Effect of Feeding Method on the Performance of Growing Dairy Animals in Mauritius

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Abstract

Providing the ration as a Total Mixed Ration (TMR) is now common practice on most commercial dairy farms in the world for nearly all classes of animals. This practice decreases sorting of the individual ration components by dairy cattle. The objective of the experiment was to evaluate the effect of two feeding methods on the average daily gain on weaned cattle and lactating cows. 14 weaned cattle were selected and randomly divided in two groups. The experimental design was a switch over. 14 lactating cows in 100±13days of lactation were separated in 2 groups. Treatments were: Normal practice, concentrate before giving chopped fodder and TMR concentrate hand mixed with chopped fodder.

First phase lasted for 122 days, there was no significant difference (P>0.5) between the two type of feeding groups. The average ADG for the control was 646±102g/day compared to 609±117 g/day in the treatment. In the second phase, there was no significant difference (P>0.5) between the control and the treatment groups. The average ADG for the control was 486±74g/day compared to 380±90 g/day in the treatment. Milk production was also not affected as was no significant difference (P>0.5) between the two feeding methods. The provision of concentrate before providing the fodder as a choice resulted in animals rapidly consuming the concentrate, before consuming the fodder portion of their ration. Providing feed components as a TMR increased the distribution of dry matter intake over the course of the day and reduced the amount of sorting in growing

dairy animals. As result, the provision of a TMR to animals promotes a more balanced intake of nutrients across the day.

Keywords: ADG, Feeding Methods, TMR

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1. INTRODUCTION

The dairy smallholder sector in Mauritius is characterized by traditional backyard low input - low output system of production (Toolsee et al 2005). Over the last decade this sector has witnessed a steady decline both in the number of cattle heads from 9600 in 2000 to 6500 in 2011 and in the number of farmers from 2500 in 2000 to 1000 in 2011, (Anon 2011).

The dairy sector including smallholder farms relies on native grasses collected from the roadsides and on sugarcane tops (Saraye et al 2003). These are of low quality and since it is not customary for farmers to cultivate fodder, supplementation with concentrates is required to meet animal requirements for a satisfactory level of milk production (Boodoo et al 1999). Dairy animals are fed forage and concentrate separately; the concentrates are given before feeding the fodder in dry form or mixed with water (Boodoo et al 1988).

Providing the ration as a Total Mixed Ration (TMR) is now common practice on most commercial dairy farms in the world especially in the developed countries for nearly all classes of animals over 6 month of age. This practice decreases sorting of the individual ration components by dairy cattle (Coppock et al 1981). However, feeding management practices employed for the young weaned dairy heifer continue to be variable. Although the typical diet consists of concentrate and roughage (Murphy 2004), the concentrate is provided in different ways, typically either separate from or on top of the roughage top dressing. This practice is applicable locally to all types of animals, cow in lactation, dry cows or growing animals, the concentrate is provided in separate feeding trough or before feeding.

Østergaard and Grohn (2000) reported that feeding concentrates separately from forage was associated with increased risk of metabolic disorders in adult dairy cattle. Maekawa et al (2002) reported that feeding the forage and concentrate separately resulted in cows consuming a higher proportion of concentrate than intended, increasing the risk of ruminal acidosis (Beauchemin et al 2002). Alternatively, feeding a TMR should promote a more uniform feed consumption, reducing the risk of acidosis (Hernandez-Urdaneta et al 1976). Borland and Kesler (1979) suggested that the use of TMR for ruminant animals may result in a better balance of nutrient intake by avoiding individual preferences for forage or concentrate. Feeding a TMR should also provide a more uniform ruminal fermentation pattern. But locally the situation is different although the concentrate is provided before intake of the fodder it is limited in the amount and there is no risk of acidosis. The experiment tries to elucidate the effect of feeding concentrates before or after the feeding of forage.

Objective

The objective was to evaluate the effect of two different feeding methods on the average daily gain on weaned cattle and on milk production.

2. MATERIALS AND METHODS

Site:

The experiment was conducted at the Curepipe Livestock Research Station, Agricultural research and Extension Unit, Mauritius.

Selection of animals:

First experiment with weaners:

14 weaned cattle (Friesian Creole cross) weighing on average 122±17 kg and average age of 5-6 months were selected randomly divided into two groups. 7 animals were put in treatment group, receiving TMR and the other 7 were in control group in a completely randomized design block design. The animals were switched treatments after first phase of the experiments.

Feeding

Treatments were:

1) Control diet, as practiced by farmer, 2.0 kg/d concentrate (locally made concentrate with CP% 17 and MJ of 10MJ/Kg) before giving chopped fodder (the fodder was chopped to 10cm long using a mechanical chipper) 10 Kg at the start of the experiment and was increased to 15kg at the end,

2) TMR, 2.0 kg concentrate hand mixed with chopped fodder, 10-15 Kg. The diet was balanced to meet the requirement of the animals at different age of growth.

Animals were housed according to sex and treatments in order to avoid bulling and had continuous access to fresh water over the experiment. Mineral was included in the concentrate fed to the animals. Diets were offered twice daily (0900 and 1600h) at a daily rate 10-15kg of fodder and 2 kg of concentrate per animal.

Twice weekly the intake and residual diets were weighed and representative samples collected for proximate analysis .The live weight was recorded monthly and feed intake was monitored daily.

The feeding trial was conducted in two phase in a switch over design. The first stage lasted for 122 days after which animals in the control and treatment groups were switched. The second stage lasted for 121 days, after a transition period of 15 days.

Data were analyzed using the MIXED procedure of SAS (SAS Institute, 2003). The model included the fixed effects of square, period, and treatment.

Second experiment with lactating cows:

Selection of animals:

Two groups of 7 lactating cows (weighing on average 467±36) which were 100±13 days post-calving was selected and allocated randomly to the control and

treatment in a completely randomized design, each animal represented a block. 7 cows were put in treatment group, receiving 'TMR' and the other 7 were in control group. Data were analyzed using the MIXED procedure of SAS (SAS Institute, 2003). The model included the fixed effects of square, period, and treatment.

Feeding

Treatments are:

1) Control diet, as practiced by farmer, concentrate (according to the milk production of the cows and was adjusted weekly) before giving chopped fodder (the fodder was chopped to 10cm long using a mechanical chipper) 50 Kg.

2) TMR, concentrate hand mixed with chopped fodder, 50 Kg. The diet was balanced to meet the requirement of the animals according to NRC (2001).

Animals were housed in the same building with individual feeding facilities and had continuous access to fresh water over the experiment. Mineral was included in the concentrate fed to the animals. Diets were offered twice daily (0900 and 1600h) according to milk production as described earlier. Milking was done at 0600h and 1600h using a semi-automatic milking machine individually and the milk production recorded.

Chemical analysis:

Samples of all feeds were periodically determined for crude protein, crude fibre, dry matter, ether extract and ash according to Association of Official Analytical Chemists (1990) procedures (AOAC, 1990). The gross energy (GE) was calculated using appropriate equations from the MAFF Technical Bulletin No. 33 (MAFF, 1975).

3. RESULTS AND DISCUSSIONS

The animals were in good health throughout the trial. The composition of the feed was fairly uniform during the trial. The chemical analysis of the feeds used during the experiment is given in table 1, based on dry matter basis.

The following fodders were used during the experiment:

Table 1: Mean and SD values of analysis of feed on dry matter basis

%	Concentrate	Elephant grass[1]	Guatemala[2]	Sugar cane tops[3]	Mixed ration(TMR)
DM	86.2±2.68	27.2±1.66	28.5±2.60	25.4±1.53	38.7±2.69
CP	17.7±0.87	6.78±3.78	5.70±1.72	5.48±1.54	15.5± 3.50
CF	4.59±0.33	34.9±4.12	32.7±2.40	33.1±2.74	21.7±4.72
ADF	6.80±0.35	46.9±7.26	39.6±8.43	42.42±1.07	27.7±6.60
ADL	3.00±0.10	6.68±1.93	6.15±2.02	7.00±1.43	4.91±1.01
EE	2.48±0.46	2.40±0.92	2.05±0.07	2.50±0.06	1.78±0.44
Ash	9.13±1.30	9.91±1.8	7.33±1.57	6.62±1.26	8.63±1.42
Ca	1.44±0.21	0.54±0.15	0.26±0.18	0.27±0.14	0.64±0.24
P2O5	1.46±0.12	0.19±0.1	0.38±0.14	0.30±0.11	0.85±0.32
ENGVAL MJ/Kg DM	17.56	17.35	17.64	17.87	17.67

1. Elephant grass: *Pennisetum purpureum* .*2.*Guatemala grass: *Tripsacum laxum* .
*3.*Sugar cane tops: *Saccharum officinarum*

First experiment with weaners:

Figure 1 indicates that the 2 groups of animals showed a similar pattern of growth curve during the first phase of the experiment. There was a steady growth rate for both groups of animals

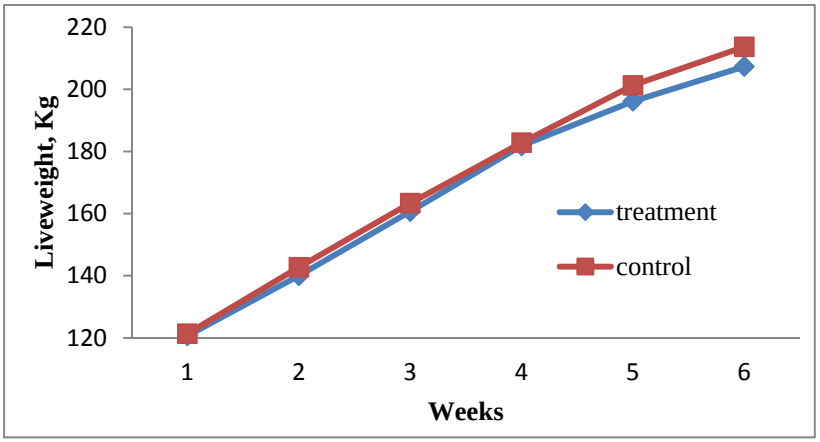

Figure 1: Growth curve of growing animals

The first phase lasted for 122 days; Table 2 shows the average live weight and weight gain for the animals in the first phase both in treatment and control groups.

Table 2: Average weight and average daily gain (ADG) of growing animals in first phase

	No. of animals	sex	Wt at start of experiment(Kg)	Wt after122 days in experiment (Kg)	ADG for 122d g/day
Control	3	M	122±17	209±23	719±77
	4	F	121±9	193±15	592±87
Treatment	3	M	113±16	196±28	678±98
	4	F	128±14	196±32	552±137

After 122 days in the experiment there was no significant difference (P>0.5) between the two feeding methods. The average ADG for the control group was 646±102g/day compared to 609±117 g/day in the treatment group. However the ADG of the young bulls was greater than that of the young heifers. The ADG

ranged from about 550g to 715g for all animals this is conformity with results obtained by Lam (2005), while using cross of Friesian breed.

After 122 days the treatments were switched over and the second phase of the experiment started after 15 days of adaptation. The experiment ended after 121 days in the second phase.

Figure 2 indicates that the 2 groups of animals showed a similar pattern of growth curve during the second phase of the experiment. There was a steady growth rate for both groups of animals

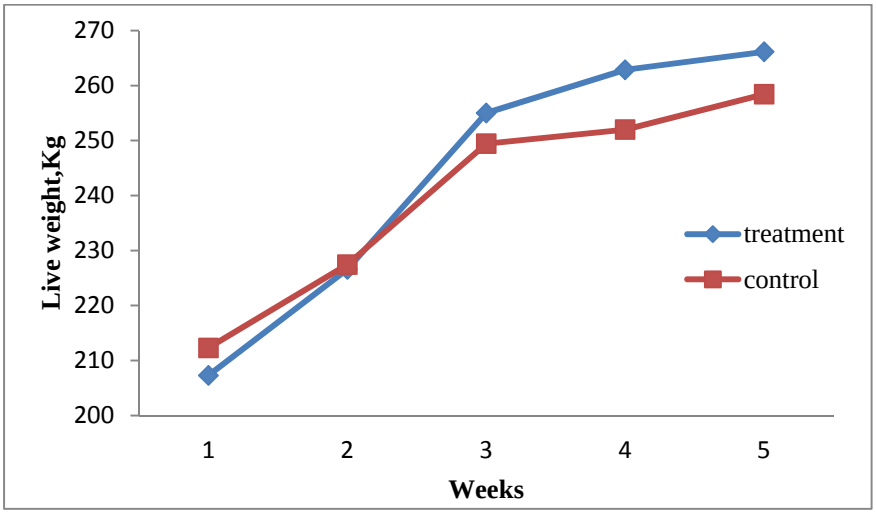

Figure 2: Growth curve of growing animals

Table 3 contains the average live weight and daily weight gain of animals both in treatment and control groups.

Table 3: Average weight and average daily gain

	No. of animals	sex	Wt at start of experiment(Kg)	Wt after 121 days in experiment (Kg)	ADG for 59d g/day
Control	3	M	211±29	274±34	518±48
	4	F	204±32	261±35	463±87
Treatment	3	M	223±27	271±28	394±29
	4	F	204±14	249±21	372±125

After 121 days in the experiment there was no significant difference (P>0.5) between the two feeding methods. The average ADG for the control group was 486±74g/day compared to 381±90 g/day in the treatment group. The growth rate decreased slightly after 3rd week in the second phase of the experiment. However the ADG was acceptable as described by Lam (2005), in the local context.

Second experiment with lactating cows:

The experiment lasted for 150 days. At the start of the experiment, animals in the control group had an average production of 13.6±2.8 litres of milk compared to the treatment group with an average production of 12.8±4.3 litres of milk. After the experiment animals in the control group had an average production of 7.8±1.1 litres of milk compared to the treatment group with an average production of 7.4±0.6 litres of milk, there was no significant difference between treatments. The average milk production was similar to that reported by Saraye (2010) under local condition and management.

The figure 3 contains the milk production of animals in both groups during the experiment:

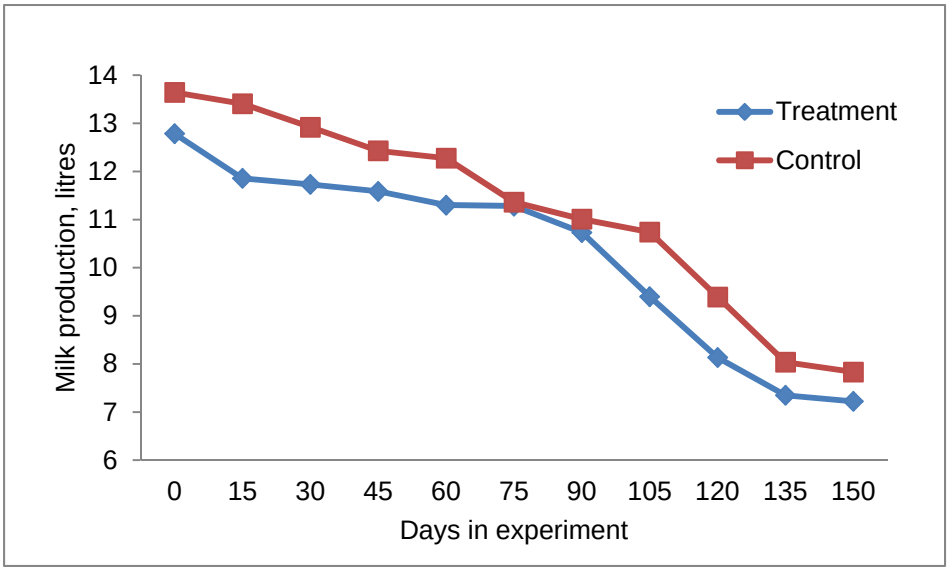

Figure 3: Milk production of animals

There was no significant difference between the two method of feeding both in growing and lactating animals. This can be explained by the fact that locally the feeding practice is mostly based on low quality forage and the amount of

concentrate given is not as much that will cause nutritional disorders. However, this can further be elaborated that diet affects ruminal microbial populations (Dehority and Orpin 1997), since forage digestion is achieved largely by bacteria, protozoa and fungi. Solid attached microbes play a major role in fiber digestion in terms of mass and fibrolytic activity (Michalet-Doreau et al 2001). As the rumen is not emptied completely during the night and some feed remains in the rumen for 48 hours or more in order to be degraded especially low quality forage, the concentration of bacteria increases to an optimum level only after 6 hours of feeding (Michalet-Doreau et al 2002). Although feeding concentrates before giving fodder may experience large postprandial drops in rumen pH. Providing concentrate before giving the fodder resulted in the animals rapidly consuming the concentrate portion of their ration before the fodder portion of the ration is provided. Similar feeding patterns were observed by Devries at al., 2003 when animals had their concentrate top dressed on the fodder or given the concentrate before the fodder, suggesting that this feeding method also facilitated the rapid consumption of concentrate before consuming fodder. Feeding animals ration of TMR or mixing the fodder and concentrate together before feeding increased the distribution of DMI over the course of the day and reduced the amount of sorting in dairy animals. As result, the provision of a TMR to ruminant animals promotes a more balanced intake of nutrients across the day and a healthier rumen (Beauchemin et al 2002). Therefore it is suggested to feed the ruminants a mixture of fodder and concentrate altogether, so as to have a more balanced nutrient uptake throughout the day. Further research is needed to fully understand how giving concentrate before feeding of fodder influences rumen fermentation patterns in ruminant animals.

4. CONCLUSION

Although there was no significant difference between the feeding methods, provisions of a TMR or mixing the fodder with the forage to animals promotes a more balanced intake of nutrients across the day.

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