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Grain aeration on the farm

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ALTHOUGH grain aeration is a well known and widespread technique employed to prevent insect development in stored grain, the installations are invariably designed for large scale grain handling authorities. Experimental work carried out in Western Australia over the last four storage seasons has shown that simple unsophisticated equipment can be of direct use in farm storage.

**Basic principles**

Grain insects have narrow physical limits of temperature and moisture in which they can live and multiply.

The rice weevil *Sitophilus oryzae* (L) cannot maintain itself and increase its population level below a temperature of 64.7° F. in grain moisture of 11 per cent. If the moisture level is decreased to 10.5 per cent. this temperature is increased to 77.9° F. The important W.A. pest *Rizopertha dominica* F. cannot maintain itself and increase below 71.6° F. at 11 per cent. grain moisture. The saw-toothed grain beetle *Oryzaephilus surinamensis* L., requires a minimum temperature of 66.2° F. to complete its life cycle in 100 days at 14 per cent. grain moisture. In practice this temperature ensures sufficient mortality to achieve economic control of this insect at 14 per cent. grain moisture.

With decreasing grain moistures the grain temperatures necessary to achieve control are increased. In Western Australia most of the wheat harvested is in the range of 9.5 to 10 per cent. and, consequently lethal temperatures are attainable by aeration in many wheatbelt areas. A temperature of 65° F. is considered adequate.

**Beverley trial**

In the course of Department of Agriculture investigations into grain aeration a 275 bushel silo was set up as a pilot trial at Beverley, followed by a 50,000 bushel trial at Mt. Kokeby.

The results achieved in this small silo indicated that this system was suitable for farm storage.

A small extraction fan unit was adapted to fit on the bottom of a Lysaght bin and a screen was placed above this to keep the grain clear of fan blades. The normal slides for opening the bottom were retained in a moving state for calibrating the airflow which passed downwards through the grain.

In the course of these trials over four years, a malathion protectant application was made to the grain to give initial protection through the summer months of the first season.

![Diagram of air path in simple aeration silo](image-url)
Aeration was commenced in April, when winter temperatures prevailed. Temperatures achieved ranged between 55° F. and 60° F. in the four seasons involved. Introduced insects failed to survive.

For the purpose of the experiment the airflow was kept to 1/20 cubic foot per bushel per minute. This was achieved by restricting the duct by the silos slides to a narrow slit 1 in. wide by 12 in. long. For farm use air flow rates exceeding this could well be used economically as the 200 watt fan unit used in this trial was capable of aerating this bin at 1/4 cubic foot per bushel per minute.

These trials were run continuously and were unattended. For domestic farm use where attention could be given the installations, the fans may be turned off when temperatures are unseasonably warm. The operating criteria used in the 50,000 bushel Mt. Kokeby trials are to run only on clear cold nights when there is no threat of rain. In this trial grain temperatures of 57.2° F. and 56.8° F. have been achieved in the last two seasons with the resultant insect-free condition.

Problems of aeration
The only difficulty likely to be encountered if aeration rates used are too high is excessive moisture accumulation in the top layer of grain. In our experimental work this has never exceeded 14 per cent., and this was restricted to the top 12 in. layer. Providing machinery is not run during wet periods no difficulty is experienced.

Growers wishing to set up installations may take advantage of Departmental facilities to have periodic grain moisture checks performed. Air flow rates will also be estimated.