Effects of Different Levels of Energy Supplementation on Growth of Grazing Holstein Heifers

L. P. Novaes
EMBRAPA, Brazil

C. E. Polan
Virginia Polytechnic Institute and State University

ID # 19-17

EFFECTS OF DIFFERENT LEVELS OF ENERGY SUPPLEMENTATION ON GROWTH OF GRAZING HOLSTEIN HEIFERS.

L. P. Novaes[1] and C. E. Polan[2]

[1]EMBRAPA- CNPGL, Rua Eugênio do Nascimento, 610, Juiz de Fora, Mg, Brasil – 36038 - 330

[2]Dairy Science Department – Virginia - Polytechnic Institute and State University, Blacksburg, VA. 24061

Abstract

Growth of Holstein heifers was studied for 1987 grazing season to evaluate pasture-drylot systems for raising dairy replacements. Orchardgrass (*Dactylis glomerata L*), tall fescue (*Festuca arundinacea Schreb*), bluegrass (*Poa pratensis L*) and white (*Trifolium repens L*) and red clover (Trifolium pratense, L) were the principal components of the grass-legume mixture in six paddocks of 1.5 ha each. Carrying capacity was estimated at six animals/ha (3.1 animal units) and excess forage was harvested as hay to control forage growth and quality. Grazing days were 140 days. None or 2.0 kg/d of cracked corn were fed in addition to grazing in a changeover design with repeated measurements. Alternating supplementation between groups did not affect body weight gains, wither height or heart girth although average daily gain was greater when corn was fed (837 vs 581 g/d).

Keywords: Holstein heifers, growth, energy supplementation, grazing

Introduction

Research has demonstrated that given adequate nutrition, dairy heifers can achieve puberty by 7 to 8 months (Amir et al. (1967); Waldo et al. (1988)) and calve the first time at 18 to 21 months, Waldo et al. (1988), or even at younger age, Amir and Kalli (1974). Usually, this has been achieved with confinement feeding and feeding high energy diets, Amir et al. (1967), Stelwagen and Grieve, (1990) and Swanson (1977).

A most common approach to reduce age at first calving has been feeding enough energy to attain daily gains between 600 and 800 g/d, Waldo et al. (1988). Costs for this period ranged from $700 to $1300, Chase and Sniffen (1988) and James (1989) and reflects varying systems of rearing which may not utilize less costly feeds such as pasture.

In countries where grazed pasture is the main component in the diet of dairy herds, a common practice is to supplement pasture with energy, which is the most likely nutrient to be limiting production. The objective of this experiment was to measure growth responses of two groups of Holstein heifers each supplemented with energy during alternating 28-d switchback feeding while grazing temperate species.

Material and Methods

Pasture

Nine hectares of an existing permanent pasture located at the Virginia Tech Dairy Center was subdivided into six paddocks of 1.5 ha each by three high tensile electric wires. Orchardgrass, tall fescue, bluegrass, and white and red clover were the principal species of the grass-legume mixture. Overseeding white clover at the rate of 4 kg/ha in early spring 1987 increased the legume stand. Nitrogen, Phosphorus and Potash were applied at rates of 45, 45 and

54 kg/ha every other spring. Carrying capacity was estimated from previous grazing studies at six animals (3.1 animal unit, AU = 450 kg BW) per hectare for the total grazing season.

Because of another experiment the heifers were not available for grazing until June 1, 1987. Thus the flush spring growth was harvested for hay in early May. The six paddocks were divided into 3 blocks of 2 paddocks for rotational grazing. The 2 treatment groups of 12 heifers were randomized to the 2 paddocks in each block each time the heifers were switched to a fresh pasture. The heifers were switched to a fresh pasture when it was estimated that the available forage had declined to a point to depress intake, about 800 kg DM/ha. The tall fescue was rarely grazed except during autumn.

Animals, supplement, and measurements

Twenty-four Holstein heifers with average body weight (BW) of 295 kg (13.2 months) were paired into groups of 2 animals based on age and weight, and pairedmates were then randomly split into two groups (G1 and G2). During the first 28-d grazing period G1 was fed cracked corn (2.0 kg/d) and G2 had only pasture forage. During each of 5 subsequent 28-d periods, the supplement was switched between groups. Because of drought during the 4^{th} period, heifers were fed in drylot. Measurements taken were BW twice monthly wither height (WH) and heart girth (HG) monthly.

Statistical analysis

Data were analyzed using the General Linear Model of SAS (1978). Heifers response variables were analyzed as complete block design with heifers as block and nonrandom repeated measurements of the units (heifers) were taken following the recommendations by Gill (1978).

Differences between treatments and treatments by group interactions were tested by random effect of interaction between treatment and heifer as the error term; and random effect of heifer in group and random effect of interaction between treatment and heifer were used to test differences between groups. Period and period interactions were tested by the residual error term.

Results and Discussion

Grazing began June 1 and extended for 140 d to November 17, 1987. From August 24 to September 23 the heifers were removed from pasture due to extreme drought and were fed as one group in confinement. During this 30-day period, the animals received a ration containing 10% CP based on corn silage and soybean meal. Expected intake was 2.5% of BW, and ADG was 571g/d. Initial BW, for both groups was 295.0 kg (Table 1). Final BW for Group 1 (G1) and Group 2 (G2) was 407 and 404 kg, respectively. Group 1 was fed supplement for 77-d and Group 2 for 56-d of the total pasture days. Average daily gains were 710 and 708 g/d for G1 and G2 respectively and did not differ ($P>.05$). These gains are similar to results of Vallentine et al. (1984) but lower than 1000 g/d reported by Cooper and Morris (1983) when Holstein heifers were supplemented with cereal grain while grazing.

Effect of corn supplementation on actual BW and daily gains (Table 2), show that supplementation increased ADG, except for period 6. However, at the end of the trial BW were similar for groups because of alternate periods of supplementation. Means for WH were 123.2 and 124.7 cm and for HG 173.5 and 172.3 cm for G1 and G2 respectively.

Usually, the periods when feeding 2 kg/d of corn resulted in higher weight gains than for the alternate periods without corn (807 vs 551 g/d). Heart girth measurements (171.7 vs 174.2 cm) were different ($P<.05$) for periods of supplement versus no supplement feeding.

Significant supplement period interactions were observed for ADG (P<.01) and WH (P<.01). Pasture availability and quality varying during the 28-d periods possibly could explain these interactions, especially since 1987 had an extended drought season. Since it is known that energy supplements to grazing animals generally increase DM, changes in quantity and quality of forage among periods could alter the relative responses of heifers fed or nor fed grain among periods.

This experiment was preliminary to stablish management of pastures and get an indication of response to a 2 kg supplementation of corn to grazing heifers. Although heifers were large, average daily gains were greater during periods of corn supplementation. ADG (837 vs 581 g/d) and heart girth increments 171.7 vs 174.3 cm was greater for supplement for all periods.

References

Amir, S., R. Volcani and M. Perlman (1967). Early breeding of dairy heifers. Page 268 in Proc. 45th Meeting Brit. Soc. Anim. Prod. 9 (Abstr.).

Amir, S. and J. Kalli. (1974). Influence of plane of nutrition of the dairy heifer on growth and performance after calving. Dairy Science Handbook.7:183. Davis, California: Agriservices Foundation.

Chase,L.E. and C.J. Sniffen. (1988). Developing a nutritional strategy for dairy replacement heifers. Page 119 in Proc. Cornell Nut. Conf. Cornell Univ., Ithaca NY.

Cooper, M. McG. and Morris, D.V. (1983). Grass Farming. Farming Press Limited. Suffolk.

Gill, J.L. (1978). Design and Analysis of Experiments in the Animal and Medical Sciences. Volume **2**. The Iowa State University Press. Ames, Iowa.

James, R.E. (1989). Economics of alternative heifer rearing systems. Page 12 in Proc. Feed Nut. Manag. Cow College. VPI&SU, Coop. Ext.Service. Blacksburg.

SAS User's Guide: Statistics, Version 5 Edition. 1985. SAS Inst., Inc., Cary, NC.

Stelwagen, K. and D.G. Grieve. (1990). Effect of plane of nutrition on growth and mammary gland development in Holstein heifers. J. Dairy Sci. **73**:2333.

Swanson, E.W. (1977). Effects of level of nutrition on growth, reproduction and lactation of dairy heifers. Page 125 in Proc. Ga. Nut. Conf. for the feed industry.

Vallentine, J. F., R. P. Shumway and S. C. James. (1984). Page 315 in Cattle ranch planning manual. Brigham Young Univ. Pub. Provo, Utah.

Waldo, D.R., A.V. Capuco and C.E. Rexroad, Jr. (1988). Growing dairy heifers for optimum milk production. Proc. Sowthwest Nut. and Management Conf. Univ. of AZ, Tempe.

Table 1 - Production measurements of two groups of Holstein heifers supplemented with cracked corn in alternate 28-d periods during a 140 day grazing period (1987) on a grass-legume mixture.

Item		Supplemented in alternate 28-d periods		Supplemented in alternate 28-d periods		Overall
		G1	G2	NS	S	
Age, months	Initial	13.4	12.9	12.9	13.4	13.1
	Final	19.0	18.5	18.5	19.0	18.5
BW, kg	Initial	295.0	295.0	295.0	295.0	295.0
	Final	407.0	404.1	401.0	405.4	405.0
WH, cm	Initial	118.4	119.4	119.4	119.1	118.9
	Final	126.5	128.5	128.4	126.5	127.5
HG, cm	Initial	163.1	160.5	162.0	164.4	161.8
	Final	183.9	182.9	183.0	184.0	183.4
Least Square Means						
BW, kg		356.0	346.8 (3.3)	351.1	352.0(14.0)	
WH, cm		123.2	124.7 (5.7)	123.7	124.2 (6.3)	
HG, cm		173.5	172.7 (5.9)	171.7	174.2 (0.4)	
ADG, kg/day		0.710	0.708 (0.02)	0.581	0.837(0.20)	

Number in parenthesis are SE for n = 12
BW – body weight, WH – wither height, HG – heart girth, ADG – average daily gain

Table 2 - Effect of alternate periods of corn supplementation on body weight and daily gain of grazing Holstein heifers from June-October, 1987.

Period	Zero Corn		Two kg Corn	
(28 day)	Body wt (kg)	Gain (ADG) (kg)	Body wt (kg)	Gain (ADG) (kg/day)
0	295.0		295.0	
1	300.1	0.209	310.7	0.695
2	327.5	0.574	318.1	0.885
3	336.0	0.506	352.7	0.858
4*	352.0	0.571	368.7	0.571
5	384.5	0.892	377.0	1.088
6	402.6	0.574	406.2	0.507
Mean	350.1 + 0.032[1]	0.551 + 0.118[1]	352.9 + 0.032[1]	0.807 + 0.118[1]

* Fed same diet in drylot during severe drought

[1] Standard Error