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EFFECT OF ABRUPT AND FREQUENT CHANGES IN FORAGE QUALITY AND THE INFLUENCE OF PATTERN OF CONCENTRATE FEEDING ON THE PERFORMANCE OF DAIRY CATTLE

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SUMMARY

Feeding of dairy cattle by smallholder farmers in Kenya is characterized by intermittent and abrupt changes in the quantity and quality of forages. Previous studies have shown that these fluctuations have a negative effect on live weight gain in growing animals. In the present study, thirty Friesian cows with a mean live weight of 459 kg were used to determine the effects of feed fluctuations on the performance of lactating animals when they receive in addition, small amounts of concentrate. The experiment also tested whether the effects of feed fluctuations could be redressed by altering the pattern of feeding the concentrate. The cows were blocked for milk yield and stage of lactation, and allocated to three treatments in a completely randomized block design. The treatments were: T1, Forage altered (Napier vs barley straw) every five days plus 3 kg/day concentrate; T2, As T1 but 1 kg/day concentrate offered with Napier and 5 kg/day with straw; T3, Napier offered in the morning and straw in the afternoon on each day, plus 3 kg/day concentrate. All animals were fed in individual pens fitted with *ad-libitum* watering facilities. Although overall there were no significant differences between the three treatments in feed intake, live weight gain or digestibility, the daily milk yield for animals on T2 was lower ($P<0.05$) than T1 and T3. Also, although there were some indications of a negative effect of alternating forage type on performance, with a trend towards lower milk yields and greater live weight loss, the differences were not significant when concentrate was offered at a flat rate. Varying the concentrate level to try and maintain a more even supply of energy and protein appeared to increase the negative effect. It appears that repeated switches from a high to low level of concentrates resulted in an unstable rumen environment, reducing the efficiency of digestion and nutrient utilization.

Keywords: Feed fluctuations, feed intakes, live weight, digestibility, milk

INTRODUCTION

The high and increasing demand for animal products and the increasing pressure on land in the tropics (Mohamed-Salem, 1995), coupled with the need to improve the incomes of rural populations, has led to intensification of dairy production. This intensification has resulted in the existence of the smallholder dairy production systems integrated with cropping which have been observed in India (Payne, 1990), Tanzania (Msanga *et al.*, 1998), Kenya (Peeler and Omore, 1997) and Indonesia (Trisunuwati *et al.*, 1991), amongst other developing countries. Under the smallhoder systems, crop residues and other farm and agro-industrial by-products play an important role in the year-round feed budget, by supplementing grazing or the major cut and carry fodder such as Napier grass in Kenya. Each of these non-conventional feeds is however deficient in one or more of the major nutrients that are necessary for optimal animal production, or is low in digestibility.

In general the smallholder farmers offer their animals the type of forage available at a given time and switch abruptly to the next available forage. Sometimes the feeding of Napier grass in Kenya is differed when another type of forage such as maize stover becomes available to enable the Napier grass to be conserved *in situ* or to allow a substantial re-growth before harvesting. These opportunistic feeding practices result in abrupt changes in the quantities and quality of basal diets, which may affect the efficiency of the rumen function and therefore the utilization of feeds. Previous studies with growing dairy animals have shown that changing every five days the basal diet from a poor quality forage, barley straw, to one of relatively better quality, Napier grass, has a negative effect on live-weight gain (Sanda *et al.*, 1999). The objective of the present study was to determine whether there is

similar effect on the performance of lactating animals when they receive in addition small amounts of concentrate, and if so, whether this can be redressed by altering the pattern of concentrate feeding.

MATERIALS AND METHODS

Thirty Friesian cows with a mean live weight of 459 kg were blocked for milk yield and stage of lactation, and allocated to three treatments in a completely randomized block design experiment. The treatments were: T1, Forage altered (Napier *vs.* barley straw) every five days plus 3 kg/day concentrate daily; T2, As T1 but 1 kg/day concentrate offered with Napier and 5 kg/day with straw; T3, Napier offered in the morning and straw in the afternoon on each day plus 3 kg/day concentrate. The feeding regimes were calculated so that by the end of every 10 days during the 60-days experiment, animals on each of the treatments had been offered similar quantities of forages and concentrate. Smallholder animals are rarely fed *ad libitum* and to reflect this practical situation, animals in T1 and T2 were offered about 90 % of their *ad libitum* intakes of the forages, while those in T3 received half of such amounts of each forage.

The Napier grass was grown under irrigation and to ensure a uniform quality, the harvesting was organized in such a way that each harvest was from a stand of 56 days re-growth. The forages were offered in two equal portions, one in the morning and the other in the afternoon. Animals in T3 received straw in the morning and Napier grass in the afternoon. Concentrates were also offered in two portions at milking which was at 07.00 h and 18.00 h daily. Napier grass and barley straw samples were analyzed daily for DM. Samples of Napier grass, straw and dairy meal were bulked every five days and analyzed for total ash and crude protein (CP), according to the AOAC (1984) methods, and for neutral detergent fiber (NDF) according to the methods of Van Soest and Robertson (1985).

Mean daily DM intake and milk yields were analyzed using the mixed procedures of SAS (SAS, 1988). Live weight was measured on three consecutive days at the start and end of the trial and once every 10 days in between. Daily live weight gains for the experimental period were estimated by regression and analyzed using the GLM procedures of SAS. Digestibility over the last 10 days was estimated from total fecal collection for three sentinel animals in each treatment group and also analyzed using the GLM procedures.

RESULTS AND DISCUSSION

The chemical compositions of the forages and concentrate are shown in Table 1. DM intakes, milk yields, live-weight changes and digestibility are shown in Table 2. There were no significant treatment effects on DM intake, live-weight change or digestibility, but cows on T2 produced significantly ($p<0.05$) less milk than those on T1 and T3.

Table 1. Chemical composition of feeds used in the experiment

	Napier grass		Barley straw		Dairy meal	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
DM (g/kg)	201	3.7	868	3.8	910	3.1
Ash (g/kg DM)	262	10.6	74	1.9	77	0.6
CP (g/kg DM)	112	2.9	30	1.0	165	0.8
NDF (g/kg DM)	576	8.8	773	3.3	--	--

Figure 1 shows that following a change from straw to Napier, milk yield rapidly increased when 3kg/day concentrate was offered (T1), while the increase was smaller and less sustained when only 1kg/day was offered (T2). Changing from Napier to straw when concentrate was offered at a flat rate (T1) resulted in a steady decline in milk yield. When straw was offered with 5 kg/day concentrate, milk yield increased, but then declined and never reached levels observed for T1. On the mixed diet (T3), yields were maintained at levels equivalent to the maximum for Napier plus 3kg/day concentrate.

CONCLUSIONS

Although there were some indications of a negative effect of alternating forage type on cow performance, with a trend towards lower milk yields and greater live-weight loss, the differences were

not significant when concentrate was offered at a flat rate. Varying the concentrate level to try and maintain a more even supply of energy and protein appeared to increase the negative effect on cow performance. It may be that repeated switches from a high to low level of concentrates resulted in an unstable rumen environment reducing the efficiency of digestion and nutrient utilization.

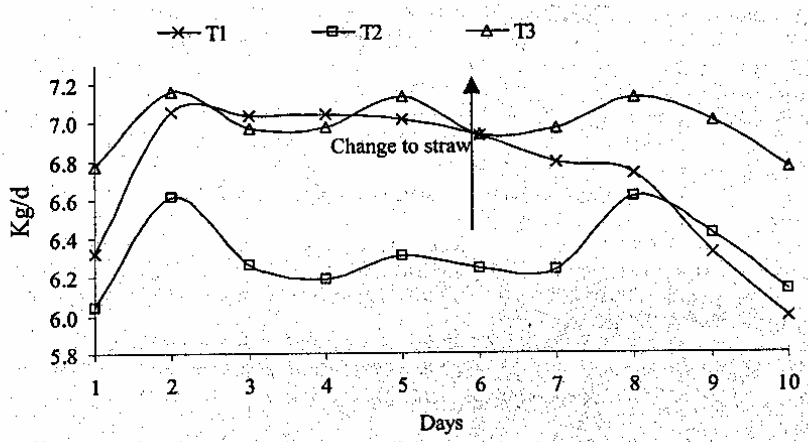

Figure 1. Daily milk yield over 10 days for cows on the different treatments

Table 2. DM intake, milk yield, liveweight change and digestibility for cows fed a 5-day alternating Napier-straw diet with a flat or differential rate of concentrate (T1 and T2 respectively) or both forages with a flat rate of concentrate (T3)1

Treatment	T1	T2	T3	S.E.D
Live weight (kg)	456	474	448	22.3
Napier offered (kg DM/d)	14.8a	15.4a	7.3b	1.80
Straw offered (kg DM/d)	11.0a	11.5a	5.4b	0.06
Napier intake (kg DM/d)	13.7a	13.9a	6.8a	0.19
Straw intake (kg DM/d)	8.2a	9.1a	4.4a	0.12
Concentrate consumed with Napier (kg DM/d)	2.7	0.9	2.7	
Concentrate consumed with straw (kg DM/d)	2.7	4.5	2.7	
DM Intakes (g /kg M0.75)	141	142	148	4.2
Milk yield (kg/d)	6.8a	6.3b	7.0a	0.18
Daily M Change (g/d)T3	-224	-185	-133	112.6
Digestibility (g/kg DM)	679	676	646	24.7

1Means with similar superscripts are not significantly different (P>0.05)

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