Small-scale farmer utilisation of diatomaceous earths during storage: Could fossil dusts be an option for increasing food security in sub-Saharan Africa?

Diatomaceous earths, are soft whitish powders formed from the fossils of tiny organisms (planktons) which live in oceans, rivers and lakes. When diatomaceous earths come into contact with insects they absorb the wax from the skin of the insect, the insect then looses water, dehydrates and dies. By mixing diatomaceous earths with grain, we can kill the insects that try and attack the grain. Diatomaceous earths have extremely low toxicity to mammals and are therefore very safe to mix with food.

Following the finding that diatomaceous earths were effective grain protectants against insect damage for small-scale on-farm storage systems in Zimbabwe, further work to evaluate these fossil dusts has been initiated in Tanzania where the larger grain borer is already widespread. The larger grain borer (*Prostephanus truncatus*) is the most destructive of the storage insect pests, causing storage losses of up to 40%. *P. truncatus* is believed to have arrived in Africa from Central America in a food aid shipment in the 1980's. The pest multiplied rapidly and caused such destruction to farm stored maize that farmers in Tanzania marched on parliament demanding help. *P. truncatus* has now spread throughout many countries in East, West and Southern Africa, but to date has not yet reached farmers stores in Zimbabwe. So although the field trials in Zimbabwe showed that diatomaceous earths could offer protection against insect attack for periods longer than 8 months, this was not in the presence of *P. truncatus*.

Farmers throughout Tanzania are known to suffer serious losses to their stored produce due to insect damage. For many people these losses threaten household food security or undermine market returns, which drives them to seek improved but affordable treatment options for their grain during storage.

In addition to many of the traditional storage protectant practices such as admixing with ash or plant materials, and funds allowing they can purchase synthetic chemical pesticides. The main one is Actellic Super dust, an organophosphate-pyrethroid cocktail (pirimiphos methyl and permethrin, respectively). *P. truncatus* is not killed by the organophosphate alone, and insects such as *Sitophilus* spp. are not killed by the pyrethroids so the cocktail is used to control the full spectrum of insect pests.

Unfortunately, since the distribution of this product was privatised, farmers have experienced widespread adulteration problems. One farmer in Shinyanga region actually managed to breed *P. truncatus* in what had been sold to him as Actellic Super dust. The government and the supplier have been working together to try and reduce these problems. New packaging displaying special symbols was issued to help customers identify the authentic product. Lists of registered pesticide distributors in each region were published to facilitate the sale of authentic products to customers.

In response to farmers' demands for alternative grain protectants, a collaborative research project - *Small-scale farmer utilisation of diatomaceous earths during storage* - was launched in June 2002. The collaborators include the Tanzanian Ministry of Agriculture and Food Security, the UK Natural Resources Institute, the University of Zimbabwe, the Zimbabwean Institute of Agricultural Engineering, EcoMark Ltd, and Diatom Research and Consulting, and the project is funded by the DFID Crop Post Harvest Programme.

The 'Small-scale farmer utilisation of diatomaceous earths during storage' project has been designed to explore and identify safe, effective and affordable treatments for rural householders. To do this community research trials have been set up in three regions of Tanzania (Shinyanga, Dodoma, Arusha) to first test and compare the effectiveness of a number of different grain protectants at protecting grain from insect damage during storage under differing environmental conditions. These initial comparative tests are being run for the 8-month storage season from July 2002 - March 2003. The treated commodities include maize, sorghum and beans. The treatments include:

- the diatomaceous earths', Protect-It® and Dryacide® at two concentrations 1g/kg and 2.5g/kg (these concentrations were chosen based on laboratory studies with P. truncatus)
- Protect-It® (1g/kg) in combination with permethrin (2mg/kg)
- Actellic Super dust (100g/90kg)
- Traditional local grain protectant practice, which varies between each trial site but is typically admixture of unwinnowed grain with rice husk or animal dung ash or a mixture of ash and dried plant material,
- Untreated control



These initial storage trials will be analysed for insect presence and damage on a bimonthly basis and evaluated by the communities throughout the 8 month storage period. To optimise the eventual uptake account will be taken of the manner in which different farmers (e.g. by gender, wealth) access and share storage knowledge, and of the mechanisms used by organisations to receive and disseminate information to these groups.

Those grain protectants that are found to be most effective, affordable and safe - will then be further tested by farmers in their own trials during the next storage season. This will not only confirm their effectiveness when used by farmers, but will also establish that they meet the farmers' wider requirements (e.g. their use does not involve unrealistic amounts of work or time, or effect seed viability etc).

The project believes in team-work and participation, and involves collaboration between the organisations mentioned above and: the communities of Mlali village in Dodoma region, Mwama karanga and Kishapu villages in Shinyanga region, Arri and Singe village in Arusha region; and the NGOs - Africare, Farm Africa, Care, Oxfam, World Vision and the Catholic Dioceses of Shinyanga Agriculture Programme in Tanzania.

Although the diatomaceous earths, Protect-It and Dryacide come from America, diatomaceous earth deposits can also be found in East and Southern Africa. During the first year of the project we will be testing diatomaceous earth samples from Kagera, Dodoma and Singida regions in Tanzania, and from Northern Zimbabwe for efficacy against storage insect pests. If local diatomaceous earth samples look promising they will be included in the community managed grain protection trials during the second storage season.

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