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DETERMINATION OF THE AMOUNT OF WET CORN GLUTEN FEED TO INCLUDE IN DIETS FOR LACTATING DAIRY COWS

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Summary

Twenty-four multiparous Holstein cows were used in six 4×4 Latin squares with 28-day periods to determine inclusion rates for wet corn gluten feed (WCGF) in diets for lactating dairy cows. Cows were housed in a tie-stall barn and fed diets to meet or exceed NRC (1989) nutrient requirements. Experimental treatments were 1) control, 2) WCGF constituting 20%, 3) WCGF constituting 27.5%, and 4) WCGF constituting 35% of the diet dry matter. Cows fed WCGF consumed more dry matter ($P<0.01$) and produced more ($P<0.001$) milk, energy-corrected milk, and fat-corrected milk than cows fed the control diet. Dry matter intakes were 58.9 lb/day for control and 60.2 lb/day for those cows consuming WCGF diets. Cows fed the control diet produced 83.2 lb/day of milk, whereas those fed WCGF diets produced 91.5 lb/day. Production efficiency was increased ($P<0.001$) on the WCGF diets. The percentage of fat in milk, total protein production, and milk urea nitrogen were higher ($P<0.01$) for cows fed WCGF diets than controls. Plasma glucose, total alpha-amino nitrogen, urea nitrogen, and tryglycerides were similar between cows fed the control and WCGF diets. No differences occurred in percentages of protein, lactose, or solids-not-fat content, nor was somatic cell count affected by the addition of WCGF. Body weight and condition score were not affected by treatment. We conclude that WCGF is an excellent feed for lactating dairy cows when included in the diet at 20%, 27.5%, or 35% of the dry matter.

(Key Words: Wet Corn Gluten, Lactating Cows, Milk Yield.)

Introduction

Wet corn gluten feed (WCGF) is a potential feedstuff for dairy cows located near a source. Data from studies conducted with feedlot steers suggest that it improves average daily gain and dry matter intake, reduces acidosis, and yields feed efficiency values comparable to those with corn. Wet corn gluten feed is relatively low in starch (18 to 22% of dry matter, DM), and high in neutral detergent fiber (42% of DM), with a protein fraction that is very degradable (65%) in the rumen. Lactation diets formulated to complement these characteristics should optimize the use of WCGF. The objectives of our study were to evaluate the effects of WCGF on the performance of lactating dairy cows when it was substituted in the diet for a portion of the forage and corn grain and to determine the optimal amount of WCGF to include in diets for multiparous, lactating dairy cows.

Procedures

Twenty-four multiparous Holstein cows averaging 65 days in milk were used in six 4×4 Latin squares with 28-day periods. Cows were housed and fed in a tie-stall facility at the Kansas State University Dairy, Manhattan, KS, and were fed individually diets formulated to meet or exceed NRC (1989) nutrient requirements. Diets were formulated to be isocaloric and isonitrogenous with similar amounts of neutral and acid detergent fiber, rumen-undegradable protein (RUP), and DM. Alfalfa hay and corn silage were used as forages, and corn as the primary grain. Expeller soybean meal (Soybest, Grain States Soya, Delevan, KS), 48% solvent soybean meal, and blood meal

were used to balance diets for RUP. Treatments were control (no WCGF) and WCGF at inclusion amounts of 20, 27.5, and 35% of diet replacing a mix of alfalfa hay, corn silage, and corn grain.

Diets were fed free choice as a total mixed ration and issued twice daily to ensure 10% orts. Daily milk production and feed intake were recorded, and milk samples (AM-PM composite) were collected weekly and analyzed for milk composition: milk protein, fat, lactose, solids-non-fat (SNF), milk urea nitrogen (MUN), and somatic cells (Heart of America DHI Laboratory, Manhattan, KS). Cows were weighed and scored for body condition at the beginning of the study and at the end of each 28-day period. Body weights (BW) were obtained immediately after the AM milking on 2 consecutive days, and the average was used for analysis. Blood samples were collected from the cooccygeal vein during the final week of each period, and the harvested plasma was frozen at –4°F until analyzed for glucose, urea nitrogen, and total alpha amino nitrogen (TAAN).

Results and Discussion

Cows fed WCGF produced more ($P<0.01$) milk and energy-corrected milk (ECM) than cows fed the control diet. Cows fed diets containing 20 and 27.5% WCGF (% of DM) consumed more ($P<0.05$) DM as a percentage of BW than cows fed the control or 35% WCGF diet. The resulting increase in milk yield can be explained partially by the increase in DM intake, but production efficiency (lb milk/lb DM intake) also improved in cows fed WCGF. Milk fat percentage was lower ($P<0.05$) in milk from cows fed 20 and 35% WCGF compared to controls. Cows fed WCGF produced more ($P<0.01$) milk protein, SNF, and lactose than cows fed the control diet, primarily because of the increase in milk yield. Cows fed 27.5 and 35% WCGF had greater ($P<0.01$) MUN than cows fed control or 20% WCGF.

Somatic cell count, BW, and body condition score were unaffected by dietary inclusion of WCGF. Plasma glucose, TAAN, and total triglycerides were similar among diets, but plasma urea nitrogen increased ($P<0.05$) when cows consumed WCGF. Fecal pH tended to be greater ($P=0.06$) for cows fed the 27.5 and 35% WCGF diets, whereas urine pH decreased ($P<0.05$) when WCGF was included in the diet.

In summary, WCGF substituted for a mix of alfalfa hay, corn silage, and corn grain in diets of multiparous Holstein cows increased ECM yield. Cows fed 35% WCGF (% of DM) were most efficient, but intake and ECM production data indicated that 27.5% WCGF (% of DM) is the optimum inclusion level.

Table 1. Ingredients and Nutrient Compositions of Experimental Diets

	Wet Corn Gluten Feed, % of DM			
Ingredient	0	20	27.5	35
Alfalfa hay	30.0	20.0	20.3	18.4
Corn silage	24.5	9.8	9.8	7.4
Whole cottonseed	9.6	9.7	9.7	9.8
Wet corn gluten feed	-	19.2	26.5	33.6
Corn grain, ground	32.4	26.7	20.7	18.3
Soybean meal, 48% CP	5.1	2.0	0.5	-
Expellers soybean meal	4.0	8.1	7.2	7.0
Wet molasses	2.2	1.3	1.3	1.3
Blood meal	-	-	0.75	0.90
Vit./Min. premix[1]	3.2	3.2	3.3	3.3
Nutrients				
Dry matter, %	81.7	75.0	71.3	69.2
CP[2], %	16.7	17.3	17.7	17.9
RUP[3], % of CP	36.1	37.2	36.7	36.6
NE_L[4], Mcal/lb	3.75	3.84	3.75	3.84
Fat, %	4.9	5.4	5.4	5.6
NDF[5], %	29.4	31.7	33.3	34.4
ADF[6], %	19.6	17.8	18.3	17.8
NFC[7], %	42.5	39.7	36.7	36.2

[1]Vitamin and mineral premix = dical; limestone; Na bicarbonate; Mg oxide; trace mineral salt; vitamins A, D, E; and selenium.

[2]Crude protein.

[3]Rumen undegradable protein.

[4]Net energy for lactation.

[5]Neutral detergent fiber.

[6]Acid detergent fiber.

[7]Nonfiber carbohydrate.

Table 2. Lactational Performance of Cows

Item	Wet Corn Gluten Feed, % of DM				SEM
	0	20	27.5	35	
DMI[1], lb/day	58.9[bc]	60.9[ab]	61.4[a]	58.3[c]	0.36
DMI, % of BW	4.25[b]	4.42[a]	4.43[a]	4.20[b]	0.052
Milk, lb/day	83.2[b]	91.5[a]	91.5[a]	91.5[a]	0.49
ECM[2], lb/day	82.9[b]	89.5[a]	89.9[a]	89.9[a]	0.49
ECM/DMI	1.41[b]	1.47[a]	1.47[a]	1.53[a]	0.015
Milk fat, %	3.47[a]	3.28[b]	3.33[ab]	3.21[b]	0.05
Milk protein, %	3.18	3.20	3.20	3.20	0.017
Milk lactose, %	4.84	4.88	4.88	4.88	0.012
Milk SNF[3], %	8.80	8.86	8.86	8.86	0.023
Milk fat, lb/day	2.86	2.97	3.01	2.93	0.023
Milk protein, lb/day	2.67[b]	2.90[a]	2.90[a]	2.90[a]	0.016
Milk lactose, lb/day	4.03[b]	4.47[a]	4.47[a]	4.47[a]	0.026
Milk SNF, lb/day	7.30[b]	8.10[a]	8.07[a]	8.10[a]	0.045
Milk urea N, mg/dL	15.14[b]	15.02[b]	15.76[a]	16.01[a]	0.20
SCC[4], × 1000	91	217	139	175	59

[1]Dry matter intake.
[2]Energy-corrected milk.
[3]Solids-not-fat.
[4]Somatic cell count.
[a,b,c]Row means not bearing common superscripts differ ($P<0.05$).

Table 3. Plasma Metabolites

Item	Wet Corn Gluten Feed, % of DM				SEM
	0	20	27.5	35	
Triacylglycerol, mg/dL	14.46	14.39	14.24	14.32	0.61
Urea N, mg/dL	11.61[b]	12.45[a]	13.05[a]	12.96[a]	0.25
TAAN[1], m*M*	2.48	2.48	2.58	2.57	0.057
Glucose, mg/dL	67.7	68.8	68.3	68.9	0.76

[1]Total alpha-amino nitrogen.
[a,b]Means not bearing common superscripts differ ($P<0.05$).