Defining Best Management Practices for Using Supplemental Heating with Natural Air Drying

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Many producers use natural air drying (NAD) systems to minimize the capital and operating costs of grain drying; however, very little practical information or best management practices are currently available. PAMI researchers conducted a two-year project to determine how the use of supplemental heat affects the drying rate and storage conditions of wheat and canola. Overall, supplemental heating for NAD systems does have the potential to be a lower capital alternative to heated air drying to extend the drying season; however, careful management is required to keep operating costs comparable to that of a dedicated dryer system. A summary of recommended general management practices was also developed.

Drying grain on-farm is a common practice in Saskatchewan to minimize the risk of spoilage during storage. Many producers use natural air drying (NAD) systems to minimize the capital and operating costs of grain drying. Adding supplemental heat to NAD can also be an efficient and effective way to dry stored grain if done correctly. However, very little practical information or best management practices are available to help producers make management and operational decisions related to using supplemental heating.

Researchers at PAMI conducted a two-year project in 2018 and 2019 to determine how the use of supplemental heat affects the drying rate and storage conditions of wheat and canola. For the first year, bench-scale drying trials, using bench-scale test bins, were conducted to evaluate the effect of air flow rate on supplemental heating with NAD compared to NAD without the addition of heat. The trials in year two assessed the rate of drying with supplemental heat at three different temperature increases. Researchers also completed an economic assessment of using supplemental heating systems with NAD, with various fuel types, to summarize the capital and operating costs related to supplemental heating systems.

All trials were planned to occur in mid-late fall to ensure the ambient conditions were representative of conditions where supplemental heating is typically used. Moisture content, grain weights, and grain temperature data from each bin were recorded for the six treatments (three airflow rates and two temperatures). Ambient temperature and humidity data were averaged for the three standard bins at the fan intake as well as for the three bins with supplemental heat.

The trial results from Year 1 indicated that adding 10°C of heat when ambient conditions are cool and damp will increase the drying rate, as long as the airflow rate is at a minimum of 1 cfm/bu and sufficient to move the moisture all the way through the grain bulk. Airflow rate has an impact on drying rate, particularly for wetter grain. The trials also showed that over-drying at the bottom of the bin may not be avoidable, therefore an average dry moisture should be targeted, followed by mixing the grain.

The trials in Year 2 showed that a 10°C increase in temperature is adequate as long as the result is a plenum temperature of greater than 5°C. However, if sub-zero ambient conditions are being experienced for prolonged periods of time, then higher temperature increases would be required. Based on the observed rates of drying for both canola and wheat in the trials, supplemental heating with a NAD system may not be suitable for starting grain moisture contents >3% above "dry" because an increased risk of spoilage is possible. Careful monitoring or reduced grain bed depths can help mitigate this risk if a heated-air dryer is not available.

The findings of the economic assessment indicated that fuel type has the greatest impact on operating costs. Natural gas (NG) is the most inexpensive fuel, compared to diesel and propane, however, access to NG can be capitally hindering in certain regions. The estimated efficiencies for NAD systems with supplemental heat range from 50% to 75% compared to efficiencies of 40% to 55% for dedicated heated-air drying systems.

Overall, supplemental heating for NAD systems does have the potential to be a lower capital alternative to heated air drying to extend the drying season, based on currently available research and knowledge. However, careful management of this practice is required to keep operating costs comparable to that of a dedicated dryer system. From this project useful baseline information on the effect of using NAD with supplemental heat on drying rate and grain storage conditions for wheat and canola have been generated.

Based on the project, general recommendations for implementing supplemental heating were also developed and are available online:
http://pami.ca/2018/09/using-supplemental-heat-to-manage-grain-in-the-bin-faq/