PERFORMANCE OF GRAZING BULL CALVES SUPPLEMENTED WITH INCREASING LEVELS OF RUMINALLY UNDEGRADABLE PROTEIN

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ABSTRACT

The objective of this study was to determine the effect of increasing levels of ruminally undegradable protein (ECP) on the performance of bull calves grazing Coastcross-1 Bermudagrass during the dry season. One hundred and twelve Zebu-Brown Swiss bull calves weighing an average of 265 kg, were randomly assigned to four treatment groups in a completely random design. Calves received a self-feeding supplement (1 kg) with 40% crude protein (CP) and 31, 38, 44, or 52% ECP. During a 96-day preliminary phase without supplementation, weight gains of the four treatment groups ranged from 0.357 to 0.394 kg/day. A linear ($P<0.01$) response of calf weight gain was observed with an increase in ECP of the supplement (0.668, 0.672, 0.823 and 0.893 kg/day, respectively). Plasma urea concentration was reduced ($P<0.05$) from 17.8 to 9.85 mg/dl with the highest level of ECP, which may reflect a reduced supply of NH_3-N for ruminal bacteria.

KEYWORDS

Grass, Grazing, Bypass Protein, Bull Calves, Growth.

INTRODUCTION

In tropical regions, grass is commonly the main source of feed for ruminants under grazing conditions. At the end of the wet season and during the dry season, the inadequate intake of forage that occurs as a result of the low protein and high cell wall contents, may reduce the overall nutrient intake. Also, a low forage availability during the dry season may also result in a reduction of dry matter intake.

The purpose of offering a supplement to cattle is to supply the nutrients that are not provided by the grasses, allowing for a better use of the forage. In other words, the supplement should supply what is lacking in the animals' diet, and should not substitute for forage intake. With respect to the type of nutrients that should be included in a supplement, protein and minerals are of primary importance since they cannot be stored in the organism. Energy in the form of body fat and vitamin A can be stored and further mobilized when the the diet does not meet the animal requirements.

A crude protein content of approximately 7% is the minimum level required in the diet of grazing ruminants to maintain proper rumen function and a positive N equilibrium in the organism (NRC, 1987). Crude protein levels of 8 to 10% (dry basis) may allow for maximum forage intake. However, for rapid growth of grazing cattle, a higher crude protein level may be required. The purpose of this study was to determine the effect of isonitrogenous supplements with different levels of ruminally undegradable protein, on the weight gain of bull calves grazing Coastcross-1 Bermudagrass.

MATERIALS AND METHODS

The study was conducted during the dry season (November 1994 to March 1995), when grasses were mature and low in quality. One hundred and twelve Zebu-Brown Swiss calves, weighing an average of 265 kg, were randomly assigned to four treatment groups in a completely random design.

Calves rotationally grazed (8-day periods) four non-irrigated pastures of 23 hectares each of Coastcross-1 Bermudagrass and received 1 kg per day (approximately 0.3% of body weight) of an isonitrogenous supplement containing 40% crude protein and ECP levels of 31, 38, 44 or 52%. Blood meal was included in the supplement to change the ECP levels (NRC, 1985). Other ingredients used were milo, soybean meal, molasses, urea, and a mineral-vitamin A premix. Lasalocid sodium (200 mg/calf/day) was included to improve weight gain and salt (100 kg/ton) was used to restrict supplement intake.

The study was 186 days long, including 96 days of a preliminary phase to determine the weight gain of the four treatment groups without supplementation. Calves were weighed at the beginning and at 45 and 90 days of the experimental phase.

Every 15 days, a total of twenty grass samples were collected from the four pastures (5 from each). Oven dried samples (60° C) were ground through a 1 mm screen before analysis. The crude protein and cell wall constituent contents of grass samples were determined every 15 days. Crude protein was calculated as Kjeldahl N x 6.25. Samples were analyzed for neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), cellulose (CEL) and acid insoluble ash (AIA) according to methods outlined by Goering and Van Soest (1970). Hemicellulose (HEM) content of grasses was calculated as NDF-ADF.

Results were tested for statistical significance by analysis of covariance with a completely random design for four treatments, using the initial weight of each calf as a covariable. Linear and quadratic effects were determined using orthogonal contrasts.

RESULTS AND DISCUSSION

During the study, the CP and cell wall constituent content were determined every 15 days. The crude protein content of grass samples ranged from 9.5 to 13.4%. A crude protein content of approximately 7% is the minimum level required in the diet of grazing ruminants to maintain proper rumen function and a positive N equilibrium in the organism (NRC, 1987). Although crude protein levels of 8 to 10% (dry basis) may allow for maximum forage intake, a higher crude protein level may be required for rapid growth of grazing cattle. Cell wall constituents ranged as follows: cell walls (NDF), 79.9 to 89.9%; ADF, 39.3 to 44.7%; HEM, 38.9 to 44.7%; CEL, 21.1 to 27.8%; LIG, 4.1 to 9.1%; and ash, 9.2 to 10.9%.

During the preliminary phase, weight gains of the four treatment groups were not different ($P>0.05$) and ranged from 0.357 to 0.394 kg/day (Figure 1). The high NDF and low energy content of the grass during the dry season may have limited the growth potential of grazing cattle during the unsupplemented phase (NRC, 1987). However, during the experimental phase, a linear effect ($P<0.01$) of ECP level on the weight gain of bull calves was observed (Figure 1). The weight gains of the calves were 0.668, 0.72, 0.823 and 0.93 kg/day for 31, 38, 45 and 52% ECP, respectively.

Forages have a high ruminally degradable protein content (NRC, 1985). Diet protein solubility and degradability affect the availability of dietary protein to meet microbial nitrogen requirements (NRC, 1987). Plasma urea concentration decreased ($P<0.05$) with the highest ECP level (Figure 2). Plasma urea concentrations were 17.65, 16.72,

17.80 and 9.85 mg/dl for 31, 38, 45 and 52% ECP, respectively. Consumption of low-quality forages may reduced supply of NH_3-N for ruminal bacteria (NRC, 1985). If the nitrogen requirements of rumen bacteria are not met, diet digestibility, and thus rate of passage, are reduced (NRC, 1987). Grass grazed by calves in this study apparently had enough protein to supply the NH_3-N needed by ruminal bacteria (NRC, 1985).

In conclusion, small quantities (0.3%) of a supplement (40% CP) with high ECP offered to grazing calves improved weight gain up to 127% (from 0.394 to 0.893 g/day). However, the level of EPC that should be included in the supplement will depend on the protein level of the forage grazed by cattle.

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Figure 1
Effect of ruminally undegradable protein on the weight gain of Zebu-Brown Swiss bull calves grazing Coastcross-1 Bermudagrass.

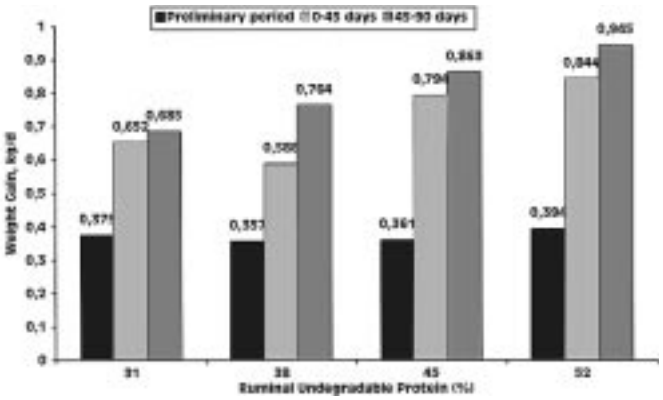

Figure 2
Plasma urea concentration of grazing Zebu-Brown Swiss bull calves supplemented with four levels of ruminally undegradable protein.