Faced with the possibility of a fuel shortage, many Kentucky farmers have been asking for information on low-temperature drying for their grain. Although this technique is not generally recommended for Kentucky, it does provide an alternative to more rapid drying at higher temperatures. Without repeating the advantages, limitations and risks involved with low-temperature drying (see Extension publication AEN-23, "Low-Temperature Drying—Use and Limitations"), the following discussion will concern itself with methods and management for successful use of this drying technique.

What Is Low Temperature Drying?

Low-temperature drying refers to drying grain with low amounts of heat, just enough to raise the drying air 5 to 10°F. Outside air temperatures should be between 30 and 50°F before this heat is added. This prevents overdrying of the lower grain layers and reduces the probability of excessive mold damage, which occurs more rapidly in the undried grain at temperatures above 60°F. Airflow rates are usually between 1 and 3 cubic feet per minute (CFM) per bushel. High airflow rates are desirable but are difficult to obtain in high depths of corn due to excessive horsepower demands.

Burners and Heaters

Both gas burners and electric heaters, available through regular market channels, have been designed to add the 5 to 10°F temperature rises required for low-temperature drying. The heat generated by the motor and fan forcing the air through the grain will add 2°F to the drying air. Although the amount of heat to be added varies with outside temperatures, the general recommendation is for a 7°F temperature rise. But, because of the heat generated by the fan and motor, only 5°F needs to be provided by the gas burner or electric heater.

The btu/hr. rating for a gas burner may be calculated as:

\[
\text{btu/hr.} = 1.1 \times \text{temperature rise (°F)} \times \text{CFM of fan.}
\]

Because of the low btu/hr. rating required in low-temperature drying, high output burners usually prove unsatisfactory. However, this problem may be solved in some cases by installing a time clock which automatically turns the burner on and off. The high temperatures (20-30°F temperature rise) over short periods of time are equivalent in many ways to a continuous low-temperature drying system.

Relatively small temperature rises allow electricity to be used for low-temperature drying. The average energy requirement for 10 points of moisture removal is usually under 4.0 kilowatt-hours (kwhr). Farmers who have electrical heating in their homes have a special advantage, in that the grain drying load would come between the air conditioning demands of summer and the heating demands of winter. Therefore, it may be possible to use the existing transformer to add electric drying. The disadvantage of electricity is that at today's prices, electric drying will cost approximately twice that of LP gas drying. However, if gas were available in Kentucky in sufficient quantity for drying, it would be better to use high-temperature drying methods rather than low-temperature drying techniques, regardless of the type fuel used.

The location of the heater relative to the fan and bin varies with the manufacturer. Regardless of location, the heater casing should never restrict the airflow of the fan. Three-stage electric heaters are available to provide three different temperatures to the grain. Electric heater sizes may be calculated by the formula:

\[
KW = \frac{\text{fan CFM} \times \text{temperature rise, °F}}{3000}
\]

Regardless of the energy source, the heater should be interlocked with the fan to prevent heater operation should
the fan stop. Humidistats are often used to eliminate the possibility of overdrying the lower layers of the grain. The usual setting is a 55% relative humidity. However, for Kentucky conditions the relative humidity is rarely lower than 55% so humidistats are not generally recommended. A plastic tube attached to the duct where air enters the grain may be filled with water to check the static pressure in the bin (see Figure 1). To determine if the fan is supplying sufficient air to the grain, substitute in the formula:

\[
\text{CFM/Bu.} = \frac{\text{hp of fan} \times 6356 \times \text{fan efficiency}}{\text{static pressure in inches of water} \times \text{bushels of grain in the bin}}
\]

If the CFM/Bu. is less than three, reduce the height of grain in the bin. A thermometer measuring the air temperature before and after heating should be installed, thereby determining if sufficient heat is being added.

By using these devices, it is possible to monitor the temperature rise and fan output. The costs of these devices are relatively low and represent an easy and accurate method of monitoring the drying system.

Managing The System

Assuming that a properly designed heater and fan are installed, the system must be managed properly to reduce the chances of spoilage.

Wet grain being brought in from the field should be cleaned to remove any fines before it is placed into the drying bin. This reduces the chance of mold growth, allows air to circulate more uniformly throughout the bin, and reduces the probability that grain will bridge across the bin. Also, when grain dries it tends to shrink. This can result in the undried grain of the upper layers bridging across the bin, resulting in a collapse of the bin walls. This is especially true if the moisture content of the grain is greater than 22%. If grain higher than 22% moisture content is to be placed in a bin, never load it over half full. Wait until the upper layers dry to 22% before adding more grain.

The drying rate is directly proportional to the quantity of drying air. The higher the airflow rate, the faster the grain will dry and the better the chances that the system will work. For Kentucky, a minimum rate of 3 CFM/bu. is recommended. As a general rule, the greater the grain depth, the less the airflow. For this reason it is advisable to keep the depth of grain in the bin to a minimum but still not restrict the harvest rate. To accomplish this, each load from the field should be loaded in a different bin until each bin contains a load. Then repeat the cycle. This allows the maximum drying to occur before any more wet grain is added. Be sure to level the grain after each filling to insure uniform airflow.

Once grain is placed in a bin, the fan should be allowed to run continuously until either the grain is dry or the temperature of the drying air is below freezing. Opening the roof hatches will reduce condensation on the roof and lower the amount of water that would normally drip onto the grain.

As drying progresses, watch the grain carefully. Check the amount of heat and air being supplied and watch the grain for any indications of spoilage. Remember, you may have the fruits of one year’s labor tied up in storage and you may want to “bail-out” by selling your grain to a local elevator should spoilage begin to occur.

Once the drying is complete, close the hatches on the bin. Aerate the grain frequently enough to prevent moisture migration in the bin.

How To Fail Without Really Trying

As has been mentioned previously, low-temperature drying is not generally recommended for Kentucky. The surest way for this system to fail is by poor management. If excessively high moisture corn is stored all at once to great bin depths with small airflows, the chances are that in Kentucky conditions the grain will spoil and the bin will fail. Low-temperature drying in Kentucky is a marginal enterprise. Only through good management, low initial moisture contents, and favorable weather conditions, can this method of drying be used successfully.