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Economic Returns of Wet Byproducts as Cattle Feed

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Feeding wet byproducts from grain processors to cattle has grown in Nebraska until over a million tons are now being fed, with net benefits of over $42 million per year.

Summary

Research at the University of Nebraska and other institutions has demonstrated the feasibility of feeding corn sweetener/ethanol industry byproducts directly to cattle in wet form, rather than marketing them as dried feeds. Using a combination of experimental results, survey data and market prices, the average value of these wet feed products was about $130 per ton of dry matter during the 1990s, compared to their alternative value as dried feed of $93 per ton. Given the amounts fed, the annual net benefits of this innovation in Nebraska grew from about $1 million in 1992 to an annual average of about $42 million during 1997-99.

Introduction

Due to new technologies and ample irrigation resources, Nebraska's grain production grew faster than any other major producing state during the 1970s and 1980s. The relatively cheap grain that resulted was a factor that both encouraged cattle feeding (to the extent that during the same period Nebraska went from fifth to second largest cattle feeding state) and attracted grain processing plants (Nebraska capacity for producing corn sweeteners and ethanol grew faster than any other state in the past decade). A second factor important in attracting corn processing plants was the research demonstrating that processing byproducts can be fed directly to the expanding numbers of finishing cattle, rather than being dried and shipped to distant markets. The study reported here is an evaluation of the direct economic benefit of the innovation of feeding wet byproducts directly to finishing cattle, rather than further processing them for the dried feed market.

The experimental work at the University of Nebraska and elsewhere has established the possibilities for substituting wet corn gluten feed, wet distillers grains and steep liquor for other feeds in beef cattle feedlots. The approach of this study is to estimate the feed value of these byproducts (the value of the feeds for which they substitute) and to subtract from that, the value of the byproducts in their next best use, which is their value as dried feeds

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adjusted for drying costs. This is a measure of the net benefit of the innovation of feeding a unit of the material in wet form rather than dry. We use survey data and plant production estimates to estimate the total amount of such feeds fed. We also examine the distribution of benefits between the processor and the cattle feeder, which depends upon the price charged for the byproducts.

Procedure

The imputed value of byproduct feed (the "shadow price" of the feed) was determined from the results of 18 different experiments (or sets of experiments) as the change in the cost of other feed inputs per pound of beef produced, divided by the number of pounds of byproduct fed per pound of beef. This in turn depends upon the prices of alternative feeds and can be represented as:

V_j *= imputed value per pound of the j-th byproduct fed*

$$= \frac{1}{x_j}\frac{\partial c}{\partial \tau} = \sum_{i \neq j} p_i \frac{1}{x_j}\frac{\partial x_i}{\partial \tau}$$

$$= \sum_{i \neq j} \beta_{ij} p_i, \text{ where } \beta_{ij} = \frac{1}{x_j}\frac{\partial \tau_i}{\partial \tau}$$

Here x_i represents pounds of feed i (dry matter basis) fed per pound of gain, c is feed cost per pound of gain, $\partial x_i/\partial \tau$ the amount in a standard ration minus that in a wet byproducts ration, p_i the price of feed i (dry matter basis here), and β_{ij} is the pounds of dry matter of feed i for which a pound of byproduct j substitutes. For those experiments which included multiple wet byproduct rations, we considered only that byproduct ration that provided the lowest cost per pound of gain.

The imputed value of wet byproduct feeds as determined by the above procedure will vary from year to year as the value of substituted feeds change. To determine the net benefit of feeding the byproduct in wet form, the estimated opportunity cost of selling the feed as a dried byproduct subtracted from the imputed value was estimated. This opportunity cost for a given year was the market price of the dried feed less an estimated $20 per ton of dry matter for drying cost. Finally, to calculate the distribution of this net benefit between cattle feeder and processor, we used the average delivered price of wet byproducts, as determined from survey responses from 183 feedlot operators in Nebraska.

Finally, to estimate the total benefits of the wet feeding innovation in Nebraska, we obtained estimates from the Nebraska Ethanol Board of the amount of grain processed by Nebraska plants, and from this we estimated the total amount of byproducts fed in wet form by Nebraska cattle feeders, from 1992 through 1999.

Table 1. Wet byproduct feed value coefficients, per ton of byproduct dry matter.

		Feed value coefficient (β_{ij})[b]		
Feed ingredient and units	Avg price per unit[a]	Wet distillers grains	Wet gluten feed	Steep liquor
Alfalfa hay, per ton	$57.88	0.0301	0.0094	0.2082
Alfalfa silage, per ton	$22.36	0	0	0
Corn cobs, per ton	$20.00	0	0.0015	0
Corn silage, per ton	$22.64	0.0279	0.0741	0
Dry rolled corn, per bushel	$2.43	49.8432	38.0045	64.2591
Liquid 32, per cwt	$7.00	0	0.0305	0
Molasses, per cwt	$9.71	1.1248	2.0104	0
Soybean meal, per ton	$192.68	0	0.0108	0
Suppl, per ton	$100.00	0.0100	0.0172	0.0405
Urea, per ton	$210.00	0.0211	0.0155	0
Other, per ton	$200.00	0	0.0064	0
Average imputed value		$140.03	$122.81	$165.07

[a]1992 to 99.
[b]Per unit of ingredient, rather than per pound of dry matter.

Results

Table 1 summarizes the value coefficients for the three wet byproducts, expressed in terms of units of traditional ingredients (units as specified in the table) for which one ton of wet byproduct substituted in the experiments. One ton of dry matter in wet distillers grains, for example, substituted for .03 tons of alfalfa hay, 49.8 bushels of dry rolled corn, etc, which had a total value of $140.03 per ton, when these traditional ingredients were valued at average 1992-99 prices. The imputed value of wet gluten feed was somewhat lower at $122.81, while that for steep liquor was somewhat higher at $165.07.

Table 2 summarizes our estimates of

Table 2. Summary of value and benefits per ton DM of wet byproduct fed from 1992-1999.

	Wet distillers grain				Wet gluten feed				Steep liquor			
	Feed value	Deliv. price	Opp. cost	Total benefit	Feed value	Deliv. price	Opp. cost	Total benefit	Feed value	Deliv. price	Opp. cost	Total benefit
1992	114.33	82.28	95.78	18.55	154.18	100.00	95.78	58.39				
1993	111.31	86.76	80.92	30.39	149.44	95.85	80.92	68.52				
1994	141.35	67.48	121.82	19.53	122.83	98.99	84.23	38.59	167.43	83.91	84.23	83.20
1995	146.08	123.96	107.02	39.06	127.67	90.26	81.98	45.69	173.02	102.13	81.98	91.04
1996	173.24	123.12	160.71	12.53	149.75	121.63	114.69	35.05	207.19	107.20	114.69	92.50
1997	150.66	113.78	135.33	15.33	131.43	102.66	80.67	50.76	178.64	113.60	80.67	97.97
1998	138.98	98.67	97.78	41.20	122.78	93.32	95.56	27.22	162.53	92.12	95.56	66.98
1999	112.47	93.97	83.33	29.13	102.37	88.87	77.78	24.60	128.15	87.73	77.78	50.37
Avg	140.03	107.08	117.24	22.79	122.81	97.09	88.95	33.86	165.07	100.45	88.95	76.12

Table 3. Quantity fed and economic benefits of wet byproduct feeds in Nebraska from 1992-1999.

	1992	1993	1994	1995	1996	1997	1998	1999
Wet distillers grains								
Quantity (1,000 tons DM)	0	0	70.0	145.8	173.3	311.0	345.1	352.4
Benefit ($1,000,000)	$0.00	$0.00	$1.37	$5.69	$2.17	$4.77	$14.22	10.27
Wet corn gluten feed								
Quantity (1,000 tons DM)	30.2	233.3	233.3	581.2	446.9	752.7	825.1	825.1
Benefit ($1,000,000)	$0.56	$7.09	$9.00	$26.55	$15.66	$38.21	$22.46	$20.30
Steep liquor								
Quantity (1,000 tons DM)	6.8	52.5	52.5	57.8	44.0	69.5	78.5	78.5
Benefit ($1,000,000)	$0.40	$3.60	$4.37	$5.27	$4.07	$6.81	$5.26	$3.95
All byproduct feeds								
Quantity (1,000 tons DM)	37.0	285.8	355.8	784.8	664.2	1133.3	1248.7	1256.0
Benefit ($1,000,000)	$0.96	$10.69	$14.74	$37.51	$21.90	$49.78	$41.94	$34.51

the net economic benefit of the wet byproduct feeding innovation. The bottom line indicates the average feed value of wet distillers grain was $140 per ton, while the opportunity cost as dried feed was $118 per ton, for an average net benefit of $22 per ton. Delivered price averaged $107, indicating an average gain of $32 per ton to feeders, and a $10 per ton loss to processors. Over the past two years processors have obtained a positive $5.77/ton benefit. It appears processors sold wet grains lower than the opportunity cost in order to establish the market during the first few years.

Conversely, corn gluten feed was marketed above the opportunity cost beginning in 1992. The benefit to the processors has been $8.14 per ton and the benefit to producers has been $25.72.

In Table 3 we summarize our estimates of the quantities of byproduct feeds fed in Nebraska, and the total net benefits generated according to the estimated values per ton as reported in Table 2. As of 1992, the amount of byproducts fed was negligible, but by 1997 the amount fed had grown to over a million tons, with an estimated net benefit of nearly $50 million. Currently, 30% of the benefits are from distillers grains from the dry milling industry and 70% from the wet milling industry which produces corn gluten feed and steep liquor.

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