AVRDC

AVRDC Training Guide

Suggested Cultural Practices for Vegetable Soybean

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Introduction

Vegetable soybean is popular in Japan, Korea, China and Taiwan, and consumption is increasing very rapidly. The green-shelled beans can be cooked to make a tasty and nutritious meal or snack.

Grain soybean is already widely cultivated in many countries of the tropics and subtropics, so the production of vegetable soybean can be readily adopted. The cultivation practices for vegetable soybean and grain soybean are similar except that vegetable soybean is harvested when the pods are green and full (Fig. 1).

The seeds of vegetable soybean are commonly larger, sweeter and more tender than grain soybean. Such green seeds are commonly used in most countries. Even grain soybeans at green pod stage can be used as a vegetable.

Vegetable soybean has excellent potential for enriching the human diet. It is a rich source of vitamin A and a good source of carbohydrate, protein and iron. It is more nutritious than vegetable green peas.

In addition to domestic consumption, vegetable soybean also has export potential. Export market requirements are: 100-dry seed rate of 30 g or more, two or more seeds per pod, gray pubescence on pod, short cooking time, easy-to-squeeze pod texture after cooking, and slightly sweet taste. Frozen vegetable soybeans are popular in supermarkets of Japan and Taiwan.

Fig. 1. Vegetable soybeans are larger, sweeter and more tender than grain soybeans.

Climate and soil requirements

The best planting date of vegetable soybean is dependent upon temperature and daylength. The optimum temperature range of soybean cultivation is 20–30 ºC with short daylength (14 hours or less). However, planting should be avoided at cooler temperatures during winter.

Loam soil with pH of 6.0-6.5 is suitable for its cultivation, but the field should be well drained.

At AVRDC, the following suggested cultural management practices are adopted for high yields of good quality vegetable soybean. You can make modifications to suit local conditions.

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Preparing the field

Land tillage makes the soil friable for good germination, increases soil porosity and aeration for healthy plant growth, and kills weeds that compete with the crop for nutrients, moisture and light. Plow and rototill the field.

For best results, take soil samples and have them analyzed. The fertilizer requirements are determined on the basis of the analysis. The higher the current level of nutrients in the soil, the lesser will be the quantity of fertilizer needed. To get a good harvest and maintain soil nutrient status of consistent productivity, a fertilizer mix containing N, P_2O_5 and K_2O at the rate of 20–30, 60 and 80 kg/ha respectively, is applied by broadcast as a basal dose. The fertilizer is incorporated into the soil with final harrowing and leveling of the field.

The soil should not be too dry at the time of seedbed preparation. At AVRDC, we irrigate the field 3–4 days prior to sowing to ensure sufficient moisture in the soil for good germination. Prepare 20-cm raised beds spaced 1 m apart from center of one bed to the center of the next.

Treating and sowing seed

Usually Rhizobium inoculation is not required in fields where legumes are cultivated. But newly opened lands need Rhizobium bacteria inoculations at 10 g per kilogram of seed (Fig. 2). This inoculation will promote nodule formation and nitrogen fixation by the plant roots (Fig. 3). The seed is also treated with fungicides such as captan or thiram for protection against soilborne fungal diseases.

Spacing between rows is 45 cm and between plants 5–10 cm depending upon seed size and season. Two to three seeds are sown in each hill. However, spacing between rows varies with variety and season. Usually seeding (60-80 kg seed/ha) is required to obtain a population of 400,000 plants per hectare. Seeds can be sown by hand or machine.

Figs. 2,3. Seeds are inoculated to promote nitrogen-fixing nodules on roots (inset).

Sidedressing

The first sidedressing is done at the rate of 20 kg N + 25 kg K_2O per hectare along plant rows at flowering for higher pod set. A second application of 20 kg N per hectare is done at the beginning of the pod filling stage to improve seed size.

Irrigating

Maintaining proper soil moisture throughout the growing season is important for good quality pods. Usually, first irrigation is needed within a week after sowing. Irrigation is done in furrows (Fig. 4). Depending upon weather and soil moisture conditions, the irrigation is continued at 10–15 day intervals until the pods are well developed. Irrigating the crop is essential at critical periods such as flowering and pod filling stages.

Fig. 4. Furrow irrigation in soybean field.

Controlling weeds

At AVRDC, application of alachlor at 1.5 kg a.i./ha either alone or combined with pendimethalin at 0.75 kg a.i./ha as pre-emergence spray is practiced to control weeds. Intertillage once or twice is beneficial for aeration of root system and to control weeds that emerge after the effect of herbicides fades off (Fig. 5).

Fig. 5. Tilling between rows of soybean.

Controlling diseases

Rust may be a serious problem, especially for seed production, causing up to 100% yield loss. Tan, dark brown or reddish brown lesions occur on leaves of affected plants (Fig. 6). No commercial varieties are resistant to rust, but rust-tolerant breeding lines have been selected at AVRDC. Fungicides such as mancozeb or triadimefon at the rate of 2 kg a.i./ha are sprayed at 10-day intervals to control rust.

Fig. 6. Rust disease symptoms.

Downy mildew disease occurs during spring and autumn seasons but it does not generally cause yield reduction. The symptoms are pale green to light yellow spots on the surface of the leaf (Fig. 7). These spots enlarge into pale to bright yellow lesions. The underside of the leaf shows white powdery spores. To control downy mildew, plant resistant cultivars. For susceptible cultivars, spray fungicides such as mancozeb at the rate of 2 kg a.i./ha depending upon severity of disease attack.

Bacterial pustule can cause yield losses of up to 40%. Early symptoms are small pale green lesions that become watersoaked with bacterial ooze that dries to become white crust on upper/lower leaf surfaces (Fig. 8). The best way to control this disease is by planting resistant varieties.

Figs. 7,8. Downy mildew and bacterial pustule damage.

Controlling insect pests

Beanfly (*Ophiomyia phaseoli*, *O. centrosematis*, *Melanagromyza sojae*, and other species) is a serious pest of soybean. Beanfly larvae feed inside the plant stem (Figs. 9-11) and their initial damage cannot be recognized easily. Beanfly populations are higher in the cool autumn at AVRDC compared to long dry weather conditions in spring.

Soybean must be protected against beanfly. For the autumn crop at AVRDC, monocrotophos, omethoate or dimethoate is sprayed at the rate of 0.5 kg a.i./ha at 3, 7, 14, 21, 28 and 35 days after emergence. The first three sprays are very important and should not be delayed. In spring, usually there is no serious damage.

Figs. 9-11. Split stem, tiny adult fly on leaf tip (inset), and close up of beanfly maggot feeding inside stem.

Pod borers (*Etiella zinckenella* and others) may attack soybean but usually they do not cause significant yield loss if insecticides are used for beanfly control (Fig. 10).

Fig. 10. Pod borer feeding in soybean pod.

Coreid and stink bugs commonly occur late in spring and summer season crops (Figs. 11, 12). If you notice high populations (i.e. 3 to 4 insects per meter row) uniformly over the entire field in early pod filling stage, spray insecticides such as fenvalerate at 100 g a.i./ha or deltamethrin at 30–50 g a.i./ha weekly till the infestation is controlled.

Defoliators feed on leaves (Fig. 13). Minor damage does not require insecticide application, but when the attack is severe, they can be controlled by the insecticides used for stink bug control.

Stop spraying chemicals at least 10 days prior to harvest. Overuse of insecticides or fungicides is hazardous for human and animal health.

Fig. 11, 12. Coreid bug on pod and stink bug (inset).

Fig. 13. Defoliating larva on leaf.

Harvesting and grading

Harvesting is done when 80% of the pods have reached physiological maturity stage. It may take 65 to 75 days after germination for vegetable soybeans to be ready for harvest depending upon variety, temperature and weather conditions. The pods are still green.

In Taiwan, harvesting usually begins at midnight when dew and cool temperature help to preserve the green color and freshness of the soybeans (Fig. 14). When harvested in daytime, the plants are kept under the shade (Fig. 15). The pods are stripped from the plants by hand (Fig. 16). Harvesting machines can save labor, cost and time.

Grading is important for export of good quality vegetable soybeans (Fig. 17). The diseases and insect-damaged pods and pods with spots and blemishes are sorted out. The good marketable yields are 7–10 t/ha of pods, or 4–7 t/ha of green beans, or 18–25 t/ha of whole plants. ⌘

Fig. 14. Harvesting at night to maximize pod quality.

Fig. 15. Harvested plants are unloaded and placed in cool shade.

Figs. 16, 17. Pods are stripped from plants and graded.