Presentation to the Tanzanian Pesticide Approval and Registration Technical Subcommittee (PARTS) on

Diatomaceous earths

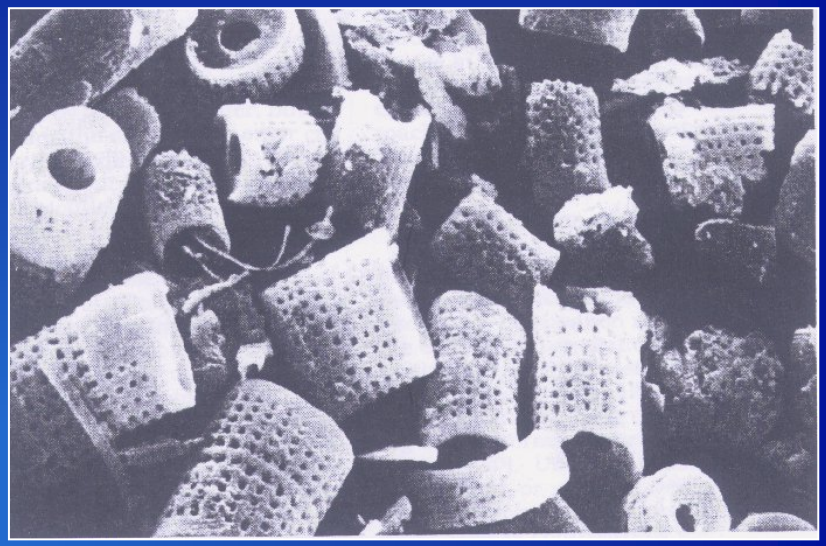
6th October 2004

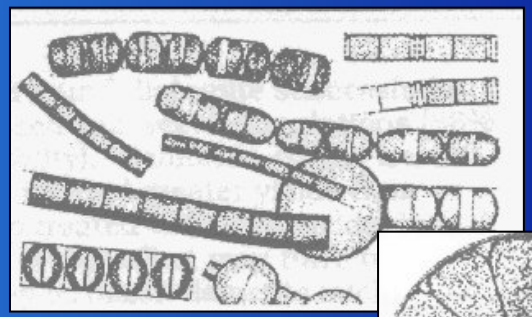
Inert dusts - History

- Birds and mammals take “dust baths” to free themselves of mites and other parasites
- The Chinese used DE for pest control 4000 years ago
- The Aztecs of ancient Mexico are said to have mixed maize with lime to preserve their grain

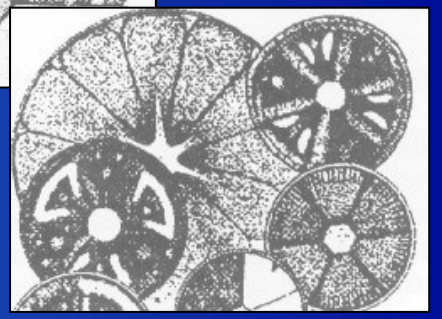
Diatomaceous earths (DE)

- are obtained from the fossils of phytoplanktons (diatoms)
- are composed mainly of amorphous hydrated silicates
- when diatoms settle to the bottoms of lakes and seas, diatomaceous earth deposits are formed





Freshwater diatoms



Marine diatoms

DE - mode of action

Exert their effects on insects through physical means

- Act as dessicating agents - DEs adsorb wax from the cuticle leading to water loss and dehydration of insects, DE's may also abrade the cuticle.

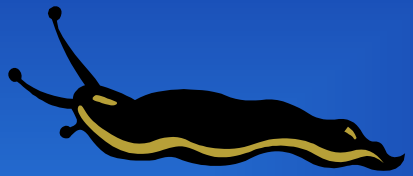
- Repellent - dusts in general are repellent to insects

Which insects are most susceptible to DE's?

- Insects with a large surface area to volume ratios (often smaller insects)
- Insects with body hair e.g. *Oryzaephilus mercator*
- Insects with a thin cuticle
- Insects protected by a low-melting grease e.g. cockroaches, rather than those with a hardened waxy cuticle
- Those that feed on dry grain as opposed to those that constantly obtain water by sucking on vegetation

Use of DEs in other aspects of pest management

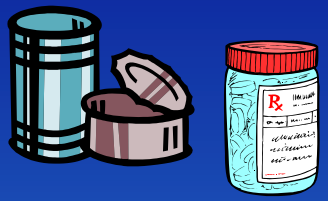
- DE can be used to treat cracks and wall crevices to repel insects



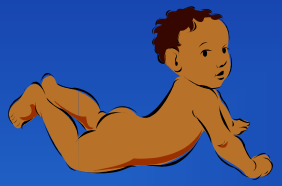
- DE's are also used against some field pests

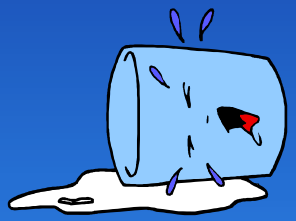
- Cattle, poultry and dog owners add 1-2% DE to animal feed

DE is used in many commercial products including:

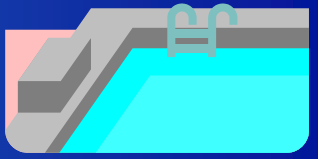


- food additives
- baby powders





- oil removers from concrete floors
- deodorizing compounds



- swimming pool filter systems
- filters in the brewery industry
- detergents

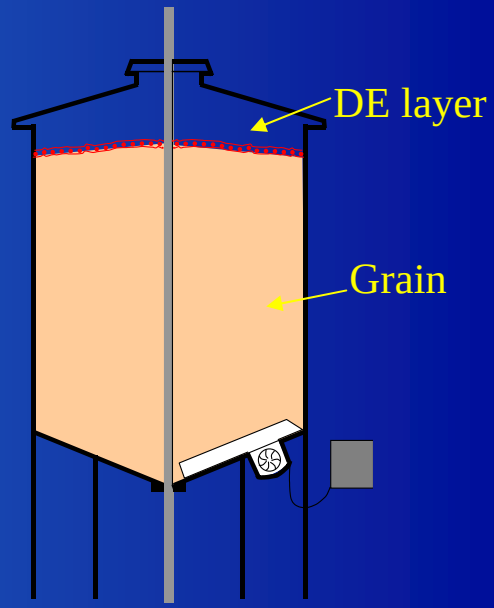
Current DE grain protectant uses

DE products are registered for use as grain protectants in Australia, Brazil, Canada, Croatia, China, Germany, Indonesia, Japan, Philippines, Saudi Arabia, United Arab Emirates and USA

Uses:

Grain treatment using a dust applicator

Structural treatment of grain silos with DE slurry spray application



Top dressing with DE layer combined with fumigation or aeration

Safety and diatomaceous earths

Toxicity - very low mammalian toxicity.

Inhalation can cause respiratory problems, hazard level is affected by:

- Amount of dust
- Particle size
- Crystalline silica contamination

Inert dusts, particularly diatomaceous earths, offer safer alternatives to synthetic chemicals, but information on their efficacy under tropical small-scale farming conditions is limited.

From 1998 - 2000, field trials set up in Binga and Buhera districts of Zimbabwe using maize, sorghum and cowpeas showed that DEs could effectively protect these products for >8 months storage.

This work has now been published:

STATHERS, T.E., MVUMI, B.M., and GOLOB, P. 2002 Field assessment of the efficacy and persistence of diatomaceous earths in protecting stored grain on small-scale farms in Zimbabwe. *Crop Protection*, 21(10): 1033-1048.

STATHERS, T.E., CHIGARIRO, J., MUDIWA, M., MVUMI, B.M. and GOLOB, P. 2002. Small-scale farmer perceptions of diatomaceous earth products as potential stored grain protectants in Zimbabwe. *Crop Protection*, 21(10): 1049-1060.

Protect-It is currently in the process of being registered for use as a grain protectant in Zimbabwe by EcoMark Ltd.

In July 2002, further work to evaluate whether diatomaceous earths and other protectants were safe, effective and affordable treatments for rural householders was initiated by the Plant Health Services Division of the Tanzanian Ministry of Agriculture and Food Security

“Small-scale farmer utilisation of diatomaceous earths during storage”

From 2002 to date, research trials have been set up in:

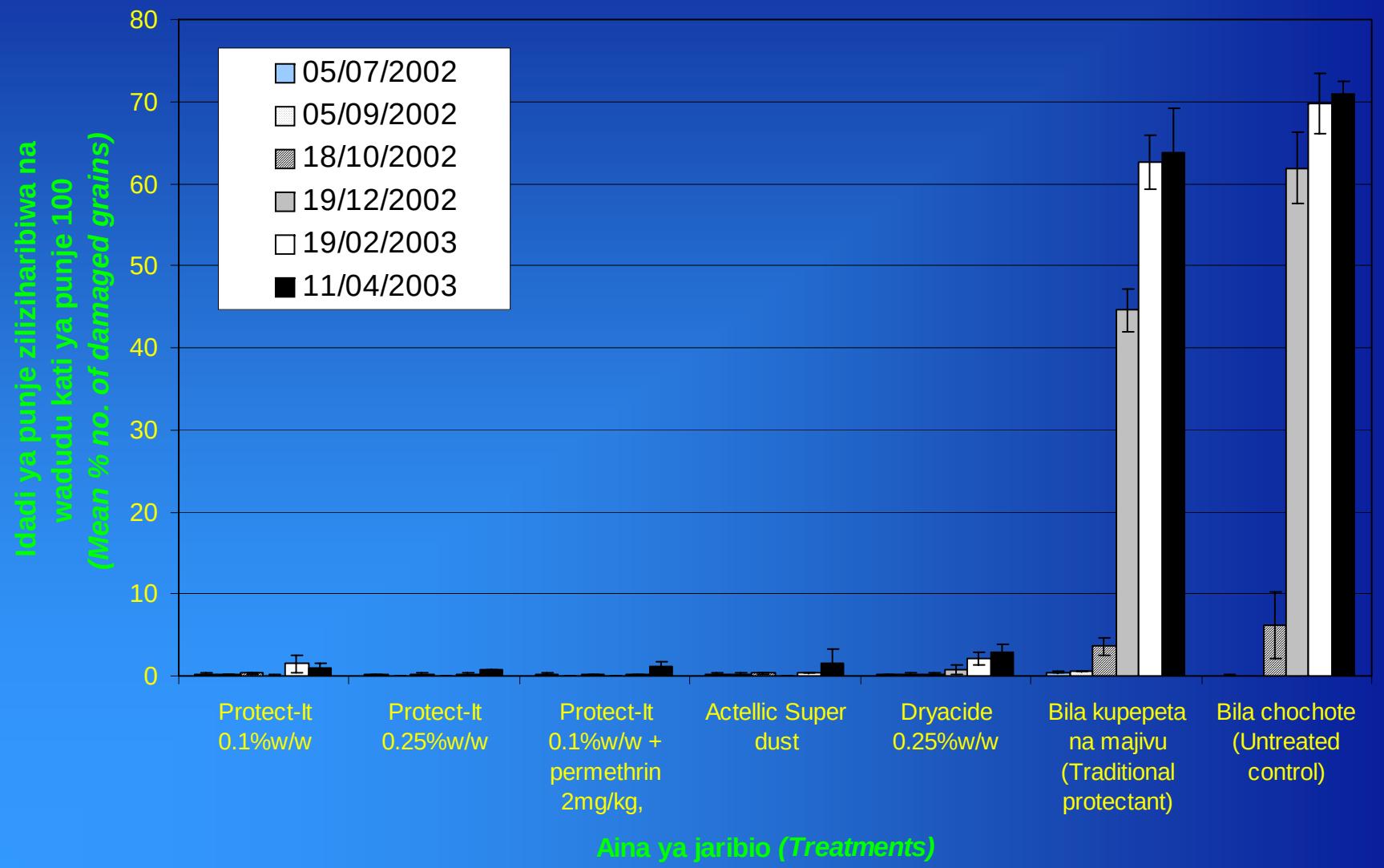
- Mlali village, Kongwa district, Dodoma Region
- Mwamakaranga village, W. Shinyanga district, Shinyanga Region
- Mwataga village, Kishapu district, Shinyanga Region
- Arri village, Babati district, Manyara Region
- Singe village, Babati district, Manyara region

The commodities studied included: maize, sorghum and beans

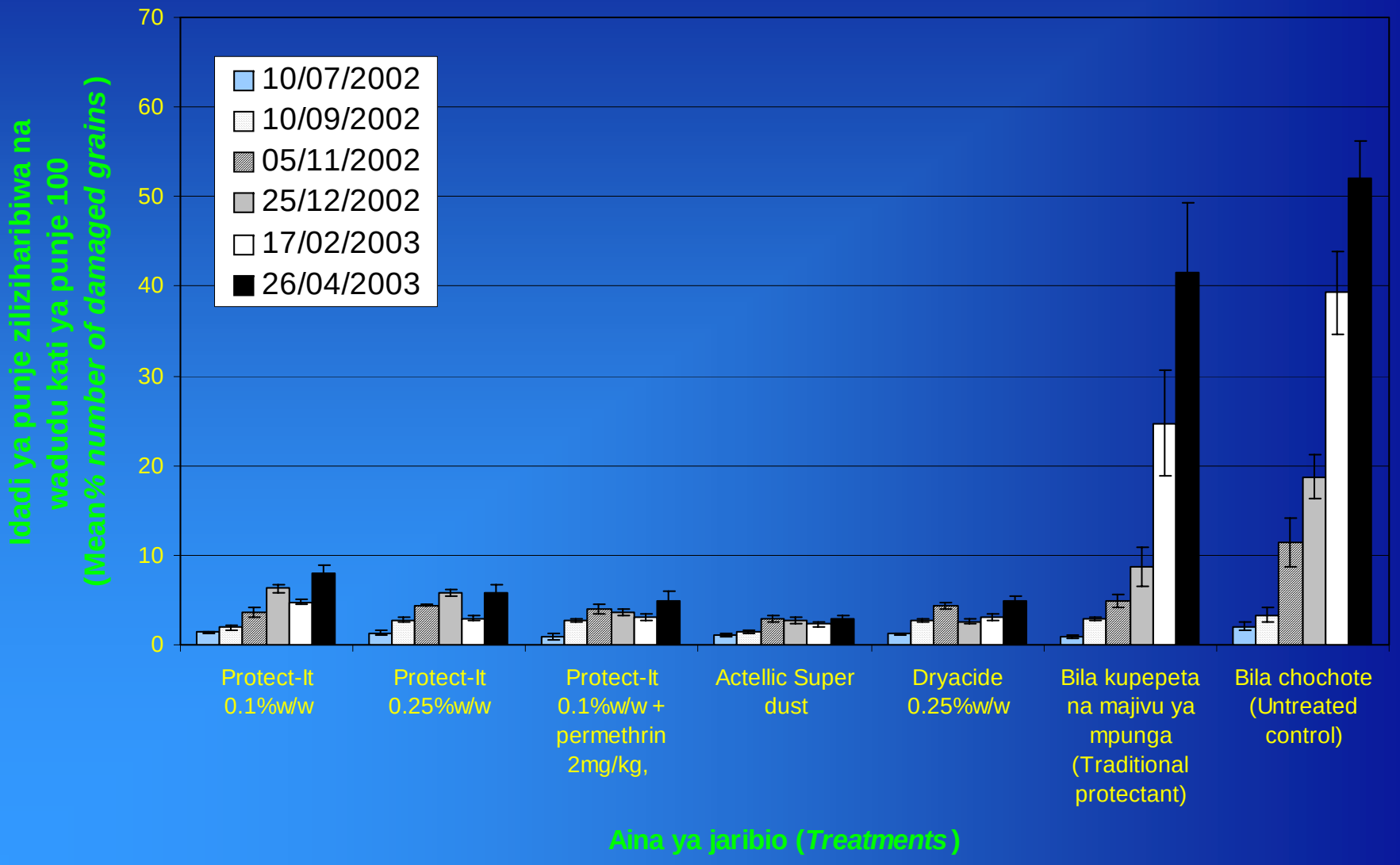
The grain protectants being tested include:

- traditional protectants (ash, plant materials)
- commercial synthetic pesticides, e.g. Actellic Super dust, Stocal Super dust, Shumba Super dust
- DEs - Protect-It and Dryacide (two diatomaceous earths)
- combinations of diatomaceous earths & synthetic chemical pesticides

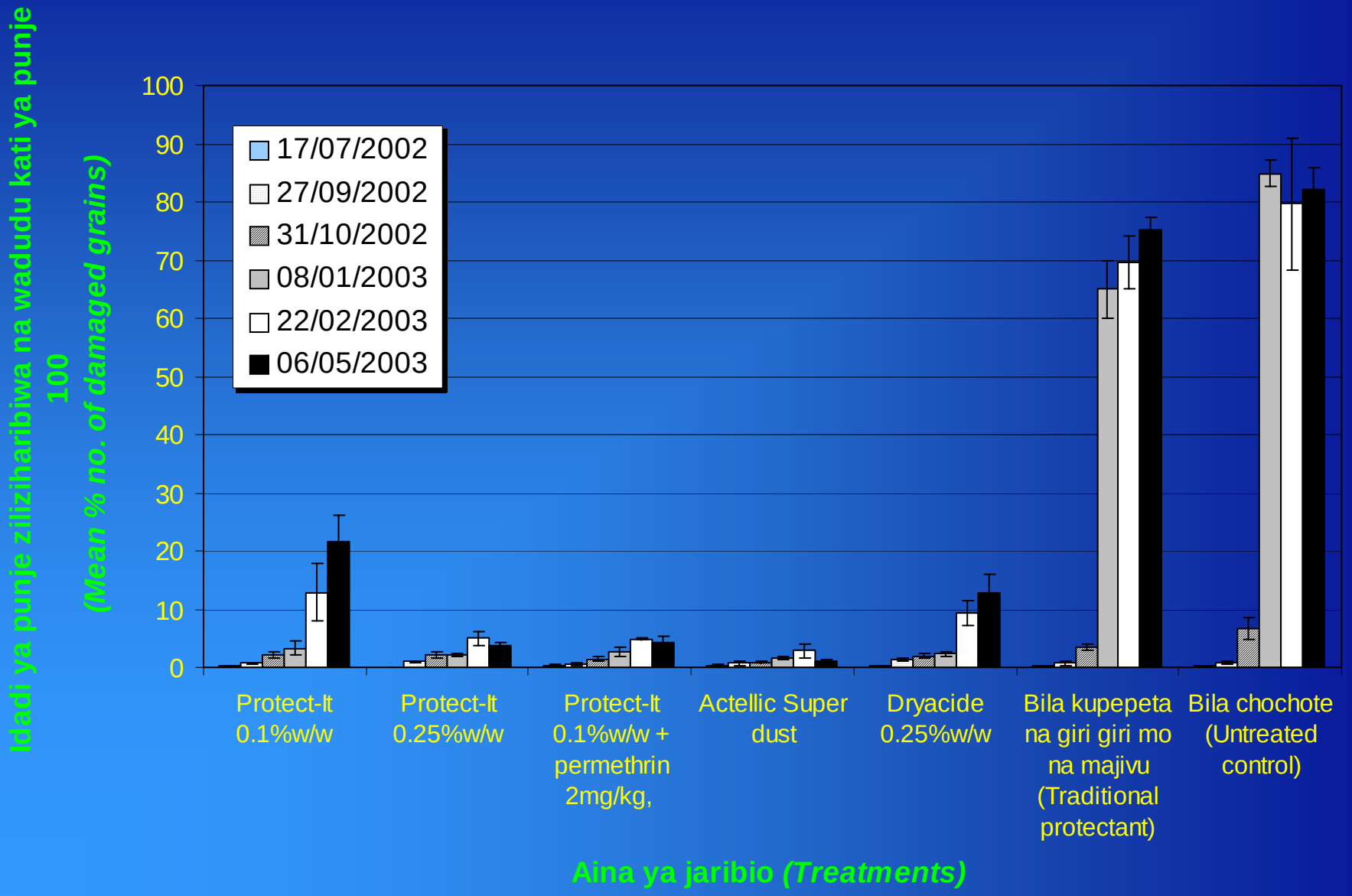
Jaribio la hifadhi ya mahindi kijiji cha Mlali (2002/03)
(*Maize grain protection trials, Mlali village, Kongwa district*)



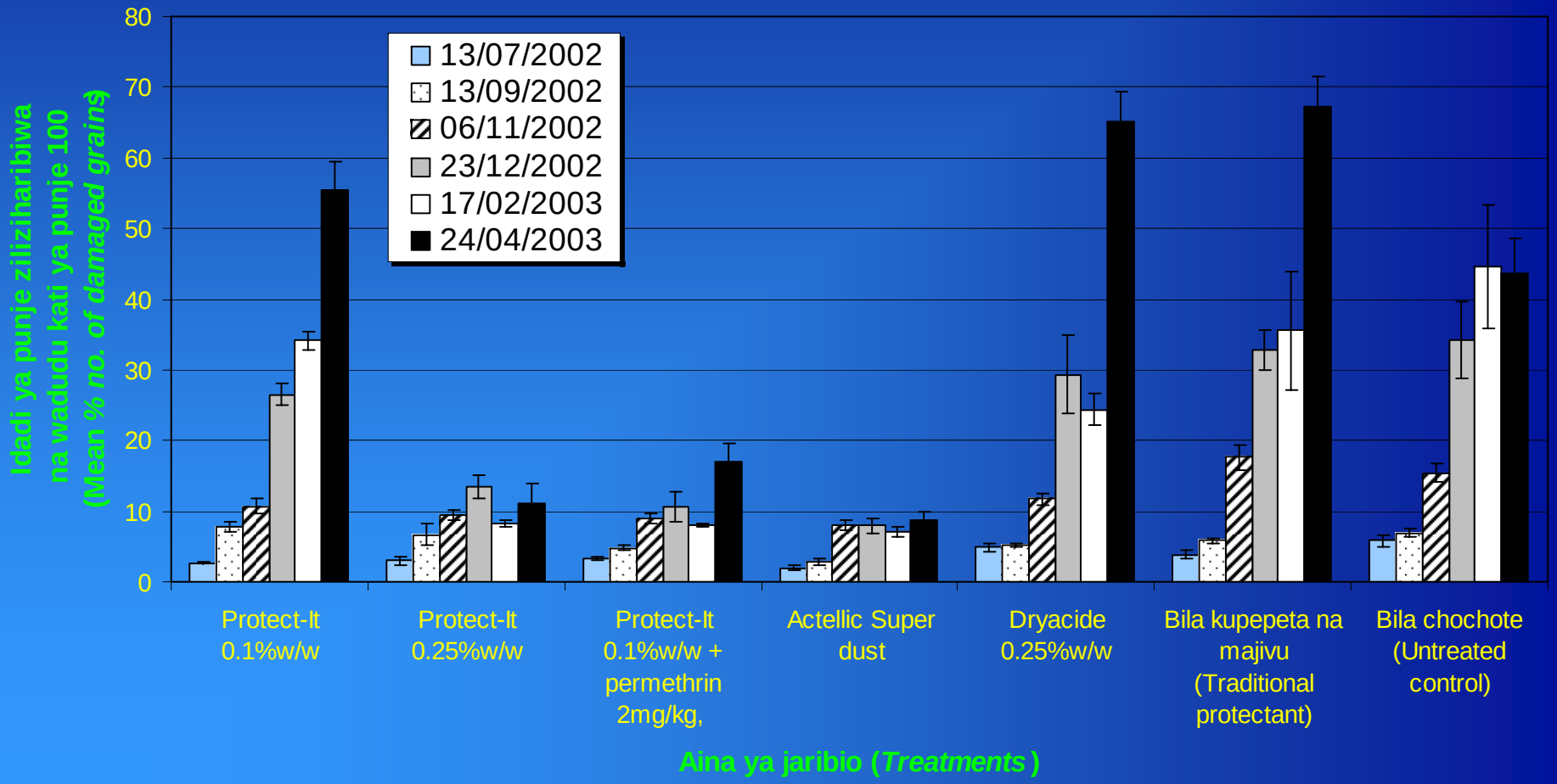
Jaribio la hifadhi ya mahindi kijiji cha Mwamakaranga (2002/03)
(*Maize grain protection trials, Mwamakaranga village, Shinyanga*)



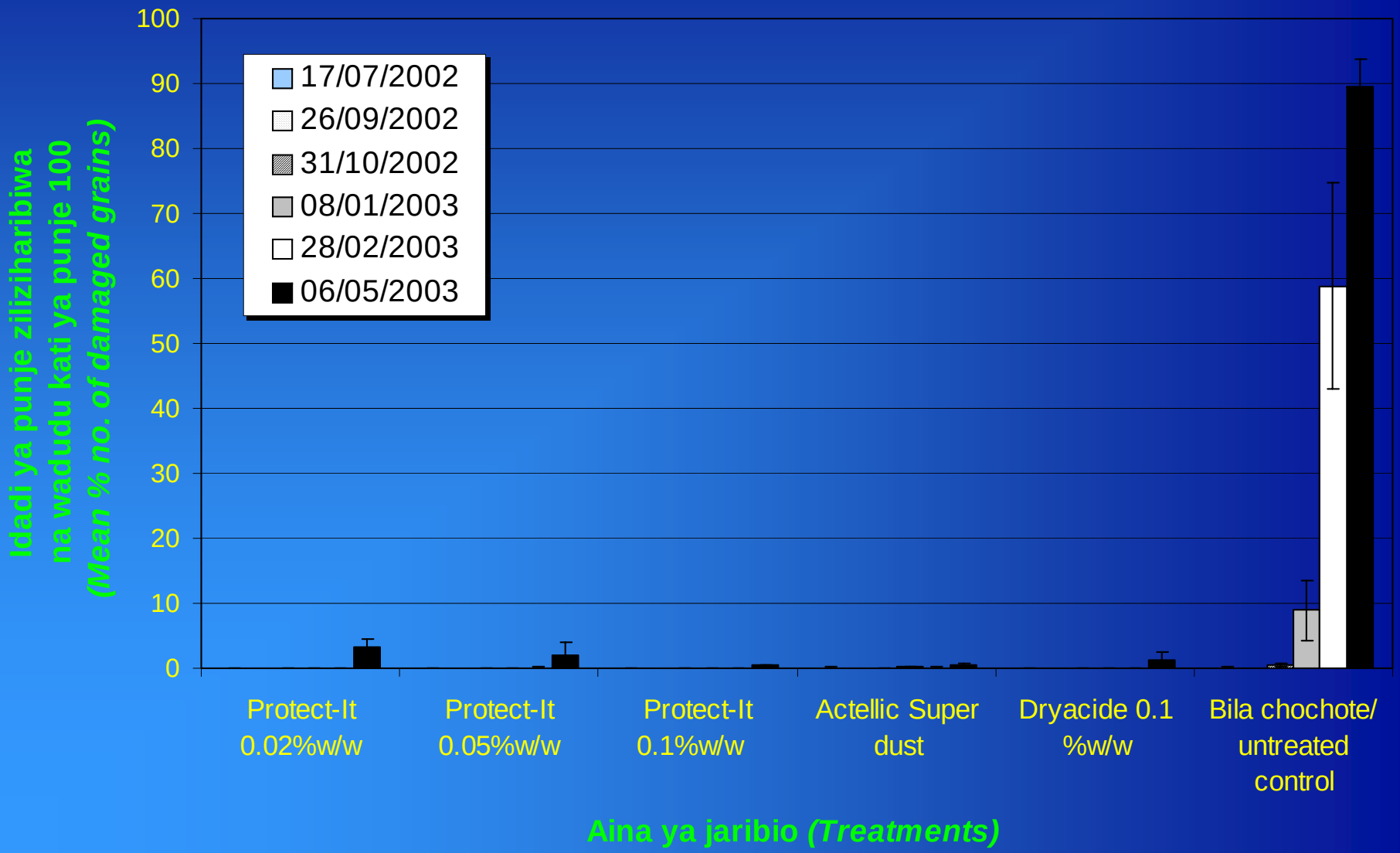
Jaribio la hifadhi ya mahindi kijiji cha Arri (2002/03)
(*Maize grain protection trials, Arri village, Babati district*)



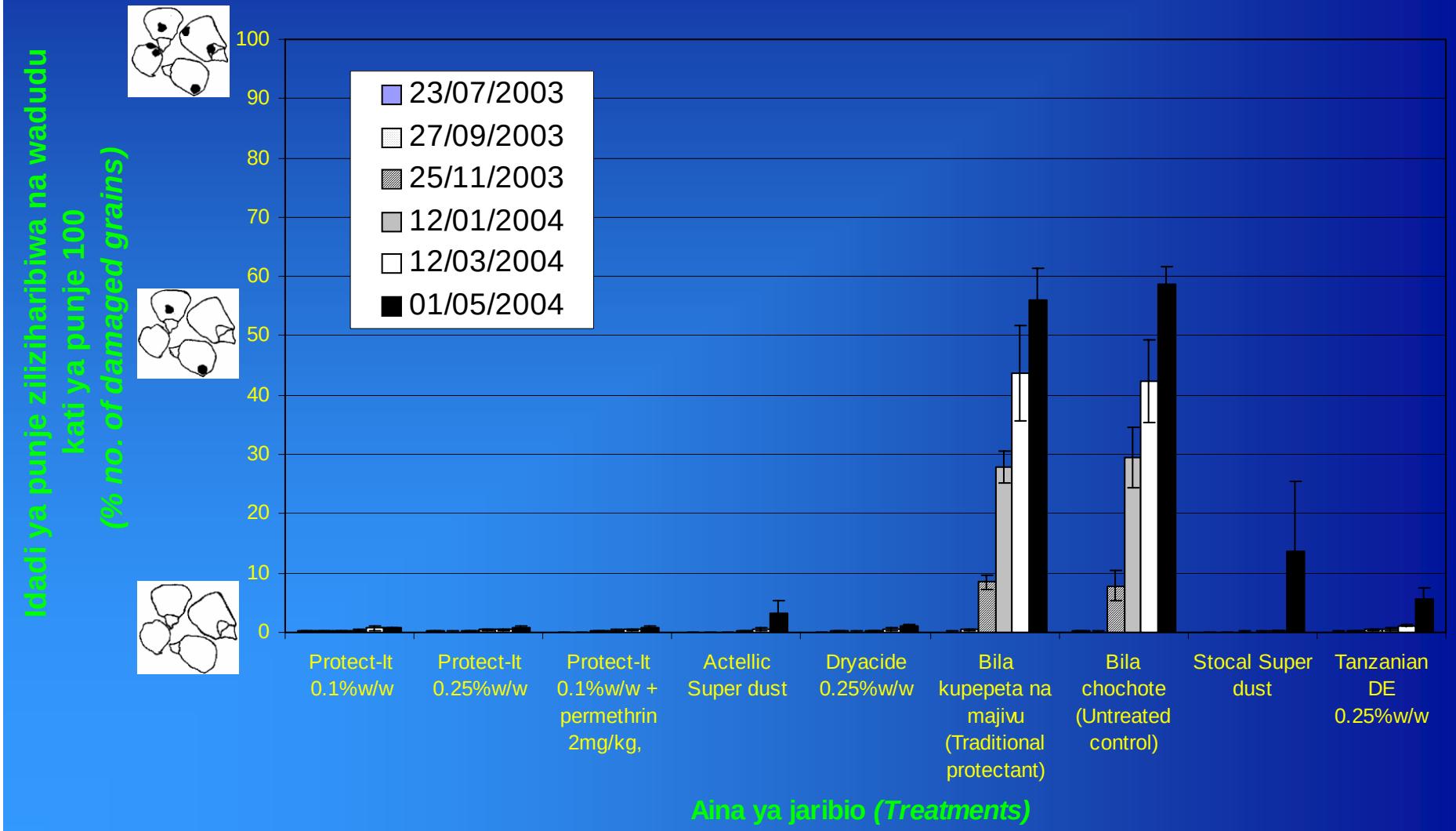
Jaribio la hifadhi ya mtama kijiji cha Mwataga (2002/03)
(*Sorghum grain protection trials, Mwataga village, Kishapu district*)



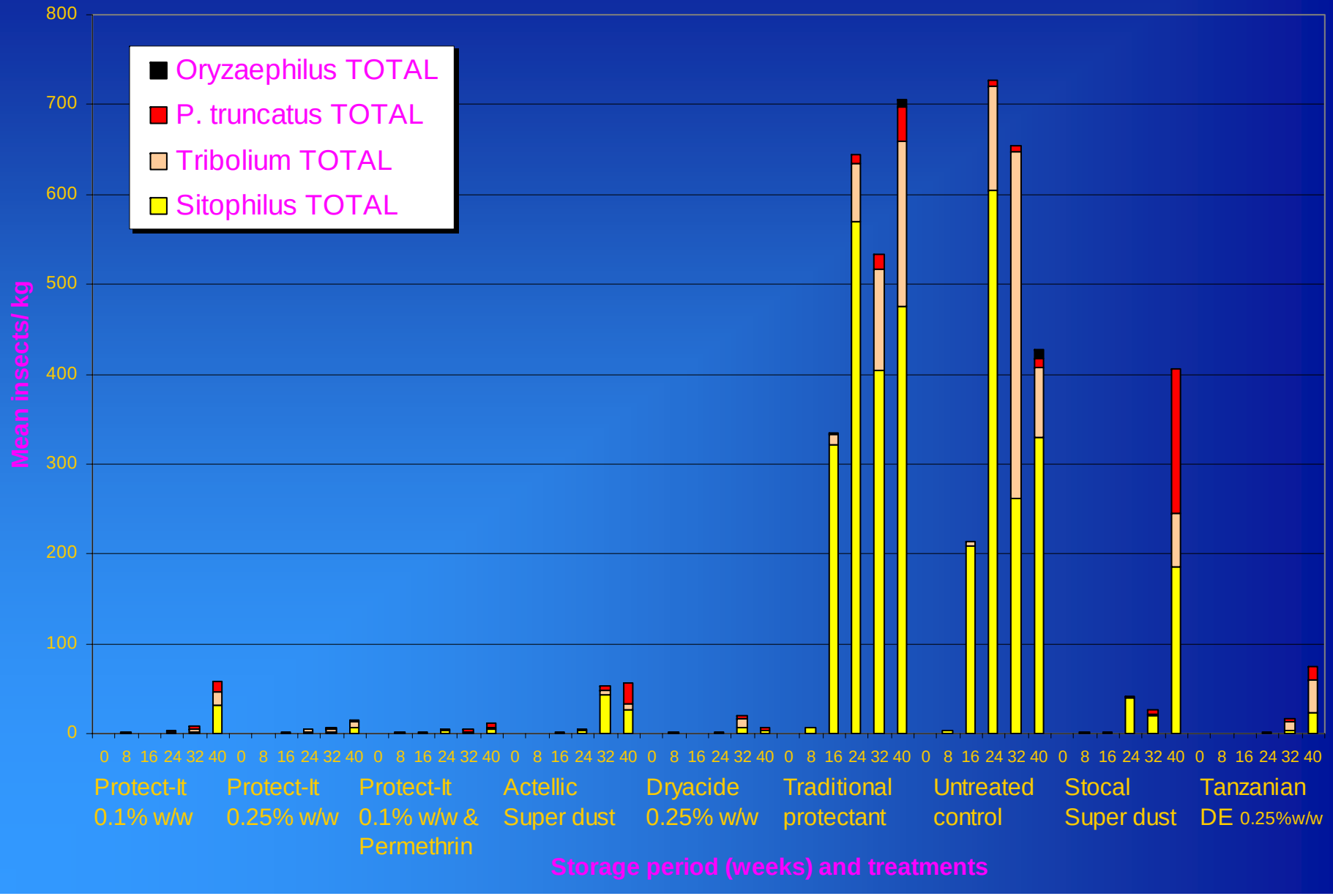
Jaribio la hifadhi ya maharage kijiji cha Singe (2002/03)
(*Bean storage trials, Singe village, Babati district*)



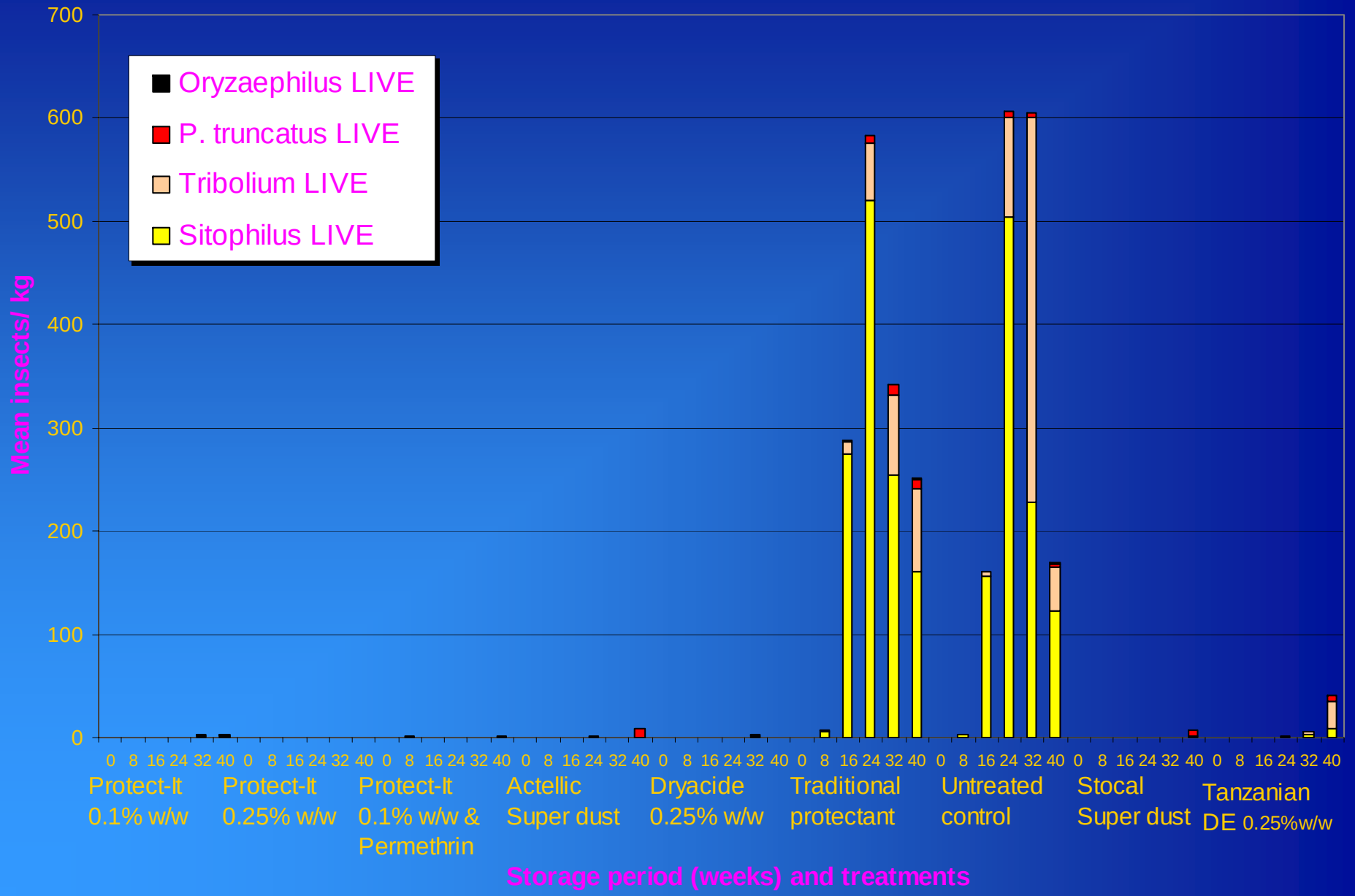
Jaribio la hifadhi ya mahindi kijiji cha Mlali (2003/04)
(*Maize grain protection trials, Mlali village, Kongwa district*)



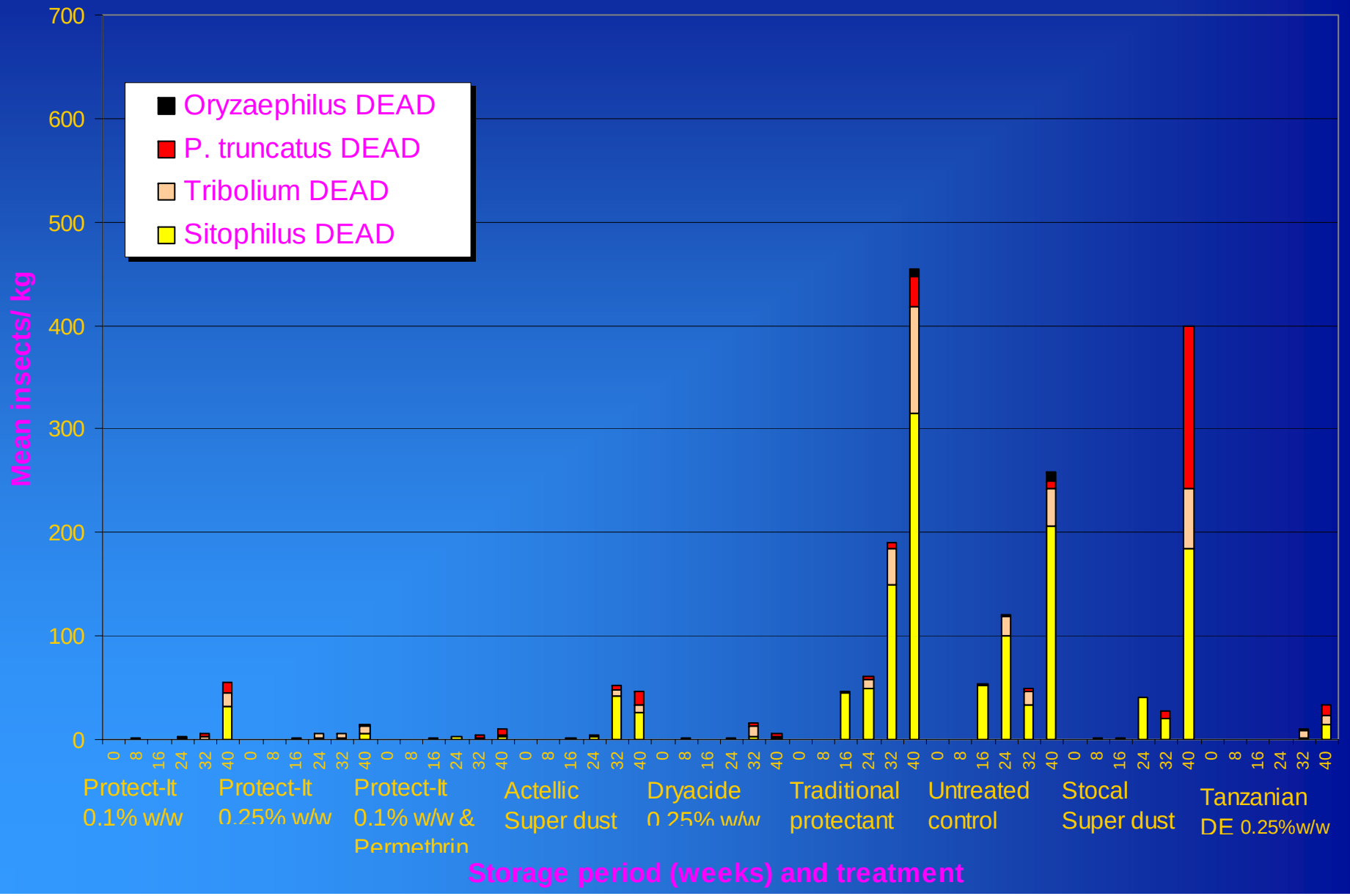
Mean number of insects in maize grain stored at Mlali village, Kongwa district using different protectants during 2003/ 2004



Mean number of LIVE insects in maize grain stored at Mlali village using different protectants during 2003/ 2004



Mean number of DEAD insects in maize grain stored at Mlali village using different protectants during 2003/ 2004



What about farmers perceptions of the DEs?

Farmers assessed the quality of grain stored for 10 months using the different treatments

Important criteria for evaluating stored maize grain

No insect boring

No unwanted chemicals hazardous to humans

No rotting

No unpleasant smells - pesticide/ dirt

No chaff

Farmer Managed Trials

In the 2nd and 3rd years farmers set up their own trials with the DE Protect-It at their homes, the project team have visited them regularly to learn about how their trials were doing.

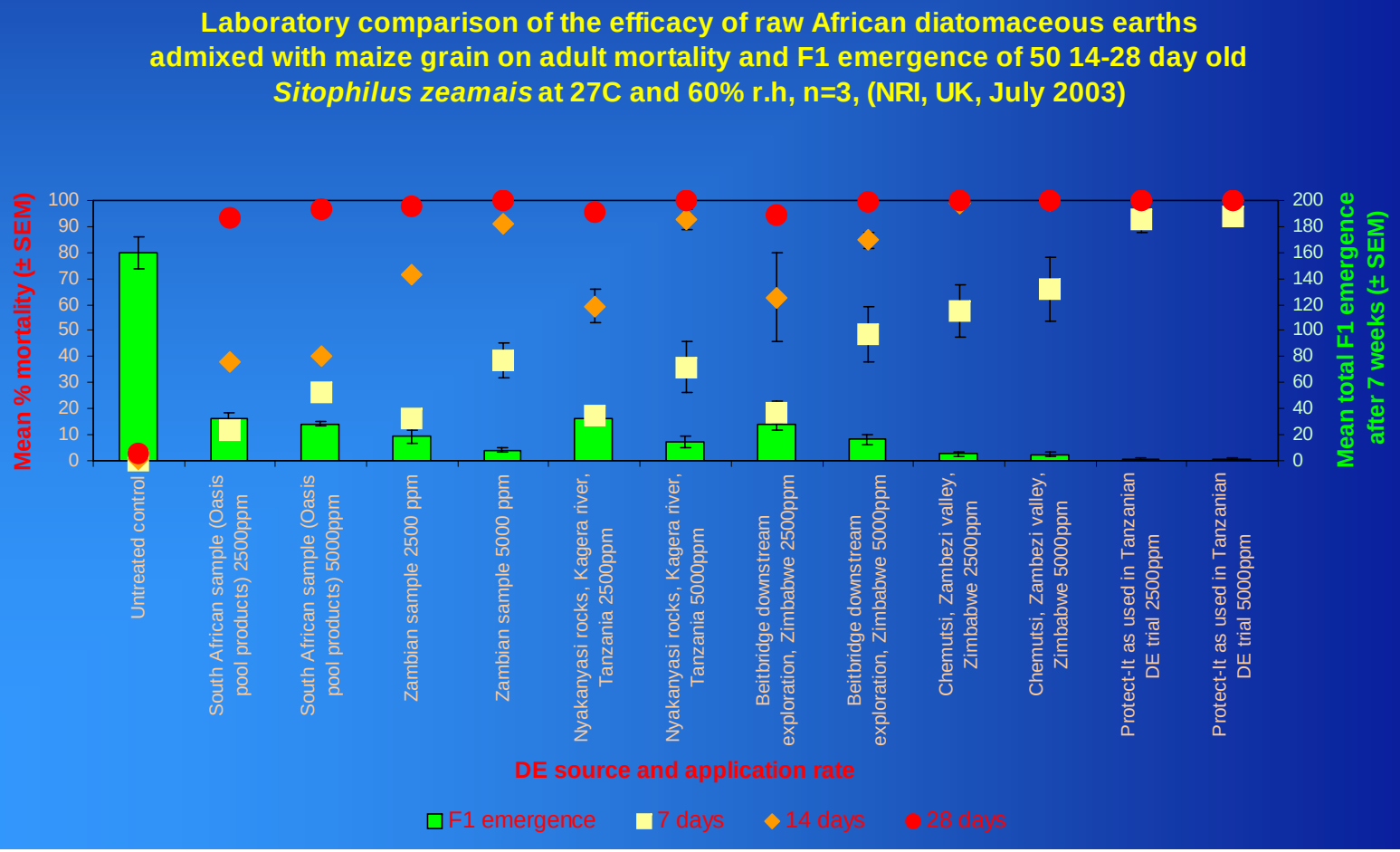
1 sack of maize grain treated with Protect-It (at 250g/ 100kg), after 10 months storage

1 sack of maize grain treated with farmers practice after 10 months storage

African deposits of DEs

The DEs, Protect-It and Dryacide come from North America, but DE deposits also exist in East and Southern Africa.

In the 1st year, DE samples from Tanzania, Zimbabwe, Zambia, and South Africa were tested against storage insect pests in laboratory trials.



The results were promising and samples from Kagera region in Tanzania, and Chemutsi river and Beitbridge in Zimbabwe have been included in field trials during the 2nd and 3rd storage seasons.

It is perhaps too early to speculate about the benefits a locally available DE may have for small-scale farmers.

What needs to be done next, to help DEs reach the market so that farmers can access these safe and effective grain protectants?

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