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GUIDE
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"Low-Profile" Bins for Grain Drying

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Grain depth is an important factor in grain drying. Extra depth increases the resistance to airflow, decreasing the airflow and the rate of drying. This extra depth also increases fan power requirements and the cost per bushel of drying grain. Reducing the depth in a low-temperature drying bin can speed drying, decrease the risk of grain spoilage and reduce drying cost. Typically, reducing the drying depth by one-fourth will reduce the energy cost per bushel by one-third.

When buying "deep" versus "shallow" or "low-profile" bins, it seems to make sense that the bin cost per bushel will be lower for a deeper bin. After paying for the concrete floor and roof, the cost of an extra ring or two results in cheap storage. However, this doesn't take into consideration the initial cost of a drying fan and motor or the cost of operating the drying fan.

A low-profile bin has a maximum grain depth of 12 to 13 feet, rather than the more typical depth of 17 to 18 feet. In order to hold the same amount of grain, the low-profile bin must have a larger diameter. Due to the larger diameter, the low-profile bin will have a higher initial cost per bushel of capacity due to the extra concrete, larger perforated floor, larger roof, etc. With the low-profile bin a smaller, less expensive, fan may be used. This may offset the extra cost of the concrete and bin structure is some cases.

This guide examines some of the costs associated with low-profile bins relative to deeper bins commonly used for low-temperature drying. In order to make this comparison, example low-temperature drying systems, complete with drying fans and motors, were designed to dry shelled corn.

Figuring bin cost

Fans were sized for bins from 27 to 36 feet in diameter to provide an airflow of 1.5 cubic feet of air per bushel (cfm/bu). This airflow is recommended for drying 21-percent-moisture or lower corn in the central one-half of Missouri on October 1 if filling in one or two days. (See Agricultural Guide G1305, Estimating airflow for in-bin grain drying systems, for recommended airflow rates for other conditions of harvest date, moisture content or location.)

Costs for bins, equipment, concrete and labor were provided by bin suppliers. Energy costs were based on an electricity rate of 6 cents per kilowatt-hour. Bin costs included the concrete slab, perforated floor, fans and motor, inside and outside ladders, power grain spreader, and 8-inch unloading augers. Costs do not include roof vents, heaters, thermostats or humidistats.

Example systems for 8,000 and 10,000 bushel bins

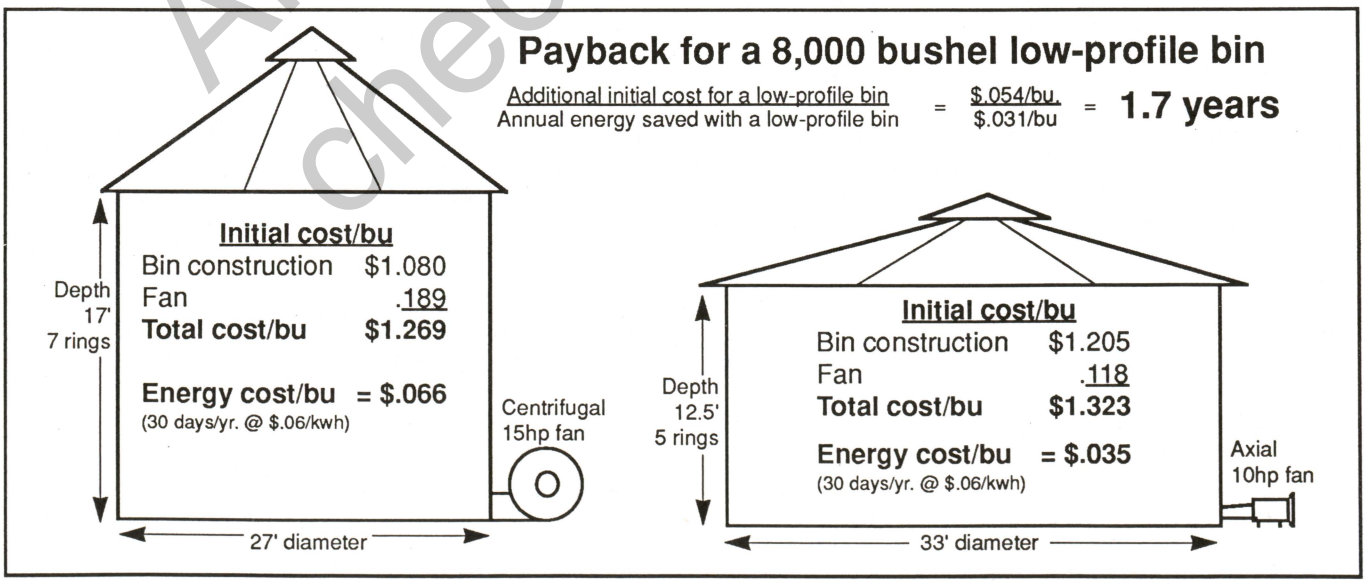

Fig.2. Cost comparisons show that the extra cost of a low-profile 8,000 bushel grain drying bin will be paid back in 1.7 years.

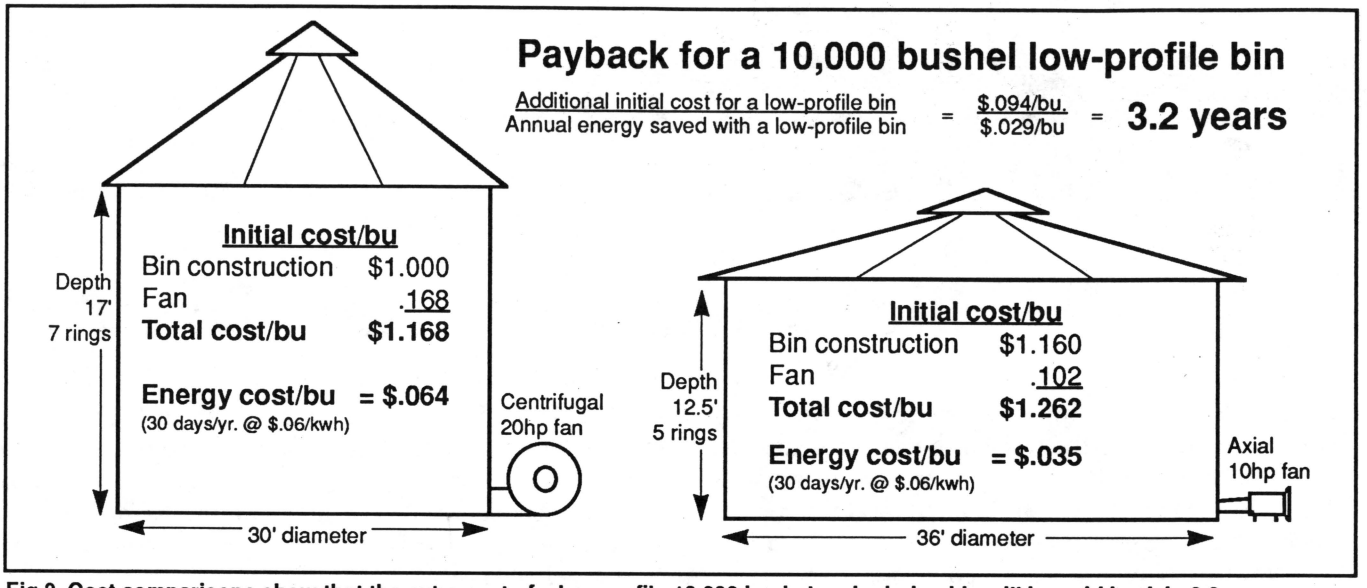

Fig.2. Cost comparisons show that the extra cost of a low-profile 10,000 bushel grain drying bin will be paid back in 3.2 years.

are shown in Figures 1 and 2. Medium-profile 8,000 and 10,000 bushel bins were also studied, but the results are not shown since the costs were similar to the deep bins.

For the 10,000 bushel bins, the low-profile bin totaled $1.262 per bushel, 9.4 cents per bushel more than the deep bin. For the 8,000 bushel bins. the low-profile bin totaled $1.323 per bushel, 5.4 cents per bushel more than the deep bin.

The main reason that the cost per bushel is so small between the deep and low-profile systems is fan costs. The 27-foot bin needs a 15-hp centrifugal fan at a cost of about $1,500 while the 33-foot bin can provide the needed airflow with a 10-hp axial fan at an approximate cost of $1,000. Likewise, for the 10,000 bushel bins, the 30-foot bin needs a 20-hp centrifugal fan at a cost of more than $1,600 while the 36-foot bin uses a 10-hp axial fan at a cost of approximately $1,000.

Figuring the payback

The electrical costs of the fans for the bins were calculated on the basis of 30 days of fan operation per year at a cost of 6¢ per kilowatt-hour. At these rates, the low-profile 8,500 bushel bin would pay back the difference in initial cost after 1.7 years of operation, and the low-profile 10,000 bushel bin would pay back the difference in 3.2 years of operation.

The time required for the low-profile bin to pay for itself depends on many factors, including bin capacity, electricity rates and airflow requirements. Some may not payback as soon as the above examples. For smaller diameter bins in the 18-to-30 foot diameter range, low-profile bins may actually have a lower initial cost than their deep counterparts when fans and motors are considered. In the latter case, the payback is immediate and the savings in energy costs from the very first day of operation is profit.

As electricity costs rise, the payback period for low-profile bins will decrease. If the recommended airflow in cfm/bu used for matching fans and bins is different from the 1.5 cfm/bu used in the examples, the payback period will likely be different. As the airflow rate in cfm/bu decreases, the payback period would be expected to increase and as the airflow rate increases, the payback period would likely decrease. Small grains such as grain sorghum have a higher resistance to airflow per unit of depth than shelled corn. Because of this, fan performance is more sensitive to increased depths of small grains and low-profile bins will payback sooner than for similar situations involving shelled corn.

It should be noted that the costs shown in this guide are not the total costs for drying a bushel of corn. It is assumed that depreciation, interest, insurance, labor and repair/maintenance costs will be nearly equal for systems of equal capacity.

This discussion has dealt with a comparison of low-profile and deep bins of equal bushel capacity. This is fine if you are considering a new bin. But you can also get some benefit from an existing deep bin if you manage it as a low-profile bin. This can be accomplished by limiting the grain depth in the bin to 12 or 13 feet. The main benefits will a higher airflow rate, faster drying time and lower energy cost per bushel. You will also decrease the risk of grain spoilage in the top layers of grain. Since you will be using the same fan as before, no savings in initial fan costs will be realized.

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