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A Cooperative Effort for Energy Efficiency

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Efficient Grain-Drying Equipment & Techniques

Post-harvest grain management

A large part of the profitability of grain farming depends on how the crop is managed after harvest. Because on-farm storage often provides advantages over commercial storage, farmers can benefit from optimizing their systems to offer the best combination of storage and energy efficiency.

One of the key challenges of grain drying is that the variables of grain moisture content, grain temperature from the field, and drying conditions will be different for each season. One year, the grain might be wet and the weather cool and damp, requiring significant heat and hours of fan use to reach the desired moisture. The next year the grain could have dried well in the field and might require little energy to take to storage conditions.

Grain drying and storage options

Harvested grain must be dried to the proper moisture content to discourage mold, fungus, and insects, which can compromise quality and marketability. Factors such as the type of grain, the size of the operation, length of storage, and climate will determine which handling, drying, and storage equipment is right for a particular farm.¹



Three main classes of systems are used for most grain-drying applications: natural-air, low-temperature, and high-temperature. High-temperature systems allow more grain to be dried more quickly, freeing up handling facilities during busy harvests, but they require more energy and higher-maintenance equipment. Natural-air and low-temperature drying take longer, but minimize grain handling and use less energy. Natural-air drying is the best option for saving propane, but only if the farmer has excess bin storage available to keep harvesting, the fan capacity to keep air moving through the grain mass, and the weather conditions to allow it.

Systems can also be categorized according to their designs and methods of operation, including: batch, automatic batch, and continuous flow; in-bin, column, and self-contained; and cross-flow, counter-flow, and concurrent-flow. All types require electricity to operate fans that move air through the bin; low- and high-temperature systems also rely on propane heat to increase drying speed.

How the energy is used

Grain-drying systems use two types of energy, which should be examined separately to gain efficiency: electricity to run fans and move grain, and propane to provide heat. Compared to other motor-driven electric loads that operate all year long, the amount of annual run time on grain systems is relatively low. Electricity use, as well as propane heating costs, can be minimized through the following practices:

- Delay harvest as long as practically possible to allow field drying of the grain.
- Monitor grain moisture closely and turn off fans and heaters when grain is dry. Over-drying is a double waste of money: Fans and heaters run longer than needed, and since grain is sold by volume at a standard moisture content, bringing in grain below this moisture percentage means less volume to sell.
- Make sure propane equipment is set to proper burn setting and seal up any leaks of hot air.
- For large grain systems on a 3-phase demand charge, keeping total demand low (i.e., not running all equipment at the same time, when possible) saves significant money. This is particularly true if a ratchet charge creates a minimum demand level that must be paid for the following 12 months.

¹University of Missouri: "Missouri System of Crop Production, Extension Manual 165"
<http://agebb.missouri.edu/storage/economic/cmanual.htm>

²North Dakota State University: "Grain Drying AE 701 (Revised)"

More energy-saving tips

Whether the farmer chooses a natural-air, low-temperature, or high-temperature drying system, certain steps can be taken during planning to ensure optimum effectiveness and energy efficiency. The first and most important step is researching the available options and comparing the strengths of the various systems with the needs of the individual operation.

The common denominator among all three types of systems is that air must be moved through the grain by one or more fans. Thorough calculations are necessary to determine the correct fan size (in horsepower) and configuration (number of fans, vane axial or centrifugal designs, etc.) to achieve proper drying with the most efficiency. A qualified dealer can help with these determinations.³

Given sufficient time for correct drying to occur, natural-air systems offer big benefits in energy savings (using only 25 to 40% of the total energy used by high-temperature systems) because they require no energy for heating. Other factors, including climate, grain type, bin size, and a low enough moisture content at harvest, must also be right for natural-air drying to work properly.⁴

Low-temperature drying systems are sometimes grouped with natural-air systems in comparative discussions, because they offer similar benefits of energy efficiency and grain quality. They also present similar drawbacks, including the time required to complete drying and limitations on starting moisture content of the grain.

Although high-temperature systems use more energy and require greater investments in equipment and maintenance, their speed and versatility may make them a better choice for farms operating at higher volumes, or for certain climates and grain types. Farmers should calculate the costs and benefits of all types of systems when weighing their grain-drying options.

Think safety

Observe all safety precautions when working in or near grain-handling operations. Never enter a grain storage area while grain is flowing. An average-sized person can be pulled under the grain in seconds; death by suffocation is likely in such an instance.

Avoid electrical hazards. Always lower grain augers and elevators to a safe level before moving, to prevent contact with overhead electrical lines. Contact your electric cooperative for complete electrical safety information.

Learn more about grain-drying systems

A number of university, state, and county extension services provide detailed information that can add confidence to the farmer's ultimate choice of a system. Consult your local electric cooperative for initial guidance, and consider these online sources for starting points:

University of Missouri - <http://agebb.missouri.edu/storage/economic/crmanual.htm>

North Dakota State University - <http://www.ag.ndsu.edu/extension-aben/documents/SelectinganenergyefficientGrainDryer.pdf>

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