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Guide to Soybean Production in Northern Nigeria

L.O. Omoigui, A.Y. Kamara, N. Kamai, I.Y. Dugje, F. Ekeleme, P. Lava Kumar, T. Ademulegun, R. Solomon

Revised Edition 2020

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Guide to Soybean Production in Northern Nigeria

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Cover: IITA Research Supervisor in a soybean field.

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Forward and Acknowledgements

This handbook is intended to guide farmers, extension personnel, students of agriculture and researchers in Nigeria to use improved varieties and complementary production practices to increase productivity. The guide draws its lessons from the work and experience of IITA and partners in Research for Development on crop-based systems in Nigeria.

This publication is a production of the Feed the Future Nigeria Integrated Agriculture Activity implemented in targeted locations of Borno and Adamawa states, Nigeria between 2019 and 2021, and was made possible through financial support from the United States Agency for International Development (USAID).

As part of its contribution to the economic recovery process in the North East Part of Nigeria which has been ravaged by the insurgent activities of armed groups, USAID awarded to the International Institute of Tropical Agriculture (IITA) and its Partners (International Crops Research Institute for the Semi-Arid Tropics and Catholic Relief Services) the two-year "Feed the Future Nigeria Integrated Agriculture Activity'' which aims to advance the objectives of inclusive and sustainable agriculture-led economic growth; strengthened resilience among people and systems; and a well-nourished population, especially among women and children in targeted locations of Borno and Adamawa states, Nigeria. The Activity seeks to support vulnerable populations to engage in basic farming activities that will improve food security, increase agricultural incomes and improve resilience among smallholder farmers and their families. It works with a coalition of partners to facilitate improved agro-inputs and extension advisory services to serve vulnerable populations;

strengthen the institutions that form the market system and the networks that serve smallholder farmers who have been disenfranchised by conflict; and facilitate the engagement of youth and women in economic and entrepreneurial activities.

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The views expressed in this publication are those of the authors and do not necessarily reflect the views or policies of the United States Agency for International Development (USAID) or the United States Government.

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Introduction

Importance of soybean in the global economy

Soybean is among the major industrial and food crops grown in every continent. The crop can be successfully grown in many States in Nigeria using low agricultural input and cultivation has expanded as a result of its nutritive and economic importance and diverse domestic uses. It is also a prime source of vegetable oil in the international market. The seeds contain about 20% oil on a dry matter basis and this is 85% unsaturated and cholesterol-free.

Soybean also has an average protein content of 40% and is more protein-rich than any of the common vegetable or animal food sources found in Nigeria.

The rapid growth of both the poultry and food processing industries in the past decade has also increased demand for soybean in Nigeria. It is believed that cultivation and production will increase as more farmers become aware of the potential of the crop, not only for cash/food but also for soil fertility improvement and Striga control. The market for soybean in Nigeria is growing very fast with opportunities for improving the income of farmers. Currently, SALMA Oil Mills in Kano, Grand Cereals in Jos, ECWA Feeds in Jos, KARMA FOOD Ltd in Gwagwalada, AFCOT Oil Seed Processors, Ngurore, Adamawa State, and P.S. Mandrides in Kano, all process soybean.

IITA, along with partners, has developed improved technologies for soybean production. This handbook outlines crop production practices that farmers may use to grow it profitably in Nigeria.

Why grow soybean?

- It is good for food—soy-milk, soy flour, soy-cheese, *dadawa*, Tom Brown (infant weaning food).
- It is the source of an excellent (cholesterol-free) vegetable oil.
- It is used in industries for paper coatings, wood veneer, adhesive and alkyd resins, printing ink, etc.
- It improves soil fertility and controls the parasitic weed, *Striga hermonthica.*
- Soybean cake is an excellent livestock feed, especially for poultry.
- The haulms provide good feed for sheep and goats.

Figure 1. Preparing land for soybean production using a tractor.

Conditions necessary for soybean production

Growth is influenced by climate and soil characteristics. The crop performs well in the southern and northern Guinea savannas of Nigeria, where rainfall is more than 700 mm. However, short-duration varieties can thrive in the much drier Sudan savanna when sown early and with an even distribution of rainfall throughout the growing period. The time for planting depends upon temperature and day-length. Soybean is a short-day plant and produces flowers in response to days becoming shorter.

It can be grown on a wide range of soils with the pH ranging from 4.5 to 8.5. It should not be planted in sandy, gravelly, or shallow soils to avoid drought stress. It should not be grown in waterlogged soils or soils with surfaces that can crust, as this will lead to poor seedling emergence.

Preparing to plant

Land preparation

Clear all vegetation before land preparation. The seedbed may be prepared manually with a hoe or animal-drawn implement or tractor (Fig. 1). Well-prepared land ensures good germination and reduces weed infestation. Planting can be done on ridges or on a flat seedbed.

Choice of variety

Selected soybean varieties grown in Nigeria are presented in Table 1. Choose a variety suited to your agroecological zone. Variety selection should be done based on the time to maturity, yield potential, susceptibility to stem lodging, drought tolerance, and resistance to pests and diseases. The maturity period should be the first consideration when choosing a variety, suited to your geographical zone. Consider varieties that are early maturing rather than late maturing in areas with low rainfall. Although late maturing varieties have increased yield potential, it is risky to grow them in drier environments because of late-season drought.

Table 1. Recommended soybean varieties for Guinea savanna ecological zones in Nigeria.

Variety	Ecology	Characteristics	Appropriate planting time
TGX 1448-2E	Southern and Northern Guinea savanna	Late maturing, high yield, low shattering, high oil content, and excellent grain color. Good for Striga control.	In weeks 2–3 of June in NGS and week 1 of July in SGS.
TGX 1951-3F	Southern and Northern Guinea savanna	Medium maturing, high yield, low shattering, high oil content, and excellent grain color. Tolerant to rust, Cercospora leaf spot, bacterial pustule, and poor soils. (2.5 t/ha).	In weeks 3–4 of June in NGS and week 1 of July in SGS.
TGX 1904-6F	Southern and Northern Guinea savanna	Medium maturing, high yield, low shattering, high oil content, and excellent grain color. High fodder yield and resistant to lodging, Cercospora leaf spot, and bacterial pustule. (1.5 - 2 t/ha).	In weeks 2–3 of June in NGS and week 1 of July in SGS.
TGX 1987-62F	Sudan savanna	Early maturing, average yield, medium shattering, good oil content, and fair grain color. Highly resistant to rust, Cercospora leaf spot, and bacterial pustule. (2.1 t/ha).	In week 4 of June to week 1 of July.
TGX 1987-10F	Sudan savanna	Early maturing, average yield, medium shattering, good oil content, and fair grain color. Highly resistant to rust, Cercospora leaf spot, and bacterial pustule. (1.5–2 t/ha).	Week 4 of June to week 1 of July.
TGX 1835-10E	Sudan savanna	Early maturing, average yield, low shattering, good oil content, and excellent grain color. Highly resistant to rust, Cercospora leaf spot, and bacterial pustule. (1.5–2 t/ha).	Week 4 of June to week 1 of July.

N.B. Early and extra-early maturing varieties are strongly recommended for the Sudan savanna because of the low amount and duration of rainfall in the zone.

Seed cleaning and preparation

Use high-quality seeds of the selected variety (Fig. 2). Soybean seeds easily lose their viability. It is common for them not to germinate after 12–15 months in storage, even when stored properly. Therefore, use seeds that are not more than 12 months old to ensure good germination. Discard the weed seeds and select good seeds for planting to ensure that they are free from insect infestation and disease. Do not purchase seeds from the open market as the germination potential is not guaranteed. Planting poor quality seeds will not produce a good yield (Fig. 3). Always buy seeds from verified seed companies or the seed producers nearest to you.

Figure 2. Use quality seeds (obtained from a seed company or Research Institute) for planting.

Figure 3. Poor quality seeds. Not good for planting

Soybean germination test

Seeds should be tested for viability before planting. The germination rate should be 85% or more to obtain a good population establishment. To conduct a quick seed germination test, select 400 seeds at random and sow 100 seeds in each of four wooden or plastic boxes or a prepared Soak cloth- or paper-lined germination boxes or the seedbed with sufficient water before sowing and provide water every morning and evening. Sow one seed/hole at a distance of 10 cm between the seeds. Start counting the seedlings 5 days after sowing and complete the counting within 10 days. A total count of 320 germinated seeds or more indicates a germination rate of 80% and above. When the percentage germination is 80% or less, the seed rate has to be increased accordingly to achieve 100% germination.

Planting

Date of planting

Soybean produces well over a wide range of planting dates when moisture is available. The recommended dates in different ecological zones in Nigeria are presented in Table 2. Do not plant too early (before the establishment of rain) because a prolonged dry spell after planting may result in permanent wilting of the crop and the need for replanting. Late planting, on the other hand, may expose the crop to attack by some late-season pests and deprive the crop of sufficient moisture if the rains stop early. Soybean should be planted as soon as the rains are well established

Table 2. Recommended dates for planting soybean in Nigeria.

Ecological zone	Suggested time of planting
Moist savanna/Southern Guinea savanna	Early June–early July
Northern Guinea–Sudan savanna	Mid-June–early July
Sudan savanna	Weeks 1–2 in July

Seed rate

About 50–70 kg (20–28 standard *mudus*) are required to obtain a population of 444,444 plants/ha for most varieties. Since soybean seed sizes vary among varieties, it is essential to consider planting in terms of the quantity of seeds required/unit area. It is not uncommon to observe seed sizes ranging from 12.6 to 18.9 g/100 seeds.

Seed dressing

Treat seeds with fungicides, such as Apron Plus, or Thiram, before planting, at the rate of 1 sachet/8 kg of seeds for protection against soil-borne fungal diseases.

Plant spacing and sowing

Sow soybean by hand, planter, or by drilling. Plant 3 to 4 seeds/hole at a spacing of 75 cm between rows and 10 cm between stands. Alternatively, drill seeds at 50–75 cm between rows and 5 cm within rows. For the early maturing varieties, a spacing of 50 cm between rows and 5–10 cm within rows is recommended because they respond better to narrow spacing than the late maturing varieties. Do not sow seeds more than 2–5 cm deep. Deeper planting may result in loss of vigour or failure of seedlings to emerge.

Figure 4. Soybean in rotation with maize

Fertilizer

A good fertilizer recommendation for soybean production depends on a good soil test. Under normal conditions, soybean as a legume should provide itself with nitrogen through biological nitrogen fixation. Until nodulation occurs, the soybean plant depends on soil nitrogen for growth. Phosphorus is often the most deficient nutrient; therefore, apply optimal phosphorous fertilizer for a good yield. Apply phosphorus at the rate of 30 kg P/ha in the form of single super phosphate fertilizer (SUPA) (3 × 50 kg bags) in addition to 2½ × 50 kg bags of compound fertilizer NPK 15:15:15. Nitrogen and potassium fertilizers are needed only when there are obvious deficiencies. Incorporate the fertilizer into the soil at land preparation while harrowing and levelling the field. Use the recommendations (Table 3) as a guide for fertilizing your soybean crop.

Soil fertility enhancement

Soybean improves soil fertility and fixes nitrogen in the soil for the succeeding crop, e.g., maize (Fig. 4). When grown in rotation with maize, it serves as a catch-crop in controlling *Striga hermonthica*, a parasitic weed that attacks maize, by stimulating suicidal germination of the Striga seed reservoir in the soil.

Table 3. Recommended fertilizer rates for soybean production in Nigeria

Recommended fertilizer rates (kg/ha)	Materials
15 kg N 40 kg P_2O_5	2 × 50 kg bags of NPK (15-15-15) plus 3 × 50 kg bags of SSP (SUPA)

Soybean Inoculation using NoduMax for higher yield

To enhance the ability of soybean to form nodules and fix nitrogen, soybean seeds need to be inoculated with rhizobia. Each legume crop needs a different type of rhizobium bacteria so always check you have the right inoculant for soybean (NoduMax Inoculant)

How to inoculate soybean with NoduMax

1. Measure 10 kg of soybean. Place the amount in any container that will accommodate the seeds.
2. Prepare the sticker. Dissolve the content of the enclosed packet of gum Arabic into 200 ml of warm water.
3. Apply the sticker to 10 kg of soybean seeds and mix them until uniformly coated.
4. Add 100g of inoculants (1 sachet of NoduMax) to the seeds and mix until seeds are uniformly covered.
5. Cover the inoculated seeds with a cloth and put it under the shade for the sticker to set. Avoid contact with direct sunlight.
6. Plant the seeds on the same day that you inoculate them.
7. Place the inoculated seeds in a well-prepared moist furrow and cover immediately with soil.

You can adjust the volumes above to any quantity of soybean seeds. Per kg seeds, use 10 g of inoculant.

How to inoculate depends on the type of inoculant you use. The above instructions are for NoduMax Inoculants. Therefore, always check the instructions on the package or ask an agro-dealer or extension worker.

Thus, inoculating soybean seeds with the correct rhizobium increases biological nitrogen fixation and gives a good yield for minimal cost. With good practices and the right varieties, grain yields can be as high as 2500 – 3000 kg/ha when soybean is grown as a sole crop.

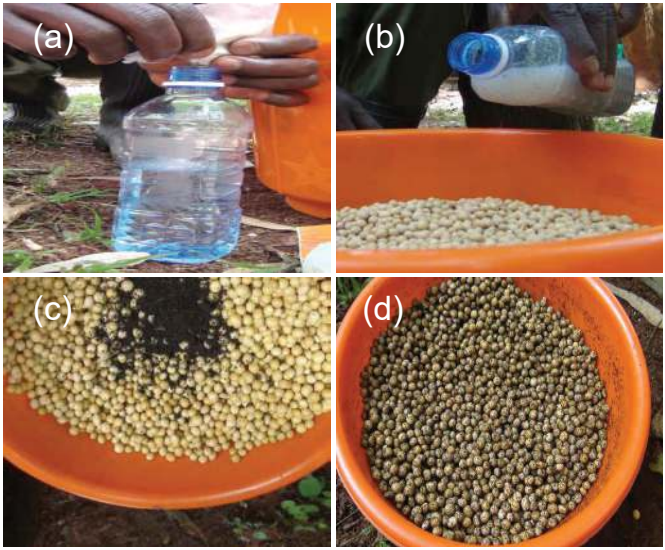

Figure 5. Soybean Inoculation with NoduMax (a) Dissolve sticker in warm water. (b) Mix sticker with soybean. (c) Mix inoculant with soybean. (d) Inoculated soybean ready for planting.

Pests and diseases

Weeds and their control

Perennial and most annual weeds can hamper growth in the early stages of soybean. A properly timed weed control program can minimize their effects. Weed control in soybean could be achieved manually or with the use of chemicals or by a combination of both methods.

Manual weed control

Carry out the first weeding at 2 weeks after planting and the second at 5–6 weeks after planting. Avoid weeding immediately after rainfall as this would lead to transplanting the weeds. Poor hoe weeding or delay in weeding could cause significant reductions in soybean yields.

Chemical weed control

Herbicides, if used properly, are safe and effective in controlling weeds in soybean. The choice, however, depends on the predominant weed species and the availability of the herbicide. Herbicides are available for pre-emergence or post-emergence weed control. If the herbicide is applied at planting, one weeding may be required at 5–6 weeks after planting. Use herbicides as presented in Table 4.

Insect pests and their control

Several different insects occur in soybean fields but few are of any economic importance, and the species that cause damage are usually not abundant enough to make control measures necessary. In the vegetative stage, the crop is very tolerant of caterpillars but very susceptible to attacks by silverleaf whiteflies.
From flowering stage onwards, soybean becomes attractive to pod-sucking bugs that can seriously reduce seed quality. Insect pests can be controlled with a single spray of Cypermethrin + Dimethoate 10 EC at the rate of 100 mL in 15 L of water.

Table 4. Recommended herbicide rates for weed control in soybean.

Product name	Brand name	Product rate/ha (L)	Quantity/sprayer load	Time of application	Remarks
(A) Pre-land preparation herbicides					
Glyphosate	Round-up, Turbo, Glycel, Kill off, Clearweed, Sarosate, Touchdown forte, Deensate, Rhonasate, Delsate etc	4–6	350–500 ml in 15-L sprayer	Apply where troublesome weeds are common. Wait for 10 days after the application before preparing the land.	Total weed killer and should be used only before land preparation.
Glufosinate ammonium	Lifeline, Slasha	1.6–5	150–400 ml in 15-L sprayer	Contact/semi-systemic herbicides for total weed control. Apply on non-cultivated land or before planting.	Total weed killer and should be used only before land preparation.
(B) Pre- emergence herbicides					
Pendimethalin	STOMP 455 CS	2–3	150–250 ml in 15-L sprayer	Apply immediately after planting or a day later. The rate of application will vary depending on product formulation. Read the product label before use.	Apply where troublesome weeds such as *Rottboellia* are common. Do not plant or replant any crop other than soybean for one year after application.
S-Metolachlor	Dual Gold 960 EC	0.6–1.6	50–150 ml in 15-L sprayer	Apply immediately after planting or a day later.	
(C) Post-emergence herbicides					
Haimeba 14% SL, Bentaforce 48% SL	Bentazone	2–3	100 ml in 15-L sprayer	Apply 19 days after planting.	Do not apply close to water bodies.
Fluzifop-p-butyl 150 EC	Fusilade forte, Narodown,	1–1.4	80–150 ml in 15-L sprayer	Apply 21–28 days after sowing.	For grass weed control only.

Note: (1) About 12 loads of a 15-L sprayer are required for 1 ha. (2) Where animal power is used for land preparation, allow rain to fall on the prepared land before planting and spray herbicides within 2 days of planting to enhance effectiveness. (3) 150 mL of chemical will fill a standard-sized container of liquid Peak milk. Good land preparation is a pre-requisite for effective weed control in soybean. Where land preparation is poorly done, and weeds are present at planting, apply glufosinate ammonium at the label rate to kill existing weeds before planting. For all herbicide applications, wear Personal Protection Equipment. Download the IITA herbicide calculator from Google Play Store to help you determine the actual quantity of herbicide to put in your sprayer.

Diseases and their control

Soybean improves soil fertility and fixes nitrogen in the soil for the succeeding crop, e.g., maize (Fig. 4). When grown in rotation with maize, it serves as a catch-crop in controlling *Striga hermonthica*, a parasitic weed that attacks maize, by stimulating suicidal germination of the Striga seed reservoir in the soil.

Fungal and bacterial diseases

Rust: Asian soybean rust, caused by *Phakopsora pachyrhizi*, is one of the most important foliar diseases in Nigeria. The infected leaves have small tan to dark brown or reddish-brown lesions (Fig. 6) on which small raised pustules (or "bumps") occur on the lower surface of the leaves (Fig. 7). Pustules produce a large number of spores. Brown or rust-colored powder falls when severely infected leaves are tapped over a white paper or cloth. Severe infection leads to premature defoliation and yield losses of up to 80%. The disease is of great economic importance in the derived savanna and southern Guinea savanna zones where rainfall and humidity are high.

Figure 6. Rust-infected soybean leaves with large number of small tan lesions

Figure 7. Large number of spores on the lower surface of tan lesions of soybean rust.

Bacterial pustule: The disease is caused by *Xanthomonas axonopodis pv. glycines*. Symptoms appear as specks to large, irregular spots with raised light-colored pustules in the elevated centers of the spots on the lower surface (Fig. 8). The elevated pustules sometimes have cracks in

them. Later lesions join together, and the dead areas tear away to give a ragged appearance to the leaves. Symptoms of rust and bacterial pustule sometimes appear similar.

Figure 8. Small spots and coalescing lesions of bacterial pustule disease

Phytophthora seedling blight and root and stem rot: *Phytophthora sojae* causes seedling blight, and root and stem rot. Young seedlings that appear to be established become off-colored then yellow, wilt, and die (Fig. 9). The stems of these plants may show a brown discoloration that begins at the soil line and extends up the stem. The brown, dead leaves remain attached to the plant, and the dead seedlings are obvious symptoms of the disease in the field. The root rot phase of the disease is rapidly becoming a very destructive disease in Nigeria.

Figure 9. Phytophthora seedling blight causing wilting of older seedlings

The *Phytophthora* fungus can kill plants at all stages of growth. Infected stands may survive but are less productive than healthy stands. Infection generally occurs in fields with poor drainage, but it can occur in normally well-drained fields that are waterlogged for 7–14 days after irrigation or very heavy or prolonged rainfall.

Frogeye leaf spot: The fungus *Cercospora sojina* that survives in infected soybean residues and seeds causes this disease. Symptoms appear as brown, circular to irregular spots with narrow, reddish-brown margins on the leaf surfaces (Fig. 10).

The central areas of the spots turn ash grey to light brown. Sometimes lesions can develop on stems and pods from where mature seeds are infected. Infected seeds may show discoloration of the seed coat that ranges from small specks to large blotches of light to dark grey or brown.

Figure 10. Initial symptoms of frogeye leaf spot

To control these diseases:

- Plant resistant varieties. This is the best option to control disease.
- Plant in a good seedbed. Avoid poorly drained or compacted soil.
- Plant seeds treated with fungicides, as mentioned earlier, under 'seed dressing'.
- Rotate crops with maize to prevent the increase in inoculum levels in a field
- Use of a foliar fungicide is seldom warranted, except on high-value fields (e.g., seed production fields) or in years when the weather is especially favorable for disease development.

Virus diseases

Soybean is susceptible to several viruses transmitted by aphids, beetles, and whiteflies prevailing in Nigeria. Most of the virus infection results in foliar symptoms such as mosaic and mottling, older leaves become thicker and brittle, puckering, leaf distortion, severe reduction in leaf size, and stunting of plants. Mixed infections with more than one virus are common under field conditions. Features of the three most common virus diseases on soybean in Nigeria are presented here.

Mosaic disease: *Cowpea mild mottle virus* (CPMMV; genus *Carlavirus*, family *Flexiviridae*) transmitted by whitefly (*Bemisia tabaci* Gennidius) is the most prevalent virus associated with soybean mosaic disease in Nigeria. In addition, Bean pod mottle virus (genus *Comovirus*, family *Comoviridae*), Alfalfa mosaic virus (genus *Alfamovirus*, family *Bormoviridae*), *Cucumber mosaic virus* (genus Cucumovirus, family *Bormoviridae*), and *Southern bean mosaic virus* (genus *Sobemovirus*) were also detected in mosaic disease-affected plants either singly or in mixed infections, particularly with CPMMV. Depending on genotype and age of infection, symptoms range from mosaic and mottling, leaf curling, green vein banding, and stunting (Fig. 11). Most severe symptoms and a significant reduction in pods are observed in plants infected at the early stages of growth (pre-flowering).

Yellow mosaic disease: It is caused by whitefly (*B. tabaci*)-transmitted different viruses belonging to the genus *Begomovirus*, family Geminiviridae. *Soybean yellow mosaic virus* was found to be the most prevalent virus associated with this disease. *Soybean mottle mosaic virus*, which also causes similar

Figure 11. Soybean plants affected by the Mosaic disease

symptoms was found to be less frequent in the fields. Virus-infected plants produce bright yellow mosaic or specks and develop into large blotches on the leaf lamina (Fig. 12), but this infection does not result in leaf distortion or reduction in lamina size. Mixed infection of these two begomo viruses and CPMMV is common in the fields, and such infection results in bright yellow mosaic symptoms and leaf puckering.

Figure 12. Bright yellow mosaic symptoms caused by begomo virus infection in soybean plants

Dwarf disease: The causal virus responsible for soybean dwarfing disease is not known. This disease occurs in low frequency in the fields. Leaves and shoots of the infected plants are severely stunted with a severe reduction in leaf lamina (Fig. 13). Infected plants do not produce any pods.

Figure 13. Dwarf disease-affected soybean

To Control Viral diseases:

Cultivate virus disease-resistant varieties. This is the most convenient, economic, and effective approach for controlling soybean virus diseases. If resistant varieties are not available, the following approaches can contribute to the management of virus diseases in the field.

- Many viruses involved in mosaic disease are seed-transmitted in soybean. Use certified seeds to avoid seed-borne infection or use seeds that are produced away from the infection source.
- Do not plant seeds obtained from mosaic-affected plants.
- Rogue (uproot and destroy) symptomatic plants. This can reduce the incidence of insect-transmitted viruses.
- Eradicate the weeds and voluntary plants in the vicinity of the soybean farms.
- Treat seeds with systemic insecticides and apply one or two foliar sprays of insecticides to reduce the insect vector activity during the pre-flowering stage (most vulnerable to virus infections) of the plant when it is most vulnerable to virus infections.

Harvesting soybean

Soybean matures within 3–4 months after planting and requires timely harvesting to check excessive yield losses. At maturity, the pod is straw- coloured. Harvesting of soybean is recommended when about 85% of the pods have turned brown for a non-shattering variety but 80% for shattering varieties. Alternatively, the crop can be harvested when the seeds are at the hard-dough stage when the seed moisture content is between 14 and 16%. Newer varieties are resistant to shattering, but losses in yield may occur from other causes if harvesting is delayed. Harvesting can be done with a cutlass, a hoe, or sickles. Cut the mature plants at ground level. Stack them loosely on tarpaulin and allow them to dry in the open (aerated space) for 2 weeks before threshing. Do not harvest by hand-pulling because this may deprive the soil of nutrients added by the crop.

Postharvest operations

Threshing soybean

Thresh manually or mechanically when the plants are properly dried and as soon as possible. Manual threshing is mainly recommended for small-scale production. It involves piling soybean plants on tarpaulin or putting dry pods in sacks and beating them with a stick. The material is then winnowed to separate the seeds from the debris (Fig. 14).

Figure 14. Manual threshing of soybean

Use mechanical threshers in large-scale production. Such threshers are equipped with blowers that separate the grains from the chaff (Fig. 15).

Figure 15. A multipurpose soybean threshing machine.

Storage

Soybean should be stored at a moisture content of 10% or less. Seeds are sufficiently dry when they cannot be dented with the teeth or fingernails. At harvest, the grains usually contain about 14% moisture. Dry to 12% moisture for storage of 6–12 months and to 10–11% for longer storage. Open-air drying is the most practical way to protect soybean in storage. Place 50-kg or 100-kg bags of clean soybean on a rack in the cold room or in the shade. High moisture content in stored soybean encourages the development of various agents of deterioration, such as insects and microorganisms. Good storage management can greatly influence the storability of soybean and subsequent germination when it is planted in the field. Do not leave soybean exposed to high temperatures, as it will increase deterioration and reduce seed viability.

Reference

Dugje, I.Y., L.O. Omoigui, F. Ekeleme, R. Bandyopadhyay, L. Kumar, and A.Y. Kamara. 2009. Farmers' Guide to Soybean Production in Northern Nigeria. International institute of Tropical Agriculture, Nigeria. 21 pp.

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