Title Optimising the performance of vertical aeration systems.

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Citation Advances in stored product protection. Proceedings of the 8th International Working Conference on Stored Product Protection, York, UK, 22-26 July 2002 (2003); 946-955

Abstract

Complex computational modelling of airflow from vertical aeration systems showed that if the aerator fan is set to blow rather than suck, then the volume of grain cooled is up to 20% greater and better cooling is obtained near the floor. Temperature, grain moisture content change and ventilating air pressure were measured in six commercial grain stores equipped with vertical ventilation systems. At each, the volume of air moved by the fan was up to 20% more when it was blowing than when it was sucking. During ventilation, diurnal temperature fluctuations were used to estimate the speed of the cooling zone, which was linked to the pressure gradient in the grain bulk and this relationship was used to estimate cooling times. Five perforated duct sections were tested to establish their air pressure/flow characteristics in sucking and blowing. Horizontal pressure drop was approximately 50% of that for vertical flow. Ducts with >30% outlet area offered little resistance to flow at working flow rates while <10% outlet area restricted the air flow. Duct wall resistance was 16% lower when blowing wheat than when sucking. A simple model, based on cooling front velocities and the pressure and flow characteristics obtained from the farm tests and trials with ducts, was developed to enable routine design of new systems in a short time. The simple model was compared with the complex model and good agreement demonstrated.