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# Backgrounder on post-harvest activities in soybeans in Malawi

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**Why is this subject important to listeners?**

* Soybean is a versatile legume that is widely grown in Malawi and has numerous uses and many benefits. Malawian soy comprises 8% of southern Africa production and has the potential to earn an equal amount of foreign exchange as tobacco.
* Soybean is mostly grown on small plots by women, but is also grown on larger farms by men, who control most of the land in the Central and Northern Regions of Malawi where most soy is grown.
* Soybean is a labour-intensive crop during planting, but does not require much labour after that.
* Soybean is a profitable crop that can generate cash income to support other agricultural value chains
* Unlike tobacco, soybean does not require curing, so avoids the kind of environmental damage associated with curing.
* As a nitrogen-fixing legume, soybean increases soil fertility, and can be rotated with nitrogen-hungry crops such as maize.

**What are some key facts about soybean?**

* Soybean crop has the capacity to fix atmospheric nitrogen in the soil, thereby improving the soil fertility.
* Soybean does not require a lot of inputs and can be grown by both male and female small-scale farmers.
* Research has proven that soybean responds well to applications of fertilizer and inoculant, and that, coupled with good crop management practices, this leads to increased productivity.
* Soybean has the potential to break the poverty cycle because it can easily generate capital to support other businesses.
* Recommended fertilizers can be applied to soybean. Where farmers cannot afford inorganic fertilizers, soybean inoculants can be used to increase production.
* Nutritionally, Soybean is rich in protein, vegetable oils, and carbohydrates. It also contains minerals such as phosphorus, manganese, folate, copper, calcium, and iron, and vitamins such as thiamine and K1.
* Soybean flour is beneficial for children under five and for pregnant or lactating women and reverses the signs of acute malnutrition that are often prevalent in these groups.
* Soybeans can be processed into oil for industrial uses and is a source of protein for human food and animal feeds. Soy products include soy milk, soy flour, and soy meat, popularly known as soya pieces in Malawi.
* Soy pod residues make a good and nutritious manure, and can be added to soil to replenish fertility. Some women burn soy pods to make local sodas (sodium bicarbonate).

## Major global producers and exporters of soybeans include the United States, Brazil, Argentina, and Paraguay. Malawi was among the top five soybean exporters in sub-Sahara Africa from 2013 to 2017.

* Global soybean markets have been affected by the increased use of soybean products for livestock and human consumption (mainly in China) since the late 1990s.

**What are the major post-harvest challenges with soybean?**

* Soybean has no major post-harvest pests. However, it can be infested with weevils if it is stored for more than one year in poor storage conditions. Hence, many farmers don’t apply chemicals to stored soybean, but simply store it in new bags stacked on raised ground.
* *Harvested soy that has not been threshed, winnowed, separated, and graded*: Many farmers lose soy to rotting if it is not properly handled after harvest either due to poor storage facilities or if they fail to cover it when it rains. Exposure to rain or being stored in a moist and poorly-ventilated area increases the incidence of infection from moulds and other fungi, and of aflatoxin contamination.
* Immediately after harvest, soy prices are usually low but increase gradually as time goes by, though occasionally prices start high and decrease. Farmers’ clubs, co-operatives, contract farming, and aggregating the crop through the warehouse receipt system can help farmers get fair prices. Ensuring that the set minimum farm gate prices are adhered to and enforced could also ensure that soybean prices don’t become fragile in Malawi.
* Farmers often cannot wait for better prices because soybean is their major cash crop and they are desperate for money after a long growing season without it. The warehouse receipt system can solve this problem.

**Gender aspects of post-harvest soybean activities**

* Women conduct most post-harvest activities on soybean.
* Harvesting and transporting soybean into and out of the shade for drying, grading, and sorting is mostly done by women working as hired labourers for cash wages.
* Women have expertise in winnowing in Malawi and are hired because they generally achieve good results with very low losses.
* Men are mostly responsible for weighing and putting soy in stacks in the storage area.
* Women mostly conduct secondary proceeding in households, but men are mostly responsible for processing at commercial and industrial levels.
* Women farmers can significantly benefit when seed is given to female-headed families. In the 2021 season, good market prices are helping many women to break the cycle of poverty.
* Various non-government organizations support both men and women to grow soybeans.
* While women can sell in farmer groups or co-operatives, in a family, men usually need to authorize soybean sales. If a woman sells without consent of a man, it is said to be stealing.
* Soybean sales help many farmers pay their children’s school fees. When prices are low, farmers are forced to sell other crops such as maize to help them meet domestic needs.

**Impact of climate change on post-harvest soybean activities**

* Early cessation of rain is a climate change-related challenge for post-harvest activities in soybeans. When rains stop abruptly after soy is mature and the crop dries quickly, it must be harvested quickly and all at the same time regardless of the time the crop was planted. If harvesting is delayed, the crop is likely to shatter.
* Some soybean-growing areas have extended rainfall, leading to high levels of loss from rotting, discolouration, and seeds that either fail to geminate or germinate poorly because of high levels of moisture. High moisture levels in the seed affect the drying process and slow drying may result in poor seed quality. The slow drying also means that the crop can take longer to attain the moisture level at which it can be stored. If farmers are not careful during this period, their soybeans can be contaminated with aflatoxins.
* Sometimes, soy that is temporarily stored on the verandas of farmers’ houses may become soaked with rain because farmers believe the rains have stopped. Thus, when it rains abruptly, there is inadequate labour to safely move soybeans to a proper storage area.

### Key information about post-harvest activities for soybean

## *Harvesting*

* Mow with a sickle when the soybean crop is fully mature and plants are dead or leaves brownish, leaving the roots in the soil. Depending on the variety, the maturity period ranges from 120 to 140 days after emergence.
* It is recommended to harvest in the morning when temperatures are cool to avoid losses from shattering of pods during uprooting or cutting or when transporting soy from the field.
* If different varieties were planted, harvest and store each variety separately in a cool, dry, and aerated place to avoid excess moisture that may trigger germination, enabling fungal infections, and grains losing their golden colour. This also avoids mixing varieties.
* Storing undried soy pods in a poorly-aerated place can result in aflatoxin contamination.

*Drying*

* Move soybean from the storage shed to the sun every day for sun drying, returning it to the shed in the evening to avoid rainwater and dew.
* Sun-dry soybean in a tent (plastic mat) or on a rack when still in pods at a temperature of not more than 60 degrees Celsius.
* Alternatively, dry in the shed if the shed allows sufficient dry heat.
* Pods are dry when they easily burst and the bean cannot be easily depressed by a fingernail.

*Threshing*

* When pods easily open after gentle beating with a stick, beat soybean pods lightly on a mat or tent that excludes particles of sand. Pods will shatter and release beans with a light beating. Alternatively, pods can be lightly beaten inside a bag to avoid scattering the grain to areas not covered by the mat.
* Gentle beating avoids damaging grains by deforming or cracking them. Heavy beating can destroy the embryo and negatively affect germination and overall seed quality.
* Minimize threshing losses by threshing during the day when it is hot and all pods are completely dry.
* Some farmers use mechanical threshers to process soybean.

## *Winnowing:*

* Winnowing involves separating the pods from the grains.
* Blowing the grains in a windy place can separate the heavier grains from the lighter pods (chaff) that are blown away by the wind.

## *Separation (also known as selection)*

* Separation involves hand removal of pod covers, soil, sand, and unopened pods. Unopened pods are more common if threshing is conducted too early when it’s still cool or too late when the pods are too cool and have absorbed moisture.
* During separation, farmers open unopened pods by hand.

*Grading:*

* The purpose of grading is to remove grains that are discoloured, diseased, cracked, insect-damaged, or shrivelled, and any debris and foreign matter.
* Grading can also remove other soybean varieties accidently present because of recycling of the previous year’s seeds.

# *Storage*

* Soybean should not be stored in pods for a long time. Farmers can keep soybeans in pods for a short time to facilitate drying and so complete primary processing. Primary processing includes threshing, winnowing, separating, and grading. Secondary processing includes the procedures that transform graded soybeans into edible products through roasting and grinding into milk, soy meat, oil, and other products.
* Soybean that is stored in pods with moisture levels of more than 10-15% in a drying area that is not well-aerated runs the risk of rotting and aflatoxin contamination.
* Soy in pods that is being primary processed or in bags waiting for secondary processing and marketing should be stored in a well-ventilated shed that is raised off the ground on a shelf or platform.
* Primary-processed soybeans with less than 10% moisture that cannot be easily depressed with a fingernail or in between the teeth can be stored in bags after grading.
* Weigh bags to ensure that all bags have equal weight and then sew them shut. Bags of equal weight are easy to stack, count, and tabulate to calculate the total harvest.
* In Malawi, the most popular bags for storing soybeans are those that hold 50 kilograms and are made of polythene.
* Bags should not be in contact with the floor to avoid absorbing moisture. Moisture encourages rotting of grains and aflatoxin contamination.
* Good platforms and shelves are made of dry wood spaced in a way that allows air to pass under the bags.
* Check the storage area regularly to ensure good aeration if keeping bags for more than three months.
* Farmers can store their soybeans as individuals at their homes or at a co-operative warehouse. Alternatively, they can use their soy as a loan surety when storing it at a *receipt system registered warehouse.* In Malawi, Agricultural Commodity Exchange (ACE) manages the warehouse registry server.
* The way farmers are organized—whether in a group or as individuals—affects the storage system used, as well as the method of marketing and the market price.

*Managing aflatoxins*

* Aflatoxins are a family of toxins produced by certain fungi (*Aspergillus flavus and Aspergillus parasiticus*) that are found on crops such as maize, legumes such as groundnuts and soy, cottonseed, and many others. These fungi are abundant in warm and humid regions of the world.
* Aflatoxins are dangerous poisons that cause cancer, including liver cancer, in human beings if consumed above a certain threshold. Many countries that import soybeans and groundnuts from humid regions assess the levels of aflatoxins in these crops before importing them. Therefore, poor handling of soybean when during harvesting, shelling, and storage can result in a country losing its export market.
* If soybean becomes soaked by rain, takes longer to dry and the storage area is poorly aerated, they are more likely to be contaminated with aflatoxins. Because of the dangers of fungal infection and aflatoxin contamination, farmers harvest soy in stages, gathering only as much as they can process. This aligns with planting strategies to sow in stages. Thus, a field of soy typically includes stands or zones that mature at different times, and these zones are harvested one at a time. Planting dates can be different from one farm to another and, depend on the timing of the first rains, may differ by weeks between different zones of the country. If there are daily rains or the soil can hold moisture for a long time, then differences in planting times are minimal.

*Using inoculants*

* The rhizobia bacteria in the inoculant form a symbiotic relationship with the soybean plant to create root nodules/swellings that act as small “factories” to fix atmospheric nitrogen.
* The decision on whether to use inoculants before planting soybean depends on the variety of soybean and the land cropping history.
* Under normal conditions, soybeans do not need nitrogen fertilizer as the nodules fix sufficient nitrogen for optimum growth. However, it is recommended to apply inorganic or organic fertilizers with high levels of phosphorus.
* If soybeans have been grown recently on land and were well-nodulated, re-inoculation is probably not necessary. But if there is any question about the abundance of nodule-forming bacteria in the soil, or if the land has no history of soybean production, inoculation of soybeans is recommended.
* Inoculant is produced in research stations at Chitedze and Bvumbwe. It is also available on demand at research stations such as Lunyangwa, Chitala, or Makoka. Private entities such as Agriculture Input Supplies Limited also produce and sell inoculant.
* Farmers can store inoculant in a cool place for up to 2-3 weeks. Otherwise, it must be kept in refrigerators.
* Malawian inoculant is packed in 50-gram packages, enough to inoculate 10-15 kg of seed.
* Farmers may need 65-80 kg of soybean seed per hectare, depending on the size of the seed. The smaller the seeds, the lower the weight of seeds that you will need. Generally, 300-400 grams of inoculant is enough for one hectare.
* Use a plastic bucket when mixing inoculant with soybean. Mixing inoculant with soybean seed should always be done under shade, and seed should be spread to dry for 20 minutes before it is planted.
  + *Mixing:*
    - Add 20 g of sugar (a match box or 4 teaspoons full) to 200 mls of water (three-quarters of a glass Coke bottle full) and mix until all the sugar is dissolved. This liquid is called a sticker.
    - Mix 200 ml of sticker with 10 to 15 kg of soybean in a plastic bucket until the seed is evenly coated with the sticker. Then, add 50 g of inoculant and mix until all soybeans are coated.
    - Thus, 20 ml (four teaspoons full) of sticker and a teaspoon of inoculant (5 grams) is enough for one kilogram of soybean seed.
* Inoculants lose their effectiveness when stored in an open package. Always store inoculants in their original package and use them quickly after opening the bag. Inoculated seed should be planted within 24 hours.
* Seeds should be coated with inoculant just before planting. Thus, farmers should inoculate just enough seed for that day’s planting.

# Marketing

Marketing refers to activities that farmers undertake to promote and sell a product or service. It includes advertising, selling, and delivering products to consumers/customers and businesses. Farmers should keep the following marketing considerations in mind:

* Farmer group members can benefit from collective marketing arrangements—for example, using aggregation centres where farmers pool their soybean bags together, *warehouse receipt systems*, and *contract farming*. (See below)
* Aim to receive a reasonable price as calculated through a gross margin analysis \*. In Malawi, the government calculates the gross margin and advertises minimum farm gate prices, and farmers are strongly encouraged not to sell below those prices. While there is no legal punishment for selling low, the community can sanction the buyer in various ways.
* Check scales at the market to ensure they are accurate and avoid being cheated. For example, farmers could use a known weight, such as a 1-kg packet of sugar, to check scales used by buyers. Also, farmers should ensure that buyers’ scales have a current certification mark from the Malawi Bureau of Standards.

## *Bargaining tips*

To get the best price for their soybean, farmers should consider forming farmer groups or co-operatives, attending Farmer Business Schools, using a warehouse receipt system, and engaging in contract farming.

* Soybean is an international crop that is exportable. Thus, when looking for a market, farmers should stretch their net wide.

*Contract farming*

Contract farming involves agreements between a farmer or group of farmers and a processing and/or marketing firm to produce and supply agricultural products under contract, frequently at pre-determined prices. The contractor often provides technical advice on production and sometimes provides farming inputs, while the farmer commits to providing a specific amount of a particular crop grown and delivered in accordance with specific quality standards.

* In Malawi, elements of contract farming date back to the 1970s when a parastatal crop authority and large commercial farming estates provided extension services, training, input credits, and marketing services to farmers and bought farmers’ produce at pre-determined prices. Farmers provided land and labour for growing crops or raising animals.
* *Risks of contract farming*: Since the mid-1990s, there have been cases of produce theft by contractors. This is mainly attributed to the absence of a clear policy framework and legislation regarding contract farming in Malawi. Thus, farmers need to exercise caution when considering contract farming.

## **Farmer groups and co-operatives**

* Farmers’ organizations provide training to members on how to handle activities throughout the soybean value chain.
* Marketing co-operatives enable farmers to more easily find markets and get higher prices because they sell larger quantities of produce. Aggregating produce reduces the cost of transport, boosts income because buyers often pay more for aggregated volumes, and provides other benefits. In some cases, large buyers decide that it is worthwhile to pay the transport costs from farmer warehouses.
* Some farmer groups who work with soybeans are formal clubs and pre-date soybean production, while others are informal and collaborate only to market aggregated crops during the marketing season, thereby boosting farmers’ bargaining power.
* One example is Kanadzeka Producers and Marketing Co-operative in central Dowa district near Dzaleka. The co-operative has 105 farmers, including 42 women and six youth. With ACE’s assistance to find markets, the 30 members of the group who were trained by the ACE Marketing School pooled almost 14 tonnes of soybean, which they sold to a large trader at 290 Malawi kwacha /kg, above the prevailing market price of 230 MK/kg.
* Farmers can also store crops through the warehouse receipt system (see below). These crops are kept in an organized warehouse and farmers receive a formal receipt that they can use for various purposes, including borrowing money from banks. Farmers who store crops at a receipt warehouse can form a group to take advantage of quantity discounts. In Malawi, one receipt system organization is the Agricultural Commodity Exchange (ACE).
* NASFAM (National Smallholder Farmers Association of Malawi) is a large co-operative that organizes farmers into smaller groups known as farmers’ clubs. NASFAM has developed manufacturing companies to process farmers’ club products and NASFAM’s technical secretariat manages the co-operative and trains its members. The various clubs in NASFAM form co-operatives and the various co-operatives form the association.
* Each farmers club needs a bank account, and all members need individual bank accounts. Having a bank account reduces the risk of theft associated with physically carrying large sums of money derived from soybean sales.
* A club’s bank account needs at least three signatories, including the chairperson, the secretary, and the treasurer.
* Individual bank accounts may have one or more signatories.
* To open an account, farmers need a national identity card and sometimes a letter from a farmers’ club certifying that their source of funds is farming and they are a member of the club.

## **Warehouse receipt systems**

* The warehouse receipt is considered a guarantee and a surety under the Securities Act. The regulator and holder of warehouse receipts is the Agricultural Commodity Exchange (ACE). ACE’s registry contains information about warehouse receipts for stored produce, which are considered legal documents. Thus, the critical components of a warehouse receipt system include:
  1. certified warehouses,
  2. receipts issued by warehouse operators as a guarantee, and,
  3. the regulator, ACE.
* If a buyer purchases a warehouse receipt from a farmer, or a bank lends out money based on the receipt as a guarantee, the buyer’s or bank’s right to the stored crop is documented in the registry by ACE. This means that both the farmer and the bank are protected because the farmer/owner of the stored crop cannot sell it to others or remove it from the warehouse without ACE’s authorization.

# *Other benefits of a warehouse receipt system*

* The warehouse receipt system promotes good quality storage to reduce post-harvest losses, which are estimated at 15-20% in Malawi.
* Farmer organizations and other buyers often pay low prices for produce, causing farmers to lose money. Because prices at harvest time are traditionally low, the warehouse receipt system enables farmers to securely store their produce while waiting for a better price.
* Rather than farmers selling their products immediately after harvest because they need cash, the warehouse receipt system helps them access finances from banks and other institutions as they wait for better prices. Farmers repay these loans after selling their produce. Also, some co-operatives pay cash to buy soybeans from farmers and add a bonus if they find better prices elsewhere as a way of sharing profits with their members.
* Nearly all domestic banks in Malawi are involved with the warehouse receipt system.
* ACE is constructing warehouses for farmer organizations so they can use warehouse receipt systems and limit their reliance on the private sector. Thus, farmers can deposit their produce in their own organization or co-operative’s warehouse, retain ownership of their produce, and financially benefit when non-members pay to use the warehouse to store their crops.
* The best reason for farmers to wait to sell after harvest is to receive a fair price. In the 2021 season, buyers are already paying more than the minimum price at the opening of the soy marketing season. This promises a good season for soybean farmers and high production next season.

# Farmer Business Schools (FBS)

* The Farmer Business School (FBS) is an approach devel­oped by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), with the support of the Bill & Melinda Gates Foundation and member companies of the World Cocoa Foundation to promote small-scale farmers’ entrepreneurial skills. It was inspired by Farmer Field Schools.
* Farmer Business Schools focus on improv­ing farmers’ business skills, which, along with adopting recommended practices and investing in agricultural production, are a pre­requisite for success in agricultural businesses.
* Farmer Business Schools aim to change farmers’ attitudes by raising their awareness of market opportunities and possibilities to improve productivity, family income, and nutrition. The main message is that farming is a business.

## Farmer Business Schools (FBS) help farmers in several ways.

* They help small-scale farmers produce for the market and make their farms profitable.
* Through FBS, farmers develop a variety of skills, including, for example, how to measure land in order to determine the right amount of inputs for a specific size of farm.
* FBS teach skills such as keeping records and calculating gross margins in order to quantify profit or loss, based on information collected during the farming season.
* FBS bring farmers together to carry out collective actions to address business and marketing problems and respond to opportunities. For example, FBS creates forums for sharing knowledge between farmers through discussion, practical exercises, and self-study.
* FBS teach lessons such as diversifying income-generating crops for profitability and food production.
* FBS result in improved product quality.
* FBS improve the quality of extension services as they are a good way to ensure demand-driven extension, and because extension officers are included as trainees and stakeholders.
* Having an FBS certificate enables farmers to earn trust from lending and financing institutions.

Farmer Business Schools operate in the field just like Farmer Field Schools.

* FBS uses a learning-by doing approach that enables farmers to, while working on their own farms, improve their knowledge, change their attitudes, and learn how to turn their farms into profitable businesses.
* Extension officers and lead farmers are trained and serve as facilitators in seasonal training programs during which farmers work in small groups at agreed times.
* FBS materials are designed to be relevant to and useful for small-scale farmers with limited resources, and are accessible and understandable to participants with basic literacy and numeracy.
* FBS manuals provide step-by-step guidelines that take the facilitator and farmer trainees through the basics of farm business management, using the production cycle on their own farms.

## *FBS tips for selling at the right price*

* To arrive at a fair selling price that enables farmers to make a living, farmers must consider the costs of the different types of practices they use, for example, tillage operations, labour costs (family and hired labour), pest and disease management, transport to market, and many others. With this information, they can calculate the selling price per kilogram required to make a reasonable profit. This is called a *gross margin analysis*. To be reasonable, a price offered by a buyer should be equal to or more than the calculated price.
* Farmers can also compare prices with the previous season and determine whether they need to wait longer before accepting a price or whether they should accept it because prices will begin to decrease.
* In Malawi, farmers can learn how to make these calculations from organizations such as GIZ and the FAO-initiated Farmers Business Schools that are operated in the Farmers Field Schools format.
* Farmers should note that, if they receive a good offer, there is no need to wait, as the price of soybean can decrease and there are costs to continuing to manage the storage facility and protect the crop against insects and rodents.
* Other methods to maximize good prices are using the warehouse receipt system, contract farming, and group sales.
* Keeping written records and an inventory of inputs and activities with relevant dates and costs helps farmers calculate gross margins and determine the selling prices needed to make a profit.
* Keeping an inventory helps farmers understand market trends and how they relate to the timing of their farming activities.
* If particular events happen at the same time for a number of years, keeping records can help farmers predict and avoid negative consequences.
* Farmers with soybeans to sell should keep their eyes and ears open to identify companies that need soybeans. Especially because soybeans are traded internationally, farmers must pay attention to all sources of market information, including radio, TV, newspapers, field assistants, and digital platforms such as the internet, SMS, and social media.

## **Soybean markets in Malawi**

* Soybean has a national market in Malawi, and there is a growing interest by the private sector in processing and export of processed commodities derived from soybean.
* Companies involved in processing of soybeans in Malawi include: Export Trading Company, Farmers World, Rab-Processors, Universal Industries, Bakressa Grain and Milling. These companies make various kinds of foods from soybeans, one of which is soy pieces. Recently, Meru established a soybean processing plant near Lumbadzi in Lilongwe with the capacity to process 800 tonnes of soybean per day
* There is also a booming market for livestock feed made from soybeans, including companies such as Central Poultry, Stewarts’ Kapani, and many others.
* Non-governmental organizations such as Mary Meals and GIZ AFIKEPO Kulima use soy for supplemental feeding of children under five, both in-school feeding and hospital-based feeding.
* The domestic and industrial market for soybeans is growing because of soy beans’ versatility. Soybeans can be used to bake bread and cakes, as a meat substitute, as a milk substitute in beverages, and as a nutritious porridge. Other famers boil and eat soy as part of a meal like other beans and simply add sodium bicarbonate and salt when cooked.
* There is also a regional market through the Common Market for East and Southern Africa (COMESA), an overseas market, and e-markets that farmers can search.

**Definitions**

*Gross margin analysis*: For a farmer, this means calculating all costs involved in production and marketing and using the total cost to determine the minimum price per unit that will result in an acceptable profit.

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**Where can I find other resources on this topic?**

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