# FEEDING STRATEGIES TO OPTIMIZE REPRODUCTIVE PERFORMANCE OF CATTLE GRAZING HIGH PROTEIN PASTURES IN URUGUAY

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**ABSTRACT**

Alternative feeding strategies were investigated for Holstein heifers grazing a vegetative red, *Trifolium pratense* L., and white clover, *Trifolium repens* L., pasture. A total of 474 grazing heifers were supplemented varying amounts of corn silage, *Zea mays*, during the breeding season in an effort to improve reproductive performance. Animal response to supplementation, whether on spring or winter pasture, was similar. Corn silage supplemented at 18.8 or 28.8% DM basis of total diet, for winter and spring pastures, respectively, resulted in animal weight gains similar to that of heifers receiving legume pasture only. Serum urea nitrogen and reproductive performance for heifers offered corn silage was similar to heifers offered pasture only. Heifers offered a higher proportion of corn silage, at 35.2 and 56.5% DM basis of total diet, for winter and spring pastures, respectively, had lower body weight gain and tended to have a lower percentage of animals exhibiting estrous and confirmed pregnant after 2 services. Treatment did not influence conception rates, with 85.5% of all heifers gravid within a 2 estrous cycle schedule.

**INTRODUCTION**

High quality legume pasture is a common dietary forage for dairy cattle in Uruguay. However, commercial and experimental herds have observed problems with reproductive performance under these conditions. Excess dietary degradable intake protein (DIP) has been implicated to reduce reproductive performance in lactating dairy cows ( Claypool et al., 1980; Edwards et al., 1980; Ferguson and Chalupa, 1989). Toxic effects of circulating ammonia and its metabolites on gametes and early embryos, and amino acid deficiencies have been implicated as causes of reduced reproductive performance.

This study was designed to evaluate reproductive performance of cycling heifers grazing high protein, legume based pasture at the time of breeding. Reproductive performance of grazing heifers led two levels of corn silage to reduce dietary crude protein and degradable crude protein was compared to those receiving pasture only.

**MATERIAL AND METHODS**

Two breeding trials were conducted. The first trial utilized 264 Holstein heifers, 340 + 32.5 kg, on winter pasture. The second trial utilized 210 Holstein heifers, 304 + 27.5 kg, on a spring pasture. Red clover, cv. Estanzuela 116 and white clover, cv. Estanzuela Zapican, were seeded at a rate of 5 and 1.5 kg $ha^{-1}$, respectively. The 70 ha pasture was divided into three paddocks, each divided into 11 sections that were rotationally grazed on a weekly basis. For each trial, animals were allocated to one of 3 dietary treatments on the basis of initial age, body weight and origin. The 3 dietary treatments included pasture only (P), pasture with corn silage supplemented at 0.6 (P+CS) or 1.2% (P+2CS) of body weight (BW) for the winter trial, and pasture with corn silage supplemented at 1.1 (P+CS) or 1.9% (P+2CS) of BW for the spring trial. Corn silage was offered once daily.

All heifers were synchronized prior to breeding using prostoglandin. Estrous detection was conducted twice daily over the course of 2 estrous cycles, during which animals were bred 8 to 10 h after first detection of standing heat using artificial insemination. Pregnancy diagnosis was conducted by blood progesterone on d 20-24 post insemination, ultrasound on d 25 post insemination, and rectal palpation on d 38-50 post insemination.

Animal body weight and condition score were determined weekly during each 10 week trial. Blood samples were taken from all animals on d 10-14 for blood progesterone and urea nitrogen determinations. Vaginal secretions were taken on day of insemination for urea determination. Rumen fluid samples were collected on d 14-17 (winter trial) and d 24 -27 (spring trial) to determine rumen fluid ammonia nitrogen concentrations.

All data was analysed as a randomized complete block design, with the exception of reproductive performance parameters. Treatment comparisons for these parameters were made by comparison of proportions using contingency tables and analysis using chi-square.

**RESULTS AND DISCUSSION**

Dry matter intake was uniform across dietary treatments (Table 1). As expected, crude protein content of diets offered to heifers consuming pasture only were excessive. Supplementation of corn silage did reduce dietary protein, however, it may also have reduced dietary energy because corn silage fiber levels were high. Heifers maintained a good rate of gain on all of P and P+CS diets, averaging 0.98±0.03 and 1.03±0.027 kg $d^{-1}$, respectively, for the winter trial and 1.02±0.03 and 0.95±0.04 kg $d^{-1}$, respectively, for the spring trial. Rates of gain for heifers fed pasture with the highest level of corn silage supplementation were lower ($P < 0.05$) than for the other treatments, averaging 0.75±0.03 and 0.70±0.03 kg $d^{-1}$, respectively for the winter and spring trials. This is likely associated with the lower energy content of the corn silage relative to the pasture forage available.

All heifers were observed to be cycling prior to the onset of these trials. Unlike previous observations, heifers grazing vegetative, high legume pastures in these trials had excellent reproductive performance. Supplementation with corn silage, under these conditions, did not improve reproductive performance. A lower reproductive performance for heifers offered corn silage at 1.9 % of body weight in the spring trial was likely related to a lower energy intake.

**REFERENCES**

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**ACKNOWLEDGEMENTS**

Funding provided by Instituto Nacional de Investigación Agropecuaria and Careco through the Fondo de Promoción de Tecnología Agropecuaria.

**Table 1**
Dry matter intake (kg heifer$^{-1}$ day$^{-1}$) and nutrient composition of forage diets offered to breeding Holstein heifers.

| | Winter Trial | | | Spring Trial | | |
|---|---|---|---|---|---|---|
| | **P** | **P+CS** | **P+2CS** | **P** | **P+CS** | **P+2CS** |
| Intake, kg DM d$^{-1}$ | 10.9 | 9.6 | 7.9 | 11.8 | 8.9 | 4.8 |
| Pasture forage | - | 2.1 | 4.3 | - | 3.6 | 6.1 |
| Corn silage | 10.9 | 11.7 | 12.2 | 11.8 | 12.5 | 10.9 |
| Total | | | | | | |
| Nutrient composition | | | | | | |
| ADF, % DM | 17.0 | 16.0 | 26.5 | 18.5 | 23.8 | 22.8 |
| NDF, % DM | 29.7 | 37.7 | 55.0 | 36.1 | 48.4 | 54.9 |
| Crude Protein, % DM | 24.6 | 19.2 | 16.0 | 22.9 | 16.6 | 12.7 |
| Degradable Protein, % CP | 54.3 | 58.2 | 48.4 | 52.1 | 58.7 | 56.4 |
| Degradable Protein | | | | | | |
| Intake, kg d$^{-1}$ | 1.46 | 1.28 | .94 | 1.32 | 1.31 | 0.66 |

**Table 2**
Serum urea nitrogen, mg dL$^{-1}$, reproductive performance of Holstein heifers offered a high legume pasture forage alone or supplemented with varying levels of corn silage.

| | Winter Trial | | | Spring Trial | | |
|---|---|---|---|---|---|---|
| | **P** | **P+CS** | **P+2CS** | **P** | **P+CS** | **P+2CS** |
| Heifers, no. | 87 | 85 | 87 | 70 | 72 | 67 |
| Initial BW, kg | 348 | 327 | 346 | 313 | 298 | 304 |
| ADG, kg | .97a | 1.03a | .75b | 1.02a | .96a | .71b |
| Serum urea N, mg dL$^{-1}$ | | | | | | |
| mean | 19.18 | 17.64 | 17.39 | 21.01 | 18.67 | 14.30 |
| max | 32.05 | 25.62 | 28.20 | 35.44 | 33.79 | 25.85 |
| min | 11.03 | 8.60 | 7.33 | 8.04 | 6.77 | 4.94 |
| Observed estrous, % | 88 | 86 | 82 | 87a | 86a | 73b |
| Conception, % of animals bred | | | | | | |
| 1st service | 41 | 76 | 69 | 77 | 66 | 55 |
| 2nd service | 54 | 46 | 64 | 50 | 68 | 86 |
| Cummulative Pregnancy Rate | | | | | | |
| % total heifers | 70 | 69 | 68 | 79a | 76a | 63b |
| % heifers bred | 79 | 81 | 84 | 90 | 89 | 86 |
| Services/conception | 1.53 | 1.39 | 1.44 | 1.38 | 1.49 | 1.57 |

a,b Ls means for treatments followed by a different letter indicate difference for either the winter pasture or spring pasture periods, P L 0.05.