Title Predicting Non-Uniform Airflow in Stored Grain during Chilled Aeration

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Abstract

Chilled aeration is one of the most feasible non-chemical strategies to control pests in stored grain. Chilled aeration through a full perforated floor re-warms the interior portion of the grain mass resulting in an increase in average temperature of the grain and increased energy cost. As the grain has good insulation properties, only the outer regions of the bin near the wall need to be re-cooled. Aeration systems targeting airflow near the wall during the wall during the summer months make chilled aeration a more economical and effective pest prevention strategy. Most of food grain storage models that have been developed to predict the heat and mass transfer during aeration assume uniform airflow through the grain mass. In reality, most grain structures have geometries or material properties that result in a non-uniform airflow distribution. Partial chilled aeration depends on non-uniform airflow distribution. A computational fluid dynamics software, Fluent, was used to solve for non-uniform airflow. Results were integrated with a comprehensive finite element model (PHAST-Post-Harvest Aeration and storage Simulation Tool) for stored grain ecosystem analysis to predict heat, mass and momentum transfer in large steel structured bins. Some existing designs of aeration systems were studied for applicability of chilled aeration as an alternative stored grain protection strategy. Based on the results obtained through PHAST using non-uniform airflow, alternative aeration system designs were suggested for effective quality preservation of stored grains.