



Managing resistance to chemicals in Qld

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► What is Resistance?

An insect population is resistant when previously successful insecticidal treatments no longer work.

Resistant insects possess a gene that is different to those possessed by normal insects. This gene allows resistant insects to survive and reproduce in the presence of insecticide or fumigant doses that would normally kill them.

Resistance genes sometimes appear in insect populations and are inherited from one generation to the next.

► How does resistance develop?

Insect populations become resistant by a process of "selection". When an insecticide is used, individuals that already have resistance continue reproducing while the others die.

Resistant insects are often not noticed at first because of their small number in the population. But the proportion of resistant insects increases if the same insecticide is used repeatedly.

Eventually resistant insects become so common that it is obvious that too many insects survive each chemical treatment. By this time it is already too late!

► Resistance in grain storage insects

There are already a number of serious and emerging resistance problems in the grain industry. These include resistance to a range of grain protectants in several insect species and the possibility of high level resistance to phosphine.

Although phosphine resistance is not yet a problem in Australia, it is a major concern in parts of Asia and Africa.

Table 1 Resistance to grain protectants in eastern Australia

Product name	Rust-red flour beetle	Sawtoothed grain beetle	Rice weevil	Lesser grain borer
• BRM	not used	not used	not used	yes
• Carbaryl, Sevin	not used	not used	not used	weak
• Reldan	no	yes	no	yes
• Dichlorvos, Mafu, Vapona	likely	yes	likely	yes
• Fenitrothion, Folithion, Fenitrogard	no	yes	no	yes
• Diacon, IGR	no	no	not used	no
• Actellic	no	yes	yes	yes
• Dryacide	no	no	no	no

cont'd

► Resistance to fumigants

Weak resistance to phosphine is already common in insects throughout Australia but is readily overcome by using well-sealed silos.

Strong resistance has not yet been detected in Australia but is present in Africa and Asia. The emergence of strong resistance to phosphine would make successful fumigations in unsealed farm storages extremely difficult.

Increasing reliance on phosphine results in enormous selection pressure for insects to evolve resistance.

No practical alternatives to phosphine are currently available. Its loss through resistance development would be extremely damaging to the Australian grain industry.

► Managing resistance in Qld

Resistance of grain insects to protectants is becoming a major problem in Queensland and other States (Table 1). Two resistances are of major concern in Queensland:

- Sawtoothed grain beetle is widely resistant to Fenitrothion (Fenitroguard, and Folithion) and, more recently showing some resistance to Reldan.
- Lesser grain borer is showing resistance to BRM 5/50 and is already resistant to most other protectant chemicals.

Resistance should be suspected when obvious numbers of insects appear in a well-treated bulk before the storage period claimed for the protectant on the label. Especially if insects of one type only are involved. If this occurs the infestation should be disinfested by fumigating. Next year's treatment needs to be reconsidered.

Grain protectants have served the grain industry well for many years and will continue to play some part. However, few new protectants will be developed to replace ones lost through resistance.

Resistance management strategies are extremely important to minimise the effects of resistance development by insects.

But to give the industry gain maximum benefit, strategies need to be adopted widely as soon as possible.

DPI recommends a resistance management program developed in cooperation with GRAINCO. It uses different combinations of chemicals between years, and alternatives to protectants as much as possible.

A summary of chemicals recommended for use during 1992-94 is given in Table 2.

Suppliers and grain handlers with stocks of chemicals that do not fit the strategy should use them this year and start the program next year.

► Resistance strategy summary (Qld)

✓ Thoroughly clean empty silos - prevents selection of resistance in the same insect population season by season.

✓ Use the correct mix of insecticides; two-part "Grain Packs" are available from suppliers - insects with resistance to one insecticide are controlled by the other.

✓ Minimise use of protectants by considering other non-chemical control measures - aerating grain lowers the temperature and lessens the opportunity for resistant insects to multiply; grading grain before storage removes the fragments needed by many insects for breeding.

✓ Use Dryacide® powder instead of chemical insecticides for treating silos and storage areas after cleaning up; apply dry to silos using a power duster or bellows-type applicator, or apply as a slurry to storage sheds.

✓ Store untreated grain in sealable silos; if an infestation develops the grain can be fumigated effectively at low cost without turning and without probing tablets.

✓ Consider rotating protectants in line with DPI/GRAINCO strategy in Table 2 - resting insecticides will slow the rate at which new resistances emerge. ■

(see table of recommended protectants on next page)

Table 2 Summary of Resistance Management Strategy for grain protectant insecticides, 1994-1995 (Queensland only)

Wheat and other cereals (except malting barley) ¹	Feed grain	Storage & equipment surface treatment	Low residue disinfestation
Diacon <i>or</i> IGR plus Reldan <i>or</i> Damfin	Carbaryl, Sevin, Diacon <i>or</i> IGR plus Reldan <i>or</i> Damfin or Dryacide	Dryacide	Mafu <i>or</i> Vapona

¹ Only Fenitrothion or Folithion or Fenitrogard and BRM 5/50 are currently approved for malting barley - don't use other protectants.

