QUICK TEST FOR PHOSPHINE SURVIVORS

A new test is helping grain handlers to rapidly identify and respond to the presence of insects with phosphine resistance

By Manoj Nayak

KNOWING THERE ARE phosphine resistant pests in the store is one thing; rapidly identifying the level of resistance so that modified fumigation practice can be applied is another.

A simple 'knock-down' assay that exposes grain insects to a high dose of phosphine can provide results within five hours of insects being delivered to laboratories for testing.

Developed through a CRC for National Plant Biosecurity project, the new test has been specially designed to determine whether flat grain beetles (*Cryptolestes ferrugineus*) found in stored grain are resistant to the fumigant phosphine.

This testing method will be evaluated in the near future for other key pest species including the rice weevil (*Sitophilus oryzae*) and rust-red flour beetle (*Tribolium castaneum*).

The flat grain beetle test applies phosphine at a rate of two milligrams per litre or 1440 parts per million (ppm). This kills non-resistant insects in only 30 minutes; insects with moderate resistance survive 30 minutes, but fail to survive 24 hours.

Any insects that survive five hours are suspected of 'strong resistance' and grain storage managers are advised immediately so that they can take remedial actions.

These strongly resistant insects are observed over a 48 to 72 hour period at the same dose and if they survive it confirms the 'strong resistance' diagnosis. Either way the storage manager is informed.

In the past three years 74 samples of flat grain beetle with strong resistance have been identified through this test. These beetles have then survived a more comprehensive test of seven days at 720ppm, validating the resistance findings.

This research work has been run in collaboration with GrainCorp. Storages are checked every month for signs of insect problems. If insects are found after fumigation or appear within three months of fumigation samples are immediately sent for testing. Receiving results within 24 hours dramatically improves store managers ability to respond to resistant insects.

In conjunction with the rapid resistance testing, new fumigation protocols are being developed as well as an eradication plan that can be used once resistance is confirmed.

Protocols to control all life stages of the strongly resistant lesser grain borer (*Rhyzopertha dominica*) require phosphine at a rate of 720ppm for five days. This is a current label rate for phosphine against the strongly resistant lesser grain borers.

For flat grain beetles new protocols require phosphine at 720ppm over 24 days, or 360ppm over 30 days, to effectively kill all insects. These are not yet registered.

Through the CRC for National Plant Biosecurity, GrainCorp has worked with the research team to develop an eradication plan for the flat grain beetle where strongly resistant populations have been identified.

This plan includes the use of registered contact grain protectants and other fumigants at ports, use of registered contact grain protectants at country storages, an intensive hygiene program at infested storage sites and continuous monitoring of insect populations for resistance.

So far, 82 different strains of the original flat grain beetle species *C. ferrugineus* have been diagnosed with strong resistance. Samples have been collected from 71 central grain storages and two farm storages during the past three years.

Of the three different *Cryptolestes* species that can infest Australian grain storages, two species have shown low-level of resistance to phosphine and only *C. ferrugineus* has shown strong resistance.

At this stage we suggest the industry should focus on managing strongly resistant *C. ferrugineus* as the current registered rates of phosphine will control the other two species. □

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Manoj Nayak (right) discusses newly developed fumigation protocols with fumigators that were to be tested at a wheat bunker in the Darling Downs, Queensland, heavily infested with flat grain beetles.

GROWERS WHO FIND LIVE INSECTS FOLLOWING FUMIGATION WITH PHOSPHINE CAN CONTACT DR NAYAK REGARDING RAPID RESISTANCE TESTING.

GRDC Research Code NPB00004 (CRCNPB project CRC50098)

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