Smart Agriculture Research

2022 Summary: In-Bin Drying Research with Top Grade Ag

Olds College Centre for Innovation and Top Grade Ag have completed a third year of in-bin grain drying research together. Areas of focus are continuations or follow-up investigations from previous projects conducted in 2020 and 2021.

INTRODUCTION

Top Grade Ag developed a digital technology to monitor in-bin drying (IBD) of various grains, oilseeds and pulses cost-effectively.

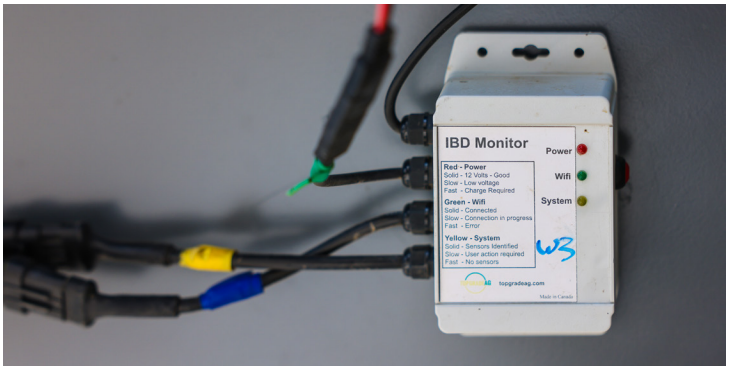
Using sensors to estimate airflow, temperature and humidity at the air inlet and outlet, the IBD technology allows operators to track the progress of a drying event. This enables farmers to optimize their drying operation while reducing energy consumption and total input drying costs.

OBJECTIVES

- Determine if growing degree days can be an indicator to estimate harvest dates with consideration for grain quality and optimal harvest timing.
- Determine if large electric motors impact Wi-Fi connection capabilities of Top Grade Ag equipment.
- Quantify energy consumption of Top Grade Ag in-bin grain drying equipment for grain conditioning activities taking place on the Olds College Smart Farm during the fall of 2022.

STUDY DETAILS

- 10 pre-harvest wheat samples were collected from Field 15/16 for grade, quality and moisture content assessments with respect to accumulated growing degree days.
- Literature review of grain harvest date prediction models.
- Literature review of Wi-Fi signal interferences.
- Wi-Fi signal strength mapping of Olds College Smart Farm bin yard with bin fans on and off.
- 10 grain conditioning events tracked and measured IBD technology in the bin yard.
    - No operational grain drying was needed during the 2022 harvest.
    - Bin fans were equipped with electricity sub-metres to measure electricity consumption per event.



Learn more at oldscollege.ca/SmartFarm

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RESULTS

Growing Degree Day & Grain Quality Study

- Accumulated growing degree days had a positive correlation to wheat test weight and thousand kernel weight, indicating they could be used as a tool for determining harvest timing.
- The use of growing degree days to estimate crop growth stages is well-documented. When growing degree days are combined with additional sources of information – such as remote sensing, in-field scouting reports, and field-specific information – the accuracy of the predictive models is increased.

Wi-Fi Interference Study

- No significant difference observed between signal strengths when bin fans were on or off.
- The north-east corner of the bin yard has the poorest Wi-Fi strength.
- Maintaining line of sight, selecting a higher bandwidth; and using directional antennae are recommendations to set up Wi-Fi connections in rural environments to improve connectivity strength.

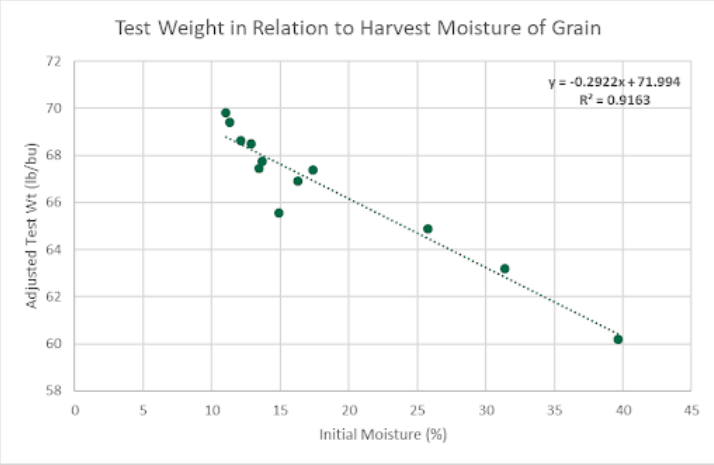
Energy Consumption of TGA In-Bin Grain Drying Equipment

- Electricity consumption of a bin fan was found to be variable based on a variety of bin-specific factors.
- Measured electricity consumption of a bin fan was not equal to the theoretical electricity consumption using horsepower conversions.
- The electricity consumption of an inline centrifugal fan and high-speed centrifugal fan were different, though each had the same three-phase ten-horsepower electric motor installed.
- Running a fan during times of high humidity to increase the moisture content of grain, and therefore revenue of grain sales, in comparison to the expense of running the fan indicates this practice is not profitable unless significant moisture can be consistently added each hour.

FUTURE RESEARCH

OCCI and Top Grade Ag are identifying research priorities for the 2023 harvest season.

The focus of projects include additional pre-harvest grain quality testing with other grain types, and studying renewable energy heat sources for in-bin drying.



Note: These are the test weights adjusted for their moisture content after drying.