THE UNIVERSITY OF MANITOBA

AERATION OF STORED WHEAT IN THE CANADIAN PRAIRIES

by

John Frederick Metzger

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ABSTRACT

Aeration of Stored Wheat

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Airflow rates and fan control methods for aeration of stored wheat to maintain quality during storage were evaluated. A computer simulation model which predicts grain conditions in two-dimensions of a cylindrical granary, with no aeration, and with aeration, was developed. The model was verified by comparing predicted and experimental data obtained during the 1979-80 storage year, and was used to investigate various design parameters of aeration systems.

Historical weather data for 15 or more harvest years from four Canadian Prairie locations ranging from Fort St. John, British Columbia, to Winnipeg, Manitoba were used. The effects of climate, initial moisture content, harvest date, and initial grain temperature on the condition of stored wheat were determined. The condition during storage of 15% initial moisture content wheat was predicted with no aeration, with aeration rates from 0.5 to 3.0 $(L/s)/m^3$, and with four different fan control methods.

All aeration airflow rates and fan control methods reduced the rate of grain deterioration. An airflow rate of 1.0 $(L/s)/m^3$ was optimum for continuous aeration. The optimum fan control methods were humidistat control with settings between 50 and 70%, 6 h time-clock operation at night, and differential thermostat control with settings between -10 and -15°C. The choice of fan control method is independent of climatic variation within the range of climates studied.

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INTRODUCTION

The trend to more storage of grain at the farm, and to larger volume granaries appears well established in Canada. Uncertainty in production and marketing can often result in lengthy storage periods. Although the Canadian Grain Commission specifies "dry" moisture contents for market, these may not necessarily be "safe" moisture contents for storage. Moisture migration, or high initial grain temperatures in large storages can result in serious deterioration, even at these "dry" moisture contents. Variable weather and field conditions during harvest may produce "tough" or "damp" grain which has an even greater tendency toward deterioration than "dry" grain.

The use of aeration has been suggested as a means of maintaining grain quality in storage. Present airflow and management recommendations are based largely on data for corn from the United States. Precise data for Canadian crops based on Canadian climatic data are unavailable.

The objectives of this study were to determine effective airflow rates and fan control methods for intermittently operated aeration systems used for on-farm storage in Canadian Prairie regions. The method of investigation was a computer simulation model. This model is capable of predicting wheat temperatures, moisture contents and deterioration, with and without ventilation, in two-dimensions of a circular steel gra-