Survey detects super-strong phosphine resistance in flat grain beetles

A national survey of stored grain from the 2006–07 harvest has found flat grain beetles which show high levels of resistance to one of the most commonly used grain fumigants in Australia – phosphine.

Almost 80 per cent of all Australian stored grain is treated with phosphine, but the lifespan of this chemical will be greatly reduced if the populations of resistant insects or the strength of the resistance expand.

Dr Joanne Holloway, research entomologist at the New South Wales Department of Primary Industries (NSW DPI), conducted the survey on stored grain which revealed the 'super-strong' phosphine-resistant flat grain beetles (*Cryptolestes ferrugineus*).

"Resistance was found across a number of sites, including bulk handling sites in NSW and Queensland, farms in central NSW, a merchant in southern NSW and bulk handlers in South Australia," Joanne said. "The level of resistance exhibited by flat grain beetles at these sites is higher than we have ever recorded in Australian insects."

Joanne's research, supported by growers and the Australian Government through the Grains Research and Development Corporation (GRDC), now turns to continuing surveys over the affected areas and confirming the full extent of the resistant populations.

AT A GLANCE

- Stored grain reveals 'super-strong' resistance of flat grain beetles to phosphine
- Populations of phosphine-resistant beetles found at several sites
- Growers must apply phosphine at recommended label rates in sealed storage

Fumigation protocols

"We must keep monitoring to make sure that the resistance isn't occurring elsewhere, and develop fumigation protocols to eliminate possible future resistant populations," she said.

Joanne said her research had shown that strong resistance to grain storage insecticides had increased in Australia's southern cropping belt due to incorrect insecticide use.

"Phosphine is widely used because it is cheap, easy to apply, and it's relatively safe," she said. "The resistance emerges due to multiple fumigations, where grain is repeatedly fumigated at concentrations lower than label recommendations resulting in insects surviving and an increasingly resistant population."

Joanne said it is essential for growers to follow label recommendations in order to preserve the life of phosphine.

"Growers must use phosphine according to label recommendations, and restrict phosphine use to gas-tight silos," she said.

"When calculating phosphine rates it's important to remember that because it's a gas it needs to fill the whole volume of the silo, not just the amount of grain that's sitting in the silo. Growers must also ensure that the dose stays at a lethal concentration for the seven to ten day fumigation period."

Joanne said follow-up monitoring of stored grain must be conducted regularly.

"Although a dose of phosphine easily kills adult insects, you may still get other life stages coming through from eggs or pupae in the grain," she said. "Growers must keep monitoring to ensure their control measures have been successful.

"Monitor not only for insects themselves but for signs of insect damage, as you may not find the live adults but instead may find damage or remains of them."

Grain hygiene

Joanne urged growers to follow good grain hygiene practices to reduce the possibility of resistance developing in their stored grain pests.

"Grain hygiene is so important and growers must keep their storage areas clean at all times," she said. "By removing grain lying around the chances of grain insects surviving and infestations are greatly reduced. Storages should also be prepared prior to harvest to get rid of excess grain from storage sheds."

Joanne urged growers to send live insects to NSW DPI where they can be tested for possible resistance to insecticides.

"If growers do find live insects in their silos they can send them to NSW DPI Wagga Wagga where there's a free diagnostic service," she said. "We will test insects for their levels of phosphine resistance so growers can stay aware of their resistance status."

The flat grain beetle, *Cryptolestes ferrugineus* has developed super-strong resistance to phosphine. (PHOTO: Joanne Holloway, NSW DPI)

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