Grain Storage Costs in Oklahoma

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One-third of Oklahoma grain storage capacity compared to 60 percent of the grain storage in the United States is on-farm. Why the difference? The main reasons are: 1) the kind of grain and location in the U.S., 2) hot summers make management of stored grain more difficult in Oklahoma than in the cooler northern states, and 3) elevators in some areas of the U.S. are better equipped to provide more storage and marketing functions.

Storage construction costs, commercial storage costs, government programs, marketing alternatives, risks of quality loss, storage management and marketing ability are all important in stored grain economics. The economics of constructing storage facilities, the cost to store grain in existing facilities and a comparison of on-farm versus off-farm storage will be addressed in this OSU Fact Sheet.

Both fixed and variable storage costs are calculated for 3,000; 5,000; 10,000 and 20,000 bins. Fixed costs are only applicable if new construction (or major modification) of storage facilities is being considered. If quality storage facilities are in place, then variable costs, including shrinkage and grain quality loss, are the costs that should be considered in the storage decision. Shrinkage is loss in volume or weight of the grain placed in the bin. This loss may be due to spillage, broken grain factions, fines lost in handling or other factors causing weight loss. Quality loss is defined as a reduction in USDA Grade and may be due to insects, moisture, mold or other factors that may cause deterioration of grain.

Opportunity cost, a variable cost which can not be ignored, is the interest cost incurred while holding grain and is a function of the grain price, the interest rate and the length of time the grain is stored. For example, if the wheat price is $2.80 per bushel and the interest rate is 12 percent per year (one percent per month), the opportunity cost per bushel per month is 2.8 cents; at $3.50 per bushel, the monthly opportunity cost is 3.50 cents per bushel. Although opportunity cost is a function of the marketing decision, the economics of storage can not be discussed without including the opportunity cost.

On-Farm Storage Costs

A relatively accurate estimate of on-farm storage costs may be determined. Storage costs are normally calculated on a per bushel per year basis, based on full bins. If bins are partially full, per bushel storage costs will be higher.

For all practical purposes, once the grain has been placed in the bin, the producer is committed to the majority of the storage costs. If grain is stored for longer periods, costs may increase due to additional chemical, aeration or deterioration of quality, but the difference is normally relatively small. The following analysis assumes that grain is stored four to ten months.

Costs are shown for 3,000; 5,000; 10,000 and 20,000 bushel round corrugated steel flat bottom bins (Table 1). Costs include construction, aeration system, plus an unload auger. Drying units were not included in wheat bin costs. Costs ($2,200) for larger motors for the aeration system and drying systems were included for corn bins.

Straight-line depreciation over 30 years, a zero salvage value, and 12 percent annual interest were used to calculate fixed costs. Costs were estimated for each year of the 30 year period. Average annual costs were then calculated on a net present value basis. Using this method to calculate fixed costs may result in lower costs than if the costs were calculated for tax purposes, or if a shorter depreciation schedule was used.

Table 1. Annual On-Farm Per Bushel Storage Cost

	Bin Capacity			
Item	3,000	5,000	10,000	20,000
	(Cents/bushel)			
Fixed Costs				
Depreciation	5.5	4.4	3.2	2.8
Interest	2.1	1.7	1.2	1.1
Total Fixed Costs	7.6	6.1	4.4	3.9
Variable Costs				
Electricity	0.8	0.8	0.8	0.8
Chemical	2.0	2.0	2.0	2.0
Maintenance	4.2	3.7	2.5	2.0
Insurance	4.0	3.0	2.6	2.5
Labor	1.0	0.9	0.8	0.7
Total Variable Costs	12.0	10.4	8.7	8.0
Total Costs (excluding shrinkage and interest on grain)	19.6	16.5	13.1	11.9

Total construction costs were $4,915 ($1.64/bushels) for the 3,000 bushel bin, $6,629 ($1.33/bushel) for the 5,000 bushel bin, $9,509 ($0.95/bushel) for the 10,000 bushel bin and $16,675 ($0.83/bushel) for the 20,000 bushel bin.

Costs due to shrinkage and quality loss are also variable costs. These per bushel costs are directly related to the grain price, volume change and quality change.

On-farm storage costs vary according to bin size and percentage of storage capacity used. Per bushel fixed (depreciation and interest costs) and variable costs decline as bin size increases. Thus, per bushel total costs (fixed plus variable costs) decline as the amount of grain stored and/or bin size increases.

Per bushel total fixed costs are estimated to be 7.6 cents per bushel for a 3,000 bushel bin, 6.1 cents per bushel for the 5,000 bushel bin, 4.4 cents per bushel for the 10,000 bushel bin and 3.9 cents per bushel for the 20,000 bushel bin. Depreciation makes up about 72 percent of fixed costs.

Variable costs include conveying and aeration electricity, chemicals, maintenance, insurance and labor (Table 1). The total variable costs shown do not include costs due to shrinkage, quality loss or opportunity cost. Variable costs for the 3,000 bushel bin were 12.0 cents per bushel, 10.4 cents per bushel for the 5,000 bushel bin, 8.7 cents per bushel for the 10,000 bushel bin and 8.0 cents per bushel for the 20,000 bushel bin.

Total storage costs per bushel per year, excluding shrink and quality loss, were 19.6 cents for a 3,000 bushel bin, 16.5 cents for a 5,000 bin, 13.1 cents for a 10,000 bushel bin and 11.9 cents for a 20,000 bushel bin.

Storage Costs–Wheat

Table 2 shows potential storage costs for hard red winter wheat in the great plains. Total fixed and variable storage costs presented in Table 1 were used. Shrinkage and quality loss are estimated to be two percent. With $2.80 wheat, the cost of two percent shrink and quality is 5.6 cents per bushel ($2.80 x 0.02). With $3.50 wheat, two percent shrink would be seven cents per bushel ($3.50 x 0.02). Costs at these two prices are presented to facilitate evaluating storage costs at different price levels.

Table 2. Annual Storage Costs for Wheat

	Bin Capacity			
	3,000	5,000	10,000	20,000
COSTS		(Cents/bushel)		
Fixed	7.6	6.1	4.4	3.9
Variable[a]	12.0	10.4	8.7	8.0
Shrink				
2% @ $2.80/bu.	5.6	5.6	5.6	5.6
[2% @ $3.50/bu.]	[7.0]	[7.0]	[7.0]	[7.0]
Variable + Shrink				
@ $2.80/bu.	17.6	16.0	14.3	13.6
[@ $3.50/bu.]	[19.0]	[17.4]	[15.7]	[15.0]
Total Costs				
@ $2.80/bu.	25.2	22.1	18.7	17.5
[@ $3.50/bu.]	[26.6]	[23.5]	[21.1]	[18.9]

[a] Variable costs do not include cost due to shrinkage

With full bins and $2.80 wheat, total storage costs per bushel for wheat in a 3,000 bushel bin is 25.2 cents, 22.1 cents for a 5,000 bushel bin, 18.7 cents for a 10,000 bushel bin and 17.5 cents for a 20,000 bushel bin.

If a producer already has storage bins, only variable costs are applicable in a stored grain decision. Thus, a wheat farmer's storage decision would be based on 17.6 cents with a 3,000 bushel bin, 16.0 for a 5,000 bushel bin, 14.3 for a 10,000 bushel bin and 13.6 for a 20,000 bushel bin at $2.80 wheat.

This implies that to store wheat, a producer with a 10,000 bushel storage bin and a harvest price of $2.80 must receive at least 14.3 cents per bushel higher price when the wheat is sold than if the wheat was sold at harvest. For example, if a producer placed 10,000 bushels in on-farm storage on July 1, just to cover storage costs the November 1st wheat price would have to be $2.94 ($2.80 + $0.143). With a wheat price of $3.50, the November 1st wheat break-even price would be $3.64 ($3.50 + $.143).

A storage decision can not be made independently of opportunity cost. If the wheat was placed in the government loan program at an interest rate of six percent per year or one-half percent per month and the wheat price was $2.80, the opportunity cost may be about 1.4 cents per bushel per month or 5.6 cents for four months ($2.80 x 0.005). Thus, the actual break-even storage price would be about $3.00 ($2.80 + $0.14 + $0.06) per bushel. For $3.50 wheat, the breakeven price would be about $3.71 ($3.50 + $0.14 + $0.07).

Storage Costs–Corn and Milo

Both fixed and variable costs will be higher for corn and milo than for wheat. Fixed costs are higher because of the need for larger fans, fan motors and possibly dryers and variable costs are higher because of additional labor, maintenance, electricity and fuel costs required to dry corn and milo. Also, there is a much higher potential for heat damage during drying, plus a high mold risk due to elevated harvest moisture; thus, there is more risk with corn or milo than with wheat. Some years milo fields dry to suitable storage moisture levels, so risks are usually lower than for corn.

Estimates of fixed and variable costs and costs due to shrink and interest are shown in Table 3. Fixed costs included an additional $2,200 for a gas dryer and LP gas tank. Interest and depreciation costs were higher because of the required higher investment.

Per bushel variable costs, excluding shrinkage, was 15.8 cents for 3,000 bushel bins, 14.0 cents for 5,000 bushel bins, 12.2 cents for 10,000 bushel bins and 11.4 cents for 20,000 bushel bins (Table 3).

Shrinkage for corn was estimated to be 3.5 percent. With $2.10 corn, shrinkage cost is 7.4 cents per bushel. For corn prices at $2.70 per bushel, shrinkage costs would be 9.5 cents per bushel.

If corn is in the government feed grain loan program, the interest rate would be about six percent per year or one-half percent per month. With $2.10 corn, the opportunity cost would be about one cent per bushel per month. A corn price of $2.70 would result in 1.5 cents per bushel per month opportunity cost.

To decide whether to store corn, a producer with an existing 10,000 bushel storage bin would only consider variable cost, shrinkage and opportunity cost. Variable costs and shrinkage

Table 3. Annual Storage Costs for Corn

	Bin Capacity			
	3,000	5,000	10,000	20,000
	(Cents/bushel)			
Fixed Costs[a]	10.4	8.4	5.9	4.7
Variable Costs	15.8	14.0	12.2	11.4
Shrink				
3.5% @ $2.10	7.4	7.4	7.4	7.4
[3.5% @ $2.70]	[9.5]	[9.5]	[9.5]	[9.5]
Variable + Shrink				
@ $2.10/bu.	23.2	21.4	19.6	18.8
[@ $2.70/bu.]	[25.3]	[23.5]	[21.7]	[20.9]
Total Costs				
@ $2.10/bu.	33.6	29.8	25.5	23.5
[@ $2.70/bu.]	[35.7]	[31.9]	[27.6]	[25.6]

[a] Includes a $2,200 high temperature gas heater and a 1,000 gallon LP tank.

would be 19.6 cents per bushel at $2.10 corn. Thus, if corn was to be stored eight months, the price of corn would have to increase about $0.28 per bushel for the producer to break even ($0.196 + $0.08). The opportunity cost for $2.10 corn is eight cents per bushel ($0.01 x 8 months). With $2.70 corn, the opportunity cost would be $0.11 per bushel ($2.70 x .005) and the break-even price increase would be $0.33 per bushel ($0.217 + $0.11).

On-Farm Versus Commercial Storage

It is difficult to compare on-farm storage costs to commercial storage costs. The major reason is that commercial storage rates are normally calculated on a daily basis and on-farm storage costs are on an annual basis. For example, the average commercial per bushel storage cost for wheat in Oklahoma is $0.00085 per day (2.5 cents per bushel per month). This cost applies no matter how long the wheat remains in storage. Once on-farm stored wheat is in the bin, storage costs are relatively fixed.

There are also marketing advantages and disadvantages for grain stored on-farm, and a different set of advantages and disadvantages for grain placed in commercial storage.

Because additional storage time will cost a set amount for commercial, about 2.5 cents per month, while costing essentially nothing for on-farm storage, longer storage time may give an advantage to on-farm storage. Government programs that subsidize construction of on-farm storage bins or government loan programs and the farmer-owned reserve may also support on-farm stored grain. It must be recognized that opportunity cost is incurred for any grain stored on-farm or in commercial storage

On-farm storage may give producers more marketing flexibility than commercial storage. Most commercial elevators charge an in-out charge on top of the storage cost if the grain is not marketed through that elevator. If producers have alternate markets (i.e. mills, river port markets or other terminal outlets), then it may be possible to obtain a higher price than is available at local elevators. If these markets are not available or if the producer does not spend time merchandising the grain, the advantage may be with commercial storage.

Producers must remember to include transportation costs and timeliness of marketing in the decision. Transportation costs will include from the field to the on-farm facilities and then from the on-farm bins to the commercial elevator.

Commercial storage has the advantage of guaranteed quantity and quality. The quantity and USDA grade is established when the grain is delivered to the elevator. The USDA grade listed on a warehouse receipt is what the producer is guaranteed. The grain can be sold by delivering a warehouse receipt rather than grain. Also, loans for the total number of bushels may be obtained with a warehouse receipt where with on-farm stored grain, loans are based on about 80 percent of the measured grain.

To compare on-farm storage costs to commercial storage costs, the amount of commercial time required from annual commercial storage cost to be equal to on-farm storage costs will be calculated (Table 4). For example, annual variable plus shrinkage costs for wheat in a 10,000 bushel bin is 14.3 cents per bushel (Table 2). If on-farm storage is available, for on-farm storage costs to be equal to or less than commercial storage costs, wheat would have to be stored an average of 5.7 months per year or more over the 30 year period (Table 4) for $2.80 wheat or 63 months for $3.50 wheat.

If storage bins are already in place and the wheat price is $2.80, the average wheat break-even storage periods were 7.0 months for a 3,000 bushel bin, 6.4 months for a 5,000 bushel bin and 5.4 months for a 20,000 bushel bin. Economic analysis with $2.80 wheat for the construction of bins indicate that the break-even storage periods were 10.1 months for 3,000 bushel bins, 8.8 months for 5,000 bushel bins, 7.5 months for 10,000 bushel bins and 7.0 months for 20,000 bushel bins based.

Commercial elevators in the Midwest may have a minimum storage charge that covers a given period. The charge used

Table 4. Length of Annual Storage for On-Farm and Commercial Storage Cost to be Equal

	Bin Capacity			
	3,000	5,000	10,000	20,000
	(Months)			
WHEAT[a]				
Variable + Shrink				
@ $2.80/bu.	7.0	6.4	5.7	5.4
[@ $3.50/bu.]	[7.6]	[7.0]	[6.3]	[6.0]
Total				
@ $2.80/bu.	10.1	8.8	7.5	7.0
[@ $3.50/bu.]	[10.6]	[9.4]	[8.4]	[7.6]
CORN[b]				
Variable + Shrink				
@ $2.10/bu.	4.5	4.0	4.0	4.0
[@ $2.70/bu.]	[5.4]	[5.6]	[4.0]	[4.0]
Total Costs				
@ $2.10/bu.	8.6	7.1	5.4	4.6
[@ $2.70/bu.]	[9.5]	[8.0]	[6.2]	[5.4]

[a] Commercial Storage Costs were $0.00085 per day.

[b] Commercial Storage Costs were $0.22 for the first four months and $0.001 per day thereafter.

here is $0.22 per bushel until February 1, and then $0.001 per day after February 1.

Variable plus shrink costs are less with each size on-farm storage facility than with the commercial minimum charge. Thus, if on-farm storage is available, it would be used rather than commercial storage.

For a producer considering building storage, the break-even storage period, based on $2.10 corn, would be 8.6 months for a 3,000 bushel bin, 7.1 months for a 5,000 bushel bin, 5.4 months for a 10,000 bushel bin, and 4.6 months for a 20,000 bushel bin. Note that these break-even storage periods are for full bins. If the bins are not full, then the break-even time period is longer than shown.

Summary

On-farm storage is an individual decision. Some producers are making on-farm storage pay. But, as one producer who is storing wheat on the farm and making it pay said, "the increased return per bushel is measured in pennies. The risk of losing a bin of grain due to improper management can be measured in dollars." Farmers considering building on-farm storage should study grain storage management technology before making the decision final by purchasing bins.

Some questions that producers should ask before building on-farm storage are: 1) Is your area deficient in commercial grain storage facilities? 2) During harvest, do you find transportation a hold-up? 3) In the months following harvest, is it common for wheat prices to increase sufficiently to cover storage cost? 4) Are you putting grain in the government loan or reserve program? 5) Are you the type of manager who can trust himself to make weekly checks of stored grain and take action if necessary? All of these questions and the economics of storing grain affect the on-farm storage decision.

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