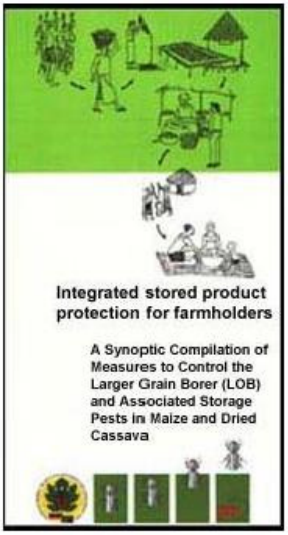

Integrated stored product protection for farmholders

A Synoptic Compilation of Measures to Control the Larger Grain Borer (LOB) and Associated Storage Pests in Maize and Dried Cassava

Elaborated

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Content

Preface

From the economic point of view and in terms of protection of the natural resources, it is much more reasonable to protect harvested produce against loss than to invest in further increases of the agricultural production. According to investigations made by GTZ 5 to 30 % of the African maize and cassava harvest is destroyed after six to eight months of storage by stored product pests. The losses depend on the storage s ystem and the presence of the Larger Grain Borer (LGB), which is particularly devastating. According to FAO statistics the overall production of maize in Africa is 36 million t per year. Tak ing into account that three quarters of the total harvest are stored at farm level, the minimum losses amount to 1.35 million t every year. Much of these losses can be prevented using integrated post-harvest protection measures.

Integrated post-harvest protection on the farm level means the selection of appropriate measures according to the specific situation on every s ingle farm. Integrated post-harvest loss prevention combines profitability with the protection of the natural resources. There are various possibilities to reduce or completely avoid the use of chemical stored product protectants. It is the task of the farmers and the extensionists to analyse the needs carefully before choosing the measures that suit them best. Criteria like simplicity, availability, cost, labour expense must always be taken into account. In this context, the extension brochure is intended to contribute to post-harvest loss reduction and to the improvement of food securit y.

However, there is a high demand for ready-made Integrated post-harvest packages which can be transmitted to the farmers in a Top-down approach. Such approaches will invariably fail, because

they do not take into account the socio-cultural and economic conditions which may prevail in a particular case. The present leaflet cannot cover all these conditions. Instead, it gives an overview of commonly practiced methods and measures to control the LOB and other stored product pests including the prevention of mould development. Methods which do not include the use of synthetic insecticides are particularly recommended in this leaflet.

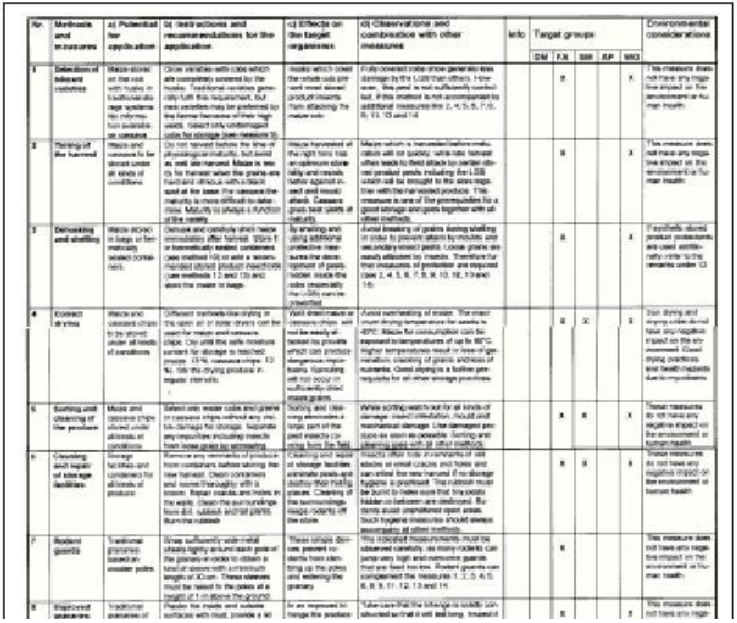
Improved post-harvest protection allows the farmers to profit from the annual fluctuations of the mark et prizes by s elling quality products at the time when the prizes are high. By this the farmers can considerably increase their incomes, because the price fluctuations are often much more important than the monetary value of post-harvest losses.

The contents of the leaflet are presented in a matrix which provides a quick access to the relevant information. The single elements included must be combined by the users of the leaflet in order to form integrated stored product protection schemes that meet the above mentioned requirements.

The leaflet is primarily directed to extension workers and subject matter specialists who are the main transmitters of agricultural innovations. The methods and measures listed below may concern different target groups. Therefore, the target groups are indicated in the matrix using the following abbreviations:

DM Decis ion makers
FA Farmers
SM Store managers
AP Applicators of insecticides to protect stored products (commercial and private)
WO Women in rural households

The numbers indicated in the column "Info" refer to the publications listed under "Further information at the end of this leaflet.



Nr.	Methods and processes	a) Potential for application	b) Restrictions and recommendations for the application	c) Effects on the target organisms	d) Observations and combination with other measures	Info	Target groups: SM	FA	SW	AP	WO	Environmental considerations
1	Selection of tolerant varieties	Maize stored on the cob in traditional storage systems (no information available on resource	Close relation with Lobs which are commonly screened for the models. Traditional varieties gene-rally lack this requirement, but new varieties may be preferred by the farmer because of their high yields. Search only undamaged cobs for storage (see measure 3)	Insects which bore the whole cob are controlled to a high level, but other insects and moulds attack. Cessano grain test grains at harvest.	Fully covered cobs show generally less damage by the Lobs than others. However, this seed is not sufficiently controlled but. If this measure is not accompanied by additional measures (no. 2, 4, 5, 6, 7, 8, 9, 10, 12 and 14			X			X	The measure does not have any negative impact on the environment or human health.
2	Timing of the harvest	Maize and cassava to be stored under all kinds of conditions	Do not harvest before the time of physiological maturity, but avoid as well late harvest. Maize is ready for harvest when the grains are hard and difficult with a blade spud at the base (for cassava the maturity is more difficult to determine. Maturity is always a function of the variety.	Maize harvested at the right time has an optimum storability and insects, mainly against in-sect and mould attack. Cassava gives best yields at maturity.	Maize which is harvested before maturation will not quickly, while late harvest often leads to field attack by beetles as well as pre-dried seeds including the LGB, which will be brought to the store-rage. Also with the rust-tested produce. This measure is one of the prerequisites for a good storage and goes together with all other methods.			X			X	The measure does not have any negative impact on the environment or human health.
3	Dehusking and shelling	Maize (ECM) in bags or traditionally stored cobs (with husk).	Dehusk and carefully check maize immediately after harvest. Store it in hermetically sealed containers (see methods 10) or add a recommended stored product insecticide (see methods 12 and 13) and store the maize in bags.	By shelling and using additional protective measures the destruction of pests, which stock the cobs (mainly the LGB) can be prevented.	Avoid breaking of grains during shelling in order to prevent attack by moulds and secondary insect pests. Loose grains demand additional so metals. Therefore for their treatment, of protection are required (see 1, 4, 5, 8, 7, 8, 9, 10, 12, 13 and 14).			X			X	Synthetic stored product protectants are used accordingly refer to the remarks under 13.
4	Kontact drying	Maize and cassava chips to be stored under all kinds of conditions	Different methods like drying in the open air or solar dryers can be used for maize and cassava chips. Do until the safe moisture content for storage is reached (maize: 13%, cassava chips: 10 %). Use the drying process in-dependent intervals.	Fast dried maize or cassava chips will not be easily attacked by insects. Drying also prevents certain pests dangerous mycotoxins forming. Sprouting will not occur in sufficiently dried maize grains.	Avoid overheating of maize. The insect mount during temperatures of above + 45°C. Maize for consumption can be exposed to temperatures of up to 60°C. Higher temperatures result in loss of germination, cracking of grains and loss of nutrients. Good storage is a further prerequisite for all other storage practices.			X	X		X	Sun drying and drying under direct heat are negative impact on the environment. Wood drying practices and health hazards due to mycotoxins.
5	Sorting and cleaning of the produce	Maize and cassava chips stored under all kinds of conditions	Select only sound cobs and grains or cassava chips without any mechanical damage. Separate any impurities including insects from loose grain by winnowing.	Sorting and cleaning eliminates a large part of the pest insects as well as from the field.	Where sorting was to out for all kinds of damage (insect infestation, mould and mechanical damage. Use damaged produce as soon as possible. Sorting and cleaning goes with all other methods.			X	X		X	These measures do not have any negative impact on the environment or human health.
6	Cleaning and repair of storage facilities	Storage facilities and containers for all kinds of products	Remove any remnants of products from containers before storing the new harvest. Clean containers and rooms thoroughly with a broom. Repair cracks and holes in the walls. Clean the surroundings from dirt, rubbish and plants. Burn the rubbish.	Cleaning and repair of storage facilities eliminate pests and destroy their hiding places. Cleaning of the surroundings keeps rodents off the store.	Insects often hide in remnants of old sacks or wood cracks and holes and specialized that new harvest. If no storage hygiene is practiced. The rubbish must be burnt to make sure that the pests hidden in between are destroyed. Rodents avoid unprotected open areas. Such hygiene measures should always accompany all other methods.			X	X		X	These measures do not have any negative impact on the environment or human health.
7	Rodent guards	Traditional granaries (wooden or wooden poles)	Store sufficiently wide metal sheets tightly around each pole of the granary or wires to obtain a funnel-shape with a minimum height of 40cm. These sleeves must be fastened to the poles at a height of 1 m above the ground.	These simple devices prevent rodents from climbing up the poles and entering the granary.	Only intact and smooth metal sheets are observed carefully - as many rodents can jump very high and nimble. guards that are fixed too low. Rodent guards can complement the measures 1, 2, 3, 4, 5, 6, 8, 9, 11, 12, 13 and 14.			X				This measure does not have any negative impact on the environment or human health.
8	Improved granaries	Traditional granaries of	Repair the roofs and outside surfaces with mud, provide a lid	In an improved building the products	Observe that the storage is usually constructed so that it will last long. Instead of			X			X	This measure does not have any nega-

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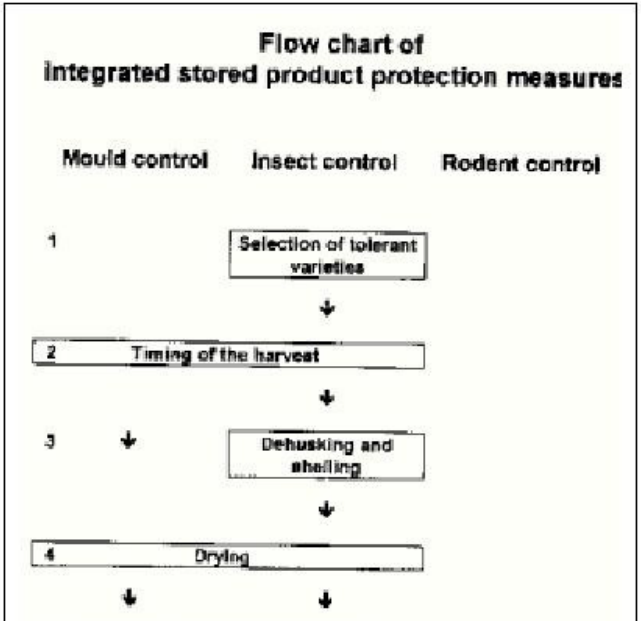
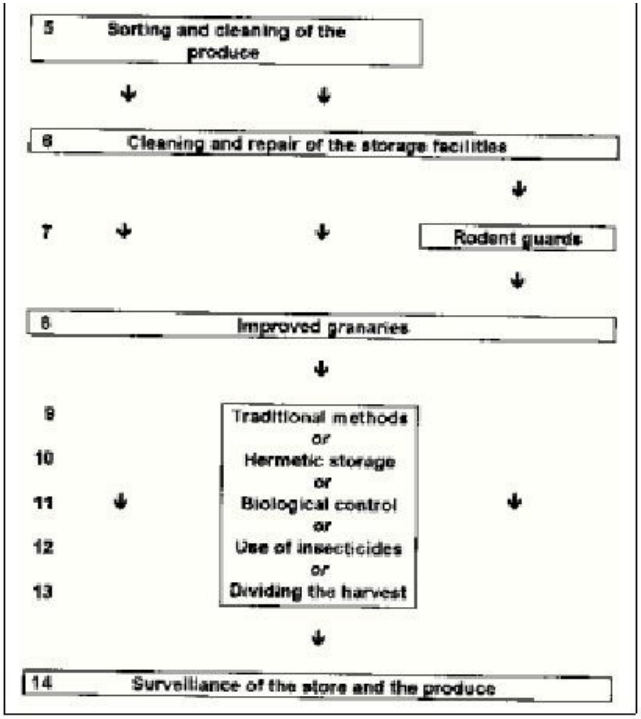
Further information

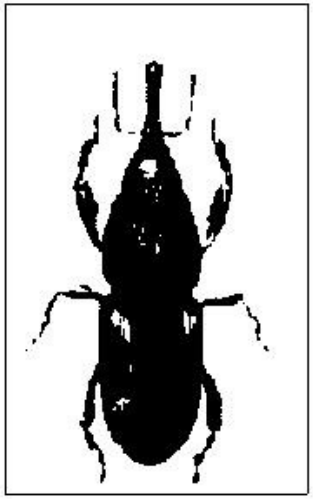
Special extension leaflets and brochures on some of the measures listed in this matrix have been published by this and other post-harvest projects of GTZ. They are listed below under the numbers appearing in the column "Info" of the matrix. These publications can be ordered free of charge from the adresses given in the preface of this leaflet. The languages in which they are available are indicated in brack ets.

1 Traditional Means and Methods of Stored Product Protection (english/french)
2 Plant-derived Products as Protectants against the Larger Grain Borer *(Prostephanus truncates)* and other Stored-food Pests (english/french)
3 Protecting stored maize cobs against pests by the use of non chemical products english/french)
4 The Pest from Afar (english/french/german)
5 News from the Larger Grain Borer (english/french)
6 Recommendations on the Use of Teretriosoma *nigrescens* for the Biological Control of *Prostephanus truncates* (english/french)
7 The Use of *Teretriosoma nigrescens* for the Integrated Control of the Larger Grain Borer *(Prostephanus truncates)* (english/french)
8 Getting it Right: Integrated approach for Short and Long Term Post harvest Protection english/french
9 Recommendations for the Choice of Insecticides to Protect Stored Products in the Tropics (english/french)
10 Hifadhi bora ya mahindi ngazi ya kaya (kisuahili)
11 Manual on the Prevention of Post-harvest Grain Losses (english/french/arabic/portuguese)





Flow chart of integrated stored product protection measures



Sitophilus zeamais (maize weevil)

The integrated stored-food protection package

It has proved to be the case that individual measures of stored-food protection the desired result, as storage constitutes merely one element of the complex

Each stage of the system influences the subsequent stages in the simplest case (subsistence farming), the post-harvest system "maize" is characterised by the following stages:

sowing - harvest - transport - drying - sorting - measures of traditional stored-food protection - shelling - processing or consumption

The pack of integrated measures to protect maize cobs against stored-food pests this leaflet, sets in at several of the above-mentioned stages of the s ystem, and following components: comprises the

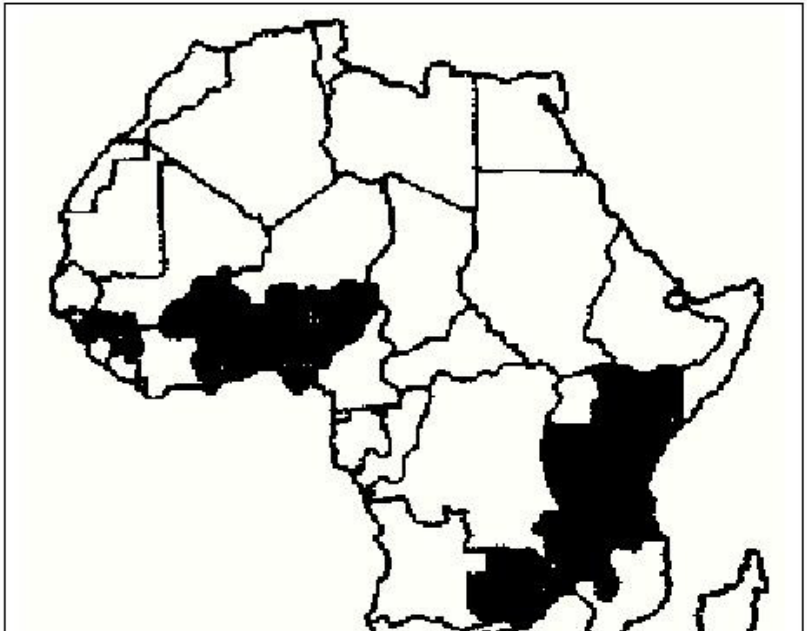
Selection of varieties

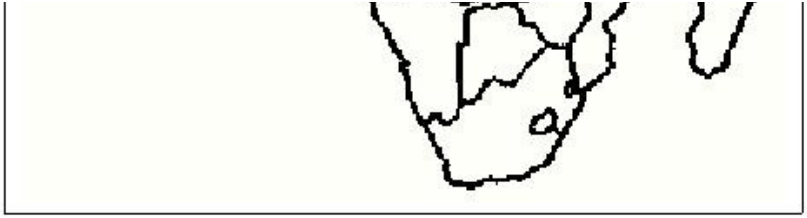
The storage properties of different varieties should already be taken into account when planning cultivation. Local varieties with long husks tightly enclosing the cob are more suitable for traditional storage than high-yielding varieties with short husks Stored product pests infesting maize have very great difficulty penetrating the protecting enclosing leaves. The only exception to this is the larger grain borer, which finds them no obstacle.

Harvest date

It is important to harmonise the framing calendar such that the required labour is available on the best date for harvest. If the harvest is brought forward, there is a risk that the maize will be too moist and later mm mouldy in the store. On the other hand, the longer "he maize remains on the field, and the greater the risk that stored-food pests might already infest the crop in the field, and continue to feed on the maize in the

African countries effected by the Larger Grain Borer





Source: Richard J. Hodges Proceeding of the 6th International Working Conference on Stored-product Protection Canberra, 1994; up-date Albert Bell, October 1996