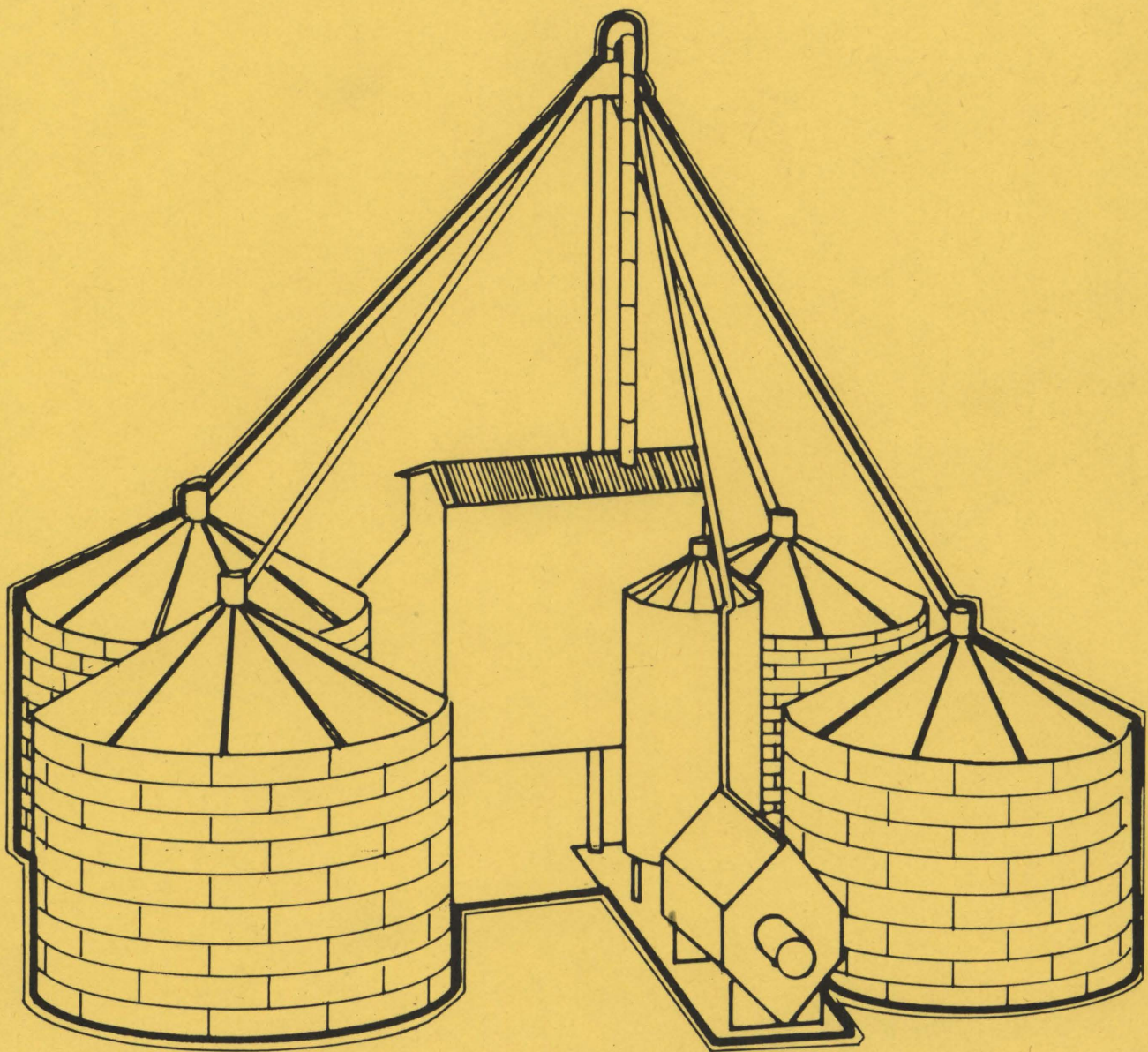


Economics of Farm Drying and Storage Systems in Ohio



ECONOMICS OF FARM DRYING AND STORAGE SYSTEMS IN OHIO

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TABLE OF CONTENTS

	<u>Page(s)</u>
Introduction	1
Objectives	1-2
Drying Systems	2-4
Cost for Five Different Conditioning and Storage Systems and Three Different Production Levels	4-9
Average Fixed Cost	4-5
Average Variable Cost	5-6
Average Total Cost	6-9
Conclusions	9-10
Appendix A. Fixed and Variable Costs, Assumptions, and Definitions	12-38
Total Fixed Costs	12-13
1. Depreciation	13
2. Insurance for Buildings and Equipment	13-14
3. Interest	14
4. Real Estate Taxes	14
5. Annual Repairs and Maintenance	14-15
Total Variable Costs	15-18
1. Insurance on Grain or Risk Equivalent	16
2. Rodent Control	16
3. Forfeited Interest	16-17
4. Drying, Aeration, and Excess Drying Loss	17
5. Labor and Management	17-18
6. Risk Cost (Grade Loss)	18
7. Loss of Grain	18
Appendix B. Methods for Calculating Costs for a Continuous Flow and Low Temperature Dryer and Storage Systems (20,000 Bushels)	38-47

LIST OF TABLES

	<u>Page</u>
Table 1. Average Fixed, Variable, and Total Costs for Five Conditioning and Storage Systems (Cents/Bu.)	7
Appendix Table 1. Components and 1974 Prices for Three Continuous Flow Drying and Storage Systems	19
Appendix Table 2. Components and 1974 Prices for Three Automatic Batch Drying and Storage Systems	20
Appendix Table 3. Components and 1974 Prices for Three Batch-in-Bin Drying and Storage Systems	21
Appendix Table 4. Components and 1974 Prices for Three Low Temperature Drying and Storage Systems	22
Appendix Table 5. Components and 1974 Prices for Three Corn Crib Storage Systems	23
Appendix Table 6. 1974 Prices and Average Fixed, Variable, and Total Costs for a Continuous Flow Dryer and Storage System (20,000 Bushels)	24
Appendix Table 7. 1974 Prices and Average Fixed, Variable, and Total Costs for a Continuous Flow Dryer and Storage System (40,000 Bushels)	25
Appendix Table 8. 1974 Prices and Average Fixed, Variable, and Total Costs for a Continuous Flow Dryer and Storage System (60,000 Bushels)	26
Appendix Table 9. 1974 Prices and Average Fixed, Variable, and Total Costs for an Automatic Batch Dryer and Storage System (20,000 Bushels)	27
Appendix Table 10. 1974 Prices and Average Fixed, Variable, and Total Costs for an Automatic Batch Dryer and Storage System (40,000 Bushels)	28
Appendix Table 11. 1974 Prices and Average Fixed, Variable, and Total Costs for an Automatic Batch Dryer and Storage System (60,000 Bushels)	29
Appendix Table 12. 1974 Prices and Average Fixed, Variable, and Total Costs for a Batch-in-Bin Dryer and Storage System (20,000 Bushels)	30

	<u>Page</u>
Appendix Table 13. 1974 Prices and Average Fixed, Variable, and Total Costs for a Batch-in-Bin Dryer and Storage System (40,000 Bushels)	31
Appendix Table 14. 1974 Prices and Average Fixed, Variable, and Total Costs for a Batch-in-Bin Dryer and Storage System (60,000 Bushels)	32
Appendix Table 15. 1974 Prices and Average Fixed, Variable, and Total Costs for a Low Temperature Dryer and Storage System of Grain Dried and Stored (20,000 Bushels)	33
Appendix Table 16. 1974 Prices and Average Fixed, Variable, and Total Costs for a Low Temperature Dryer and Storage System of Grain Dried and Stored (40,000 Bushels)	34
Appendix Table 17. 1974 Prices and Average Fixed, Variable, and Total Costs for a Low Temperature Dryer and Storage System of Grain Dried and Stored (60,000 Bushels)	35
Appendix Table 18. 1974 Prices and Average Fixed, Variable, and Total Costs for a Crib Storage System (20,000 Bushels)	36
Appendix Table 19. 1974 Prices and Average Fixed, Variable, and Total Costs for a Crib Storage System (40,000 Bushels)	37
Appendix Table 20. 1974 Prices and Average Fixed, Variable, and Total Costs for a Crib Storage System (60,000 Bushels)	38
Appendix Table 21. Dryer Performance Records Based on an Ambient Air Temperature of 60° F	46
Appendix Table 22. Million BTU/Hr. Required for Temperature Rise Shown in Degrees F	47

THE ECONOMICS OF FARM DRYING AND STORAGE SYSTEMS IN OHIO

Roger W. Smith and E. Dean Baldwin*

Introduction

Rapid changes in the production and marketing of corn are affecting many Ohio farmers. Some of these having the greatest economic implications to farmers, as well as to machinery manufacturers and grain marketing firms, are the changes requiring new investments in farm drying and storage equipment. Since the acquisitions of conditioning and storage equipment by individual farms represent long-term specialized investments, the decision to farm dry and store corn depends upon the careful assessment of many factors, one of which is the cost of owning and operating the farm equipment.

Past research at Ohio and Illinois reported fixed and variable costs for an on-farm batch-in-bin dryer and storage system for selected production and moisture levels. (5,6) Because of inflation and the introduction of different on-farm drying systems, these cost data are rapidly becoming obsolete and are of limited use in the decision-making process.

OBJECTIVES

The general objective is to define and report the methods for calculating current on-farm drying and storage costs for selected sets of conditioning and storage systems. Specifically, the goals are:

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1. To describe the different types of on-farm drying and storage systems that are available to Ohio farmers.
2. To identify the components and respective purchase price for each drying and storage method.
3. To determine fixed and variable cost for the selected drying and storage methods for three different levels of corn production.
4. To report the assumptions, methods, formulas, and required calculations in order that all cost data may be revised by the producer as the need arises.
5. To compare and contrast the cost data among the five different conditioning and storage systems.

DRYING SYSTEMS

Farmers in Ohio are predominately using five different types of drying and storage systems. The first requires natural air drying and crib storage of ear corn. Since high moisture corn is also field shelled, the remaining four systems are designed to artificially dry shelled corn by either a continuous flow process, automatic batch, batch-in-bin, or by a low-temperature method. It is assumed that artificially dried shelled corn is stored in steel bins.

Although only 20 percent of the corn supply is harvested in ear form, the corn crib continues to provide a viable alternative drying and storage method for many Ohio farmers. In addition, some elevator firms pay a ten to fifteen cent premium to obtain ear corn. Because of these economic factors, the cost and components of a wire constructed crib with a corrugated

roof are reported in this study.

The four artificial drying and storage systems are differentiated by dryer type and by method of drying. The first two systems, the continuous flow and the automatic batch, have very similar characteristics. The "continuous flow" dryer perpetually moves wet and dry grain into and out of the drying chamber. Temperatures of 180° to 240° with per bushel air flow rates of 100 cubic feet/minute (CFM's) are normal for this dryer type. Manufacturers recommend this drying method for farms which annually harvest and dry at least 20,000 bushels of grain. (3) The "automatic batch" perpetually feeds "batches" of grain into and out of the drying chamber. Since large batches of grain are rapidly moved through the drying system, these dryers also have relative large drying capacities. (3) Temperatures of 150° to 250°F are normal for this dryer type with air flows ranging from 40 to 100 CFM's per bushel of grain.

The "batch-in-bin" artificial drying system dries one batch of grain in a 16-21 hour period. The bushels of grain dried in each batch usually equal the volume of corn harvested daily. Manufacturers recommend this drying system to farms which harvest and dry a maximum of 70,000 bushels of grain annually. (3) Temperatures range from 100° to 130° F with air flows of 15-30 CFM's per bushel. Since the grain is not continuously moving through the drying chamber, each batch of grain dries unevenly throughout the batch. Previous research indicated that the moisture content at the bottom of the tank ranges from 5-8 percentage points lower than at the top of the tank. (3) To prevent spoilage due to the variation

in the moisture levels for each batch of grain, this drying process must be carefully managed.

The low temperature drying method is relatively new and is not widely used in Ohio. The low temperature dryer functions as a batch-in-bin drying system, but the hot air temperature exceeds the ambient outside air temperature by only a few degrees. The air flow requirement for this system is also relatively low ranging from 1-3 CFM's per bushel. Since drying temperatures and the CFM's are relatively low, batches of grain are dried over a 25-50 day period. To assure proper drying and to prevent spoilage, corn with moisture levels above 26% should not be dried in this system.

COSTS FOR FIVE DIFFERENT CONDITIONING AND STORAGE SYSTEMS AND THREE DIFFERENT PRODUCTION LEVELS

Average Fixed Costs

The components and respective 1974 prices for the five conditioning and storage systems are reported in Appendix A and in Appendix Tables 1-5. Since the total fixed cost data (Appendix Tables 6-20) are derived from the drying and storage equipment prices, the producer must carefully gather the appropriate price data to accurately estimate the fixed cost. The average fixed cost data reported in Table 1 and in Appendix Tables 6-20 are the total fixed cost divided by the respective production levels. Although additional equipment is specified by the dealer for increased levels of production, the average fixed cost of drying and storage declines as grain volumes increased from the 20,000 to 60,000 bushel level.

The average fixed cost for storage increases as volumes increase from 20,000 bushels to 40,000 bushels for the continuous-flow and automatic batch systems, Table 1 and Appendix Tables 6-11. In each of these cases, the increase is due to the addition of a grain elevator leg to the system's component list. Since additional major investments are not required to store more grain, the average fixed storage cost declines as volumes increase from 40,000 to 60,000 bushels. As grain volumes increase from 40,000 to 60,000 bushels, the batch-in-bin and low temperature drying units exhibit increasing average fixed storage costs, Table 1 and Appendix Tables 12-17. These cost averages increase because the additional storage volumes require the selection of stronger, more expensive, bins or added reinforcement in the existing lower quality bins.

Average fixed cost of drying decreases as production volumes increase because the existing drying equipment is used more intensely. For the continuous flow, automatic batch, and low temperature drying units, the decreasing average fixed costs of drying, tend to offset the increases in average fixed costs of storage with a net result of an overall decrease in average total fixed cost, Table 1 and Appendix Tables 6-11, 15-17. The average fixed cost ratio for the crib system declines as production levels are increased, Table 1 and Appendix Tables 18-20.

Average Variable Costs

The assumptions, formulas, and calculations underlying total variable costs are reported in Appendices A and B. The average variable cost, the per bushel variable cost of drying and storing grain, is determined

by dividing the total variable cost by the respective production levels. As reported in Table 1 and Appendix Tables 6-20, the average variable cost decreases as production volumes increase. The resulting inverse relationship occurs because the larger grain producers can more efficiently use the drying and storage equipment. Specifically, costs related to rodent control for grain in storage tend to reflect that larger volumes of grain require less expense per bushel. This lower expense is attributed to the fact that (1) extermination rates for rodent control depends upon the number of bins to be treated rather than the amount of grain contained in each bin, and (2) at larger grain volumes, fewer but larger bins are utilized for storage purposes, resulting in a decrease in the average variable cost.

Another factor upon which larger volumes have an impact on variable cost is in the labor and management function. Many times the labor involved both in drying and storage of grain tends to be more efficiently utilized when greater volumes of grain are processed. Basically, this is due to the fact that less time and effort are required for managing and working with grain in proportion to the volumes of grain handled.

Average Total Costs for the Respective Conditioning and Storage Systems

The average total cost is the sum of average variable cost and average fixed cost. For the continuous flow, automatic batch, low temperature, and crib systems, the average total cost decreases as grain volumes increases, Table 1 and Appendix Tables 6-20. Due to the variation in the average fixed cost for the batch-in-bin system, the average total cost at first decreases and then increases as values increase from the 20,000 to 60,000 bushel levels.

Table 1. Average Fixed, Variable, and Total Costs for Five Conditioning and Storage Systems (Cents/Bu.)

Dryer and Storage System	20,000 Bushels			40,000 Bushels			60,000 Bushels		
	Storage	Drying	Sum	Storage	Drying	Sum	Storage	Drying	Sum
Continuous Flow									
Ave. Fixed Costs	17.35	13.61	30.96	18.60	7.68	15.29	15.29	6.38	21.67
Ave. Var. Costs	16.96	12.54	29.50	16.84	12.55	29.39	16.73	12.54	29.27
Ave. Costs	34.31	26.15	60.46	35.44	20.23	55.67	32.02	18.98	50.94
Automatic Batch									
Ave. Fixed Costs	14.24	8.78	23.02	16.72	5.53	22.25	15.17	5.68	20.85
Ave. Var. Costs	17.07	12.31	29.38	16.89	12.31	29.20	16.77	12.31	29.08
Ave. Costs	31.31	21.09	52.40	33.61	17.84	51.45	31.94	17.99	49.93
Batch-in-Bin									
Ave. Fixed Costs	17.02	6.74	23.76	12.29	3.50	15.79	13.45	3.34	16.79
Ave. Var. Costs	17.42	11.57	28.99	17.02	11.57	28.59	16.91	11.42	28.33
Ave. Costs	34.44	18.31	52.75	29.31	15.07	44.38	30.36	14.76	45.12
Low Temperature									
Ave. Fixed Costs	11.46	9.72	21.18	11.23	8.27	19.50	11.27	7.56	18.83
Ave. Var. Costs	18.90	16.62	35.52	18.83	16.60	35.43	18.76	16.60	35.36
Ave. Costs	30.36	26.34	56.70	30.06	24.87	54.93	30.03	24.16	54.19
Crib									
Ave. Fixed Costs	15.68	-0-	15.68	14.27	-0-	14.27	14.28	-0-	14.28
Ave. Var. Costs	17.30	-0-	17.30	17.23	-0-	17.23	17.16	-0-	17.16
Ave. Costs	32.98	-0-	32.98	31.50	-0-	31.50	31.44	-0-	31.44

¹Corn dried from 25.5% moisture level to 15.5% level.

For the small producer handling 20,000 bushels of corn annually and desiring artificial drying facilities, the least costly system would be the automatic-batch facility. At this production level, the annual cost is 52.40¢ per bushel. The batch-in-bin facilities are the second least costly, at 52.75¢ per bushel; low-temperature drying is the third least costly at 56.70¢; and the continuous-flow facilities are the most costly of the four at 60.46¢ per bushel.

Of particular interest for producers desiring capacities of 40,000 bushels annually, the batch-in-bin system is the least costly at an expense of 44.38¢ per bushel. Automatic-batch systems, as analyzed in this study, are the second least costly at 51.45¢ per bushel; low-temperature units are third with an expense of 54.93¢ per bushel; and continuous-flow systems are the most costly at 55.67¢ per bushel.

At the 60,000 bushels production level, this study indicates that the batch-in-bin facility is once more the least expensive with a cost of 45.12¢ per bushel. The second least expensive system at this production level is the automatic-batch facility at a cost of 49.93¢ per bushel; the third least expensive is the continuous-flow system, and the most costly system is the low-temperature system.

For producers desiring natural drying and crib storage, the average total costs are approximately 32.98¢, 31.50¢, and 31.44¢ for the 20,000 bushel, 40,000 bushel, and 60,000 bushel production levels, respectively. Since wet corn is naturally air dried, costs for this conditioning and storage method are relatively low when compared with the artificial drying and storage systems. However, the appropriate decision to harvest and sell ear or shelled corn cannot be made on the basis of these data alone.

Additional costs associated with harvesting, trucking, and marketing eared and shelled corn must also be considered.

CONCLUSIONS

The results from this study indicate that the batch-in-bin dryer system is the least costly artificial drying unit. Batch-in-bin systems are able to process relatively large volumes of corn at rather moderate investment levels. Since it is more difficult to maintain correct moisture levels, more spoilage or overdrying may result than with the more automated drying units. Hence, the cost advantage of this system may be somewhat offset by the discounting process at the time the grain is sold.

Continuous-flow systems provide producers with the advantage of greater grain drying accuracy. While these systems are much more easily adapted to automatic control, thus reducing labor and management demands, benefits from use of this system are possible only with highly integrated handling and control systems. Due to the relatively high capital expenditures, this facility is economical only for relatively large production levels.

The automatic-batch unit operates at a lower cost than the continuous-flow systems for comparable capacity. More management may be required in checking initial and final corn moisture levels and making appropriate control corrections. Sophisticated handling equipment and wet-corn holding capacity ahead of dryer are still required.

Low-temperature drying systems allow less margin for error than some other drying systems. Management requirements may be greater for low-temperature systems as grain spoilage is a greater risk. These systems are somewhat more costly than other systems included in this study; however, higher quality grain can be produced through utilization of low-temperature drying methods. Producers may find the increased value of the high-quality product from low-temperature systems to more than offset the increased cost of its implementation.

Due to differences in farm characteristics and assumptions, these data should not be used blindly. The prices of the various systems do not represent average price data. These prices are based upon information obtained from five equipment dealers. For this reason, acquisition prices may vary widely depending upon time of year, available brands, dealer locale, or size of dealership. Furthermore, costs of operation may vary due to differences in managerial expertise, in weather and drying conditions, in regional fuel costs, and in type and age of the equipment. All cost data can and should be altered by the user to meet specific needs.

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APPENDIX A

FIXED AND VARIABLE COSTS, ASSUMPTIONS, DEFINITIONS

The components and respective prices for the drying and storage systems are collected by personally interviewing dealers from five retail outlets located in central Ohio. The design of each conditioning and storage unit is contingent upon the expected volume and types of grain that are simultaneously dried and stored. These dealers thus agree to design systems for farms which could annually produce 20,000 bushels of corn, 40,000 bushels, and 60,000 bushels. Since each dealer also assumed that more than one grain type may be simultaneously stored, the bin sizes are smaller than required for storing only one type of grain. The required components are defined and are reported in the Appendix Tables 1-5.

The prices reported in these tables include labor and installation costs and reflect September 1, 1974 manufacturer's suggested retail prices. Since these price data reflect the average price for all retail outlets in Ohio, farmers are frequently able to bargain for discounts ranging from 10-30 percent of the suggested retail price. The size of the discount is contingent upon dealer's locale, supply and demand conditions for a particular brand, services offered by the dealer, season of year, and/or total sales volume of a particular dealer. Prices paid by any one farmer may vary from those reported in this table.

Total Fixed Costs

The survey data are used to determine the total fixed and variable costs for the alternative drying and storage systems. Since the respective

drying and storage units for each system perform a unique task, the fixed and variable costs are separately determined for the drying and storage functions. In addition, the cost data for the storage components are further subdivided into permanent facilities (buildings) and operational equipment.

1. Depreciation

Fixed costs are those expenditures which do not change in magnitude irrespective of the level of output. These costs are the sum of depreciation, interest on borrowed money, taxes, repairs and maintenance, and equipment insurance. Depreciation, which is an implicit cost, is the decline in value of assets due to wear and obsolescence. The depreciation costs presented in the Appendix Tables 6-20 assumes zero salvage values and are estimated by the straight line method. Based on past obsolescence rates, the economic life value used in these calculations are: 12 years for all bins and associated equipment, and 8 years for all other components in the drying and storage systems.

2. Insurance for Buildings and Equipment

Insurance represents a fixed explicit cost and is a contract guaranteeing protection against losses from a contingent event. A local insurance firm, which insures central Ohio farm enterprises, supplied the following rate information. Although rates vary by type of dryer, by brand name, and by farm characteristics, the annual rate most commonly quoted by this agent to firms average .005¢ per dollar value of equipment. The annual insurance

costs data are derived by multiplying the mid-value (price of equipment \div 2) times the .005¢ rate, Appendix Tables 6-20.

3. Interest

The interest charge is an explicit cost for compensation paid by a borrower for the use of money. These funds are used to acquire drying and storage equipment. The interest cost data are calculated by multiplying the mid-value (price \div 2) of the drying and storage equipment times a 10% interest rate, Appendix, Tables 6-20.

4. Real Estate Taxes

Real estate taxes are fixed explicit costs paid to the state for ownership rights on all immobile equipment including buildings. The assessed value of the equipment in central Ohio is 35% of the market price and the average millage for the state is 40 mills per dollar of the assessed value. (1) The real estate cost data reported in Appendix Tables 6-20 are derived by multiplying the initial investment cost of the building components times 35%. The resulting product, the assessed value, is then multiplied by 40 mills (.04¢). The final product is the real estate tax.

5. Annual Repairs and Maintenance

Since secondary repairs and replacement cost data are not readily available, agricultural engineers at the Ohio State University, estimated these annual costs. Based on average management and maintenance practices, the annual repair rates for the low temperature and batch-in-bin dryers,

continuous flow and automatic batch dryers, and the corn crib system are estimated at 1.5%, 2.5%, and 1%, respectively, of the initial purchased value. The repair and cost data in Appendix Tables 6-20 are derived by multiplying the respective percentage times the initial purchase price.

6. Total Fixed Costs

The total fixed cost data are the sum of depreciation, insurance, interest, taxes, annual repairs, and maintenance costs minus the investment tax credit, Appendix Tables 6-20. A tax credit is a deduction for personal property with a useful minimum life of seven years. A tax credit is legally deductible for the year in which the property is placed into service or for the year in which the depreciation of the property begins. During 1974, the legal value of the deduction is 7% of the total purchase value. For 1975 and 1976 only, the legal deduction will be 10% of the purchase price. Since all data presented in the Appendix Tables represents 1974 trends, the reported total tax credit data are derived by multiplying the 1974 purchase price times the 7%. The annual tax credit is derived by dividing these products by the economic life of the equipment, Appendix Tables 6-20.

Total Variable Costs

Total variable or operating costs are a function of production and increase (decrease) in magnitude as production increases (decreases). These costs include expenditures on grain insurance, rodent control, forfeited interest, drying and aeration, excess drying loss, labor and management, risk (grade loss), and physical loss of grain. Since the variable cost data

in Appendix Tables 6-20 represent costs per bushel, all recorded results are averaged variable costs.

1. Insurance on Grain or Risk Equivalent

These expenditures secure a contract guaranteeing the value of grain against loss from fire or wind damage. If the producer does not acquire an insurance contract, these costs are considered as imputed risk expenditures. Although the rates vary by farm characteristics, type, and brand of structure, a central Ohio insurance company quoted an average rate of 18¢ per one-hundred dollar value of grain for a seven-month storage period. For the life of the conditioning and storage equipment, corn prices are assumed to range from \$2.50 per bushel to \$3.50. The total insurance premiums reported in Appendix Tables 6-20 are derived by multiplying the insurance rate (.18 dollars) times \$3.00 per bushel times the total bushel in storage.

2. Rodent Control

These cost data include monthly visits by local exterminators who inspect and apply pesticides to prevent grain damage by rodents and insects. The seven-month storage period service rate is .05¢ per bushel, .04¢, and .03¢, respectively, for the 20,000 bushel, 40,000 bushel, and 60,000 bushel production levels.

3. Forfeited Interest

Since the grain is not sold at harvest, funds, which could be used to earn interest from alternative investments, are tied to the stored corn supply. This cost is not unique to the farm storage operation. It is

paid by farmers who store at commercial elevators and is over and above the storage charge. In this example, the forfeited interest cost data are based on a seven-month investment period, \$3.00 per bushel corn, and an average interest payment of 7.5%. This forfeited interest rate is a December 1974 premium which could have been earned on U.S. treasury bills.

4. Drying, Aeration, and Excess Drying Loss

The drying and aeration data are derived from engineering tables and formulas. All assumptions and calculations are presented in Appendix B. Propane gas is used for drying grain in the continuous flow dryer, the automatic batch, and the batch-in-bin. The estimated cost for the propane gas is 35¢ per gallon. Electricity for aeration and heating is priced at \$1.85 for the first 20 kilowatt hours and \$.0365 for each kilowatt hour thereafter.

Since the drying process is very complex, many farm producers overdry grain to prevent spoilage. Research results suggest that many farm producers dry grain to 13.5% rather than to the 15.5% level. (2, p.51) Because overdrying increases shrinkage and reduces the weight of a bushel of corn, excess drying costs are incurred by the farm firms. The assumptions, methods, and calculations for these costs are also presented in Appendix B.

5. Labor and Management

The labor and management costs associated with the drying and storage functions are presented in the Appendix Tables 6-20. These costs are calculated based on the rate of \$3.00 per man-hour of labor multiplied by

the estimated minimum number of hours required to operate and manage the respective drying and storage systems. The assumptions and methods for deriving the required number of hours are presented in Appendix B. The labor costs associated with all trucking activities are not included in these calculations.

6. Risk Cost (Grade Loss)

Because grain is a living organism, corn quality deteriorates during the storage period. Inappropriate drying, storage, and/or aeration techniques also inhibit the storability of this grain. Since farm producers do not continually buy, sell, and blend grain, it is impossible to maintain a constant grade of grain over an extended storage period. It is assumed that #2 grade grain is stored and #3 grade corn is sold from storage. Minimum test weights of #2 and #3 grade corn are used to evaluate these costs. Based on U.S.D.A. grading system, the minimum allowable test weight per bushel of #2 corn is 54 pounds while the minimum allowable test weight for #3 corn is 52 pounds. Since the two pound difference is discounted at the rate of 1/2 cent for each 1/2 pound under the 54 pound minimum, the total discount cost is 2 cents per bushel.

7. Loss of Grain

These cost data represent the physical loss of grain (dust) resulting from the handling functions. Since these losses cannot be determined from existing primary or secondary data, those data are derived from minary publications (4) and represent estimated costs.

Appendix Table 1. Components and 1974 Prices For Three Continuous Flow Drying and Storage Systems

20,000 Bushels			40,000 Bushels			60,000 Bushels		
	Description	Price		Description	Price		Description	Price
Bins	2-10,000 Bu.	\$ 9,732	Bins	2-15,000 Bu. 1-10,000 Bu.	\$ 12,272 4,866	Bins	4-15,000 Bu.	\$ 24,544
Dryer	175 Bu./hr. ¹	10,102	Dryer	240 Bu./hr. ¹	18,451	Dryer	300 Bu./hr. ¹	17,062
Wetbin	1700 Bu.	1,884	Wetbin	1700 Bu.	1,884	Wetbin	1700 Bu.	1,884
Aeration	2--1/2 HP.	400	Aeration	3--1/2 HP.	600	Aeration	4--1/2 HP.	800
Augers	Unloading		Augers	Unloading		Augers	Unloading	
	2-6" tube & auger	1,246		3-6" tube & auger	1,869		6" tube & auger	2,492
	Wetbin filler							
	6" x 51"	2,370						
	Dryer Unloader	1,200	Elevator Leg	72'---1500 Bu./hr. incl. pipes, guys, pit screw	8,700	Elevator Leg	72'---1500 Bu./hr. incl. pipes, guys, pit screw	9,150
	Wetbin Unloading	724	Framing Steel		2,000	Framing Steel		2,000
Concrete	Bins-18 yds. @	900	Concrete	15,000 Bu. bins-20 yds. @	1,000	Concrete	Framing-4 yds.	100
	Wetbin Pad-4 yds.	100		10,000 Bu. bin-16 yds.	400		Bins-20 yds @	2,000
	Dryer Pad-5 yds.	125		Dryer Pad-5 yds.	125		Leg, Pit, Aprons-16 yds.	400
	Reinforcement-incl. plastic	540		Framing-4 yds.	100		Dryer Pad-5 yds.	125
Labor ²	Total	2,820	Labor ²	Leg, Pit, Aprons-16 yds.	400	Labor ²	Total	6,200
				Reinforcement-incl. plastic	700			
Wiring		1,200	Wiring		2,500	Wiring		2,950
Freight		650	Freight		1,100	Freight		1,400
		*****			*****			*****
		\$ 33,993			\$ 57,967			\$ 71,907

¹ 10% moisture removal

² Labor charge excludes wiring; wiring charge includes wiring labor.

Appendix Table 2. Components and 1974 Prices For Three Automatic Bathh Drying and Storage Systems

20,000 Bushels			40,000 Bushels			60,000 Bushels						
	Description	Price		Description	Price		Description	Price				
Bins	2-10,000 Bu.	7,760	Pins	2-20,000	\$ 14,400	Bins	3-20,000 Bu.	\$ 21,600				
Dryer	110 Bu./hr. ¹	5,300	Dryer	210 Bu./hr. ¹	9,500	Dryer	320 Bu./hr. ¹	15,400				
Wetbin	2,000 Bu.	2,000	Wetbin	2,000 Bu.	2,000	Wetbin	2-2000 Bu.	4,000				
Aeration	2--1/2 HP.	400	Aeration	2--1/2 HP.	400	Aeration	3--1/2 HP.	600				
Augers	Wetbin filler 8' x 52'	2,000	Elevator Leg	80'---1800-2000 Bu./hr. incl. pipes, guys, pit screw	9,300	Elevator Leg	80'---3,000 Bu./hr. incl. pipes, guys, pit screw	11,600				
	Dryer filler 8' x 21'	1,050	Augers	Unloading 2-6" tube & auger	1,246	Augers	Unloading 3-6" tube & auger	1,869				
	Dryer to bin 6' x 62'	1,400	Framing Steel		1,600	Framing Steel		1,600				
	Unloading 2-6" tube & auger	1,250	Concrete	Bins-30 yds. @ Dryer Pad-4 yds. Framing-6 yds. Leg, Pit, Aprons-15 yds. Reinforcement-incl. plastic	1,500 100 150 375 700	Concrete	Bins-30 yds. @ Dryer Pad-6 yds. Framing-6 yds. Leg, Pit, Aprons-18 yds. Reinforcement-incl. plastic	2,250 150 150 450 800				
Concrete	Bins-18 yds. ²	900	Labor ²	Total	5,500	Labor ²	Total	6,000				
	Wetbin Pad-4 yds.	100		Wiring			1,600	Wiring		1,800		
	Dryer Pad-3 yds.	75			Freight				800	Freight		900
	Reinforcement-incl. plastic	500										
Labor ²	Total	1,400										
Wiring		900										
Freight		350										
		=====			=====			=====				
		\$ 25,385			\$ 49,171			\$ 69,169				

¹ 10% moisture removal

² Labor charge excludes wiring; wiring charge includes wiring labor.

Appendix Table 3. Components and 1974 Prices for Three Batch-in-Bin Drying and Storage Systems

20,000 Bushels			40,000 Bushels			60,000 Bushels		
	Description	Price		Description	Price		Description	Price
Dry-o-vator	100 Bu./hr. ¹	\$ 2,900	Dry-o-vator	100 Bu./hr. ¹	\$ 2,900	Dry-o-vator	200 Bu./hr. ¹	\$ 3,075
Bins	Dryer Unit		Bins	Dryer Unit		Bins	Dryer Unit	
	1-5000 Bu.	3,200		1-5000 Bu.	3,200		1-8000 Bu.	6,000
	Fan & Heater	2,000		Fan & Heater	2,000		Fan & Heater-2	4,100
	Perforated Floor	650		Perforated Floor	850		Perforated Floor	1,270
	Grain Distributor	200		Grain Distributor	200		Grain Distributor	200
	Unloading Auger	395		Unloading Auger	395		Unloading Auger	395
	Moisture Control	375		Moisture Control	375		Moisture Control	575
	Storage Units			Storage Units			Storage Units	
	2-7500 Bu.	6,800		2-16000 Bu.	14,000		3-17500 Bu.	25,125
	Perforated Floor-2	1,700		Perforated Floor-2	2,540		Perforated Floor-3	3,800
	Grain Distributor-2	400		Grain Distributor-2	400		Grain Distributor-3	600
	Unloading Auger-2	820		Unloading Auger-2	820		Unloading Auger-3	1,225
	Roof Augers-2			Roof Augers-2			Roof Augers-3	
	4" x 20'	400		4" x 20'	400		4" x 20'	600
	Aeration-2	900		Aeration-2	900		Aeration-3	1,350
	Sweep Auger-1	240		Sweep Auger-1	240		Sweep Auger-1	240
Concrete	5000 Bu. bin-8 yds.	200	Concrete	5000 Bu. bin-10 yds.	250	Concrete	8000 Bu. bin-8 yds.	200
	7500 Bu. bins-15 yds @	750		16000 Bu. bins-25 yds. @	1,250		17500 Bu. bins-25 yds. @	1,875
	Concrete blocks-1000	300		Concrete blocks-1500	465		Concrete blocks-2150	645
Labor ²	Total	4,200	Labor ²	Total	4,500	Labor ²	Total	6,800
Wiring		1,100	Wiring		1,200	Wiring		1,300
Freight		750	Freight		1,200	Freight		1,660
	=====			=====			=====	
		\$ 28,280			\$ 38,085			\$ 61,035

¹ 10% moisture removal

² Labor charge excludes wiring; wiring charge includes wiring labor.

**Appendix Table 4. Components and 1974 Prices For Three
Low Temperature Drying and Storage Systems**

20,000 Bushels			40,000 Bushels			60,000 Bushels		
Description		Price	Description		Price	Description		Price
Bins	2-10,000 Bu.	\$ 9,749	Bins	4-10,000 Bu.	\$ 19,480	Bins	6-10,000 Bu.	\$ 29,220
Dryer Unit-2		4,120	Dryer Unit-4		8,240	Dryer Unit-6		12,360
Grain Distributor-2		1,040	Grain Distributor-4		2,080	Grain Distributor-6		1,560
Unloading Auger & Tube-2		1,240	Unload Auger & Tube-4		2,480	Unloading Auger & Tube-6		3,720
Auger	8' x 51'	2,040	Auger	8' x 51'	2,040	Auger	8' x 51'	2,040
Storage Bin---Perforated Floor-2		800	Storage Bin---Perforated Floor-4		1,600	Storage Bin--Perforated Floor-6		2,400
Concrete	Bins-16 yds. # Reinforcement-incl. plastic	800 280	Concrete	bins-16 yds. # Reinforcement-incl. plastic	1,600 560	Concrete	Bins-16 yds. # Reinforcement-incl. plastic	2,400 840
Sweep Auger		425	Sweep Auger		425	Sweep Auger		425
Labor ¹	Total	2,500	Labor ¹	Total	4,560	Labor ¹	Total	6,840
Wiring		1,200	Wiring		1,600	Wiring		3,200
Freight		1,000	Freight		1,600	Freight		2,200
		=====			=====			=====
		\$ 24,985			\$ 46,265			\$ 67,205

¹ Labor charge excludes wiring; wiring charge includes wiring labor.

Appendix Table 5. Components and 1974 Prices For
Three Corn Crib Storage Systems

		<u>20,000 Bushels</u>				<u>40,000 Bushels</u>				<u>60,000 Bushels</u>	
	Description		Price		Description		Price		Description		Price
Bins	10-2,100 Bu.	\$	14,470	Bins	19-2,100 Bu.	\$	27,493	Bins	29-2,100 Bu.	\$	41,563
Concrete	6 yds. @		1,500	Concrete	6 yds. @		2,850	Concrete	6 yds. @		4,350
Labor	Total		2,000	Labor	Total		3,800	Labor	Total		5,800
Freight			600	Freight			1,140	Freight			1,740
Auger	8" x 35'		1,540	Auger	8" x 35'		1,540	Auger	8" x 35'		1,540
			=====				=====				=====
			\$ 20,110				\$ 36,823				\$ 55,393

Appendix Table 6. 1974 Prices and Average Fixed, Variable, and Total Costs for a Continuous Flow Dryer and Storage System (20,000 Bushels)

	BLDGS.	STORAGE	EQUIPT.	DRYING
Bins	\$ 9732			
Metbin	1884		Aeration \$ 400.	Dryer \$ 10102
Concrete	900		Unloading 1246	Unloading 1200
	100		W. Bin fill 2370	Loading 724
Wiring (1/4)	400			Concrete 125
Freight (3/4)	300			Reinf. 140
Labor (3/4)	488			Wiring (3/4) 900
	2120			Freight (1/4) 162
	\$ 15924			Labor (1/4) 700
			\$4016	\$ 14953

--- FIXED COSTS ---

	12 years	8 years	8 years	TOTAL cents/bu)
1. Depreciation	1327.00	502.00	1756.63	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)	39.81	10.04	35.13	
3. Interest-Mid Value x rate (rate = 10%)	796.20	200.80	702.65	
4. Taxes-Value x 40 mills x 35%	222.94	none	none	
5. Annual Repairs & Maint. (price x 2.5%)	398.10	100.40	351.33	
6. Total fixed costs	2784.05	813.24	2845.74	
7. Investment credit/yr.	- 92.89	-35.14	-122.96	
8. Total fixed costs (adj)	\$ 2691.16	\$ 3469.26	\$ 2722.78	
9. Ave. annual fixed costs		17.35¢	13.61¢	30.96¢
10. Insurance on grain (risk equiv.)		.32¢		
11. Rodent Control (.05¢/bu. x 7)		.35¢		
12. Loss of grain (est. 1/2¢/bu.)		.50¢		
13. Interest forfeited by holding grain		13.13¢		
14. Drying and aeration fuel & elec totl. ²		.24¢	5.33¢	
15. Excess drying loss 15.5% to 13.5%			6.94¢	
16. Labor mgt. costs (no truck)		.42¢	.27¢	
17. Risk cost (grade loss) T.W. loss		2.00¢		
18. Ave. variable costs/bu.		16.96¢	12.54¢	29.50¢
19. Ave. total costs.			69.46¢	

¹ Fractions denote portion of cost allocated to that heading.

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 7. 1974 Prices and Average Fixed, Variable, and Total Costs for a Continuous Flow Dryer and Storage System (40,000 Bushels)

	STORAGE		DRYING				
	BLDGS.	EQUIPT.					
Bins	\$ 17138	Aeration \$ 600	Dryer	\$ 13455			
Wetbin	1884	Augers 1869	Concrete	125			
Concrete Bins	1400	Leg 8700	Reinf. (1/4)"	175			
Frame	100	Steel 2000	Freight	275			
Leg, Pit, etc.	400		Labor	1000			
Reinf. (3/4)"	525		WIRING (1/2)"	\$ 31			
Wiring (2/3)"	1665						
Freight (3/4)"	825						
Labor (5/6)"	5000						
	\$ 28937		\$ 13169	\$ 15668			
--- FIXED COSTS---							
1. Depreciation	12 years	2411.42	8 years	1646.13	8 years	1982.63	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		72.34		32.92		39.65¢	
3. Interest-Mid Value x rate (rate = 10%)		1446.85		658.45		793.05	
4. Taxes-value x 40 mills x 35%		405.12		NONE		NONE	
5. Annual repairs & maint. (price x 2.5%)		723.43		329.23		396.53	
6. Total fixed costs.		5059.16		2666.73		3211.86	
7. Investment credit/yr		-168.80		-115.23		-138.78	
8. Total fixed costs (adj)		\$ 4890.36	\$ 7441.86	\$ 2551.50		3073.08	
9. Ave. total fixed costs			18.60¢			7.68¢	26.29
--- VARIABLE COSTS PER BUSHEL---							
10. Insurance on grain (risk equiv.)			.32¢				
11. Rodent Control (.04¢/bu. x 7)			.28¢				
12. Loss of grain (est. 1/2¢/bu.)			.50¢				
13. Interest forfeited by holding grain			13.13¢				
14. Drying and aeration fuel & elec totl. ²			.29¢			5.33¢	
15. Excess drying loss 15.5% to 13.5%						6.94¢	
16. Labor mgt. costs (no truck)			.32¢			.28¢	
17. Risk cost (grad loss) T.W. loss			2.00¢				
18. Ave. variable costs/bu.			16.84¢			12.55¢	29.39
19. Ave. total costs.							55.67

¹ Fractions denote portions of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 8. 1974 Prices and Average Fixed, Variable, and Total Costs for a Continuous Flow Dryer and Storage System (60,000 Bushels)

	STORAGE		DRYING				
	BLDGS.	EQUIPT.			TOTAL		
Bins	\$ 24544	Aeration \$ 800	Dryer	\$ 17062			
Wetbin	1884	Augers 2492	Concrete	125			
Concrete	2000	Leg 9150	Reinf. (1/4)	200			
Bins	100	Frame 2000	Wiring (1/3)	983			
Frame	400		Freight (1/4)	350			
Leg, Pit, etc.	600		Labor (1/4)	1033			
Reinf. (3/4)	1967						
Wiring (2/3)	1050						
Freight (3/4)	5167						
Labor (5/6)	\$ 37712						
		\$ 14442		\$ 19753			
---FIXED COSTS---							
1. Depreciation	12 years	3142.67	8 years	1805.25	8 years	2469.13	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		94.28		36.11		49.38	
3. Interest-Mid Value x rate (rate = 10%)		1885.60		722.10		987.65	
4. Taxes-value x 40 mills x 35%		527.97		NONE		NONE	
5. Annual repairs & maint. (price x 2.5%)		942.80		361.05		493.83	
6. Total fixed costs		6593.32		2924.51		3999.99	
7. Investment credit/yr		-219.99		-126.37		-172.84	
8. Total fixed costs (adj)		\$ 6373.33	\$ 9171.47	\$ 2798.14		\$ 8827.15	
9. Ave. total fixed costs			15.29¢		6.38¢	21.57¢	
---VARIABLE COSTS PER BUSHEL---							
10. Insurance on grain (risk equiv.)			.32¢				
11. Rodent Control (.03¢/bu. x 7)			.21¢				
12. Loss of grain (est. 1/2¢/bu.)			.50¢				
13. Interest forfeited by holding grain			13.13¢				
14. Drying and aeration fuel & elec totl. ²			.29¢		5.33¢		
15. Excess drying loss 15.5% to 13.5%					6.94¢		
16. Labor mgt. costs (no truck)			.28¢		.27¢		
17. Risk cost (grade loss) T.W. loss			2.00¢				
18. Ave. variable costs/bu.			16.73¢		12.54¢	29.27¢	
19. Ave. total costs.						50.94¢	

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture from 15.5% moisture

Appendix Table 9. 1974 Prices and Average Fixed, Variable, and Total Costs for an Automatic Batch Dryer and Storage System (20,000 Bushels)

	BLDGS.	EQUIPT.				
Bins	\$ 7750	Aeration	\$400	Dryer	\$5300	
Wetbin	2000	Unloading	1250	Unloading	1400	
Concrete Bins	900	W. Bin fill	2000	Loading	1050	
W. Bin	100			Concrete	75	
Reinf. (3/4) ¹	375			Reinf. (1/4) ¹	125	
Wiring (1/4) ¹	225			Wiring (3/4) ¹	675	
Freight (3/4) ¹	262.50			Freight (1/4) ¹	87.50	
Labor (3/4) ¹	1050			Labor (1/4) ¹	350	
	\$ 12672.50		\$3550		\$9062.50	
---FIXED COSTS---						
1. Depreciation	12 years	1056.04	8 years	456.25	8 years	1132.81
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		31.68		9.13		22.60
3. Interest-Mid Value x rate (rate = 10%)		633.63		162.50		456.13
4. Taxes-value x 40 mills x 35%		177.42		NONE		NONE
5. Annual repairs & maint. (price x 2.5%)		316.81		91.25		223.56
6. Total fixed costs.		2215.58		739.13		1935.16
7. Investment credit/yr		- 73.92		-31.94		- 79.30
8. Total fixed costs (adj)		\$2141.66	\$2848.85	\$707.19		\$1755.86
9. Ave. total fixed costs			14.24¢			8.78¢
---VARIABLE COSTS PER BUSHEL---						
10. Insurance on grain (risk equiv.)			.32¢			
11. Pesticide control (.05¢/bu.x 7)			.35¢			
12. Loss of grain (est. 1/2¢/bu.)			.50¢			
13. Interest forfeited by holding grain			13.13¢			
14. Drying and aeration fuel & elec totl.			.35¢			5.04¢
15. Excess drying loss 15.5% to 13.5%						6.94¢
16. Labor mgt. costs (no truck)			.42¢			.33¢
17. Risk cost (grade loss) T.W. loss			2.00¢			
18. Ave. variable costs/bu.			17.07¢			12.31¢
19. Ave. total costs.						

¹ Fraction denotes portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 10. 1974 Prices and Average Fixed, Variable, and Total Cost for an Automatic Batch Dryer and Storage System (40,000 Bushels)

	STORAGE		DRYING	
	BLDGS.	EQUIPT.		
Bins	\$ 14400	Aeration \$ 400	Dryer	\$ 9500
Wetbin	2000	Augers 1246	Concrete	100
Concrete	1500	Leg 9300	Reinf. (1/4)'	175
Bins	150	Steel 1600	Wiring (1/3)'	532.80
Framing	375		Freight (1/4)'	200
Leg, Pit	525		Labor (1/6)'	916.67
Reinf. (3/4)'	1067.20			
Wiring (2/3)'	600			
Freight (3/4)'	4583.33			
Labor (5/6)'	\$ 25200.53	\$12546		\$11424.47

---FIXED COSTS---

					TOTAL (cents/bu)
1. Depreciation	12 years	2100.04	8 years	1568.25	8 years 1428.06
2. Insurance-Mid Value x rate (rate = ,005¢ per bu.)		63.00		31.37	28.56
3. Interest-Mid Value x rate (rate = 10%)		1260.03		627.30	571.22
4. Taxes-value x 40 mills x 35%		352.81		NONE	NONE
5. Annual repairs & maint. (price x 2.5%)		630.01		313.65	285.61
6. Total fixed costs.		4405.89		2540.57	2313.45
7. Investment credit/yr		-147.00		-109.78	- 99.96
8. Total fixed costs (adj)		4258.89	6689.68	2430.79	2213.49
9. Ave. total fixed costs			16.72¢		5.53¢ 22.25¢

---VARIABLE COSTS PER BUSHEL---

10. Insurance on grain (risk equiv.)	.32¢	
11. Rodent control (.04¢/bu. x 7)	.28¢	
12. Loss of grain (est. 1/2¢/bu.)	.50¢	
13. Interest forfeited by holding grain	13.13¢	
14. Drying and aeration fuel & elec totl. 2	.34¢	5.04¢
15. Excess drying loss 15.5% to 13.5%		6.94¢
16. Labor mgt. costs (no truck)	.32¢	.33¢
17. Risk cost (grade loss) T.W. loss	2.00¢	
18. Ave. variable costs/bu.	16.89¢	12.31
19. Ave. total costs.		29.12¢

1 Fractions denote portion of cost allocated to that heading.

2 Corn dried from 25.5 % moisture to 15.5% moisture.

Appendix Table 11. 1974 Prices and Average Fixed, Variable, and Total Costs for an Automatic Batch Dryer and Storage System (60,000 Bushels)

	STORAGE		EQUIPT.		DRYING	
	BLDGS.					
Bins	\$ 21600		Aeration	\$ 600	Dryer	\$ 15400
Wetbins-2	4000		Augers	1869	Concrete	150
Concrete	2250		Leg	11600	Reinf. (3/4) ¹	200
Bins	150		Steel	1600	Wiring (1/3) ¹	599.40
Framing	450				Freight (1/4) ¹	225
Leg, Pit	600				Labor (1/6) ¹	1000
Reinf. (3/4) ¹	1200.60					
Wiring (2/3) ¹	675					
Freight (3/4) ¹	5000					
Labor (5/6) ¹	\$ 35925.60			\$ 15669.00		\$ 17574.40
---FIXED COSTS---						
1. Depreciation	12 years	2993.80	8 years	1958.63	8 years	2196.80
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		89.81		39.17		43.94
3. Interest-Mid Value x rate (rate = 10%)		1796.28		783.45		878.72
4. Taxes-value x 40 mills x 35%		502.96		NONE		NONE
5. Annual repairs & maint. (price x 2.5%)		898.14		391.73		439.36
6. Total fixed costs.		6280.99		3172.98		3558.82
7. Investment credit/yr		-209.57		-142.56		-153.78
8. Total fixed costs (adj)		\$ 6071.42		\$ 9101.85		3405.04
9. Ave. total fixed costs				15.17		5.68¢
---VARIABLE COSTS PER BUSHEL---						
10. Insurance on grain (risk equiv.)				.32¢		
11. Rodent control (.03¢/bu. x 7)				.21¢		
12. Loss of grain (est. 1/2¢ bu.)				.50¢		
13. Interest forfeited by holding grain				13.13¢		
14. Drying and aeration fuel & elec totl. ²				.33¢		5.04¢
15. Excess drying loss 15.5% to 13.5%						6.94¢
16. Labor mgt. costs (no truck)				.28¢		.33¢
17. Risk cost (grade loss) T.W. loss				2.00¢		
18. Ave. variable costs/bu.				16.77¢		12.31¢
19. Ave. total costs.						20.09¢

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 12. 1974 Prices and Average Fixed, Variable, and Total Costs for a Batch-in-Bin Dryer and Storage System (20,000 Bushels)

	STORAGE		DRYING		
	BLDGS.	EQUIPT.			
Bins	\$ 10000	Unload. Augers-3	1215	Dry-o-vator	2900
Perf. Floor	2350	Sweep	240	Roof Augers	400
Moisture Control	375	Aeration	900	Fan & Heater	2000
Concrete Bins	950	Grainscatter-3	600	Labor (1/4) ¹	1050
Blocks	300			Wiring (2/3) ¹	734
Labor (3/4) ¹	3150			Freight (1/3) ¹	250
Wiring (1/3) ¹	366				
Freight (2/3) ¹	500				
	\$ 17991		\$ 2955		\$ 7334

--- ANNUAL FIXED COSTS---

	12 years	8 years	8 years	TOTAL (cents/bu)
1. Depreciation	1499.25	369.38	916.75	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)	44.98	7.39	18.34	
3. Interest-Mid Value x rate (rate = 10%)	899.55	147.75	366.70	
4. Taxes-value x 40 mills x 35%	251.87	NONE	NONE	
5. Annual repairs & maint. (price x 2.5%)	269.87	44.33	110.01	
6. Total fixed costs.	2965.52	578.85	1411.80	
7. Investment credit/yr.	-104.95	-25.86	-64.17	
8. Total fixed costs (adj)	2860.57	3403.56	1347.63	
9. Ave. total fixed costs		17.02¢	6.74	23.76¢
--- VARIABLE COSTS PER BUSHEL---				
10. Insurance on grain (risk equiv.)	.32¢			
11. Rodent control (.05¢/bu. x 7)	.35¢			
12. Loss of grain (est. 1/2¢/bu.)	.50¢			
13. Interest forfeited by holding grain	13.13¢			
14. Drying and aeration fuel & elec totl. ²	.49¢		4.32¢	
15. Excess drying loss 15.5% to 13.5%			6.94¢	
16. Labor mgt. costs (no truck)	.63¢		.31¢	
17. Risk cost (grade loss)T.W. loss	2.00¢			
18. Ave. variable costs/bu.	17.42¢		11.57¢	28.99¢
19. Ave. total costs.				52.75¢

¹ Fractions denote portion of cost allocated to that heading.

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 13. 1974 Prices and Average Fixed, Variable, and Total Costs for a Batch-in-Bin Dryer and Storage System (40,000 Bushels)

	STORAGE		DRYING		TOTAL (cents/)	
	BLDGS.	EQUIPT.				
Bins	\$ 17200	Unload. Augers-3	\$1215	Dry-o-vator	\$ 2900	
Perf. Floor	3390	Sweep	240	Roof Augers	400	
Moisture Control	375	Aeration-2	900	Fan & Heater	2000	
Concrete Bins	1500	Grainscatter-3	600	Labor (1/4) ¹	1125	
Blocks	465			Wiring (2/3) ¹	800	
Labor (3/4) ¹	3375			Freight (1/3) ¹	400	
Wiring (1/3) ¹	400					
Freight (2/3) ¹	800					
	\$ 27505		\$ 2955		\$ 7625	
--- FIXED COSTS ---						
1. Depreciation	12 years	2292.08	8 years	369.38	8 years	953.13
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		68.76		7.39		19.06
3. Interest-Mid Value x rate (rate = 10%)		1375.25		147.75		381.25
4. Taxes-value x 40 mills x 35%		385.07		NONE		NONE
5. Annual repairs & maint. (price x 2.5%)		412.58		44.33		114.38
6. Total fixed costs.		4533.74		568.85		1467.82
7. Investment credit/yr.		-160.45		-25.86		-66.72
8. Total fixed costs (adj)		\$ 4373.29	\$ 4916.28	\$ 542.99		1401.10
9. Ave. total fixed costs			12.29¢			3.50¢ 15.79¢
--- VARIABLE COSTS PER BUSHEL ---						
10. Insurance on grain (risk equiv.)		.32¢				
11. Rodent control (.04¢/bu. x 7)		.28¢				
12. Loss of grain (est. 1/2¢/bu.)		.50¢				
13. Interest forfeited by holding grain		13.13¢				
14. Drying and aeration fuel & elec totl. ²		.47¢				4.32¢
15. Excess drying loss 15.5% to 13.5%						6.94¢
16. Labor mgt. costs (no truck)		.32¢				.31¢
17. Risk cost (grade loss) T.W. loss		2.00¢				
18. Ave. variable costs/bu.		17.02¢				11.57¢ 28.59¢
19. Ave. total costs.						44.39¢

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 14. 1974 Prices and Average Fixed, Variable, and Total Costs for a Batch-in-Bin Dryer and Storage System (60,000 Bushels)

	STORAGE		DRYING			
	BLDGS.	EQUIPT.				
Bins	\$ 31125	Unload. Augers ¹ 1620	Dry-o-vator	\$ 3075		
Perf. Floor	5070	Sweep 240	Roof Auger	600		
Moisture Control	575	Aeration 1350	Fan & Heater	4100		
Concrete Bins	2075	Grainscatter 800	Labor (1/4) ¹	1700		
Blocks	645		Wiring (2/3) ¹	867		
Labor (3/4) ¹	5100		Freight (1/3) ¹	553		
Wiring (1/3) ¹	433					
Freight (2/3) ¹	1107					
	\$ 46130	\$ 4010		\$ 10895		
---FIXED COSTS---						
					TOTAL (cents/Bu)	
1. Depreciation	12 years	3844.17	8 years	501.25	8 years	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		115.33		10.03		27.24
3. Interest-Mid Value x rate (rate = 10%)		2306.50		200.50		544.75
4. Taxes-value x 40 mills x 35%		645.82		NONE		NONE
5. Annual repairs & maint. (price x 2.5%)		691.95		60.15		163.43
6. Total fixed costs.		7603.77		771.93		2097.30
7. Investment credit/yr.		-269.09		-35.09		- 95.33
8. Total fixed costs (adj)		\$ 7334.68	\$ 8071.52	\$ 736.84		\$ 2001.97
9. Ave. total fixed costs			13.45¢			3.34¢ 16.79¢
---VARIABLE COSTS PER BUSHEL---						
10. Insurance on grain (risk equiv.)		.32¢				
11. Rodent control (.03¢/bu. x 7)		.21¢				
12. Loss of grain (est. 1/2¢/bu.)		.50¢				
13. Interest forfeited by holding grain		13.13¢				
14. Drying and aeration fuel & elec totl. ²		.47¢				4.32¢
15. Excess drying loss 15.5% to 13.5%						6.94¢
16. Labor mgt. costs (no truck)		.28¢				.16¢
17. Risk cost (grade loss) T.W. loss		2.00¢				
18. Ave. variable costs/bu.		16.91¢				11.42¢ 28.33¢
19. Ave. total costs.						45.12¢

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 15. 1974 Prices and Average Fixed, Variable, and Total Costs for a Low Temperature Dryer and Storage System of Grain Dried and Stored (20,000 Bushels)

	STORAGE		DRYING		
	BLDGS.		EQUIPT.		
Bins	\$9740		Dryer Units	\$ 4120	
Perf. Floor	800		Load. Auger	2040	
Concrete	800		Unload. Auger	1240	
Reinf.	280		Grain Distributor	425	
Labor (3/4) ¹	1725		Labor (1/4) ¹	1040	
Wiring (1/3) ¹	400		Wiring (2/3) ¹	575	
Freight (2/3) ¹	667		Freight (1/3) ¹	800	
				333	
	\$14412			\$10573	
---FIXED COSTS---					
					TOTAL (cents/bu)
1. Depreciation	12 years	1201.00	8 years	1321.63	
2. Insurance-Mid Value x rate (rate = .005¢-per bu.)		36.03		26.43	
3. Interest-Mid Value x rate (rate = 10%)		720.60		528.65	
4. Taxes-value x 40 mills x 35%		201.77		NONE	
5. Annual repairs & maint. (price x 1.5%)		216.18		158.60	
6. Total fixed costs.		2375.58		2035.31	
7. Investment credit/yr.		- 84.07		- 92.51	
8. Total fixed costs (adj)		\$ 2291.51		\$ 1942.80	
9. Ave. total fixed costs		11.46¢		9.72¢	21.18¢
---VARIABLE COSTS PER BUSHEL---					
10. Insurance on grain (risk equiv.)		.32¢			
11. Rodent control (.05¢/bu. x 7)		.35¢			
12. Loss of grain (est. 1/2¢/bu.)		.50¢			
13. Interest forfeited by holding grain		13.13¢			
14. Drying and aeration fuel & elec totl. ²		.08¢		8.69¢	
15. Excess drying loss 15.5% to 13.5%				6.94¢	
16. Labor mgt. costs (no truck)		2.52¢		.99¢	
17. Risk cost (grade loss) T.W. loss		2.00¢			
18. Ave. variable costs/bu.		18.90¢		16.62¢	25.24¢
19. Ave. total costs.					56.70¢

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 16. 1974 Prices and Average Fixed, Variable, and Total Costs for a Low Temperature Dryer and Storage System of Grain Dried and Stored (40,000 Bushels)

	<u>STORAGE</u>		<u>DRYING</u>		
	<u>BLDGS.</u>		<u>EQUIPT.</u>		
Bins	\$19480		Dryer Units	\$ 8240	
Perf. Floor	1600		Load. Augers	2040	
Concrete	1600		Unload. Augers	2480	
Reinf.	560		Sweep Auger	425	
Labor (3/4) ¹	3420		Grain Distributor	2080	
Wiring (1/3) ¹	533		Labor (1/4) ¹	1140	
Freight (2/3) ¹	1067		Wiring (1/3) ¹	1067	
	<u>\$28260</u>		Freight (2/3) ¹	533	
				<u>\$ 18005</u>	
--- FIXED COSTS---					
					Total (cents/bu)
1. Depreciation	12 years	2355.00	8 years	2250.63	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		70.65		45.01	
3. Interest-Mid Value x rate (rate = 10%)		1413.00		900.25	
4. Taxes-value x 40 mills x 35%		395.64		NONE	
5. Annual repairs & maint. (price x 1.5%)		<u>423.90</u>		<u>270.08</u>	
6. Total fixed costs.		4658.19		3465.97¢	
7. Investment credit/yr.		<u>-164.85</u>		<u>-157.54</u>	
8. Total fixed costs (adj)		\$4493.34		\$ 3308.43	
9. Ave. total fixed costs		11.23¢		8.27¢	19.5¢
---VARIABLE COSTS PER BUSHEL---					
10. Insurance on grain (risk equiv.)		.32¢			
11. Rodent control (.04¢/bu. x 7)		.28¢			
12. Loss of grain (est. 1/2¢/bu.)		.50¢			
13. Interest forfeited by holding grain		13.13¢			
14. Drying and aeration fuel & elec totl. ²		.08¢		8.67¢	
15. Excess drying loss 15.5% to 13.5%				6.94¢	
16. Labor mgt. costs (no truck)		2.52¢		.99¢	
17. Risk cost (grade loss) T.W. loss		<u>2.00¢</u>			
18. Ave. variable costs/bu.		18.83¢		16.60¢	<u>35.43¢</u>
19. Ave. total costs.					<u>54.93¢</u>

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 17. 1974 Prices and Average Fixed, Variable, and Total Costs for a Low Temperature Drying and Storage System of Grain Dried and Stored (60,000 Bushels)

	<u>STORAGE BLDGS.</u>	<u>DRYING EQUIPT.</u>	
Bins	\$ 29220	Dryer Units	\$12360
Perf. Floor	2400	Load. Augers	2040
Concrete	2400	Unload. Augers	3720
Reinf.	840	Sweep Augers	425
Labor (3/4) ¹	5130	Grain Distributor	1560
Wiring (1/3) ¹	1066	Labor (1/4) ¹	1710
Freight (2/3)	1467	Wiring (2/3) ¹	2134
	\$ 42523	Freight (1/3) ¹	733
			\$24682

--- FIXED COSTS---

				Total cents/bu)
1. Depreciation	12 years	3543.58	8 years	3085.25
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		106.31		61.71
3. Interest-Mid Value x rate (rate = 10%)		2126.15		1234.10
4. Taxes-value x 40 mills x 35%		595.32		NONE
5. Annual repairs & maint. (price x 1.5%)		<u>637.85</u>		<u>370.23</u>
6. Total fixed costs.		7009.21		4751.29
7. Investment credit/yr.		<u>-248.05</u>		<u>-215.97</u>
8. Total fixed costs (adj)		¢ 6761.16		¢ 4535.32
9. Ave. total fixed costs		11.27¢		7.56¢

18.83¢

--- VARIABLE COSTS PER BUSHEL---

10. Insurance on grain (risk equiv.)	.32¢		
11. Rodent control (.03¢/bu. x 7)	.21¢		
12. Loss of grain (est. 1/2¢/bu.)	.50¢		
13. Interest forfeited by holding grain	13.13¢		
14. Drying and aeration fuel & elec totl. ²	.08¢		8.67¢
15. Excess drying loss 15.5% to 13.5%			6.94¢
16. Labor mgt. costs (no truck)	2.52¢		.99¢
17. Risk cost (grade loss) T.W. loss	<u>2.00¢</u>		
18. Ave. variable costs/bu.	18.76¢		16.60¢
19. Ave. total costs.			<u>35.36¢</u>
			54.19¢

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 18. 1974 Prices and Average Fixed, Variable, and Total Costs for a Crib Storage System (20,000 Bushels)

	STORAGE				
	BLDGS.	EQUIP.			
Bins	\$ 14470	Elevator	\$1540		
Concrete	1500				
Labor	2000				
Freight	600				
	\$ 18570		\$1540		
--- FIXED COSTS---					
			Total (cents/bu)		
1. Depreciation	12 years	1547.50	8 years	192.50	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)		46.43		3.85	
3. Interest-Mid Value x rate (rate = 10%)		928.50		77.00	
4. Taxes-value x 40 mills x 35%		259.98		NONE	
5. Annual repairs & maint. (price x 1%)		185.70		15.40	
6. Total fixed costs.		2968.11		288.75	
7. Investment credit/yr		-108.33		-13.48	
8. Total fixed costs (adj)		\$ 2859.78		\$ 275.27	
9. Ave. total fixed costs		14.30¢		1.38¢	15.68¢
---VARIABLE COSTS PER BUSHEL---					
10. Insurance on grain (risk equiv.)		.32¢			
11. Rodent control (.05¢/bu. x 7)		.35¢			
12. Loss of grain (est. 1/2¢/bu.)		.50¢			
13. Interest forfeited by holding grain		13.13¢			
14. Drying and aeration fuel & elec totl. ²					
15. Excess drying loss 15.5% to 13.5%					
16. Labor mgt. costs (no truck)		1.00¢			
17. Risk cost (grade loss) T.W. loss		2.00¢			
18. Ave. variable costs/bu.		17.30			17.30¢
19. Ave. total costs.					32.98¢

¹ Fractions denote portion of cost allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

Appendix Table 19. 1974 Prices and Average Fixed, Variable, and Total Costs for a Crib Storage System (40,000 Bushels)

	STORAGE		
Bins	BLDGS.	EQUIPT.	
Concrete	\$ 27493	Elevator \$1540	
Labor	2850		
Freight	3800		
	1140		
	\$ 35283	\$1540	
--- FIXED COSTS---			
			Total (cents/bu)
1. Depreciation 12 years	2940.25	8 years 192.50	
2. Insurance-Mid Value x rate (rate = .005¢ per bu.)	88.21	3.85	
3. Interest-Mid Value x rate (rate = 10%)	1764.15	77.00	
4. Taxes-value x 40 mills x 35%	493.96	NONE	
5. Annual repairs & maint. (price x 1%)	<u>352.83</u>	<u>15.40</u>	
6. Total fixed costs.	5639.40	288.75	
7. Investment credit/yr	<u>-205.82</u>	<u>-13.48</u>	
8. Total fixed costs (adj)	\$ <u>5433.58</u>	<u>\$275.27</u>	
9. Ave. total fixed costs	13.58¢	.69¢	14.27¢
---VARIABLE COSTS PER BUSHEL---			
10. Insurance on grain (risk equiv.)	.32¢		
11. Rodent control (.04¢/bu. x 7)	.28¢		
12. Loss of grain (est. 1/2¢/bu.)	.50¢		
13. Interest forfeited by holding grain			
14. Drying an aeration fuel & elec totl. ²			
15. Excess drying loss 15.5% to 13.5%			
16. Labor mgt. costs (no truck)	1.00¢		
17. Risk cost (grade loss) T.W. loss	<u>2.00¢</u>		
18. Ave. variable costs/bu.	17.23		<u>17.23¢</u>
19. Ave. total costs.			31.50¢
1	Fractions denote portion of cost allocated to that heading		
2	Corn dried from 25.5% moisture to 15.5% moisture		

Appendix Table 20. 1974 Prices and Average Fixed, Variable, and Total Costs for a Crib Storage System (60,000 Bushels)

		STORAGE		
		BLDGS.	EQUIPT.	
Bins		\$41963	Elevator	\$1540
Concrete		4350		
Labor		5800		
Freight		1740		
		<u>\$53,853</u>		<u>\$1540</u>
---FIXED COSTS---				
				Total (cents/bu)
1.	Depreciation 12 years	4487.75	8 years 192.50	
2.	Insurance-Mid Value x rate (rate = .005¢ per bu.)	134.63	3.85	
3.	Interest-Mid Value x rate (rate = 10%)	2692.65	77.00	
4.	Taxes-value x 40 mills x 35%	753.94	NONE	
5.	Annual repairs & maint. (price x 1%)	<u>538.53</u>	<u>15.40</u>	
6.	Total fixed costs.	8607.50	288.75	
7.	Investment credit/yr	<u>-314.14</u>	<u>- 13.48</u>	
8.	Total fixed costs (adj)	<u>\$8293.36</u>	<u>\$275.27</u>	
9.	Ave. total fixed costs	13.82¢	.46¢	14.28¢
---VARIABLE COSTS PER BUSHEL---				
10.	Insurance on grain (risk equiv.)	.32¢		
11.	Rodent control (.03¢/bu. x 7)	.21¢		
12.	Loss of grain (est. 1/2¢/bu.)	.50¢		
13.	Interest forfeited by holding grain	13.13¢		
14.	Drying and aeration fuel & elec totl. ²			
15.	Excess drying loss 15.5% to 13.5%			
16.	Labor mgt. costs (no truck)	1.00¢		
17.	Risk cost (grade loss) T.W. loss	<u>2.00¢</u>		
18.	Ave. variable costs/bu.	17.16		<u>17.16¢</u>
19.	Ave. total costs.			31.44¢

¹ Fractions denote portion of costs allocated to that heading

² Corn dried from 25.5% moisture to 15.5% moisture

APPENDIX B

METHODS FOR CALCULATING COSTS FOR A CONTINUOUS
FLOW AND LOW TEMPERATURE DRYER AND STORAGE SYSTEMS
(20,000 Bushels)

Since prices vary over geographical regions and through time, the reported cost data will rapidly become obsolete. These data are reported for only three levels of production and one moisture level. Hence, producers will need to derive cost data to satisfy specific needs. To facilitate the updating and revision procedures, the specific methods for calculating costs for a continuous flow and low temperature dryer and storage systems are reported in detail. Although this example only encompasses two drying systems with 20,000 bushels of annual capacity, the techniques are applicable for the other drying units, different volumes of production, and for different moisture levels.

CONTINUOUS FLOW
(20,000 Bushels)

FIXED COSTS

1. Depreciation

Total value ÷ years of life = depreciation

Building	\$15,924 ÷ 12 = \$1,327
Equipment	4,016 ÷ 8 = 502
Drying equipment	14,053 ÷ 8 = 1,756.63

2. Insurance

(Purchase price ÷ 2) x insurance rate

Building	\$15,924 ÷ 2 x .005 = \$39.81
Equipment	4,016 ÷ 2 x .005 = 10.04
Drying equipment	14,053 ÷ 2 x .005 = 35.13

3. Interest

(Purchase price ÷ 2) x interest rate = interest charge

Building	\$15,924 ÷ 2 x 10% = \$796.20
Equipment	4,016 ÷ 2 x 10% = 200.80
Drying equipment	14,053 ÷ 2 x 10% = 702.65

4. Taxes (Real Estate)

(Purchase price x percent taxable x millage 1 mill = \$.001)

Building	\$15,924 x 35% x \$.04 = \$222.94
----------	-----------------------------------

5. Repairs and Maintenance

Purchase price x annual repairs & maintenance charge = annual repairs

Building	\$15,924 x 2.5% = \$398.10
Equipment	4,016 x 2.5% = 100.40
Drying equipment	14,053 x 2.5% = 351.35

6. Investment credit per year

Purchase price ÷ years of life x % investment credit =

Building	\$15,924 ÷ 12 x 7% = \$ 92.89
Equipment	4,016 ÷ 8 x 7% = 35.14
Drying equipment	14,053 ÷ 8 x 7% = 122.96

VARIABLE COSTS PER BUSHEL

1. Insurance on grain

Value of grain per bushel x rate x storage (in years) = grain insurance costs.

$$\$3.00 \times \$.18/\$100 \times 7/12 = .32\text{c}$$

2. Rodent Control

Rate per bushel per month x storage (in months) = rodent control costs.

Rates used in calculation

.05¢/Bu./Month	20,000 Bushels
.04¢/Bu./Month	40,000 Bushels
.03¢/Bu./Month	60,000 Bushels

$$.05\text{¢/Bu./Month} \times 7 \text{ Months} = .35\text{c}$$

3. Loss of grain

Estimated at the rate of .05¢/Bu.

4. Interest forfeited by holding grain

Value of grain per bushel x storage time (in years) x estimated rate at which interest could earn = interest forfeited.

$$\$3.00 \times 7/12 \times .075 = 13.13\text{c}$$

5. Drying and Aeration

a. Fuel cost

Step A - wet bushels x weight/bu. = total weight

Step B - original weight x $\frac{100\text{-wet percentage}}{100\text{-dry percentage}}$ = weight of dry corn

Step C - original weight - dry weight = pounds of moisture removed

Step D - B.T.U.'s required to evaporate 1 lb. of water (Appendix Table 21) x pounds of moisture removed = total B.T.U.'s required.

Assumed: 1.5" S.P. @ 140° rise (ambient 60°F 20 H.P. fan)

Step E - total B.T.U.'s needed (from Step D) to dry ÷ B.T.U.'s/gallon of propane x cost/gallon ÷ bushels (dry) = total fuel cost.

b. Electricity cost

Step F - calculation of hours to dry = total B.T.U.'s ÷ B.T.U./hour of operation.

Step G - dryer horsepower (fan) x hours to dry = kilowatt hours

Aeration assumed: 24 hrs. operation per month horsepower (fan) x hours of operation (total) = kilowatt-hours.

Step H - total cost of kilowatt-hours used ÷ bushels = electricity cost per bushel.

Rates used: \$1.85 for first 20 KW hrs
3.65 KW hrs for each remaining KWHR used

Assumed:

20,000 bu. of corn @ 15.5% moisture = 22,667 bu. @ 25.5% moisture
40,000 bu. of corn @ 15.5% moisture = 45,334 bu. @ 25.5% moisture
60,000 bu. of corn @ 15.5% moisture = 68,000 bu. @ 25.5% moisture

Fuel Cost

Step A - 22,667 x 56 lbs. = 1,269,352 lbs.

Step B - 1,269,352 lbs. x $\frac{100-25.5}{100-15.5}$ = 1,119,568 lbs. (wt. of 20,000 bu. @ 15.5%)

Step C - 1,269,352 lb - 1,119,568 lbs. = 149,784 lbs. of water removed

Step D - (from Appendix Table 21) 1850 B.T.U. x 149,784 lbs. = 277,100,400 total B.T.U.'s needed

Step E - 277,100,400 B.T.U.'s ÷ 91,000 B.T.U.'s/gal. propane x \$.35 ÷ 20,000 = 5.33c

Step F - 73 hrs. to dry = 277,100,400 B.T.U.'s ÷ 3,780,000
(from Appendix Table 22)

Step G - drying - 20 H.P. x 73hrs. = 1095 KW-Hrs.
aeration - 1 H.P. x 7months x 24 hrs. - 168 KW-Hrs.

Step H - 1263 KWHS total first 20 KWHS @ \$1.85 \$ 1.85
remaining 1243 @ 3.65¢ ea. = 45.37
47.22

\$45.22 ÷ 20,000 Bu. = .24¢/Bu.

6. Excess drying loss

15.5% to 13.5% moisture

(original wet bu. x $\frac{100-25.5}{100-15.5}$) - (original wet bu. x $\frac{100-25.5}{100-13.5}$) x \$3.00

$(22,667 \times \frac{74.5}{84.5} - (22,667 \times \frac{74.5}{86.5})) \times \$3.00 = 6.94¢/bu.$
20,000

7. Labor and management

Assumed continuous - flow: system requires 2 hrs. per bin (labor)
For 20,000 we have 2 bins and labor is \$3.00/hr.

Dryer: $\frac{\text{Hrs. to dry} \times \$3.00/\text{hr.}}{\text{portion of hour of labor required per check of system}} \times \frac{1}{\text{bushels of corn (total)}}$

Storage: $\frac{\text{Hrs./month of storage} \times \$3.00 \times \text{mos. storage}}{\text{Bushels (total)}}$

Dryer Labor: $\frac{73 \text{ hrs.} \times \$3.00/\text{hr.} \times 1/4 \text{ hr. per check} \times 1}{20,000} = .27¢/bu$

Storage Labor: $\frac{4 \text{ hrs./mo.} \times \$3.00/\text{hr.} \times 7 \text{ mos.}}{20,000 \text{ bushels}} = .42¢/bu.$

LOW TEMPERATURE
(20,000 Bushels)

ASSUMPTIONS

Ave. Ambient Temp. 40°
Ave. Ambient Humid. 60°
Temp. rise desired 3°
2.0 CFM needed air-flow to dry from 25.5% → 15.5%

REQUIRED DAYS TO DRY GRAIN

22670 bu. x 56 lb. = 1,269,520 x 25.5% → 323728 lbs. H₂O
1,269,520 x .882 → 1,119,717 lbs. corn @ 15.5% moisture
149,803 lbs. H₂O to remove = 7.49 lbs. H₂O/bu.

$$\frac{7.49 \text{ lb.}}{.226 \text{ lb.}} = 33 \text{ Days}$$

Electric Cost (Fans - drying process)

$$\text{H.P.} \times \text{hours to dry} \times 1 \text{ KW/HP} = \text{total KW}$$

$$20 \times 792 \text{ hrs.} = 15840 \text{ KW} \quad \begin{array}{l} \$ 1.85 \text{ (first 20 KWHRs)} \\ \underline{577.43} \text{ (15820 KWHRs} \times \$.0365) \end{array}$$

$$\$579.28 = 2.90\text{¢/bu.}$$

HEATER UNIT ELECTRICALLY POWERED

$$\text{Heater KW} = \frac{\text{CFM} \times \text{Temp. Rise}}{3000} = \frac{2 \times 20,000 \times 3^\circ}{3000} = 40 \text{ KW}$$

$$40 \text{ KW} \times 792 \text{ hr.} = 31680 \text{ KWHR} =$$

$$\begin{array}{l} \$ 1.85 \text{ (first 20 KWHRs)} \\ \underline{1155.59} \text{ (31660 KWHRs} \times \$.0365) \end{array}$$

$$\$1157.44$$

Total and Average Electric Cost (Drying process)

\$ 579.28	2.90¢/bu.	Fan
<u>1157.44</u>	<u>5.79¢/bu.</u>	Heater
\$1736.72	8.69¢/bu.	Total

AERATION

20,000 3 HP x (6 mos. x 24 hrs./month x 1 = 432 KWH

412 KWH x \$.0365 + \$1.85 for first 20 KWH = \$16.89, .08¢/bu.

LABOR & MANAGEMENT

7 mos. storage

1 hr/day for labor during drying/bin

12 hr/month for labor drying storage/bin

\$3.00/hr

$$\frac{2 \text{ bins} \times \$3.00 (1 \text{ hr./day} \times 33 \text{ days})}{20,000 \text{ bu.}} = .99\text{¢/bu. drying labor}$$

$$\frac{2 \text{ bins} \times 12 \text{ hrs./month} \times 7 \times \$3.00}{20,000 \text{ bu.}} = 2.52\text{¢/bu. storage labor}$$

Appendix Table 21.¹ Dryer performance records
based on an ambient air temperature of 60° F

	<u>OPERATING MOISTURE</u>	<u>MOISTURE CONTENT B.T.U./LBS. OF WATER</u>		
		27%	25%	20%
Batch-Bin	100° - 120°	1,350	1,500	1,600
Automatic-Batch	160° - 180°	1,750	1,750	1,850
Continuous Flow	180° - 220°	1,750	1,850	2,200

¹Behlen Manufacturing Company, Modern Grain Conditioning, 2nd Edition
Page 12, Columbus, Nebraska.

Appendix Table 22. ^{1/} Million BTU/Hr. Required
for Temperature Rise Shown in Degrees F

10 H.P. HEAT UNIT 38" DIA.												
Static Water Pressure	50° F.	60° F.	70° F.	80° F.	90° F.	100° F.	110° F.	120° F.	130° F.	140° F.	150° F.	160° F.
5.0"	.335	.402	.469	.536	.603	.670	.737	.804	.870	.937	1.004	1.071
4.5"	.432	.518	.605	.691	.778	.864	.950	1.037	1.123	1.210	1.296	1.382
4.0"	.540	.648	.756	.864	.972	1.080	1.188	1.296	1.404	1.512	1.620	1.728
3.5"	.678	.813	.949	1.084	1.220	1.355	1.491	1.626	1.762	1.898	2.033	2.169
3.0"	.815	.978	1.142	1.305	1.468	1.631	1.794	1.957	2.120	2.283	2.446	2.609
2.5"	.907	1.089	1.270	1.452	1.633	1.814	1.996	2.177	2.359	2.540	2.722	2.903
2.0"	.972	1.166	1.361	1.555	1.750	1.944	2.138	2.333	2.527	2.722	2.916	3.110
1.5"	1.152	1.218	1.421	1.624	1.827	2.030	2.233	2.436	2.640	2.843	3.046	3.249
1.0"	1.056	1.267	1.478	1.690	1.900	2.111	2.323	2.534	2.745	2.956	3.167	3.378
1750 RPM 15 H.P. HEAT UNIT 38" DIA.												
5.0"	.535	.642	.748	.855	.962	1.069	1.176	1.283	1.390	1.497	1.604	1.711
4.5"	.616	.739	.862	.985	1.108	1.231	1.354	1.477	1.600	1.724	1.847	1.970
4.0"	.710	.852	.994	1.136	1.278	1.420	1.562	1.704	1.846	1.988	2.130	2.272
3.5"	.842	1.011	1.179	1.348	1.516	1.685	1.853	2.022	2.190	2.359	2.527	2.696
3.0"	.959	1.150	1.342	1.534	1.725	1.917	2.109	2.300	2.492	2.684	2.876	3.067
2.5"	1.048	1.257	1.467	1.676	1.886	2.095	2.305	2.514	2.724	2.933	3.143	3.352
2.0"	1.121	1.345	1.569	1.793	2.017	2.241	2.465	2.689	2.913	3.137	3.362	3.586
1.5"	1.180	1.416	1.652	1.888	2.124	2.360	2.596	2.832	3.068	3.304	3.540	3.776
1.0"	1.231	1.477	1.724	1.970	2.216	2.463	2.709	2.955	3.201	3.447	3.694	3.940
20 H.P. HEAT UNIT 38" DIA.												
5.0"	.645	.774	.903	1.033	1.162	1.291	1.420	1.549	1.678	1.807	1.936	2.650
4.5"	.729	.875	1.021	1.166	1.312	1.458	1.606	1.750	1.895	2.041	2.187	2.333
4.0"	.843	1.109	1.179	1.348	1.516	1.685	1.853	2.022	2.190	2.359	2.527	2.696
3.5"	.977	1.763	1.368	1.564	1.759	1.955	2.150	2.346	2.541	2.737	2.932	3.128
3.0"	1.118	1.341	1.565	1.788	2.012	2.236	2.459	2.683	2.906	3.130	3.353	3.577
2.5"	1.215	1.458	1.701	1.944	2.188	2.430	2.673	2.916	3.159	3.402	3.645	3.888
2.0"	1.293	1.552	1.811	2.070	2.328	2.587	2.845	3.104	3.366	3.621	2.880	4.139
1.5"	1.350	1.620	1.890	2.160	2.430	2.700	2.970	3.240	3.510	3.780	4.050	4.320
1.0"	1.040	1.685	1.966	2.246	2.527	2.808	3.089	3.369	3.650	3.931	4.212	4.493
25 H.P. HEAT UNIT 38" DIA.												
4.0"	.945	1.134	1.323	1.512	1.701	1.890	2.079	2.268	2.457	2.646	2.835	3.024
3.5"	1.134	1.361	1.588	1.814	2.041	2.268	2.495	2.722	2.948	3.175	3.402	3.629
3.0"	1.261	1.513	1.766	2.017	2.270	2.522	2.774	3.026	3.278	3.531	3.783	4.035
2.5"	1.350	1.620	1.890	2.160	2.430	2.700	2.970	3.240	3.510	3.780	4.050	4.320
2.0"	1.428	1.714	2.000	2.285	2.571	2.857	3.142	3.428	3.714	3.999	4.285	4.571
1.5"	1.504	1.805	2.105	2.406	2.707	3.008	3.309	3.609	3.910	4.211	4.512	4.812
1.0"	1.580	1.895	2.211	2.527	2.843	3.159	3.475	3.791	4.107	4.423	4.739	5.054
PTO 2200 RPM 20 H.P. HEAT UNIT 38" DIA. = 40 H.P. ENGINE												
5.0"	.535	.642	.748	.855	.962	1.069	1.176	1.283	1.390	1.497	1.604	1.711
4.5"	.702	.842	.983	1.123	1.264	1.404	1.544	1.685	1.825	1.966	2.106	2.246
4.0"	.945	1.134	1.323	1.512	1.701	1.890	2.079	2.268	2.457	2.646	2.835	3.240
3.5"	1.134	1.361	1.588	1.814	2.041	2.268	2.495	2.722	2.948	3.175	3.402	3.629
3.0"	1.261	1.513	1.765	2.017	2.270	2.522	2.774	3.026	3.278	3.531	3.783	4.035
2.5"	1.350	1.620	1.890	2.160	2.430	2.700	2.970	3.240	3.510	3.780	4.050	4.320
2.0"	1.428	1.714	2.000	2.285	2.571	2.857	3.142	3.428	3.714	3.999	4.285	4.570
1.5"	1.504	1.805	2.105	2.406	2.707	3.008	3.309	3.609	3.910	4.211	4.512	4.813
1.0"	1.580	1.895	2.211	2.527	2.843	3.159	3.475	3.791	4.107	4.423	4.739	5.544
PTO 2200 RPM 40 H.P. HEAT UNIT 38" DIA. = 80 H.P. ENGINE												
5.0"	1.350	1.620	1.890	2.160	2.430	2.700	2.970	3.240	3.410	3.780	4.050	4.320
4.5"	1.445	1.733	2.022	2.311	2.600	2.889	3.178	3.467	3.756	4.045	4.334	4.622
4.0"	1.515	1.818	2.121	2.435	2.726	3.029	3.332	3.635	3.938	4.241	4.544	4.847
3.5"	1.577	1.892	2.208	2.523	2.838	3.154	3.469	3.784	4.100	4.415	4.730	5.046
3.0"	1.636	1.963	2.291	2.618	2.945	3.272	3.600	3.927	4.254	4.581	4.909	5.236
2.5"	1.682	2.019	2.355	2.691	3.028	3.364	3.701	4.037	4.373	4.710	5.046	5.383
2.0"	1.728	2.074	2.419	2.765	3.110	3.456	3.802	4.147	4.493	4.838	5.184	5.530
1.5"	1.766	2.119	2.472	2.825	3.178	3.532	3.885	4.238	4.591	4.944	5.297	5.651
1.0"	1.800	2.160	2.520	2.880	3.240	3.600	3.960	4.320	4.680	5.039	5.400	5.760

^{1/} Behlen Manufacturing Company, Modern Grain Conditioning, Second Edition, p. 9, Columbus, Nebraska.