Sulfuryl fluoride can break phosphine resistance

Using an alternate fumigation chemical to break the development of insect pest resistance will help protect the efficacy of phosphine fumigation

By Chris Warrick

KEY POINTS

- Rotating phosphine fumigation with sulfuryl fluoride will protect against the development of phosphine resistance
- Sulfuryl fluoride can only be purchased and applied by licensed fumigators

■ Rotation with sulfuryl fluoride fumigation (ProFume® or Zythor®) is a viable option to prevent the development of phosphine resistance.

Sulfuryl fluoride carries no market restrictions when used correctly on cereal grains but is not registered for use on pulses or oilseeds.

CHEMICAL OPTIONS

Phosphine is widely used in Australia as it is the only chemical fumigant that can be applied by growers without a fumigation licence. It should enable reliable control of storage pests when used properly in gas-tight storage, even for most pests with strong resistance. But not every fumigation is perfect; parts of the grain bulk might not have reached a high-enough gas concentration for a long-enough period to control all life cycle stages.

If any grain storage pests survive a phosphine fumigation, repeat fumigations with the same chemical will breed resistance very quickly.

There is also a strain of the flat grain beetle – specifically, the rusty grain beetle – which has very high resistance to phosphine. If flat grain beetles are found to have survived a fumigation with phosphine, a sample should be sent for testing and the grain bulk-fumigated with sulfuryl fluoride.

Unlike phosphine, sulfuryl fluoride can only be purchased and used by licensed fumigators. The fumigant itself is not expensive, but cost-effectiveness will depend on how far the licensed fumigator has to travel and how much grain has to be fumigated.

Monitoring grain regularly and well before planned outloading provides time to control insect pests and avoids costly, ineffective and often dangerous last-minute fumigation attempts.

CONTROL TAKES TIME

All fumigants, including sulfuryl fluoride, require gas-tight sealable storage to effectively control insects at all life stages. Unsealed storages will not hold a high-enough gas concentration for a long-enough period of time to kill the eggs, larvae and pupae.

Research by the Queensland Department of Agriculture and Fisheries, with GRDC investment, has shown that effective control of all insect life stages with sulfuryl fluoride requires seven-day exposure for grain above 25°C, and 10-day exposure for grain between 20°C and 25°C. When grain is below 20°C, fumigation with sulfuryl fluoride is unlikely to be successful as the insect life cycle is too slow, meaning the gas is not absorbed by the adolescents.

If a shorter than seven-day fumigation is suggested, be aware that eggs, larvae and pupae will survive the fumigation and continue breeding.

Sulfuryl fluoride is a heavy gas at 3.7 times the density of the atmosphere. Most applicators will introduce the gas into the top of a storage, anticipating it will settle to the bottom. Best practice is to have some form of sealed recirculation system to gently transfer gas through the storage to ensure an even concentration throughout the grain bulk for the duration of the fumigation.

Without recirculation, it will take longer for the gas to reach all parts of the storage and, as it sinks, it will likely leave the top of the storage with a sub-lethal gas concentration.

Licensed fumigators are required to supply a clearance certificate once gas concentration is measured below three parts per million. Research and experience suggest this does not take very long and is typically achieved in less time than it would take to vent phosphine. For insurance, growers should insist on and keep a copy of the fumigation documents, including the clearance certificate. After venting, the label directs a one-day withholding period. □

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Photo: Chris Warrick

Sulfuryl fluoride should be used in rotation with phosphine to prevent the development of resistance. Gas-tight sealable storage is required to control all life stages of grain storage pests.

FOR INSURANCE, GROWERS SHOULD INSIST ON AND KEEP A COPY OF THE FUMIGATION DOCUMENTS, INCLUDING THE CLEARANCE CERTIFICATE.