PERFORMANCE OF HOLSTEIN COWS FED WET CORN GLUTEN FEED OR SOYHULL-STEEP LIQUOR PELLETS DURING EARLY LACTATION

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Summary

Wet corn gluten feed and soyhull-steep liquor pellets tended to increase dry matter intake and milk yield. Combining condensed corn steep liquor with raw soybean hulls provides a convenient source of digestible fiber and rumen degradable protein.

(Key Words: Wet Corn Gluten Feed, Dairy, Soyhulls, Corn Steep Liquor.)

Introduction

Complete lactation milk yield is positively related to peak milk yield, which generally occurs by 50 to 60 days in milk. Nutrition limits peak milk yield because of inadequate dry matter intake. Body tissue mobilization and ruminal adjustments are made in an attempt to meet nutrient deficits. Therefore, it is imperative during early lactation to provide dietary ingredients that are highly digestible in order to enhance nutrient availability. A critical issue in diet formulation is balancing fiber content to prevent ruminal acidosis. Short-term studies (28-day period) conducted at Kansas State University with wet corn gluten feed (WCGF) and a pelleted feedstuff made by combining soy hulls and condensed corn steep liquor (SHSL) indicated that these feedstuffs improve dry matter intake and maintain ruminal pH. The purpose of this study was to evaluate the response of dairy cows to WCGF and SHSL during the first 90 days in milk.

Procedures

Forty-six multiparous Holstein cows were used in a randomized incomplete block design. Cows were blocked on calving date and assigned randomly to either of three diets: 1) control, 2) wet corn gluten feed at 20% of dry matter; or 3) soy hull-steep liquor pellet at 20% of dry matter. Treatment diets were balanced for previous lactation milk yield, body weight, and body condition score as much as possible. Wet corn gluten feed (WCGF) replaced 10, 5, and 5% of the alfalfa hay, corn silage, and corn grain in the control diet (DM basis), respectively and soy hull-steep liquor (SHSL) replaced 10, 5, 2, and 3% of the alfalfa hay, corn silage, corn grain, and solvent soybean meal in the control diet (DM basis), respectively. Treatment diets were initiated beginning at the first feeding after calving and fed ad libitum twice daily as a total mixed ration. Feed ingredients were collected weekly and composited monthly for analyses. Individual feed intakes and milk yield were measured daily. Milk samples (am and pm composite) were analyzed weekly for milk composition. Protein, fat, lactose, solids-not-fat, milk urea nitrogen (MUN), and somatic cells were measured by the Heart of America DHI Laboratory, Manhattan. Cows were weighed within 24 hr after calving and on two consecutive days weekly thereafter. Body condition was scored weekly.

Results and Discussion

The experimental diets and their composition are shown in Table 1. Diets containing WCGF or SHSL provided more neutral-detergent fiber (NDF) than the control diet and SHSL increased the dietary acid-detergent fiber (ADF) relative to the other diets. Cows fed diets containing WCGF or SHSL tended to consume approximately 3 to 4 lb more dry matter, respectively, than cows fed the control diet. The increase in dry matter

intake tended to increase daily milk yield by approximately 8 to 9 lb for cows fed WCGF or SHSL, respectively, than those fed the control diet. Peak milk yield and days to peak milk yield prior to rbST administration (9th week of lactation) was 112, 44; 116, 46; 119, 39 for cows fed the control, WCGF, and SHSL diets, respectively.

Milk from cows fed the control diet contained more ($P<0.05$) than fat (4%) than cows fed the other diets (3.7%), but fat yield (lb/day) was similar for all diets due to the difference in milk volume. Milk protein percentage was similar but protein yield tended to increase with milk volume. Energy corrected milk divided by dry matter intake (ECM/DMI) provides a gross measure of efficiency. During the first 90 days in milk, cows usually have a relatively high ECM/DMI value (>1.5) because they mobilize fat to support milk production. All cows in our study seemed to be very efficient but efficiencies were not different among diets. Loss in body weight was unaffected by diets but cows fed the control diet tended to have less condition at the end of the first 90 days in milk.

In summary, WCGF and SHSL pellets tended to increase dry matter intake and milk yield. Combining condensed corn steep liquor with raw soybean hulls provides a convenient source of digestible fiber and rumen degradable protein.

Table 1. Composition of Experimental Diets

	Diet		
Ingredient	Control	WCGF[1]	SHSL[2]
	---------- % of dry matter ----------		
Alfalfa hay	30.00	20.00	20.00
Corn silage	15.00	10.00	10.00
Corn grain	32.00	27.00	30.17
WCGF	-	20.00	-
SHSL	-	-	20.00
Whole cottonseed	9.30	9.30	9.30
Soybean meal	4.39	-	1.40
Soybest	3.30	7.71	3.32
Fish meal	1.30	1.31	1.31
Molasses	1.00	1.00	1.01
Dicalcium phosphate	0.88	0.59	0.18
Limestone	1.36	1.54	1.62
Sodium bicarbonate	0.75	0.75	0.67
Magnesium oxide	0.21	0.21	0.22
Trace mineralized salt[3]	0.32	0.32	0.32
Vitamin ADE premix[4]	0.11	0.11	0.11
Vitamin E premix[5]	0.02	0.02	0.02
Sodium selenite	0.01	0.01	0.01
Nutrient			
Crude protein, %	18.53	18.28	19.06
RUP, (% of CP)	6.86	7.19	7.32
ADF, %	18.54	17.01	20.51
NDF, %	27.30	29.77	29.49
NE_L, Mcal/lb	0.77	0.80	0.79
NFC[6]	40.99	39.48	39.01
Calcium, %	1.38	1.43	1.14
Phosphorus, %	0.66	0.75	0.60
Sulfur, %	0.20	0.25	0.25

[1]Wet corn gluten feed. [2]Soyhull steep liquor: pellet containing 75% raw soybean hulls, 25% condensed corn steep liquor (DM basis). [3]Compositions: not less than 95.5% NaCl, 0.24% MN, 0.24% Fe, 0.05% Mg, 0.032% Cu, 0.032% Zn, 0.007% I, and 0.004% Co. [4]Contributed 5,733 IU of vitamin A, 2,866 IU of vitamin D, 17 IU of vitamin E per kg of diet DM. [5]Contained 600 mg of Se per kg premix. [6]NFC = 100 – (%NDF + %CP + % Ether Extract + %Ash).

Table 2. Effects of Diet on Performance during the First 90 Days in Milk

	Diet			
Item	Control	WCGF	SHSL	SEM
Dry matter intake, lb/day	51.3	54.6	55.1	2.0
Milk yield, lb/day	90.1	97.6	98.9	4.3
Peak milk yield, lb	111.8	116.5	119.1	4.6
Days to peak milk yield	43.9	46.5	38.8	3.6
Milk protein, %	3.0	3.0	3.0	0.1
Milk protein yield, lb/day	2.7	2.9	2.9	0.2
Milk fat, %	4.0[a]	3.7[b]	3.7[b]	0.1
Milk fat yield, lb/day	3.6	3.6	3.7	0.2
Milk urea nitrogen, mg/dL	14.6	14.7	14.8	0.5
ECM, lb/day[1]	94.1	98.2	100.2	1.9
ECM/DMI[2]	2.0	1.9	1.9	0.1

[a,b]Means within a row not bearing common superscripts differ ($P<0.05$).

[1]ECM = energy corrected milk, (0.327*milk kg) + (fat kg*12.95) + (protein kg*7.2).
[2]Energy corrected milk divided by dry matter intake.

Table 3. Effects of Diet on Body Weight and Condition[1]

	Diet			
Item	Control	WCGF	SHSL	SEM
Body weight initial, lb	1613	1583	1571	22.47
Body weight final, lb	1394	1413	1354	17.0
BCS initial[2]	3.0	3.2	3.0	0.1
BCS final[2]	2.7[a]	2.8[b]	2.8[b]	0.1

[a,b]Means within a row not bearing common superscripts differ ($P=0.08$).

[1]Initial body weight and BCS measured within 24 hrs after calving, final body weight, and BCS measured on day 90 and 91 after calving.
[2]BCS = body condition score.