Effects of Multiple Feeding upon Performance of Guernsey Heifers Fed Urea-Treated Corn Silage

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Abstract

The effects of feeding grain and urea-corn silage (0.5% urea) two and four times daily were studied in a 74-day trial utilizing 40 Guernsey heifers in a 2 × 2 factorial design. Urea-corn silage fed 4× daily resulted in a nonsignificant (at P < .05) 18.4% greater gain than 2× daily feeding. No significant effect (at P < .05) on growth was observed for 2× vs. 4× daily feeding of both grain and urea-treated corn silage. However, feeding urea-treated corn silage 4× daily resulted in a significant (at P < .05) 13.7% decrease in estimated kg of TDN required per kg of weight gain when compared to 2× daily feeding. When grain was fed 2× and 4× and silage 2× daily, 14.4% less TDN was required per kg of gain in the group receiving grain 4× than among those fed grain 2× daily. Blood urea nitrogen and rumen volatile fatty acids (VFA) were not significantly affected by treatments. However, their trends favored more frequent feeding of silage.

An all-silage forage program was shown to be feasible for lactating cows by Hemken and Vandersall (4) and equal to an all-hay or hay and corn silage for lactating cows by Lassiter (8). The favorable value of corn silage for dairy heifers was demonstrated by Martz et al. (9). However, a supplement containing urea was not a completely satisfactory source of protein with corn silage for dairy heifers fed only twice daily (9). Urea can be added at ensiling time to alleviate the protein deficiency of corn silage (16).

Urea is converted to ammonia in the rumen and used by the microbes in protein synthesis. It may also enter the protein cycle, as noted by Houpt (5) and Weeth et al. (17). The ability of microbes to use ammonia is dependent upon a readily available source of energy (13). Nitrogen retention appeared to be related to energy consumption in the studies of Nicholson et al. (12). Feeding 6× daily apparently maintained more nearly optimal rumen ammonia and energy levels, which resulted in faster weight gains than 2× daily feeding in the study of Campbell et al. (1).

Hull (7) observed a direct relationship between rumen ammonia and blood urea. Preston et al. (14) reported a close relationship (r = 0.986) between blood urea nitrogen and protein intake. Huber et al. (6) found no effect on blood urea and ammonia when three isonitrogenous rations including 0.0, 0.5, or 0.75% urea-treated corn silage were fed to lactating cows. Increasing dietary urea from 22.5 to 274.8 g in lactating cows resulted in an increase in blood urea from 26.2 to 37.4 mg per cent in the studies of Moller et al. (10). In another study, Moller (11) used urea to replace 20 and 40% of the true protein and observed a sharp, but nonsignificant, increase in blood urea 1 to 2 hours after feeding.

Robertson and Hawke (15) added starch as an energy source to diets high in protein. They concluded that a reduction in ammonia concentration without an accompanying increase in VFA concentration may mean that starch is being used by rumen bacteria as an energy source in protein synthesis.

The purpose of this study was to determine the effect of feeding frequency of grain and of urea-treated corn silage as the only forage on growth, blood urea nitrogen, and rumen VFA's of dairy heifers.

Experimental Procedure

Forty Guernsey heifers (12-18 months) were randomly assigned to one of four treatments for a 74-day study following a one-week adjustment period during which time the urea-treated corn silage was fed twice daily. Animals were fed 22.7 kg of 0.5% urea-treated corn silage (10.25% crude protein) and 1.8 kg of grain (6.25% CP, 71.5% TDN) daily at 6- or 12-hour intervals on a group basis. The four treatments included: (1) S2×—G2×, (2) S2×—G4×, (3) S4×—G2×, and (4) S4×—G4× feedings of silage and grain daily, respectively. The level of ration fed was selected with the intention of providing adequate
urea-treated silage for heifers

nutrients for moderate growth and also to minimize weigh-back, thus providing an equalized feed intake. Uneaten feed was removed and weighed daily.

Two consecutive-day body weights were taken on the first and last two days and at three-week intervals. Jugular vein blood samples were taken on the second day of each weighing in glass vacuum tubes containing heparin. Blood samples were chilled in ice water immediately following collection, and frozen until analyzed for blood urea nitrogen according to the method of Friedman (3).

Rumen samples were taken from three animals in each group by stomach tube at the end of four and six weeks. Samples were drawn five-hours post-feeding and three-hours post-watering. Samples (5 ml) and 10% metaphosphoric acid (1 ml) were centrifuged and the supernatant frozen until analyzed for acetic, propionic, and butyric acids according to the method of Erwina et al. (2).

Results and Discussion

Table 1 presents a summary of the data. Weight gains were greater when silage was fed 4X daily (Treatments 3 and 4), but these gains were not significantly higher (at P < .05). A comparison of groups fed urea-treated silage 2X daily (Treatments 1 and 2) with those fed 4X daily (Treatments 3 and 4) shows an 18.4% greater gain on 4X daily feeding. A similar benefit in weight gain was reported by Campbell et al. (1) for feeding heifers 6X compared to 2X daily.

Estimated kg of TDN required per kg of gain was significantly greater (P < .05) for animals fed silage 2X (avg Treatments 1 and 2) than for those fed urea-treated silage 4X daily (avg Treatments 3 and 4). Feeding urea-treated silage 4X daily resulted in a 13.7% better feed efficiency (5.24) than when fed only 2X daily (6.07). While not significant (at P < .05), the feeding of grain 4X daily, when silage was fed only twice (Treatment 2), resulted in 14.4% less TDN required per kg of gain than did the feeding of grain and urea silage twice daily (Treatment 1). This suggests that frequent feeding of grain is beneficial when urea-treated silage is fed only 2X daily, which confirms the data of Packett and Groves (13) related to efficient energy and ammonia utilization.

Frequency of feeding had no significant effect (at P < .05) on blood urea nitrogen. However, the feeding of grain 4X daily resulted in a slightly lower average blood urea nitrogen of groups fed urea-treated silage 2X or 4X daily (Table 1). Animals fed silage 2X daily (Treatments 1 and 2) averaged 7.83 mg per cent blood urea nitrogen, 6.2% less than the 8.35 mg per cent blood urea nitrogen among animals fed silage 4X daily (Treatments 3 and 4).

The concentration of VFA was lower in animals fed urea-treated silage 2X daily. However, the difference was not significant (at P < .05). Table 1 shows the rumen VFA concentration of animals fed silage 4X to be 6.2% greater (avg 8.14 meq/100 ml) than in those fed urea-treated silage only 2X daily (avg 7.66 meq/100 ml).

Acknowledgment

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References


(3) Friedman, H. S. 1953. Modification of the

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<td>Frequency of feeding effects on body weight, BUN, and VFA</td>
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<td>Silage and grain</td>
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<td>S2X G4X</td>
<td>S4X G2X</td>
<td>S4X G4X</td>
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<td>Initial wt (kg)</td>
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<td>438</td>
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<td>Final wt (kg)</td>
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<td>7.59</td>
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