

## Grain storage – resistance to protectant insecticides

Agency for Food and Fibre Sciences

Resistance of grain insects to protectant insecticides is becoming a major problem in Australia. Mixtures of protectants are recommended because no single protectant will give long-term protection against all resistant species.

### Which species are resistant?

In Table 1 we have classified the resistance status of the five common beetle pests of stored cereal grain as:

- common – at least 30% of strains tested include resistant individuals; alternative insecticides or other control measures should be used to control this species
- moderate – between 5% and 30% of strains tested include resistant individuals; alternative insecticides or other control measures should be used to control this species if the insecticide has not given effective control at the storage site
- rare – less than 5% of strains tested include resistant individuals; rotation with alternative insecticides may prolong the useful life of the insecticide
- none – resistant individuals have not been detected in any strain
- tolerant – the species was never controlled by the insecticide.

Resistance to protectant insecticides is of major concern in two beetle pests of grain in Queensland:

- Lesser grain borer is resistant to all the organophosphorus (OP) insecticides fenitrothion, Reldan, Actellic and dichlorvos, and a few cases of resistance to IGR/Diacon have been found. Thus, lesser grain borer is resistant to some degree to almost all registered grain treatments.
- Sawtoothed grain beetle is also resistant to some extent, to the organophosphorus insecticides fenitrothion, Reldan and Actellic. IGR/Diacon is still effective against this species.

To identify these beetles, see the DPI&F note *Stored grain – identification of insect pests*.

Two tiny pests of stored grain, mites and psocids (see DPI&F note *Grain storage - psocid and mite pests*), are also difficult to kill using protectants. Mites and psocids are naturally tolerant of the insecticides.

**Table 1.** Status of resistance in Queensland to registered grain treatments in the common beetle pests of stored grain in 2003.

Treatment	Pests				
	Lesser grain borer	Sawtoothed grain beetle	Flour beetle	Flat grain beetle	Weevil
<b>OP sprays</b>					
Dichlorvos	common*	none	none	none	none
Fenitrothion	common	common	rare	none	none
Actellic	common	common	none	none	none
Reldan	common	common	none	none	none
<b>IGR/ Diacon</b>	moderate	none	rare	none	tolerant
<b>Amorphous silica / diatomaceous earth</b>	none	none	none	none	none

\* the higher dose rate of dichlorvos is reasonably effective against resistant lesser grain borer

## Do you have resistant insects?

Resistance should be suspected when:

- insects appear before the end of the storage period claimed on the label, and
- the protectant was applied evenly at the label rate,
- especially if insects of one type only are involved.

If this occurs use different insecticides for future treatments. For a full summary of insecticides approved for use in Queensland for treatment of grains and grain handling and storage equipment, see the DPI&F note *Grain Storage - Insect Control in Stored Grain*.

However, don't jump to the conclusion that every control failure is caused by resistance - most are not. Usually the reason for control failure is a problem with the dose rate or application technique.

## Slowing development of resistance

You can affect the build up of resistance by the control methods you use. Repeated use of the same chemicals will speed up resistance development. Rotation between alternative chemicals may slow resistance. Unfortunately after the suspension of BRM use on grain, IGR<sup>®</sup> / Diacon<sup>®</sup> is the only chemical option for long term protection against lesser grain borer. Selection for resistance can also be minimised by limiting the use of protectant chemicals. Use the non-chemical control methods such as hygiene in grain storage and handling facilities and cooling with aeration.

We also recommend amorphous silica / diatomaceous earth powder (e.g. Dryacide<sup>®</sup>, Absorbacide<sup>®</sup>, Perma-Guard D10<sup>®</sup>) instead of chemical insecticides for treating silo surfaces and storage areas after cleanup because this reduces selection for resistance to the chemicals.

## New chemicals

Over the past 30 years, resistance in stored grain pests has been overcome by registration of new groups of chemicals that are effective against the resistant insects. New groups of chemicals are being tested which are both effective against the current range of resistant insects and safe for use on grain. Testing and registration of new chemicals is time consuming and expensive. New chemicals for treating stored grain insects are likely to be available within the next five years.

## Further information

For information on control methods for stored grain pests, including registered insecticides, see DPI&F note *Insect control in stored grain*.

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### See Also:

- On-farm storage of organic grain
- Organic grain storage
- Grain storage – resistance to phosphine fumigant