Text Box 1: Post-harvest losses in sub-Saharan Africa (SSA)

- There is a paucity of evidence to support this claim
- victuals are exaggerated
- Research studies are focused on post- harvest losses
- Assessments of the entire value chain of losses, and post-harvest innovations, are crucial
- Impressions are improved at the smallholder level, yet there are local methods that are user-friendly, and economic benefits of innovations.

2007 saw new races of Sesamia nonagrioides from Central America that are adapted to different climates and has new molecular tools to differentiate these new races after releases in the field.

Triple bagging for maize weevil and LGB control

As an alternative to the use of chemical pesticides during storage, triple bagging approach (hermetic sealing paper plastic bags) against maize weevil and the LGB. Originally created for cowpea storage, PICS technology is a simple, low-cost, practical, and effective way to enable resource-poor farmers in Africa to preserve their grain after harvest with minimal losses to stored grains. It also advocates removal of seeds from all parts of the plant before the grain is harvested since the pest enters the maize during the grain is harvested; hence the need for pre-harvest quarantine of maize. It is expected to allow long-term (months) storage of maize without significant losses, and enables farmers to store the maize grain until the commodity has a higher market value.

Analytical review of post-harvest losses in sub-Saharan Africa (SSA)

A review and analysis that will provide evidence of current magnitude of post-harvest losses in SSA, identify the gaps, and give a future outlook to assist decision makers improve the strategies for post-harvest losses.

icicle – Working in Africa for Africa workplaces in sub-Saharan Africa: Small-scale agriculture and food production.

icicle – African Institute for Science for Food and Health – was established in 1982 in direct response to the need for innovative and implementable food and vector control development strategies. It's mandate further extends to conserving and utilising the rich insect biodiversity found in Africa.

icicle contributes to sustained food security in Africa through developing integrated pest management, exploring and assessing alternative options for farmers. The Centre’s post-harvest research focuses on selecting the most effective techniques, which are then tested in farmers’ fields, and are developed on-farm with farmers’ participation. The Centre’s attempt to provide a maggot that is adapted to cooler temperatures.

Biological control of the larger grain borer in ESA

A search for biological control agents of LGB in its areas of origin in Central America in the 1980s and 1990s, revealed the predator Termetrius nigrescens, which is adapted to cooler temperatures.

Stemborer IPM in western Africa

In contrast to eastern Africa, all stemborers in western Africa are indigenous. A comparison of regions of 2006. The wasp got established; however, no post-release surveys have been carried out to evaluate the impact on stemborer populations.

Table: 1

<table>
<thead>
<tr>
<th>Climatic Conditions</th>
<th>Effectiveness</th>
<th>African Predator</th>
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<tbody>
<tr>
<td>Hot-dry climates</td>
<td>Low</td>
<td>T. nigrescens</td>
</tr>
<tr>
<td>Cool-climates</td>
<td>High</td>
<td>T. nigrescens</td>
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</tbody>
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as Tek-o-Rex sisal, which did not exist in SSA, was introduced and released in Kenya in 2005, and has been successful in different release sites.

Mould-infected maize cobse pose a serious health threat to humans and animals, since the moulds grow on grains damaged by insects and storage pests. The moulds are adapted to cooler temperatures.

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Improved technologies are impractical at the smallholder level, yet there are local methods that are easy to handle, and economic benefits of innovations.

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Top: The LGB invades maize plants through the shank, where it is a grain beetle that supplies most of the region with maize staple; the grain-mold stemborers in SSA has affected farmers in SSA, especially in ESA, wasp Cotesia spp., which is parasitising the African maize stemborer in highland ESA, is rarely found in SSA and has been recovered in different release sites. In contrast to eastern Africa, all stemborers in western Africa are indigenous. A comparison of regions of 2006. The wasp got established; however, no post-release surveys have been carried out to evaluate the impact on stemborer populations.

New molecules to control stemborer pests

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In East Africa, maize has been introduced from Central America approximately 500 years ago. In Africa, maize encountered a plethora of indigenous pests that attack the crop in the field and in store.

Two exotic invasive pests were accidentally introduced to Africa, worsening the situation. The first was the spotted stemborer (Ostrinia furnacalis from Asia), which arrived around 40 years ago and spread over the lowlands and mid-altitudes of East and southern Africa (EAS). The second is a borer, Prostephanus truncatus, from Asia and India, which was brought from India and Pakistan, there has been a significant spread over most of sub-Saharan Africa, causing 20–40% of losses in stored grain, depending on the region. This pest has spread from South Africa to the rest of the continent, and currently is a matter of time before it spreads to Central and West Africa. Modelling shows that it is a matter of time before it spreads to Central and West Africa.

The complex of indigenous African and invasive borer species that attack maize, together, causes partial losses of 30–60% in sub-Saharan Africa, which could feed 37 million people. Aside from the stemborer, the maize weevil, Sitophilus zeamais, and the grain moth, Sitotroga cerealella, are significant maize pests. The maize weevil has been a constant problem in East Africa. This pest is poisonous to people and animals, and endemic to Africa, where it is considered a pest when the maize is stored on the cob, and not as shelled grain.

The maize weevil is a borer known as Protoparthenos sordidus, or the maize or parthenos weevil. In East Africa, maize is a food crop that has been extensively intensively managed for centuries. Maize is a key crop in sub-Saharan Africa but is vulnerable to pests and diseases that can significantly impact its productivity. The spread of invasive pests such as stemborers and storage pests is a significant concern for farmers, as these pests can cause significant losses in stored grain. The maize weevil is a major pest in Africa, causing significant damage to stored maize and other crops.

Control

Stemborers, weevils, and storage pests are interlinked; thus, the stemborer program in Africa will also reduce problems with other pests. Because both the spotted stemborer and maize weevil cause significant losses in storage, it is crucial to develop integrated pest management (IPM) strategies that address both pests. The spotted stemborer is a significant pest in East Africa, causing significant losses in stored grain and affecting the production of maize and other crops. The maize weevil is another significant pest in Africa, causing significant losses in stored maize and other crops.

Farmers have intercropped their maize with a legume for control of stemborers. The net present value from the programme over the period 1993–2013 is US$ 39 million for Zambia. Estimates of the internal rate of return (IRR) of the BP programme is on average 57,400 persons (consumer and producers) per year in Kenya, 44,120 persons in Mozambique, and 36,170 persons in Zambia, representing an annual average of 0.35, 0.25 and 0.20% towards reducing total poverty in each of the three countries.

Biological control in East and southern Africa

In the early 1960s, the maize weevil was introduced to East Africa, causing significant losses in stored maize. To combat this pest, the wasp Cotesia flavipes was introduced from Asia. However, its populations declined. In recent years, the wasp has been reintroduced to the region, with promising results. The wasp is a natural enemy of the maize weevil, and its reintroduction has led to significant reductions in maize weevil populations. The wasp is a parasitoid that lays its eggs on the maize weevil, and the larvae develop inside the weevil, eventually killing it. The wasp and its natural enemy often results in keeping pest populations in control, making it a sustainable and environmentally friendly approach for pest control.

Other potential benefits include increase in caloric intake of households (as a result of producing more maize, decrease in number of empty stomachs, reduction in number of households affected by food insecurity, and decrease in number of cases of maize weevil damage), and ability to conserve biodiversity (as a result of introducing the parasitoid wasp, which has the potential to control the maize weevil). After these successes in Kenya, the wasp was released and got established between 1998 and 2000 in Ethiopia, Somalia, Malawi, Mozambique, Tanzania, Zanzibar, and Zimbabwe. While the wasp imported from Asia is keeping the exotic spotted stemborer under control, the indigenous African stemborers remain a major problem for farmers. For example, the wasp imported from Russia, the African maize stemborer, which is a serious pest in the cooler areas of SSA. While it attacks maize, it is not a major pest in Central Africa, it is the main maize pest across all altitudes, from the humid forest to the mountain areas. The existence of different geographic races of the pest that vary in their requirement explains these differences, and also the differences in natural enemy species occurring in the different regions. The latter opens up avenues for the ‘redistribution’ biological control approach. Redistribution implies the expansion of the geographic range of a natural enemy to areas where it did not exist. For example, a tiny egg parasitoid from Asia that is biological control in East and southern Africa