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Economic Evaluation of Wet Corn Gluten Feed in Beef Feedlot Finishing

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Abstract

An economic evaluation of wet corn gluten feed used in beef feedlot finishing was done. Data were from feeding trials at North Dakota State University. Four rations were analyzed at 0 percent, 28 percent, 56 percent, and 85 percent wet corn gluten based on dry matter intake. Data were entered into a computer model that integrated the feeding trial data with economic input and output prices. A typical feedlot example was used. Results indicated that the 56 percent ration was the most biologically efficient. A matrix of results can be shown for various corn prices, relative to wet corn gluten feed prices and quantities fed. Based on this study, wet corn gluten feed is priced competitively with other feed stuffs.

Key Words: wet corn gluten feed, feeding trials, feedlot, finishing, beef, economic analysis, North Dakota

Economic Evaluation of Wet Corn Gluten Feed in Beef Feedlot Finishing*

Ronald H. Haugen and Harlan G. Hughes**

The Situation

Opening of the ProGold wet milling corn processing plant near Wahpeton, North Dakota, has created a need to determine the economics of feeding wet corn gluten feed (WCGF). WCGF is produced by the plant as a co-product of manufacturing fructose corn sweetener. WCGF may be used as a feed alternative by feedlot operators and cattle owners attempting to improve profits in the face of fluctuating prices for feeder cattle and feedstuffs. The economic feasibility of feeding WCGF in beef cattle feedlot rations was studied by considering various rations in a 1,000-head maximum capacity lot.

Background

"Corn gluten feed is the part of the corn kernel that is left after extraction of starch, gluten, and germ. It is composed mainly of corn bran (fiber fraction) and condensed steep liquor (corn extractives) in a two-third to one-third proportion. Wet corn gluten feed is extremely palatable and traditionally has been used as a protein and energy source for cattle." (ProGold)

"Wet corn gluten feed can be stored by unloading on cement slab, placed into a pit silo or extended with other feeds, and put into tower silos. For long-term storage, wet corn gluten feed can be stored in pit silos, if the surface is well-packed or sealed, or it can be mixed with other ingredients (such as corn silage, etc.) prior to ensiling in tower silos. Feeding and handling wet corn gluten feed will depend on the method of storage and feeding systems available. Wet corn gluten feed can easily be handled in traditional automated systems or front end loader mixer wagon combination." (ProGold)

Feeding Trials

Data were from feeding trails conducted in Fargo, North Dakota, by the NDSU Agricultural Experiment Station from February 7, 1996, to June 26, 1996 (D.V. Dhuyvetter et al., 1996). One-hundred forty-four Charolias and Red Angus crossbred steers were purchased from a single producer in central North Dakota and fed for 140 days. Incoming steer weights were 746 pounds ± 35 pounds.

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Six rations were used for analysis with WCGF included at 0 (control ration), 28, 56, and 85 percent of dry matter substitute for dry rolled corn. Two additional rations were 28 percent WCGF with barley and 28 percent WCGF with naked oats (V. Paul). All rations were isocaloric and supplemented with minerals and an ionophore (Bovatec or Rumensin®). Table 1 shows the results of the feeding trials. This paper discusses only the incremental increasing of WCGF diets using the 0 (control ration), 28, 56, and 85 percent rations.

Table 1. Cumulative Feeding Performance for Finishing Steers

Item	Percent Dietary WCGF			
	0	28	56	85
Liveweight	----------pounds----------			
0 days	743	752	753	750
28 days	844	854	870	851
56 days	942	962	982	928
84 days	1033	1060	1075	1016
112 days	1116	141	1159	1101
140 days	1206	1251	1272	1199
Dry Matter Intake	----------pounds/head/day----------			
28 days	17.5	19.3	19.8	18.8
56 days	18.0	20.2	20.6	18.9
84 days	19.0	21.1	21.4	19.6
112 days	19.5	21.8	21.9	20.0
140 days	19.6	22.5	22.1	20.5
Average Daily Gain	----------pounds/head/day----------			
28 days	3.50	3.87	4.03	2.74
56 days	3.56	3.74	4.10	3.45
84 days	3.46	3.66	3.85	3.16
112 days	3.33	3.48	3.63	3.13
140 days	3.31	3.56	3.71	3.20
Feed/Gain	----------pounds/pounds----------			
28 days	5.02	5.49	4.76	5.28
56 days	4.88	5.41	5.04	6.10
84 days	5.37	5.78	5.58	6.22
112 days	5.79	6.28	6.02	6.39
140 days	5.86	6.32	5.97	6.40

SOURCE: Dhuyvetter, 1996.

Performance with this feeding trial was consistent with other studies. Most research on WCGF was done in a warmer climate than North Dakota. Perry (1987) showed a 14 percent average daily gain over the control ration at 44 percent WCGF and a decrease in average daily gain at 99.5 percent WCGF. Ham et al. (1993) had similar results. North Central Regional Research Publication No. 319 (1989) also showed a decrease in performance at 90 percent WCGF.

The Economic Model

The main objective of the study was to measure the economic differences of feeding alternative levels of WCGF in the ration. The optimal ration depended on relative prices and quantities for corn and WCGF. A computer model that integrated the feeding trial data with economic input and output prices was used to determine the economic returns for each ration. A typical feedlot example was used. All variables were held constant except the feed cost and quantities. The model used was the "*Feeding Ver 1.0*" computer budgeting tool developed by the NDSU Extension Service (Haugen, 1994).

Model Assumptions

The model was not intended to forecast prices or costs, but to determine the economics of feeding WCGF in cattle feeding rations.

Feedlot assets were assumed to be 60 percent financed with 40 percent equity. A 5 percent nominal opportunity cost on equity capital and a 10 percent nominal interest rate on operating capital was assumed. Operating capital was assumed to be 100 percent borrowed. Operating interest was calculated based on the sum of the beginning head value plus one-half of the sum of the feed and variable costs times the interest rate. A 10 percent nominal interest rate was assumed for fixed asset financing. Shrink, the estimated loss of weight from transporting the animals to market, was assumed to be 3 percent. Death loss was assumed to be 1 percent and was calculated by multiplying the sum of the beginning head value plus one-half of the sum of feed and variable costs by 1 percent. It was assumed that the deaths occur halfway through the feeding cycle. Hauling (to market) costs were assumed to be $1.06 per hundredweight. Marketing costs were assumed to be zero with a $1.00 per head promotion checkoff fee.

Prices for beginning value and sales value were obtained from the West Fargo Stockyards, West Fargo, North Dakota, on February 7, 1996, and June 26, 1996, respectively. These are the beginning and ending dates of the feeding trial period.

Feed Cost Calculations

Feed costs are shown in Table 2. Corn prices of $2.00, $2.50, and $3.00 were selected. The WCGF price was calculated at 37.5 percent of the corn price per ton on a wet basis. ProGold uses the average corn price of five local elevators. For example, at $3.00 corn, the cost

is $0.05357 per pound. $0.05357 times 2000 pounds equals $107.14 per ton for corn. $107.14 times 37.5 percent equals $40.18 per ton for WCGF.

Fifty-mile transportation of WCGF from Wahpeton to Fargo was assumed. In the 50-mile zone, ProGold charges $3.50 per ton (on the date of this publication) with a 25 ton load per truck assumed. This calculates to $0.0018 per pound for transportation and is included in the WCGF price. It was assumed that the WCGF was used as it was delivered and a concrete slab was available for short-term storage.

Table 2. Feed Price Assumptions

Major Ingredients:	Wet Corn Gluten Feed	37.5% the price of corn
	Corn Grain	$2.00, $2.50, $3.00 per bushel
	Alfalfa	$50 per ton
Supplement Ingredients:	Corn Meal	$0.065 per lb
	Corn Gluten Meal 60%	$0.2835 per lb
	Soybean Meal 44%	$293 per ton
	Limestone 44%	$0.045 per lb
	Urea	$18.60 per cwt
	Molasses, Dried	$0.1275 per lb
	Trace Salt Mineral	$1.08 per lb
	Zinc Sulfate	$0.444 per lb
	Fat	$0.25 per lb
	Thiamin	$21.56 per lb
	Bovatec	$5.81 per lb
	Dicalcium Phosphate	$19.00 per cwt
	Potassium Sulfate	$12.00 per cwt

SOURCE: Dhuyvetter , 1996.

Operating Costs

Operating costs including fuel, oil, electricity, supplies, veterinary, medicine, insurance, bedding, repairs, office expenses, and miscellaneous supplies were from the Duncan (1997) feedlot study. A $0.12 per head per day cost was assumed for operating costs for a 140-day

feeding cycle. This would amount to $16.80 per head. These costs were combined and divided into four main areas: veterinary and medicine, repairs, utilities and miscellaneous. The Jones (1996) and USDA ERS (1990) studies were used to allocate costs with a breakdown listed in Table 3.

Table 3. Breakdown of Operating Costs of $16.80 Per Head

Operating Costs	
Veterinary and Medicine	$5.00
Repairs	$4.00
Utilities	$3.00
Miscellaneous	$4.80
TOTAL	$16.80

Labor and Management

Total labor costs of $52,000 per year were used from the Duncan (1997) study, including a lot manager at $35,000 per year and an assistant manager at $17,000 per year. The per head allocation would be $20.80 per head if this 1000-head lot was utilized at capacity (2.5 turns per year or 2500 head). This would equate to $0.057 per head per day.

Machinery, Equipment, and Buildings

Machinery, equipment, and building investment costs and loan data were taken from Duncan (1997). The feedlot was assumed to have a 1000-head maximum capacity with 2.5 turns per year (2,500 head). Fixed costs were allocated per head for the year. Prices for machinery, equipment, and buildings used are listed in Tables 4, 5, and 6, respectively. The length of loan was used as a proxy for years of usable life. A 10 percent salvage value was assumed for each item. Insurance cost was assumed to be 0.25 percent of the value.

Table 4. Machinery List for a 1000-Head, One-Time Capacity Feedlot

Machinery List	Price
Tub Grinder	$59,360.00
Loader Tractor	$52,000.00
Feed Truck	$51,000.00
Tandem Truck	$40,000.00
Tractor	$20,000.00
4wd Pickup	$10,000.00
Other Machinery	$19,610.00
TOTAL	$251,970.00

SOURCE: Duncan, 1997.

Table 5. Equipment List for a 1000-Head, One-Time Capacity Feedlot

Equipment List	Price
Feed Bunks	$56,442.00
Corral Fence	$30,946.00
Scale	$25,000.00
Lights	$8,400.00
Waterers	$2,240.00
Gates	$2,806.00
Plank/Work Fence	$7,151.00
Windbreak/Wells	$11,915.00
TOTAL	$144,900.00

SOURCE: Duncan, 1997.

Table 6. Building List for a 1000- Head, One-Time Capacity Feedlot

Building List	Price
Concrete	$29,110.00
Office	$23,000.00
Lagoon	$12,442.00
Ditching	$1,520.00
Grain Handling	$31,792.00
Land	$6,000.00
TOTAL	$103,844.00

SOURCE: Duncan, 1997.

Results

Difference in net return was due to changes in gross margin (based on pounds gained per animal), feed cost, operating margin, hauling costs, shrink, and death loss. Results are shown in Table 7 and Figure 1. Many factors influenced the net return, including biological effects of the ration in terms of gain per day and feed efficiency. The 56 percent ration had more biological effect on net return than feed cost effect. The 85 percent ration showed a decline in production with an increased quantity of WCGF.

Table 7. Economic Net Return Per Head for Various Rations at Selected Corn Prices (WCGF 37% Price of Corn)

Corn Price/ bu	0% WCGF	28% WCGF	56% WCGF	85% WCGF
$2.00	$36.30	$47.07	$68.34	$33.97
$2.50	$12.00	$21.98	$45.32	$14.68
$3.00	($12.86)	($3.52)	$22.09	($4.60)

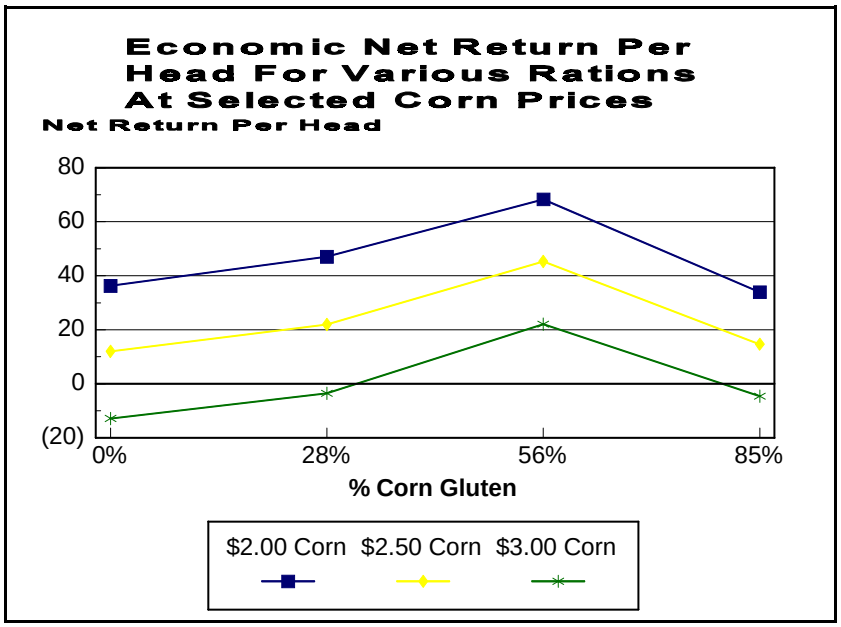

Figure 1. Economic Net Return Per Head for Various Rations at Selected Corn Prices (WCGF at 37.5% Price of Corn)

Integrating the price and quantity changes of WCGF in the computer model changed various items. Items affected are gross margin, feed cost, operating interest, hauling costs, shrink, and death loss. Gross margin was affected by the various gains based on the rations. Feed cost varied depending on the price and quantity of each type of feed. Operating interest cost varied directly as a result of changes in gross margin, feed cost, and variable costs. Hauling costs varied with the pounds of beef marketed. Shrink loss estimate was directly related to the pounds marketed. Death loss estimate varied based on the beginning head value, feed costs, and variable costs. Tables 7a, 7b, and 7c show the breakdown of net return changes for each ration (totals may vary due to rounding error).

Table 7a. Breakdown of Net Return Change Comparing the 28%, 56%, and 85% Ration to the Control Ration with $2.00 Corn

Ration Percent	28 %		56 %		85 %	
$2.00 corn control ration net return		36.30		36.30		36.30
Change in gross margin	21.39		33.21		(8.14)	
Change in feed cost	(8.88)		0.96		5.68	
Change in operating interest	(0.37)		(0.20)		(0.05)	
Change in hauling cost	(0.48)		(0.70)		0.07	
Change in shrink estimate	(0.80)		(1.17)		0.12	
Change in death loss estimate	(0.10)		(0.05)		(0.01)	
Total adjusted net return		10.77		32.04		(2.33)
Net return for ration		47.07		68.34		33.97

Table 7b. Breakdown of Net Return Change Comparing the 28%, 56%, and 85% Ration to the Control Ration with $2.50 Corn

Ration Percent	28 %		56 %		85 %	
$2.50 corn control ration net return		12.00		12.00		12.00
Change in gross margin	21.39		33.21		(8.14)	
Change in feed cost	(9.65)		(2.21)		10.57	
Change in operating interest	(0.38)		(0.17)		0.05	
Change in hauling cost	(0.48)		(0.70)		0.07	
Change in shrink estimate	(0.79)		(1.16)		0.13	
Change in death loss estimate	(0.10)		(0.05)		0.01	
Total adjusted net return		9.98		32.32		2.68
Net return for ration		21.98		45.32		14.68

Table 7c. Breakdown of Net Return Change Comparing the 28%, 56%, and 85% Ration to the Control Ration with $3.00 Corn

Ration Percent	28 %		56 %		85 %	
$3.00 corn control ration net return		(12.86)		(12.86)		(12.86)
Change in gross margin	21.39		33.21		(8.14)	
Change in feed cost	(10.28)		3.79		16.01	
Change in operating interest	(0.40)		(0.15)		0.15	
Change in hauling cost	(0.48)		(0.70)		0.07	
Change in shrink estimate	(0.80)		(1.17)		(0.12)	
Change in death loss estimate	(0.11)		(0.04)		0.04	
Total adjusted net return		9.35		34.95		8.26
Net return for ration		(3.52)		22.09		(4.06)

The increased profit (loss) as a percent comparing the control ration to other rations for selected corn prices is shown in Table 8. The greatest percentage increase was at the $2.50 corn price for the 56 percent ration, a $12.00 net return increased by 278 percent to a $45.32 net return. At the $2.00 corn price the 85 percent ration decreased 6 percent from $36.30 to $33.97.

Table 8. Increased Profit (Loss) as a Percent Comparing the Control Ration to Other Rations at Selected Corn Prices

Corn Price / bu	0% WCGF Control Ration Net Returns	28% WCGF		56% WCGF		85% WCGF	
		Percent Increase (Decrease)	Net Return	Percent Increase (Decrease)	Net Return	Percent Increase (Decrease)	Net Return
$2.00	$36.30	30%	$47.07	88%	$68.34	(6%)	$33.97
$2.50	$12.00	83%	$21.98	278%	$45.32	22%	$14.68
$3.00	($12.86)	72%	($3.52)	271%	$22.09	64%	($4.60)

Wet Corn Gluten Feed Variable Pricing

Since only the fixed WCGF price of 37.5 percent of the price of corn was assumed, variable WCGF prices were analyzed to determine the breakeven percentage. Table 9 shows the percentage of the corn price where the WCGF price would make each ration equal in net returns to the control ration. In other words, what could be charged for WCGF to make it equal in profit to a ration containing only corn grain.

Table 9. Percent of Corn Price to Determine WCGF Price to Equate to Control Ration Net Return for Selected Corn Prices

Corn Price/bu	0% WCGF (Control Ration) Net Return	28% WCGF	56% WCGF	85%WCGF
$2.00	$36.30	51.8%	51.8%	36.4%
$2.50	$12.00	48.2%	55.6%	38.5%
$3.00	($12.86)	45.5%	53.2%	39.9%

Additional analysis was conducted to look at variable percentage pricing of WCGF. For this analysis a variable percentage was used to equate to the 56 percent ration. The 56 percent WCGF ration showed a high economic return for each corn price and the best biological effect. The WCGF price as a percentage of corn was varied in the 28 percent and 85 percent rations to equal the 56 percent ration economic return for each corn price (Table 10).

Table 10. Percent of Corn Price to Determine WCGF Price at the 28% and 85% Rations for Selected Corn Prices

Corn Price/bu	28% Ration		85% Ration	
	Percent of Corn Price	Net Return	Percent of Corn Price	Net Return
$2.00	9.2%	$68.34	21.0%	$68.34
$2.50	12.5%	$45.32	25.8%	$45.32
$3.00	14.6%	$22.09	28.7%	$22.09

Conclusions

It is profitable to feed wet corn gluten feed. The 56 percent ration showed the best net return and is the most biologically efficient. Variable WCGF pricing would make either ration economically feasible. The returns are dependent on the price of corn, the relative price of WCGF and quantities fed. This analysis does not give a definite answer but shows variable outcomes based on common scenarios. For the feedlot manager interested in feeding WCGF, feeding WCGF at the current ProGold 37.5 percent of corn price looks profitable. WCGF is priced competitively with other feed stuffs and would be an effective alternative use of the co-product and provide a benefit to the feedlot as well as a value-added benefit to the region.

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