PHOSPHINE RESISTANCE TESTING

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Phosphine gas is a widely used fumigant used to protect stored commodity from insect damage. After 60 years of use and misuse, evidence of insect resistance to phosphine is showing up in many parts of the world. It is believed that ineffective fumigations from low gas concentrations are the driving force that contributes to phosphine resistance. Recent studies have shown that phosphine resistance has increased in both frequency and strength of resistance. Now the use of phosphine is threatened by the development of insect resistance.

Current research is working to identify and understand the extent of phosphine resistance. Knowing the species of insect and its level of resistance can give us a better understanding of the extent of insect infestation and allow managers to make more effective and efficient fumigation decisions. Outlined are three methods to test for phosphine resistance in insects. Each method requires a different number of sample insects, exposure periods and phosphine concentration.

Screening of Phosphine Resistance

The resistance kit by Detia Degesch can be used out in the field by managers or fumigators to do a quick test to determine if insects have the presence of phosphine resistance and take the recommended actions before fumigating.

- 20 insects
- 3000 – 8000 ppm
- 8 – 15 minute exposure

Frequency of Phosphine Resistance

Testing for the frequency of resistance identifies the presence or absence of phosphine resistance. The frequency of resistance is determined by the number of insects who survive a period of phosphine exposure. Insect populations that have about ≥ 80% survival are considered to have high frequencies of phosphine resistance and should be tested in a level of phosphine resistance study.

- 200 insects
- 20 – 50 ppm
- 20 hour exposure
- Sampled insects vs non-resistant insects (USDA sample)

Level of Phosphine Resistance

Testing for the level of resistance identifies the concentration of phosphine gas required to kill resistant insects. This will give managers and fumigators the information needed to determine if a higher concentration of phosphine gas is needed or if an alternative fumigant should be used to eradicate insects.

- 500 insects
- Range from 20 - 1000 ppm
- 72 hour exposure
- Sample insects vs non-resistant insects (USDA sample)

When phosphine resistance insects are found some management strategies to eradicate resistant insects include:

1. Better fumigation practices (better sealing, monitoring, ability to add gas, pressure testing)
2. Increase phosphine dosage rates
3. Use of alternative chemicals (alternative fumigants, combination of grain protectants)
4. Sanitation (clean transfer equipment, clean bins before and after use, cool grain to minimize insect activity and populations)
5. Continue using phosphine with a plan and strategy to manage phosphine resistance (test for resistance, monitor insect activity)

Phosphine fumigants are effective when used correctly. They are inexpensive, easy to apply, kill a wide range of pest species and have a broad acceptance as a residue free treatment. It is necessary to do regular testing of phosphine resistance in insects to ensure the sustainability and use of phosphine fumigants.