STORAGE PESTS AND STORAGE STRUCTURES

C. J. CROSBIE

Department of Agriculture, Christchurch

FOLLOWING the introduction of bulk harvesting techniques in the late 1950s, farm bulk grain storage grew apace in New Zealand. Farm grain storage capacity in silos and bins, increased from 232,196 tons in 1968, to 271,727 tons in 1969, and to 316,036 tons in 1970.

The importance of good conditions for grain storage was brought home to me most strikingly on a visit to U.K. in 1961. I met a grower who had been stopped by the Ministry of Agriculture from selling and delivering his feed grain to local users because of a heavy infestation of insect storage pests. Poor hygiene and lack of inspection and care on his part had allowed a severe infestation to build up and, prior to the embargo, each delivery from his farm had infected the premises of the purchaser.

On my return to New Zealand, I gave this matter publicity through continuous extension work, and local growers who farm store grain should be aware of the need for good storage conditions and regular inspections. Whether or not they observe the necessary precautions is a matter of their personal decision. To date, I do not know of any grower who has lost heavily as a result of storage pest depredation although several have come close to doing so.

The factors that influence the growth of storage pests also affect the viability and quality of stored grains. Conditions that maintain good germination potential and high quality also impede pest reproduction. These factors are discussed below.

MOISTURE CONTENT

Broadly, the higher the moisture content, the faster storage pests multiply. Below 14 to 15% moisture content insect pests will not multiply at a rate to be of concern to the grower unless some other factor is also present.

Much of Canterbury's grain ripens naturally to these safe levels, however; growers in areas enjoying uncertain harvest conditions install grain driers to ensure independence of the weather. For the 1971 harvest Canterbury had (approximately) 25 continuous flow driers, 15 radial driers and 220 in-bin driers, the latter being the cheapest and most efficient drier that can be built using farm labour. These driers are located along the coastal belt where high humidity easterly winds obtain and along the foothill areas in the nor'-west rain belt.

As a result, Canterbury has few problems associated with the storage of high or borderline moisture grains and where these occur they are the result of accident or improper respect for a well-known rule. The problems that do occur frequently result from farmers' delaying the drying of damp lines of grain. Nothing is gained from delaying this process. In fact, it is more costly and slower to dry later in the season and the risk of a storage pest infestation is high.

TEMPERATURE

Storage pests multiply faster in warm temperatures than they do in cold conditions. Grain insects cease to breed at approximately 60° F and mites at 40° F, but both multiply happily in the 60 to 80° F range.

On a bright sunny day of 85° F in the shade, wheat can be measured at 95° F in the headers bulk bin—*i.e.*, 10° above ambient shade temperature (ryegrass and peas have been recorded at 20° above ambient). This is a common occurrence in Canterbury and such grain stored in silos cools only slowly to 60° F some 3 months later. By the end of the winter, it has cooled to 45° F on average in Canterbury.

The long, warm storage conditions in silos and bins in the autumn favour storage pest reproduction. However, these conditions can be negated by grain cooling. At harvest time in Canterbury (Feb.) night temperatures often fall to 55° F and if this air is blown through warm wheat it is rapidly cooled.

HYGIENE

Storage pests breed up faster when they get a good start, from a resident population living in the debris of a previous years crop. Pests can carry over not only in whole and broken grain, but also in dust containing particles of seed coating. Thus hygiene is most important and should be borne in mind when planning storage facilities and also during the construction phase.

Silos and bins must always incorporate features that make for easy cleaning and a high standard of hygiene. Thus concrete floors should be made from a properly graded aggregate, poured over a vapour barrier and finished with a steel trowel. In this way a good floor is obtained that can be swept pickle free and dust free. It is not good enough to take a load of shingle from the nearest river-bed, make a rough mix and belt it down with the back of a shovel.

Walls are best built from galvanized sheet metal because it is easily cleaned and where double walls are constructed inside a building they should be capped with sheet metal. Double walls on the outside of a corrugated iron building are easiest capped with a fillet made from a firm plaster mix and this will prevent grain spillage down inside the wall. Grain spilt inside a double wall is impossible to remove and forms a breeding place for storage pests.

Where drying floors are installed in storage structures, they should preferably be of perforated metal on a steel or timber base. Perforated metal strips alternating with boards of dressed timber have been used, as have hessian sheets on a base of mesh sheets. Another system of drying uses a system of inverted wooden ducting. In all cases where timber is used in drying structures, it should be dressed on all sides to make for easy hygiene. Grain dust is not easy to remove from rough-sawn timber. All drying floors must be built in such a way that large sections can be removed to enable the concrete floor below to be swept and vacuum cleaned as required for storage pest and seed certification hygiene. It is completely wrong to build a fixed metal floor over a base made from half a truck load of reject concrete building blocks. This floor cannot be easily lifted for cleaning and, even if it could be, the rough texture of the blocks, their close proximity and the cavities within them make thorough cleaning impossible.

All grain storage structures should be built well away from present farm buildings—especially those used for the storage of hay, seeds, con-

centrated foods and the like. This type of storage shed is frequently infested with mites and insect pests and they will migrate considerable distances—even across the farm yard.

REGULAR INSPECTIONS

One of the best ways of ensuring the storage of grain in good condition is to arrange a system of regular inspections of the stored mass. It is not sufficient just to look at the top of the grain—it is probably in good order anyway. What is required is a deep sampling spear with which to obtain samples of grain at regular depth intervals. Immediately after harvest, it is wise to check these samples for moisture content (using someone else's meter in case yours is wrong) to ascertain if in fact they are in good storage condition. Thereafter check them regularly for storage pests, mould and general condition.

It is excellent practice to bury a thermometer on a long probe deep in the mass and to withdraw it regularly and note the reading and date on a piece of heavy cardboard kept nearby. Grain storing in good order can be expected to cool quietly through the autumn and the recorded figures should show this trend. If the temperature of the mass rises during storage, trouble can be expected and deep sampling with the spear will show the cause.

Grain spears and thermometers are cheap and readily available on the market.

GENERAL

Safe and efficient grain storage on a farm is easily attained provided the simple rules above are followed. The safest line to store is one that is dry and cold and preferably is held in a metal silo.

Most insect storage pests do not occur naturally on the farm—they are brought in from outside by man, in second-hand sacks, seeds, food concentrates and the like. These purchases must never be stored near or in grain storage structures. Mites, on the other hand, are widespread over a farm. They occur in pastures and crops and come into the farm yard in the grain from the header. They can be found in large numbers in grain in a recently completed and otherwise clean silo in its first season.

Accordingly, each season there is a chance of re-infesting storage structures and safe storage precautions must be taken every year.