MUNGBEAN

Seed Production Training Manual

AVRDC
The World Vegetable Center

MUNGBEAN (Vigna radiata (L.) R. Wilczek var. radiata) is one of the most important food legume crops in South, East and Southeast Asia, where 90% of global production currently takes place. Mungbean is a relatively drought-tolerant and low-input crop that can provide green manure as well as livestock feed and thus is favoured by smallholder farmers.

Climate

Mungbean grows in a wide range of climatic conditions. A warm humid climate with temperature ranging from 25^0 C to 35^0 C, with 400-550 mm rainfall, well distributed during the growing period of 60 - 90 days, is suitable for cultivation.

Soil

Mungbean is grown on a wide range of soils including red laterite soils, black cotton soils and sandy soils. A well-drained loamy to sandy loam soil is best for its cultivation. The crop does not grow well on saline and alkaline soil or waterlogged soils.

Preparation of the field

Mungbean requires proper drainage and ample aeration in the field so that activities of the nitrogen fixing bacteria are not hampered at any stage of plant growth. Prepare ridges and furrows in the field by ploughing, harrowing and levelling by bullock drawn (**Figure1**) or tractor drawn **(Figure 2)** implements.

Figure 1

Figure 2

Manures and Fertilizers

The application of well decomposed 10-12 tonnes of farmyard manure (FYM) provides the desired quality to the soil. The FYM is mixed with soil one month before sowing.

Trichoderma inoculation: It may be desirable to add Trichoderma viridae @ 5 kg/ ha with FYM and keep this mixture under partial shade for 4-5 days. Then apply this to soil before sowing.

In addition to the above, a fertilizer mix containing N, P_2O_5 and K_2O at the rate of 15, 60 and 100 kg/ha, respectively is broadcasted and incorporated into the soil before planting. Top dressing of N at 15 kg/ha is done at flowering stage.

Seed rate

Seeds which are healthy, undamaged and free from insect pests and fungi should be selected. The seed rate varies with seed size and season. In the case of bold-seed types a seed rate of 20 kg/ha is appropriate in spring and autumn, and 16 kg/ha in summer.
It is advised to establish a plant population of 25 plants/m^2 for obtaining good seed yield.

Seed treatment

Well dried seed may be treated with Captan or Thiram @ 3g/kg seed against any seed borne fungal disease.

Seed inoculation

Rhizobium inoculation is highly recommended in fields where mungbean cultivation is taken up for the first time.

Isolation distance

Mungbean is a self-pollinated crop, but some cross-pollination can occur. An isolation distance of 3 m is usually sufficient.

Method of sowing

Line sowing is more advantageous as it requires less seed, produces a more even crop that is easier to manage and will have higher yield potential. The space between the ridges is kept at 30-45 cm and 10 cm between the plants.

Broadcasting of seed, while an established practice makes weeding, crop management and harvest much more labour intensive and significantly reduced crop productivity and economic return.

Irrigation

Irrigate depending upon weather, soil and field conditions. Usually the first irrigation is required just after seedling emergence. Later, apply two to three more irrigations at 10 to 15 day intervals during the dry season. The last irrigation should be stopped about 50 days after sowing. Generally, no irrigation is needed during the rainy season except when drought occurs.

Rogueing

It is important to inspect the seed crop regularly to rogue out off type plants.

Weed control

Weed control options are limited in mungbean and the most effective practice is to select a field with lower weed pressure. Weed control can be obtained either by manual weeding **(Figure 3)** or by using herbicides like Basalin 45 EC (fluchloralin) @ 5 ml/L or Treflan 48 EC (trifluralin) @ 4ml/L as pre-sowing or Stomp 30 EC (pendimethalin) @ 5 ml/L pre-emergence spray or apply 3ml/L Stomp 30 EC as pre-emergence, with one hoeing four weeks after sowing.

Five hundred (500) liters of water/ha is sufficient for herbicide spray. Spray the herbicide immediately after sowing for pre-emergence application. Practice intertillage by hand or cultivator once or twice to promote healthy growth.

Figure 3

Diseases

The important diseases affecting this crop and control measures are described below.

Seed and seedling rot

A number of fungi such as Fusarium sp, Macrophomina phaseoli, Rhizoctonia solani, cause seed and seedling rot. This results in poor germination. It is a serious disease and sometimes re-sowing of the crop has to be done if it is not controlled well on time.

Control: (1) Treat the seeds with Thiram or Captan @ 3 g/kg of seed (2) Sow fresh and clean seeds obtained from a healthy crop and (3) Adopt crop rotation.

Yellow mosaic

This disease is caused by virus, starting as small yellow specks along the veinlets and spreading over the lamina; the pods become thin and curl upward (**Figure, 4**). The disease is transmitted by whitefly (Bemisia tabaci).

Control: (1) Spray the crop with Neem oil at 20ml/L or with Metasystox (oxydemeton methyl) 25 EC @ 3ml/L of water to control white flies. (2) Grow disease resistant varieties. (3) Use yellow sticky traps against whiteflies.

Cercospora leaf spot

Cercospora is recognized by the appearance of leaf spots that are circular to irregularly shaped with greyish white centres and reddish brown to dark brown margins (**Figure 5**).

Control: (1) Spray Dithane Z- 78 or Dithane M-45 @ 3.2 g /L of water. (2) Remove the plant debris from the field. (4) Remove all the infected plants and burn them. (5) Do not sow the seeds in the field which was affected last year by this disease.

Powdery Mildew

(Erysiphe sp. /Podosphora sp.)

It occurs under cool temperature (20-26 °C) and is favoured by cloudy weather. A white-grey powdery mildew (**Figure 6**) appears first in circular patches, but later spreads over the surface of the leaves, stems and pods.

Control: (1) Spray Neem Seed kernel Extract (NSKE) at 50g/L or Neem oil at 20ml/L twice at 10 days interval from initial disease appearance. (2) Spray Eucalyptus leaf extract 10% at initiation of the disease and 10 days later. (3) Spray Carbendazim @ 1 g/L or wettable sulphur @ 2.5 g/ L of water.

Figure 4: Mungbean plant infected with yellow mosaic disease

Figure 5: Mungbean infected with Cercospora leaf spot disease

Figure 6: Mungbean plant infected with Powdery mildew disease

Pests

The important pests and their control measures are described here.

Tobacco caterpillar

(Spodoptera litura)

The small larvae are black whereas grown up larvae are dark green with black triangular spots on body. Its moth lays eggs in masses covered with brown hairs on the lower side of leaves. After hatching, first and second instar larvae feed gregariously and skeletonize the foliage. Besides leaves they also damage floral buds, flowers and pods.

Control: (1) Collect egg masses and young larvae with leaves and destroy them. (2) Spray with neem (commercial neem formulations or neem oil or neem seed kernel extract), Bacillus thuringiensis formulations and/or Spodoptera litura nuclear polyhedrosis virus (NPV), novaluron 10 EC @ 1.5 ml/L or acephate 75 SP @ 8 g/L or Chlorpyriphos 20 EC @ 15 ml /L of water.

White fly

(Bemisia tabaci)

The adults are tiny and very delicate and have white or smoke coloured wings with which they flitter away from plants on little disturbance. Insects stick to the lower surface of leaves. The leaves of infested plants show yellowish discolouration.

Control: (1) Spray the crop with Neem oil at 20ml/L or with Metasystox (oxydemeton methyl) 25 EC @ 3ml/L of water to control white flies.
(2) Use yellow sticky traps against whiteflies.

Figure 7

Bean Pod borer (Maruca testulalis) and Asian corn borer (Ostrinia furnacalis)

In recent years, they have become a very serious pest and cause substantial damage to the crop. They feed on buds, flowers, pods (**Figure 7**) and grains. The larvae may be pale-green, yellow, brown or black in colour, 3-5 cm in length. Larvae presence can be judged from dark green faeces under the plant canopy.

Control: To control pod borer, spray the crop with following insecticides or bio-pesticides: Acephate @ 8 g /L or Spinosad @ 0.6 ml/L or Indoxacarb @ 2 ml /L of water, neem (commercial neem formulations or neem oil or neem seed kernel extract), B. thuringiensis formulations

Beanfly (Ophiomyia phaseoli, O. centrosematis, Melanagromyza sojae)

It is the most important insect pest of mungbean. It causes significant damage during the seedling stage. The adult flies are too tiny, only 2 mm, and cannot be recognized easily. The beanfly maggots feed inside the plant stem and their damage cannot be seen from the outside.

Figure 8

Control: Spray Rogor 30 EC (dimethoate) @ 1 ml/L of water is sprayed at days after emergence followed by 5 weekly sprays. The first three sprays are very important and must not be delayed. Effective seed-dressing insecticides have been identified. Moth bean, chickpea, lentil, and cluster bean could be used as 'dead-end trap crops'—the bean fly adults lay eggs on these crops, but the eggs fail to hatch.

Thrips

(Megalurothrips distalis and M. usitatus)
Thrips are very small insects found in the flowers and causes flower drop, deformation of pods and ultimately reduction in yield.

Control: To control thrips, crop must be sprayed at flower initiation stage with Spinosad @ 0.6 ml/L of water. Do not control the thrips infestation with broad-spectrum chemical pesticides, as a resurgence of thrips will likely occur.

Cowpea aphid

(Aphis craccivora), can attack mungbean.

Control: If you notice unusually high aphid populations (over 20 insects/plant), spray Rogor 30 EC (dimethoate) @ 1 ml /L of water weekly until aphids are eradicated. Use neem oil, either alone or in combination with the entomopathogenic fungi biopesticides. The ladybird beetles and green lacewings are efficient predators of aphids. Protect the population of these predators by avoiding the use of broad-spectrum pesticides. A. craccivora can develop resistance to pesticides.

Bruchids (Callosobruchus chinensis and C. maculatus), commonly called pulse beetles or cowpea weevils, attack mungbean both in field and storage (**Figure 8**). But the greater losses occur in storage. The nutritional quality of the grains deteriorates rendering them unmarketable.

Control: Clean storage area properly, dry the seeds well (9-10 % moisture), and apply non-toxic chemicals such as vegetable oils. For large-scale seed storage, fumigation with phosphine or other suitable fumigants can be adopted. Treating the mungbean grains with clays, sand, kaolin, and ash has been proven effective in controlling bruchid infestation in storage. Vegetable oils (e.g., olive oil or mustard oil at the rate of 15 ml/kg of seed) can also be used to treat mungbean grains and seeds to protect from bruchid infestation.

However, some vegetable oils may reduce the seed viability. Novel gadgets such as traps (e.g., pitfall trap and probe trap) can be used to monitor as well as mass-trap bruchids in storage. Storage of mungbean grains or seeds in air-tight containers is an effective way to eliminate bruchids, as they are unable to survive without air. Triple-bagging mungbean grains for storage can substantially reduce bruchid infestation.

***Note:** Always follow the label directions when using any pesticide/herbicide. Consult the local extension agents to choose the appropriate (recommended) pesticide in your region. Follow proper pesticide rotation (avoid using the chemicals from the same pesticide mode group) to prevent or delay the development of resistance.

Harvesting

Harvest when pods are mature and dry, but before they start shattering. Manual harvesting is usually practiced, but mechanical harvesting (**Figure 9**) can save labour cost and time. Desiccation of the plants is needed before mechanical harvesting. Spray Diquat (2-3L/ha or Glyphosate to desiccate the plants.

If you are following manual harvesting then threshing must be done as soon as the pods are dry. Beat pods with a stick until pods are opened, or put dry pods in a jute bag, place the bag on the floor, and walk on it. Remove any foreign materials by winnowing. Sun dry for 3–5 days. Drying of seed to 9-10% moisture level is very important for good storage. Use a seed moisture meter (**Figure 10**) for accurate determination of the moisture content. Use of solar dryers (**Figure 11**) would be a better option for quicker drying. Collect only good seeds (free from diseases, seed coat cracking, split, or immature).

If using a threshing machine, adjust the speed of the machine in order to avoid seed damage. Dried seeds can be safely stored for at least three years. Place seeds in jars, manila envelopes, cloth or mesh bags, plastic containers (**Figure 12**), or foil envelopes. The best containers are air-tight, such as a sealed glass jar, metal can, or foil envelope. Protect seed from sunlight.

Store seeds in a cool (below 15 °C is ideal), dry location. Place the seeds in a refrigerator for long-term storage. For short-term storage, keep the seeds in a cool, shady and dry place. Please follow the recommended storage practices mentioned above (bruchid control section) for the control of storage pests.

Figure 9

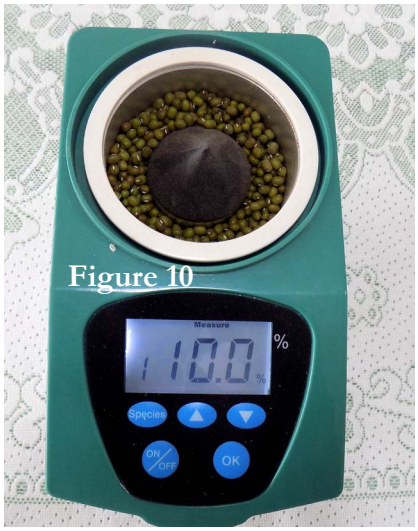

Figure 10

Figure 11

Figure 12

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