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Reduce Grain Drying Costs this Fall

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Natural gas and propane prices have been increasing over the past few years due to increasing demand and tight supplies. In the wake of Hurricane Katrina, prices have jumped due to disruptions with supply, refining and distribution. In October 2004 Henry Hub natural gas prices climbed to an all time high of $9.00 per mmBtu on the NYMEX commodity exchange for natural gas delivered to the Henry Hub in Louisiana before retreating to the $7.00 range in December 2004. Currently, wholesale natural gas futures are trading at an average of $11.50 per mmBtu for October and November 2005 deliveries but are expected to decline as storm damage is repaired and supplies are restored. If mild temperature across the US delays heating needs, it could help to reduce prices. Propane prices have also taken a dramatic jump with wholesale prices reaching record levels at $1.11 per gallon the first week of September 2005, 25% above the October-November 2004 average price and 120% higher than the average price for October-November for the years of 2000 through 2003. Propane prices are also expected to decline as oil refineries come back on line. Natural gas or propane is a major cost of high temperature grain drying. Over the next 30 to 60 days the price is expected to drop. In the last week, natural gas spot prices have dropped from 65 cents from the panic prices immediately following Katrina. Warm weather and dry conditions in the Midwest will aid in drying the crops down faster this fall. If the weather stays dry, delaying harvest and therefore the purchase of fuel for drying may reduce your drying and harvesting costs if you have not forward contracted for fuel. More information on what drives propane prices can be found at http://tonto.eia.doe.gov/FTPROOT/other/Propane_Prices_Pub.pdf.

Estimating fuel costs:
One can estimate the energy costs for high temperature drying at 0.02 gallons per bushel per percentage point of moisture removed for propane or 0.018 therms of natural gas per bushel per percentage point of moisture removed.

Example: 50,000 bushels dried from 23% to 17% moisture could be calculated as:

50,000 x 6% moisture x 0.02 = 6000 gallons propane

The following are some things that can be done to reduce the impact of higher energy costs.

Can the grain be used as "High Moisture Shelled Corn" (HMSC) instead of dried shell corn?
This avoids the cost of drying. If storage is not available, there will be some cost for temporary storage but is usually less than the energy cost to dry the corn. A sealed silo is optimal for storage of HMS corn but an open silo or a silo bag can also be used provided the grain can be fed out fast enough to prevent spoilage and lower feed quality. Regardless of storage type, the HMS corn should be harvested at 25 to 30% moisture to get good fermentation. This could also aid in spreading out the harvesting time frame, allowing corn to be harvested earlier than corn that will be dried. If temporary storage such as a silo bag is used, care must be taken to make sure the bag is air tight and any holes are patched to minimize spoilage. Putting up enough HMS corn to provide feed for the cold months, November to March, will save a considerable amount of energy and have the lowest risk for spoilage. More information on storing shelled corn in silage bags can be found at www.bae.umn.edu/extens/ennotes/enspr01/storage.htm.

Delay harvest of corn to allow field dry down.
This is usually a trade off between increased field losses, time available for harvest, drying capacity and weather affecting the ability to harvest the crop. Delaying harvest early in the season usually has favorable results, but later in the fall the field loss will likely be greater than energy cost savings. Choosing varieties that mature earlier in the fall will allow more time for natural field drying without increased field losses associated with late harvests.

Tune up your drying system.
Clean screens and aeration floors, check belt drives (make sure safety guards are in place), clean fan housing and blades, calibrate temperature sensing devices, clean and check burner for proper operation, have gas company personnel check gas pressure regulators and have any grain moisture tester or sensors calibrated

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annually. Here is two link to a fact sheets to ensure dryers are operating efficiency: the first is entitled "Last Minute Grain Dryer Checks" - www.ces.purdue.edu/extmedia/GQ/GQ-19.html and the second is titled "Optimizing Grain Dryer Operations" - www.ces.purdue.edu/extmedia/GQ/GQ-15.htm .

Reduce over-drying.
Corn can be safely stored at 14-15% moisture for 6 to 9 months. If grain is over-dried, there is less to sell and it is more susceptible to cracking and breakage. Besides using more energy, over-drying also reduces dryer capacity.

Calibrate your grain moisture meter
Monitoring of several grain drying system last fall found moisture meters that were out of calibration. This can increase cost one of two ways. If the meter is reading high, then extra fuel is being used to dry the grain and if it's being sold you be losing on water weigh you could have been paid for. If the meter reading is low than actual grain moisture you run the risk of spoilage and reduced quality. A bulletin on proper use of moisture meters can be found at www.ces.purdue.edu/extmedia/GQ/GQ-14.html or www.extension.iastate.edu/Publications/PM1633.pdf.

Clean grain before it enters the dryer to remove fines.
Cleaning grain to remove fines will ensure unrestricted flow of air through the column or pile of grain which will increase dryer efficiency and saves energy (energy not used to dry fines). If filling a bin where the grain will be dried and stored, a distribution spreader is recommend to achieve level fill and to evenly distribute any remaining fines. Clean grain in bin dryers will reduce the risk of spoilage by reducing areas that have poor air flow due to the accumulation of fines. The results of a study that looked at the affects of cleaning grain can be found at www.extension.umn.edu/extensionnews/2003/NewUofMstudy.html.

Do you have a grain bins with a full perforated floors and aeration?
Option 1 - *Low temperature bin drying*
You might consider using ambient or natural air drying if the corn crop comes out of the field at less than 22% moisture. Ambient or low temperature bin drying in a typical weather year uses ***half the energy*** that a typical cross-flow high temperature dryer uses. The energy source switches from 98% natural gas or propane to 100% electrical energy. You will need a minimum of 1.25 cfm per bushel air flow rates for Wisconsin. The fan requirement works out to ¾ to 1 horsepower per 1000 bushels of corn for grain up to 18 ft deep. If multiple grain bins are available, fill them each with a layer of grain (layered fill) rather than filling one bin at a time. This allows the grain to dry faster because of higher air flow due to less grain depths (higher air flow rate per bushel) and reduces the risk of spoilage. Fans are started when the filling starts and run constantly until the grain is dry, usually 4 to 8 weeks or until the grain temperature drops below 30ºF. If the grain is not completely dried before winter, it will be necessary to finish drying in the spring when the temperature rises above freezing. Refer to MidWest Plan Service publication MWPS-22, "Low Temperature & Solar Grain Drying Handbook" for additional information or an on-line source is available at www.extension.umn.edu/distribution/cropsystems/DC6577.html

Option 2 - *Using Combination drying*
To reduce some of the risks with ambient air drying, use a high temperature dryer to dry the corn down to about 20% and then finish drying it using ambient air or a low temperature bin dryer. The grain can be transferred hot to the bin dryer and the aeration fans are started immediately. This can reduce energy requirements by up to 60% and will improve grain quality due to less kernel cracking. The capacity of a high temperature dryer is doubled or tripled using combination drying.

If you are using a cooling section on your continuous flow dryer, does it have heat recovery?
Adding heat recovery to your existing dryer to recycle air can save 10-15% in energy usage. Recycling the cooling air for some of the intake air to the heating section of the dryer by reverse flow through the grain or by ducting the exhaust from the cooling section to the inlet of the heating section can save 10-15% in heating costs. If heat recovery is added to the lower heating column, an additional 5-10% in heating costs can be saved. Heat recovery can also be added to the lower section of full heat dryers for a 5-10% energy savings.

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Want more dryer capacity, better grain quality and save energy?
Using In-bin cooling or Dryeration will reduce energy use by 15 to 25%, respectively, while increasing dryer through put by 33 to 70%, respectively. It can be used with continuous flow or batch dryers. The dryer is operated in a full heat mode for either process. With In-bin cooling the grain is removed from the dryer while still hot, transferred to a storage bin and cooled. The grain exiting the dryer can be about 1-1.5% moisture above the desired storage moisture percentage. The moisture is removed during the slow cooling process in the storage bin. With Dryeration the grain can exit the dryer about 2-3% moisture above the desired storage moisture percentage. The grain is transferred hot to an intermediate holding bin where the grain is allowed to steep for 4 to 12 hours before the cooling fans are started. This process allows the kernel moisture to equalize which results in less kernel stress and cracking. Typically two intermediate holding bins will be needed for this process. The grain should be removed from the steeping bin to eliminate spoilage from condensation on the bin walls. A Dryeration cycle typically requires 48 hours to fill, steep, cool and empty a bin. Refer to Midwest Plan Service publication MWPS-13, "Grain Drying, Handling and Storage Handbook", for additional information or on-line information is available at www3.extension.umn.edu/distribution/cropsystems/DC7356.html.

Adding a stirring device to your bin dryers can save 20 to 30% in drying costs.
A stirring device will loosen the grain and increase air flow through the mass, resulting in an increased drying rate. It also mixes dry grain from the bin floor with higher moisture grain from the upper layers, reducing over drying. Studies suggest stirring the grain two or three times: the first time right after filling the bin, a second time when the grain is about half dry (about 20%) if the initial grain moisture was greater than 22%, and the third time when the average grain moisture is 15.5% moisture is sufficient. Over stirring can lead to fines sifting to the drying floor which reduces air flow.

Need to replace a grain dryer? Choose a high efficiency type.
Aside from natural air bin dryers, continuous flow In-bin dryers are the most efficient high temperature dryers using only 60% of the energy that a typical continuous cross-flow dryer would use. Often an existing storage bin can be retrofitted to be used as a bin dryer which reduces initial costs, and the bin/dryer can still be used to store the last batch of grain of the season by drying it in a recirculating bin dryer mode. Another type of high efficiency continuous flow dryer is a mixed-flow column dryer. The air flow through the grain is both in a concurrent and counter flow path which is why it is called a mixed flow dryer. Due to the relatively short air path and multiple plenum zones, dryers can be adjusted to optimize crop drying needs. These dryers can be used to dry all sizes of seeds (rape seed to corn) and there are no screens to be cleaned daily.

Relative Efficiency of Grain Dryers (based on drying corn)
(Lower values are more energy efficient)

Dryer Type	Thermal Efficiency (Btu/ # water removed)	% Gas	% Electric
Combination High/Low Temperature	1200	75%	25%
No Heat Bin Dryer	1500	0	100
Low Temperature Bin Dryer	1650	0	100
Continuous Flow In-Bin Dryer	2000	98	2
Mixed Flow Dryer	2050	98	2
High Temperature Batch Bin Dryer	2430	98	2
Batch Cross-Flow Dryer	2450	98	2
Continous Cross Flow Dryer	2500 plus (3200 typ.)	98	2

Do you use a low temperature dryer? Add solar heating.
Solar assisted heating has been shown to reduce drying time and energy costs between 9% and 13% in an Iowa study. Intake air was drawn through a solar collector before it entered the grain bin. The solar collector increased the air temperature in this study an average of 2.1ºF. The amount of saving provided by solar heating will vary with weather and collector area. Refer to Midwest Plan Service publication MWPS-22, "Low Temperature & Solar Grain Drying Handbook", for additional information.

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Do the controls on your dryer give you consistent drying?
Updating the controller on your current dryer can increase its efficiency. Two-stage burners and modulated burners can reduce the extreme temperature variation caused by on / off thermostatic controls for high temperature dryers. Moisture and temperature sensors in the grain can be used to sense when the grain is dry enough to remove from the dryer, preventing over-drying and reducing energy costs. A humidistat can be used in a low temperature dryer to control a heater to keep the humidity below a specified level for faster drying.

Energy Efficiency Grants:
Wisconsin has a grant program, Focus on Energy, to aid growers in becoming more energy efficient. The grants can be used to cover up to 25% of the cost of equipment and are based on the estimated first year energy savings. Growers must be in a participating utility's service area. For more information, call 1-800-762-7077 or access the web site at www.focusonenergy.com.

The 2002 Farm Bill also provides funds for renewable energy and energy efficiency projects. The Notice of Funding is usually published in May each year with applications due in mid-July. Grants cannot exceed 25% of total project costs and range from a minimum of $2500 to $500,000. Energy efficiency projects must demonstrate at least a 15% energy savings and an 11-year investment payback to be considered. Applications are handled by the USDA Rural Development office in each state. The Wisconsin office is located in Stevens Point and can be contacted at 715-345-7615. More information and applications can be found at www.elpc.org/farmenergy/9006FAQ.htm or www.rurdev.usda.gov/rbs/farmbill/index.html.

Online Resources:
Purdue University maintains a website with all known grain drying related information on the web. - http://pasture.ecn.purdue.edu/~grainlab/exten-pubs.htm

University of Minnesota – Grain Drying, Handling and Storage website - http://www.extension.umn.edu/topics.html?topic=4&subtopic=44
Saving Fuel in Corn Drying, Bill Wilcke, www.bae.umn.edu/extens/ennotes/enaug01/corndrying.htm

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Low Temperature & Solar Grain Drying Handbook, MWPS-22, Midwest Plan Service, Ames, IA, 1980.

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Dry Grain Aeration Systems Design Handbook, MWPS-29, Midwest Plan Service, Ames, IA, 1997.

Wilcke, W.F., C.J. Bern, "Natural-Air Corn Drying with Stirring: II. Dryer Performance", ASAE Transactions Vol. 29, no. 3, pg 860-867, 1986.

Midwest Plan Service publications can be order online from Midwest Plan Service at www.mwpshq.org or contact them at 1-800-562-3618 or mwps@iastate.edu.

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