FARMING-SYSTEM SPECIFIC EXTENSION CONTENT FOR ENHANCING CLIMATE CHANGE ADAPTATION AND RESILIENT FOOD SYSTEMS IN SORGHUM-BASED DRYLAND FARMING SYSTEMS OF TANZANIA AND BURKINA FASO

HARVEST AND POST-HARVEST MANAGEMENT

1.1 CLIMATE CHANGE ADAPTATION AND FOOD SYSTEM ISSUES

Yield levels in arid and semi-arid environments are low because of chronic water stress and very high temperatures that cause the little available moisture to evaporate into the atmosphere. Conserving the little produced is essential to sustain farm households living in this environment. So, the issues targeted by this advisory are:

- How to reduce/ eliminate the losses due to insects without using insecticides?
- How can farmers safely store grains so that they can choose when to sell and/ or have healthy, clean, and insecticide-free food for their families throughout the year?

1.2 ESSENTIAL TECHNICAL INFORMATION

Approximately one-third of the food produced (about 1.3 billion ton), worth about US $1 trillion, is lost globally during postharvest operations every year. According to the World Bank report, sub-Saharan Africa (SSA) alone loses food grains worth about USD 4 billion every year. “Food loss” is defined as food that is available for human consumption but goes unconsumed. Postharvest loss includes the food loss across the food supply chain from harvesting of the crop until its consumption. The losses can broadly be categorized as weight loss due to spoilage, quality loss, nutritional loss, and commercial loss. Insects contribute to these losses. Insecticides are commonly used to reduce the losses they cause. However, they are not sustainably affordable for many rural farmers and - if not properly used - can be harmful to health.

Principally, key technical concerns for which advice has to be given to farmers are:

- Ensuring that the harvested grain has appropriate moisture content. If moisture exceeds the threshold, storage problem may emerge where the grain may grow mould or become more susceptible to insect and fungal damage
- Grain must be stored in cool and dry environment so as to discourage mould growth.

1.3 IMPLEMENTING HARVESTING AND POST-HARVEST PROCESSES

1.3.1 Harvesting

Crop harvesting of dryland cereals is performed manually using hand cutting tools such as sickle, knife, scythe, cutters. A large amount of losses occurs before or during the harvesting operation. Too early harvesting of a crop at high moisture content increases the drying cost,

making it susceptible to mould growth, insect infestation, and resulting in a high amount of broken grains and low milling yields. However, leaving the matured crop un-harvested results in high shattering losses, exposure to birds and rodents attack and rain. Ensure crops are mature and dried at harvest.

1.3.2 Threshing, winnowing and cleaning

This is achieved through rubbing, stripping, or impact action, or using a combination of these actions. The operation is performed manually (trampling, beating), using animal power, or mechanical threshers. Grain should fall on a cemented floor or canvas.

Cleaning through winnowing or otherwise is performed to separate whole grains from broken grains and other foreign materials, such as straw, stones, sand, chaff, and weed seed. Winnowing is the most common method used for cleaning in developing countries. Screening/sifting is another common method of cleaning, which can be performed either manually or mechanically. If not cleaned well, it increases chances of insect infestation and mould growth during storage. This area is important both for human health and marketing. A crop product full of stones and other types of dirt is not good for human health. On the other hand, crop markets continue to be sensitive to quality and standards. Thus, contaminated produce is likely to fetch low value in the markets.

1.3.3 Drying

Grains are harvested at high moisture content to minimize the shattering losses in the field. The recommended moisture content for storage is at about 13%. Inadequate drying results in mould growth and significantly high losses during storage and milling. Drying should be performed naturally (sun or shade drying) on cemented floor and canvas or using mechanical dryers.

1.3.4 Storage

High losses happen during storage. There are several storage methods (a) The indigenous storage structures are made of locally available materials (grass, wood, mud etc.) (b) Sacks. For both a and b, there is need to use pesticide properly and requires training and (c) The Purdue Improved Crop Storage (PICS) technology.

This advisory focuses on the PICS technology because it is relatively new.

A PICS bag is made of a triple layer composed of two polyethylene bags and one outer woven polypropylene bag. It minimizes insect storage losses by limiting the supply of oxygen to insects living in stored grain. After PICS bags are closed, insects in stored grain use up much of the oxygen left inside the bag, cease feeding, and stop growing and reproducing and eventually die.

This low-cost technology was developed and initially disseminated for cowpea grain, but it has more recently been found effective for all types of grain and even other products. PICS bags allow farmers to store their grain without the use of insecticides and provides them the flexibility to sell when prices are high, while having chemical-free high-quality food for their families throughout the year.

The bags can be reused for three consecutive seasons and so, they are economically efficient when the benefits are compared with the cost of the bag. The use of PICS bags provides farmers the flexibility to sell their grains when they choose while supplying healthy, clean, and insecticide-free food to their families throughout the year. In addition to the physical bags, low-cost method to store grain and hence improving food availability for millions of farm households.

PICS is one form of integrated pest management (IPM). It is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through *habitat manipulation* of the pest. This technique fits well with the arid and semi-arid sorghum based farming systems where yields are low because of the low precipitation and where saving the little produced is of paramount importance.

The use of PICS bags follows the following steps:

i. Dry the grain until the moisture content is below or equal to 13 % . An easier and practical way of knowing that the grain is sufficiently dry is to bite it between your teeth and it will break with a sharp loud sound.
ii. Place the grain in a clean and dry PICS bag and knit tightly with a proper needle and string and store the bags in a dry cool place.
iii. Open to remove grain for use and re-knit the partially filled bag carefully without leaving any hole that may let in air which would render the grain liable to insect damage.

Figure 11: PICS bags in use