

# Pack 106, Item 6

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**Backgrounder on growing soybean** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Introduction***

Soybean (*Glycine max)* originated in East Asia, and was introduced to Africa in the late 1800s, and to Tanzania in the early 1900s. Most soybean in Tanzania is grown in the Southern Highlands. There is an increasing demand for soybean to nutritionally fortify human foods. Many small- to medium-scale processors (mostly women) in Tanzania are involved in this business.

There is also a growing demand for soybean as an ingredient in animal feeds, especially poultry feed. It is estimated that Tanzanian soybean production is currently about 5,000 tonnes a year on about 5,000 hectares of land.

This backgrounder talks about growing soybean in Tanzania, but you can adapt the information here to other sub-Saharan African countries where soybean is grown.

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

Because growing soybeans has many benefits, including:

*Nutrition and food security:*Soybeans contain on average 35-40% protein, and is one of the most protein-rich food sources in Tanzania Soybeans can be used directly as food for the household, or processed into soymilk, cooking oil, and a variety of other products, including infant weaning foods.

*Livestock:*Soybean-based feeds are particularly used in poultry production, and crop residues are also good feed.

*Livelihood:*There is a good market for soybeans in Tanzania. Demand exceeds supply, and soybean fetches a good price.

*Benefits to the soil:*Crop residues from soybean are rich in protein and help improve soil organic matter. Leaving soybean roots, leaves, and stems in the soil after harvest results in an extra 15-40 kg of nitrogen per hectare in the soil, which is available for the next crop. This is the equivalent of ½-1½ free bags of urea, and can give the next crop a very good boost.

*Yield:* With good practices and the right varieties, soybean yields can reach 2,500 kg/ha when grown as a sole crop.

***What are some key facts?***

* Soybean is good for food, including soymilk, soy cheese, and edible oil
* Soybean improves soil fertility and helps control the parasitic weed, *Striga hermonthica*
* Soybean cake is an excellent livestock feed, especially for poultry

***What are the big challenges of growing soybean in Tanzania?***

* Limited availability of quality seeds and a limited number of adapted varieties
* Prevalence of insect pests, especially whiteflies and bean stem maggot
* Diseases, including soybean rust and bacterial blight, and (occasionally) soybean mosaic virus.
* Uncertain weather conditions, including drought and uncertain onset and finish of the rainy season
* Low soil fertility
* Lack of information on bean markets and poor access to market information

***Is there misinformation about growing soybean that I should cover?***

* Some farmers may be confused about whether specific varieties are improved or traditional.
* Some people may believe that inoculants and chemical fertilizers are damaging or poisonous.

***Gender aspects of growing soybean***

* Women are generally involved in the most labour-intensive production and post-harvest activities, but have little involvement in or control over marketing.
* In some areas, trainings, meetings, and other supports are generally oriented towards male farmers.
* Women have limited access to land and resources, restricting their involvement in soybean production.

***Predicted impact of climate change on production of soybean***

* Soybean yields decline over 30°C. Most bean-growing areas in East Africa are cool enough that they will not be negatively affected by the expected temperature rise over the next 50 years. However, variability of rainfall, both in terms of intensity and the pattern of rainfall may negative effect soybean.
* With climate change, elevated levels of carbon dioxide will change the type and frequency of soybean diseases.
* In drier soybean-growing parts of East Africa, rainfall variability and soil moisture content will be crucial for soybean production in the future. Yields may rise in rain-fed highlands but decline in rain-fed humid and sub-humid regions. In arid and semiarid areas, yields are predicted to rise in the 2030s and decline in the 2050s.

***Key information about growing soybean***

1. **Suitable land and land preparation**

It is recommended that soybean be planted on productive soils, with a pH between 4.5 and 8.5, and at altitudes from sea level to about 2000 metres. Soybean grows best at temperatures between 21-300 C.

Avoid planting in waterlogged, or very sandy, gravelly soils. Do not plant soybean in the same field for more than two seasons, as this will increase the incidence of disease.

Soybean can be planted on ridges or flat seedbeds.

Clear all vegetation and prepare the field. Good land preparation ensures good germination and reduces weed problems.

For further information: See document 3 in *the Resource List* below.

1. **Selecting varieties**

Select a variety that suits your agro-ecological zone.

Pay attention to maturity period. Short-maturing beans:

* Are suitable for areas with low rainfall.
* Can be useful for farmers who must plant late because, for example, the rains failed, or an early season crop was badly affected by pests or diseases.

Long- or late-maturing beans:

* Often have higher yields, but are less suitable for drier environments.
* Fix more nitrogen and contribute more to soil fertility than early-maturing varieties.

Seeding rate: 12-20 kg per acre (40 kg/ha) with 10 cm between plants, or 20-30 kg per acre (50-75 kg/ha) with 5 cm between plants. Closer plant spacing increases yield.

Farmers should also choose varieties that have a ready market and/or meet the family’s expectations for taste and cooking. Choosing a variety may require some market research by farmers or farmers’ groups.

For further information, see document 3.

1. **Seed quality**

Use only high-quality seed for planting. To encourage good germination, make sure seed is not more than six months old. Ensure that seeds are free from insects, diseases, and weed seeds. Do not use damaged or wrinkled seeds, or seeds with holes.

Bean seed can be saved from season to season, but for best yields and quality, new seed for improved varieties should be purchased every two seasons.

To ensure good seed, conduct a germination test 10 days before planting.

To ensure nodule formation on soybeans, inoculate seeds with registered rhizobium bacteria inoculants. Always check that you have the right inoculant for soybean, since each legume crop needs a different type of rhizobium bacteria. Directions for using inoculants are on the inoculant package.

For further information, see document 3.

1. **Soil fertility**

Soybean fixes its own nitrogen with the help of bacteria (called *bradyrhizobia* bacteria) which live in plant roots. But using inoculants increases the number of these bacteria, with the result that more nitrogen is fixed in the soil. It is therefore not necessary to apply nitrogen-rich fertilizers like urea or CAN. Soybean cannot fix other nutrients, so you do need to apply nutrients such as phosphorus at planting.

To supply phosphorus, farmers can useSSP, TSP, DAP, or Minjingu Phosphate, SSP and TSP are not readily available in Tanzania. Choose Minjingu Phosphate when the pH of the soil is below 5.

Apply fertilizer at recommended rates directly in the planting furrow, which should be 5-7 cm deep. Cover with 2 cm of soil to ensure that the fertilizer does not burn the seed. If a soil test is not available, it is recommended to apply 25-30 kg of phosphorus per hectare (supplied by 125-150 kg of DAP per hectare) or 50-60 kg of DAP per acre during sowing time.

It is advisable to get a soil test before applying any fertilizer. Soil testing services are available at several places, including Selian Agricultural Research Institute, Mlingano Agricultural Research Institute, Sokoine University of Agriculture (SUA), the Tea Research Institute of Tanzania (TRIT), and these organizations supply both results and recommendations.

If available, farmyard manure can also help boost soybean production. Apply 2-4 tonnes per acre at planting and supplement with 1 bag per acre of TSP, DAP, or *Minjingu plus*.

Fertilizer (either chemical or organic) also helps stop diseases from becoming established or allows the plant to bounce back.

For further information, see document 3.

1. **Planting and spacing**

Plant when the rains are well-established to avoid dry spells after planting.

Plant in the morning or evening to avoid direct sunlight on inoculated seed, as sunlight makes the inoculant ineffective.

Planting in rows with recommended spacing makes weeding and harvesting easier, and ensures the correct plant density. It may take longer at planting, but saves time later.

Plant at 2-5 cm depth. Planting deeper than 5 cm may result in loss of vigour or failure to emerge.

*Spacing for soybean as a mono crop*:

On flat land: Space rows 45 cm apart. Plant seeds at 5 cm apart (1 seed per stand) within rows.

On ridges: Space ridges 60 cm apart. Plant soybean on both sides of the ridges. Plant seeds 5 cm apart within rows (1 seed per stand).

Fill gaps after seeds emerge.

*Intercropped soybeans*:

You can intercrop soybean with a cereal crop, but soybean does not grow well when shaded.

Plant 2-4 rows of soybean and then 2 rows of a cereal crop, using the recommended spacing for each crop.

You can also plant soybean between rows of newly-established cassava. Use the recommended planting distances for both crops.

If you don’t have a tape measure, clip soda tops to a string at the appropriate distances.

For further information, see document 3.

1. **Weeding**

Removing weeds minimizes competition between crops and weeds for nutrients, water, sunlight, and space. Weeds are also a host for some common pests. You can manage weeds manually or chemically, or with a combination of the two approaches.

*Manual weed control:*

Weed about 2 weeks after planting and again 5-6 weeks after planting. If crop plants grow well and the canopy closes early, the second weeding is not needed.

*Chemical weed control:*

Herbicides are avalable and can be cost-effective. Farmers can apply pre-emergence or post-emergence herbicides to control a range of weeds. However, there are challenges both because farmers are unfamiliar with using them and may not follow recommended application rates or application procedures, and because they may not use safety precautions such as wearing recommended clothing.

If you wish to use herbicides, seek advice from an extension agent.

For further information, see document 3.

1. **Field pests**

*Insect pests*

Insect pests which commonly affect soybean in Tanzania include: whiteflies, aphids, thrips, cutworms, bean maggot, and bugs such as two-spotted spiders and bean leaf beetles. There is no need to spray if pests are damaging leaves, because leaf damage is unlikely to reduce yield. It is important to control pests to avoid the spread of diseases if disease symptoms are noticed.

From flowering onwards, soybean is attractive to pod-sucking bugs that can seriously reduce seed quality. Also, aphids can transmit viral diseases to soybean.

Check the field regularly for insect pests. If pests are damaging soybean pods, you can use insecticides. Always follow the manufacturer’s recommendations or seek advice from an extension agent.

Preventive measures include:

* Rotating beans with non-legume crops to help prevent a build-up of pests.
* Intercropping to create spaces in fields where soybean pests cannot thrive.
* Planting soybean in well-prepared, fertile soil to promote healthy plants that are better able to withstand pests.

Farmers should remove pest-damaged or diseased plants if they plan to grow soybeans on the same soil next season.

The bean bruchid is the major storage pest, though it appears first in the field. Signs of infestation include holes in beans and adults on the stored crop.

To prevent infestation:

* Use seed which is certified clean.
* Harvest beans as soon as mature to reduce the risk of heavy infestation.
* Remove and destroy all infested crop residues immediately after harvest.

For further information, see documents 2, 3, 7.

1. **General disease control**

Soybean diseases can be caused by fungi, bacteria, or viruses, and can result in major yield losses.

Fungal diseases in soybean include:

* soybean rust,
* frogeye leaf spot, and
* red leaf blotch.

Bacterial diseases include bacterial blight and wildfire. Viral diseases such as soybean mosaic virus can be transmitted by aphids, beetles, and whiteflies

To manage fungal and bacterial diseases:

### Plant tolerant varieties.

### Plant in a good seedbed and avoid poorly drained or compacted soils.

### Rotate soybean with non-legumes to prevent build-up of disease.

### Weed properly.

### Treat seeds with fungicides to protect against soil-borne fungal diseases.

### Plant early (to manage soybean rust).

### Spray fungicides to control fungal diseases such soybean rust, leaf spots, and downy mildew

Use certified seed or seeds from healthy plants only. Do not use seed from diseased plants because these seeds are also infected. For viral diseases, uprooting and burying infected plants off-site is recommended.

Soybean is most vulnerable to viral infections in the pre-flowering stage. During this time, you can spray insecticides once or twice to reduce the number of insects that can transmit viruses.

For further information, see documents 2, 3, 7.

1. **Harvesting**

*Timing of harvest:* Harvest soybean when 9 out of 10 pods are mature (brown or dry). Pick the pod and shake. If the seeds are detached from the pod, the crop is ready for harvest. Harvesting early in the day will reduce shattering of pods. Any delay in harvesting can cause crop losses.

For further information, see documents 1, 3.

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

1. Africa Soil Health Consortium (ASHC), 2015. *Crop pests and diseases: Legumes.* <http://africasoilhealth.cabi.org/wpcms/wp-content/uploads/2015/10/AHSC-Summary-cards-legumes-lowres.pdf> (in English, 479 KB)
2. Africa Soil Health Consortium (ASHC), undated. *Zalisha Soya Bora* (booklet). <http://africasoilhealth.cabi.org/wpcms/wp-content/uploads/2016/11/549-Final-Soya-Booklet-A3-Print-Version.pdf> (in Swahili, 27.1 MB)
3. Africa Soil Health Consortium (ASHC), undated. *Zalisha soya bora* (manual). <http://africasoilhealth.cabi.org/wpcms/wp-content/uploads/2016/11/550-Soybean-manual.pdf> (in Swahili, 1.4 MB)
4. Clinton Development Initiative, 2015. *How to inoculate Soya bean*. <http://africasoilhealth.cabi.org/wpcms/wp-content/uploads/2015/04/349-How-to-inoculate-with-Biofix-poster1.pdf> (in English, 3.3 MB)
5. Maruku Agricultural Research Institute (LZARDI) and Africa Soil Health Consortium (ASHC), undated. *Get quality soybean seed through good agricultural practices; Guidelines for Tanzania.* <http://africasoilhealth.cabi.org/wpcms/wp-content/uploads/2014/07/205-ARI-Maruku-soybean-leaflet-English.pdf> (in English, 849 KB)
6. Maruku Agricultural Research Institute (LZARDI) and Africa Soil Health Consortium (ASHC), undated. *Zalisha mbegu bora za soya*. <http://africasoilhealth.cabi.org/wpcms/wp-content/uploads/2014/05/206-ARI-Maruku-soybean-booklet-Swahili.pdf> (Swahili, 1.5 MB)
7. Murithi, H., Kijoji, A., and Beed, F., 2014. *Integrated Pest Management (IPM) of Soybean*. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. <http://biblio.iita.org/documents/U14BkMurithiIntegratedNothomNodev.pdf-ac9019985b7a26be9b7e890e423110c6.pdf>
8. Wilson, R. Trevor, 2015. *The Soybean Value Chain in Tanzania*: *A Report from the Southern Highlands Food System Programme*. Food and Agriculture Organization, 2015. <http://soybeaninnovationlab.illinois.edu/sites/soybeaninnovationlab.illinois.edu/files/Tanzania_soybean.pdf> (in English, 4.5 MB)

***Key definitions***

1. *Legume*: A plant in the *Fabaceae* or *Leguminosae* family, or the fruit or seed of such a plant. Legumes are mostly grown for their grain seed, which is called a pulse, and also for livestock forage, and as a green manure. Examples of edible legumes include: dried peas, beans, lentils, soybeans, groundnuts, and tamarind.

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