# RESPONSES OF LACTATING HOLSTEIN COWS TO INCREASING AMOUNTS OF WET CORN GLUTEN FEED

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## Summary

Forty lactating Holstein cows were allocated into groups of 5 cows each and assigned to 8 pens containing 10 freestalls each. Each group contained 3 heifers and 2 multiparous cows. Groups were balanced by milk production and days in milk. Diets were formulated to contain none (control), 12, 24, or 36% wet corn gluten feed (WCGF) on a dry matter (DM) basis. Increasing amounts of WCGF and heat-treated expeller soybean meal replaced a portion of the corn silage, alfalfa hay, corn grain, soybean meal, and soybean hulls of the control diet to maintain similar concentrations of crude protein (CP), ruminally undegraded crude protein (RUP), and neutral detergent fiber (NDF). A Latin Square design with 4-week periods was used. Periods were 4 weeks in duration, with 2 weeks of adjustment followed by 2 weeks of data collection. Milk weights were recorded at each milking, and weekly milk samples (a.m. and p.m.) were collected for milk component analysis. Milk and feed data were averaged by pen and week before analysis. Milk production, energy-corrected milk production, and efficiency of energy-corrected milk production increased with increasing amounts of WCGF. Dry matter intake was unaffected by diet. These data indicate that WCGF can be utilized effectively at 36% of the ration DM if concentrations of RUP, CP, and NDF are maintained in the diet.


(Key Words: By-products, Nutrition, Wet Corn Milling.)

## Introduction

Increased ethanol and corn sugar production have greatly increased the availability of corn processing co-products. One of the co-products of the wet milling process is wet corn gluten feed (WCGF). It is readily available in the Midwest and can be easily incorporated into dairy cattle diets. Wet corn gluten feed is an excellent source of ruminally fermentable fiber and crude protein. It can be used to replace a portion of the forage and crude protein supplements of lactating dairy cattle diets. The objective of this experiment was to determine the impact of increasing amounts of WCGF on the performance of lactating Holstein dairy cattle.

## Procedures

Forty lactating cows, averaging 155 days in milk and producing an average of 112 lb of milk daily, were allocated into groups of 5 cows each and were assigned to 1 of 8 pens containing 10 freestalls each. Each group contained 3 heifers and 2 multiparous cows. Groups were balanced by milk production and stage of lactation. Diets containing none (control), 12, 24, or 36% WCGF on a dry matter (DM) basis were formulated to contain similar concentrations of crude protein (CP), ruminally undegraded crude protein (RUP),

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and neutral detergent fiber (NDF). This was achieved by replacing a portion of the corn silage, alfalfa hay, corn grain, soybean meal, and soyhulls in the control diet with WCGF (SweetBran, Cargill, Inc., Blair, NE) and heat-treated expeller soybean meal. Ingredients and nutrient composition of diets are in Table 1. Cows were fed a TMR twice daily, and amounts fed and refused were recorded daily by pen. Cows were milked twice daily, and milk yield was recorded. Milk samples (a.m. and p.m.) were collected once weekly for composition analysis. Milk composition was then calculated, based on the actual percentages of the a.m. and p.m. milking during which samples were collected. Before data analysis, all results were averaged by pen, period, and week within period. Feed samples of individual diet ingredients were collected weekly and composited by period before analysis. Diet nutrients were then calculated from individual diet ingredients.

## Results and Discussion

Diets provided adequate amount of nutrients to meet or exceed NRC requirements (Table 1). Amounts of CP were greater than anticipated because of greater than expected concentrations in the diet ingredients. Dry matter intake was unaffected by treatment. Addition of WCGF to the diet reduced the DM content of the TMR. Cows fed 36% WGCF produced more ($P$<0.05) milk (Table 2) than cows fed the other diets. Linear increases in milk production were observed when feeding diets containing 12 to 36% WCGF. These results indicate that milk production was still increasing at the 36% DM rate. Therefore, feeding greater concentrations of WCGF may be beneficial. Feeding only 12% WCGF did not offer any advantage over the control diet.

Milk fat percentage was unaffected by treatment, but milk fat production increased ($P$<0.05) with increasing amounts of WCGF. Milk protein percentage increased with increasing amounts of WCGF. Cows fed the 24 or 36% diets had greater ($P$<0.05) concentrations of milk protein and milk protein production than did controls. Energy corrected milk production and efficiency of ECM production also increased ($P$<0.05) with increasing amounts of WCGF. Occurrence of increased milk, protein, and fat production with increasing amounts of WCGF, without a change in DM intake, might indicate that total diet digestibility was increased when WCGF replaced diet ingredients that were possibly less digestible than WCGF. Adding WCGF to the diet also increased the amount of soluble CP in the rumen. More soluble CP may have increased rumen fermentation, resulting in a more complete fermentation of the diet and increased energy and bacterial protein becoming available to the cows.

These data show that milk, protein, fat, and ECM increased when WCGF was fed at 24 to 36% of DM. In addition, efficiency of milk production was improved. Data suggest that more than 12% WCGF is required to increase milk, protein, and fat production. Additional studies are warranted to determine the optimum amount of WCGF that could be fed to lactating dairy cows.

**Table 1. Ingredients and Nutrient Composition of Diets**

| | Diet[1] | | | |
|---|---|---|---|---|
| Item | 0% | 12% | 24% | 36% |
| Ingredient | ----------% of dry matter (DM)---------- | | | |
| Alfalfa hay | 24.54 | 24.70 | 21.26 | 18.14 |
| Corn silage | 23.06 | 23.22 | 20.10 | 17.07 |
| Corn grain | 23.88 | 20.37 | 17.60 | 15.11 |
| WCGF[2] | - | 11.36 | 22.97 | 34.05 |
| Whole cottonseed | 8.43 | 8.48 | 8.57 | 8.62 |
| Solvent soybean meal | 8.68 | 4.98 | 2.21 | … |
| Soybean hulls | 5.08 | … | … | … |
| Expeller soybean meal | 3.33 | 3.82 | 4.06 | 3.71 |
| Limestone | 1.02 | 1.10 | 1.29 | 1.41 |
| Sodium bicarbonate | 0.82 | 0.82 | 0.82 | 0.83 |
| Trace mineralized salt[3] | 0.37 | 0.37 | 0.37 | 0.37 |
| Magnesium oxide | 0.27 | 0.24 | 0.21 | 0.17 |
| Vitamin ADE premix[4] | 0.02 | 0.02 | 0.02 | 0.02 |
| Vitamin E premix[5] | 0.02 | 0.02 | 0.02 | 0.02 |
| Sodium selenite premix[6] | 0.01 | 0.01 | 0.01 | 0.01 |
| 4-Plex®[7] | 0.06 | 0.06 | 0.06 | 0.06 |
| Molasses | 0.41 | 0.41 | 0.41 | 0.41 |
| | | | | |
| Nutrient | | | | |
| DM, % | 65.20 | 61.91 | 60.91 | 60.04 |
| Crude protein, % | 18.45 | 18.36 | 18.67 | 18.90 |
| ADF, % | 21.53 | 21.03 | 20.22 | 19.14 |
| NDF, % | 33.62 | 34.25 | 35.01 | 35.38 |
| $NE_L$, Mcal/lb | 0.75 | 0.76 | 0.77 | 0.77 |
| Calcium, % | 1.15 | 1.04 | 1.04 | 0.99 |
| Phosphorus, % | 0.33 | 0.41 | 0.49 | 0.56 |
| Magnesium, % | 0.39 | 0.37 | 0.38 | 0.37 |
| Potassium, % | 1.46 | 1.52 | 1.49 | 1.49 |

[1]0%=0% WCGF, 12%=12% WCGF, 24%=24% WCGF, 36%=36% WCGF (DM basis).

[2]WCGF=Wet corn gluten feed (SweetBran, Cargill Nutrition).

[3]Composition: not less than 95.5%NaCl, 0.24% Mn,. 0.24% Fe, 0.05% Mg, 0.032% Cu, 0.032% Zn, 0.007% I, 0.004% Co.

[4]Contributed 5,750 IU vitamin A, 2,875 IU vitamin D, 17 IU vitamin E per kg of diet DM.

[5]Provided 23 IU vitamin E per kg of diet DM.

[6]Provided 0.06 mg Se per kg of diet DM.

[7]Zinpro corporation.

**Table 2. Effects of Diets on Performance of Lactating Cows**

| | Diet[1] | | | | |
|---|---|---|---|---|---|
| Item | 0% | 12% | 24% | 36% | SEM |
| DM intake, lb/day | 56.8 | 56.2 | 57.3 | 57.4 | 0.92 |
| Milk, lb/d | 80.7[a] | 82.8[ab] | 85.5[b] | 89.3[c] | 1.42 |
| Milk fat, % | 3.58 | 3.54 | 3.73 | 3.67 | 0.08 |
| Milk protein, % | 2.96[a] | 2.96[ab] | 2.98[b] | 3.02[b] | 0.02 |
| Milk MUN, mg/dL | 17.0 | 16.3 | 16.5 | 17.0 | 0.35 |
| | | | | | |
| Milk fat, lb/day | 2.88[a] | 2.93[b] | 3.15[c] | 3.29[c] | 0.08 |
| Milk protein, lb/day | 2.37[a] | 2.44[b] | 2.54[b] | 2.68[b] | 0.09 |
| ECM[2], lb/day | 80.8[a] | 82.5[a] | 87.06[b] | 91.08[c] | 1.62 |
| ECM/DM intake | 1.42[a] | 1.47[ab] | 1.52[b] | 1.60[c] | 0.03 |

[1]0%=0% WCGF, 12%=12% WCGF, 24%=24% WCGF, 36%=36% WCGF (DM basis).
[2]Energy corrected milk.