in the two study areas are shown in Table I. Land holdings were bigger in Nyandarua district compared to Kiambu and more area was under pasture. Table II shows the composition of the most common feedstuffs in the two study areas.

TABLE I. CHARACTERISTICS OF FARMS SELECTED IN THE TWO STUDY AREAS

	Kiambu (stall-fed)	Nyandarua (pasture-grazed)
Number of farms	11	12
Average farm size (ha)	6.6 ± 6.8	16.2 ± 10.1
Pasture area (ha)	1.5 ± 1.7	14.2 ± 5.9
Average number of milking cows	6.6 ± 4.6	8.7 ± 3.7

The distribution of the breeds were 67% Friesian, 14% Guernsey, 9% Ayrshire and 10% crosses. Cows were housed in loose barns in Kiambu and open paddocks in Nyandarua. In both areas calves were not allowed to suckle.

TABLE II. CHEMICAL COMPOSITION OF COMMON FEEDSTUFFS IN THE TWO STUDY AREAS

Feed material	DM (%)	CP (% DM)	Ash (% DM)
Nyandarua district			
Napier grass	17.1	6.3	16.6
Kikuyu grass	22.3	11.7	10.5
Lucerne	16.0	16.8	-
Fodder oats	19.2	10.9	12.4
Green maize	21.5	7.7	7.4
Cabbage	5.0	19.1	13.2
Turnip	4.5	16.6	25.4
Rutabaga	5.5	16.3	13.0
Kiambu district			
Commercial Dairy Meal	89.9	14.0	10.8
Green Maize	20.0	9.2	6.6
Maize Germ	87.6	-	1.8
Multicums	87.9	8.7	-
Napier Grass	20.0	9.0	16.0
Kikuyu grass	20.0	15.4	11.4

The influence of breed, parity and calving season on lactation milk yield, standardized to a 10-month lactation period to allow comparison, for the different feeding systems are shown in Table III.

The milk yield was significantly higher ($P < 0.05$) for stall-fed cows. The Ayrshire recorded the highest yield for both feeding systems. The performance of cross breeds were similarly under both feeding systems. Milk yield for stall-fed animals increased with parity while for grazed animals milk yield decreased with parity.

TABLE III. INFLUENCE OF BREED, PARITY AND CALVING SEASON ON 10-MONTH LACTATION MILK YIELD

	Feeding system		
	Stall-fed	Grazed	Mean
	lactation milk yield (kg/cow)		
Type of breed			
Ayrshire	3936 (7)	2514 (8)	3225
Friesian	3621 (43)	2346 (63)	2983
Guernsey	3206 (8)	2282 (15)	2747
Crosses*	1839 (3)	2054 (15)	1706
Mean	3150	2299	2665
Parity			
1 and 2	2753	2230	2492
3 and 4	3043	2527	2785
>5	3304	1828	2751
Season			
Dry	3069	2352	2711
Intermediate	3172	2185	2681
Wet	2945	2313	2969

* Crosses mainly between exotic and East African Zebu
Number of animals within parenthesis

The calving seasons were divided into 3 based on rainfall pattern. The seasons were classified as dry (January to March), wet (April to August) and intermediate (September to December). As shown in Table III the season of calving did not have any significant effect on lactation milk yield.

The 10 month lactation curve for the stall-fed and grazed animals is shown in Figure 1. Animals under the grazing system did not reach a peak after calving and the curve took a downward trend. Stall-fed animals had a slight increase in milk production during the second month.

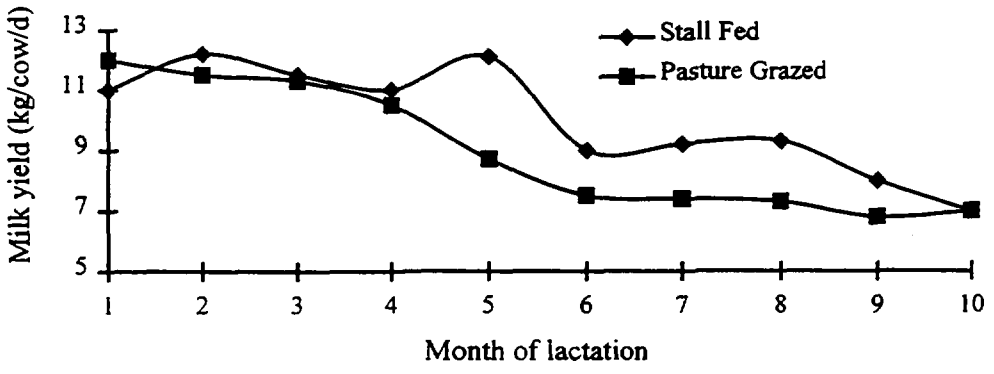

FIG.1. Lactation curves for stall-fed and grazed cows.

Body weight and body condition scores varied with month of lactation and feeding system (Figure 2). For the stall-fed animals, body condition and body weight improved over the lactation period, the highest increase being during the last month of lactation. For grazed animals there was an initial loss of body condition and weight with an improvement from 6 months of lactation. The stall-fed animals in Kiambu were of higher body weight and better condition than the grazed animals in Nyandarua, throughout the lactation.

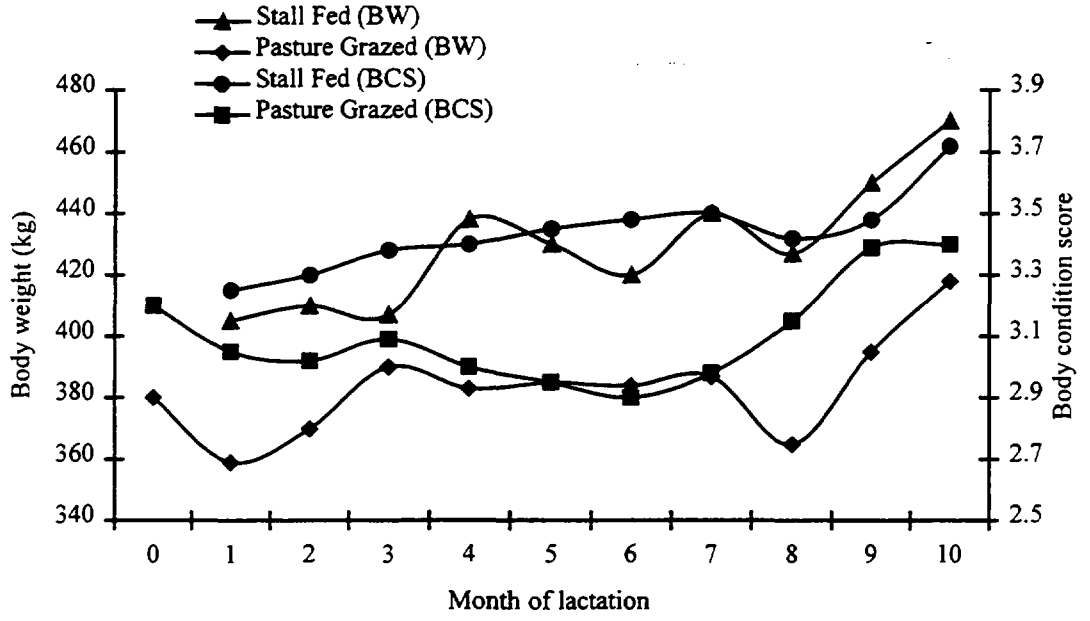

FIG.2. Body weight and BCS for stall-fed and grazed cows.

The reproductive performance of cows under the two feeding systems are shown in Table IV. 47% of stall-fed animals came into heat during the first 70 days post calving compared to 32% for grazed animals. Stall-fed cows showed significantly ($P < 0.05$) shorter calving intervals and required fewer services per conception.

TABLE IV. DAYS FROM CALVING TO FIRST OBSERVED HEAT, MEAN SERVICES TO CONCEPTION AND CALVING INTERVALS FOR THE TWO FEEDING SYSTEMS

	Feeding system	
	Stall-fed	Grazed
Percentage showing oestrus		
Within 50d	16	9
51-70d	47	32
71-100d	58.3	55.5
>100d	100	100
Services per conception	1.85	2.36
Calving interval	437 ± 103	513 ± 123

4. DISCUSSION

The higher lactation milk yield for stall-fed animals could be attributed to better feeding and management of these animals. Although the yields were higher than 2,800 kg per lactation quoted by Stotz, [5] they were still lower than the value of over 4,000 kg reported in large scale commercial farms in the same locality. Some of the animals found in this area had been purchased from these commercial farms.

Although the land holdings are smaller in Kiambu district compared to Nyandarua (Table I), there was a greater tendency for farmers to purchase feeds off farm (either fodder or concentrates) to supplement the home grown feed. This led to better nutrition of the animals resulting in higher yields. Although there was a wider variety of feeds in the pasture grazing system, animals were normally grazed and some supplement was given during milking. Some of the feeds used for supplementation had very low dry matter content (e.g. cabbage, turnip) and this might have limited dry matter intake. Due to proximity to the city (about 50 km) there was a readily available milk market, thus enabling the farmers to purchase commercial concentrates. Conversely, there was a problem of milk marketing in Nyandarua due to lack of adequate infrastructure.

The superior performance of the Ayrshires compared to other breeds was surprising as over the years, the Friesians have been known to perform better. Probably the Friesians perform better in a production system where quality and quantity of feed are not limiting. Another factor might have been due the fewer number of Ayrshires recorded in the farms (67% vs 9%). Performance of the crossbreds in the grazing system was comparable to the exotic breeds suggesting lack of any clear advantage of rearing pure breeds over crossbred animals especially when nutrition could be a constraint.

The increase in milk yield with parity as was observed in Kiambu was to be expected. However, in Nyandarua district the reduced milk yield after parity 4 could not be well explained other than to point at inadequate feed supply as a possible reason.

The lactation curve for both feeding systems did not show a distinct peak. This agrees with earlier reports from Kiambu district [6] and has been attributed to inadequate nutrition post calving. Adequate feeding post calving is critical to minimize weight and body condition loss and maximize milk yield. During the study it was observed that pasture-grazed animals lost both weight and body condition post calving and regained the same two months later. The stall-fed animals lost neither body weight nor condition. Therefore, they should have been expected to show a peak lactation at the second month of lactation. The lactation curve (Figure 1) did show a small rise which was not maintained. The loss in body weight and body condition for grazed animals could have contributed to the delayed onset of heat and low conception resulting in longer calving intervals of 437 and 513 days for stall-fed vs grazed animals (Table IV). This is clearly an area that needs addressing for both regions.

Attempts to use progesterone levels in milk as indicator of ovarian activity were not successful due to logistical problems. These have now been addressed for the second phase. Reasons for the larger number of services per conception could not be clearly identified as a result of a lack of information on ovarian activity but this area could be improved for grazed animals.

5. CONCLUSION

Stall-fed animals performed better than grazed animals. This was attributed to better feeding. There is room for improvement in both feeding systems. Body condition scoring proved to be a useful tool for assessing nutritional status of animals.

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