



Controlling grain insects in bulk soya bean storage

By GSI Group South Africa

Insect pests do not only wreak havoc on crops in the field – they can also cause major damage to grain stored in silos. Generally, problems caused by stored product insects (SPIs) are less common in soya bean bulk storage than in other grains due to the hard chitinase seed coat, which is resistant to insect damage. However, insect damage can occur where soya beans are stored for extended periods.

Insects that pose a threat

The primary grain insects that are able to bore through the seed coat are:

- Maize weevil (*Sitophilus zeamais*).
- Rice weevil (*Sitophilus oryzae*).
- Bean weevil (*Acanthoscelides obtectus*).
- Cowpea weevil (*Callosobruchus macalartus*).

However, there is a wide variety of secondary grain insects that attack damaged beans, including:

- Saw-toothed grain beetle (*Oryzaephilus surinamensis*).
- Rust-red grain beetle (*Cryptolestes ferrugineus*).
- Flat grain beetle (*Cryptolestes pusillus*).

- Rust-red flour beetle (*Tribolium castaneum*).
- Confused flour beetle (*Tribolium confusum*).
- Broad-horned flour beetle (*Gnathocerus cornutus*).
- Cigarette beetle (*Lasioderma serricorne*).
- Drugstore beetle (*Stegobium paniceum*).
- Tropical warehouse moth (*Ephestia cautella*).
- Tobacco moth (*Ephestia elutella*).
- Indian meal moth (*Plodia interpunctella*).
- Book lice or dust lice (*Psocids*).

Controlling insects in silos

The most effective way to treat soya beans is through fumigation with toxic phosphine gas (PH_3), which is released by aluminium or magnesium phosphide. The grain silo should be gas-tight for effective phosphine fumigation, which is not the case with most grain silos on farms. However, steel grain silos can be made gas-tight, preferably by the manufacturer.

The main reasons for failed PH_3 fumigation are:

- *Silo tubes that are not gas-tight:* A minimum gas concentration of 1 000

- parts per million (ppm) is required after five days to kill grain insects at all stages. Some of the grain insects enter a stupor phase when they come into contact with the PH_3 gas, which then enables them to dramatically lower their metabolism so that the effect of the toxic gas is reduced. They can sustain the stupor phase for up to 72 hours, which is why the PH_3 gas will only start working effectively after three days.
- *Exposure time that is too short:* PH_3 fumigation should be maintained for a minimum of seven days to achieve maximum efficacy.
- *A dose that is too low:* Repeated low doses can result in insect resistance.

Alternative treatments

An effective way to treat bulk grain stored in silos that aren't gas-tight is spraying the grain with a grain protector. However, there is no product registered in South Africa for bulk application on soya beans because the high lipid content of soya beans can absorb the insecticide and lead to undesirable chemical residues in the beans.

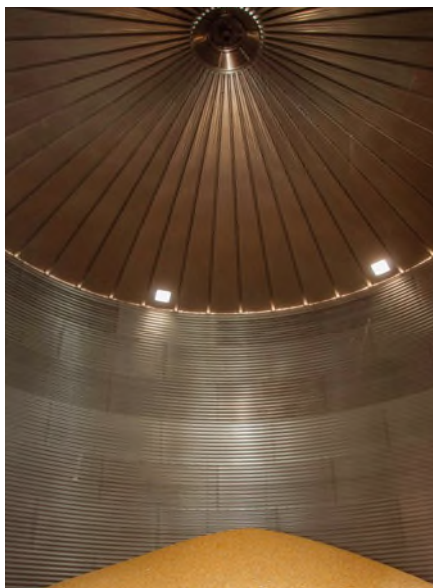
In the United States (US) and other grain-producing countries, bulk treatment

is done by adding a powder, which inhibits the development of grain insects, to the soya beans. This botanical pesticide contains agents such as spinosad or diatomaceous earth. The main advantages of botanical pesticides are that they are eco-friendly, easily biodegradable and harmless to non-target organisms. The disadvantage of the agents, however, is that zero tolerance cannot be maintained and therefore the natural agents are only used on a small scale.

Reducing the risk of infestation

The following precautions can be taken to reduce the risk of soya bean SPI-infestation:

- Ensure that combines are thoroughly cleaned before the harvesting season. Soya beans are some of the first crops harvested during autumn. Combines often stand idle for months after the previous harvesting season; during this time, small kernels left in the combine can serve as food for grain insects. The first loads of the new harvesting season are then often infested with grain insects.
- Clean silos thoroughly before the new intake. Many steel silos have suspended floors that can be removed for thorough



This silo is not gas-tight. Even if both aeration shutters are closed, there are still many openings through which fumigation gas can escape.

cleaning. Make sure that the silo itself, as well as the screw and chain conveyors, are clean. Also pay attention to the bucket elevator.

- After cleaning, the empty silo can be treated with an insecticide that contains

pyrethroid as active ingredient. However, stay away from organophosphates in the case of soya beans.

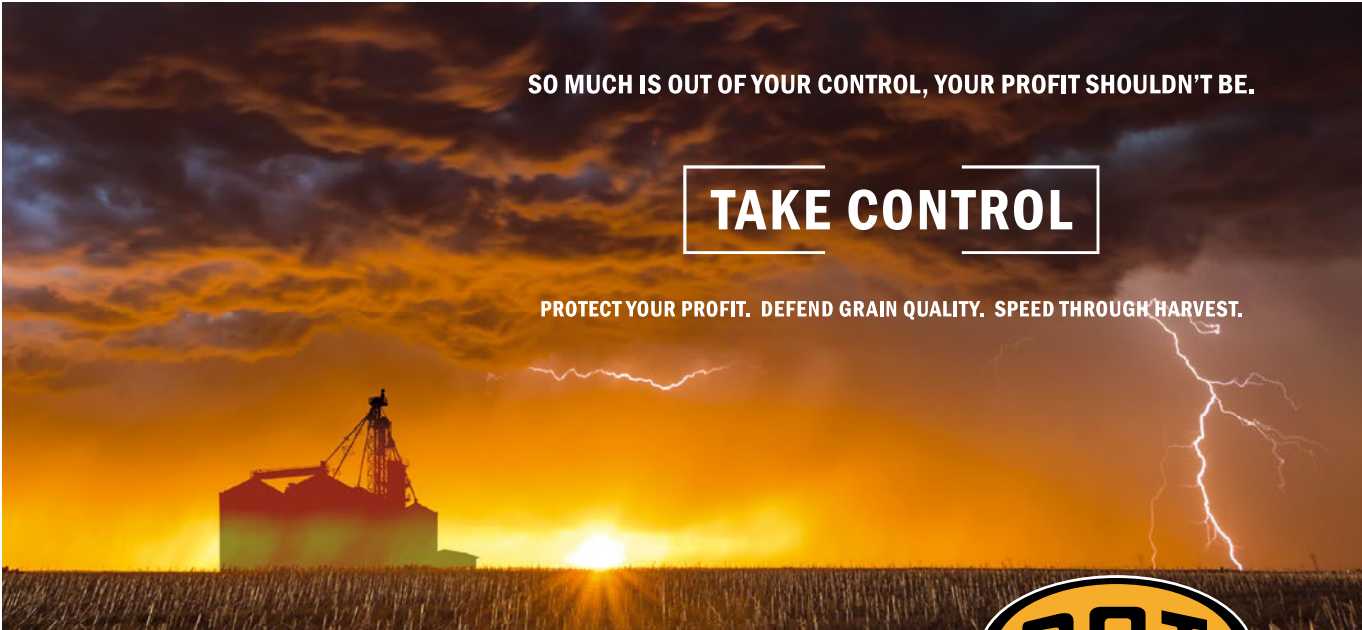
- Make sure that no other grain that may be infested is stored on the site as it may lead to cross-contamination.
- Keep the grain temperature as low as possible. Silos can be painted with a reflective white paint that reflects heat. A white roof can reduce the temperature inside a silo by 6°C or more on a sunny day. Use the aeration fans to cool the grain as much as possible after intake. Grain insects become inactive and stop breeding at temperatures below 15°C. Insect development also slows down at lower temperatures.
- Strictly adhere to moisture regulations for the storage of soya beans. 'Wet' grain, as well as grain with a lot of residues, can lead to a high level of insect infestation. 🌱

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