

Diatomaceous earth dusts for grain protection by small-scale farmers in Tanzania and Zimbabwe

B. Mvumi, T. Stathers, W. Riwa, M. Morris, L. Kitandu, R. Masha, K. Mngara, F. Janga, P. Masiwa, E. T. Dube, R. Kuseri, B. Kaoneka, A. Zhou, P. Jowah

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Presentation Outline

- Introduction
- Lab experiments with raw African DEs
- Field Experiments
- Results
- Gaps & Challenges

Introduction

- Farmers throughout sub-Saharan Africa suffer serious grain losses due to insect attack
- Losses threaten household food security or undermine market returns
- Grain protection options- admixing with ash, plant materials or synthetic chemical insecticides
- Main pesticides - organophosphate-pyrethroid cocktails (Pirimiphos-methyl 1.6% +Permethrin 0.3%; Fenitrothion 1% + Deltamethrin 0.13%; Pirimiphos-methyl 2.5% + Deltamethrin 0.1%)
- Widespread adulteration and misuse problems esp. East Africa
- Farmers demanded alternatives

Introduction (*cont.*)

- Diatomaceous earths (DEs) attractive alternative but limited information available on efficacy under tropical small-scale storage conditions
- What are DEs?
- CPHP of DFID-UK funded research in Zimbabwe from 1998 - 2000
- Imported enhanced DEs found effective in small-scale on-farm storage systems for periods of 8-10 mths @ 0.1%w/w
- *R. dominica* on sorghum required 0.2%w/w
- Further work initiated in Tanzania
 - for wider geographical testing, and
 - to test vs devastating LGB, *Prostephanus truncatus*
- Local deposits of DEs identified but efficacy unknown

Assessment of African DEs

- 5 Raw African DE samples assessed on *S. zeamais* compared to Protect-It
- Controlled conditions: $27 \pm 2^\circ\text{C}$; $60 \pm 5\% \text{RH}$

NRI -DE applied at 0, 2500 & 5000ppm

UZ- applied at 0, 1000, 2500 & 5000ppm



Raw DE from Zambezi Valley, Zimbabwe

Field Experiments: 2002-2005

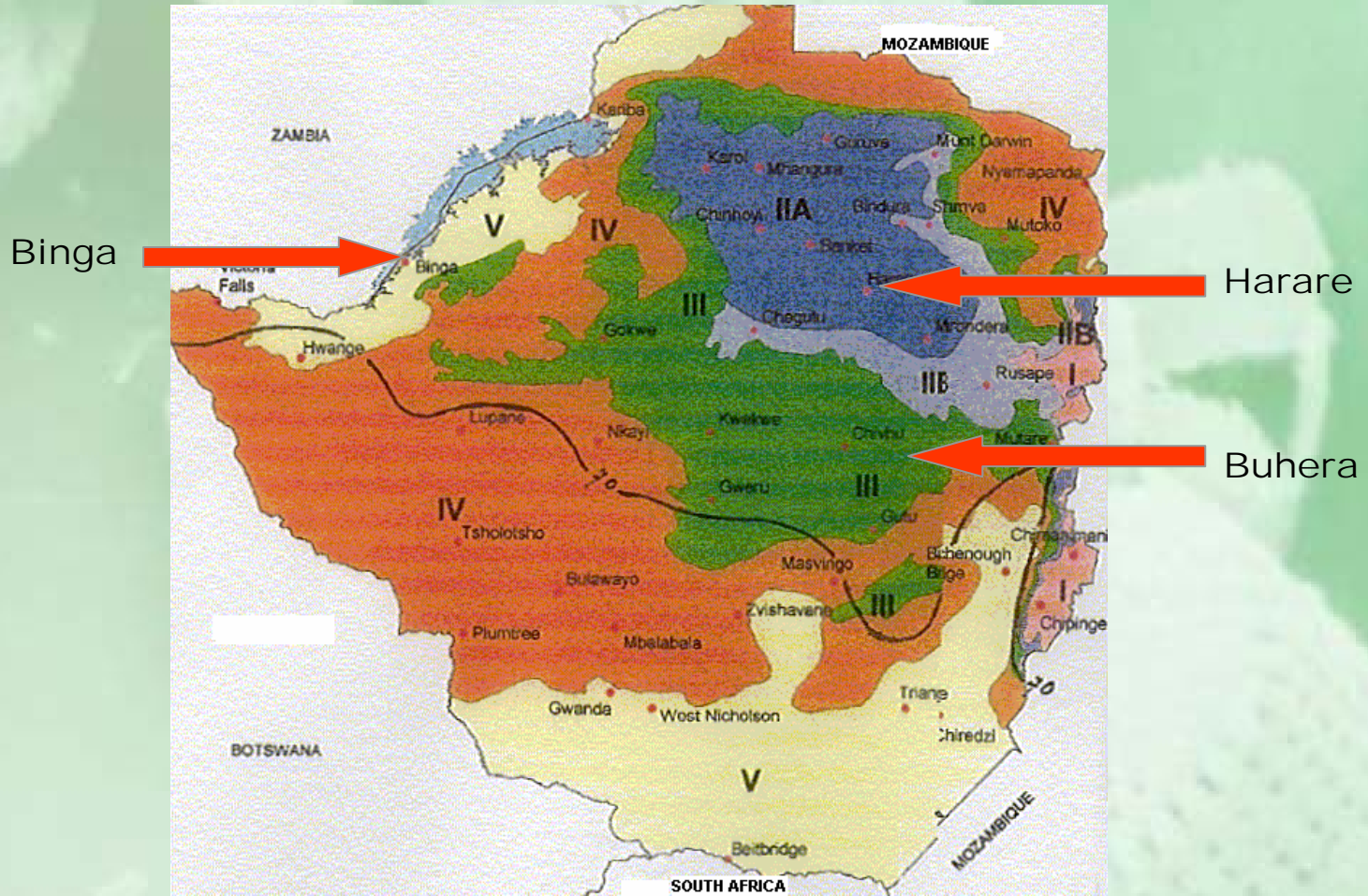
Zimbabwe – Harare, Buhera & Binga

– Maize, sorghum, cowpeas

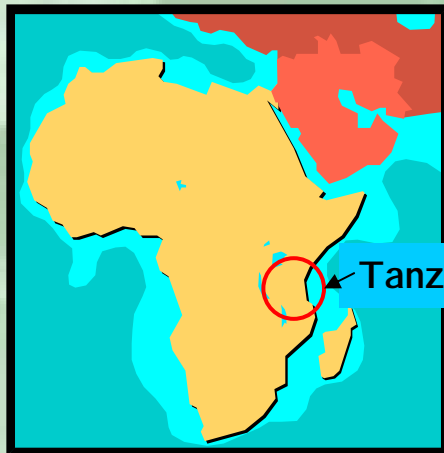
- Tanzania – Dodoma, Shinyanga, Manyara

– Maize, sorghum, beans

Project sites - Zimbabwe

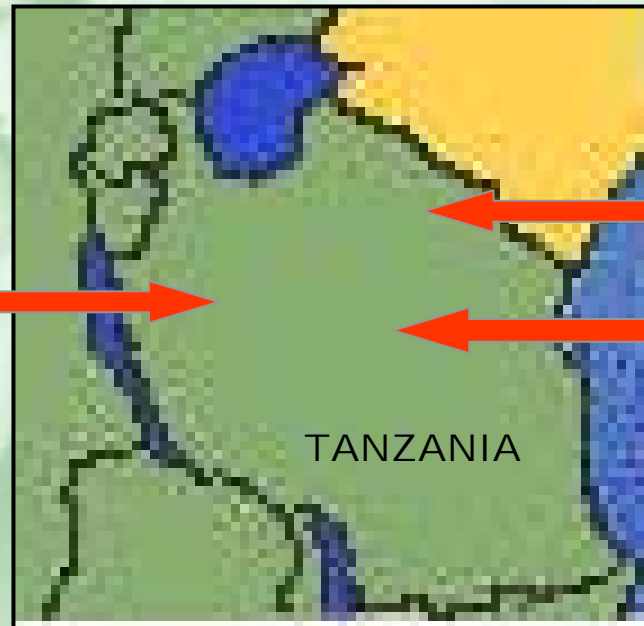


Project sites - Tanzania



Tanzania

Shinyanga region



Manyara region



Dodoma region



Treatments - Zimbabwe

Harare 2003/04 (Maize)

- Actellic Super Dust
- Protect-It 0.1%w/w
- Zimbabwean DE1 @0.1; 0.2; 0.25%w/w
- Untreated control

Buhera 2004/05 (Maize)

- Shumba Super Dust
- Protect-It 0.1%w/w
- Zimbabwean DE1 @0.1; 0.2; 0.25%w/w
- Finger millet chaff 50% w/w

Harare 2004/05 (Maize)

- Protect-It 0.1%w/w
- Zimbabwean DE1 @0.15; 0.2; 0.25%w/w
- Zimbabwean DE2 @ 0.2%w/w
- Untreated control

Binga 2004/05 (Sorghum)

- Shumba Super Dust
- Protect-It 0.15%w/w
- Protect-It 0.1%w/w+Permethrin 2mg/kg
- Zimbabwean DE1 @ 0.2 & 2.5%w/w
- Zimbabwean DE2 @ 0.2% w/w
- Untreated control

Note: 4 replicates of each treatment were used

Treatments - Tanzania

2002/2003 Maize & Sorghum

- Protect-It (100g/100kg)
0.1%w/w
- Protect-It 250g/100kg)
0.25% w/w
- Protect-It 0.1%w/w +
Permethrin 2mg/kg
- Actellic Super Dust
(100g/90kg)
- Dryacide (250g/100kg)
0.25% w/w
- Traditional protectants
- Untreated control

2003/2004 Maize & Sorghum

- Protect-It
(100g/100kg) 0.1%w/w
- Protect-It (250g/100kg)
0.25% w/w
- Protect-It 0.1% w/w+
Permethrin 2mg/kg
- Actellic Super Dust
(100g/90kg)
- Dryacide (250g/100kg)
0.25% w/w
- Traditional protectants
- Untreated control
- Stocal Super Dust
(100g/90kg)
- Tanzanian DE
(250g/100kg) 0.25%w/w

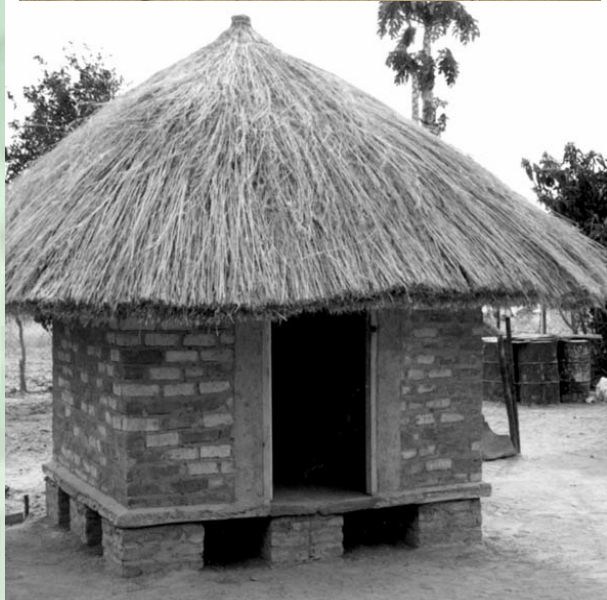
2004/2005 Maize

- Protect-It (100g/100kg)
0.1%w/w
- Protect-It (250g/100kg)
0.25% w/w
- Protect-It 0.1% w/w+
Permethrin 2mg/kg
- Actellic Super Dust
(100g/90kg)
- Dryacide(250g/100kg)
0.25% w/w
- Traditional protectants
- Untreated control
- Stocal Super Dust
(100g/90kg)
- Tanzanian DE
(250g/100kg)
0.25%w/w
- Shumba Super Dust
(50g/90kg)

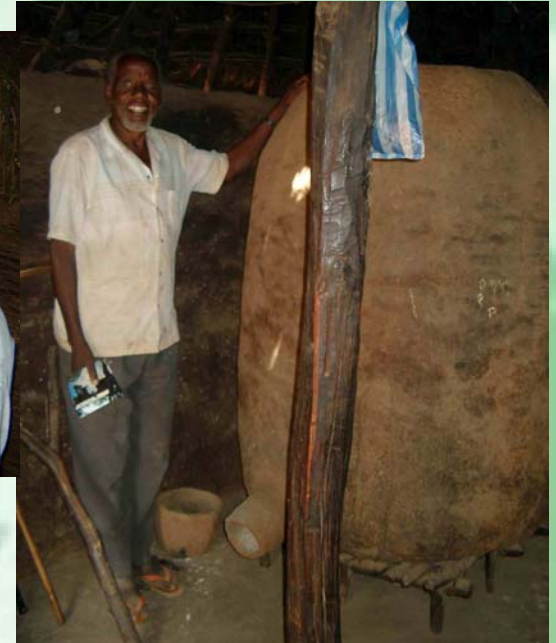
Note: 4 replicates of each treatment were used

Storage facilities & Sampling

Zimbabwe



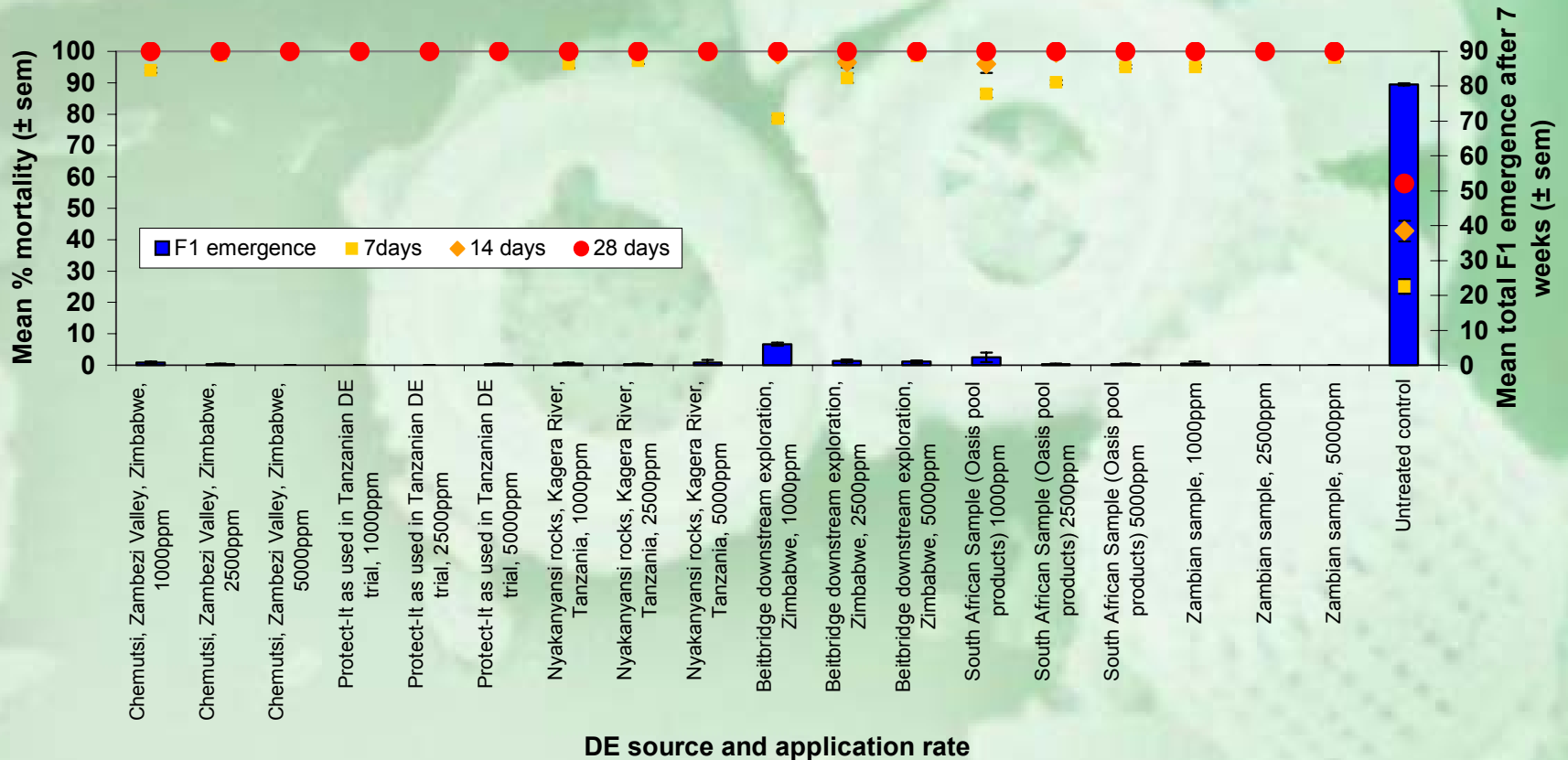
Tanzania



RESULTS (only for 2002/03 & 2003/04)

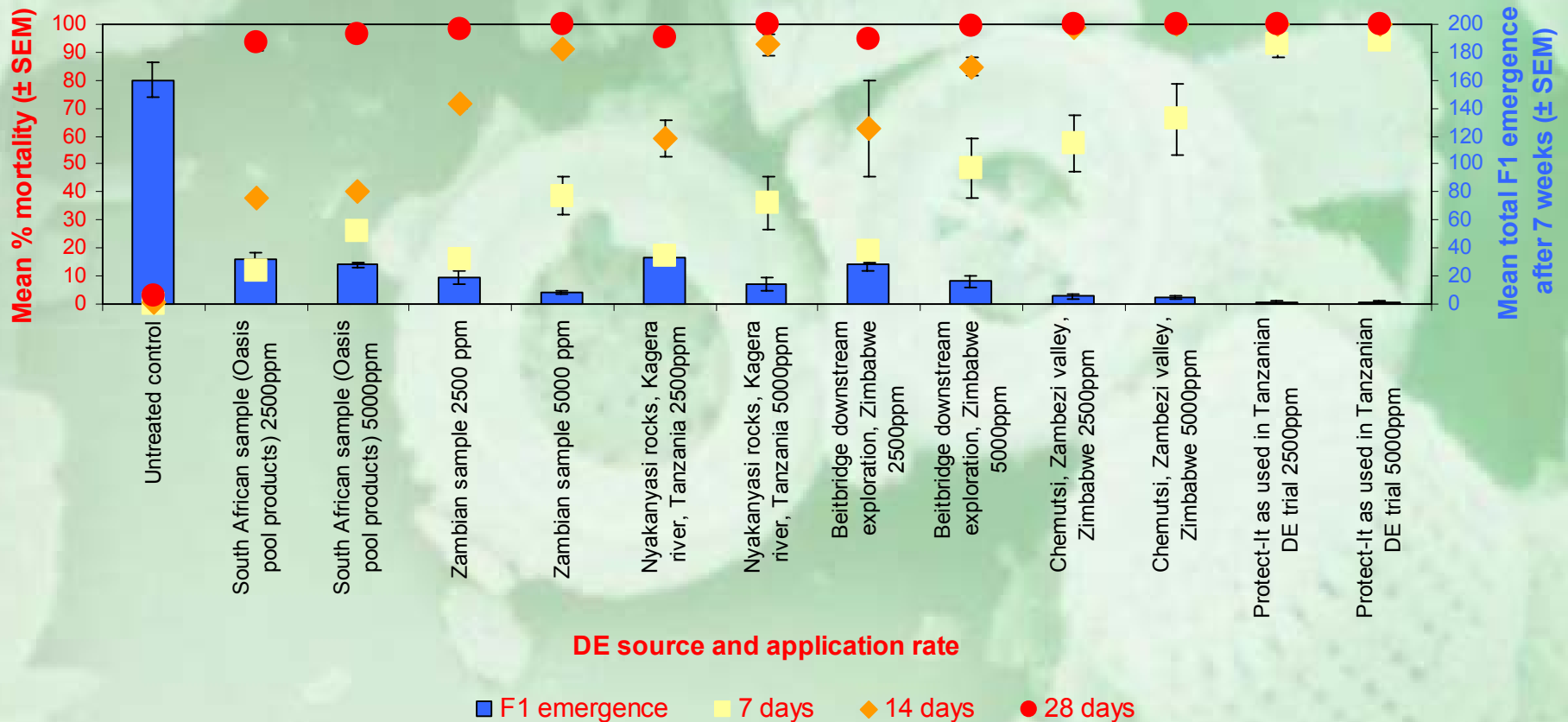
Raw African DEs - Zimbabwe

Laboratory comparison of the efficacy of raw African diatomaceous earths admixed with maize grain against *Sitophilus zeamais*; n=4 (UZ, Zimbabwe)

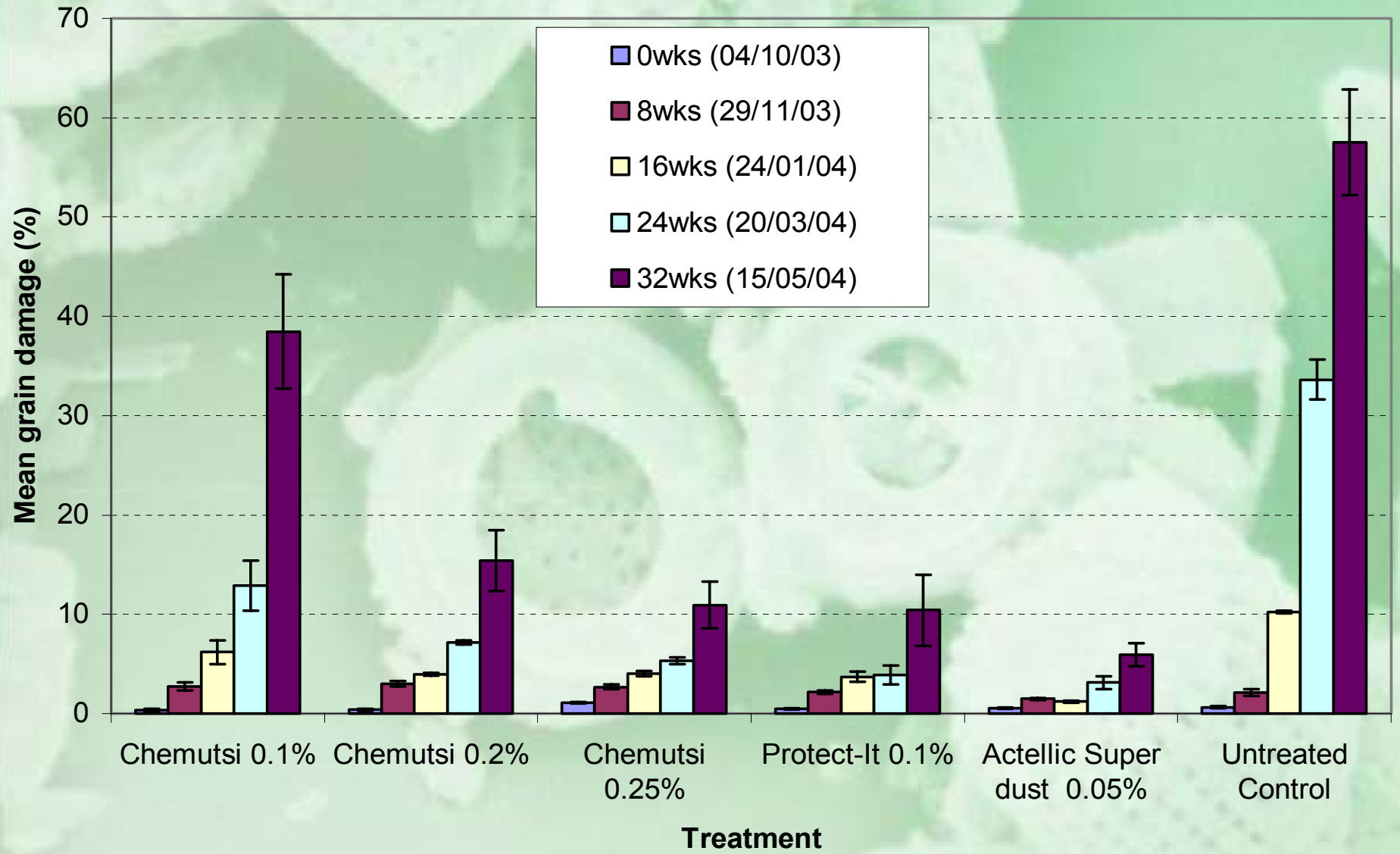


Raw African DEs - Tanzania

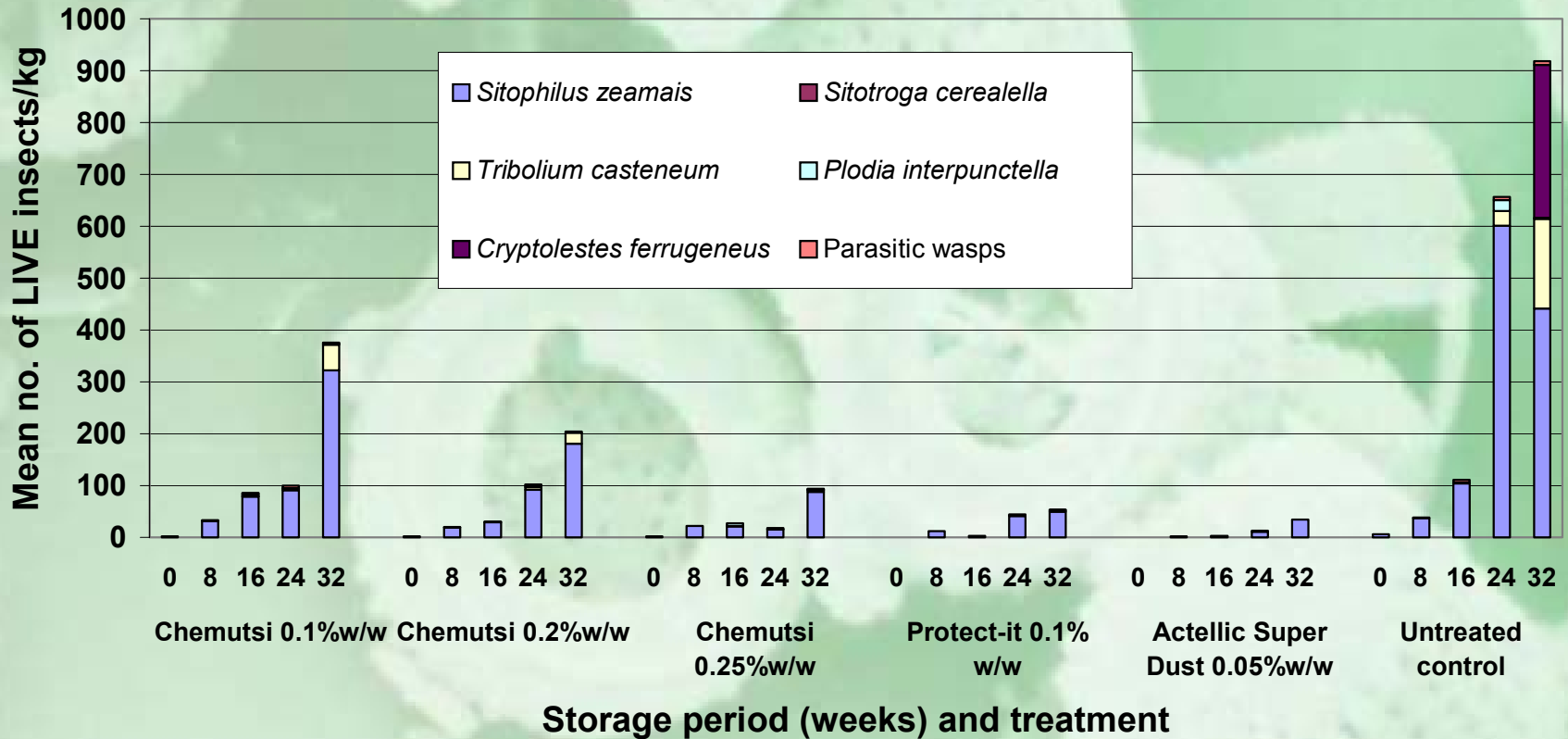
Laboratory comparison of the efficacy of raw African diatomaceous earths admixed with maize grain on adult mortality and F1 emergence of 50 14-28 day old *Sitophilus zeamais* at 27C and 60% r.h, n=3, (NRI, UK, July 2003)



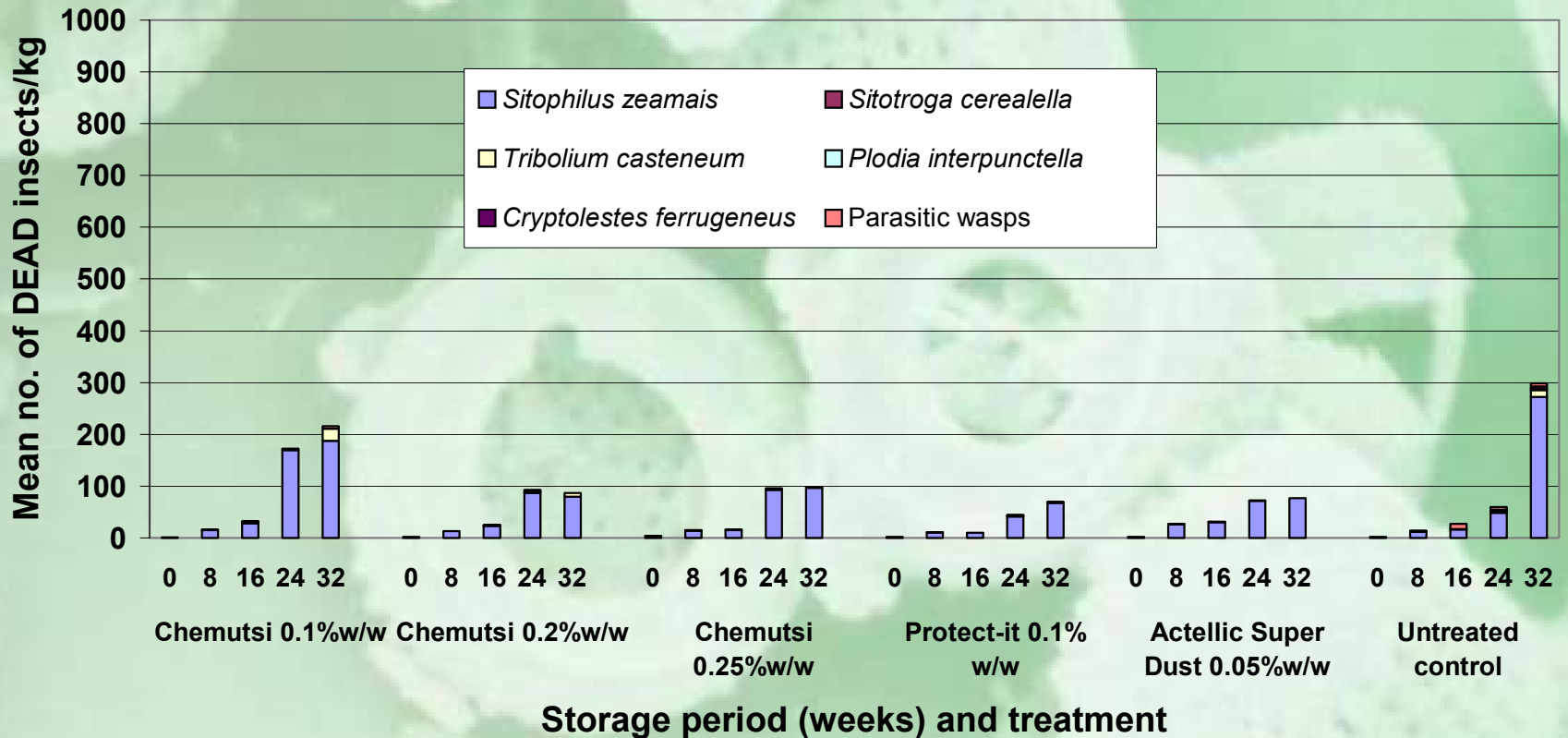
Maize grain protection trials using raw DE from Chemutsi, Zimbabwe compared to commercial DE or synthetic insecticide, Hatcliffe farm, Harare, 2003/04



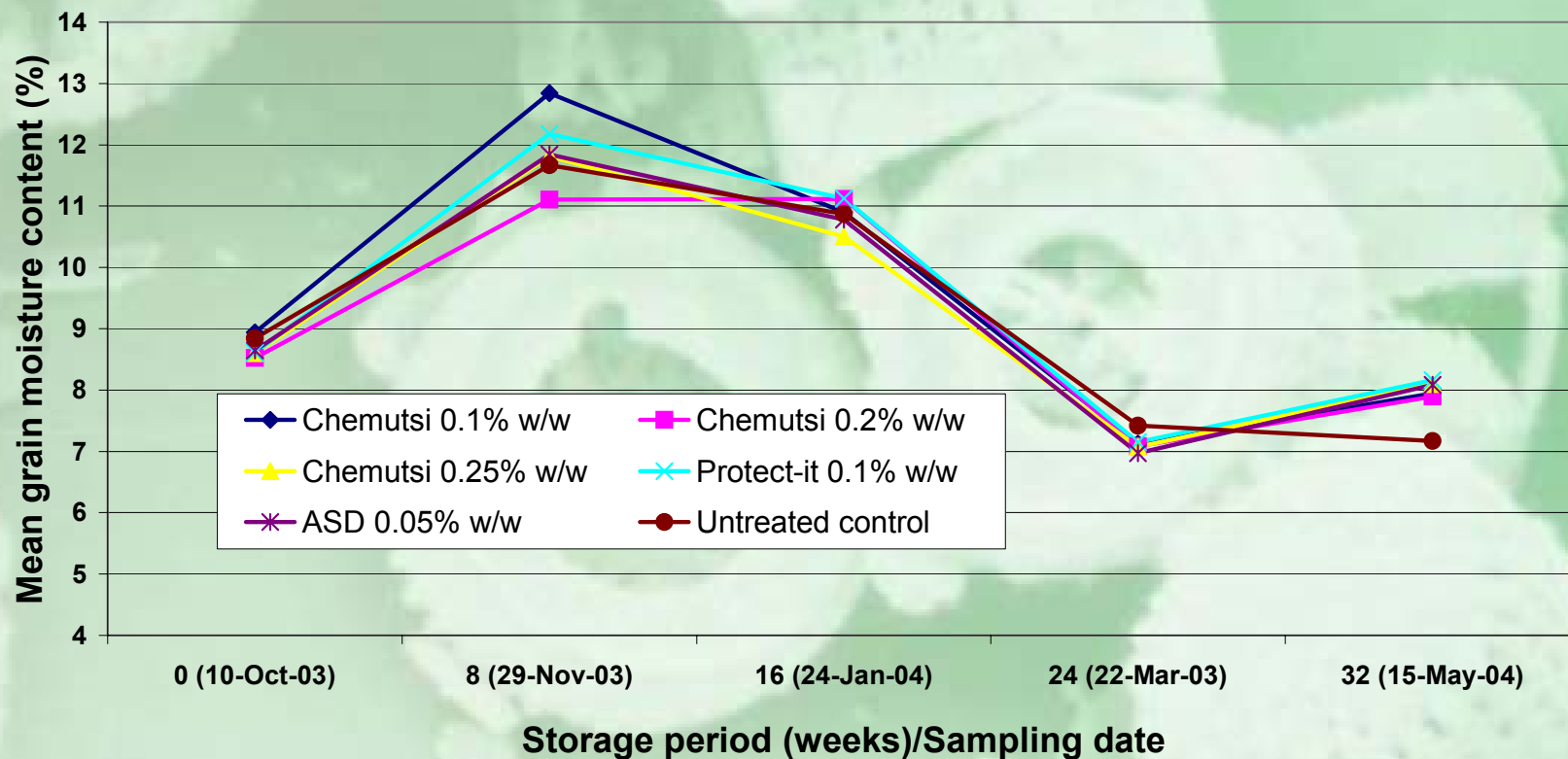
Comparison of mean number of LIVE adult insects/kg per species on maize grain treated with different protectants during 2003/04 storage season, Harare, Zimbabwe (n=4)



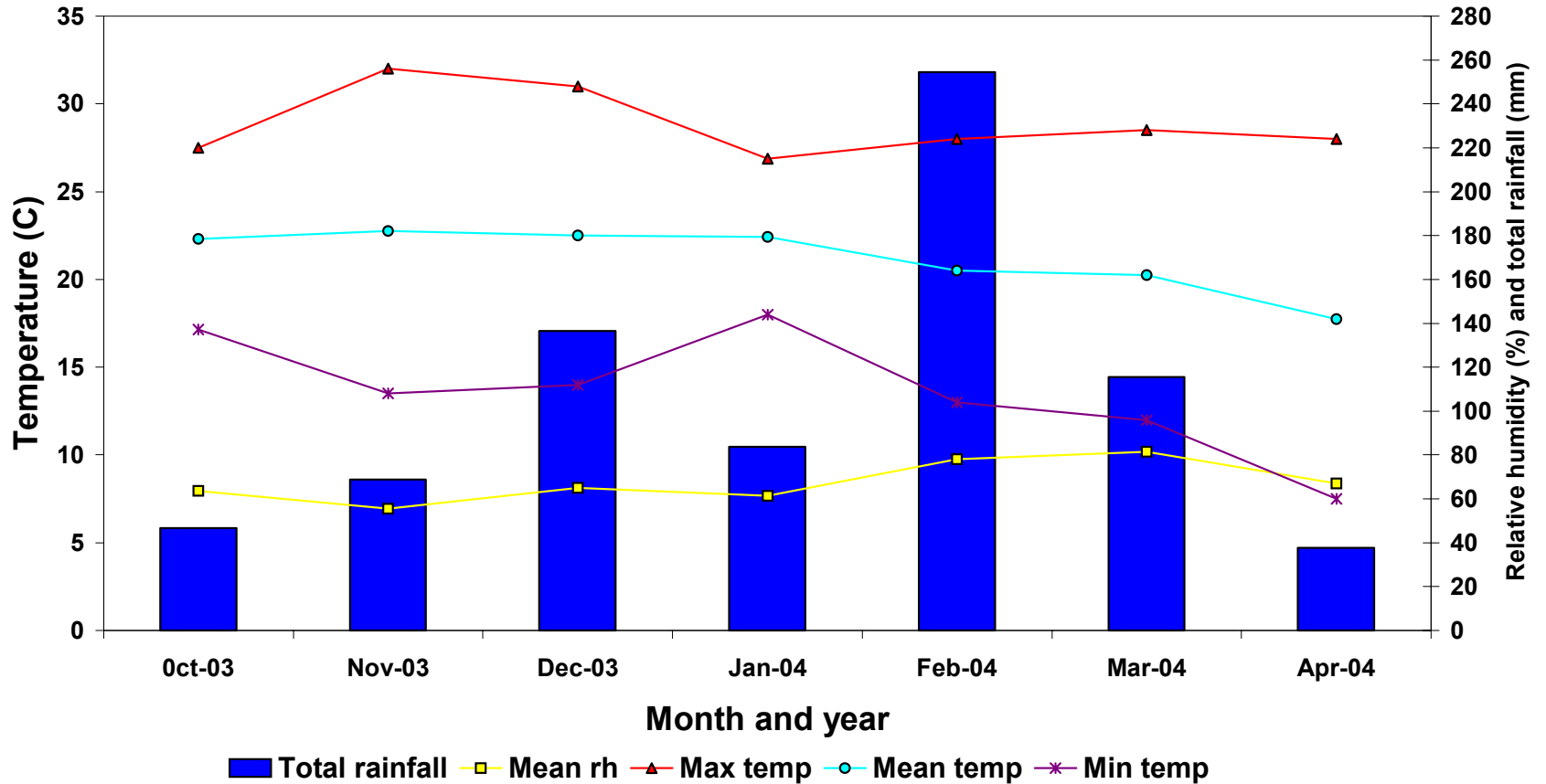
Comparison of mean number of DEAD adult insects/kg per species on maize grain treated with different protectants during 2003/04 storage season, Harare, Zimbabwe (n=4)



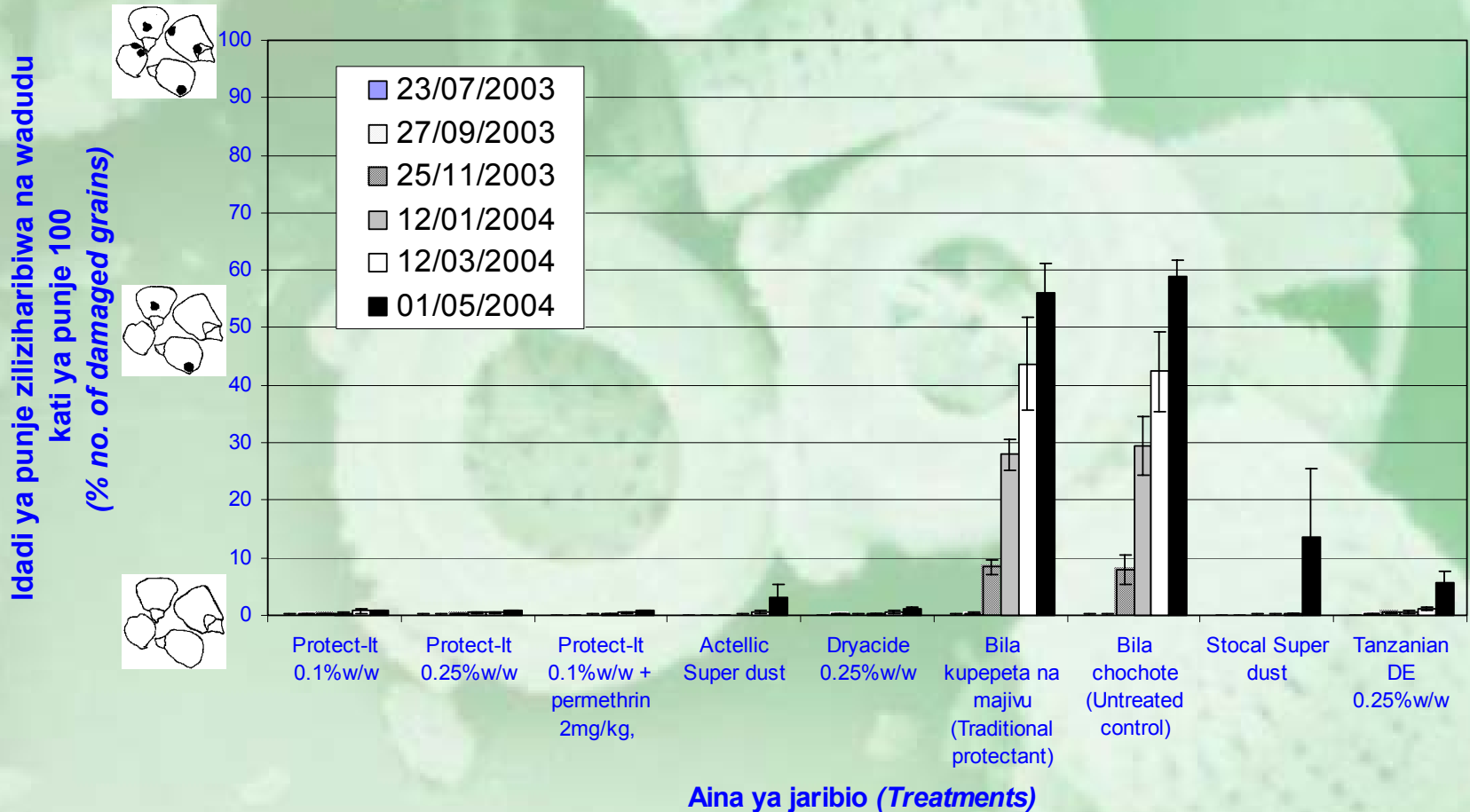
Mean moisture content (%) of grain samples, 2003/2004 storage season, Harare (n=4)



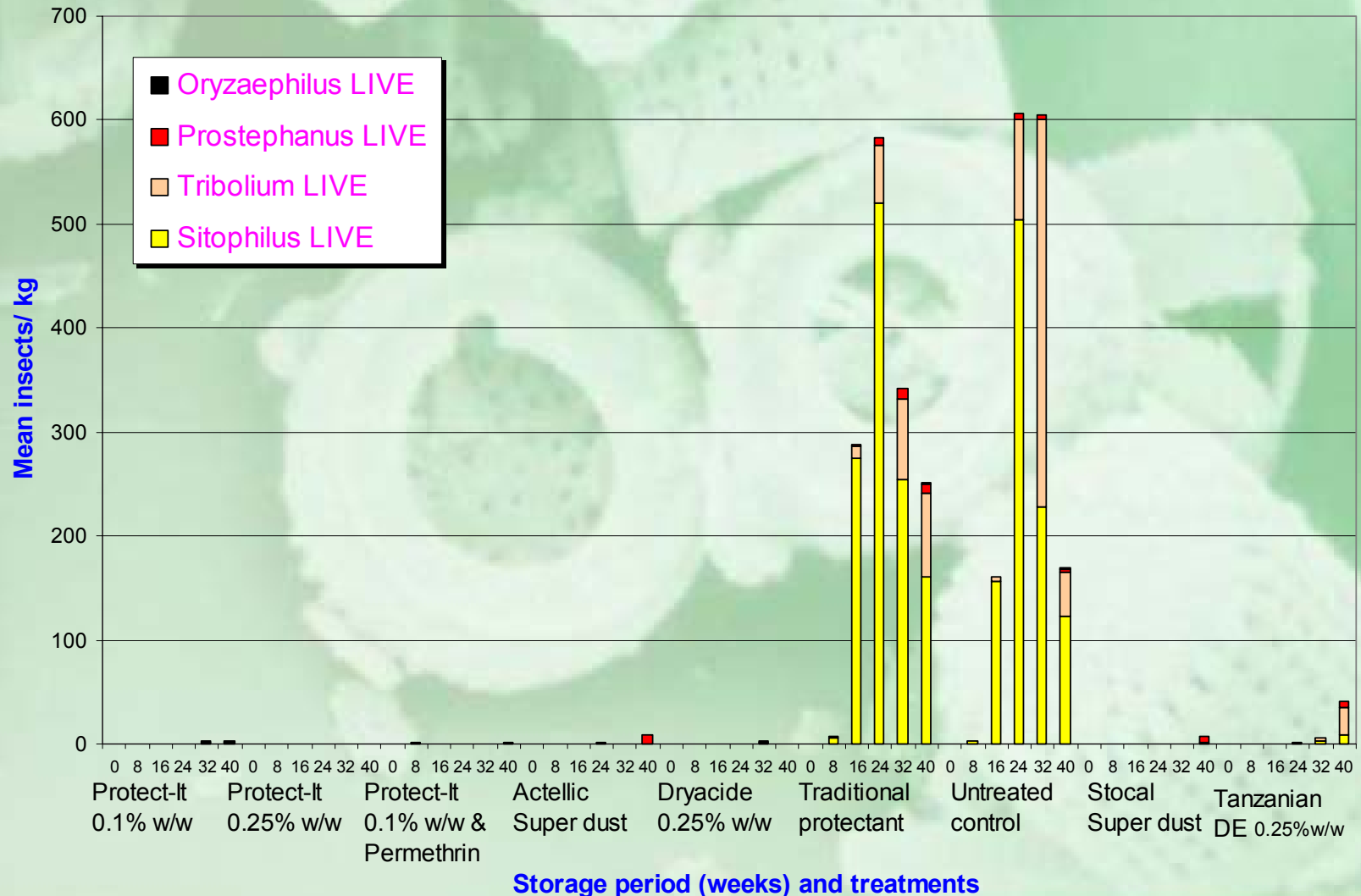
Met data - Harare



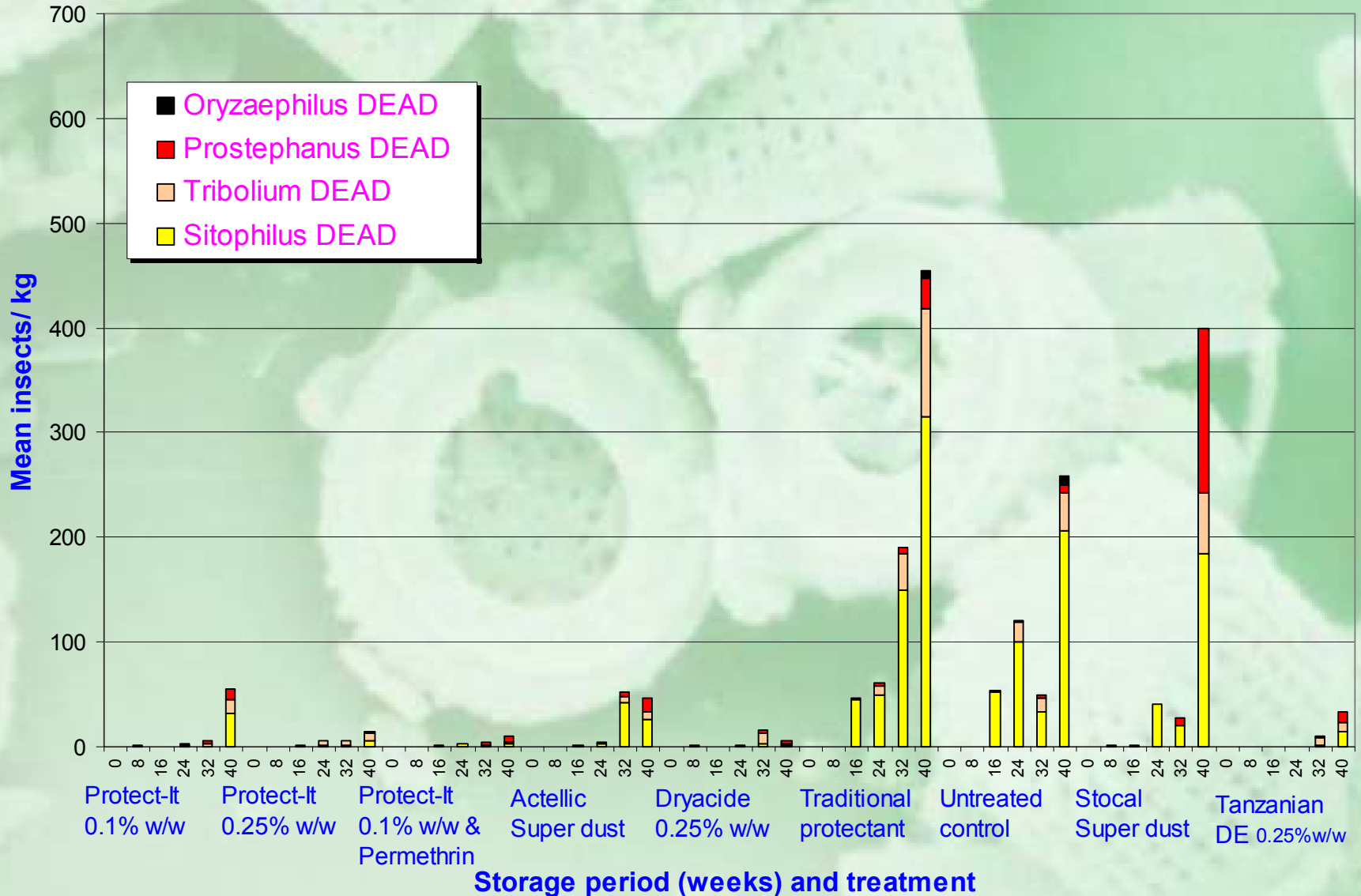
Maize grain protection trials, Mlali village, Kongwa district (2003/04)



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



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.

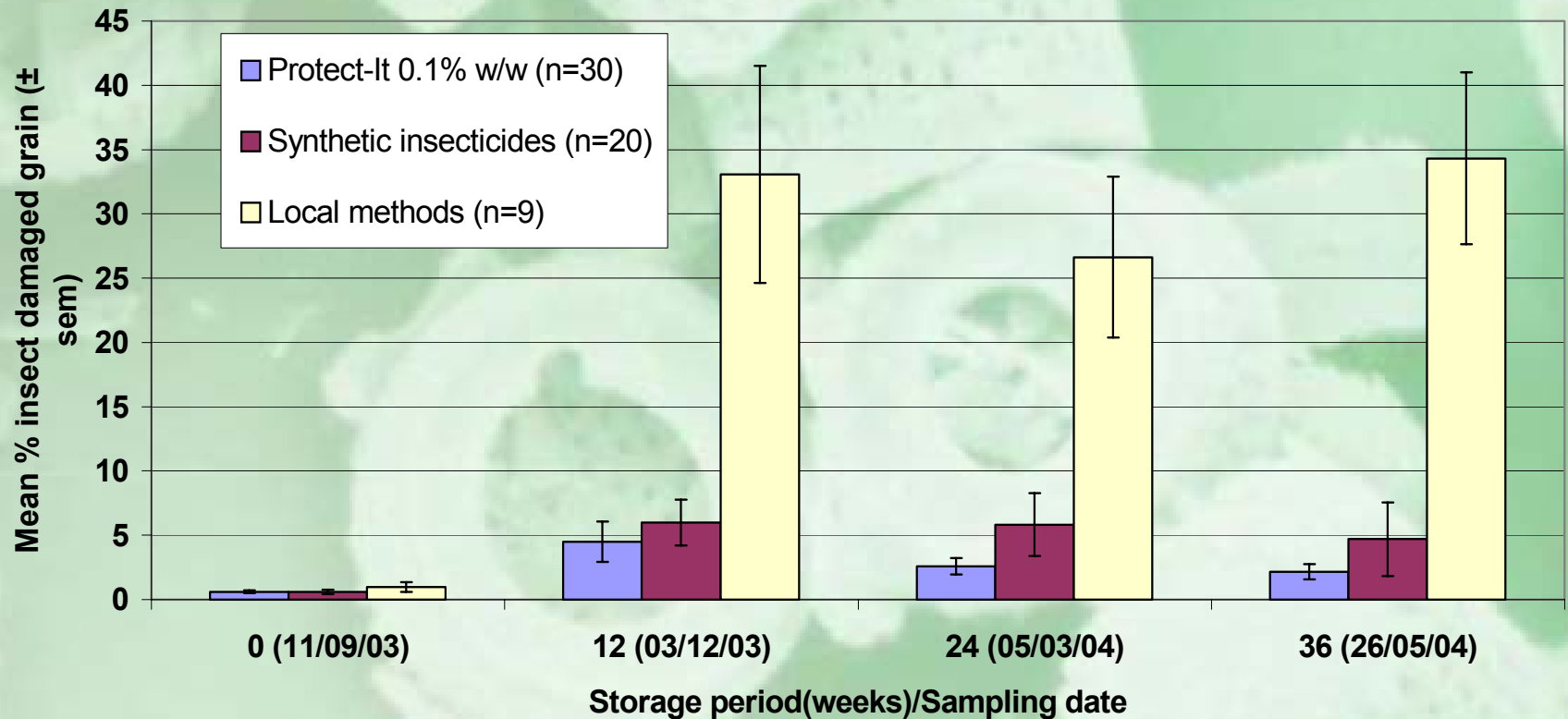
1 sack of maize grain treated with Protect-It (at 250g/100kg), after 10 months storage

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



Esther's trial, Mlali village, Tanzania

Farmer managed trial: performance of Protect-It DE compared to other farmer grain protection methods, Buhera District, Zimbabwe (2003/04)



Challenges/Gaps

- Farmer expectations raised
- Registration of imported DEs
- Consider farmer diversity
- Local exploitation of DEs
- Inadequate challenge of DEs by *Prostephanus truncatus*
- *P. truncatus* Seeding?
- DE combinations with other protectants for bostrichid control?

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The views expressed are not necessarily those of DFID.

R8179. Crop Post Harvest Programme

Visit the DE project website: www.nri.org/de/



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