KENYA AGRICULTURAL AND LIVESTOCK RESEARCH ORGANIZATION

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FACTSHEET FOR TECHNOLOGY INNOVATORS WORKING WITH SMALL HOLDER FARMERS IN KENYA

SOYBEANS

INTRODUCTION

- Soyabean (*Glycine max*) is a crop with high quality protein (35-40) % and oil (18-20) % maturing in 3 to 6 months depending on the variety and prevailing climatic conditions. There are both erect and creeping varieties of Soyabean.
- It has a high commercial value and contains all the amino acids required by the human body except methionine, usually found in cereals such as maize (Osho, 1995).
- Of all grain legumes, soybean has the highest concentration of protein. While most other grain legumes contain about 20% protein by volume, soybean contains about 40% protein (Greenberg and Hartung, 1998). It is important to note that beef and fish contain about 18% protein. Soybean products are cholesterol free and high in calcium, phosphorus, and fiber (Greenberg and Hartung, 1998).
- Soybean provides more protein and low levels of saturated fat (BIDCO, 2005) than most other vegetable grains. Kenya is a very small soybean producer, even within the African context.
- Earlier FAO records did not recognize Kenyan production in global soybean statistics. In Kenya, soybean is grown in all the regions except Coast and North Eastern.

SITE SELECTION

Climatic requirements

Rainfall

- Soybean is moderately drought tolerant requiring a minimum of 400mm of well-distributed rainfall during the vegetative growth period which lasts 3-4 months.
- High moisture requirement is critical at the time of germination, flowering and pod-forming stage.
- Short duration varieties are recommended in areas where soybean is produced under rain-fed conditions. However, dry weather is necessary for ripening.

Temperatures

- Soybeans grow well under warm and humid conditions. For good germination, soil temperatures should be above 15°C and for best growth about it requires 20-25^0 C.

Soils types and soil condition

- Soybeans can grow on a wide range of soils but thrive best on sand, clay loams and alluvial soil of good fertility.
- The soils should be well drained, fertile and rich in calcium with a pH range of 5.6-7.0.

Altitude

- Soybean can be grown from sea level up to about 3000 m altitude. It performs well between 0-2000 m above sea level.
- At altitudes higher than 2000 masl, the late maturing varieties take as long as 180 days (6 months) but they yield more than the early maturing varieties.

LAND PREPARATION

- Plough land early to conserve moisture and enhance weed control.
- The seedbed should be properly prepared (as for maize).
- Eliminate all grassy weeds especially Couch grass, Kikuyu grass etc.
- Plough in crop residues and vegetation to improve soil fertility. Break up large lumps of soil and level.
- It is recommended to have soil tested to know the acidity/alkalinity status.
- In acidic soils, plough in agricultural lime up to 5 bags (250kg)/acre.

PLANTING

Common soybean varieties

Use recommended variety for your agro ecological area. Average yields in Kenya ranges from 800-1200 kg/ha.

Description	Area	Varieties
Warm temperature areas	Homabay Mitunguu	Duicker, EAI 3600 & Nyala
Moderate temperature areas	Bukura Kakamega Kitale Embu	SCS – 1, Duicker, Nyala & Gazelle
Cool temperature areas	Bahati (Nakuru) Baraton Njoro Menengai	Sable, SCS – 1, Nyala & Gazelle
Marginal rainfall areas	Matayos Gachoka Makueni Ol Rongai	Gazelle, EAI 3600, Nyala & Gazelle

Characteristics of selected soybean types

Type/Characteristics	Perry 41	Black Hawk	Red Tanner	Duicker
Days to flowering	61	81	65	84
Days to maturity	131	151	138	180
Plant height (cm)	48	60	70	43
Seed yield (kg/acre)	720	520	720	400

- Soybean is propagated directly from seed. If seeds are to planted in a field where soybean has not been been grown in the 3–5 year previous, they should first be inoculated with nitrogen fixing bacteria.
- Use recommended variety at a seed rate of 20- 30 kgs/acre.
- Plant at a depth of 2.5-5 cm.
- The soil should be adequately moist and warm when planting.
- Plant manually at a spacing of 45 cm x 10 cm.
- Machine planting at a spacing of 30 cm x 15 cm.

SOIL AND WATER CONSERVATION MEASURES

- Soybean is sensitive to waterlogging but are tolerant of drought conditions once established.
- Soybean grows best on a light, loose, well draining loam with a pH of 6.5.
- More frequent irrigation is needed in sandy, well-drained soils than in heavy clay soils.
- Irrigation at flowering and during seed filling is essential to gain optimum yield.

SOIL FERTILITY REQUIREMENTS

- At planting, apply DAP or TSP fertilizer at 50 kg (23 kg P_2O_5 and 9 kg N) per acre to supply phosphorus.
- Apply one soda bottle top of DAP/TSP per 30 cm (2 feet) along the furrow or place the fertilizer in the planting hole; cover with thin soil, and put in 2 seeds.

Cover with top soil.

- If manure is available, make furrows slightly deeper, apply manure and fertilizer along the furrow or hole and mix with soil before placing seed.

ROUTINE CROP MANAGEMENT PRACTICES

Cropping system

- Soybeans are cultivated both as a sole crop and in various intercropping systems with maize, cassava, sorghum, banana, sugar cane, rubber, oil palm, coconut and fruit-trees.
- In maize and sorghum, soybeans can be intercropped with two rows.
- Intercropping soybean with maize attracts parasitic wasps that control African bollworm (*Helicoverpa armigera*) and at the same time serves as weed cover.
- Soybeans should not be grown on the same site for more than two years to prevent a build-up of soil-borne diseases.
- Practice crop rotation of 3 to 4 years as a part of disease control.
- Soybean grows best in a rotation after maize or small grains but should not follow edible beans, or sunflowers because white mould disease can be carried over.

Weed management:

- Early seedbed preparation is necessary to successful weed control. There are 2 methods of weed control

Chemical method:

- Weed killers (herbicides) can be used either before germination or planting (pre-emergent), or after germination (post-emergent).

Cultural method

- 2-3 hand weedings are necessary to keep the field weed free.
- Weed on time.
- Do the first weeding 2 weeks after planting and the second at 5–6 weeks after planting.
- Uproot diseased plants and plants that look different from the rest.

PEST AND DISEASE MANAGEMENT

Pests

Root-knot nematodes (*Meloidogyne* spp.)

- Field symptoms are typically of stunted, poorly growing plants with yellowing leaves. They may cause also wilting and death of plants particularly in hot weather.

Control

- Plant resistant varieties, where available.
- Rotate for at least 3 to 4 years with cereals.
- Use bio-products (e.g. neem extracts). Some are commercially available for nematode control.

Bugs

Sucking bugs are major soybean pests. They feed on pods and soft growing plant parts. While feeding they inject toxins into pods/seeds causing necrosis.

Control

- Control strategies should be related to the stage of pod development. It has been shown that early pod fill is the most sensitive stage to attack by green stinkbugs and the only one in which yield, seed weight and oil content was significantly reduced.
- Bugs should be controlled before this stage is reached, towards the end of pod elongation.
- Once pod fill is completed, soybeans are not at risk and control is not warranted unless planting seed or edible seed is being grown.
- Neem-based pesticides reportedly reduce feeding by green shield bugs.

Beanflies

- Female flies lay eggs on young leaves, piercing the leaves and sucking the exuding sap resulting in yellow blotches on the leaves, which are the first signs of bean fly attack and are useful for early detection of this pest.

- Maggots mine their way from the leaves down to the base of the stem, where they complete their development. Maggot feeding destroys the tissue causing the steam to swell and split and reducing formation of lateral roots.

Control

- Plant early in the season. Bean fly numbers tend to be low during the early stages of the growing season and increase with time.
- Avoid planting soybeans near cowpea, beans and other leguminous crops, that may be the source of bean flies.
- Remove and destroy crop residues and all plant parts with symptoms of damage by bean flies.
- Monitor the field shortly after emergence.
- If necessary, spray neem extracts. Frequent foliar applications of neem extract give satisfactory control of bean flies.

Diseases

Soybean rust

Control

Plant resistant varieties, if available.

Soybean mosaic potyvirus

Control

- Use certified disease-free seeds.
- Practise aphid control to reduce the spread of virus.
- Plant resistant cultivars, if available.

White mould (*Sclerotinia sclerotiorum*)

Control

- Use certified disease-free seeds.
- Plant resistant varieties, if available. Early maturing cultivars tend to escape infection because of their usually short stature and early flowering. In contrast, late maturity cultivars are believed to have more disease because of lush vegetative growth and later flowering.
- Avoid planting soybean directly after common bean or sunflower

Control

- Use certified disease-free seeds.
- Plant resistant varieties, if available.
- Avoid overhead irrigation.

Bacterial blight *Pseudomonas syringae*

Control

- Plant only certified seed; plant resistant varieties; treat seeds with an appropriate antibiotic prior to planting to kill off bacteria.
- Spray plants with an appropriate protective copper based fungicide before appearance of symptoms.

Bacterial pustule *Xanthomonas campestris*

Control

- Plant varieties of soybean that are resistant to bacterial pustule; spray plants with an appropriate protective copper based fungicide before appearance of symptoms.

Rust *Phakopsora pachyrhizi*

Control

- Plant soybean varieties that are resistant to rust;
- Applications of appropriate foliar fungicides can help to control the disease.

HARVESTING

Maturity

- Early-maturing varieties can be harvested for grain 70 days after planting and late maturing varieties need up to 180 days.
- Timely harvesting is important to avoid shattering and loss of grains.
- Harvest when about 90% of the pods turn brown, most of the leaves have been shed and seeds in pods rattle when plants are shaken.
- Use a panga to cut the mature plants and leave roots in the field to add nutrients to the soil.
- Combine harvesters can be used in large fields when moisture content is 16-18% after 1.0 - 1.5 weeks post physiological maturity.

POSTHARVEST HANDLING

- Dry the harvested plants on clean surface like tarpaulin, canvas, mats in sunlight for about 4 days before threshing, this reduce crop moisture content to 13% or less (which is good for safe storage).
- Soybean seed is sufficiently dry when it cracks between teeth.
- Winnow and sort to remove plant materials, broken or shivered seeds etc.
- Clean seed should be treated with Actellic 2% to protect against brucchids before putting in clean bags or metallic silos placed on wooden pallets.

Storage:

- Store seed in bags or silos in a cool dry, aerated place (below 75% relative humidity at low temperature).
- Seed meant for planting should not be stored for more than 6 months due to rapid loss of viability.

Utilization

- Soybeans are used in the preparation of a variety of fresh, fermented and dried food products like milk, tofu, soya sauce and bean sprouts.

- Soybeans are used not only for food but they serve also as a cure for various diseases and body ailments. Soybeans (preferably black ones) are included in medicines to improve the function of the heart, liver, kidneys, stomach and bowels.
- They are also processed to extract oil for food and for numerous industrial purposes.
- As edible oil, soybean enters the market as salad oil, cooking oil, margarine and shortening.

MARKETS

- Current demand for soybean in Kenya exceeds supply despite numerous efforts by the government to increase production.
- Currently, the country is producing 2000-5000 metric tonnes per year against domestic demand of 12,000 metric tonnes, forcing local companies like Bidco and Promidisor to import.
- BIDCP is one of the major markets buying a kilo of soya beans for Sh90-120, which is at least Sh30 more compared to the current market price.
- Other companies that buy soybean in Kenya include Prosoya Kenya Limited, Kapa Oil Refineries Ltd, Kenya Industrial Research And Development Institute (KIRDI) and TruTrade Africa.

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