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CUSTOM FEED GRINDING AND MIXING IN NORTHWESTERN ILLINOIS

Preliminary Report

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Edward J. Smith, Agricultural Economist
Farm Economics Division
Economic Research Service

In June 1960, 212 farmers and 45 operators of custom feed grinding and mixing services in 21 counties of northwestern Illinois--a random sample--were interviewed. Information from the interviews forms the main basis for a forthcoming economic study of alternative methods of grinding and mixing feed. Northwestern Illinois was chosen because it is an important livestock and dairy area in which a variety of methods are used in grinding and mixing feed.

A number of the custom operators expressed interest in how their own operations compared with those of others in the area. In response to this interest, this brief preliminary report was prepared to describe some of the equipment used by these 45 firms, the feed grinding and mixing services performed, and the charges made for these services. The report may also be of interest to farmers.

Since the end of World War II, the volume of custom feed grinding and mixing in northwestern Illinois has increased sharply. To process the feed quickly and economically, many local elevators and feed dealers have installed modern, high-capacity grinding, mixing, and handling equipment, and custom-operated mobile mills are a common sight on the rural highways of this area. Of the 45 firms visited, 31 operated stationary grinding and mixing equipment only, 13 had mobile mills only, and 1 firm had both types of equipment.

STATIONARY MILLS

Most of the stationary facilities in this area are quite modern (table 1). About three-fourths of both the grinders and mixers now in use were installed since 1949. Seven of the eight grinders installed before 1940 are burr mills; except for an occasional rollermill or crimper, all grinders bought since 1940 are hammermills.

Table 2 shows the distribution, by size, of the grinding and mixing equipment used by these custom operators. Of the 32 hammer-type mills in use, 26, or more than 80 percent, were powered with motors of 75-horsepower or more.

Table 1.- Number of stationary grinders and mixers, by period of installation, 32 custom operators, northwestern Illinois, June 1960

Period installed	Grinders	Mixers
1920-29	3	0
1930-39	5	2
1940-49	2	8
1950-60	28	38
Not known	1	2
Total	39	50

Table 2.- Size of stationary equipment used for custom feed grinding and mixing, 32 custom operators, northwestern Illinois, June 1960

Grinders		Mixers	
Size of motor	Number of grinders	Capacity per batch	Number of mixers
Less than 50 hp.	1/ 8	1 ton	6
50-74 hp.	5	1 1/2 tons	5
75-99 hp.	13	2 tons	23
100 hp. or more	11	2 1/2 and 3 tons	14
Not known	2	5 tons	1
Total	39	Not known	1
		Total	50

1/ Of these, 7 were burr-type mills.

Custom operators were asked what size of screen they generally used in grinding corn and oats for dairy cattle, beef cattle, and hogs. Although other things, such as the speed of the hammer tips, influence the fineness of grinding, the screen size used provides an approximate indication. Apparently, there is some tendency to grind grains finer for hogs than for dairy or beef cattle (table 3).

The bases for grinding and mixing rates charged by the 32 custom feed grinders using stationary equipment were:

	Number of operators
One rate for all grinding and mixing	11
Higher rate only if another dealer's supplement is used	6
Rate varies only with fineness of grinding	10
Rate varies with both kind of grain and fineness of grinding	2
Rate varies with both fineness of grinding and source of supplement	1
Rate varies with both kind of grain and source of supplement	1
Rate varies with kind of grain, fineness of grinding, and source of supplement	1
Total	32

Eleven firms charged a flat rate per 100 pounds for grinding and mixing regardless of the kind of grain, the fineness of grinding, or whether or not their supplement was used. Six other firms made an additional charge only if they did not furnish the supplement used. Of these 17 firms, 13 charged a flat rate per 100 pounds ground, with no additional charge for mixing. This rate varied from 12 1/2 cents to 20 cents per 100 pounds, with the most common rate (10 firms) at 15 cents. The remaining 4 of these 17 firms charged from 10 to 15 cents per 100 pounds ground, plus 5 cents per 100 pounds mixed.

Ten firms varied their rates only with the fineness of grinding. Most of the 10 charged two rates, according to the size of screen used. Thus, few rate schedules fully reflect variations in grinding costs. The two main reasons for this seem to be: a complicated rate schedule leads to clerical errors and higher bookkeeping costs; and customers who use a finer grind may feel that the higher rates are unfair to them and may take their business elsewhere.

The dealers were asked about their minimum, or startup, charges for grinding and mixing. Seven made no minimum charge, but the other 25 did. Nineteen of these charges ranged from 50 cents to $1. None of the firms gave a quantity, or volume, discount on grinding and mixing.

Those who offered delivery service had a variety of delivery charges on mixed feed, but several firms charged $2 for the first ton plus $1 per additional ton delivered. Practically all of the firms charged the regular

Table 3.- Screen sizes commonly used in grinding grain for livestock, 32 custom operators, northwestern Illinois, June 1960

Livestock	Size of screen mesh used for grinding --		
	Ear corn	Shelled corn	Oats
	Inches	Inches	Inches
Dairy cattle	1/2 to 1	---	1/4 to 1
Beef cattle	1/2 to 1	---	1/4 to 1
Hogs	Up to 3/4	Up to 3/4	Up to 1/2

retail price for the supplements used in mixing. When straight supplements were sold and delivered to the farm, 13 firms made no delivery charge. Eight made a uniform charge of $1 to $2 per ton. Several other firms made a charge per trip, or had a sliding scale of charges per ton, so that the delivery charge per ton for a large load was lower than that for a small load. Several firms offered volume discounts on supplements, and a few gave discounts for cash and for taking sacked supplements direct from the freight car.

The prevalence of grain-bank plans in the area is shown by the fact that 21 of these 32 firms had grain-bank plans in operation and several others said they were expecting to offer such a plan to their customers in the near future.

MOBILE MILLS

Operators of 14 mobile mills were also interviewed. The two oldest mills were not equipped to mix feed. Twelve mills had complete grinding, mixing, and molasses-blending equipment. These 12 were bought since 1955, and their capacity on a per-mill basis appeared to be comparable with that of the stationary custom equipment used in the area.

Nine mobile mills made a minimum charge of $3 to $4.50 per visit, but the other five had not set a minimum because their customers rarely wanted them to process less than a full batch.

Ten of the complete mills charged by the batch, with the maximum batch varying from 1 1/2 to 3 tons. Another charged by the hundredweight, and the remaining one by the minute of "Diesel time." Also, both mills that did only grinding charged by the amount of time spent on the job.

A meaningful average of rates charged by these mills cannot readily be given, but $5.50 per 3,000-pound batch was fairly common. Eight of the operators varied their charge with the fineness of grinding, which usually

meant a higher charge for feed for hogs than for dairy or beef cattle. Of the 10 operators who charged by the batch, six gave a 50-cent discount on the second batch processed at a visit, and a discount of $1 on the third and succeeding batches. Two others charged 50 cents less on the second and succeeding batches, and one on the third and succeeding batches.

WHICH IS THE LOWER COST SERVICE TO THE FARMER?

How do the costs of these two services compare? Is it more economical for the farmer to haul his grain to town or to hire a mobile mill? Although the analysis of the survey information has not yet been completed, an illustrative comparison can be drawn from the results that are available.

As an example, let's take the case of a hog producer. He has a small truck, so he can either haul his grain 5 miles to the local elevator and have it ground and mixed, or he can have a mobile mill grind the feed on his farm. His protein supplement, which makes up 20 percent of the ration, costs the same either way, and we assume that he will get an equally good job by either method. The cost and the farmer's labor requirements for batches of various sizes are shown in table 4. 1/ The operator of the mobile mill charges $5.50 per batch, regardless of its size, and he can grind and mix a maximum batch of 3,000 pounds. The cost is thus $5.50 per ton for a 1-ton batch; it is only $3.67 per ton for a full batch of 1 1/2 tons. Similarly, the amount of the farmer's time required per ton is less with a full batch than a partial one.

It costs the farmer $0.50 to drive his truck the 10-mile round trip to the mill, with no allowance for other errands that he may run at the same time. Grinding and mixing charges are $0.15 per 100 pounds ground. As the ration is 80 percent corn, only 1,600 pounds of grain is ground for each ton of feed mixed. This is $2.40 per ton (1,600 x 0.15 = $2.40), or $0.12 per 100 pounds mixed. The small savings in total cash cost as the size of the batch increases is due to the constant transportation cost of $0.50, whether or not a full load is hauled. As with the mobile mill, the labor requirement per ton is less with a full load than with a partial one.

Which is the more economical method for this hog producer to use? His cash costs are lower if he hauls his grain to the mill, but this takes more time. The lowest cost method, therefore, depends upon what the farmer's labor is worth. It depends on what other uses he has for his labor. If he can use his labor to better advantage at other work, it may pay him to hire the mobile mill.

As an example, let's assume that, at the slack season, the hog producer decides he will haul his grain to the mill if hauling will net as much as $0.50 an hour. He needs 1 1/4 tons of feed at a time, so according to the

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1/ Farmers with few livestock usually prefer to grind and mix small amounts of feed at a time in order to keep it fresh. For this reason, cost data have been worked out for both partial and full batches.

Table 4.- Cash costs and farmer's labor requirements per ton for grinding and mixing specified quantities of feed

Size of batch	Cost per ton			Labor requirements per ton		
	Mobile mill	Farmer hauls	Difference	Mobile mill	Farmer hauls	Difference
	Dollars	Dollars	Dollars	Hours	Hours	Hours
3/4 ton	7.33	3.07	4.26	1.0	2.2	1.2
1 ton	5.50	2.90	2.60	.8	2.0	1.2
1 1/4 tons	4.40	2.80	1.60	.7	1.8	1.1
1 1/2 tons	3.67	2.73	.94	.5	1.5	1.0

table he can save $1.60 per ton by taking about 1.1 hours to haul it. In effect, he saves, or earns, $1.60 in 1.1 hours, or about $1.45 per hour for his time. So it pays him to haul the grain to the mill.

On the other hand, if he must stop planting corn to take a load of feed to town, he may decide that his time is worth $2 an hour. Since, with a 1 1/4 ton batch, his labor earns only $1.45 an hour by hauling, he will save money by hiring the mobile mill and using his labor where it brings the highest return--in planting corn.

Another way of making this comparison is to figure the total cost (including labor) for each method, thus:

Labor valued at $0.50 an hour:
Haul to town: $2.80 + (1.8 hrs. at 0.50) = $3.70
Mobile mill: $4.40 + (0.7 hrs. at 0.50) = $4.75

Labor valued at $2.00 an hour:
Haul to town: $2.80 + (1.8 hrs. at $2.00) = $6.40
Mobile mill: $4.40 + (0.7 hrs. at $2.00) = $5.80

However, it is not necessary to figure the lowest cost method for each size of batch at each labor rate. As long as the above costs and labor requirements apply, a single chart will show the lowest cost method for any batch from 3/4 ton to 1 1/2 tons and for a wide range of labor rates.

In figure 1, the curved line separates the batch sizes and labor rates for which the costs of hauling are less from the combinations for which the costs of hiring a mobile mill are less. This line is an "equal-cost" line, representing those combinations of batch sizes and labor rates for which the

costs of the two methods are the same. With smaller batches and lower labor rates (to the left of and below the line), it costs less to haul the feed to town; but with larger batches and higher labor rates (to the right of and above the line), the mobile mill is the lower cost method.

This chart can be used with the same combinations compared previously. The first was a combination of a $0.50 labor rate with a 1 1/4 ton batch. In figure 1, if we locate the 1 1/4 ton mark on the horizontal scale, then move straight up to a point opposite the $0.50 mark on the vertical scale (point "A"), we are in the area marked "haul to town," and this is the lower cost method. But if we move up from this point to one opposite the $2 labor rate on the vertical scale (point "B"), we are in the mobile mill area, and this is the less costly alternative.

To use the chart for any other combination, it is only necessary to locate the size of batch on the bottom (horizontal) scale, then move straight up to the point opposite the appropriate labor rate.

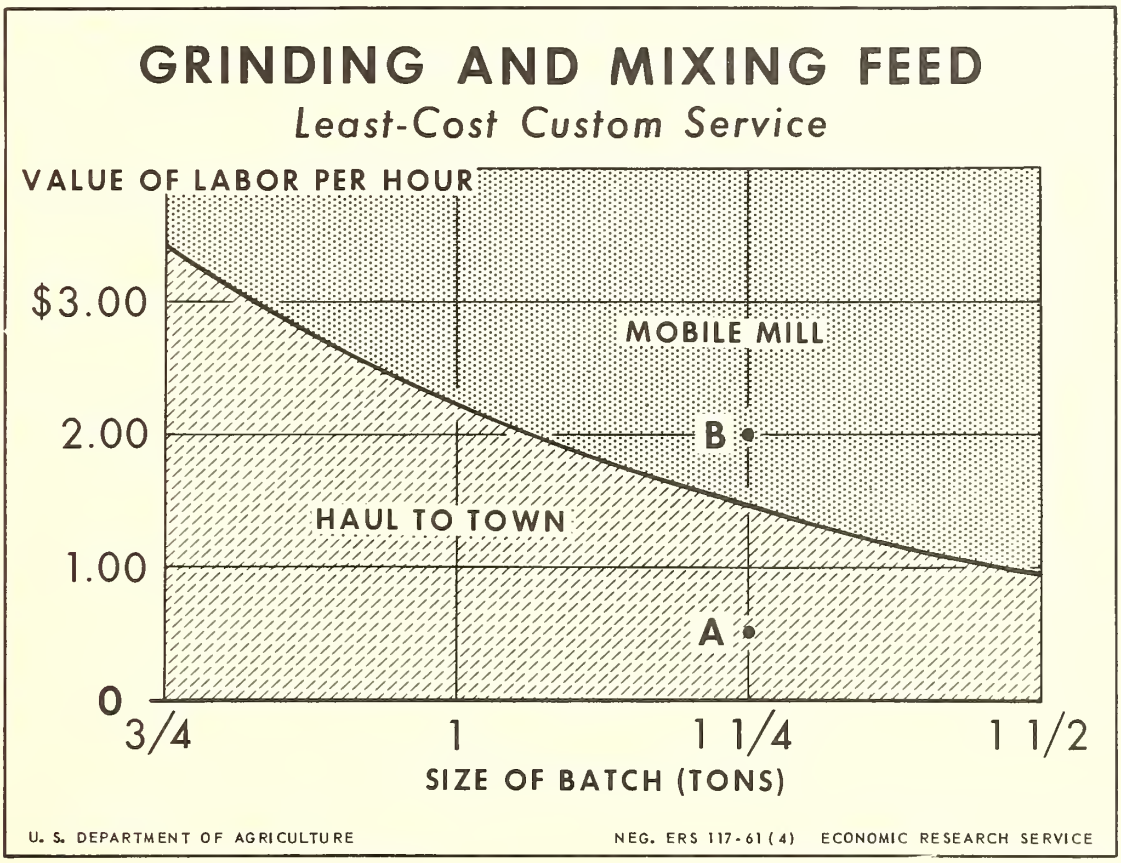

Figure 1

With other custom rates or labor requirements, the break-even points will differ slightly, but the same general relationships will prevail. This type of analysis can be used for any costs and labor requirements.

The break-even labor rate (that is, the height of the line) for each size batch can easily be found by using high school algebra. We let the letter "L" represent the per-hour value of labor, set the two cost functions equal to each other, and solve for L. Using the figures in table 4, the break-even labor rate for a 3/4 ton batch, for example, would be found as follows:

Mobile mill cost function	=	Farmer hauls cost function
$7.33 + 1.0L	=	$3.07 + 2.2L
$7.33 - $3.07	=	2.2L - 1.0L
$4.26	=	1.2L
L	=	$3.55

This means that, with a 3/4 ton batch, the cost of the two methods is the same when the hog producer's labor is worth $3.55 per hour. With a higher labor rate, the mobile mill is the less costly alternative, while labor rates of less than $3.55 tilt the advantage in favor of hauling to town.

The break-even labor rates for other batch sizes are determined the same way:

Size of batch	Mobile mill cost function	=	Farmer hauls cost function	Break-even labor rate
1 ton	5.50 + .8L	=	2.90 + 2.0L	$ 2.17
1 1/4 ton	4.40 + .7L	=	2.80 + 1.8L	1.45
1-1/2 ton	3.67 + .5L	=	2.73 + 1.5L	0.94

The break-even labor rates could be determined for other points between those shown, but it is accurate enough for our purpose to draw a smooth line between the calculated points.