Original Research Article

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Effect of Feed Additives on Nutrient Intake and Feed Efficiency of Lactating Crossbred Cows


Department of Animal Husbandry and Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, India

Abstract

This study was conducted to evaluate the nutrient intake of crossbred cows fed different feed additives based diets using twelve lactating crossbred cows of Holstein Fresian X Sahiwal (HFXS) and Jersy X Sahiwal (JXS) nearly similar stage of lactation. The cows were assigned into treatments having, T1 = Feed Additive-A based diet, T2 = Feed Additive-B based diet, T3 = Feed Additive-C based diet with similar concentrate mixture, using randomized complete block design into three blocks of four animals. The Feed intake and milk production were assessed. The daily intake of DM, CP, TDN and ME for cows fed, the T1 based ration than for the cows fed the T2 and T3 based diets. The daily ME intake was almost similar in T2 and T3 groups than T1 group of animals. However, the daily intake of DM, CP, TDN and ME for crossbred cow on T1 based diet was higher (P < 0.05) than for cows on T2 based diet and T3 based diet. The DMI (% of body weight) was higher in T2 T1 and T2 based diets, while CPI (% of body weight) was higher in T2 based diet than T3 and T1 based diets. Nutrient intake of Crossbred cows was affected (P < 0.05) by the addition of Feed Additive in the diets. The performances of the cows on the Feed Additives in the diets were superior to that of Feed Additive-A based diet.

Keywords
Nutrient intake, Feed additives, Season, Feed efficiency, Crossbred cows.

Article Info

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Introduction

The nutritional needs of dairy animals with respect to energy, protein, minerals and vitamins have long been known, and these have been refined in recent decades. Various requirement determination systems exist in different countries for ruminants and non-ruminants, which were originally designed to assess the nutritional and productive consequences of different feeds for the animal once intake was known. In modern-day farming, the nutritional requirements of farm animals are well understood and all requirements can be met through direct dietary supplementation of the limiting nutrients in concentrated form. Feeding high-producing cows continues to challenge dairy farmers and nutritionists.

Feed additives are a group of feed ingredients that can cause a desired animal response in a non-nutrient role such as pH shift, growth, or metabolic modifier (Hutjens, 1991). Feed additives provide a mechanism by which such dietary deficiencies can be addressed which benefits not only the nutrition and thus the growth rate of the animal concerned, but also its health and welfare. Nutritional quality of a feed is influenced not only by nutrient content but also by many other aspects such as, feed presentation, hygiene, content of anti-
nutritional factors, digestibility, palatability and effect on intestinal health to name a few. Feed additives provide a mechanism by which such dietary deficiencies can be addressed which benefits not only the nutrition and thus the growth rate of the animal concerned, but also its health and welfare. In addition, the beneficial effect of probiotics could be produced in two ways. They could operate by: (1) Suppressing harmful bacteria; this could manifest itself in reduced numbers of bacteria or in a decreased concentration of harmful metabolites such as enterotoxin. (2) Stimulation of bacteria which are engaged in beneficial activities such as production of essential nutrients like vitamins or in digestion of food components (Mulder, 1991).

In view of the aforesaid, the present research work was planned at the dairy farm, Banaras Hindu University, Varanasi. The plan of work comprised finding out the effect of feed additives and their impact on nutrient intake of lactating crossbred cows maintained at the dairy farm.

Materials and Methods

This investigation was undertaken to study the nutrient intake of crossbred lactating cows on diet containing different feed additives at dairy farm, of Banaras Hindu University, Varanasi. The trial was conducted on 12 crossbred cows Holestein Fresian X Sahiwal (HFXS) and Jersy X Sahiwal (JXS) nearly similar stage of lactation were selected from the herd maintained at the dairy farm. The animals were quite healthy and their calves have been weaned soon after birth. All the 12 crossbred cows were randomly divided into 3 groups with 4 animals in each group according to their milk production and body weight to maintain the similarity in the trial. Daily feed intake was recorded in terms of DMI, DMI (% of BW), CP intake, CP intake (% of BW), TDN intake and ME intake and data were analyzed using the general linear model of the Statistical Analysis System (SAS 2002). Duncan’s multiple range tests was used to separate treatment means. The response variables were analyzed using the statistical model:

\[ Y_{ijk} = \mu + P_i + \alpha_j + \beta(x_{ijk} - \bar{X}) + \epsilon_{ijk}, \]

Results and Discussion

Dry matter intake (kg/day)

Results regarding average dry matter intake (DMI) of the animals is shown in table 1, and daily dry matter intake was recorded 8.84 + 0.34, 8.77+ 0.30 and 9.12 + 0.22 kg/d in T1, T2 and T3 groups respectively (Table 1) in summer season. However, the DMI in rainy season was 2.84+ 0.09, 3.10+ 0.13 and 2.84 + 0.12 kg/d in T1, T2 and T3 groups respectively (Table 1). While DMI in winter season DMI was 2.84+ 0.09, 3.10+ 0.13 and 2.84 + 0.12 kg/d in T1, T2 and T3 groups respectively (Table 1). The dry matter intake was highest in winter season in all the groups and group T1 was highest followed by T3 and T2 groups in rainy and winter season in terms of daily dry matter intake but in summer season T3 group was higher than T1 and T2 groups. Differences between the groups were not significant (P>0.05). The results in this trial confirm those of Williams et al., (1991), Wohlt et al., (1991, 1998), Robinson and Garrett (1999), and Dann et al., (2000), who observed that feed additives improvement in DM intake when lactating cows were fed. Supplementation with a blend of cinnamaldehyde and eugenol as a feed additive can increase DMI and milk production in lactating dairy cows (Wall 2014). However, Aikman et al., (2008) observed no difference in DM intake between the control and treated cows.

When dry matter intake compared between two breeds during summer season the DMI was higher in B1 breed (9.04+ 0.22) than B2 breed (8.77+ 0.23). Again in rainy season...
DMI was higher in B1 breed (9.13 + 0.04) than B2 breed (9.10 + 0.17) but in winter season B2 breed was higher (9.34 + 0.21) than B1 breed (8.95 + 0.21) in DMI (Table 2). These results are in agreement with those obtained by Ballantine et al., (2002) who reported that cows fed organic mineral consumed more DM than cows receiving inorganic mineral.

**Dry matter intake per cent of body weight**

DMI per cent of body of cows to be expressed as changes in the DMI was observed to be 3.01 + 0.03, 2.95 + 0.05 and 2.97 + 0.03 kg/d in T1, T2 and T3 groups respectively (Table 1) in summer season. In rainy season DMI per cent of body weight was 2.84 + 0.09, 3.10 + 0.13 and 2.84 + 0.12 kg/d in T1, T2 and T3 groups respectively (Table 1).

In winter season DMI per cent of body weight was 2.99 + 0.02, 2.95 + 0.05 and 2.97 + 0.03 kg/d in T1, T2 and T3 groups respectively (Table 1). DMI per cent of body weight was also highest in winter season in all the groups. Among all the groups during all three seasons T2 group was highest in rainy season in respect of DMI per cent body weight. These observations were statistically similar between the groups in various treatments.

Results showed that DMI (% body weight) in summer season was same as dry matter in take, B1 breed was higher (2.97 ± 0.03) than B2 breed (2.95±0.02) but in rainy and winter season pattern was vice-versa to DMI. In rainy season the DMI (% body weight) B2 breed was higher (2.98± 0.12) than B1 breed (2.90± 0.07) while in winter season it was higher in B1 breed (3.00± 0.07) than B2 breed (2.97± 0.02) (Table 2).

**Total crude protein intake (g/day)**

Total CP intake of the animals (g/day) is shown in table 1 and it intake was 1398.03 ± 17.28, 1395.15± 9.04 and 1405.58 ± 11.83 g/d in T1, T2 and T3 groups respectively (Table 1) in summer season. In rainy season CP intake of animals was 1158.08± 21.21, 1177.93± 21.75 and 1181.53 ± 22.91 g/d in T1, T2 and T3 groups respectively (Table 1). In winter season CP intake was 1309.70+ 12.46, 1276.80+ 33.90 and 1187.73 ± 37.04 g/d in T1, T2 and T3 groups respectively (Table 1). The CP intake was highest in summer season in all the groups and group T3 was highest in summer and rainy season while in winter season T1 group was higher than T2 and T3 groups. Differences between the groups were not significant (P>0.05) but within the groups it was highly significant. In accordance with the present results agrees with the work of Allen (2000) who summarized that increasing CP content of the diets can increase DMI of lactating cows. These results are in agreement with the reports of Sarker (2010) who reported mixed additives showed better nutrient utilization.

The comparative study of two breeds showed that CP in take in summer season was almost similar in both breeds but in rainy season it was slightly higher in B1 breed (1173.47± 18.95) than B2 breed (1171.55±16.19) and winter season CP in take was higher in B2 breed (1279.37±15.45) than B1 breed (1236.78±14.38) (Table 2).

**Crude protein intake per cent of body weight**

CP intake per cent of body weight was observed to be 376.40+ 3.87, 391.52+ 4.05 and 379.27 + 6.04 g/d in T1, T2 and T3 groups respectively (Table 1) in summer season. In rainy season CP intake per cent of body weight was 341.30+ 2.69, 342.45+ 3.87 and 332.20 + 5.99 g/d in T1, T2 and T3 groups respectively (Table 1) in summer season. In rainy season CP intake per cent of body weight was 341.30+ 2.69, 342.45+ 3.87 and 332.20 + 5.99 g/d in T1, T2 and T3 groups respectively (Table 1). In winter season CP intake per cent of body weight was 338.92+ 3.02, 362.80+ 4.36 and 358.80 + 5.02 g/d in T1, T2 and T3 groups respectively (Table 1).
CP intake per cent of body weight was also highest in summer season in all the treatment groups. Among the entire groups T2 group was highest in summer season followed by T3 and T2 in terms of CP intake per cent body weight. These observations were statistically significant (P>0.05) between the groups in winter treatments but in rainy and summer results were not significant.

CP intake (% body weight) was higher B1 breed (384.91+4.33) than B2 breed (379.88+4.80) in summer season but in rainy season same was also higher in B1 breed (341.71+3.31) than B2 breed (335.58+4.11) and in winters the CP intake (% body weight) was higher in B2 breed (354.45+6.05) than B1 breed (352.61+ 5.29) (Table 2).

**TDN intake (kg/day)**

The TDN intake response of cow to control and experimental diets The average TDN intake kg/day was 7.50 ± 0.07, 7.58 ± 0.10 and 7.58 ± 0.07 kg/d in groups T1, T2 and T3 respectively (Table 1) in summer season. In rainy season TDN intake was 6.91 ± 0.15, 6.81 ± 0.15 and 6.75 ± 0.19 kg/d in T1, T2 and T3 groups respectively (Table 1). In winter season TDN intake was 7.41 ± 0.03, 7.22 ± 0.20 and 7.14 ± 0.05 kg/d in T1, T2 and T3 groups respectively (Table 1). TDN intake was higher in summer season among all the groups followed by winter and rainy season. Here again the values in T2 and T3 groups were significantly higher than T1 group and were almost similar in summer season. But in rainy and winter season TDN intake was highest in T1 group followed by T2 and T3 groups. There was no significant difference in TDN intake among the groups. These results are in accordance with those obtained by Bendary *et al.*, (2013) who reported that the seaweed treatment showed significantly (P<0.05) highest average daily intake of TDN while the lowest intake was in control treatment.

The comparison of TDN in take between two breeds showed that, in summer season breed B1 was better (7.59± 0.07) than B2 breeds (7.52 ± 0.05) and in winter season also B1 breed was better (7.30±0.12) than B2 breed (7.20±0.08) but in rainy season TDN in take was higher in B2 breed (6.88±0.09) than B1 breed (6.77±0.16) (Table 2).

**ME intake (Mcal/day)**

The ME intake Mcal/day was 18.85 ± 0.03, 19.18 ± 0.32 and 19.42 ± 0.27 in groups T1, T2 and T3 respectively (Table 1) in summer season. In rainy season ME intake was 18.12± 0.15, 18.23± 0.15 and 19.42 ± 0.09 Mcal/d in T1, T2 and T3 groups respectively (Table 1). In winter season ME intake was 18.47± 0.07, 18.85± 0.10 and 18.86 ± 0.13 Mcal/d in T1, T2 and T3 groups respectively (Table 1). Results showed that the ME intake was also highest in summer season among all the groups followed by winter and rainy season. The values in T3 group were significantly higher than T2 and T1 groups in all three seasons. There was no significant difference in TDN intake among the groups. Energy in take was higher in B2 breed than B1 breed in all three seasons (Table 2).

These results are agreement with Michael (2007) reported that the supplementation of feed additive in lactating cow rations are beneficial for nutrient intake ant their utilization and also improved performance of cows.
Table 1 Seasonal effect of various feed additives on feed intake of crossbred cows

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>l Intake (kg/day)</th>
<th>DM intake (% of BW)</th>
<th>CP intake (g/day)</th>
<th>CP intake (% of BW)</th>
<th>TDN intake (kg/day)</th>
<th>intake (Mcal/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer Season</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>T1</td>
<td>8.84±0.34a</td>
<td>2.99±0.02a</td>
<td>1398.03±17.28a</td>
<td>376.40±3.87a</td>
<td>7.50±0.07a</td>
<td>18.85±0.03a</td>
</tr>
<tr>
<td>T2</td>
<td>8.77±0.30a</td>
<td>2.95±0.05a</td>
<td>1395.15±9.04a</td>
<td>391.52±4.05a</td>
<td>7.58±0.10a</td>
<td>19.18±0.32a</td>
</tr>
<tr>
<td>T3</td>
<td>9.12±0.22a</td>
<td>2.97±0.03a</td>
<td>1405.58±11.83a</td>
<td>379.27±6.04a</td>
<td>7.58±0.07a</td>
<td>19.42±0.27a</td>
</tr>
<tr>
<td></td>
<td>Rainy Season</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>9.28±0.20a</td>
<td>2.84±0.09a</td>
<td>1158.08±21.21a</td>
<td>341.30±2.69a</td>
<td>6.91±0.15a</td>
<td>18.12±0.15a</td>
</tr>
<tr>
<td>T2</td>
<td>8.87±0.08a</td>
<td>3.10±0.13a</td>
<td>1177.93±21.75a</td>
<td>342.45±3.87a</td>
<td>6.81±0.15a</td>
<td>18.23±0.15a</td>
</tr>
<tr>
<td>T3</td>
<td>9.18±0.04a</td>
<td>2.84±.12a</td>
<td>1181.53±22.91a</td>
<td>332.20±5.99a</td>
<td>6.75±0.19a</td>
<td>18.51±0.09a</td>
</tr>
<tr>
<td></td>
<td>Winter Season</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>9.37±0.11a</td>
<td>3.01±0.03a</td>
<td>1309.70±12.46a</td>
<td>338.92±3.02b</td>
<td>7.41±0.03a</td>
<td>18.47±0.07a</td>
</tr>
<tr>
<td>T2</td>
<td>8.89±0.42a</td>
<td>2.95±0.05a</td>
<td>1276.80±33.90ab</td>
<td>362.80±4.36a</td>
<td>7.22±0.20a</td>
<td>18.85±0.10a</td>
</tr>
<tr>
<td>T3</td>
<td>9.17±0.16a</td>
<td>2.95±0.10a</td>
<td>1187.73±37.04a</td>
<td>358.87±5.02a</td>
<td>7.14±0.05a</td>
<td>18.86±0.13a</td>
</tr>
</tbody>
</table>

Means within the same column, with the same letters are not significantly different (P<0.05)

Table 2 Seasonal variation due to breeds on feed intake in different groups

<table>
<thead>
<tr>
<th>Breed</th>
<th>DM Intake (kg/day)</th>
<th>DM intake (% of BW)</th>
<th>CP intake (g/day)</th>
<th>CP intake (% of BW)</th>
<th>N intake (kg/day)</th>
<th>E intake (Mcal/day)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Summer Season</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>9.04±0.22a</td>
<td>2.97±0.03a</td>
<td>1399.53±11.75a</td>
<td>384.91±4.33a</td>
<td>7.59±0.07a</td>
<td>19.02±0.17a</td>
</tr>
<tr>
<td>B2</td>
<td>8.77±0.23a</td>
<td>2.95±0.02a</td>
<td>1399.63±8.82a</td>
<td>379.88±4.80a</td>
<td>7.52±0.05a</td>
<td>19.28±0.24a</td>
</tr>
<tr>
<td></td>
<td>Rainy Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>9.13±0.04a</td>
<td>2.90±0.07a</td>
<td>1173.47±18.95a</td>
<td>341.71±3.31a</td>
<td>6.77±0.16a</td>
<td>18.23±0.16a</td>
</tr>
<tr>
<td>B2</td>
<td>9.10±0.17a</td>
<td>2.98±0.12a</td>
<td>1171.55±16.19a</td>
<td>335.58±4.11a</td>
<td>6.88±0.09a</td>
<td>18.34±0.07a</td>
</tr>
<tr>
<td></td>
<td>Winter Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>8.95±0.21a</td>
<td>3.00±0.07a</td>
<td>1236.78±41.38a</td>
<td>352.61±5.29a</td>
<td>7.30±0.12a</td>
<td>18.71±0.12a</td>
</tr>
<tr>
<td>B2</td>
<td>9.34±0.21a</td>
<td>2.97±0.02a</td>
<td>1279.37±15.45a</td>
<td>354.45±6.05a</td>
<td>7.20±0.08a</td>
<td>18.75±0.10a</td>
</tr>
</tbody>
</table>

Means within the same column, with the same letters are not significantly different (P<0.05)

Table 3 Overall efficiency of feed additives on feed intake into experimental groups of cows

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>DM Intake (kg/day)</th>
<th>l intake (% of BW)</th>
<th>(%) intake (g/day)</th>
<th>CP intake (% of BW)</th>
<th>TDN intake (kg/day)</th>
<th>ME intake (Mcal/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>9.16±0.14&quot;</td>
<td>2.95±0.03&quot;</td>
<td>1288.63±31.22&quot;</td>
<td>352.20±5.43&quot;</td>
<td>7.27±0.09&quot;</td>
<td>18.48±0.10&quot;</td>
</tr>
<tr>
<td>T2</td>
<td>8.85±0.16&quot;</td>
<td>3.00±0.05&quot;</td>
<td>1283.24±29.52&quot;</td>
<td>365.59±6.43&quot;</td>
<td>7.20±0.12&quot;</td>
<td>18.84±0.18&quot;</td>
</tr>
<tr>
<td>T3</td>
<td>9.16±0.08&quot;</td>
<td>2.94±0.05&quot;</td>
<td>1258.24±33.23&quot;</td>
<td>356.78±6.53&quot;</td>
<td>7.16±0.12&quot;</td>
<td>18.84±0.12&quot;</td>
</tr>
</tbody>
</table>

Means within the same column, with the same letters are not significantly different (P<0.05)

Efficiency of feed additives on feed intake of cows

The overall efficiency of feed additives on feed intake into experimental groups of cows was determined in all three treatment groups during all the seasons of experimental trial and results showed in table 3. The overall DMI was highest in T1 group followed by T3 and T2 groups. DMI (% of body weight) was highest in T2 group followed by T1 and T3 groups and in CP intake T1 group was highest followed by T2 and T3 groups. The CP intake (% of Body weight) was highest in T2 group followed by T3 and T1 groups and the differences were statistically different (P<0.05). TDN intake was highest in T1 group followed by T2 and T3 groups and ME intake was highest and similar in T2 and T3 groups followed by T1 group. Accept CP intake (% of BW) all other means were not statistically different within the groups (P<0.05). Vahora and Pandey (2006) used Jersey X Kankrej crossed lactating cows to evaluate DMI that...
was similar to present study, they observed a non significant difference for DMI.

In conclusion, results of the present study suggest the supplementation of feed additives in the diets increases in DMI, CP intake, total digestible nutrient intake, as well as ME intake and income over feed. The use of feed additives should be highly recommended as a feed supplement source in the ration of lactating dairy cows.

References


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