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IN VIEW OF THE ENERGY SHORTAGE

# NATURAL AIR CROP DRYING FOR OKLAHOMA

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Farmers, like everyone else, are finding themselves in the midst of the energy shortage. And, like everyone, else, they are looking for ways to conserve fuel supplies. The amount of fuel required for crop drying is highly variable from one year to the next. Which grain crops and how much of each crop will require drying are highly weather dependent. It is therefore difficult to plan crop drying fuel needs for any one year.

Natural air drying is one method of eliminating fuel requirements of grain drying. Storage bins can be modified to provide drying in those years when it is required. Oklahoma is well adapted for natural air drying. Humidities are lower than most other grain producing areas. Equilibrium moisture contents are low enough for long-term storage in most cases, and the large dialy temperature fluctuations experienced in much of Oklahoma are beneficial to natural air drying.

## Safe Storage

Table 1 gives approximate maximum moisture contents for safe storage of one year for several crops grown in Oklahoma. In general, the higher the oil content of the crop, the lower the moisture content for safe storage. For example, soybeans must be below 11% and peanuts below 9% moisture content for safe long-term storage.

Table 1. Approximate Maximum Moisture Content for Safe Storage for One Year

| Grain | Moisture for Safe Storage % w.b. |
|---|---|
| Shelled Corn | 13.5 |
| Wheat | 14.0 |
| Barley | 13.5 |
| Oats | 14.0 |
| Grain Sorghum | 12.0 |
| Soybeans | 11.0 |

Molds which destroy grain are moisture and temperature dependent. Grain of any moisture content can be stored indefinitely if the grain is maintained at a temperature below 30°F. Also, grain of any temperature can be stored indefinitely if its moisture content is maintained below the levels given in Table 1. For combinations of storage temperature and moisture content above these levels, a definite allowable storage time applies.

## The Drying Process

When air is passed through moist grain, a drying zone is established which moves through the grain in the direction of air movement. Grain behind the drying zone is in vapor pressure (moisture) equilibrium with the air while grain in front of the drying zone remains at the initial moisture content. Drying is completed when the drying zone passes out of the grain mass. The temperature and moisture content of grain in front of the drying zone determine the allowable drying time before mold will develop.

## Natural Air Drying

Natural air drying maintains relatively low grain temperatures in front of the drying zone. Fan operation at night further cools the undried grain. By holding the grain to low temperatures until reached by the drying zone the risk of mold growth is reduced. In this case, use of supplemental heat would cause a greater risk of molding since it reduces allowable storage time more than it reduces drying time.

## Final Moisture Contents

In Oklahoma, natural air available during the harvest seasons will dry most crops to safe storage levels. Table 2 presents natural air equilibrium moisture contents for several crops during their normal harvest seasons in Oklahoma. Values in Table 2 are expected final moisture contents resulting from natural air drying.

## System Design

Natural air drying systems should be designed to deliver at least 1 cfm/bu (one cubic foot of air per minute per bushel). A 6,000 bu. bin should have a fan which will deliver at least 6,000 cfm when operating against the expected static pressure. The static pressure against which the fan will operate is determined by the type of grain and grain depth. Since static pressure increases rapidly with grain depth, 16 feet should be the maximum depth.

Table 2. Natural Air Equilibrium Moisture Contents* During Harvest for Crops in Oklahoma

| Month | Crop | Location in the State | | |
|---|---|---|---|---|
| | | N.W. %w.b. | Central %w.b. | S.E. %w.b. |
| July | Wheat, Oats, Rye, Barley | 11.5 | 12.5 | 13.5 |
| Oct. | Grain Sorghum | 12.5 | 13.5 | 14.0 |
| | Shelled Corn | 12.0 | | |
| | Soybeans | | 11.0 | |

*All values are calculated from mean monthly temperatures and relative humidities and should be considered ±1% to account for yearly weather variations.

Table 3 presents maximum recommended initial moisture contents, expected static pressures and recommended fan type for drying various crops.

## Management Factors

1. Choose a standard drying bin with perforated floor and 16 foot or less sidewalls. Drying duct systems can be used, but should be designed by a competent engineer to avoid excessive static pressure and nonuniform air distribution.
2. Provide an escape for air when

Table 3. Design Factors for Natural Air Drying Assuming 1 CFM/BU and 16 Foot Grain Depth

| Crop | Maximum Harvest Moisture Content | Expected Static Pressure | Type of Fan Required |
|---|---|---|---|
| | % w.b. | Inches of water | |
| Corn | 22 | 2 to 3 | axial or centrifugal |
| Soybeans | 18 | 1.5 to 2 | axial or centrifugal |
| Grain Sorghum | 22 | 4 to 5 | centrifugal |
| Wheat, barley oats, or rye | 18 | 5 to 6 | centrifugal |

the fan is operating with the roof hatches closed during periods of rain.

Roof vents can be installed or the bin roof can be mounted in a raised position off the sidewall to provide an eave opening. Where the bin roof is raised off the sidewall, roof condensation drains outside the bin.

3. Select a fan system to deliver 1 cfm/bu when operating against the static pressures given in Table 3.

   Higher static pressures (above 3 inches) will require a centrifugal fan. When more than one grain will be dried in the bin, select the fan for the highest static pressure. In general, the power requirement is 1 to 1½ hp/1,000 bu.

4. Adjust combines to remove trash and avoid grain damage.

   Broken grain and trash increase static pressure, making drying more difficult and mold more quickly than whole, sound grain.

5. Start the fan as soon as the bin floor is covered with grain and operate the fan continuously.

6. Do not add heat to speed up drying.

7. Use a grain distributor to maintain a level grain surface as the bin is filled. A traveling auger distributor works well.

8. Operate the fan continuously, night and day, until the top grain layer has dried to a safe level.

9. Expect a 3 to 4 week drying period to be required.

10. Make a daily inspection of the fan to check for obstructions and a daily inspection of surface grain.

    Condensation on bin roof and walls will be evident on cool mornings. Fan operation will sweep this moisture out of the bin during the day.

## Advantages of Natural Air Drying

Unheated air drying has several advantages over other drying methods.

1. Unrestricted harvest rate. Grain may be added to the bin as rapidly as it is harvested. The grain will dry over a 3 to 4 week period.

2. Little management required. The grain is moved only once - when it is placed in the bin. Fan operation is continuous until the moisture in the top layer of grain has been reduced. Daily inspection of fan operation and surface grain is all that is required.

3. Low operating cost. No fuel is required. From 1/2 to 2¢/bu. of electricity is required depending on the amount of moisture removed.

4. Improved grain quality. Natural air drying has no effect on germination, so it is ideal for seed crops. Corn dried with natural air retains its bright color and has no stress cracks. It suffers less breakage during handling than corn dried rapidly with high temperatures.

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