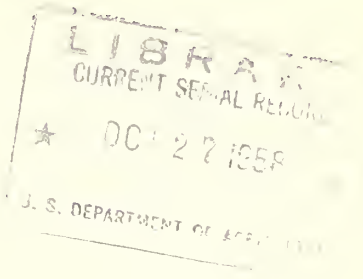
CUSTOM FEED MILLING IN THE MIDWEST



Model Plant Operations, Costs, and Charges

Marketing Research Report No. 273

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Marketing Research Division
Washington, D.C.

PREFACE

This report on costs and charges in custom feed mills is the final report on a study of custom feed milling in the Midwest. A preliminary report, "Cost Standards for a Model Stationary Custom Feed Mill for the Midwest," AMS-215, covered the cost standards for a model custom feed mill and much of that report is included. This model mill also is used as the basis for comparisons between current industry costs and incomes.

The Department of Agriculture conducted this study of custom milling because farmers have a double stake in the costs of operating these mills. They may benefit either as producers of many of the ingredients used or as purchasers of the services and products of the industry. The model mill designed in this report can become a tool of management, and the cost and income comparisons will help many operators understand better the cost and income situation of their custom operation. This project is part of a broad program of research to improve the efficiency and cut the costs in marketing farm products.

The report is based upon research conducted by the Midwest Research Institute, Kansas City, Mo., under contract with the Department.

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SUMMARY

This report summarizes a plant layout and flow pattern for a typical or model stationary custom feed mill and analyzes how it would operate in the industry. This analysis thus provides a standard of comparison and a tool which custom mill management can use to estimate its own cost and income situation. Data used in this report were obtained in a survey made in 1957.

A plant of this type, relying only on service charges to farmers for grinding and mixing, would need to grind the grain and mix about 2,000 tons of feed, grind an additional 1,500 tons of grain, and bag 400 tons per year in order to have its service income equal its operating costs. Service charges assumed in this analysis were the average charges per ton reported by more than 100 midwestern custom feed mills; namely, grinding and mixing, $4.17, grinding only, $2.90, and bagging, $1.50 per ton.

In the mixing operation, however, the model mill would also receive a margin of gross profit on 500 pounds of a mixing supplement added to each ton of feed mixed. At the average markup of $15 per ton, this model mill would begin to show a profit from the combined service and mixing operations at a volume of about 1,200 tons of feed mixed, 900 additional tons of grain ground, and about 250 tons bagged per year. At larger volumes, profits would result and charges could be reduced below this average level.

Some mills also add molasses to the custom feed and obtain additional income from this source.

Costs and incomes in the portable, or mobile, custom mills did not differ greatly from those of the stationary mills. Mobile mills and stationary mills, therefore, have similar break-even points.

Costs of operating the model mill were reconstructed from industry studies, plant and equipment costs, and power requirements. Labor costs were based on the usual industry practice of using 2 or 3 men per mill.

An analysis of labor requirements, however, indicates that 2,500 tons of feed could be mixed, an additional 1,875 tons ground, and 500 tons bagged with one man operating the mill. All additional labor should thus be considered as providing (1) additional service and reducing the delay in waiting on customers or (2) work for employees who temporarily are not needed in the department for which they were hired.

CUSTOM FEED MILLING IN THE MIDWEST
Model Plant Operations, Costs, and Charges

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INTRODUCTION

The purpose of this report is to assist operators of feed mills to improve their efficiency by analyzing costs and charges in custom feed mills in the Midwest. Efficient operation of custom feed mills requires detailed knowledge of their actual operating costs and net income. Since previous studies have dealt with the larger commercial mills, little research information on costs and charges in custom feed mills is available. Most cost information relating to commercial mills is not applicable to custom mills because of the differences in operating conditions.

Custom milling is the process of grinding the farmers' locally produced grains and mixing them with balanced concentrates. As such, it provides the farmer with another alternative to feeding the grain straight or selling it and purchasing commercial formula feeds. Custom milling provides farmers the opportunity to obtain feeds mixed according to an infinite variety of formulas. This may be either an advantage or a disadvantage, depending upon the degree of nutritional knowledge available to the farmer through his custom miller, the State agricultural experiment station, and the producer of any premix or mixing concentrate used. In the purchase of commercial formula feeds most of these decisions are made for the farmer by the formula feed manufacturer.

Stationary custom milling in the Midwest is generally conducted as one department along with country grain elevators, farm machinery and equipment, farm supplies, seed cleaning, and other rural retail services. Frequently, the service feature of the custom milling operation is considered to be very important since it helps sell more molasses and concentrates, and attracts farmer patronage for purchases of other farm supplies. Many of these stationary custom mills have been in business for a number of years.

Portable or mobile mills have become very popular in recent years and have caused changes in the feeding operations of many farmers. In years past, a portable mill was just a grinder mounted on a truck, which moved from farm to farm grinding grain. The majority of the portable mills operating today are complete mobile milling units which grind grain, mix in feeding concentrates, and blend in molasses.

These portable mills are in a sense competitive with stationary mills performing the same services at the grain producing and feeding locations. Actually, however, many people in the industry believe that portable

feed mills will continue to be closely associated with some local stationary feed establishment. This local feed establishment will thus be making available another service and the mobile unit will have storage space, repair facilities, and a home office.

METHODOLOGY

This study is based on data for 1956 and 1957, obtained in a survey conducted in 1957. The sources of information were as follows:

(1) Data from 104 stationary custom milling establishments located in Illinois, Iowa, Kansas, and Missouri, obtained in response to a mail survey.

(2) An analysis of 36 of these custom milling establishments. This analysis included a personal interview with the management, a review of such cost and production records as were available, and personal observations. 1/

(3) Data from time-studies made during these personal observations at the plants that were in operation at the time of the interviewer's visit.

(4) Basic operating data supplied by feed mill equipment manufacturers.

(5) Experience gained by the contractor during an earlier study pertaining to an analysis of cost standards in model formula feed mills producing about 7,500 tons, 25,000 tons, and 50,000 tons of feed per year. 2/

(6) An analysis of 10 portable milling units located in Illinois, Iowa, Kansas, and Missouri. Like the analysis of stationary mills, a personal interview with the management and a review of available cost and production records were conducted.

CHARACTERISTICS OF CUSTOM MILLING

Stationary Mills

The mail survey of 104 stationary custom milling plants indicates that

1/ The cost and production records in most of the plants did not appear to be sufficient for use by management in decision making and were not refined sufficiently to become the only source of data for the type of analysis made in the study.

2/ Midwest Feed Manufacturers' Association. "Cost Model for In-Plant Operations." Midwest Feed Production School Proc., 1956.

only 20 percent of the firms milled more than 2,000 tons of feed per year, whereas 42 percent milled less than 500 tons per year. In addition, possibly because of this small annual volume, most custom milling is a sideline to some other type of business. Over half of the mills responding to the questionnaire reported that custom milling accounted for less than 10 percent of their total income. Firms reporting that custom milling accounted for 50 percent or more of their total income comprised only 3 percent of the total respondents.

It also might be considered a characteristic of this industry that many mill managers did not expect a reasonable profit from their custom milling service since less than one-quarter cited profits as a reason for being in the business. 3/ In fact, almost one-half of those responding stated that their reason for engaging in custom milling was to serve customers and create goodwill. Apparently they look upon the milling operation as a necessary component of their major business, providing a service that helps increase sales of molasses and mixing concentrates and which induces farmers to visit their establishments more often. In many of these instances the gross profits of the entire business are the single determining factor, and the cost-profit relationship of custom milling is not considered as important as the other business that it generates. As might be expected, 75 percent of the mills surveyed were country grain elevators. However, almost all the mills sold commercial feeds, fertilizers, farm machinery, and other supplies.

Portable Mills

Portable or mobile milling operations differ widely among geographic areas and within these areas. Most mobile operators tend to schedule routes for their operation, although some operate on a call basis. Some carry their concentrates with them either on the portable mill or in a truck, whereas others have them delivered before the mill arrives.

The 10 mobile mills analyzed in this survey operated 6 to 10 hours per day and 5 or 6 days per week. Each of them averaged between 3 and 10 stops per day and traveled an average of 17 to 72 miles per day. Batch size varied from $1\frac{1}{4}$ to $2\frac{1}{2}$ tons and averaged 1 to 2 batches per stop.

CUSTOM FEED MILL CHARGES

Various methods are used by custom feed mills to determine the charges for performing each particular service offered. Competition and an estimated cost of operation are often the factors used in setting service charges.

3/ Based on personal interviews at 36 of the larger mills.

Fixed Charges

In this 4-State survey, 104 stationary custom feed mills supplied information pertaining to charges for performing custom milling services. These services include such operations as: Grinding, crimping, cracking, mixing, pelleting, packaging, and delivery. Many mills based their charges on a hundredweight, while others charged by the bushel or by the ton. In summarizing these charges, all were changed to the ton basis for better comparison.

Table 1 summarizes all charges for the three main services offered by most custom mills in the 4-State area. The table includes average charges for the following: Grinding, $2.90 per ton, mixing, $1.80, grinding and mixing combined, $4.17, and packaging, $1.50. The lower charge for the combination grinding and mixing indicates that service charges are established to encourage the mixing operation and the resultant sale of concentrates and possibly molasses.

Table 1.--Custom feed mill charges, 1957

Operation	Mills reporting	Charges per ton	
		Range	Average
	Number	Dollars	Dollars
Grinding	98	1.20 to 6.00	2.90
Mixing	79	.50 to 4.00	1.80
Grinding and mixing	73	2.00 to 8.00	4.17
Packaging	1/ 34	1/ .40 to 2.00	1/ 1.50

1/ Excluding those plants where the packaging charge is included in their standard grinding and mixing charges.

Most mills reported a minimum charge to the customer to cover the expense of operation. Minimum charges ranged from $2.50 to $4.50 per job, with the average being near the top limit.

Average charges in Iowa and Illinois tended to be lower than the 4-State average. Charges in Kansas custom mills were less than the 4-State average except for the straight mixing charge, which was slightly higher than average. Custom feed mills in Missouri had substantially higher charges than those in the other States. Mills producing less than 500 tons annually generally reported higher charges for each service rendered. The competitive situation of the area seems to control and regulate the minimum charges.

Various other services were studied in this survey but only three were reported frequently by the custom miller. These were packaging, grinding hard-to-grind grains, and special granulation. Additional charges for these

specialized services ranged widely. Some of the mills did not perform any special service; others provided the service but did not make a separate charge and considered the service as part of another. For example, packaging of the finished feed in some mills was considered part of the grinding and mixing operation and therefore no extra charge was made.

Portable Mill Charges

Operators of the 10 portable mills reported as wide a range of charges for their services as was found in the stationary mills. Portable mills perform nearly all of the services available at the stationary units. The portables tended to charge largely on a batch basis, the size of the batch depending upon the size of the mixer. Some operators reported that when just the service of grinding was performed, an hourly rate was charged.

The operators interviewed reported a range of $10 to $15 per hour for the grinding service only. Grinding and mixing charges, on the other hand, ranged from $3.20 to $4.25 per ton. On the average, there was very little difference between the average charges for the portable operations and those for the stationary mill as shown in table 1.

MODEL MILL

Possible Mill Arrangement

In many cases the building used by custom feed mills was not planned and built around the milling operation. Instead, it represented the conversion of existing space or the result of additions to a structure currently being used. A desirable custom mill layout is shown in figure 1. This floor plan permits each customer to weigh and dump his grain and move out without delaying other customers. The grinder and mixer are near the loading area and feed may be bulk-loaded in trucks by using portable conveyors or, if packaged, may be hand-trucked or carried to the loading dock as the sacks are filled and tied.

Flow Diagram

After the incoming grain is weighed on the truck scale and unloaded by hoisting the truck, the grain moves through the grain feeder or by gravity to the grinder (fig. 2). Following grinding to the proper texture, the grain is elevated by an air system through a blower spout to the dust collector and then moves by gravity to either holding bins or directly to the mixer. Here concentrates and premixes are dumped by the operator and incorporated with the ground grain. As soon as the mixing is completed, the feed is either sacked off the mixer spout or moved by conveyor to the customer's truck. Since dock space is adequate, two trucks can load simultaneously, if two mixers are used or if holding bins are installed.

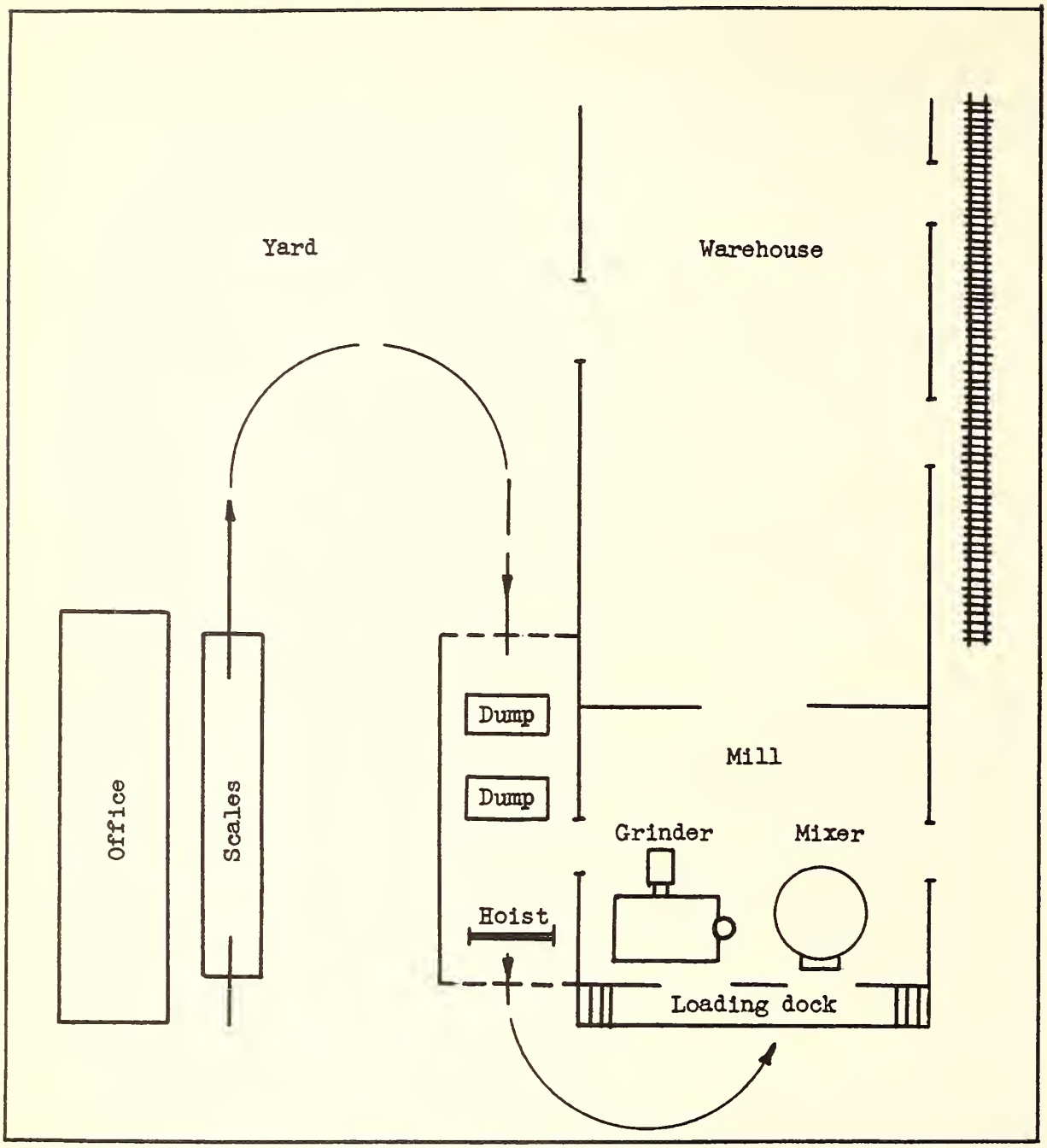
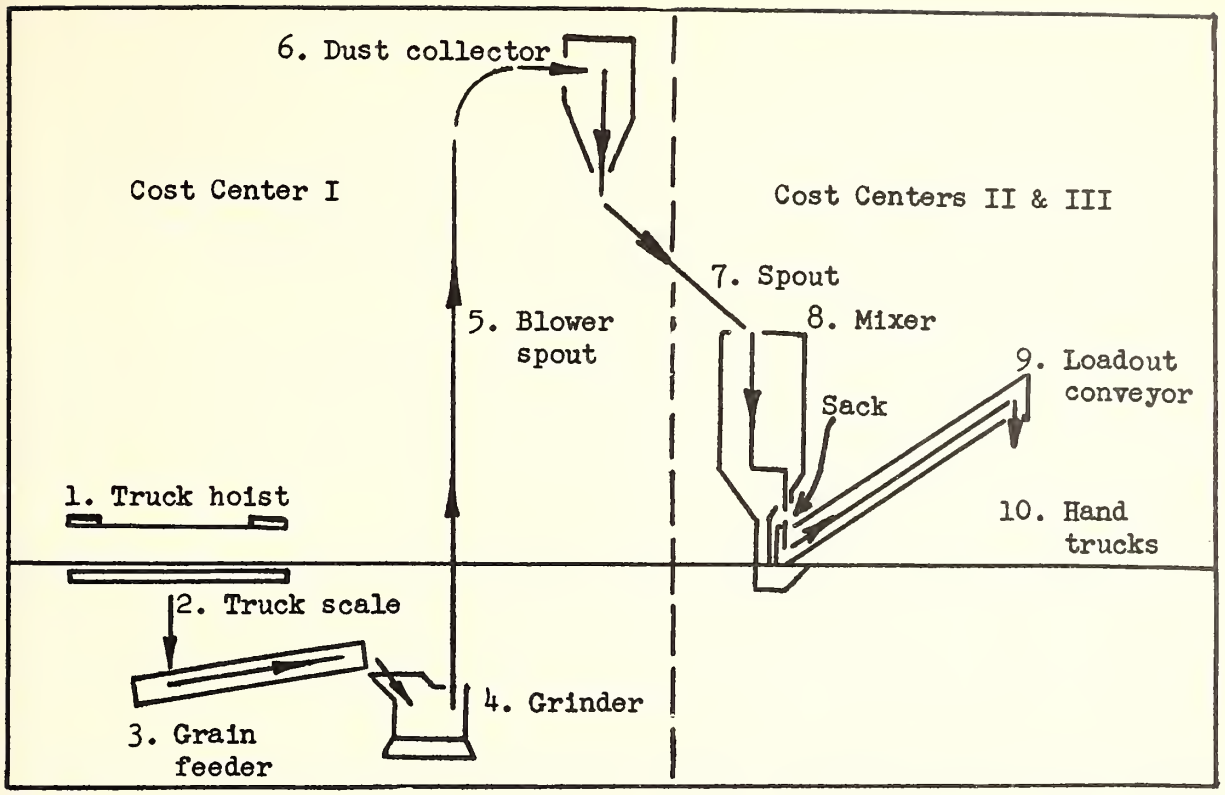


Figure 1.--Possible arrangement of custom feed mill. (Adapted from Bul. AE-250, "Modernizing Local Feed Mill Facilities in Ohio," by J. W. Sharp, G. F. Henning, and C. W. Beaty, Ohio Agr. Expt. Sta. and Ohio State Univ. December 1954. Mimeo.)



Cost centers and equipment	Capacity or size of unit	Approximate cost range
Cost center I:		Dollars
1. Truck hoist, 5 horsepower	5 tons	900-1,000
2. Truck scale	20 tons	3,500-4,500
3. Grain feeder, 1-3 horsepower	4½ tons per hour	500-1,000
4. Grinder, 75 horsepower	4-8 tons per hour)	
5. Blower spout	8-inch pipe)	3,500-5,000
6. Dust collector	---)	
Estimated installation cost 1/		2,800-3,833
Cost centers II and III:		
7. Spout	8-inch pipe	15-25
8. Mixer, 10 horsepower	2 tons	1,500-2,500
9. Conveyor, 2-3 horsepower	4 tons per hour	500-700
10. Hand trucks (2)	---	75-100
Estimated installation cost 1/		665-1,064
Total cost		13,955-19,722

1/ Allowance of 33 percent of equipment cost for installation and wiring.

Figure 2.--Flow diagram and equipment capacities and cost range for model custom feed mill.

Equipment Investment

The model mill was designed around a 2-ton vertical mixer, which is widely used by small mills, and a 75-horsepower hammermill. Only 2 plants were using horizontal mixers while every mill used a hammermill. The cost range for these items as well as other equipment used in the model mill is shown in figure 2. The range of costs for each item is used because prices asked by equipment manufacturers vary according to specifications.

The grinder and the truck scale represented the largest items in the cost of equipment, with costs of grinding equipment varying as much as $1,500. The cost of the grinder includes the costs of an 8-inch blower spout and a dust collector. The total cost of equipment required for weighing, unloading, and grinding ranged from $11,200 to $15,333, including an allowance for installation and wiring.

The mixer is the most costly of the remaining equipment, ranging in price from $1,500 to $2,500. The total cost of the mixer and the equipment used to load grain into the mixer and to move feed from the mixer ranged from $2,755 to $4,389, including an allowance for installation and wiring. The total installed cost of equipment for the entire mill ranged from $13,955 to $19,722.

Since some agricultural areas have special feeding requirements, optional equipment to meet the particular needs of the area may be needed. A molasses tank, blender, meter, and pump, all of which would be required for molasses handling, range in cost from $2,700 to $3,400, excluding installation. A crimper or cracker of 5 to 10 horsepower would cost between $700 and $900 while a crusher of 5 horsepower would cost between $900 and $1,000. Holding bins, with a 2-ton capacity, range in cost from $150 to $250. Sewing machines for bag closing and platform scales for bag weighing range in cost from $250 to $500 and $300 to $600, respectively. All of these costs for additional equipment are approximate and do not include allowances for installation and wiring.

LABOR STANDARDS IN MODEL MILL

Many stationary custom mills operating in the Midwest have the general layout and flow pattern shown in this model mill. Some of these mills operated with annual volumes of less than 500 tons and others with more than 5,000 tons per year. It is customary when establishing a model mill to choose the building, machinery, and other equipment to operate at or near capacity at the given production chosen for the model mill. The industry under consideration includes a majority of the plants operating considerably below the capacity of their plant, equipment, and manpower. For this reason, a model plant grinding and mixing in excess of 5,000 tons per year would have value to only a relatively small number of the custom mills.

On the other hand, to establish the operating volume of the model mill at the extremely low volumes noted among many of the custom mills would appear to be advocating a volume of operation which, under most circumstances, would result in a loss.

The standards determined by this survey are based upon an annual grinding volume of about 3,700 tons, an annual mixing volume of about 2,500 tons, and the packing or bagging of about 500 tons per year. In terms of daily operations the labor standards are based upon the custom grinding of 15 tons, mixing of 10 tons, and bagging of 2 tons per 8-hour day.

This volume of operation was chosen after consideration of the above factors but primarily because (1) with this equipment and model plant one man could be expected to operate all phases and produce this output, and (2) preliminary cost and charges information indicates that under most circumstances this volume of operation could reasonably be expected to break even or return a profit. This does not mean that only one man should operate the plant. Other considerations, such as delay of customers, and available labor, have caused many plants to use 2 or even 3 men in this type of an operation. It does mean, however, that if more than one man is used, other departments of the organization would have to assume that part of the time of 2 or 3 additional men which exceeded 8 hours per day. Likewise, it does not mean that a plant should not seek a larger custom volume, especially in view of the unused plant and equipment capacity.

Definition

Labor standards basically are an estimate of the production hours necessary to perform certain operations with a given plant and equipment. These standards must include, in addition to the time actually spent on each task or job, the time spent in moving between jobs, moving to other plant locations, and time out for personal requirements. In custom feed milling the standards also must take into account some waiting for the customers, answering customer questions on the correct formula to use, sales promotion, normal maintenance, etc., since many of these jobs are normally required of the custom feed mill employees.

Normally about 10 to 14 percent of an employee's time is required for personal requirements and rest. Including the time actually spent in moving from one job to another and to different plant locations, a 30-percent allowance was added to the production time in determining the labor standards for a formula feed mill, larger than the model, mixing approximately 7,500 tons of feed per year. 4/

In view of the additional peculiarities of custom milling and on the basis of observations in actual plants, an allowance of a 50-percent increase in production time will be used in this analysis.

4/ See footnote 2, page 2.

These man-hour standards are not meant to be presented as perfect or ideal, but they are standards which can be equaled or exceeded by mills with a plant layout and a daily output similar to the model mill. They are to be used as a method of measurement for the individual custom miller to evaluate the labor requirements and thereby determine the labor efficiency in his own plant.

Labor standards have been analyzed for individual operations, insofar as possible, and will be summarized for the following cost centers:

(1) Grain receiving and grinding

(2) Additive receiving and mixing

(3) Packaging or bagging

The operations conducted under items 1 and 2 above are necessary in all custom feed mills. Those conducted under item 3 above are necessary only in those plants bagging custom feed.

Grain Receiving and Grinding

In determining the labor standards for the grain receiving and grinding phase of the custom milling operation, it was assumed that a total of 15 tons was received and ground during each 8-hour day (table 2). The basic equipment used in performing this operation includes a truck scale, truck hoist, grain feeder, grinder, and dust collector, cost center I (fig. 2).

Labor operations involved in this grain receiving and grinding phase are as follows:

1. Weigh loaded truck.

2. Start hoist motor to elevate truck, unload grain, and lower truck.

3. Sweep spilled grain into dump.

4. Weigh empty truck and compute net weight of grain delivered.

5. Change grinder screens an average of 3 times per 8-hour day.

6. Start grinder and adjust flow.

7. Start grain feeder to move grain to grinder and shut off when pit is empty.

8. Stop grinder when operation is completed.

9. Clean area periodically.

Table 2.--Labor standards: Receiving and grinding 15 tons of grain per day in 2-ton loads

Job	Job standards	Minutes per day	Hours per day	Man-hours per ton
Grain receiving:				
Weigh loads of grain	1 minute per load	7.5		
Dump loads, sweep	5 minutes per load	37.5		
Move to grinder	5 minutes per load	37.5		
Total		82.5	1.375	
Grinding:				
Change screens	5 minutes 3 times a day	15		
Start and stop grinder	2 minutes per load	15		
Move to load out or mix	2 minutes per load	15		
Clean up	5 minutes per day	5		
Total		50	.833	
50 percent time allowance			1.104	
Grain receiving and grinding:				
Standard man-hours per day			3.312	
Standard man-hours per ton				0.221

10. Move ground grain to mixer or load out to customer's truck.

While this is the basic operation assumed in determining labor standards in the model mill, it must be recognized that special processing and special services rendered by individual custom mills may vary the type of equipment used or the steps taken. Basically, however, these labor standards can be changed to fit the individual mill operation by the inclusion of one or two estimates of the time required for these additional operations. The revised standard man-hours per ton can in turn be multiplied by the individual plant's tonnage of grain received and ground to determine an individual plant's standard man-hours per day, if the volume does not differ too much from the 15 tons assumed in this model operation.

In this model mill operation, the labor standards indicate that a man can handle about 4.5 tons of grain per hour or that 0.221 man-hour per ton are required (table 2). These standards also indicate that a majority of the worktime is involved in receiving the grain and moving it to the grinder.

Additive Receiving and Mixing

Labor standards in the additive receiving and mixing phase of the custom milling operation are based upon the mixing of 10 tons of custom feed, including the receiving and handling of 2.5 tons of additives or mixing concentrates (table 3). The basic equipment used in performing the work in this operation includes a 2-ton mixer, a conveyor for loading out, and a hand truck (cost center II and III, fig. 2).

Table 3.--Labor standards: Additive receiving and mixing 10 tons per day in 2-ton batches

Job	Job standards	Minutes per day	Hours per day	Man-hours per ton
Additive receiving:				
Receive 2.5 tons from truck:				
and move to warehouse ...	6 tons per hour	25		
Total		25	0.416	
Mixing:				
Start mixer and move in				
0.5 ton of additives	5 minutes 5 times a day	25		
Open 2.5 tons of bagged additives 1/	15 tons per hour	10		
Dump 2.5 tons of additives.	20 tons per hour	7.5		
Wait on mixer	10 minutes per batch	50		
Clean up, etc.	4.5 minutes per batch	22.5		
Move to load out	2 minutes per batch	10		
Total		125	2.083	
50 percent time allowance ...			1.250	
Additive receiving and mixing:				
Standard man-hours per day			3.749	
Standard man-hours per ton				0.375

1/ Ground grain is received from grinder in a continuous flow.

Tasks performed by labor in this additive receiving and mixing phase are as follows:

1. Unload additives and move to warehouse.

2. Move additives to the mixer.

3. Start mixer and flow of ground grain to the mixer.

4. Open and dump one-half ton of additives to each batch.

5. Sweep spilled feed into mixer.

6. Load out to customer's truck by connecting a portable conveyor from mixer to truck.

7. Stop mixer and loading conveyor.

8. Dispose of empty sacks and clean up.

The basic operations in most custom feed mills will be similar to those in the model mill except for variations in the volumes. Both the volume of additives handled and put into the mixer and the total volume of feed mixed can be changed and new standards computed for man-hours per ton and per day.

On the basis of these standards, about 2.7 tons can be mixed per man-hour, or 0.375 man-hours are required to mix a ton of feed (table 3). Approximately one-fifth of the worktime is required for additive receiving and the remaining four-fifths to charge the mixer and mix the feed.

Packaging

Packaging or bagging the custom feed involves the following operations:

1. Obtain 40 burlap sacks each capable of holding at least 100 pounds.

2. Place empty sack under spout, open slide and fill (do not weigh).

3. Shake down full sacks and tie at top with twine.

4. Carry sack 10 feet to customer's truck.

In this model operation it is assumed that only 2 tons of custom feed will be packed per day (table 4). The remaining 8 tons are moved out in bulk. Changes in distances and the resultant time required and a correction in the average volume bagged will again permit the application of these standards to a given custom mill operation, if the differences in operation from the model mill are not too great.

Table 4.--Labor standards: Packaging one 2-ton batch per day

Job	Job standards	Minutes per day	Hours per day	Man-hours per ton
Packaging:				
Obtain empty sacks	4 minutes once a day	4		
Fill sacks	5 sacks per minute	8		
Hand tie sacks	5 sacks per minute	8		
Move to load out	4 sacks per minute	10		
Clean up	5 minutes per batch	5		
Total		35	0.583	
50 percent time allowance			0.292	
Standard man-hours per day			0.875	
Standard man-hours per ton				0.437

Standards for Entire Model Mill

The model mill, receiving and grinding 15 tons of grain, mixing 10 tons of feed, and bagging 2 tons per day, can deliver these custom mixed feeds to the farmer's truck with a theoretical total of 7.936 man-hours per day. The figure includes allowances for moving between jobs, talking with customers, standard maintenance, and personal requirements. Thus, excluding the possibility that plant management might want to use other labor intermittently, one man can handle the entire operation. The use of such labor would make it possible to reduce the amount of time that customers wait. This might be desirable in many mills. Nearly 1 hour of this man's time would be spent in packaging, nearly 4 hours in additive receiving and mixing, and a little more than 3 hours in grain receiving and grinding.

OPERATING COSTS FOR THE MODEL STATIONARY MILL

Typical operating costs for the model mill were reconstructed on the basis of a survey of 36 custom feed mills and the equipment, building, and flow pattern developed for the model mill. Nine mills with operating volumes approximating the model mill had relatively complete and accurate cost records. These records were supplemented and checked by comparison with a few other sizes of custom operations, other cost records, and observations made by the enumerator.

Labor

Typical labor costs for the model stationary mill were established at $6,000 per year and are shown in figure 3 as the area between the base of the figure and line E. This represents some combination of 2 to 3 men operating at an average rate of $1.00 to $1.50 per hour. The equivalent of 2 to 3 men were used in nearly all of the 36 plants included in the survey. Even those plants mixing only 500 to 1,000 tons of custom feed per year tended to use this amount of labor in their operation. In some cases as many as 3 men were actually assigned to the mill with some additional in and out movement occurring as the workload shifted. In other cases only 1 man was assigned to the mill and other men helped when the mill load increased or other jobs could not keep them busy.

Accounting records of the 9 comparable custom mills indicated that on the average these mills paid $7,600 per year for mill labor. This may represent more than three men or operations extending longer than 8 hours per day or more than 250 days per year.

At the other extreme, the analysis of labor standards for the model mill indicates that theoretically one man could operate the entire milling operation. Included in this man's time are allowances for personal requirements, sales, maintenance, etc. From the standpoint of operating efficiency this is a goal worth keeping in mind. It sets a standard for hiring and scheduling workers for the custom operation. All additional men should be hired and scheduled into the milling operation to reduce the waiting time of customers or to make use of the free time of workers normally hired and needed in other departments.

Power

Consumption of electricity in the model mill and actual power costs were used in developing the annual power cost of $2,404.71, with a minimum annual charge of $576. Rate schedules of electric companies operating in the Midwest were used to determine an applicable rate for feed mills. Some companies provided special rates for this operation while others offered no appropriate rates, and still others had several rates that might be used. Appropriate rates were examined in towns in each of the four States and the total power cost for operating the 2,500-ton mill was determined. These costs were then divided by the kilowatt hours consumed to derive an average cost per kilowatt hour. The average cost per kilowatt hour for various locations in each State was weighted by the proportion of custom feed mills listed as operating in the State. The average cost per kilowatt hour in the 4-State area, including consideration of demand charges when applicable, was 3.25 cents per kilowatt

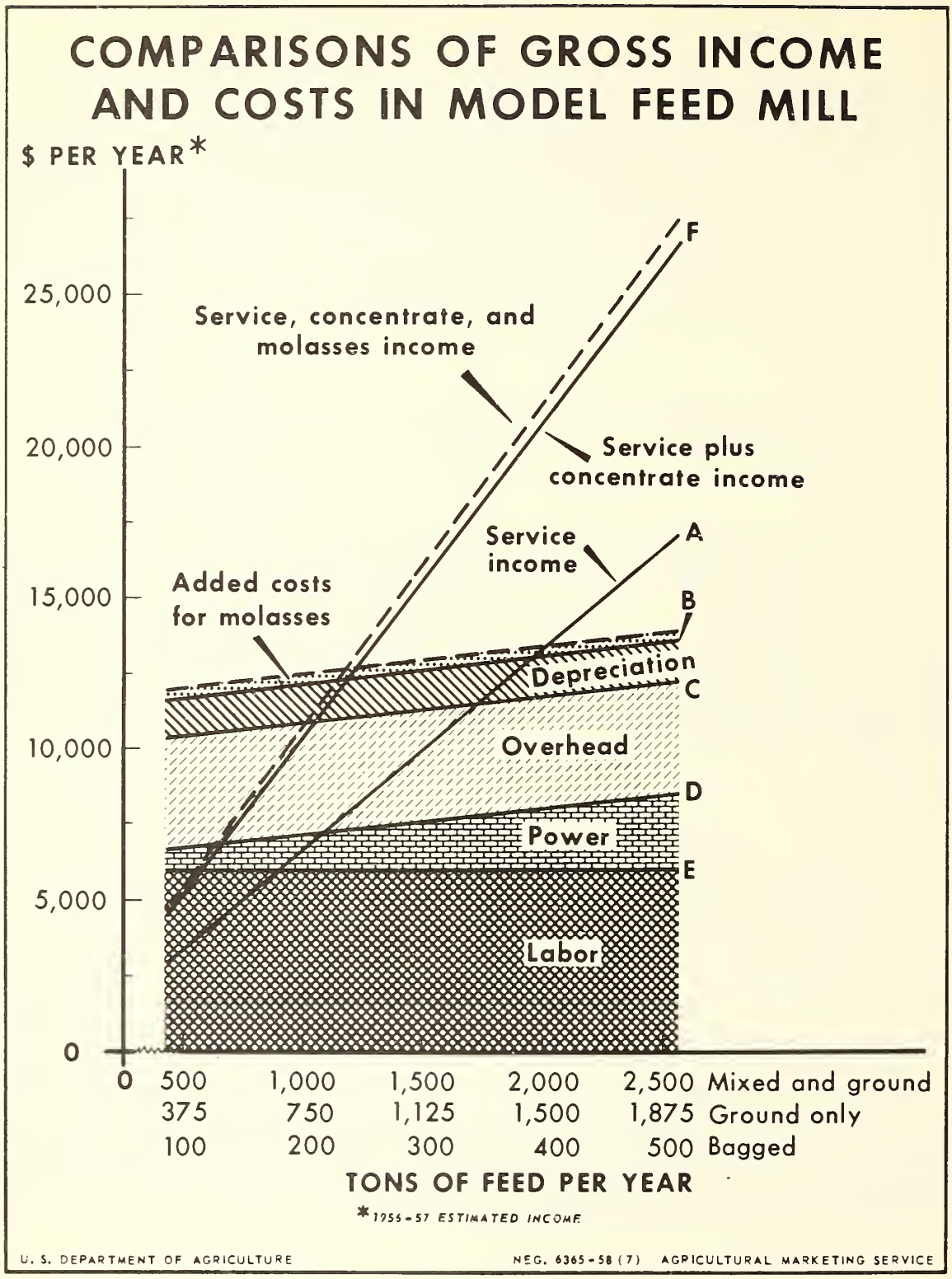

COMPARISONS OF GROSS INCOME AND COSTS IN MODEL FEED MILL
$ PER YEAR*
25,000
20,000
15,000
10,000
5,000
0
Service, concentrate, and molasses income
Service plus concentrate income
Service income
Added costs for molasses
F
A
B
C
D
E
Depreciation
Overhead
Power
Labor
0 500 1,000 1,500 2,000 2,500 Mixed and ground
375 750 1,125 1,500 1,875 Ground only
100 200 300 400 500 Bagged
TONS OF FEED PER YEAR
*1955-57 ESTIMATED INCOME
U. S. DEPARTMENT OF AGRICULTURE
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Figure 3

hour. 5/ This cost was then applied to the kilowatt hours computed in table 5. A minimum charge of 50 cents per horsepower per month was most frequently applied in this area.

The cost of power was found to increase directly with increases in annual custom milling tonnage among the different levels of output considered. For this reason, electricity costs are taken on a straight line basis rather than a growth curve normally used for utility rates.

Estimated costs of the power used in the model mill are approximately $950 higher than the average reported in the 9 comparable mills. This could result from area rate differences, the use of power in other departments, or the type and amount of equipment used.

Power cost was substantially increased by the intermittent nature of the custom milling operation, the extra capacity equipment requiring large amounts of power for short periods, and the demand charge included in many rate schedules. The demand charge for custom mills, based on rated machinery horsepower, is far in excess of actual power consumption in many custom mills. When the demand charge is applied, these small mills are penalized by any difference between power demanded and that consumed.

The addition of some extra equipment to the model mill may reduce power costs considerably in certain areas. For example, if a holding bin were provided to hold ground grain, the grinder could operate at a greater proportion of capacity with a consequent reduction in the length of time it would be used. This would cut down on electricity use and cost considerably since the grinder is the heaviest consumer of current in the mill, and a faster rate of operation would not increase its power usage. However, if the grinder were operated at a faster rate, the present grain feeder would have to be replaced with one capable of meeting the increased demands of the grinder, and an elevator leg would be required to transport incoming grain up to the bin. The use of a holding bin is not without problems however, since many farmers do not want their grain commingled with other grain.

Power costs are shown in figure 3 as the area between lines E and D, with line D representing total labor and power costs in the model mill.

Overhead

Overhead costs, excluding depreciation, could not be reconstructed because the model mill would usually operate as one department in a multiple department operation. Therefore, the average overhead costs of the 9 comparable operating mills, $3,742, are shown in figure 3 as the area between lines D and C. Line C therefore represents total cost excluding depreciation.

5/ A demand charge is made by the supplier of electricity to the consumer for reserving and guaranteeing that amount of capacity in its system to handle adequately the consumer's needs.

Table 5.--Electric power: Requirements and costs for 2,500-ton model custom feed mill

Equipment and operation	Adjusted horsepower 1/	Processing operations: Performed during day	Processing operations: Time required for each	Kilowatt hours consumed 2/	Cost per year 3/
		Number	Hours		Dollars
Truck hoist	5.88	7.5	0.0833	694	22.56
Grain feeder	3.53	7.5	0.4444	2,194	71.30
Grinder	88.23	7.5	0.4444	54,844	1,782.43
Mixer	11.76	5.0	0.1666		
Other operations requiring use of mixer:					
Grain from grinder	11.76	5.0	0.2222		
Sacking	11.76	1.0	0.1333		
Loading conveyor	11.76	4.0	0.5000		
Total mixer	-	-	-	8,942	290.62
Load-out conveyor	3.53	4.0	0.5000	1,317	42.80
Allowance for heat and lights	-	-	-	6,000	195.00
Total	-	-	-	73,991	2,404.71
Molasses blender	17.64	1.0	0.5000	1,645	53.46

1/ Electric motors under 100 horsepower must be adjusted for average efficiency by use of 0.85 conversion factor.

2/ Kilowatt hours (KWH) = Number of times operation performed per day x adjusted horsepower x time (expressed in hours) required to perform operation once x KWH conversion factor (.746) x number operating days (250).

3/ Based on National Electric Rate Book, Federal Power Commission, Washington, D. C. Average cost per KWH in area studied 3.25 cents.

These overhead costs include payments for administration, office work, insurance, selling, taxes, and other minor expenses. Most of the mill managers believed that these overhead costs should be allocated among departments according to the ratio of the department and total gross income. Overhead costs for the individual operations in the 9 comparable mills were primarily the result of this type of computation.

Depreciation

Depreciation of equipment and building for the model mill in this study is estimated at $1,311.66 per year. This cost was established on the basis of the capital investment required for the model mill, using new facilities, and the depreciation rates suggested for Federal tax purposes (table 6). 6/ Depreciation charges in some cases may decrease considerably when the more costly prices of equipment have been fully depreciated.

Depreciation was kept separated from other overhead costs to permit it to be excluded or included when cost and income comparisons were made. Many of the custom mills visited reported that all equipment had been fully depreciated, and many of those charging depreciation had either partially depreciated their facilities or were depreciating used equipment.

Depreciation charges are given in figure 3 as the area between lines C and B. Total operating costs including depreciation are indicated by line B.

Additional Costs for Molasses

Since a 2- or 3-man labor force is not utilized completely in the model mill, it was assumed that the inclusion of molasses equipment would not increase the labor costs. Molasses equipment would, however, increase depreciation by $271.07 and power costs by $53.46 per year. These added costs are represented by the area between the dotted horizontal line and line B, figure 3.

GROSS INCOME

Estimated gross income for the model mill was computed by assuming the average service charges and the markups for concentrates and molasses. Gross income was estimated separately for service income, for service plus concentrate income, and for service, concentrate, and molasses income combined.

Service income is computed for the model mill at outputs of 500 to 2,500 tons of feed ground and mixed, at $4.17 per ton; 375 to 1,875 tons of grain

6/ U. S. Internal Revenue Service. Bulletin "F," Tables of Useful Lives of Depreciable Property. IRS Publication No. 173. 67 pp. 1955.

Table 6.--Annual depreciation charges in 2,500-ton model custom feed mill

Equipment	Average life 1/	Approximate cost 2/	Annual depreciation
	Years	Dollars	Dollars
Truck hoist	12	1,267	105.58
Truck scale	25	5,333	213.32
Grain feeder	15	1,000	66.66
Grinder, spout and dust collector 3/	15	5,667	377.80
Spout 3/	15	27	1.80
Mixer	15	2,667	177.80
Conveyor	15	800	60.00
Hand truck (2)	10	87	8.70
Building	50	15,000	300.00
Total		31,848	1,311.66
Molasses blender 4/	15	4,066	271.07
Total with blender		35,914	1,582.73

1/ It should be noted that the useful lives shown are not mandatory but are a guide to what might be considered reasonably normal periods of useful life. IRS Pub. 173 (see footnote 6).

2/ Average of range shown in figure 2. Include installation charge at 33 percent of machine cost.

3/ Spouts and dust collector have longer useful life, but they are considered as part of larger equipment since their cost is small and they are normally installed with this equipment.

4/ Discussed in section on "Gross Income."

ground only, at $2.90 per ton; and 100 to 500 tons bagged at $1.50 per ton. Total income for these services is shown by line A of figure 3. This basic relationship of mixed, ground, and bagged volumes was retained throughout the range of volume. Thus, for every ton mixed, an additional three-quarters of a ton is custom ground for the farmer and one-fifth of a ton of mixed feed or ground grain is bagged.

Service and concentrate income line adds to this service income, at each point of the line, the income from the sale of one-quarter of a ton of concentrate for each ton mixed. The average markup reported per ton of concentrate of $15 was used to estimate this theoretical gross income. This gross income appears in line F, figure 3.

Service, concentrate, and molasses income adds the average markup of three-fourths of a cent for molasses to the above service and concentrate income. This new gross income is shown by the dotted line, figure 3. It is based on the estimated use of 50 tons of molasses per year for a plant mixing 2,500 tons of custom feed per year. Many plants add much more than 50 tons of molasses per year in this size of operation.

BREAK-EVEN POINTS

Model Stationary Mills

By comparing the typical cost and gross income estimates for the model mill (fig. 3), we can determine the different volumes which are required for the mill to break even.

When all costs are considered, the model mill will require a mixing and grinding volume of about 2,000 tons (fig. 3) to break even on its service operation. This point is shown in figure 3 by the intersection of service income line A and total cost line B. It will require a volume of little more than 1,200 tons per year when concentrate income is considered along with service income (intersection of line F and line B).

Excluding depreciation reduces the service income break-even point to 1,750 tons per year (intersection of lines A and C). When service income and concentrate income are considered, the break-even point becomes about 1,100 tons per year (intersection of lines F and C).

Comparing the two dotted cost and income lines indicates that the addition of molasses equipment further decreases the break-even point. These 2 dotted lines intersect at about 1,200 tons per year, indicating that the model mill, considering service, concentrate, and molasses, would break even at about this volume. Apparently the volume of molasses must exceed 25 tons per year to cover the added depreciation and power costs.

Basically these break-even points show the volume necessary for this model mill to break even under various assumed conditions. Under any of these assumptions a volume larger than the break-even volume will result in a profit, or enable adjustments in service charges paid by patrons. A volume smaller than the break-even volume will require that some of the assumed costs will have to be carried by some other part of the business. Many of the small custom mills appear to be operating in this type of a situation.

Mobile Mills

Mobile mills generally provide the same basic services as the model stationary custom mill except that they perform them at the farm. Most mobile units, however, have a route schedule to follow, and farmers may have to wait for the service.

Mobile milling operations vary from slightly more than a 1-man operation to slightly more than a 2-man operation. In one case a truck delivers the mixing concentrates before the mobile unit arrives and the mobile unit is operated by 1 man. In another operation the mobile unit and a truck carrying the concentrate arrive together and both men operate the mixer. A 2-man mobile unit also may involve the predelivery of the mixing concentrate. Manufacturers of mobile milling units tend to recommend that their unit be used in a 2-man operation.

Assuming a 2-man operation during an 8-hour day, 250 days per year, as in the model stationary mill, the total costs 7/ for grinding and mixing the model mill volumes will not differ significantly from those of the model stationary mill. Differences in individual cost items do appear, especially as a result of the shorter depreciation period for mobile units and the resultant higher depreciation costs. Another difference results from the addition of the fuel necessary to transport the unit.

Apparently, however, either type of mill will require a volume of nearly 2,000 tons per year to break even on the service operation and nearly 1,200 tons per year when molasses, concentrate, and service incomes are combined. 8/

VALUE OF THE ANALYSIS

Operators of custom mills should learn more about their own operating and net income position by reviewing this analysis of the model mill. Even if the custom milling operations help obtain a larger net income from the entire farm supply business, operators should know whether the mill covers its own operating costs or not. At some point the milling operation may result in larger losses than its additions to the net incomes of other departments may warrant. Increases in service charges may result in reducing volume and further increasing the loss ratio.

The method used to show the model costs and incomes in figure 3 can easily be adapted to the operation of an individual plant. Using the various cost and income categories shown, the specific mill costs, incomes, and volumes can be substituted, and the broad assumptions of the model can be made more realistic for the specific plant at alternate volumes. This technique should have value as a tool of custom mill management in determining costs and incomes at specific volume levels.

7/ Based on the data obtained in the 10 mobile mill survey and other available data.

8/ Service charges and concentrate and molasses markups are assumed to be the same for the mobile mills as those used in the model stationary mill. Service charges are shown to be nearly identical in an earlier section of this report.

In assigning labor to the custom milling department, management should consider the fact that theoretically the model mill is a 1-man operation. The assignment of additional labor to this department, therefore, should be substantiated by the desire to increase the service available or to make use of part time labor normally needed in another department.

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