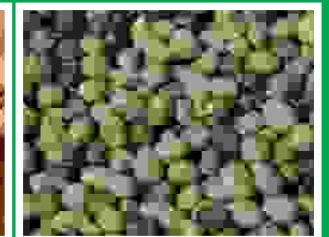
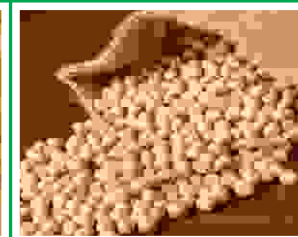
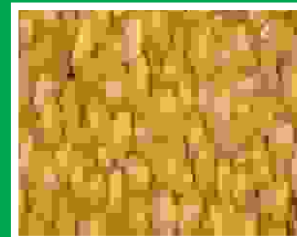
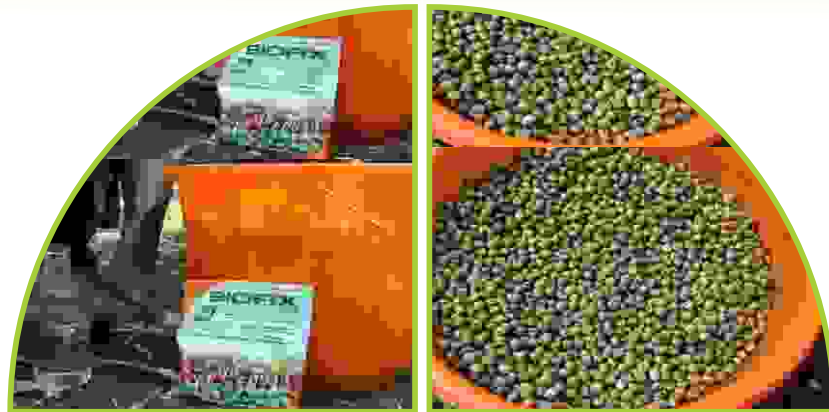


EKKLESIYAR YAN'UWA A NIGERIA
SOYBEAN PRODUCTION
(Glycine max)

GUIDE IN(Northern)
NIGERIA

BY

**REUBEN SOLOMON
KEFAS JOHN USMAN
DANIEL Y.Z. BWALA**



Global Food Initiatives



Church of the Brethren



**THANK YOU
FOR
READING**

SOYBEAN PRODUCTION *(Glycine max)*

Guide
In
Northern
Nigeria

BY

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In collaboration with US Feed
The Future Soybean Innovation Lab



The importance of soybean

- Major industrial crops (Production of animal feed, cooking oil, powdered milk, biodiesel, candle, seasonings etc)
- The crop can be successfully grown in many West African Countries using low agricultural input.
- Soybean production system goes well with maize in northern Nigeria
- A source of income for farmers.
- It serves as a trap crop in the control of striga and also improves soil fertility.



Harvesting

- The optimum time for harvesting maize is when stalks have dried and the moisture of grain is about 17-20%.
- Remove cobs and thresh mechanically or manually.



Storage

- Maize seed/grains should be dry at a moisture content of 14% before for storage.
- Store in sacks, or cribs.



Climatic and Soil Requirement

- Soybean 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 savannah.
- Soybean is a short-day plant and flowers in response to shortening days.
- Soybean should not be planted in sandy, gravelly, or shallow soils to avoid drought stress.
- Avoid waterlogged soils as this will lead to poor seedling emergence.



- The most significant diseases identified in northern Nigeria are Maize rust, Leaf Spot, leaf Blight, Maize Streak virus, Downy mildew, stalk and ear rot etc.
- Diseases can cause 20-40% losses during cultivation and 30-90% at post harvest and storage.
- However resistant lines have been bred and in market.
- Other pests may include ear borers, armyworms, cutworms, grain moth, beetles, weevils, grain borers and white grubs etc.
- The parasitic striga weed is another major maize pest.
- Insect pests such as stem borers, silk worms, grasshoppers, termites, weevils are the economically important insect pests of maize and can be controlled by use of insecticide and integrated pest management.



Land preparation

- Clear all vegetation before land preparation.
- The seedbed may be prepared manually with a hoe or animal-drawn implement or tractor.
- You can plant on ridges or on a flat seedbed, but soybean grows more vigorously on good seed bed.

Seed cleaning and preparation

- Use high quality seeds of the selected variety.
- It is common for soybean, even when stored properly, not to germinate after 12 –15 months in storage.
- Sort out the good seeds for planting to ensure that they are free from insects, disease infestation, and weed seeds.
- Always buy from seed Companies

Choice of variety

- Choose a variety suited to your growing zone.
- Soybean variety selection should be based on:
 - Maturity
 - yield potential.
 - lodging.
 - Shattering.
 - drought tolerance.
 - Resistance to pests and diseases.

Weed Control

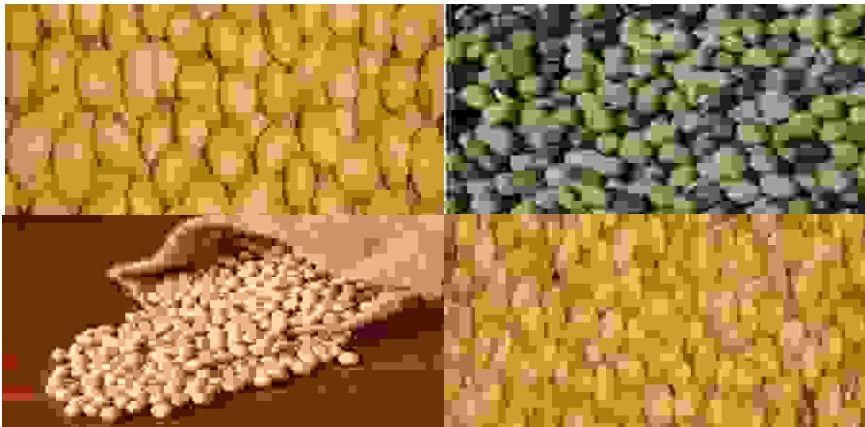
- Herbicide are used (pre-emergence) primextra 4L/per ha
- Glyphosate 4L/ha using Knapsack sprayer with proper calibration.
- Apply Herbicide when soil moisture is adequate.
- Use proper clothing during herbicide spray.
- Good weed control is essential for good maize yield.
- Weed cause yield reduction in maize .
- Hand weeding can also be employed to control weeds.



Seed cleaning and preparation

Good and clean seed

Poorly sorted seed

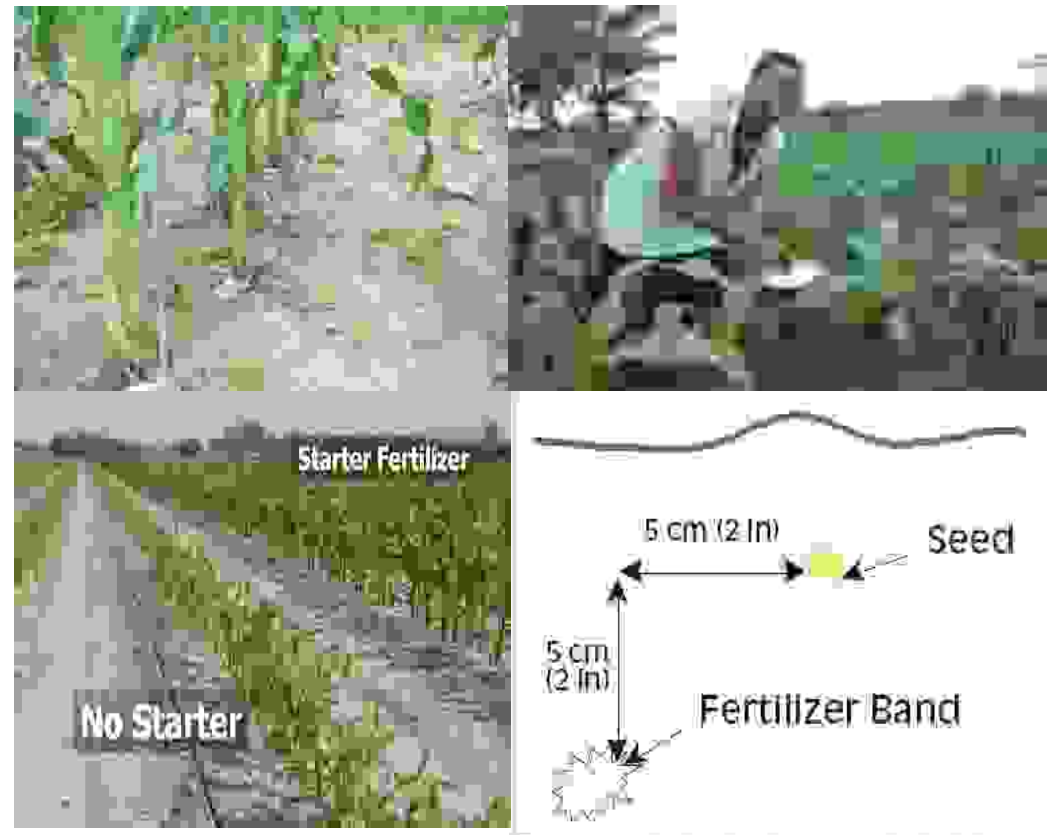


Soybean seed germination test

- Test seeds for germination before planting.
- The germination rate should be 85% or more to obtain a good stand.
- To conduct a quick seed germination test, select 400 seeds randomly and sow 100 seeds each in four wooden or plastic boxes or a prepared seedbed.
- Sow four seed/hole at a distance of 10 cm between the seeds.



- Nitrogen, (N) Phosphorus (P), Potassium (K) NPK 15:15:15 or 20:10:10.
- Fertilizer NPK should be applied by sowing at planting time same date at the rate of 6 bags (50kg) and 2 bags (50kg) Urea 1st application per ha.
- About 8g per Stand about 10cm from the plant
- Use Urea 2bags (50kg) at knee height (4WAP) per ha 2g per stand .
- Some times its splited into 1st, 2nd and 3rd applications.



➤ water it morning and evening.

➤ Start counting the seedlings 5 days after sowing and complete the counting within 10 days. (320 = 80% and above).

➤ When the percentage germination is 80% or less, the seed rate has to be increased accordingly to achieve desired plant population.

➤ For better well less cost it will be wise to buy another seed with good germination

Date of planting

➤ In Nigeria it is usually planted June/July in Northern and Southern guinea Savannas. Depend vavaly date to maturity.

➤ July in Sudan Savannah. because rains become establish in July in the area such as Yobe and Borno

Seed rate

➤ About 50–80 kg *are required to obtain a* population of 444,444 plants/ha for soybean varieties.

➤ Since soybean seed size varies among varieties, it is essential to consider planting in terms of seeds/unit area.

Date of Planting

➤ In north eastern Nigeria it usually planted as early as June – early July, Nov – Feb Irrigations.

➤ Yields declines with late ness or planting after an optimum time, usually at the start of the rains.

➤ Some times as soon as the rains are established

Method of Planting

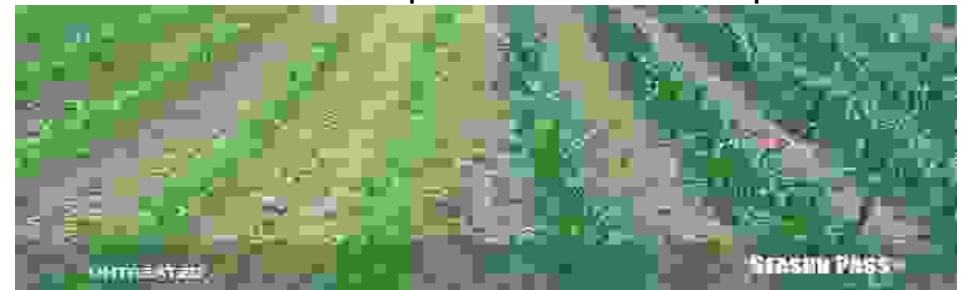
➤ Hand sowing with a spacing of 75cm x 25cm.

➤ 16 – 20kg of seed rate per hacter.

➤ An optimum plant population is essential for maximum yields in maize.

➤ A plant population of 53,333 plants per Hacter is recommended.

➤ Do not sow seed deeper than 2-5cm deep.



Plant nutrient and fertilizer application

➤ For good growth and high yields maize plant most be provided with adequate nutrients (OPV 120:60:60 NPK/ha, hybrid 150:60:60 kg NPK/ha).

Planting /Spacing

- Mix soybean with inoculants before sowing to increase yield and improve soil fertility.
- Sow soybean by hand, planter, or by drilling.
- Plant 4 to 5 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.
- Do not sow seeds more than 2–5 cm deep.
- Deeper planting may result in loss of vigour or failure of seedlings to emerge.

What is Inoculation?

- **Inoculation** simply means bringing the appropriate rhizobia into contact with legume seeds or roots.
- For most soybean varieties there are not enough rhizobia in the soil naturally for good BNF, so the need for Inoculation.

Seed cleaning and preparation

- Use high quality seeds of selection variety open pollinated varieties and hybrid seed
- Grains from hybrid seed should not be used as seed.
- Clean seed by picking broken, rotten and damaged seed and other impurities
- Always buy from seed companies of known reputation.
- Treat seed with seed dressing chemical such as Apron star etc.

Maize seed germination test

- Test seeds for germination before planting
- The germination rate should be 95% or more.
- Select 100 seeds, sow one seed/hole at a distance of 10cm between the seeds.
- Water it morning and evening.
- Count the seedlings 5–7 days after sowing and complete the counting within 10 days.
- For better yields with less cost buy good seed with good germination %.

Why Inoculation?

- Inoculation ensures good nodulation
- With good nodulation, the legume can fix its own nitrogen
- When more nitrogen is fixed, legume yield increases
- Succeeding crops or intercrops benefit from fixed nitrogen
- Inoculants are more cheaper than nitrogen fertilizers



Land Preparation

- Clear all vegetation before land preparation.
- Seed bed may be prepared manually with a hoe or animal drawn implement or tractor.



Choice of Seed Varieties

- Choose a variety suited to your growing zone.
- Variety selection should be based on days to maturity, yield potentials, lodging, drought tolerance, Resistance to pest and diseases.

IMPORTANT POINT TO NOTE ABOUT INOCULATION

- The right inoculant must be used with the right legume
- Inoculant contain living organism that must be protected from heat and sun, therefore always store the package in a cool place away from the sun.
- Inoculate seed just before planting
- Inoculant can be contaminated and loose their effectiveness when stored in open package
- Follow instruction on the package for inoculation procedure
- Protect inoculated seed from direct sunlight by covering container with paper or cloth
- Do not use inoculate after its expiration date

Importance of Maize crop In Nigeria

- Major stable food for human, livestock, oil, biodiseal industries e.t.c
- Can be Successfully grown in many countries
- Source of food and income Farmers
- Important to most north east farming families.

Climate and Soil Requirement

- Maize grows well in deep fertile soil that is well drained.
- With good water holding capacity, Rich in organize Matter.
- Soil can range between heavy clay to light sandy soil
- Loam or Sandy – Loam Soils are Preferable.
- Ideal pH is 5.6 – 7.5, Temperature ranges between 18 - 32°C (Air).
- Water 500 – 1500mm of rainfall in growing season.
- More Moisture is required during flowering and grain filling.
- Avoid Water logged soils.

NODULES



BENEFIT OF INOCULATION IN AN INTERCROP



Ears of *Zea mays* ssp. *parviglumis* (maize's teosinte ancestor) and maize

Teosinte and "reconstructed" primitive maize.

CLASIFICACION



Field corn



Popcorn



Podcorn



Sweet corn

HOW TO INOCULATE SOYBEAN

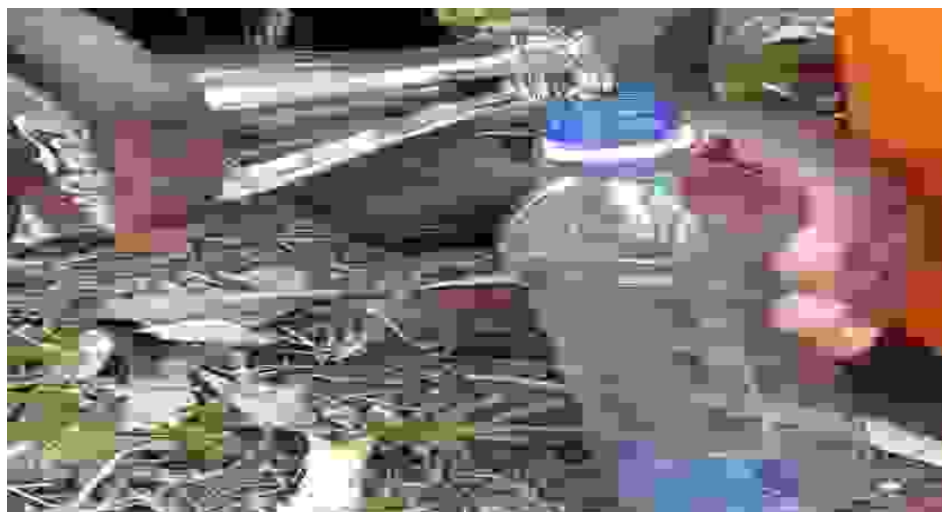
Using Nodulmax

STEPS TO INOCULATE

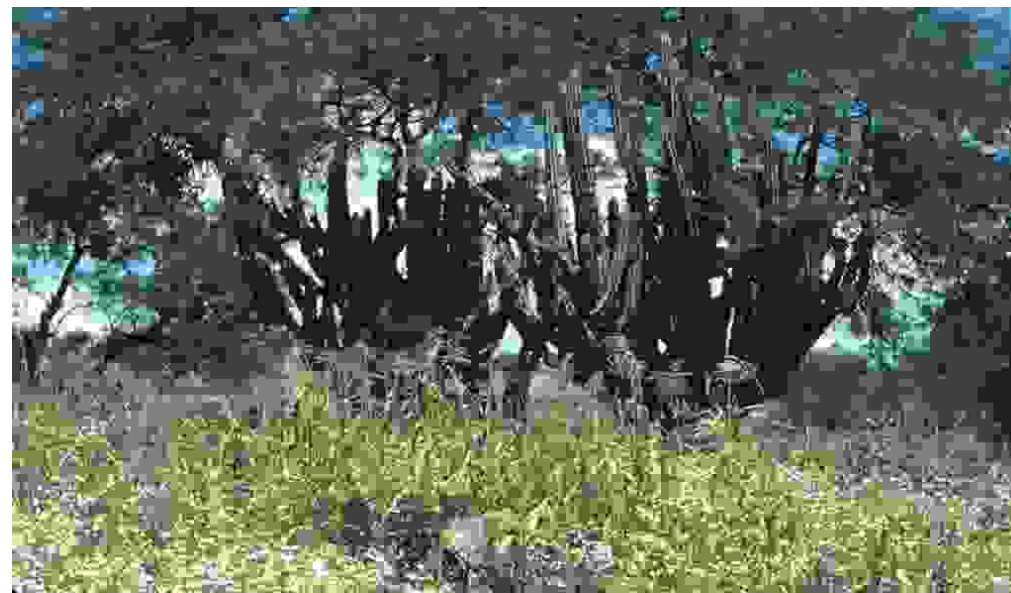
GET 300ML CONTAINER AND YOUR
NODULMAX



PUT 100ML OF CLEAN LUKEWARM
WATER IN 300ML CONTAINER



MAIZE HISTORY



Zea mays ssp.
mexicana (teosinte)
plant

ADD STICKER TO 100ML OF
LUKEWARM WATER



ADD THE MIXED STICKER TO 10-15 KG
OF SOYBEAN SEED



HISTORY OF MAIZE

- Maize is a domesticated form of **Teosinte** (*Zea mays* ssp. *parviglumis*).
- Native to the Balsas River Valley area of southern Mexico.
- About 12% of its genetic material obtained from another **teosinte** species *Zeamays mexicana* through introgression.

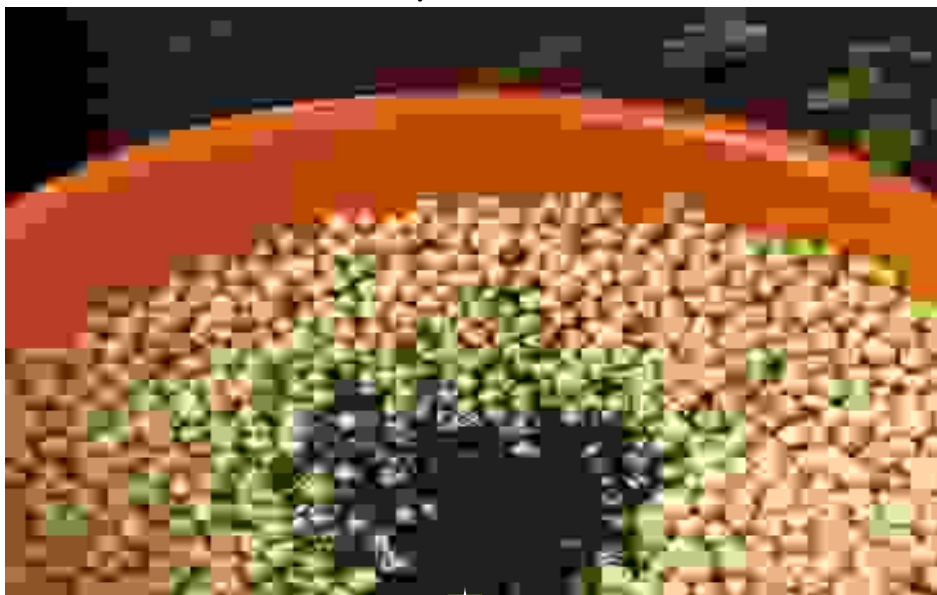
MAIZE DOMESTICATION

- Maize development is thought to have started about 7,500 years ago.
- Archaeological remains of the earliest maize cob, found at Guila Naquitz Cave in the Oaxaca Valley of Mexico, date back roughly 6,250 years

MIX THE STICKER AND SOYBEAN
THOROUGHLY



ADD THE INOCULANT TO THE
STICKER/SOYBEAN



Maize (*Zea mays*)

Production Guide for North East Region
of Nigeria

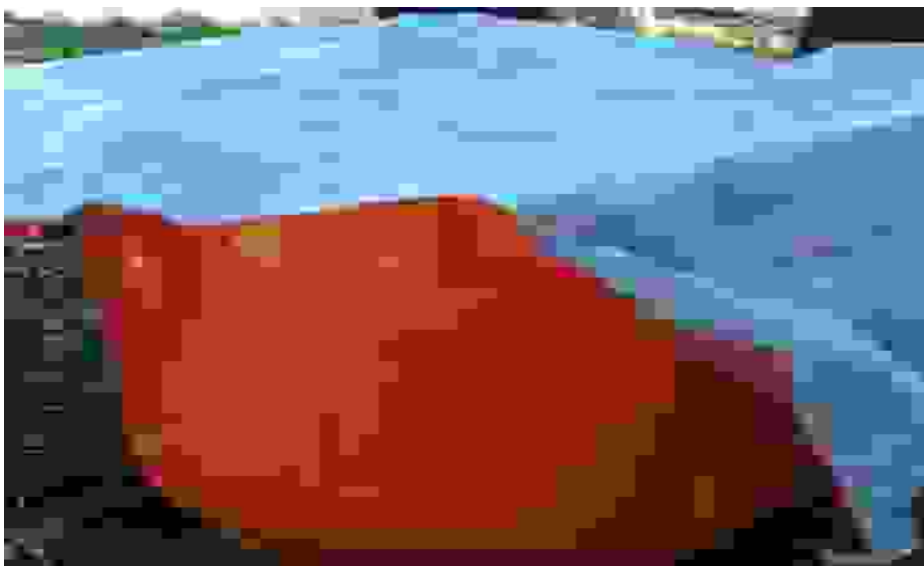
BY

REUBEN SOLOMON
KEFAS JOHN USMAN
DANIEL Y. Z. BWALA

MIX THE INOCULANT WITH THE
STICKER/SOYBEANSOYBEAN
THOROUGHLY



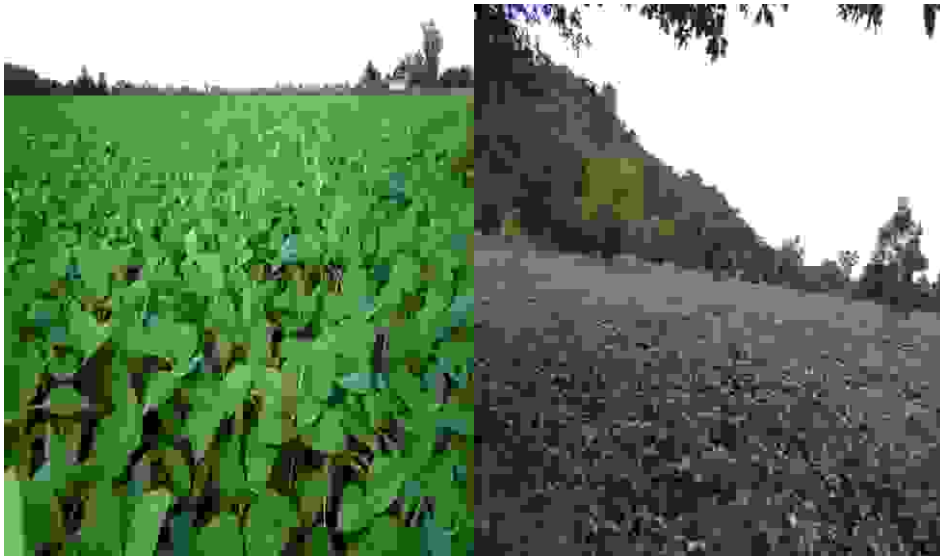
COVER THE MIXED SEED WITH A
PAPER OR CLOTH AND KEEP AWAY
FROM THE SUN



MID SESON EVALUATION OF
TECHNOLOGY



Plant spacing and sowing Good plant population



Plant spacing and sowing Good plant population

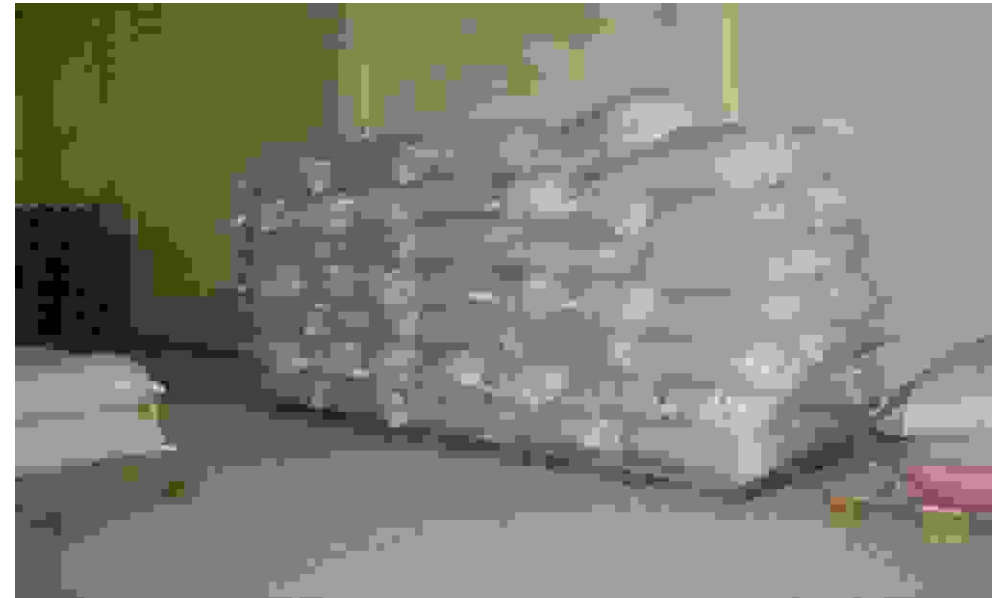


➤ Place clean bagged soybean on a rack in the cold room or in shade.

➤ High moisture content in stored soybean encourages the development of various agents of deterioration, such as insects and microorganisms.

➤ Good storage can greatly influence the storage of soybean and subsequent germination during planting.

Good storage practice



Soybean in rotation with maize



Fertilization

- 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 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 during harrowing and levelling the field.

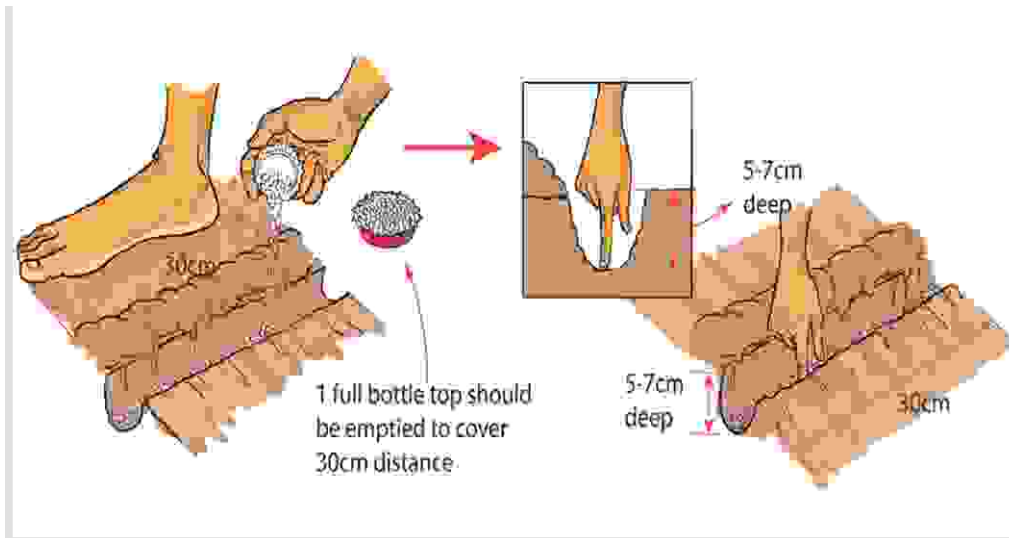
Soybean Combine Harvesters



Storage of soybean

- Soybean should be stored at a moisture content of 10% or less.
- A soybean seed is sufficiently dry when it cannot be dented with the teeth.
- At harvest, the grains usually contain about 14% moisture.
- Dry in the open air to 13% moisture for storage of 6–12 months and to 10–11% for longer storage.

How to apply Fertilizer



Soil fertility enhancement

- Soybean improves soil fertility and fixes nitrogen in the soil for the succeeding cereal crop.
- When grown in rotation with maize, it serves as a trap crop in controlling *Striga hermonthica*, a parasitic weed that attacks maize, by causing suicidal germination of *Striga*.

Soybean Threshers



Soybean Threshers

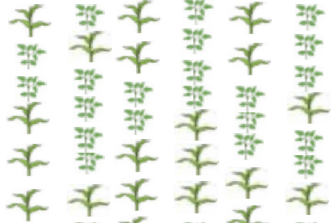


Maize Soybean Inter crop

(c) Strip cropped maize and legume



(d) Mixed cropped maize and legume



(e) Relayed maize and legume



Soybean in rotation with maize



Threshing of soybean

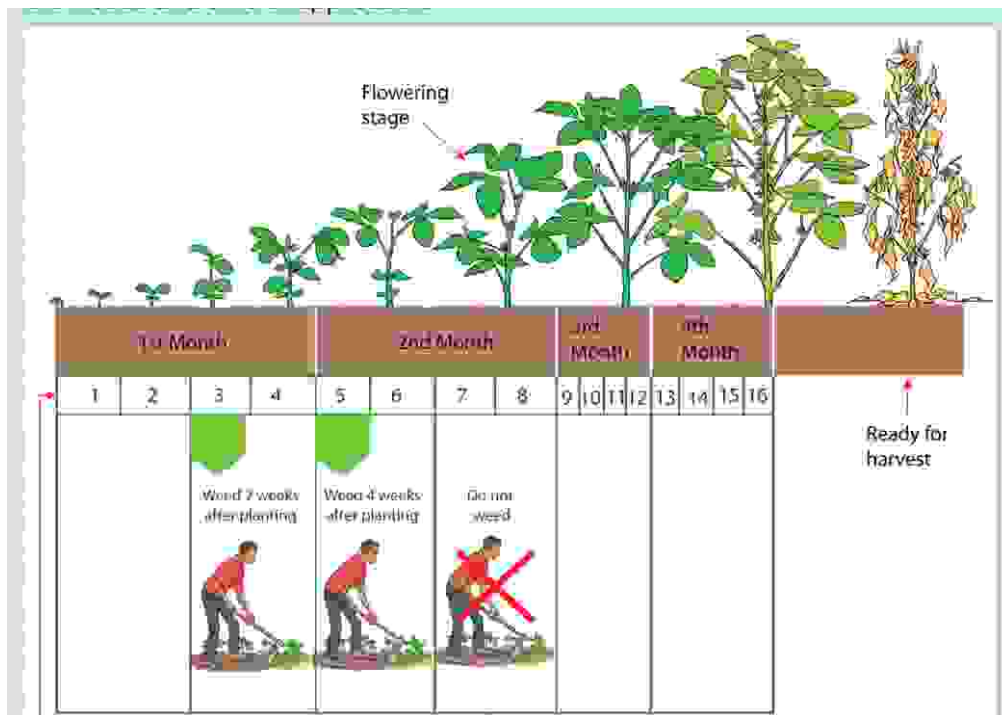
- Thresh manually or mechanically when the plants are properly dry and as soon as possible.
- Manual threshing is mainly recommended for small-scale production.
- It involves piling soybean plants on tarpaulin or putting dry soybean pods in sacks and beating them with a stick.
- The material is then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

Manual threshing and winnowing of soybean



Weed control

- Carry out the first weeding at 2 weeks after planting and the second at 4 or 4 weeks of planting.
- Avoid weeding immediately after a rainfall as this would lead to transplanting the weeds.
- Avoid Weeding when plants are at flowering stage to reduce damage to the plant



Chemical weed control

- Herbicides, if used properly, are safe and effective in controlling weeds in soybean.
- Herbicides are available for pre-emergence (Pendelin or Metaforce)
- Post emergence (Bentaforce).
- If herbicide is applied at planting, one weeding may be required at 4 weeks after sowing.

Pest control

- Kind of different insects occur in soybean fields, But few are of economic importance.
- At the vegetative stage, the crop is very tolerant of caterpillars but very susceptible to silver leaf whitefly attack.
- From flowering onwards, soybean becomes attractive to pod-sucking bugs chewing infest 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.

Harvesting of soybean

- Soybean matures within 3–4 months after planting and requires timely harvesting to check excessive yield losses. (Pod shattering)
- At maturity, the pods are brown in colour. Pod and stem at plant maturity, differ by variety. Common colors include grey, tawny, tan and brown.
- It is recommended that soybean be harvested when about 85% of the pods have turned brown for a non-shattering variety Harvest at 80% for shattering varieties.
- 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 for 2 weeks before threshing.
- Do not harvest by hand pulling because this may remove the nutrient that the soybean has added to the soil.

Diseases control

Diseases

Fungal and bacterial diseases

➤ **Rust:** Asian soybean rust, caused by *Phakopsora pachyrhizi*. Appears like Pustules which 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 up to 80%.

➤ **Rust:** Asian soybean rust, caused by *Phakopsora pachyrhizi*.

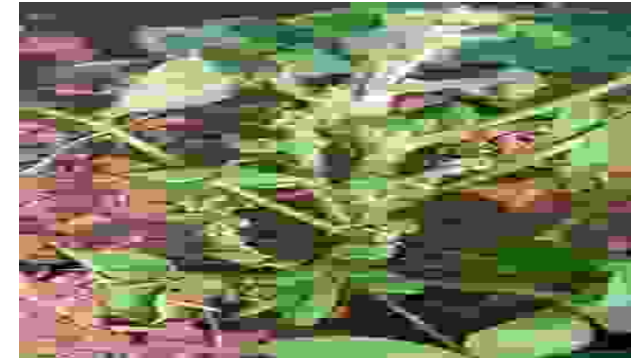
➤ The disease is common where rainfall and humidity are high. (Rust infected soybean)



Dwarf disease:

➤ The causal virus responsible for soybean dwarfing disease is not known.

➤ Leaves and shoots of the infected plants are severely stunted with severe reduction in leaf lamina.



Control of Virus diseases of soybean

➤ Cultivate virus disease-resistant varieties. This is the most convenient, economical, and effective approach for controlling soybean virus diseases.

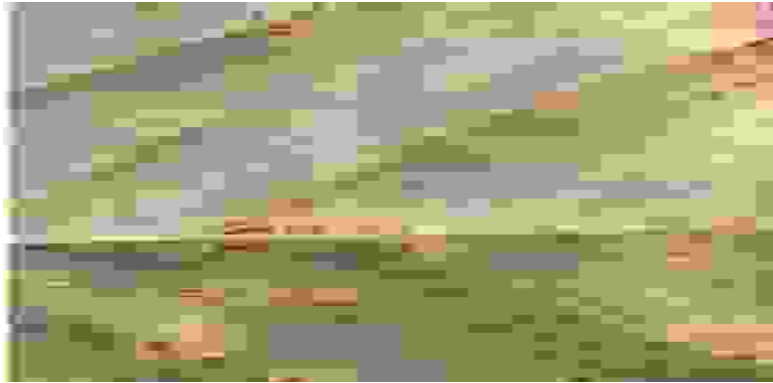
➤ Use certified seed to avoid seed-borne infection.

➤ Rouge (uprooting and destruction) symptomatic plants.

➤ Apply one or two foliar sprays of insecticides to reduce the insect vector activity during pre-flowering stages.

Bacterial pustule

Caused by *Xanthomonas axonopodis*. Symptoms appear as specks to large, irregular spots with raised light-colored pustules in the elevated centres of the spots on the lower surface.



Phytophthora seedling blight and root and stem rot: *Phytophthora sojae*

➤ Young seedlings that appear to be established turn off-colour to yellow, wilt, and die.

➤ 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.

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.

➤ Virus-infected plants produce bright yellow mosaic or specks, and develop into large blotches on the leaf lamina.

Yellow Mosaic disease:



Phytophthora seedling blight and root and stem rot: *Phytophthora sojae*.

- 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.

➤ Phytophthora seedling blight and root and stem rot: *Phytophthora sojae*.

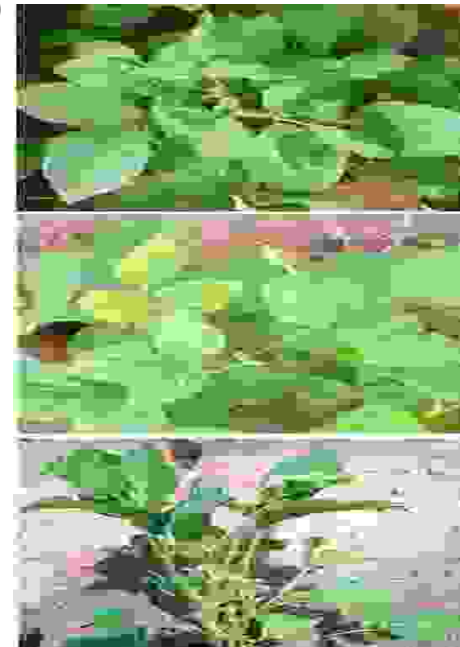
(Soybean attacked by seedling blight and root and stem rot)



Mosaic disease: Cowpea mild mottle virus (CPMMV)

- Southern bean mosaic virus (genus *Sobemovirus*) were also detected in mosaic disease affected plants either singly or in mixed infections, especially CPMMV.
- Symptoms range from mosaic and mottling, leaf curling, green vein banding, and stunting.
- Severe symptoms are seen in plants infected at early stages of growth and significant reduction in pods.

Mosaic disease: Cowpea mild mottle virus (CPMMV)



Frog eye leaf spot: The fungus *Cercospora sojina* ➤ *survives in* infected soybean residue and seeds causes this disease.

➤ Symptoms appear as brown, circular to irregular spots with narrow reddish brown margins on the leaf surfaces.



Control of fungal 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 level in a field.

Viral diseases of soybean

- 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, thickening/brittling of older leaves, puckering, leaf distortion, reduction in leaf size, and stunting of plants.
- **Mosaic disease:** Cowpea mild mottle virus (CPMMV; genus *Carlavirus*, family *Flexiviridae*) transmitted by whitefly (*Bemisia tabaci* Gennadius) 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 *Alfavirus*, family *Bromoviridae*),