Table of Contents

Introduction 2
Before planting 3
Site selection 3
Land Preparation 3
Choice of Variety 3
Seed preparation for planting 5
Germination Test 5
Planting 6
When to plant 6
Seeding rate 6
Plant spacing and sowing 6
Fertilizer application 7
Pests and diseases 7
Weeds and their control 7
Manual weed control 7
Chemical weed control 7
Insect pests and their control 8
Diseases and their control 8
Harvesting and Post-Harvest handling 9
Threshing soybean 10
Storage 10
References 10
**Introduction**

Soybean is among the major industrial and food crops grown worldwide in almost every continent. The Presbyterian Missionaries at the Aburi gardens introduced it to Ghana before 1910. Soybean is described as a wonder crop offering a lot of economic, nutritional and health benefits to rural smallholder producers. Nutritionally, it has grain composition of 40% protein and 20% oil and contains all the essential amino acids, Methionine, Cysteine and Lysine and therefore, has the potential of eradicating malnutrition among low income earners who cannot afford adequate animal protein in their diets. Soybean cake is an excellent source of feed in the livestock industry. Also, the haulms provide good feed for goats and sheep. The revamping of the poultry sector in the past four years has also increased demand for soybean meal in Ghana. Soybean also has many non-food industrial uses. The soils of northern Ghana are generally poor in organic matter and nitrogen partly due to centuries of continuous bush burning. As a nodulating legume, soybean is able to fix atmospheric nitrogen and thereby minimise the amount of chemical fertilizers to be applied to cereal crops such as maize, sorghum and millet. The revamping of the poultry sector in the past four years has also increased demand for soybean meal in Ghana. The market for soybean in Ghana is growing fast with opportunities for improving the income of farmers. Currently, a number of soybean processing factories have been established in almost every region of Ghana.

CSIR-Savanna Agricultural Research Institute (CSIR-SARI) has developed improved varieties and technologies for soybean production. This guide outlines crop production practices that farmers may use to grow soybean profitably in Ghana.
Before Planting

Site Selection

Soybean can be grown in all parts of Ghana except in the acidic soils of the high rainforest and the drier savannah areas. The best environments occur in the savannah and the transition zones.

Choose a flat, well-drained loamy soil. Avoid gravelly or clayey areas. Gravelly soil cannot hold enough water to support good plant growth whereas clayey soil do not drain fast enough after rains, leading to water-logging and resulting in poor soybean plant growth. Soybean can be grown in any soil that is suitable for growing maize.

Land preparation

The land can be prepared mechanically by a tractor or animal-drawn implement and manually with a hoe in the absence of tractor services. A good contact between the seed and the soil enhances germination therefore proper land preparation is required to ensure good germination and reduced weed infestation.

Choice of variety

Selected soybean varieties grown in Ghana are presented in Table 1. Farmers must select varieties that are adaptable and recommended in their respective agro-ecological areas. Select soybean variety based on maturity, yield potential, lodging, drought tolerance, shattering resistance (Figure 1) and resistance to pests and diseases. SARI has developed varieties which are high yielding, early maturing and resistant to shattering. Choose varieties that are early maturing rather than late maturing in areas with low rainfall like the Upper East Regions. Although late maturing varieties have the capacity to give higher yields, it is risky to grow late-maturing varieties in areas with low rainfall because of late-season dry spells. Choose Jenguma or “Quarshie” for shattering resistance and high yield, Soung-Pungun for early maturity and Afayak and Songda for striga control.
**Table 1. Recommended soybean varieties for Guinea savanna ecological zones in Ghana**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Maturity</th>
<th>Ecology</th>
<th>Characteristics</th>
<th>Striga control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salintuya-1</td>
<td>Medium</td>
<td>Throughout Ghana</td>
<td>High grain yield, susceptible to shattering, high oil content and excellent grain colour</td>
<td>Not known</td>
</tr>
<tr>
<td>Salintuya-2</td>
<td>Late</td>
<td>Throughout Ghana</td>
<td>High grain and fodder yield, highly susceptible to shattering, high oil content and excellent grain colour</td>
<td>Not known</td>
</tr>
<tr>
<td>Jenguma</td>
<td>Medium</td>
<td>Southern and northern Guinea savannas</td>
<td>High yield, shattering resistance, high oil content and excellent grain colour</td>
<td>Good</td>
</tr>
<tr>
<td>“Quarshie”</td>
<td>Medium</td>
<td>Southern and northern Guinea savannas</td>
<td>High grain yield, moderately resistant to shattering</td>
<td>Not known</td>
</tr>
<tr>
<td>Afayak</td>
<td>Medium</td>
<td>Southern and northern Guinea savannas</td>
<td>High grain yield, good trap-crop for <em>striga hermonthica</em> control</td>
<td>Excellent</td>
</tr>
<tr>
<td>Suong-Pungun</td>
<td>Early</td>
<td>Northern Guinea and Sudan savanna</td>
<td>High grain yield, shattering resistance, drought tolerant</td>
<td>Good</td>
</tr>
<tr>
<td>Songda</td>
<td>Medium</td>
<td>Southern and northern Guinea savannas</td>
<td>High grain yield, good trap-crop for <em>striga hermonthica</em> control</td>
<td>Good</td>
</tr>
</tbody>
</table>
Use high quality seed of the selected variety. Soybean seeds easily lose viability during storage especially when stored beyond 12 months. Therefore, seeds that are not more than 12 months old should be used to ensure good germination. The seeds should be sorted to ensure that seeds for planting are free from insects, disease infestation and weed seeds. It is also recommended that seeds should not be purchased from the open market as the germination potential is not guaranteed. They should be purchased from seed companies or accredited seed producers nearest to you.

**Germination test**

Test seeds for germination before planting. The germination rate should be 85% or more to obtain a good plant stand. To test for germination, select 400 seeds randomly and sow 100 seeds each on a prepared seedbed. Sow one seed per hole at a distance of 10 cm between the seeds. Water the seedbed well before sowing and provide water every morning and evening. Start counting the seedlings 5 days after sowing and complete the counting within 10 days. When the percentage germination is 80% or less, the seed rate has to be increased accordingly to achieve 100% germination.

*Fig. 1 Shattering resistant soybean  Fig. 2 Shattering susceptible soybean*
Planting

When to plant

Soybean should be planted such that maturity and harvest coincide with the dry period. The recommended dates for planting soybean in different ecological zones in Ghana are presented in Table 2. Plant soybean as early as the rains are well stabilized. Do not plant too early because a prolonged dry spell after planting may result in permanent wilting of the crop whereas late planting may expose the crop to attack by some late season pests and deprive the crop of sufficient moisture if the rains stop early.

Table 2. Recommended dates for planting soybean in Ghana

<table>
<thead>
<tr>
<th>Ecological zone</th>
<th>Suggested time of planting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derived savanna/southern Guinea</td>
<td>Early June to early July</td>
</tr>
<tr>
<td>Northern Guinea savanna</td>
<td>Mid-June to early July</td>
</tr>
<tr>
<td>Sudan savanna</td>
<td>Early July</td>
</tr>
</tbody>
</table>

Seeding rate

The required seed rate for optimum population is about 40-45 kg/ha. Since soybean seed size varies among varieties, it is essential to consider planting in terms of seeds/unit area. Most soybean seed sizes range from 12.6 to 18.9 g/100 seeds.

Seed dressing

Seed treatments can help protect seeds and seedlings from fungal pathogens and insect pests. Therefor seeds should be treated before planting. They should be treated with fungicides such as, Captan, Apron Plus or Thiram at the rate of one sachet/8 kg seeds before planting for protection against soil-borne fungal diseases.

Plant spacing and sowing

Sow soybean by hand, planter or by drilling. Plant in lines to make the control of weeds, pests and harvesting easier. Planting can be done on the flat or on ridges made by the tractor, bullock or by hand. Plant 2-3 seeds per hole at a spacing of 75 cm between rows and 5 cm within rows. Alternatively, drill seeds at 60-75 cm between rows and 5 cm within rows to cut down labour cost. For the early maturing varieties such as Soung-Pungun a spacing of 60 cm
between rows and 5 cm between plants in a row is recommended because they respond better to narrow spacing than the late maturing varieties.

**Fertilizer application**

Until nodulation, the soybean plant depends on soil nitrogen for growth. Phosphorous is often the most deficient nutrient, therefore, apply optimum phosphorous fertilizer for good yield. In northern Ghana, we recommend a rate of 25 kg nitrogen (urea or Sulphate of ammonia), 60 kg P2O5 (Single super phosphate) and 30 kg K2O (Muriate of potash). Incorporate the fertilizer into the soil at land preparation during harrowing and levelling the field. Farmers who can afford cow dung, back yard manure or compost can apply it to such poor soils.

**PESTS AND DISEASES**

**Weeds and their control**

Control weeds to minimize competition for nutrients, water, sunlight and space. Early weed control is very important in soybeans to ensure minimal competition from weeds in the first 6 weeks. Weeds control in soybean could be manual or chemical or both.

**Manual weed control:**

Weed your field at about 2 weeks after planting and again 2 weeks later (4-5 weeks after planting) depending on the density of the weed. If the plants grow very well and the canopy closes early, the second weeding may not necessary. The second weeding should be completed before flowering to prevent the flowers from dropping. Avoid weeding immediately after a rainfall as this would lead to transplanting some of the notorious weeds.

**Chemical weed control**

Herbicides when used properly are safe and effective in controlling weeds in soybean. The choice of herbicide, however, depends on the predominant weed species on the field and the availability of the herbicide. Herbicides are available for pre-emergence or post-emergence weed control in soybean. Some of the soybean herbicides are; Paraquat Plus Butachlor, Pendimethalin, Butachlor, Fusilade forte and Glyphosate products. Please read instructions for rate and time of application carefully before applying the herbicide. Seek the assistance of your agricultural extension agent (AEA) if necessary.
Insect pests and their control

Soybean in the past was relatively free of the numerous pests that attack other legumes in Ghana. This trend has changed as several insects now occur in soybean fields although only a few are of economic importance. However, in areas where large scale production has been going on for a long time, pests control is necessary. In the vegetative stage the crop is very tolerant of caterpillars such as leaf rollers but very susceptible to silverleaf whitefly (figure 3) attack. Under most conditions, moderate defoliation early in the season is compensated for by the growing crop and therefore has little effect on grain yield. However, as plants reach flowering and pod-filling stages, defoliation may pose a threat to yield due to limited compensation at this stage.

From flowering onwards soybean becomes attractive to pod-sucking bugs (Figure 4) that can cause serious reduction in grain yield and seed quality. Therefore, the crop should be protected at this stage for optimum yield. Insect pests can be controlled with a single or two sprays of Cypermethrin + Dimethoate 10 E.C., K-Optimal (Lambda-cyhalothrin + Acetamiprid) or any appropriate insecticide. Ask your extension agent for guide on the selection of insecticides. Also, read the chemical label for application rates and conditions.

Diseases and their control

In Ghana, the soybean rust caused by *Phakopsora pachyrhizi* is the major disease of economic importance. The infected leaves have small tan to dark brown or reddish brown lesions on which small raised pustules (or ‘bumps’)
occur on the lower surface of the leaves (Figure 6). The disease is severe in high rainfall areas. Bacterial postule caused by *Xanthomonas axonopodis* pv. *glycines* is another disease with symptoms sometimes similar to rust. Symptoms of this disease appear as minute pale green spots that enlarge to irregularly shaped lesions. Most lesions have prominently raised postules on the under surface of leaves.

The soybean mosaic virus disease is another common disease of soybean in Ghana. The disease is transmitted by aphids and other insect vectors. Symptoms of plants infected with soybean mosaic virus can range from no apparent symptoms to severely mottled and deformed leaves (Figure 7). Mottling appears as light and dark green patches on individual leaves. Symptoms are most obvious on young, rapidly growing leaves. Infected leaf blades can become puckered along the veins and curled downward.

Other diseases of soybean in Ghana include charcoal rot, *Cercospora* leaf blight, brown spot, anthracnose etc. Contact the agricultural extension area in your area for proper diagnosis and control of diseases in your soybean field.

**HARVESTING AND POST-HARVEST HANDLING:**

Soybean matures within 3-4 months after planting and requires timely harvesting to check excessive yield loss. It is recommended that soybean be harvested when about 85% of the pods have turned brown for a non-shattering variety but 80% for shattering varieties. Stack them loosely on a 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 nutrients that the soybean has added to the soil. Harvest by cutting the mature plants just above ground level. Harvesting should normally be done in the morning hours when temperatures are low to avoid shattering.
Threshing soybean:

Thresh manually or mechanically when the plants are properly dry and as soon as possible. Manual threshing is recommended for small scale production. It involves piling soybean plants on tarpaulin or putting soybean pods in sacks and gently beating them with a stick (Figure 8). The beating should be gentle to avoid destroying the embryo which may affect germination and overall seed quality. The material should then be winnowed to remove soybean debris and other trash. Use mechanical threshers in large-scale production. Such threshers are equipped with blowers that separate the grains from the chaff.

Storage

At harvest the grain contains about 14% moisture. Dry to 13% moisture for storage of 6-12 months and to 10 or less for longer storage. A soybean seed is sufficiently dry when it cannot be dented with the teeth or fingernails. Do not leave soybean exposed to high temperatures, as it will increase deterioration and reduce seed viability. Soybean should be stored in sacks that should be raised off the ground.

References


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