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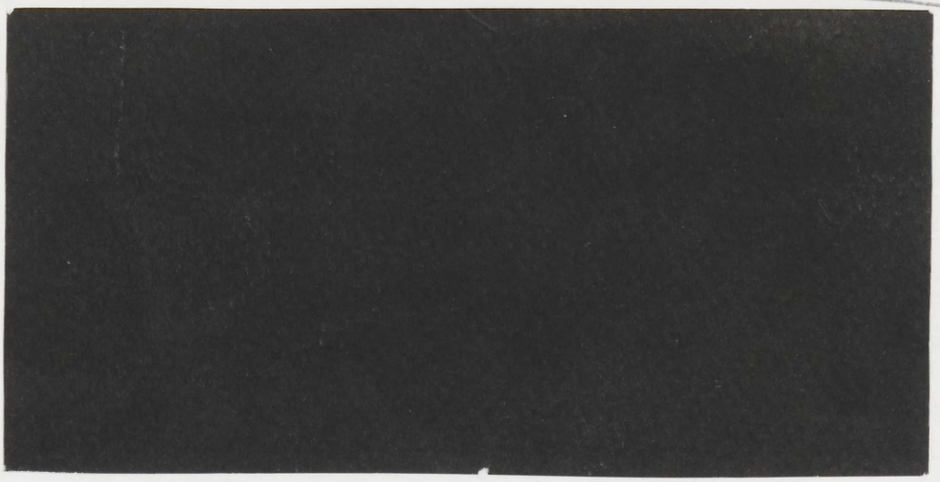

PRESENTED AT AAEA ANNUAL MEETINGS,
URBANA - CHAMPAIGN, JULY 27-30, 1980

THE PENNSYLVANIA STATE UNIVERSITY · 1855 ·

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY DEPARTMENT

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Staff Paper 34 July 1980

Recycling Paper Mill Wastes as Cattle Feed in Small Livestock Operations

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Presented at AAEA meetings, Urbana, July 27-30, 1980.

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Millions of tons of wastes produced annually by food processing and forest product firms are now disposed of by landfill or burning. These disposal activities frequently involve significant costs to the firm and often have undesirable environmental effects. A portion of this waste has been utilized in the past for livestock feed. Cotton gin thrash, brewer's grain, apple pommace, tomato pulp, sweetcorn wastes and sugar beet pulp have all been used for livestock feed in the past. Organic wastes from the forest products industry present a source of potential feedstuff that is largely untapped. Nearly 60 million tons of waste are produced each year by forest products firms and a significant portion of it is in the form of processed cellulose--a ready energy source for ruminants.

This study looks at a specific waste product from sulfite-based paper mills. The product consists of the wood fibers that are too short to be used in the paper-making process and are referred to as "fines." Because of the sulfite treatment, the fines are predigested for ruminants and constitute a high energy feed source. It is hypothesized that including fines in the ration for cattle will significantly reduce the cost of beef production relative to operations based on conventional feeds.

The Study

The study simulates the costs and returns for typical 100 head cow-calf, stocker and feeder operations using either a conventional ration or a ration including fines. The daily rations and costs based on 1978 prices in eastern Pennsylvania markets are shown in Table 1. The fines

were priced at $2.00 per ton. This is the price charged for fines by a paper products plant in northeastern Pennsylvania which sells fines to cattle feeders. None of the rations shown have been optimized, but rather, reflect typical rations used in eastern Pennsylvania for feeding the indicated types of livestock. All of the rations meet the nutritional requirements given by Ensminger. The proportion of fines in Ration 2 have been demonstrated by Lemieux and Wilson to be palatible and to produce carcases of quality equivalent to grain based rations, such as Ration 1. Rations which combined fines with hay or corn silage rather than corn stover were also studied, but were found to cost between seven and nine cents per day more than the ration using corn stover and thus, were dropped from further analysis.

For each of the three types of livestock, Ration 2 costs less than Ration 1. The savings amount to 30.3 percent for dry cows, 35.1 percent for stockers and 28.1 percent for feeders. This substantial reduction in feed costs contributes significantly to the profitability of raising cattle. As is shown in Table 2, the net profit of a cow-calf operation increases $16.06 per head (50.4 percent) and that of a feeder program increases $40.14 per head (57.8 percent) while the losses shown for stocker operations using conventional rations are turned to a slight profit. For the total livestock program, profits increase $79.24 (101.2 percent). If the stocker and feeder programs were integrated in one location, the profits would increase more since transportation, shrinkage and death losses from moving the feeder cattle would be eliminated.

Thus far the analysis has not considered transportation costs for

shipping the wood fines from the paper mill to the livestock operation. At the time of this study (Spring 1978), the cost most frequently quoted in the northeastern Pennsylvania study area for hauling this type of product was five cents per ton-mile. At that rate fines could be hauled 97 miles from the paper mill and the fines ration would just equal the cost of the conventional ration for dry cows. The break even distance is 205 miles for stockers and 223 miles for feeders. In the studied area of eastern Pennsylvania these distances are great enough that the livestock feeding areas of southeastern Pennsylvania are well within the feasible shipping region from the paper mill located in the northeastern part of the state. The 250 tons per day of fines produced by this paper mill would be sufficient to provide the basic ingredient for the feeding of 25,000 head of feeders per year at a saving in feed costs if the feedlots were within 223 miles of the mill.

Sensitivity Analysis

Several factors in the preceding analysis can vary and would affect the results. The price charged by the paper plant for the waste fines, the transportation rates for hauling fines and the price of conventional feed materials, especially corn are major elements of the analysis that are examined in this section.

For the paper mill, fines are a waste product and incur a cost for disposal, usually by landfilling. The cost will vary depending upon distance to a suitable landfill and the charge for using the landfill. The paper plant referred to in this study has a cost of between $3.50 and $5.50 per ton for fines disposal depending on the landfill used. In theory

at least, a company would be indifferent among acceptable disposal alternatives and would be willing to pay up to the landfilling cost for a farmer to take the fines. The farmer would perceive this as a negative price for a feed ingredient. In practice, the studied paper mill has sold the fines to farmers for $2.00 per ton. There does not seem to be any analytical basis for this price and a higher or lower price could be arrived at through bargaining.

A range of prices for the fines was examined and the results are presented in Table 3. Also shown in Table 3 is the result of increasing the transportation costs from five cents per ton-mile to 10 and 15 cents per ton-mile. With the five cents per ton-mile charge used in the previous example, one can see the impact of different prices for fines on the feasible region for feeding fines based rations to different types of livestock. The maximum distance for using fines for feeding dry cows increases from 97 miles to 177 miles when the price falls from $2.00 per ton to a minus $4.00 (payment of $4.00 per ton from the paper mill to the farmer). Similarly the feasible region increases to a radius of 320 miles for stockers and 343 miles for feeders. Raising the price to $4.00 per ton or increasing the transportation costs decreases the radius of the feasible region, but even with the highest price and transportation costs shown, there is an area of considerable size around a paper mill where it would be feasible to feed cattle fines based rations.

The economic benefits from the use of waste products in livestock feed rations are, of course, a function of the price differential between a waste-based ration and conventional rations. The previous analysis

assumed that conventional feeds were priced at the levels prevailing in the study area in 1978. At that time the price for number two shelled corn was $2.25 per bushel. Sensitivity to changes in the price of the conventional ration was determined by varying the shelled corn price and increasing or decreasing the price of other components of the conventional ration proportionately.

The results of varying conventional ration costs for feeders are shown in Figure 1. The price of feed ingredients are represented on the horizontal axis by corn price. The resulting cost of the conventional ration (#1) is shown by the diagonal line. The horizontal lines indicate the cost of a fines based ration if the fines cost $2.00 per ton at the paper plant and transportation costs five cents per ton-mile for the indicated distances. For example, at a distance of 100 miles from the paper plant, the conventional ration and the fines based ration have equal costs if the corn price is $1.75 per bushel and other conventional ingredients are proportionately (22.5 percent) lower than in the base analysis. At all higher prices of conventional ration ingredients, the fines based ration is cheaper. At a distance of 300 miles, the break-even price for conventional ingredients is $2.30 per bushel for corn. Similar results, although with lesser distances, were found for dry cows and for stockers.

Conclusions

The objective of this study was to analyze the economics of changing from conventional feeds to rations based on a paper mill waste product in small cattle raising and feeding operations. Significant savings can be achieved in the overall costs of raising, growing and fattening livestock

by including waste products in the feed rations. In a cow-calf operation the potential feed cost savings is 31 percent, for a stocker operation it is 35 percent and for feeders, the potential feed cost saving amount to 28 percent. These savings are reduced as the distance the paper mill fines have to be transported increases and as the price charged for the fines increases. The potential savings increase as the prices of conventional feeds increase. Using prices in effect in eastern Pennsylvania in 1978, it is economically feasible to use fines based rations within a 225 miles radius of the paper mill for feeders and a 100 mile radius for dry cows. The savings in feed costs and the size of the feasible regions appear to be large enough for farmers to consider using paper mill fines in the feeding of cattle. Such use would have the additional social benefit of recycling at least a portion of a product that is currently treated as a waste. The reduced demand for landfill space could be a significant benefit in certain areas near large paper mills.

References

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Table 1. Composition and Costs per Head per Day of Alternative Rations[a]

	Ration 1 Conventional		Ration 2 Fines and Stover	
	lbs.	cents	lbs.	cents
Dry Cows				
Corn silage	50	22.5	---	---
Corn stover	---	---	10.0	6.0
Protein supplement	1	9.5	1.3	12.3
Fines	---	---	40.0	4.0
Cost		32.0		22.3
Stockers				
Corn silage	32	27.0	---	---
Corn stover	---	---	10.0	6.0
Protein supplement	1	9.5	1.6	15.2
Fines	---	---	25.0	2.5
Cost		36.5		23.7
Feeders				
Corn grain	5	27.5	1.8	9.9
Corn silage	40	34.0	---	---
Corn stover	---	---	10.0	6.0
Protein supplement	2	19.0	4.0	38.0
Fines	---	---	40.0	4.0
Cost		80.5		57.9

[a]Costs of rations are computed using market prices for ingredients in eastern Pennsylvania, Spring 1978.

Table 2. Revenues and Costs per Head for Cow-calf, Stocker and Feeder Operations under Alternative Feeding Programs.

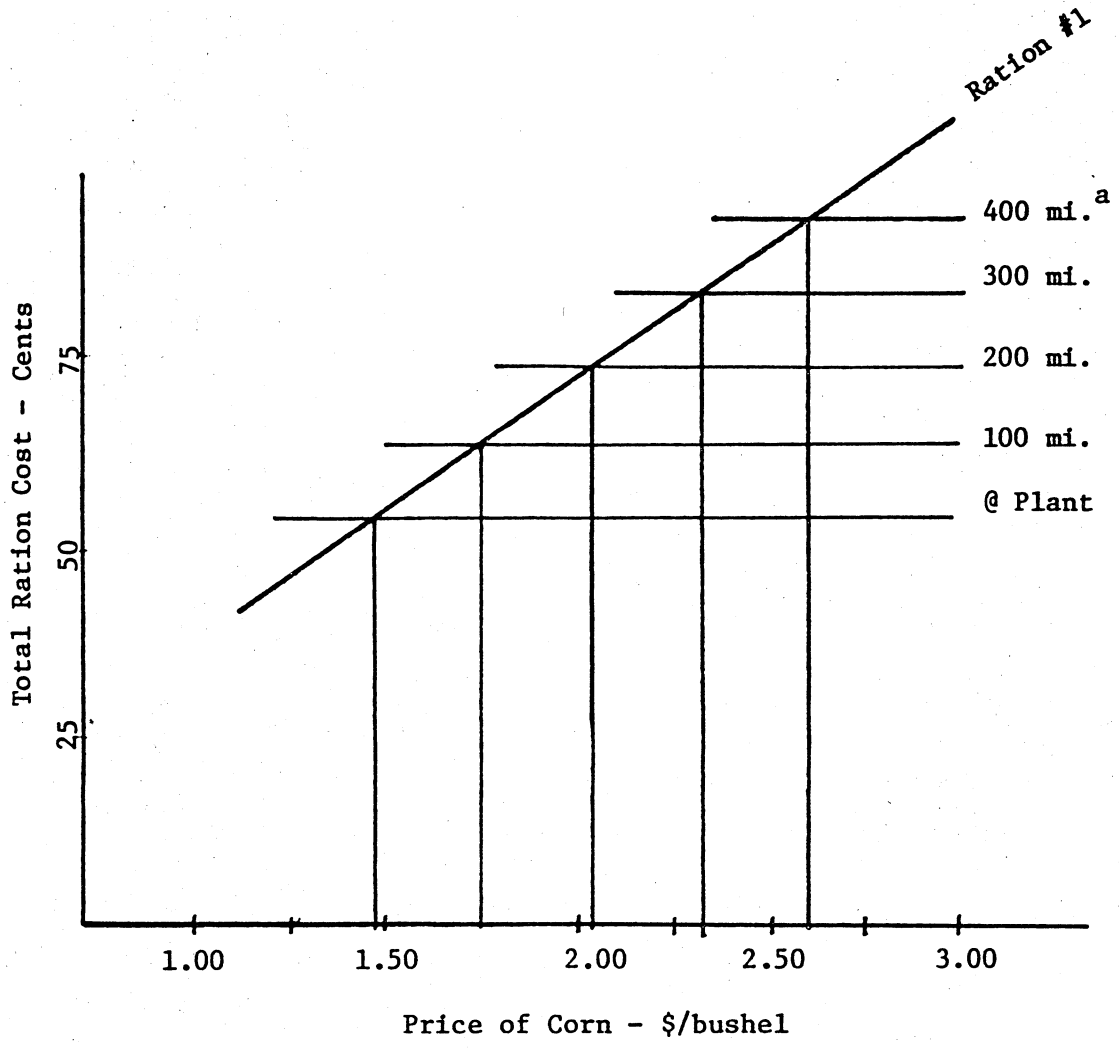
	Ration 1	Ration 2
Cow-calf		
Gross revenue (@ $55/cwt.)	$247.00	$247.00
Non-feed costs[a]	136.00	136.00
Feed costs	57.60	40.14
Net profit	$ 31.87	$ 47.93
Stocker		
Gross revenue (@ $52/cwt.)[b]	$320.00	$320.00
Cost of calf	247.00	247.00
Non-feed costs	30.24	30.24
Feed costs	65.70	42.66
Net profit (loss)	$(22.94)	$ 0.10
Feeder		
Gross revenue (@ $60/cwt.)[b]	$564.00	$564.00
Cost of feeders	320.00	320.00
Non-feed costs	30.24	30.24
Feed costs	144.36	104.22
Net profit	$ 69.40	$109.54
Profit for total program	$ 78.33	$157.57

[a]Cost of pasture rent and maintenance is included.

[b]Shrinkage and death losses of 2 percent have been subtracted.

Table 3. Maximum Distances Wood Fines Can Be Transported to Form Economically Competitive Rations With Selected Transportation Rates and Prices of Fines, F.O.B. the Paper Mill.

Price of Fines ($/ton)	Transportation Costs (¢/ton-mile) 5	10	15
		(miles)	
	Dry Cows		
-4.00	177	108	72
Free	137	68	46
2.00	97	48	32
4.00	57	28	19
	Stocker		
-4.00	320	162	108
Free	245	122	82
2.00	205	102	68
4.00	165	82	55
	Feeder		
-4.00	343	172	101
Free	263	132	88
2.00	223	112	74
4.00	183	92	61



[a]Distance at which cost of fines-based ration reaches indicated level when fines cost $2.00 per ton at the plant and transportation costs $.05 per ton-mile.

Figure 1. Cost of Conventional Ration as a Function of the Price of Corn with Comparison to Cost of Fines-Based Ration - Feeder Rations.