

Inert dust offers safe insect control option

CSIRO Stored Grain Research Laboratory researcher Sylvia Allen explains the benefits of inert dusts for insect control in stored grain and how these products can be used as a successful and safe alternative to insecticides.

Refined inert dusts offer grain growers a successful chemical-free and long-term protection option for controlling insect infestations in stored grain.

According to CSIRO Stored Grain Research Laboratory researchers, inert dusts are mineral earths which offer a range of benefits for stored grain compared with conventional insecticides.

These include low toxicity to humans and animals, long-term effectiveness against stored product insects and grain commodities which are free of chemical residues.

Inert dust use

Historically the use of inert dusts has been favoured for insect control because of their chemical inactivity, low toxicity, lasting persistence and local availability.

But more recently growing demand for 'chemical-free' food products, widespread chemical resistance in stored product insects and the need to store grain for longer periods, is supporting the use of refined inert dusts.

In Australia, inert dusts have been used periodically since the early 1940s for the prevention or control of insect infestation.

The use of dusts was particularly important during the war years when it was necessary to establish emergency reserves of large tonnages of grain.

Magnesite and dolomite were two of the earliest minerals used in Australia and were applied to grain at a dosage rate of five



Photos: CSIRO Entomology

Inert dusts offer successful long-term protection against insect infestations in stored grain and provide grain growers with a safe, chemical-free alternative compared with the use of conventional insecticides.

kilograms per tonne. But the variability in biological efficiency was a major problem with minerals extracted from local deposits.

These mineral earths were also generally only effective against insect infestation on dry grain stored at or less than 10 per cent moisture content.

Desiccant dusts

Interest is now focusing on the use of desiccant or absorptive dusts for the protection of stored grain. Desiccant dusts include materials such as synthetic silicas, diatomaceous earths, kaolinite clays, activated carbon and silica aerogels.

Some desiccant dusts will abrade and absorb the protective waxy outer layers of insects, leaving them vulnerable to dehydration and death in all but high humidity situations.

The effectiveness of desiccant dusts is reduced in humid environments where passive movement of moisture from the atmosphere into an insect's body appears to compensate for moisture loss due to desiccation.

In stored grain, an equilibrium relationship exists between moisture inside and outside the grain.

Typical maximum moisture contents recommended for long-term protection by inert dusts are 12% for winter cereals such as wheat, barley and oats and 13% (wet basis) for sorghum. Above these moisture contents, the amount of water vapour (relative humidity) surrounding grain is high enough to allow insect survival.

Storage advantages

Storers of seed and feed grain can benefit from the use of inert dusts to protect stored grain, particularly where adequately sealed storage is not available.

Inert dusts offer ease of application and maintenance of grain quality. They also leave treated commodities free of chemical residues, no withholding period is required (directly available as feed) and are safe for animal consumption. Some products have been accepted under the Organic Standards and Certification Scheme established by the National Association of Sustainable Agriculture, Australia Limited.

It is wise to investigate the limitations associated with the sale of grain treated with inert dusts since there are some disadvantages and restrictions to their use.

Admixture of inert dust products with grain alters some grain properties. It limits the free flowing properties of grain reducing the flow rate through handling equipment and increases bulk volume (see Figure 1).

The abrasive nature of many dusts also causes machinery and equipment stress. These are not significant factors in small farm



Inert dusts absorb the protective waxy outer layer of insects, leaving them vulnerable to dehydration and death, except in high humidity situations.



- CSIRO researchers believe the use of inert dusts to prevent insect infestation in stored grain is a safe and successful alternative to insecticides.

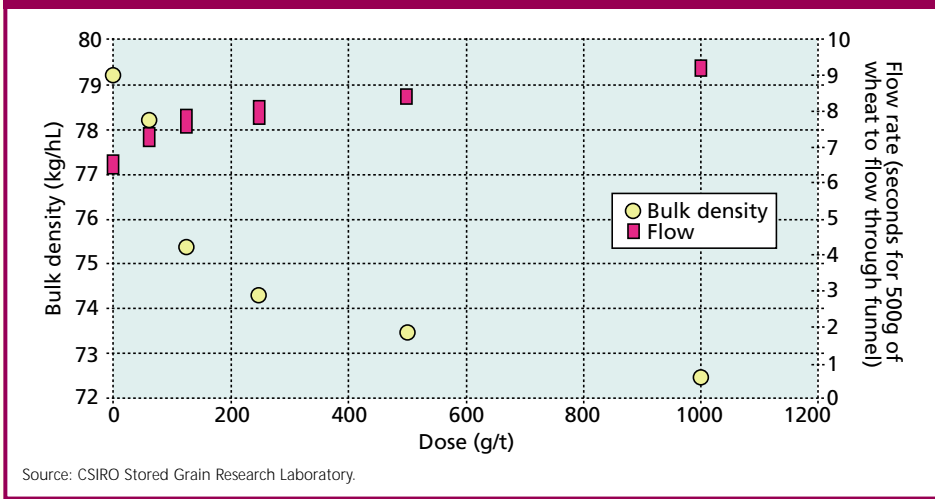
- The advantages of inert dusts include long-term protection, low toxicity, ease of application and maintenance of grain quality. Treated grain is also free of chemical residues and safe as livestock feed.

- Inert dusts can be added to grain by an auger, or used as structural treatment for silo walls and floors and farm machinery.

- Recent research has shown inert dusts are also effective as barrier treatments against re-infestation of grain bulks.

in brief

FIGURE 1 Changes in grain density and flow with admixed Dryacide treatments



Source: CSIRO Stored Grain Research Laboratory.

stores but are of concern in large commercial facilities. Consequently, grain admixed with inert dusts cannot be delivered to commercial bulk handling facilities.

Application range

Diatomaceous earths are the most common inert dusts registered for protection of grain in storage. Diatomaceous earths are the remnants of tiny fossilised diatoms now occurring in deposits in various areas of the world.

Diatomaceous earth is registered as a food additive in many countries and some products based on these earths are acceptable as grain treatments under organic standards.

Dryacide and Permaguard are diatomaceous earth products currently registered for use on grain. Inert dusts are added to the grain stream by auger, generally at a rate of one kilogram of dust per tonne (0.1%) or 1.5–2kg/t for heavily infested grain.

Research shows Dryacide is highly effective at killing insects when applied to wheat at these treatment rates, which is a significant decrease in the amount of mineral earth

products previously required for effective insect control.

The costs of inert dust products will vary, but New South Wales Agriculture quotes a cost of \$2.35 per tonne for Dryacide when used as a dry preparation at a dosage rate of 1kg/t.

To avoid blockages during application, take care to ensure dust is admixed at an even rate into the grain stream.

Inert dusts are also suited as structural and spot treatments such as application to the walls of empty stores, to farm equipment (for example, headers and augers), treatment of wall voids and around grain stores. Inert dusts can be applied to walls and floors, either as a dry dust or water-based slurry.

The dry dust can be applied with an air gun powered by an air compressor. A hand bellows pump and extension pipe (to provide distance from the dust) can also be used to apply the dust as a dry powder.

Inert dust applied at the rate of one gram of dust per square metre will produce a very light coating on treated structure, similar to dust

settled on household furniture which has not been dusted for some time. Take care to avoid excessive application since a thick dust coating may flake off.

Some dusts can also be applied as a water-based slurry using a centrifugal pump. A slurry has the advantage of reducing the dustiness of the application procedure.

In commercial use, a slurry preparation of Dryacide is prepared in water at 11% weight to volume and applied to the structure at 6g/m².

The slurry application requires more dust per square metre because insects do not pick up the dust on their bodies as easily in this form. The slurry also can be applied with a broom or paintbrush if necessary.

Take precautions to protect eyes and respiratory passages when handling or applying inert dusts as a powder. Hand cream and gloves also can be used to protect skin from drying out.

Lack of protection during application may cause symptoms such as eye soreness, irritation through inhalation and drying of the skin. Additional information is given on the product labels of commercially available dusts.

Gas barrier

The CSIRO Stored Grain Research Laboratory has developed application methods to allow inert dusts to be used as a barrier to gas loss in fumigated grain stores.

The effectiveness of Siroflo (a pressurised distribution system for phosphine use in partially sealed stores) can be improved by applying a thin dry blown layer of dust that acts as a cap to retard phosphine gas loss.

The dust coating maintains higher fumigant concentrations in the critical surface layer of grain. In addition, inert dusts can be combined with aeration, where the upper 300 millimetres of the surface is treated with an admixture of 1–2kg/t of grain (see Figure 2).

The inert dust layer acts as a barrier to re-invasion by most stored grain pests. But in the presence of saw-toothed grain beetle (*Oryzaephilus surinamensis*) and flat grain beetle (*Cryptolestes species*), a depth of inert dust admixture of 1–1.5 metres is required.

Ongoing research

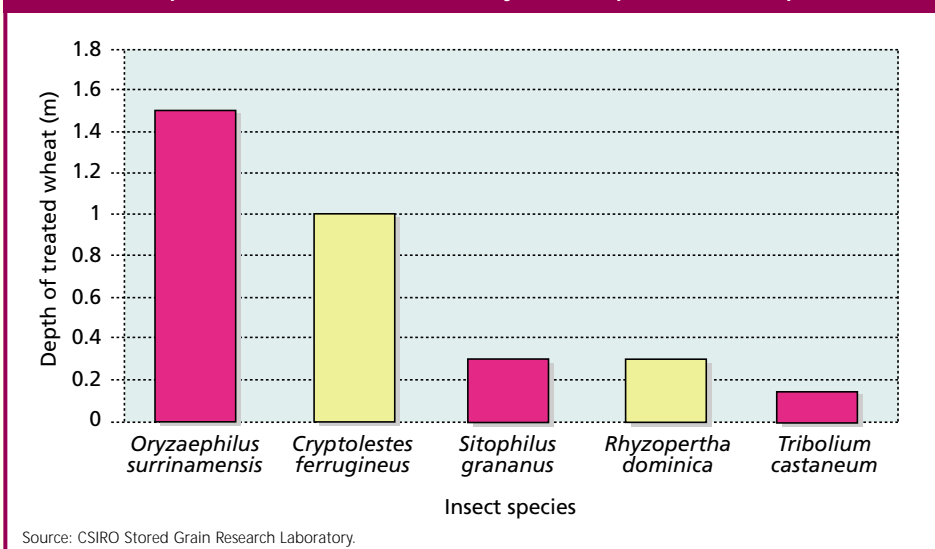
Inert dusts are a versatile and effective treatment for long-term protection of grain and structures from insect attack.

With financial support from the Grains Research and Development Corporation, the CSIRO Stored Grain Research Laboratory is continuing to research new application methods to broaden the range of uses of inert dusts and to assess the attributes of effective dusts.

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FIGURE 2 Depth of wheat treated with Dryacide to prevent insect penetration



Source: CSIRO Stored Grain Research Laboratory.

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