Low-temp drying

Farm Energy

By DANA PETERSEN

LAST year, weather conditions before harvest allowed for weeks of in-field drying, with many high-temperature grain dryers sitting empty. For some Iowa farmers, low-temperature or natural-air drying systems may be better-suited to their needs and use less energy than high-temperature dryers fired by propane or natural gas.

When field drying conditions are not favorable, artificial drying is necessary. Corn moisture content in the field can stubbornly hold steady for weeks or more in cold, wet weather. Corn is hygroscopic, meaning that it allows moisture to enter and exit the kernels depending on surrounding conditions. Limited field-drying data from across the state suggests that daily drying rates may average 1% in mid-September, 0.7% in late September and 0.5% in early October in Iowa.

It's important to consider that drying conditions vary significantly depending on local weather conditions, according to ISU Extension ag engineers Shawn Shouse and Mark Hanna. Early in the harvest season, such as the first week of October, air temperatures are typically in the mid-70s degrees F. Combined with dry winds, these temperatures may increase the in-field drying rate above average to nearly 1% daily.

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Like in-field drying, low-temperature drying systems take advantage of the natural drying potential in the warm autumn air. The process often needs less energy but more time than high-temperature grain drying, say Shouse and Hanna.

"It is important to understand the process and to determine if it may be a good fit for your operation given the right conditions," says Hanna.

Compared to high-temperature grain drying, low-temperature drying may span weeks or months of time. It should be noted that corn harvested above 21% moisture content is typically not suitable for low-temperature drying with commonly used airflow rates and normal Iowa weather. "Management considerations are different for each drying method, so do your homework," says Shouse.

Specifically, low-temperature drying can be an energy efficiency strategy for grain stored in shorter bins, typically 18 feet or less of grain depth, according to Shouse. Due to airflow requirements, this method is not well-suited to larger bin sizes.

Consider a 40,000-bushel bin. At a diameter of 42 feet, the corn is 36 feet deep. To provide 1 to 1.25 cubic feet per minute airflow per bushel for drying, more than 180 horsepower of fan capacity would be required to force air up through 36 feet of grain!

Compare this to two 42-foot-diameter bins each filled 18 feet deep and requiring 28 hp of fan capacity each (56 hp total), or three 36-foot-diameter bins filled 16 feet deep and requiring only 14 hp of fan capacity each (42 hp total). Each system stores 40,000 bushels, but as grain depth increases with bin size, increasing horsepower and airflow requirements make low-temperature drying more inefficient.

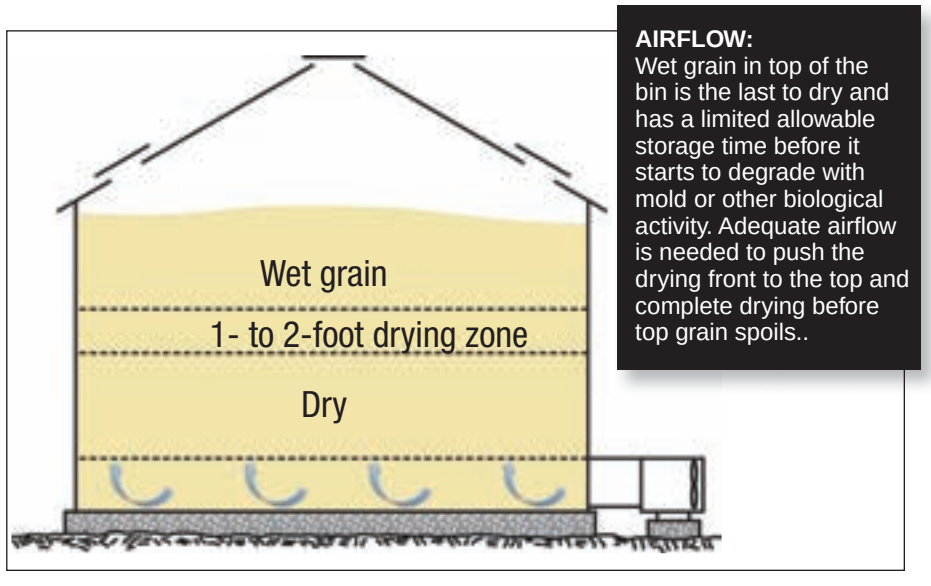
If the farm operation can store grain in smaller bins, it can gain energy efficiency by using the drying potential of natural air for low-temperature drying. If we assume that on-farm bin storage is already in place and a full perforated drying floor is used, low-temperature drying could be accomplished with a larger fan and additional electricity — and without the need for gas, heaters or extra drying equipment.

An additional benefit is less grain handling as corn is dried and stored in the same bin.

Time is critical to the success of low-temperature drying, as illustrated below. Corn kernels come into equilibrium moisture content with air blowing past them. The "drying zone" consists of a layer of corn approximately 1 to 2 feet deep. The drawing shows how the drying zone moves slowly upward through the bin, with previously dried corn below it, and wet corn (yet to be dried) above it.

For more information, see the ISU Farm Energy publication "Energy considerations for low-temperature grain drying," PM 2089U, at *farmenergy.exnet.iastate.edu* or follow @ISU_Farm_Energy on Twitter.

Petersen is program coordinator for ISU Farm Energy in collaboration with the Iowa Energy Center.



AIRFLOW: Wet grain in top of the bin is the last to dry and has a limited allowable storage time before it starts to degrade with mold or other biological activity. Adequate airflow is needed to push the drying front to the top and complete drying before top grain spoils..