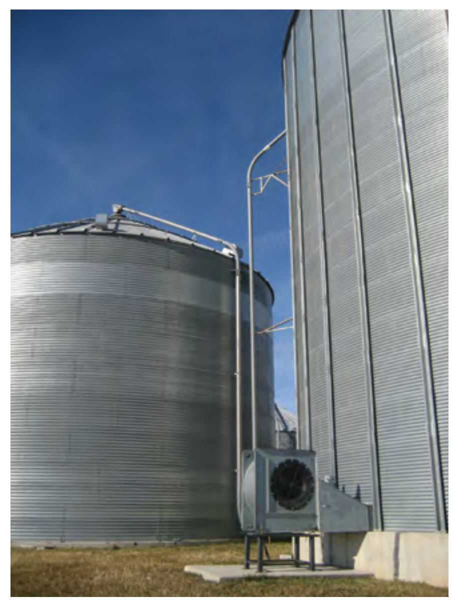
Dryeration and combination drying for increased capacity and efficiency

In years when artificial corn drying is necessary, the grain dryer is often the bottleneck that limits harvest rate. Two management strategies, dryeration and combination drying, can help you increase the drying rate from your high-temperature (above 120 degrees F) corn dryer.



Stop high-temperature drying sooner to increase dryer capacity/efficiency

In both dryeration and combination drying, the drying process in the high-temperature dryer is stopped at a grain moisture content higher than the final target moisture content. This allows more bushels per hour to be moved through the high-temperature dryer, increasing drying capacity. At the same time, delayed cooling of the grain allows the drying process to finish with less fuel input, increasing drying energy efficiency.

Delayed cooling is the key

In a high-temperature dryer, moisture is being removed from corn kernels faster than the moisture can equalize within the kernel. At the end of high-temperature drying, the moisture in the center of the kernel is still higher than around the outside of the kernel. Delaying the cooling process 4-12 hours (dryeration) allows kernel moisture to equalize, moving this extra core moisture toward the surface of the kernel where it is more easily removed. Cooling the corn after this resting period, sometimes called "steeping" or "tempering" time, removes an extra 0.2 to 0.25 points of moisture from the corn for each 10 degrees of temperature change (2-3 points of moisture for typical high-temperature dryers) compared to immediate cooling.

Drying capacity can increase 50-70% with dryeration. Drying energy efficiency can increase 15-30%. Additional benefits of delayed cooling are reduced stress cracking of kernels during cooling, reduced kernel brittleness, and improved millability.

Planning for dryeration

Systems designed for dryeration must have the ability to transfer hot grain from the dryer and hold it for several hours before cooling. This is best done in a dedicated cooling bin with full floor aeration.

Because condensation occurs on the bin sidewall and nearby grain during delayed cooling in cold weather, delayed cooling in storage bins is not recommended.

For batch loading and unloading, use two cooling bins so that one bin is steeping and cooling while the other bin is loading. Convenient operation results when each cooling bin is sized for one day's drying capacity. Size the cooling fans to cool the bin in about 12 hours. This requires approximately one cubic feet per minute of airflow per bushel of grain to be cooled (cfm/bushel).

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Consider sizing cooling bins for up to 1.5 times your current drying capacity to allow for expansion and the fact that drying capacity increases with dryeration. Good grain handling equipment and layout is critical for dryeration.

Manage your dryeration by transferring hot grain from the dryer at a moisture content 2-3 points higher than the final target moisture. Allow the first grain into the cooling bin to steep for at least 4, and preferably 6-12 hours before starting the cooling fan. Once grain is cooled, move it to storage bins. Monitor the final grain moisture content and adjust drying times as necessary. Avoid immediate bin cooling of grain as this removes 1-2 points less moisture than delayed cooling with dryeration and does not provide as much protection against cracking.

Dryeration requires additional grain handling equipment and additional management time, but can result in significant increases in drying capacity and energy efficiency.

Combination high-temp./low-temp. drying

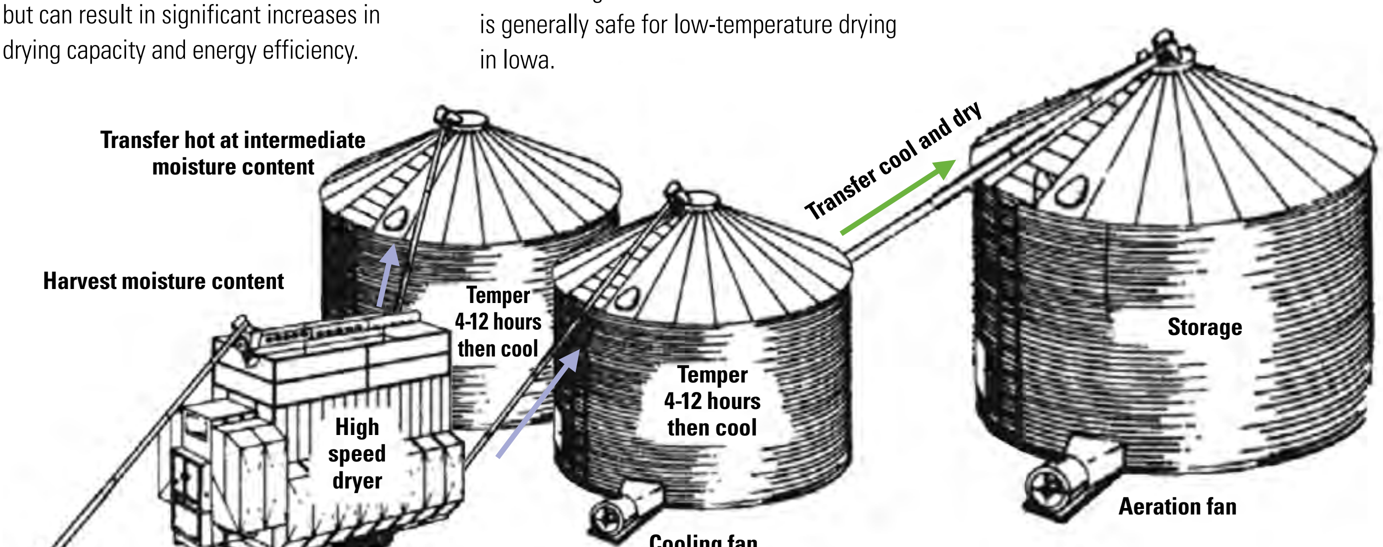
Another adaptation of delayed cooling combines high-temperature and low-temperature drying systems. This combination works particularly well for corn harvested at a moisture content too high for reliable low-temperature drying alone.

For combination drying, the high-temperature dryer must be equipped to transfer hot grain to a low-temperature drying bin.

In this system, corn is dried in the high-temperature dryer to a moisture content of 22% or less. The partially dried hot corn is transferred to a low-temperature drying bin where the fans are started immediately to cool and finish drying the corn. Immediate cooling in the low-temperature bin reduces the risk of condensation but still removes an additional point of moisture during cooling. The resulting moisture content of 21% or less is generally safe for low-temperature drying in Iowa.

Combination drying can reduce drying energy use by up to 50%. Drying capacity can be doubled or even tripled compared to conventional high-temperature drying alone. Because combination drying relies on low-temperature drying in addition to high-temperature drying, more electricity is used in place of natural gas or propane, and more drying system investment is required.

When considering any changes to your grain drying system, start first with an energy audit to determine your energy efficiency and opportunity for improvement. Consult a qualified engineer or system planner for equipment selection and sizing. More information on grain drying systems is available from your Extension Ag Engineer and in the Midwest Plan Service Grain Drying, Handling and Storage Handbook available at www.mwps.org.



Drawing from North Dakota State University

Dryeration example: high-temperature dryer system with two tempering bins. Tempering bins are filled in alternating order, making sure hot grain has at least 4 hours of time to temper before exposure to cooling air. After tempering and cooling, transfer grain to storage bin.

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