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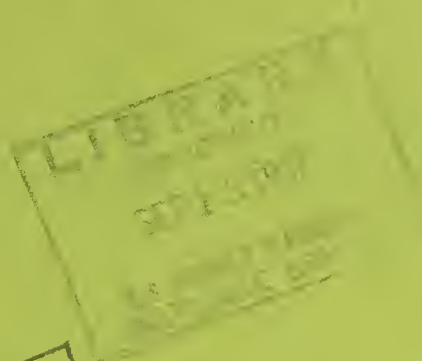
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COSTS OF DRYING AND STORING ROUGH RICE IN LOUISIANA AND TEXAS

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in cooperation with Farmer Cooperative Service
U.S. Department of Agriculture and
Texas Agricultural Experiment Station

FARMER COOPERATIVE SERVICE
U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

Farmer Cooperative Service conducts research; advises directly with cooperative leaders and others; promotes cooperative organization and development through other Federal and State agencies; and publishes results of its research, issues News for Farmer Cooperatives, and other education material.

This work is aimed (1) to help farmers get better prices for their products and reduce operating expenses, (2) to help rural and small-town residents use cooperatives to develop rural resources, (3) to help these cooperatives expand their services and operate more efficiently, and (4) to help all Americans understand the work of these cooperatives.

JULY 1967

PREFACE

The study reported here was undertaken in response to a request from rice producers and representatives of rice cooperatives in Louisiana and Texas. It was conducted by the Department of Agricultural Economics and Agribusiness, Louisiana State University, under contract with the Farmer Cooperative Service, U.S. Department of Agriculture. Louisiana State University, in turn, entered into an agreement with Texas A&M University concerning phases of the study relating to Texas. Work on the project was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

The report evaluates costs of drying and storing rough rice in on-farm and off-farm units during three marketing seasons, 1959/60, 1960/61, and 1961/62.

Progress reports were presented annually during conduct of the study to the Rice Research and Marketing Advisory Committee and its successor, the Grain and Forage Crops Research Advisory Committee.

The authors recognize that technological, price level, and other changes since 1959-62 may have affected the values shown in this report. However, there is no reason to believe that these changes have affected one type of facility more than another. These relative cost comparisons between and among facilities are as valid today as in 1959-62.

This information is currently needed by extension personnel in helping farmers and others decide whether to develop more on-farm drying and storage units or to expand the use of off-farm facilities. It will also be of value to cooperative officials and other first handlers in developing more efficient rice marketing conditions. No comparable information of the type contained in this report is available to the rice industry.

We wish to express our appreciation for the assistance provided by cooperative officials and other rice drier operators, trade associations, banks, government agencies, marketing firms, and others too numerous to mention here. Special credit is due Job K. Savage and Wesley Nicklas, Farmer Cooperative Service, for helping conduct the study. The assistance of Paul Justis, Lonnie L. Fielder, Barton R. Farthing, and Bill B. Townsend, Louisiana State University, is also gratefully acknowledged.

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SUMMARY

The importance to rice growers and others of efficient, low cost drying and storage of rough rice is reflected in the amount spent for these services. Of the \$150 million received annually by rough rice growers in Louisiana and Texas, an estimated \$15 to \$16 million is spent for drying and storing. Typical investments of \$25,000 in on-farm facilities and \$350,000 in off-farm units further emphasize the importance of achieving efficient operations. Regardless of these costs and investments, some rough rice drying and storage facilities lie idle while others are used only at a fraction of capacity.

To accumulate data for determining why some facilities are successful and presumably low cost, while others are not, 51 driers in Louisiana and 44 in Texas were studied during three marketing seasons, 1959/60, 1960/61, 1961/62.

The 95 driers were of four types: (1) on-farm round stationary bulk bins, (2) on-farm buildings with bulk bins, (3) on-farm multipass, continuous flow driers, and (4) off-farm or commercial multipass, continuous flow driers.

Items compared in evaluating these driers included in-plant operating costs, marketing costs, and effect of drying and storing on rice quality. To facilitate comparisons, all data were expressed on the basis of hundredweights of dry rice, rather than on the basis of barrels of green rice, as is common to the trade.

For on-farm units, operating costs were analyzed in terms of type of facility, location, and year. Of these, type of facility was the only factor found to significantly affect operating costs. Average total costs ranged from a high of 52 cents per hundredweight of rice dried and stored in buildings with bulk bins to a low of 32 cents for multipass units. The average cost of drying and storing for all on-farm facilities was 40 cents.

For off-farm units, operating costs were evaluated in terms of type of ownership (cooperative and other), location, and year. None of these factors were found to significantly affect the total combined cost of drying and storing rough rice. Total costs for providing these services averaged 53 cents in cooperative facilities and 62 cents in those not cooperatively owned. Cooperative units used their storage capacity to a greater extent than did facilities not cooperatively owned, and therefore had substantially lower costs per hundredweight of stored rice.

In addition to considering in-plant expenses of drying and storing rough rice, growers must take into account costs associated with alternative marketing situations: (1) selling rough rice immediately after drying, (2) selling rough rice after storage, or (3) forfeiting rough rice under the Government price-support loan program.

Among the on-farm units, multipass driers demonstrated the lowest cost and buildings with bulk bins the highest cost per unit for all three marketing situations. If the drying operation were to be abandoned, however, buildings with bulk bin driers could easily be converted into ordinary farm buildings by

removal of the bin partitions and screened air tunnels. Multipass and round bulk bin type driers are not as flexible in this respect.

Cooperative and other types of commercial facilities incurred the lowest costs when rice was sold immediately after drying and the highest costs when rice was sold on the open market after storage.

Considerable excess capacity existed in rice drying facilities both on and off the farm. To help growers decide whether it would be to their advantage to use on-farm facilities more intensively or to shift to the use of off-farm facilities, costs were summarized for those units which operated at or above 80 percent of capacity.

At this level of capacity, the relationships among on-farm units were the same as when all facilities were considered: multipass driers were the most efficient and buildings with bulk bins the least efficient operations for all marketing situations.

Since only 2 of the 63 observations made of off-farm storage included plants operating at 80 percent or more of capacity, costs could not be summarized by type of ownership -- cooperative and other. Based on the two observations, the relationships were the same as when all observations were included: average costs were lowest when rice was sold immediately after drying and highest when rice was sold after storage.

The average value of rice dried and stored in the facilities studied was not significantly different. Small differences existed in favor of the stationary bulk bins immediately after drying, but these disappeared after storage. Thus, it was concluded that all types of facilities were equally efficient with respect to quality of rice. The large amount of variation in the quality of rice between individual lots tested, however, suggested that certain operators did a superior job of drying and storage in each type of facility studied.

COSTS OF DRYING AND STORING ROUGH RICE IN LOUISIANA AND TEXAS

By Harlon D. Traylor, Carter Price,
and Clyde B. Markeson

Rice growers in Louisiana and Texas receive about \$150 million a year for rough rice of which nearly \$11 million is spent for artificial drying. Typical industry charges for storing rough rice -- a cost not usually borne directly by growers -- amount to another \$4.5 to \$5.0 million. In total, between \$15 and \$16 million is spent annually for drying and storing rough rice in the two States. Typical investments of \$350,000 for off-farm driers and \$25,000 for farm driers help to explain why costs of drying and storing rough rice are so great.

Of the approximately 20 million hundred-weight of rice grown each year in Louisiana and Texas in 1953-58, more than 90 percent was dried and stored off farms, either in commercial facilities where rice was dried and stored on a custom basis or by rice millers who purchased rice before it was dried. The remainder was dried on the farms

and stored in the farm driers until it was marketed.

In 1958, there were 235 on-farm rice driers in Louisiana and Texas (appendix table 12). Of these, 133 were constructed during the 4-year period 1953-56, a time when producers' marketing opportunities were severely limited by the amount of available storage capacity.

During the past few years operations of some drying and storage facilities have been expanding while other facilities lie idle or are used only at a fraction of capacity. To determine why some facilities are more successful, and presumably more efficiently operated, than others, costs of four types of facilities in Louisiana and Texas were studied during the period 1959-61. Other factors affecting the efficiency of these facilities were also examined. Study findings should be useful to growers and other first handlers who must decide whether to develop more on-farm drying and storage facilities or to increase the use of off-farm units.

METHOD AND SCOPE OF STUDY

Types of Facilities Evaluated

Four types of facilities were analyzed (table 1). On-farm units consisted of (1) round stationary bulk bins, (2) buildings with bulk

bins, and (3) multipass, continuous-flow units. All off-farm facilities analyzed were multipass, continuous-flow units. Rice drying and storage operations by millers were not included in this study.

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Major Factors Considered

Three major factors were considered in appraising the various types of facilities. These were in-plant operating costs, marketing costs, and rice quality.

Table 1.--Rice drying and storage facilities providing cost information, by State and type of facility, Louisiana and Texas, 1959-61

Type of facility	State		Total
	Louisiana	Texas	
	----- Number -----		
<u>On-farm</u>			
Round bulk bin	26	8	34
Buildings with bulk bin	3	23	26
Multipass units with bulk storage	11	3	14
Total	40	34	74
<u>Off-farm</u>	11	10	21
Total	51	44	95

Operating Costs (in-plant)

Operating costs were obtained from 95 rice drying and storage facilities for three marketing seasons, 1959/60 through 1961/62. The facilities, stratified by type and State and drawn at random, included 74 on-farm and 21 off-farm units (table 1). Based on data available at the time the sample was drawn, the chances that a sample of 79 units would yield reliable cost data within 5 cents per hundredweight were more than 95 in 100. To further assure reliable results, 95 units were included in the study. The general locations of the sample driers are shown in figure 1.

Marketing Costs (nonplant considerations)

Included in marketing costs are expenses associated with the Government price-support program, hauling, sales methods, and growers'

FIG. 1-- APPROXIMATE LOCATION OF ROUGH RICE DRYING AND STORAGE UNITS STUDIED



contributions for market development. These expenses are importantly affected by the marketing method used and the location of the facility in relation to a railroad siding. Data on these costs were obtained by consulting with Government officials and marketing firm operators, and from various published materials.

Quality of Rice

To compare the quality of rice dried and stored in the various types of facilities, samples were drawn from 494 lots after drying and from 182 lots after storing. Control samples from the same lots were drawn when the rice was still green, and dried in thin layers on screens with natural air. The samples were obtained over the 3-year period 1959-61.

Unit of Measurement for Rough Rice

The most usual industry measure of rice in Louisiana and Texas is the barrel, which is considered to be equivalent to 162 pounds whether the rice is green or dried. Green rice loses approximately 10 percent of its weight during the drying process. Individual

lots of green rice may lose more or less than this amount. Thus, costs and other factors measured on a green weight basis vary considerably from lot to lot, season to season, and drier to drier. To facilitate comparisons, all figures in this report refer to dried rice in 100-pound units rather than to barrels of rice.

Drying and Storage Capacity

Maximum drying capacity of a multipass unit depends on (1) the initial moisture content of the green rice received, (2) the flow rate capability of the drying columns, (3) bin holding space for green and partly dried rice, and (4) bin aeration capability. Any one factor, alone or in combination with one or more of the other factors, may place a limitation on output. A detailed explanation of the procedure used to determine drying capacity for multipass facilities is included in the appendix.

Drying and storage capacity of bulk bin facilities is defined for purposes of this report as the total bin space at a facility. In practice, however, drying operations compete with storage operations for bin space and reduce potential storage space during the harvest season. Only at the end of the drying season is all bin space available for storage.

DESCRIPTION OF DRYING AND STORAGE FACILITIES

Pictures of the three types of on-farm facilities included in this study are shown on page 4. Figure 2 is a sketch of the stationary type units showing the basic principles on which driers of this type operate. In these driers, rice is placed in bins and remains stationary while either heated or natural air is blown through it until moisture content is reduced to below 13 percent. This normally requires 21 to 42 days.

Figure 3 shows the basic principle of the multipass, continuous flow driers. In facilities of this type rough rice continuously descends

the drying column through which heated air is blown. The rice is passed through this column several times, being placed in holding bins between passes to allow moisture near the inside of the kernel to gravitate toward the outside. Three to seven days are normally required to complete the drying-tempering process.

On-farm drying and storage facilities are seldom large enough to handle rice from more than one producer. They are operated by growers or by hired labor on a seasonal basis. They are usually on farms that do not have direct access to rail facilities.



are frequently provided, especially during seasons when rice harvesting is not in progress. Typical services include seed treating and cleaning and rice marketing. Off-farm driers are normally located where they have direct access to a rail siding. A view of an off-farm type drier is shown below.



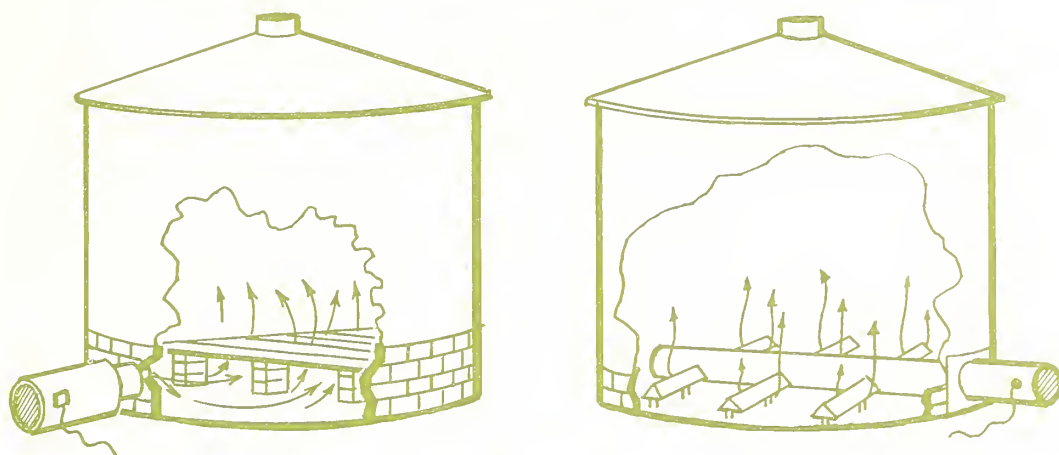
Typical on-farm rice drying and storage facilities: upper left, round bulk bin facility; upper right, building with bulk bins; lower left, multipass facility.

Off-farm facilities normally provide rough rice drying and storage on a custom basis. Because of the size of their operations, off-farm enterprises generally retain key personnel on a year-round basis. To make more productive use of personnel and facilities, services other than drying and storage

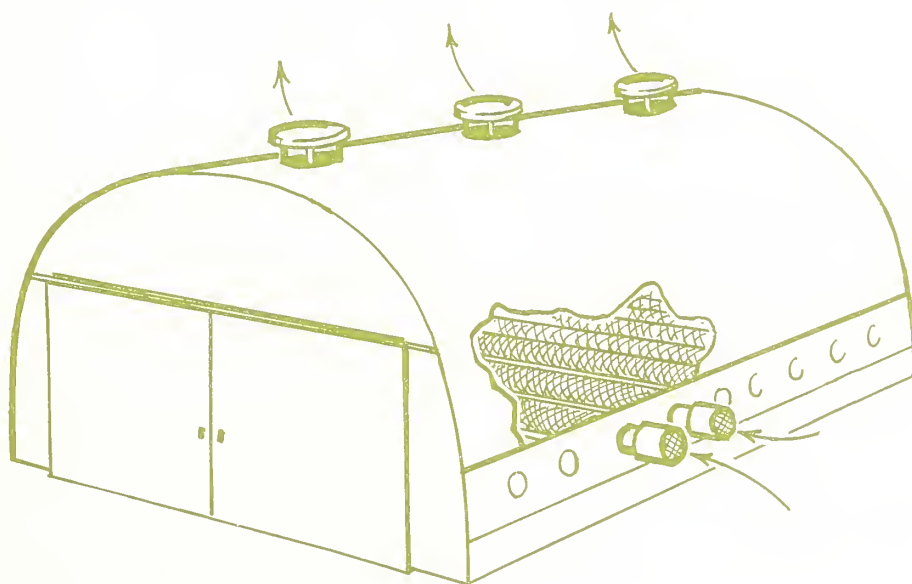


Typical off-farm rice drying and storage facility.

**FIG. 2-- TYPICAL AERATION SYSTEMS IN
STATIONARY BULK-BIN RICE DRIERS**

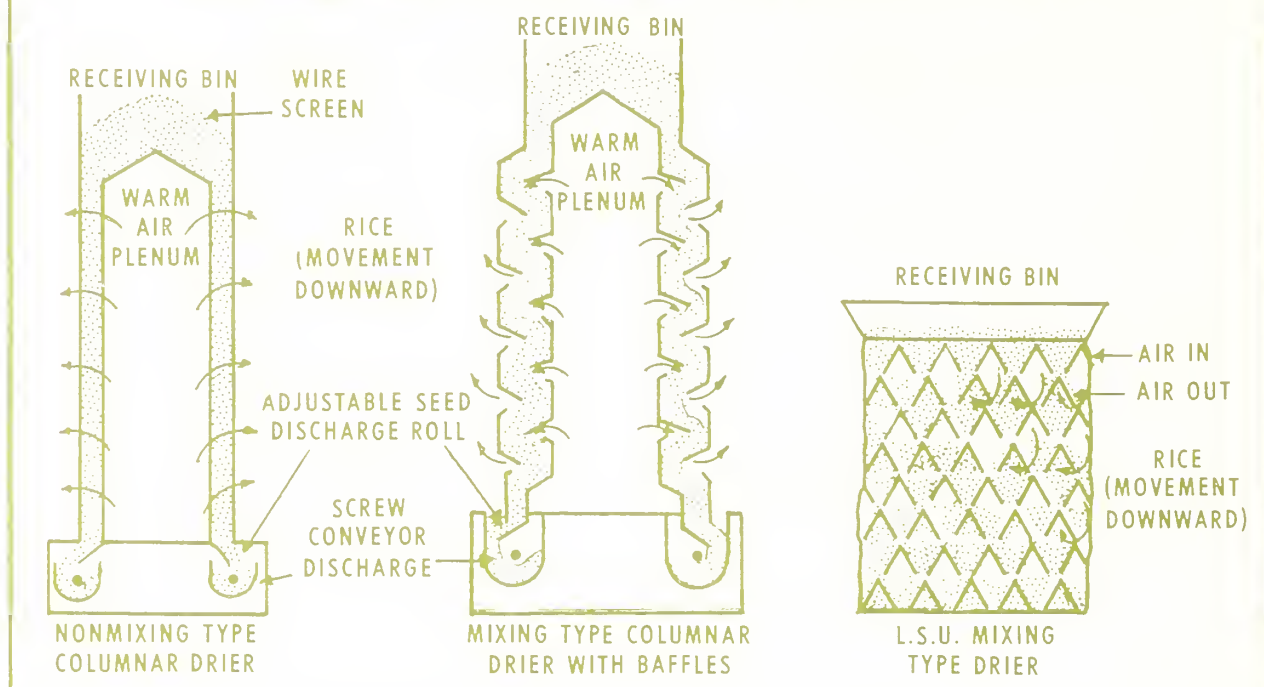


ROUND BULK BINS



BUILDINGS WITH BULK BINS

**FIG.3-- FLOW PATTERN IN DRYING COLUMN
FOR BASIC MODELS OF MULTIPASS RICE DRIERS**



OPERATING COSTS

Operating costs for on-farm and off-farm facilities are discussed separately since there is a marked difference in operating patterns. For each system, costs are summarized into two groups, variable and fixed. Variable costs are those which vary with output. Fixed costs are those which would be incurred even if there were no output.

On-farm Drying

Variable Costs

Variable costs of on-farm facilities were grouped as labor, sprays and fumigants, fuel, repairs, electricity, grain insurance, and miscellaneous or "other" items.

Labor costs covered loading and unloading the driers, turning rice in bins, checking the condition of rice, checking and adjusting operations of the drier, cleaning bins, other necessary maintenance activities, and repairs. Family labor was included at a cost based on prevailing wages in the area.

Under the classification sprays and fumigants were included amounts spent for sprays and fumigants and amounts paid to exterminating firms.

Heated air is an essential feature of multipass driers and is frequently used in stationary types. An estimate of fuel costs for heating the air was made for all three types of driers.

Cost of repairs included replacing parts and materials, rewinding electric motors, and other maintenance done on a custom

basis. Cost of repairs made by farm labor was not included.

Electricity costs consisted chiefly of expense incurred in operating fans which move air through the rice during drying and storage. Also included were costs of electricity used for grain augers, lights, and exhaust fans.

Grain insurance cost was estimated on the basis of a drying period extending from September 15 to October 15 for stationary type driers. Standard insurance rates, developed in cooperation with the Louisiana Insurance Bureau, were applied. Some growers did not carry such insurance on rice in farm driers, but it was assumed that a risk commensurate with the cost of such insurance was borne by these growers.

Other costs include expenses of miscellaneous items such as cleaning supplies, fuses, oil, and filters.

Fixed Costs

Fixed costs consisted of depreciation, insurance on the facility, taxes, and interest.

Depreciation expense was computed by applying the following rates suggested by the Internal Revenue Service to the original cost of structures and equipment:

Item	Rate	Expected Years of Use
Concrete buildings	.020	50
Steel frame buildings	.040	25
Wood frame buildings	.050	20
Equipment	.067	15

Insurance expenses for building and equipment were used as reported except when these items were not insured. In such cases standard rates to give normal coverage, developed by the Louisiana Insurance Bureau, were used. Building insurance varied slightly with building materials, location, and other factors.

Taxes were based on a valuation of 15 percent of the original cost of the facilities and a tax rate of \$50 per \$1,000 assessed valuation.

Interest on investment in facilities was used instead of interest cost reported for loans on the facility. There is a provision for loans on such facilities at a more nominal rate of interest under the Government loan price-support program, but such loans must be repaid in a relatively short period of time and may not be made for the full amount of the investment. Moreover, some facilities had already been paid for, and operators reported no interest expense for these facilities. There is still a cost to such operators, however, since they are foregoing a return that would be obtained if such amounts were invested elsewhere. A reasonable average annual return on investment in facilities was estimated at 6 percent applied to 50 percent of the original investment.

Total Operating Costs

Total operating costs for drying in all on-farm units averaged 40 cents per hundred-weight of rice dried (table 2). Buildings with bulk bins had the highest cost (52 cents), followed by round bulk bins (40 cents) and multipass facilities (32 cents). These differences resulted chiefly from the relative importance of fixed costs, which accounted for 77 percent of the total costs for buildings with bulk bins, 73 percent for round bulk bins, and 65 percent for multipass driers.

Based on the analysis of variance, such differences in total operating costs could be expected due to chance in less than 5 cases out of 100 (appendix table 13).

Per unit costs of operating stationary bulk type driers were lower in Louisiana, and per unit costs of operating multipass facilities were lower in Texas (appendix tables 14-16). However, the analysis of variance shows that cost differences between the States were not significant (appendix table 13).

To determine the relationship between operating costs and percentage of capacity used, the data were summarized as shown in tables 3, 4, and 5. The percentage class limits shown were selected because they appeared to be representative of the items included in each class.

Table 2.--All on-farm facilities: operating costs per hundredweight of dried rough rice, by type of facility, Louisiana and Texas, 1959-61

Cost item	Facility			Average or total
	Round bulk bins	Building with bulk bins	Multipass	
	----- Cents per hundredweight -----			
<u>Variable</u>				
Labor	2.8	4.5	4.2	3.9
Spray and fumigants	0.4	0.4	0.1	0.3
Fuel	1.3	0.4	2.1	1.4
Repairs	1.4	0.5	1.3	1.1
Electricity	4.0	5.1	1.8	3.3
Grain insurance	0.2	0.2	0.3	0.2
Other	0.8	1.1	1.4	1.1
Total	10.9	12.2	11.2	11.3
<u>Fixed</u>				
Depreciation	15.6	21.1	10.2	14.8
Insurance	1.6	2.6	2.3	2.2
Taxes	2.4	3.3	1.6	2.3
Interest	9.8	13.2	6.2	9.2
Total	29.4	40.2	20.3	28.5
Grand total	40.3	52.4	31.5	39.8
Number of observations	102	78	42	222
Number of facilities	34	26	14	74
Average cost of facilities (dollars)	14,762	29,519	38,671	24,454
Average capacity (cwt.)	6,761	11,495	39,979	14,709
Average output (cwt.)	4,519	6,709	18,712	7,974

Table 3.--Round bulk bins: operating costs per hundredweight of dried rough rice, by percentage of capacity used, Louisiana and Texas, 1959-61

Cost item	Percentage of capacity used			Average or total
	50 or less	51-79	80 or more	
	-----Cents per hundredweight-----			
<u>Variable</u>				
Labor	2.7	2.7	2.8	2.8
Sprays and fumigants	0.6	0.7	0.3	0.4
Fuel	1.4	1.0	1.4	1.3
Repairs	1.9	1.5	1.2	1.4
Electricity	6.2	5.9	2.6	4.0
Grain insurance	0.2	0.2	0.2	0.2
Other	0.7	1.1	0.7	0.8
Total	13.7	13.1	9.2	10.9
<u>Fixed</u>				
Depreciation	29.2	15.3	12.1	15.6
Insurance	3.0	1.3	1.3	1.6
Taxes	4.6	2.4	1.9	2.4
Interest	18.3	9.5	7.6	9.8
Total	55.1	28.5	22.9	29.4
Grand total	68.8	41.6	32.1	40.3
Number of observations	36	27	39	102
Number of facilities	(1)	(1)	(1)	34
Average capacity (cwt.)	6,692	6,317	7,112	6,761
Average output (cwt.)	1,997	4,183	7,007	4,519

¹Some facilities operated at different levels from one year to the next.

Table 4.--Buildings with bulk bins: operating costs per hundredweight of dried rough rice, by percentage of capacity used, Louisiana and Texas, 1959-61

Cost item	Percentage of capacity used			Average or total
	50 or less	51-79	80 or more	
	-----Cents per hundredweight-----			
<u>Variable</u>				
Labor	6.6	4.3	3.5	4.5
Sprays and fumigants	0.3	0.3	0.4	0.4
Fuel	0.6	0.4	0.6	0.4
Repairs	1.2	0.3	0.8	0.5
Electricity	7.1	4.8	4.5	5.1
Grain insurance	0.2	0.2	0.2	0.2
Other	1.0	1.1	1.0	1.1
Total	17.0	11.4	11.0	12.2
<u>Fixed</u>				
Depreciation	37.3	19.3	15.5	21.1
Insurance	3.3	2.4	2.6	2.6
Taxes	5.8	3.0	2.4	3.3
Interest	23.4	12.1	9.7	13.2
Total	69.8	36.8	30.2	40.2
Grand total	86.8	48.2	41.2	52.4
Number of observations	22	44	12	78
Number of facilities	(¹)	(¹)	(¹)	26
Average capacity (cwt.)	11,115	11,815	11,077	11,495
Average output (cwt.)	3,476	7,576	9,800	6,709

¹ Some facilities operated at different levels from one year to the next.

Table 5.--Multipass on-farm driers: operating costs per hundredweight of dried rough rice, by percentage of capacity used, Louisiana and Texas, 1959-61

Cost item	Percentage of capacity used			Average or total
	50 or less	51-79	80 or more	
	-----Cents per hundredweight-----			
<u>Variable</u>				
Labor	4.5	3.5	4.2	4.2
Sprays and fumigants	0.1	0.1	0.2	0.1
Fuel	2.2	1.6	2.2	2.1
Repairs	1.0	0.5	1.9	1.3
Electricity	2.0	1.7	1.5	1.8
Grain insurance	0.3	0.3	0.3	0.3
Other	1.4	1.3	1.5	1.4
Total	11.5	9.0	11.8	11.2
<u>Fixed</u>				
Depreciation	13.9	7.4	6.4	10.2
Insurance	2.9	1.7	1.9	2.3
Taxes	2.1	1.2	1.0	1.6
Interest	8.5	4.6	3.8	6.2
Total	27.4	14.9	13.1	20.3
Grand total	38.9	23.9	24.9	31.5
Number of observations	29	5	8	42
Number of facilities	(1)	(1)	(1)	14
Average capacity (cwt.)	42,394	33,420	35,324	39,979
Average output (cwt.)	13,230	21,349	36,937	18,712

¹Some facilities operated at different levels from one year to the next.

Total cost per hundredweight generally declined as the volume of rice dried increased from 50 percent or less to 80 percent or more of drier capacity. For example, round bulk bin facilities operated at 50 percent or less of capacity averaged 69 cents per hundredweight dried, and those operating at 80 percent or more averaged 32 cents.

The larger stationary type facilities had the lowest average unit costs (appendix tables 17 and 18). They also utilized a greater proportion of their capacity than the smaller facilities. All multipass on-farm units were classified as large.

Average operating costs rose slightly during the 3-year period 1959-61 (appendix tables 19-21). The analysis of variance shows, however, that cost differences among years were not significant.

Off-farm Drying

Operating costs for off-farm units were allocated to drying, storing, and servicing by management representatives of each of the commercial facilities. Those costs that would not have been incurred had only drying and storage been performed were allocated to services. Next, that part of the remaining costs that would not have been incurred had only rice drying been performed were allocated to storage. The remaining costs were assigned to the drying operation. Based on these reports, average variable and fixed costs per hundredweight were estimated.

Variable Costs

Variable costs were classed as wages and salaries, utilities, grain insurance, repairs, administrative, and other.

The item wages and salaries included directors' fees, payments made under the Insurance Contributions Act, unemployment insurance taxes, workers' compensation insurance, and cost of fringe benefits such as group health insurance paid by the employer.

Cost of utilities included the cost of electricity, fuel, and water. Fuel used in trucks

and automobiles was included in "other" expenses.

Operators of commercial driers ordinarily assume responsibility for safekeeping of rice, and insure the rice to minimize the risk of large losses beyond their control. The cost of such insurance was classed as grain insurance. Grain insurance covers only losses such as those from fire and windstorms; it does not cover damage to rice in the drying process.

Cost of repairs included expenditures for replacement parts and materials and for repairs made on a contract basis.

Administrative expense included cost of office supplies, telephone, auditing, advertising, donations, postage, and travel of management personnel.

Other expenses included cost of supplies for insect and rodent control, truck expense, cost of sacks, inspection and grading fees, and payments to growers for rice damaged at the drier.

Fixed Costs

The fixed costs were depreciation, interest, taxes, and insurance.

Depreciation on buildings and equipment was computed as for on-farm driers by applying appropriate rates suggested by the U.S. Internal Revenue Service. Lease expense was listed as "depreciation" by firms leasing some of their facilities.

A charge of 6 percent on one-half the original investment was imputed in place of interest expense.

Tax expense included ad valorem taxes on the facility and the costs of bonds and licenses as reported.

Building and equipment insurance costs were used as reported.

Miscellaneous Drying Income

A small amount is earned by off-farm driers from selling rice sweepings and for handling rice that has been dried, or dried and stored, on farms. The net income associated with these operations was estimated at

1.0 cent per hundredweight of rice dried. This amount was deducted from the costs of the drying operation. It was believed that this made the estimated costs more comparable with costs of on-farm drying.

Total Operating Costs

The estimated operating costs for drying rice in all off-farm units averaged 32.7 cents a hundredweight of rice dried (table 6). According to these estimates -- which were based on

allocations by management representatives -- cooperative driers had significantly higher unit drying costs than other off-farm driers, 34.3 cents compared with 28.7 cents. Results of the analysis of variance are shown in appendix table 22.

Average unit costs for all commercial driers in Louisiana were slightly higher than in Texas (appendix table 23).

Other comparisons showing differences that were not statistically significant are reported in appendix tables 24 and 25.

Table 6.--Off-farm driers: Operating costs per hundredweight of dried rough rice, by ownership of drier, Louisiana and Texas, 1959-61

Cost item	Ownership		Average or total
	Cooperative	Other	
	----- Cents per hundredweight -----		
<u>Variable</u>			
Wages and salaries	14.4	10.8	13.4
Utilities	2.3	1.9	2.2
Grain insurance	0.5	0.7	0.6
Repairs	1.6	0.7	1.3
Administrative	1.4	0.8	1.2
Other	0.9	1.0	0.9
Total	21.1	15.9	19.6
<u>Fixed</u>			
Depreciation	6.9	5.1	6.4
Interest	4.7	6.6	5.2
Taxes	1.3	0.4	1.1
Insurance	1.3	1.7	1.4
Total	14.2	13.8	14.1
Grand total	35.3	29.7	33.7
Less miscellaneous drying income	1.0	1.0	1.0
Net selected costs	34.3	28.7	32.7
Number of observations	36	27	63
Number of facilities	12	9	21
Average capacity (cwt.)	268,715	137,073	212,297
Average output (cwt.)	213,125	116,836	171,858

Facilities operating at 80 percent or more of capacity experienced considerably lower costs than those operating at lower capacities (appendix table 26). Compared with on-farm facilities, a larger proportion of the off-farm facilities were operated near capacity levels.

Storage

Most operators of on-farm facilities reported little or no additional operating cost for storage over that already incurred for

drying. However, operators of off-farm units did report additional costs averaging 21 cents a hundredweight (table 7).

Cooperative facilities averaged lower storage costs per unit stored than other commercial facilities. Results of the analysis of variance are shown in appendix table 27.

Plants with the largest plant capacity had the lowest average storage costs per unit (appendix table 28).

Plants are grouped in appendix table 29 by percentage of storage capacity used. As volume stored increased from 50 percent or less of

Table 7.--Off-farm driers: Operating costs per hundredweight of stored rough rice, by ownership of drier, Louisiana and Texas, 1959-61

Cost item	Ownership		Average or total
	Cooperative	Other	
-----Cents per hundredweight-----			
<u>Variable</u>			
Wages and salaries	4.8	9.4	5.5
Utilities	0.7	1.5	0.8
Repairs	0.8	0.8	0.8
Administrative	0.7	0.8	0.7
Other	1.5	2.6	1.7
Total	8.5	15.1	9.5
<u>Fixed</u>			
Depreciation	5.4	10.0	6.2
Interest	4.2	5.5	4.4
Taxes	0.9	1.0	0.9
Insurance	0.6	2.6	0.9
Total	11.1	19.1	12.4
Grand total	19.6	34.2	21.9
Less miscellaneous storage income	1.0	1.0	1.0
Net selected costs	18.6	33.2	20.9
Number of observations	36	27	63
Number of facilities	12	9	21
Average capacity (cwt.)	245,476	103,761	184,741
Average output (cwt.)	83,040	20,602	56,281

capacity to 80 percent or more, average costs per hundredweight decreased from 24 cents to 10 cents.

Louisiana firms reported lower costs for storage than Texas firms (appendix table 30). Cooperatives in Louisiana reported lower average costs for storing than cooperatives in

Texas. The reverse was found for private commercial facilities.

Off-farm facilities experienced their lowest average operating unit cost of storage for the 3-year period during the 1959-60 season and the highest during the 1960-61 season (appendix table 31).

MARKETING COSTS

Growers have, in addition to operating or in-plant expenses of drying and storage, certain other important costs, many of which vary with the marketing method used and with whether rice is stored on farms or in commercial units (tables 8, 9). Such costs, grouped here as "marketing costs," include charges

by sales agencies, hauling and handling expenses, contributions for market development, cost of grain insurance during storage, interest on the amount invested in grain, losses from shrinkage, and costs associated with Government loans under the price-support program.

Table 8.--On-farm driers: Marketing costs per hundredweight of dried and stored rough rice, by marketing method used, and by type of drier, Louisiana and Texas, 1959-61

Type of drier and cost item	Selling on the open market		Forfeiting grain under Government loan program
	After drying	After storage	
STATIONARY BULK BINS	----- Cents per hundredweight -----		
Sales agencies	3.1	3.1	--
Extra hauling and handling	--	--	11.9
Contributions for market development	1.8	1.8	--
Grain insurance during storage	--	1.0	1.0
Grain investment	2.5	10.0	2.5
Shrinkage	2.5	5.0	5.0
Application for Government loan	--	2.0	2.0
Total	9.9	22.9	22.4
MULTIPASS TYPE DRIERS			
Sales agencies	3.1	3.1	--
Extra hauling and handling	--	--	11.9
Contributions for market development	1.8	1.8	--
Grain insurance during storage	--	3.3	3.3
Grain investment	1.2	9.5	1.2
Shrinkage	2.5	5.0	5.0
Application for Government loan	--	2.0	2.0
Total	8.6	24.7	23.4

Table 9.--Off-farm driers: Marketing costs per hundredweight of dried and stored rough rice, by marketing method used, Louisiana and Texas, 1959-61

Cost item	Selling on the open market		Forfeiting grain under Government loan program
	After drying	After storage	
	----- Cents per hundredweight -----		
Sales agencies	3.1	3.1	--
Contribution for market development	1.8	1.8	--
Grain insurance during storage	--	3.3	3.3
Grain investment	1.2	9.5	1.2
Shrinkage	2.5	5.0	5.0
Application for Government loan	--	2.0	2.0
Total	8.6	24.7	11.5

Sales Agencies

Growers selling rice immediately after drying, and those redeeming their Commodity Credit Corporation loans and selling the rice on the open market, often utilize the services of a sales agency. These agencies advise growers on the value of their rice and whether it would be advantageous to store it or to sell at the prevailing price.

In holding a sale, the agencies display rice samples from several producers in a room arranged and equipped for that purpose. Often they handle much of the paper work between growers and buyers, landlords, creditors, the Commodity Credit Corporation, and others.

Charges to growers for providing these services averaged 3.1 cents a hundredweight during the 1959-61 seasons (table 8). Growers generally do not use the services of a sales agency when they forfeit the rice under the Government loan program.

Extra Hauling and Handling

When rice is sold on the open market, the terms of sale usually specify delivery at the point where the rice is located. The location

of the rice is usually not a consideration of any consequence in this case.

But when a grower elects to deliver rice to the Commodity Credit Corporation under the price-support program, rather than to sell the rice and repay the loan, location of the rice is a very important consideration. The CCC usually requires that all rice taken over under the loan program be delivered into railroad cars and that official weights be established on the rice. Growers with rice stored in commercial units can meet the terms of the loan without extra expense. Farm-stored rice must be hauled to elevators or driers equipped to weigh and load it into railroad cars. The typical charge for hauling rice from farms to commercial driers at the time of the study was about 3.9 cents a hundredweight, and the typical elevator charge for receiving, weighing, and loading into railroad cars was about 8.0 cents a hundredweight--a total of 11.9 cents (table 8).

Contributions for Market Development

The Rice Council, an organization for promoting and advertising the use of rice, ordinarily receives 1.8 cents a hundredweight

from growers who sell their rice on the open market (tables 8, 9). The Rice Council does not normally receive any amount from the grower when his rice is delivered to the Commodity Credit Corporation under the loan program.

Grain Insurance

Grain insurance costs shown in tables 8 and 9 were based on a storage period extending from October 15 to March 15 for stationary type driers and from October 1 to March 15 for multipass facilities. Standard insurance rates, developed in cooperation with the Louisiana Insurance Bureau, were used.

Although some growers did not carry insurance on rice stored in farm driers, they bore a risk commensurate with the cost of such insurance. Commercial driers ordinarily carry such insurance on the rice in their driers. The cost of this insurance is shown here rather than under in-plant costs for convenience in comparing marketing costs of rice dried in on-farm and in off-farm driers.

Grain Investment

When a farmer's money is tied up in rice, it cannot be used for other investments. Grain investment costs shown in tables 8 and 9 represent the returns foregone by missing these opportunities.

When rice was sold immediately after drying, or forfeited under the loan program, the rate of interest used was 6 percent. This rate was applied to rice valued at \$5 per hundredweight and based on a 30-day drying period for stationary type driers and a 15-day drying period for both on-farm and off-farm units.

Growers may obtain loans on their stored rice under the Government price-support program at 3.5 percent. They are not required to pay interest on the loan, however, if the rice is forfeited under the loan program. Grain investment costs for growers selling out of storage were imputed on this basis. Rice was valued at \$5 per hundredweight. The storage season was assumed to extend from October 15 to March 15 for stationary type units and from October 1 to March 15 for multipass type facilities.

Shrinkage

Shrinkage may occur due to moisture loss; insect and rodent damage; spilling during handling; loss of dust during drying, aeration, and handling; and loss of trash during cleaning.

If rice is cleaned, the increase in value due to the improved quality of the rice probably compensates for the weight loss plus the extra cost of cleaning.

It was estimated that shrinkage other than from trash and moisture removal amounted to 0.5 percent during the drying period and another 0.5 percent during the storage period.

Application for Government Loan

Growers are charged 2 cents a hundredweight by the Commodity Credit Corporation at the time an application for a loan is made under the price support program. This charge helps defray costs of sampling and inspecting the rice and of administering the loan.

TOTAL COSTS

Table 10 summarizes average total costs to growers in 1959-61 for drying, storing, and marketing rough rice over the 3-year period, by type of facility and marketing system used.

Among the on-farm units, multipass facilities had lower total unit costs than stationary bulk bins in all marketing situations. Cost differences observed among the farm

Table 10.--Average total costs per hundredweight of drying, storing, and selling rough rice, by type of facility and marketing situation, Louisiana and Texas, 1959-61

Marketing situation and cost item	Type of facility				
	On-farm			Off-farm	
	Round bulk bins	Buildings with bulk bins	Multipass	Cooperative	Other
-----Cents per hundredweight-----					
<u>Selling rice immediately after drying</u>					
Drying costs	40.3	52.4	31.5	34.3	28.7
Marketing costs	9.9	9.9	8.6	8.6	8.6
Total	50.2	62.3	40.1	42.9	37.3
<u>Selling rice after storage</u>					
Operating costs					
Drying	40.3	52.4	31.5	34.3	28.7
Storage	--	--	--	18.6	33.2
Marketing costs	22.9	22.9	24.7	24.7	24.7
Total	63.2	75.3	56.2	77.6	86.6
<u>Forfeiting rice under Government price-support loan program</u>					
Operating costs					
Drying	40.3	52.4	31.5	34.3	28.7
Storage	--	--	--	18.6	33.2
Marketing costs	22.4	22.4	23.4	11.5	11.5
Total	62.7	74.8	54.9	64.4	73.4

facilities were primarily due to differences in costs of drying.

Of the two types of stationary facilities, buildings with bulk bins incurred higher costs than round bulk bins for all three marketing alternatives.

Within the commercial group, cooperatively owned and operated facilities incurred lower costs than other ownership arrangements in two of the three marketing situations, but the analysis of variance indicates that these differences were not significant (appendix table 32).

Because of differences in size of farm and commercial facilities, a comparison of average total costs is not very meaningful. The average maximum output of farm driers did not approach the lowest output reported for a commercial unit.

On the average, round bulk bins operated at 67 percent of their drying capacity; buildings with bulk bins, 58 percent; on-farm multipass units, 47 percent; and off-farm commercial facilities, 81 percent. Commercial units operated at an average of 30 percent of their storage capacity.

The above costs are based on the average level of operation of each type of facility over the 3-year period. In table 11, average total per unit costs are summarized for those facilities which operated at or above 80 percent of capacity. Since only 2 of the 63 observations made of off-farm storage facilities included plants operating at this level, costs were not summarized by type of ownership (cooperative or other).

On-farm multipass units operating at this capacity averaged lower costs per hundredweight than other type facilities under all three marketing situations. Between the stationary type facilities, round bulk bins averaged lower costs than buildings with bulk bins for all marketing alternatives. Off-farm facilities had the lowest average costs for rice sold immediately after drying. Both on-farm and off-farm units had the highest average costs for rice sold after storage.

Table 11.--Average total costs per hundredweight for drying, storing, and selling rough rice, by type of facility and marketing situation, for plants operating at 80 percent or more of capacity, Louisiana and Texas, 1959-61

Marketing situation and cost item	Type of facility			
	On-farm			Off-farm
	Round bulk bins	Buildings with bulk bins	Multipass	
	-----Cents per hundredweight-----			
<u>Selling rice immediately after drying</u>				
Drying costs	32.1	41.2	24.9	31.3
Marketing costs	9.9	9.9	8.6	8.6
Total	42.0	51.1	33.5	39.9
<u>Selling rice after storage</u>				
Operating costs				
Drying	32.1	41.2	24.9	31.3
Storage	--	--	--	9.8
Marketing costs	22.9	22.9	24.7	24.7
Total	55.0	64.1	49.6	65.8
<u>Forfeiting rice under Government price-support loan program</u>				
Operating costs				
Drying	32.1	41.2	24.9	31.3
Storage	--	--	--	9.8
Marketing costs	22.4	22.4	23.4	11.5
Total	54.5	63.6	48.3	52.6

QUALITY

Differences in the value of rice resulting from the drying and storage operations must be considered in analyzing the efficiency of the various types of drying and storage facilities. An attempt was made to measure such differences by comparing a number of samples of rice dried and stored in the various types of facilities.

The number of rice samples studies-- control vs. dried, and control vs. dried and stored -- and their differences in grade, milling yield, and estimated values are shown in appendix tables 33 and 34. Differences in both grade and milling yield were determined from U.S. grade certificates obtained for each of the samples. Values were computed by applying price support rates for the qualities shown on the grade certificates.

Little difference in average value was found between rice dried in multipass and rice dried in stationary units. Such differences as did exist disappeared after the rice had been stored.

A possible explanation for the disappearance of differences after storage is contained in

research findings showing that milling yields increase when rice is stored for more than 3 weeks.² In the present study, samples from multipass driers were analyzed for quality within 7 to 14 days after harvest, whereas the samples from stationary type driers were analyzed 21 to 42 days after harvest because of the more gradual drying process. Thus, the slightly poorer milling yield and value of rice from multipass driers at the end of the drying period may have been due to the lack of aging rather than to type of drying facility.

While there was little difference in the average value of rice from the different types of driers, individual lots differed greatly. Possible explanations for such differences are sampling errors, grading errors, and differences in the exact operating techniques at particular driers.

After considering the influence of aging on quality and the wide variation among individual samples, it was concluded that no significant difference existed in the average quality of rice dried in the stationary and rice dried in the multipass facilities.

OTHER CONSIDERATIONS

In addition to costs of drying and storage and possible differences in quality of rice, growers need to consider some other factors before deciding whether to increase the use of farm units or patronize commercial facilities. These include size of farm operation, variety of rice grown, alternative uses for facilities, and timeliness of the operation.

Size of Farm Operation

Because of the relatively large drying capacity of even the smallest farm multipass drier, these driers can be used efficiently only in rather large-scale farm operations.

In the sample drawn for this study, all farm multipass driers were classified as large, that is, had a drying capacity of more than 11,340 hundredweight.

In some of the situations studied, stationary bin driers were used efficiently in relatively small-scale farm operations. However, the small-scale farm drying and storage facilities tended to be underutilized by growers, resulting in relatively high unit cost operations (appendix tables 17 and 18).

²D. Faulkner Macon and Finis T. Wratten. Abstracts on Drying and Storage, Summary of Rice Drying Research in Louisiana. Proceedings, Tenth Rice Technical Working Group, U.S. Dept. Agr., Agr. Res. Serv. ARS 72-39, October 1965.

Variety of Rice

During the 3-year period studied, prices for Bluebonnet rice rose an average of 29 cents a hundredweight after the harvesting season (figure 4). Considering the uncertainty of seasonal price rises and the cost of storing rice, the incentive for storing Bluebonnet rice is not very great.

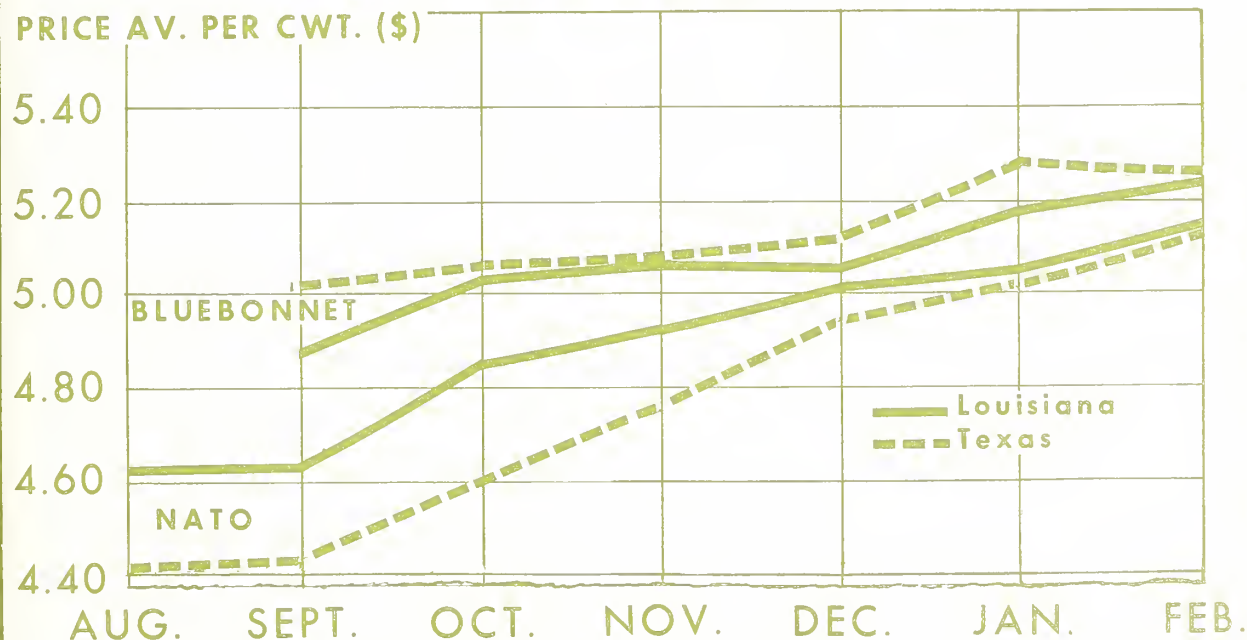
In contrast, the seasonal price rise for the Nato variety averaged about 61 cents a hundredweight, far more than enough to justify the cost of storage as determined by this study. A possible reason that more Nato rice was not stored is the difficulty of drying and storing medium grain rice such as Nato compared with the long grain varieties such as Bluebonnet. Moreover, medium grain rice ordinarily matures somewhat earlier than the long grain varieties, and hence requires more storage time which involves more expense.

Medium grain rice is thicker and in many cases requires more passes through multipass driers to achieve a safe storage moisture content than do the slender, long grain varieties. It probably also requires more time in the stationary bulk bin driers. Thus, the increased risk of medium grain rice becoming damaged and the additional cost of minimizing this risk may help to explain the large difference between prices of medium grain rice sold at harvest and of that sold after storage.

Alternative Uses for Facilities

Although driers consisting of buildings with bulk bins showed the highest drying and storage costs, they have more alternative uses. Should the drying and storage operation be abandoned they can easily be converted into other types of buildings needed on most farms.

**FIG. 4-- SEASONAL ROUGH RICE PRICE PATTERNS
IN LOUISIANA AND TEXAS, 1959-62**



Timeliness of Operation

At certain times commercial driers are unable to receive all the green rice that growers would like to deliver. Rice should be harvested at a definite stage of maturity and the drying process needs to begin soon thereafter to avoid loss in quality and yield. Moreover, a threat of storm may cause a

large number of growers to harvest at the same time, almost regardless of the stage of maturity, in order to minimize field losses. On-farm driers are more likely to have storage space readily available under such circumstances than are commercial driers. Also, during periods of peak receipts, growers' trucks may be tied up for a longer period at commercial driers than at on-farm driers.

SELECTED BIBLIOGRAPHY

Barr, H. T., Wratten, F. T., Poole, W. D., and Walker, R. P.

1955. Recommendations for Bin Drying and Storage of Rough Rice. La. Agr. Expt. Sta. Agr. Engin. Dept. Cir. 18.

Calderwood, David L., and Hutchinson, Reed S.

1961. Drying Rice in Heated Air Dryers With Aeration as a Supplemental Treatment. U.S. Dept. Agr. Mktg. Res. Rpt. 508.

Efferson, J. Norman, Hathorn, Roane, and Gerlow, Arthur.

1954. Economic Study of Rough Rice Storage in the Southern States. U.S. Dept. Agr. Mktg. Res. Rpt. 75.

Faulkner, Macon D., and Wratten, Finis T.

1965. Abstracts on Drying and Storage, Summary of Rice Drying Research in Louisiana. Tenth Rice

Tech. Working Group, U.S. Dept. Agr. Agr. Res. Serv. ARS 72-39.

Hildreth, R. J., and Sorenson, J. W.

1957. Profits and Loss from On-Farm Drying and Storage of Rice in Texas. Tex. Agr. Expt. Sta. Bul. 865.

Moore, Clarence A., and Whitney, Howard S.

1957. Seasonal Price Change and Commercial Storage Costs of Rice. Tex. Agr. Expt. Sta. Bul. 849.

Price, Carter

1964. The Relationship Between Costs, Output and Capacity for Rice Drying Facilities in Louisiana and Texas. La. State Univ. Dept. Agr. and Agribusiness unpublished thesis.

APPENDIX I. DETERMINING MULTIPASS DRIER CAPACITY

To standardize the drying time required for all green rice receipts, an average moisture content of 19 percent was assumed. The average was determined from interviews with multipass drier operators who indicated the usual moisture content of green rice receipts. Based on equipment manufacturers' specifications as to each model's maximum flow rate per hour and a detailed list of the numbers and models of all drying equipment in a plant, each firm's maximum hourly output was determined. Assuming 23 drying hours per day and 7 working days per week during a maximum week, the number of operating hours per week was multiplied by the hourly output to give the potential flow rate per week. Assuming that, on the average, five passes at a maximum flow rate are required to dry green rice to a moisture content safe for storage, the maximum weekly drying output was obtained by dividing the weekly flow rate by five.

The maximum weekly drying output was also adjusted by bin aeration capability and the ratio of total storage space to weekly drying output. Rice can be held for varying amounts of time between passes through the drying column, and these time periods may be further lengthened by aeration in the bin. Thus, the holding space at a multipass drier will influence the volume of rice that can be in the drying process during any period.

According to engineering estimates, bin space should be five times the maximum weekly drying output of multipass drying equipment. Maximum weekly output was increased 5 percent when the storage space at a drier exceeded the "5 to 1" ratio. Also, bin aeration capability was assumed to increase

multipass weekly drying capacity by an additional 10 percent.

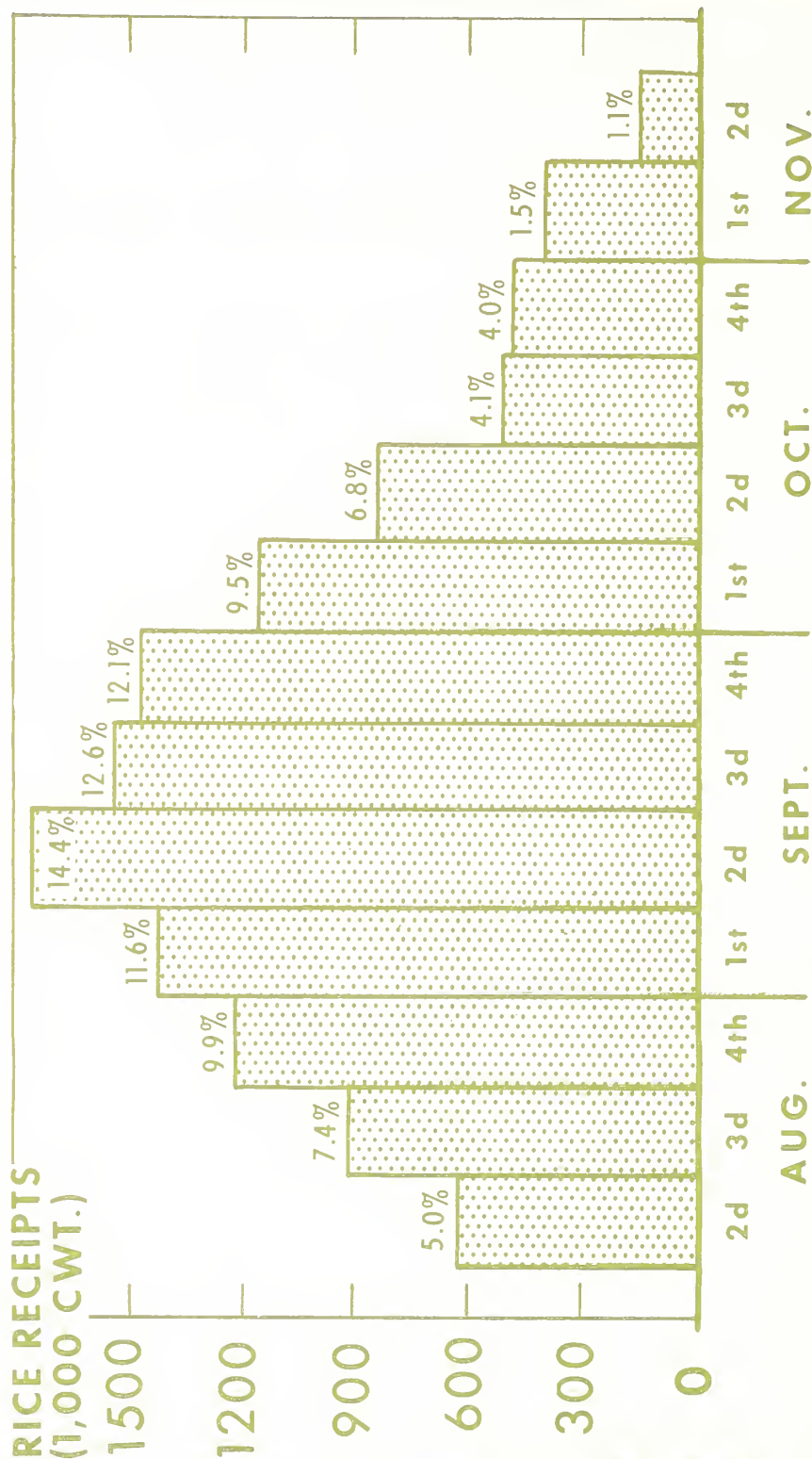
Holding space at a multipass drying facility could become a limitation on drying output because bin space is required for both receiving green rice and storing dry rice. It was assumed that total season drying capacity could not exceed three times the storage space at a multipass drier. This absolute limit was based on time requirements for receiving, drying, and merchandising rice in addition to past experience of rice drier operators.

Assuming that drying output would follow the same distribution as green rice receipts shown in figure 5, a potential season's drying output was calculated for each multipass drying facility. The week of greatest green rice receipts was considered the week of greatest drying output. Thus, the weekly ratio of peak receipts to total receipts was used to relate maximum weekly drying output to total season drying output. It was assumed that sufficient green rice would be present to require maximum output only during the week of greatest green rice receipts. Receipts during preceding and succeeding weeks would call for less than maximum operation with corresponding decreases in output.

Multipass drier capacity (maximum season drying output) was defined first in terms of the maximum weekly output based on specified drying equipment capability, bin space, and bin aeration. Green rice receipts were introduced to define the length of season and the rate of operation in each week. The rate of drying operations was assumed to vary directly in proportion with green rice receipts.

FIG. 5-- AVERAGE WEEKLY RECEIPTS OF GREEN RICE AT PUBLIC RICE DRIERS AND RICE MILLS AND WEEKLY RECEIPTS

As Percentage of Total Receipts, Louisiana and Texas, 1958-62



APPENDIX II. TABLES

Table 12.--Number and capacity of farm driers by year of construction, Louisiana and Texas, 1948-58

Year constructed	Louisiana		Texas	
	Number	1,000 hundredweight	Number	1,000 hundredweight
1948	7	172	2	91
1949	5	56	--	--
1950	2	12	--	--
1951	3	18	3	37
1952	9	81	2	44
1953	14	116	7	59
1954	29	198	12	124
1955	21	178	21	246
1956	12	72	17	194
1957	7	34	12	121
1958	6	34	10	108
Unknown ¹	5	Unknown	29	Unknown
Total	120	971	115	1,024

¹ Thirty-four owners of farm drying and storage units did not provide information on storage capacity of driers and year of construction.

Source: Carter Price. The Relationship Between Costs, Output and Capacity for Rice Drying Facilities in Louisiana and Texas. Unpublished Thesis, Dept. Agr. Econ. and Agribusiness, La. State Univ., Baton Rouge, May 1964, p. 5.

Table 13.--On-farm driers: Analysis of variance for operating costs per hundredweight of dried rough rice, Louisiana and Texas, 1959-61

Source of variability	Degrees of freedom	Sums of squares	Mean square	F-ratio
Type of facility	2	940,258	470,129	² 3.30
Location (State)	1	84,615	84,615	0.59
Year	2	144,132	72,066	0.51
Type x location	2	293,116	146,558	1.03
Type x year	4	267,433	66,858	0.47
State x year	2	64,365	32,182	0.23
Type x state x year	4	269,218	67,304	0.47
Error	184	26,235,182	142,582	--
Total	¹ 201	28,298,319	1,082,294	--

¹ Includes only those facilities operating all three seasons.

² Significant at the 0.05 level.

Table 14.--On-farm driers: Operating costs per hundredweight of rough rice dried in round bulk bins, by State, Louisiana and Texas, 1959-61

Cost item	State		Average or total
	Louisiana	Texas	
	----- Cents per hundred weight -----		
<u>Variable</u>			
Labor	2.9	2.3	2.8
Sprays and fumigants	0.4	0.5	0.4
Fuel	1.7	(¹)	1.3
Repairs	1.5	1.2	1.4
Electricity	3.3	6.0	4.0
Grain insurance	0.2	0.2	0.2
Other	0.8	0.8	0.8
Total	10.8	11.0	10.9
<u>Fixed</u>			
Depreciation	14.9	17.7	15.6
Insurance	1.7	1.0	1.6
Taxes	2.3	2.8	2.4
Interest	9.3	11.3	9.8
Total	28.2	32.8	29.4
Grand total	39.0	43.8	40.3
Number of observations	78	24	102
Number of facilities	26	8	34
Average capacity (cwt.)	6,406	7,916	6,761
Average output (cwt.)	4,492	4,605	4,519

¹ Less than 0.1 cent per hundredweight

Table 15.--On-farm driers: Operating costs per hundredweight of rough rice dried in buildings with bulk bins, by State, Louisiana and Texas, 1959-61

Cost item	State		Average or total
	Louisiana	Texas	
	----- Cents per hundredweight -----		
<u>Variable</u>			
Labor	4.5	4.5	4.5
Sprays and fumigants	0.2	0.4	0.4
Fuel	0.3	0.5	0.4
Repairs	0.3	0.5	0.5
Electricity	5.0	5.1	5.1
Grain insurance	0.2	0.2	0.2
Other	0.5	1.2	1.1
Total	11.0	12.4	12.2
<u>Fixed</u>			
Depreciation	19.5	21.3	21.1
Insurance	4.3	2.3	2.6
Taxes	3.1	3.4	3.3
Interest	12.3	13.4	13.2
Total	39.2	40.4	40.2
Grand total	50.2	52.8	52.4
Number of observations	9	69	78
Number of facilities	3	23	26
Average capacity (cwt.)	11,610	11,480	11,495
Average output (cwt.)	8,035	6,536	6,709

Table 16.--On-farm driers: Operating costs per hundredweight of rough rice dried in multipass driers, by State, Louisiana and Texas, 1959-61

Cost item	State		Average or total
	Louisiana	Texas	
	----- Cents per hundredweight -----		
<u>Variable</u>			
Labor	3.7	5.0	4.2
Sprays and fumigants	0.1	0.2	0.1
Fuel	2.1	2.2	2.1
Repairs	0.7	2.2	1.3
Electricity	1.8	1.7	1.8
Grain insurance	0.3	0.3	0.3
Other	1.3	1.6	1.4
Total	10.0	13.2	11.2
<u>Fixed</u>			
Depreciation	12.0	7.5	10.2
Insurance	2.6	2.0	2.3
Taxes	1.9	1.1	1.6
Interest	7.5	4.3	6.2
Total	24.0	14.9	20.3
Grand total	34.0	28.1	31.5
Number of observations	33	9	42
Number of facilities	11	3	14
Average capacity (cwt.)	33,862	62,408	39,979
Average output (cwt.)	14,204	35,240	18,712

Table 17.--On-farm driers: Operating costs per hundredweight of rough rice dried in round bulk bins, by size of driers, Louisiana and Texas, 1959-61

Cost item	Size of drier ¹			Average or total
	Small	Medium	Large	
	----- Cents per hundredweight -----			
<u>Variable</u>				
Labor	2.9	2.9	1.7	2.8
Sprays and fumigants	0.4	0.5	0.3	0.4
Fuel	1.7	1.4	(²)	1.3
Repairs	1.9	1.5	0.2	1.4
Electricity	2.6	3.6	8.1	4.0
Grain insurance	0.2	0.2	0.2	0.2
Other	0.6	0.9	0.5	0.8
Total	10.3	11.0	11.0	10.9
<u>Fixed</u>				
Depreciation	18.8	15.2	14.4	15.6
Insurance	1.7	1.7	0.7	1.6
Taxes	2.9	2.4	2.3	2.4
Interest	11.6	9.6	9.3	9.8
Total	35.0	28.9	26.7	29.4
Grand total	45.3	39.9	37.7	40.3
Number of observations	33	63	6	102
Number of facilities ³	--	--	--	34
Average capacity (cwt.)	3,200	7,905	14,337	6,761
Average output (cwt.)	1,711	5,586	8,760	4,519

¹Facilities with capacity less than 4,860 cwt. were classified as small, 4,860 to 11,339 cwt. as medium, and 11,340 cwt. and over as large.

²Less than 0.1 cent per hundredweight

³Numbers not specified since some facilities operated in different size classes from one year to the next.

Table 18.--On-farm driers: Operating costs per hundredweight of rough rice dried in buildings with bulk bins, by size of drier, Louisiana and Texas, 1959-61

Cost item	Size of drier ¹			Average or total
	Small	Medium	Large	
	----- Cents per hundredweight -----			
<u>Variable</u>				
Labor	5.8	4.1	4.7	4.5
Sprays and fumigants	1.6	0.6	0.2	0.4
Fuel	(²)	0.5	0.4	0.4
Repairs	(²)	0.6	0.4	0.5
Electricity	6.1	5.5	4.8	5.1
Grain insurance	0.2	0.2	0.2	0.2
Other	0.4	1.1	1.0	1.1
Total	14.1	12.6	11.7	12.2
<u>Fixed</u>				
Depreciation	48.7	23.0	19.5	21.1
Insurance	3.5	3.1	2.2	2.6
Taxes	7.8	3.6	3.0	3.3
Interest	31.2	14.4	12.2	13.2
Total	91.2	44.1	36.9	40.2
Grand total	105.3	56.7	38.6	52.4
Number of observations	3	42	33	78
Number of facilities ³	--	--	--	26
Average capacity (cwt.)	2,106	8,492	16,170	11,495
Average output (cwt.)	864	5,112	9,273	6,709

¹ Facilities with capacity less than 4,860 cwt. were classified as small, 4,860 to 11,339 cwt. as medium, and 11,340 cwt. and over as large.

² Less than 0.1 cent per hundredweight

³ Numbers not specified since some facilities operated in different size classes from one year to the next.

Table 19.--On-farm driers: Operating costs per hundredweight of rough rice dried in round bulk bins, by year, Louisiana and Texas, 1959-61

Cost item	Year			Average or total
	1959	1960	1961	
-----Cents per hundredweight-----				
<u>Variable</u>				
Labor	2.3	2.9	3.1	2.8
Sprays and fumigants	0.6	0.4	0.3	0.4
Fuel	1.2	1.5	1.3	1.3
Repairs	1.2	1.2	1.8	1.4
Electricity	4.1	4.1	3.7	4.0
Grain insurance	0.2	0.2	0.2	0.2
Other	1.0	0.7	0.7	0.8
Total	10.6	11.0	11.1	10.9
<u>Fixed</u>				
Depreciation	14.8	15.1	16.8	15.6
Insurance	1.6	1.5	1.6	1.6
Taxes	2.4	2.4	2.6	2.4
Interest	9.4	9.5	10.5	9.8
Total	28.2	28.5	31.5	29.4
Grand total	38.8	39.5	42.6	40.3
Number of observations	34	34	34	102
Number of facilities	34	34	34	34
Average capacity (cwt.)	6,761	6,761	6,761	6,761
Average output (cwt.)	4,638	4,694	4,225	4,519

Table 20.--On-farm driers: Operating costs per hundredweight of rough rice dried in buildings with bulk bins, by year, Louisiana and Texas, 1959-61

Cost item	Year			Average or total
	1959	1960	1961	
----- Cents per hundredweight -----				
<u>Variable</u>				
Labor	3.9	4.8	4.8	4.5
Sprays and fumigants	0.4	0.3	0.3	0.4
Fuel	0.3	0.4	0.6	0.4
Repairs	0.2	0.6	0.7	0.5
Electricity	5.0	5.1	5.2	5.1
Grain insurance	0.2	0.2	0.2	0.2
Other	1.3	1.1	0.7	1.1
Total	11.3	12.5	12.5	12.2
<u>Fixed</u>				
Depreciation	19.6	21.1	22.8	21.1
Insurance	2.5	2.6	2.7	2.6
Taxes	3.1	3.3	3.6	3.3
Interest	12.3	13.3	14.3	13.2
Total	37.5	40.3	43.4	40.2
Grand total	48.8	52.8	55.9	52.4
Number of observations	26	26	26	78
Number of facilities	26	26	26	26
Average capacity (cwt.)	11,349	12,035	11,100	11,495
Average output (cwt.)	7,127	6,959	6,041	6,709

Table 21.--On-farm driers: Operating costs per hundredweight of rough rice dried in multipass driers, by year, Louisiana and Texas, 1959-61

Cost item	Year			Average or total
	1959	1960	1961	
	----- Cents per hundredweight -----			
<u>Variable</u>				
Labor	3.5	4.5	4.8	4.2
Spray and fumigants	0.1	0.2	0.2	0.1
Fuel	2.2	2.2	2.0	2.1
Repairs	0.8	2.0	1.1	1.3
Electricity	1.7	1.7	2.0	1.8
Grain insurance	0.3	0.3	0.3	0.3
Other	1.9	1.1	1.2	1.4
Total	10.5	12.0	11.6	11.2
<u>Fixed</u>				
Depreciation	9.6	9.7	11.4	10.2
Insurance	2.2	2.3	2.5	2.3
Taxes	1.5	1.5	1.8	1.6
Interest	5.9	5.9	6.9	6.2
Total	19.2	19.4	22.6	20.3
Grand total	29.7	31.4	34.2	31.5
Number of observations	14	14	14	42
Number of facilities	14	14	14	14
Average capacity (cwt.)	41,021	41,021	37,895	39,979
Average output (cwt.)	19,517	19,497	17,123	18,712

Table 22.--Off-farm driers: Analysis of variance for operating costs of drying rough rice, Louisiana and Texas, 1959-61

Source of variability	Degrees of freedom	Sums of squares	Mean square	F-ratio
Type (Ownership)	1	62,527	62,527	² 12.05
Location (State)	1	10,877	10,877	2.10
Year	2	9,602	4,801	0.93
Type x location	1	18,338	18,338	3.53
Type x year	2	2,000	1,000	0.19
State x year	2	6,241	3,120	0.62
Type x state x year	2	1,435	718	0.14
Error	51	264,728	5,191	---
Total	¹ 62	375,748	106,572	---

¹ Includes only those facilities operating all three seasons.

² Significant at the 0.01 level.

Table 23.--Off-farm driers: Operating costs per hundredweight of dried rough rice, by ownership of drier and by State, 1959-61

Cost item	Cooperative		Other		All off-farm	
	Louisiana	Texas	Louisiana	Texas	Louisiana	Texas
	-----Cents per hundredweight-----					
<u>Variable</u>						
Wages and salaries	12.7	16.6	11.3	10.1	12.3	14.7
Utilities	2.4	2.1	1.9	1.9	2.3	2.0
Grain insurance	0.6	0.4	0.8	0.5	0.7	0.4
Repairs	1.6	1.5	0.7	0.6	1.4	0.5
Administrative	1.3	1.4	1.0	0.5	1.2	1.2
Other	1.3	0.4	1.2	0.7	1.3	1.3
Total	19.9	22.4	16.9	14.3	19.2	20.1
<u>Fixed</u>						
Depreciation	8.4	5.1	5.4	4.8	7.5	5.0
Interest	5.1	4.3	3.3	10.4	4.5	6.0
Taxes	1.5	1.2	0.4	0.3	1.2	0.9
Insurance	1.9	0.5	2.2	1.0	2.0	0.6
Total	16.9	11.1	11.3	16.5	15.2	12.5
Grand total	36.8	33.5	28.2	30.8	34.4	32.6
Less miscellaneous drying income	1.0	1.0	1.0	1.0	1.0	1.0
Net costs	35.8	32.5	27.2	29.8	33.4	31.6
Number of observations	21	15	12	15	33	30
Number of facilities	7	5	4	5	11	10
Average capacity (cwt.)	244,191	303,048	166,768	113,318	216,037	208,183
Average output (cwt.)	201,762	229,033	147,953	91,942	182,195	160,487

Table 24.--Off-farm driers: Operating costs per hundredweight of dried rough rice, by plant capacity, Louisiana and Texas, 1959-61

Cost item	Capacity ¹			Average or total
	Small	Medium	Large	
	-----Cents per hundredweight-----			
<u>Variable</u>				
Wages and salaries	5.1	13.5	14.1	13.4
Utilities	1.2	2.2	2.3	2.2
Grain insurance	0.4	0.7	0.5	0.6
Repairs	0.5	1.1	1.5	1.3
Administrative	0.3	0.9	1.4	1.2
Other	1.3	0.9	0.9	0.9
Total	8.8	19.3	20.7	19.6
<u>Fixed</u>				
Depreciation	3.4	6.1	6.8	6.4
Interest	13.4	4.7	4.6	5.2
Taxes	0.4	0.5	1.3	1.1
Insurance	0.7	1.7	1.3	1.4
Total	17.9	13.0	14.0	14.1
Grand total	26.7	32.3	34.7	33.7
Less miscellaneous drying income	1.0	1.0	1.0	1.0
Net selected costs	25.7	31.3	33.7	32.7
Number of observations	12	21	30	63
Number of facilities ²	--	--	--	21
Average capacity (cwt.)	71,885	162,323	303,444	212,297
Average output (cwt.)	58,476	132,583	244,703	171,858

¹ Facilities with capacity of less than 100,001 cwt. were classified as small, 100,001 to 199,999 cwt. as medium and 200,000 cwt. and over as large.

² No classification was made of number of facilities by capacity. Some facilities operated in one class one year and in another the next.

Table 25.--Off-farm driers: Operating costs per hundredweight of dried rough rice, by year, Louisiana and Texas, 1959-61

Cost item	Year		
	1959	1960	1961
	----- Cents per hundredweight -----		
<u>Variable</u>			
Wages and salaries	13.1	14.0	13.1
Utilities	2.2	2.3	2.1
Grain insurance	0.5	0.6	0.6
Repairs	1.1	1.6	1.2
Administrative	1.3	1.2	1.1
Other	1.0	0.9	0.9
Total	19.2	20.6	19.0
<u>Fixed</u>			
Depreciation	6.5	6.3	6.4
Interest	4.8	4.8	6.0
Taxes	1.0	1.1	1.1
Insurance	1.5	1.3	1.3
Total	13.8	13.5	14.8
Grand total	33.0	34.1	33.8
Less miscellaneous drying income	1.0	1.0	1.0
Net selected costs	32.0	33.1	32.8
Number of observations	21	21	21
Number of facilities	21	21	21
Average capacity (cwt.)	210,483	212,008	214,401
Average output (cwt.)	174,864	168,118	172,592

Table 26.--Off-farm driers: Operating costs per hundredweight of dried rough rice, by percentage of drying capacity used, Louisiana and Texas, 1959-61

Cost item	Percentage of capacity used			Average or total
	50 or less	51-79	80 or more	
	-----Cents per hundredweight-----			
<u>Variable</u>				
Wages and salaries	10.6	14.7	12.7	13.4
Utilities	3.0	1.9	2.3	2.2
Grain insurance	0.8	0.5	0.6	0.6
Repairs	1.5	1.4	1.3	1.3
Administrative	1.0	1.2	1.2	1.2
Other	2.6	0.7	1.0	0.9
Total	19.5	20.4	19.1	19.6
<u>Fixed</u>				
Depreciation	10.8	6.4	6.3	6.4
Interest	8.1	6.6	4.4	5.2
Taxes	1.5	1.2	1.0	1.1
Insurance	1.0	1.2	1.5	1.4
Total	21.4	15.4	13.2	14.1
Grand total	40.9	35.8	32.3	33.7
Less miscellaneous drying income	1.0	1.0	1.0	1.0
Net costs	39.9	34.8	31.3	32.7
Number of observations	4	23	36	63
Number of facilities ¹	--	--	--	21
Average capacity (cwt.)	97,337	220,102	220,084	212,297
Average output (cwt.)	45,208	155,340	196,483	171,858

¹ Some facilities operated at different levels from one year to the next.

Table 27.--Off-farm driers: Analysis of variance for cost per hundredweight of stored rough rice, Louisiana and Texas, 1959-61

Source of variability	Degrees of freedom	Sums of squares	Mean square	F-ratio
Type (Ownership)	1	391,512	391,512	0.47
Location (State)	1	973,778	973,778	1.18
Year	2	3,575,097	1,787,549	2.16
Type x location	1	137,654	137,654	0.17
Type x year	2	834,872	417,436	0.50
Location x year	2	2,457,338	1,228,669	1.49
Type x location x year	2	249,989	124,994	0.15
Error	51	42,201,129	827,473	--
Total ¹	62	50,821,369	5,889,065	--

¹ Includes only those facilities operating all three seasons.

Table 28.--Off-farm driers: Operating costs per hundredweight of stored rough rice, by plant capacity Louisiana and Texas, 1959-61

Cost item	Capacity ¹			Average or total
	Small	Medium	Large	
	----- Cents per hundredweight -----			
<u>Variable</u>				
Wages and salaries	12.4	3.9	5.7	5.5
Utilities	1.0	0.8	0.8	0.8
Repairs	1.0	0.5	0.9	0.8
Administrative	0.6	0.7	0.7	0.7
Other	3.4	1.0	1.9	1.7
Total	18.4	6.9	10.0	9.5
<u>Fixed</u>				
Depreciation	7.2	9.3	4.2	6.2
Interest	3.8	6.3	3.3	4.4
Taxes	0.9	1.0	0.9	0.9
Insurance	1.0	1.7	0.4	0.9
Total	12.9	18.3	8.8	12.4
Grand total	31.3	25.2	18.8	21.9
Less miscellaneous storage income	1.0	1.0	1.0	1.0
Net selected costs	30.3	24.2	17.8	20.9
Number of observations	14	33	16	63
Number of facilities ²	--	--	--	21
Average capacity (cwt.)	53,031	157,373	356,434	184,741
Average output (cwt.)	15,162	37,749	130,480	56,281

¹ Facilities with capacity of less than 100,001 cwt. were classified as small, 100,001 to 199,999 cwt. as medium, and 200,000 cwt. and over as large.

² No classification was made of number of facilities by capacity. Some facilities operated in one class one year and in another the next.

Table 29.--Off-farm driers: Operating costs per hundredweight of stored rough rice, by percentage of storage capacity used, Louisiana and Texas, 1959-61

Cost item	Percentage of capacity used			Average or total
	50 or less	51-79	80 or more	
	----- Cents per hundredweight -----			
<u>Variable</u>				
Wages and salaries	6,7	2,3	(¹)	5,5
Utilities	1,0	0,6	0,2	0,8
Repairs	0,9	0,2	0,1	0,8
Administrative	0,8	0,6	0,4	0,7
Other	1,8	1,7	0,1	1,7
Total	11,2	5,4	0,8	9,5
<u>Fixed</u>				
Depreciation	6,9	3,3	4,5	6,2
Interest	4,9	2,1	4,0	4,4
Taxes	1,0	0,4	0,7	0,9
Insurance	1,1	0,3	0,8	0,9
Total	13,9	6,1	10,0	12,4
Grand total	25,1	11,5	10,8	21,9
Less miscellaneous storage income	1,0	1,0	1,0	1,0
Net selected costs	24,1	10,8	9,8	20,9
Number of observations	56	5	2	63
Number of facilities ²	--	--	--	21
Average capacity (cwt.)	187,207	166,341	161,704	184,741
Average output (cwt.)	48,193	108,567	152,001	56,281

¹ Less than 0.1 cent per hundredweight.

² Numbers were not specified by percentage of capacity used since some facilities operated at different levels from one year to the next.

Table 30.--Off-farm driers: Operating costs per hundredweight of stored rough rice, by State and by ownership of facility, 1959-61

Cost item	Cooperative		Other		All off-farm units	
	Louisiana	Texas	Louisiana	Texas	Louisiana	Texas
----- Cents per hundredweight -----						
<u>Variable</u>						
Wages and salaries	3.0	5.6	16.5	4.3	5.5	5.4
Utilities	0.4	0.9	1.9	1.2	0.7	0.9
Repairs	0.8	0.7	1.3	0.4	0.9	0.7
Administrative	0.6	0.7	1.2	0.5	0.7	0.7
Other	0.5	2.0	4.0	1.6	1.2	1.9
Total	5.3	9.9	24.9	8.0	9.0	9.6
<u>Fixed</u>						
Depreciation	5.6	5.4	5.2	13.4	5.5	6.5
Interest	3.6	4.5	3.3	7.1	3.5	4.8
Taxes	0.7	1.0	1.1	0.9	0.8	1.0
Insurance	0.6	0.6	3.0	2.3	1.1	0.8
Total	10.5	11.5	12.6	23.7	10.9	13.1
Grand total	15.8	21.4	37.5	31.7	19.9	22.7
Less miscellaneous storage income	1.0	1.0	1.0	1.0	1.0	1.0
Net selected costs	14.8	20.4	36.5	30.7	18.9	21.7
Number of observations	21	15	12	15	33	30
Number of facilities	7	5	4	5	11	10
Average capacity (cwt.)	193,753	317,888	130,218	82,596	170,649	200,242
Average output (cwt.)	47,257	133,136	19,192	21,730	37,051	77,433

Table 31.--Off-farm driers: Operating costs per hundredweight of stored rough rice, by year, Louisiana and Texas, 1959-61

Cost item	Year		
	1959-60	1960-61	1961-62
-----Cents per hundredweight-----			
<u>Variable</u>			
Wages and salaries	4.3	6.3	6.0
Utilities	0.7	0.9	0.9
Repairs	0.8	0.8	0.7
Administrative	0.4	0.9	0.8
Other	1.6	1.8	1.6
Total	7.8	10.7	10.0
<u>Fixed</u>			
Depreciation	4.8	7.1	6.8
Interest	3.5	5.1	4.7
Taxes	0.7	1.2	0.9
Insurance	0.8	1.1	0.9
Total	9.8	14.5	13.3
Grand total	17.6	25.2	23.3
Less miscellaneous storage income	1.0	1.0	1.0
Net selected costs	16.6	24.2	22.3
Number of observations	21	21	21
Number of facilities	21	21	21
Average capacity (cwt.)	181,969	183,450	188,805
Average output (cwt.)	62,252	54,589	52,002

Table 32.--Off-farm driers: Analysis of variance for total costs per hundredweight of drying and storing rough rice, Louisiana and Texas, 1959-61

Source of variability	Degrees of freedom	Sums of squares	Mean square	F-ratio
Type (Ownership)	1	141,116	141,116	0.17
Location (State)	1	1,190,492	1,190,492	1.45
Year	2	3,848,373	1,924,186	2.35
Type x location	1	55,507	55,507	0.07
Type x year	2	915,089	457,545	0.56
Location x year	2	2,495,742	1,247,871	1.52
Type x location x year	2	3,213,570	1,606,785	1.96
Error	51	41,854,582	820,678	--
Total ¹	62	53,714,471	7,444,180	--

¹ Includes only those facilities operating all three seasons.

Table 33.--Long grain rice: Comparisons of change from control samples to test samples for multipass and stationary bulk bin drying systems, by year, 1959-61

Sample comparisons	1959-60		1960-61		1961-62	
	Multipass	Bulk bin	Multipass	Bulk bin	Multipass	Bulk bin
<u>Dried (Y₁)</u>						
Number of observations	44	46	81	75	75	58
Grade:						
Mean difference ¹	-0.2	-0.2	-0.3	0	0.2	-0.3
F-ratio (and error) ²	0.76(1.32)	--	--	0.81(0.74)	1.15(1.3)	--
Milling yield:						
Mean difference ³	-3.01	-3.74	-0.62	0.70	-11.51	-5.94
F-ratio (and error)	0.001(1.42)	--	--	1.1(0.20)	--	7.63**(3.23)
Value:						
Mean difference ⁴	-0.20	-0.40	0.01	0.06	-0.86	-0.55
F-ratio (and error)	1.4(1.14)	--	--	4.27*(0.08)	--	4.67*(2.87)
<u>Dried and stored (Y₂)</u>						
Number of observations	11	28	28	37	19	28
Grade:						
Mean difference	0.1	-0.8	-0.2	-0.2	-0.1	-0.3
F-ratio (and error)	4.63*(1.49)	--	1.43(0.65)	--	0.75(0.80)	--
Milling yield:						
Mean difference	-0.27	0.90	2.64	4.12	-7.42	--
F-ratio (and error)	--	0.25(0.21)	--	6.99*(0.18)	--	2.58(0.41)
Value:						
Mean difference	0.08	-0.08	0.214	0.195	-0.30	-0.001
F-ratio (and error)	1.66(1.02)	--	0.97(0.10)	--	--	1.15(0.16)

¹ In terms of discrete grades 1 through 6.

² The F-ratio is followed by the error mean square in parentheses.

³ In terms of pounds of whole kernels milled from 100 pounds of dried rough rice.

⁴ In terms of dollars per cwt. as indicated by CCC support price computed from a USDA sample certificate.

*0.05 significance level or a probability of less than 5 in 100 that observed differences were due to random sampling variation.

**0.01 significance level or a probability of less than 1 in 100 that observed differences were due to random sampling variation.

Table 34.--Medium grain rice: Comparisons of change from control samples to test samples for multipass and stationary bulk bin drying systems, 1960

Sample comparisons	Drier System	
	Multipass	Stationary bulk bin
<u>Dried (Y₁)</u>		
Number of observations	37	22
Grade		
Mean difference ¹	0.1	-0.4
F-ratio ²	0.54(1.09)	--
Milling yield		
Mean difference ³	-3.23	1.57
F-ratio	--	11.4**(3.08)
Value		
Mean difference ⁴	-0.01	0.04
F-ratio	--	4.06*(0.07)
<u>Dried and stored (Y₂)</u>		
Number of observations	9	11
Grade		
Mean difference ¹	-0.3	-0.3
F-ratio	0.001(1.41)	--
Milling yield		
Mean difference ³	1.44	3.57
F-ratio	--	2.57(1.41)
Value		
Mean difference	0.165	0.115
F-ratio	1.67(6.24)	--

¹ In terms of discrete grades 1 through 6.

² The F-ratio is followed by the error mean square shown in parentheses.

³ In terms of pounds of whole milled kernels from 100 pounds of dried rough rice.

⁴ In terms of dollars per cwt, as indicated by CCC support price computed from a USDA sample certificate.

*0.05 significance level or a probability of less than 5 in 100 that observed differences were due to random sampling variations.

**0.01 significance level or a probability of less than 1 in 100 that observed differences were due to random sampling variation.

OTHER PUBLICATIONS AVAILABLE

Help for Rural Cooperatives. Information 55. Farmer Cooperative Service, U.S. Department of Agriculture, Washington, D. C. 20250.

Financing Farmer Cooperatives. Educational Circular 5. Farmer Cooperative Service, U.S. Department of Agriculture, Washington, D. C. 20250.

Farmer CooperativesFarm Business Tools. Agricultural Information Bulletin 275. By Beryle Stanton. Farmer Cooperative Service, U. S. Department of Agriculture, Washington, D. C. 20250.

Grain Cooperatives. Bulletin Reprint 1. Farmer Cooperative Service, U. S. Department of Agriculture, Washington, D. C. 20250.

Production Labor Requirements in Southern Rice Mills. Marketing Research Report No. 714. By J. C. Eiland. Economic Research Service, U. S. Department of Agriculture, Washington, D. C. 20250.

The Local Grain Elevator Business in Louisiana, A Study of Characteristics and Problems. Bulletin No. 573. By Harlon D. Traylor and Bernis E. Williamson. Louisiana State University, Baton Rouge, Louisiana 70803.

Economic Feasibility of Soybean Oil Milling in South Central Louisiana. D.A.E. Research Report No. 355. By F. Raeford Baker, Harlon D. Traylor, and Ewell P. Roy. Louisiana State University, Baton Rouge, Louisiana 70803.

Economic Feasibility of Shipping Grain and Soybeans by Water in Louisiana. D.A.E. Research Report No. 357. By Harlon D. Traylor and Henry Bernard, Jr. Louisiana State University, Baton Rouge, Louisiana 70803.

Selected Operating Costs for Storage of Sorghum Grain. By. C. A. Bonnen and W. C. Cunningham. Texas A&M University, College Station, Texas. 77843.

Copies of these publications may be obtained upon request from the publishing agency while a supply is available.

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