GRAIN QUALITY
Task Force
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Costs of Drying High-Moisture Corn

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Corn is physiologically mature when the ears reach 35% moisture. Corn can be field-shelled with a combine at moisture contents of 35+% moisture. Shelled corn must be dried to around 15% moisture and cooled with aeration to prevent spoilage (heating). Corn with moisture contents above 15% is discounted in the marketplace.

In a normal year, many farmers like to wait until the moisture content is at least below 28% before beginning harvest. The field moisture content continues to decrease during the fall. Typically, the average moisture content during the harvest season is around 20-22%. In a normal year, the average moisture removed by drying is around 7 percentage points. This year, it may be up to 15 percentage points. The extra expense will be in the form of increased fuel costs and drying time (less drying capacity). Table 1 shows the approximate BTU's needed to dry a bushel of corn in a typical column-type, high-temperature dryer from various initial to final moisture contents. As the moisture removal from the grain is increased, the energy required to dry the wet corn increases.

The actual amount of fuel required to dry corn in your facility depends not only on the initial and final moisture contents but also on the type of drying system (for example, column batch or continuous, in-bin batch or continuous, no or low heat); the airflow rate (typically 75-125 cfm/bu for a column dryer, 8-15 cfm/bu for an in-bin dryer, and 1-3 cfm/bu for a no or low heat dryer); the drying air temperature (typically 180-230°F for a column dryer, 120-160°F for an in-bin dryer, and ambient-plus 5-10°F for a no or low heat dryer); and the outside weather conditions.

The temptation is to delay harvest of high-moisture corn until the moisture content falls to an acceptable level to save on drying costs. The difficulty is that with cool (and perhaps wet) weather, the field moisture content of corn is not expected to decrease very fast this season in Indiana. One way of deciding when to begin harvest is to evaluate the energy costs for drying and compare them against the costs of potential field losses.

Table 1. Energy (BTU's) required to dry a bushel of wet corn[1]

Final Moisture	Initial Moisture Content				
	22%	24%	26%	28%	30%
17%	8,744	11,714	14,487	17,086	19,545
16%	10,596	13,506	16,241	18,784	21,188
15%	12,589	15,447	18,118	20,624	22,978
14%	14,582	17,388	19,994	22,463	24,768
13%	16,774	19,528	22,088	24,486	26,744

[1]Column-type dryer operating at an airflow rate of 100 cfm/bu and 180°F air temperature.
(Source: National Corn Handbook NCH-21)

Calculating Energy Costs

Farmers use many sources of fuel for drying corn. Natural gas and liquid propane (LP) are the most popular fuels. The costs per unit vary depending upon the type of fuel and the quantity discounts. Fuel costs per bushel of corn can be estimated by using the following equation (Eq. 1):

$$\text{Fuel cost/bu} = \frac{\text{BTU's/bu} \times \text{unit cost of fuel}}{\text{BTU's/unit of fuel}}$$

where: *BTU's/bu* is the drying energy requirement from Table 1

unit cost of fuel is the present fuel price

BTU's/unit of fuel is listed in Table 2

Table 2. Energy content (BTU's) per unit of fuel commonly used for grain drying

Fuel	Unit	BTU's/unit of fuel
Fuel oil	gallon	140,000
LP gas	gallon	92,000
Electricity	kWh	3,414
Natural gas	cubic foot	1,000

Example: If corn is to be dried from 28% moisture down to 15% in an automatic column batch dryer using LP gas priced at 60 cents per gallon, the fuel costs per bushel would be:

$$\frac{20{,}624 \text{ BTU's/bu} \times \$0.60\text{/gal}}{92{,}000 \text{ BTU's/gal}} = \$0.135 \text{ or } 13.5 \text{ cents/bu}$$

Electricity costs per bushel of corn can be estimated by using the following equation (Eq. 2):

$$\text{Electricity cost/bu} = \frac{\text{HP} \times 0.746 \text{ kW/HP} \times \text{cost/kWh}}{\text{bu dried/h}}$$

where: *HP* is the combined horsepower to operate dryer fans and augers

0.746 kW/HP is the conversion factor from horsepower to kilowatt

cost/kWh is the present electricity price

bu dried/h is the rated dry bushel capacity at the dryer outlet

Example: If the combined heating and cooling fans and augers of the automatic column batch dryer require 42.5 HP, the electricity costs are 7 cents per kWh, and the rated drying capacity is 300 dry bushels per hour, the electricity costs per bushel would be:

$$\frac{42.5 \text{ HP} \times 0.746 \text{ kW/HP} \times \$0.07\text{/kWh}}{300 \text{ bu/h}} = \$0.007 \text{ or } 0.7 \text{ cents/bu}$$

The total energy costs to dry corn from 28% to 15% moisture (excluding labor costs) would be 14.2 cents/bu (13.5 + 0.7 = 14.2) for this example.

To Delay or Not to Delay Harvest

Total drying costs per acre can be estimated by using the following equation (Eq. 3):

$$\text{drying costs/acre} = \text{total drying costs/bu} \times \text{expected yield/acre}$$

where: *total drying costs/bu* are the combined fuel and electricity costs (Eqs. 1 and 2)

expected yield/acre is the expected average corn harvest yield

Example: If the expected yield is 130 bu/acre (which is the predicted average yield for Indiana this season), and corn is dried from 28% to 15% moisture, the drying costs per acre would be:

$$\$0.142\text{/bu} \times 130 \text{ bu/acre} = \$18.46\text{/acre}$$

In a normal year when corn is only dried from an initial moisture content of 22% to 15%, the total drying costs for the same example (assuming a 25% higher drying capacity for the same dryer) would be 8.8 cents/bu:

$$\text{Fuel costs/bu} = \frac{12{,}589 \times 0.6}{92{,}000}$$

$$= 8.2 \text{ cents/bu}$$

plus

$$\text{Electricity costs/bu} = \frac{42.5 \times 0.746 \times 0.07}{375}$$

$$= 0.6 \text{ cents/bu}$$

This would yield per acre drying costs of $11.44 (0.88 x 130 = 11.44).

Thus, in our example, the difference in drying costs between a normal year and a year when higher moisture content corn has to be dried is $7.02 per acre ($18.46 - $11.44 = $7.02). Even with prices hovering around $2.00 per bushel at harvest time, a field loss of 3.5 bushels per acre would pay for the additional fuel costs of drying corn from 28% to 15% versus from 22% to 15%. Delaying harvest to allow field drying to take place could easily cause field losses due to unfavorable weather to be more than 3.5 bushels per acre.

Your Bottom Line

The bottom line is that you cannot afford to delay harvest this year to wait for the moisture content to drop due to field drying. Relative to the price of corn, energy for drying is cheap! Paying the extra fuel and electricity costs will actually save you money in the end.

Total drying costs per acre can be estimated by using the following equation (Eq. 3):

drying costs/acre = total drying costs/bu * expected yield/acre

where: total drying costs/bu are the combined fuel and electricity costs (Eqs. 1 and 2)
expected yield/acre is the expected average corn harvest yield

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