Mungbean (Wg«« radiaia I. WHczek) grains are rich in protein (about 24%) and iron (6 mg per 100 g of dry seed), easily digestible, easy to cook. Free from flatulence and can help to overcome the protein deficiency problem. It can be used as dal (whole or split), noodles, sprouts and confectioneries. Apart from nourishing the people its cultivation improves soil health by adding nitrogen through symbiosis. L2SS water and energy are required to raise a good crop of mungbean as compared to cereal crops.

In Punjab (India), mungbean is one of the major pulse crops. The crop is grown during summer as well as kharif (rainy) season. Efforts are on to develop improved varieties, production and protection technology of mungbean cultivation for increasing area and productivity. The DF1D-AVRDC mungbean project on "Improving income and nutrition by incorporating mungbean in cereal fallows in the Indo-Gangetic Plains of India" has changed the scenario tremendously. The new variety SML 668 can not only fit well in summer mungbean-rice-wheat system but can also be grown during the two seasons (summer and kharif). It has a great scope in crop diversification and can help in sustaining crop productivity. To realize the yield potential of new variety the adoption of new improved technology is very essential.

**Climatic Requirements**

Mungbean requires hot and dry climate. Cloudy weather, continuous and heavy rains adversely affect the flowering and podding, causing low yields. The climate of Punjab is highly suitable for mungbean cultivation.

**Crop Rotations**

Summer mungbean - rice - wheat/barley/raya/field pea/lentil
Summer mungbean - maize-wheat barley/raya/field pea/lentil
Summer mungbean-kharif mungbean-wheat/barley/raya
Summer mungbean-rice/maize-potato/toria
Cotton/sugarcane-summer mungbean
Varietal Improvement

The main aim is to develop short duration, stable, synchronously maturing, disease resistant particularly 10 mungbean yellow mosaic virus (MYMV) and high yielding varieties of mungbean. In addition the new varieties should be more responsive to inputs and of good cooking quality.

<table>
<thead>
<tr>
<th>Season</th>
<th>Variety</th>
<th>Year of release</th>
<th>Salient features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer /Spring</td>
<td>SML668</td>
<td>2002</td>
<td>Short stature, determinate, synchronous maturity, possesses shining green bold seeds, tolerant to MYMV, matures in 60-65 days and average yield 1125 kg/ha.</td>
</tr>
<tr>
<td>Kharif /Rainy</td>
<td>ML 818</td>
<td>2002</td>
<td>Medium-tall stature, highly resistant to MYMV, cercospora leaf spot (CLS) and bacterial leaf spot (BLS) diseases, identified at national level for North West Plain Zone (NWPZ), matures in about 85 days, medium seed size, average yield 1250 kg/ha.</td>
</tr>
<tr>
<td></td>
<td>SML668</td>
<td>2002</td>
<td>Short stature, early maturing (75 days), shining green bold seeds, tolerant to MYMV, CLS and BLS. average yield 1250 kg/ha.</td>
</tr>
<tr>
<td></td>
<td>ML 613</td>
<td>1995</td>
<td>Medium-tall stature, fairly resistant to MYMV, CLS, and BLS diseases, medium-sized shining green seeds, matures in about 85 days, average yield 1075 kg/ha.</td>
</tr>
</tbody>
</table>
New variety, SML 668 has high yield potential (1.5-2.0 t/ha). It is the first variety recommended for cultivation during both summer and kharif seasons in the state. It has short stature, short duration, synchronous maturity, sturdy stem, bold seeds (which fetch high market price), resistance to shattering, drooping pods (less affected by rain) and can give 1-2 flushes by which farmers can obtain up to 2.0 t/ha yield. It has very good cooking quality.

**Crop Production Technology**

*Soil and seedbed preparation*

Mungbean can be grown on well-drained loamy sand to sandy loam soils. The crop should not be raised on alkaline, saline or waterlogged soils. A well prepared seedbed is required for proper germination and establishment of the crop. For this give two to three ploughings followed by planking to make the seedbed free from clods and weeds. Experimental data indicate that summer mungbean can be raised successfully without tillage after the harvest of wheat.

*Seed rate and seed treatment*

The optimum seed rate is the key factor for obtaining proper plant stand and higher crop yields. Use 37.5 kg/ha seed in summer
Seed rate (kg/ha)
Effect of seed rate on grain yield in summer mungbean

and 30 kg/ha in kharif of SML 668 while for other varieties 20 kg/ha seed is required. Before sowing treat the seed with Captan or Thiram @ 3g per kg of seed against seed-borne diseases.

**Rhizobium inoculation**

The treatment of seed with *Rhizobium* culture is quite helpful particularly where crop is sown for the first time. This may increase yield up to 10-12%. For its treatment spread the required quantity of seed on a clean floor, put culture on it and sprinkle little water and mix so that seed can mix with culture completely. Seed and culture can be mixed with hands and after mixing dry the culture treated seed in shade. The treatment of culture with seed should be done just prior to sowing and with a recommended culture. *Rhizobium* culture is available in the Department of Microbiology, Punjab Agricultural University, Ludhiana and Chief Agricultural Officer, Ludhiana, Department of Agriculture, Punjab.

**Time of sowing**

For raising successful crop time of sowing is the most important non-monetary input. Time of sowing not only helps in achieving higher productivity but also in obtaining synchronous maturity. After potato or loria sow the crop from 20 March to 10 April while after the harvest of wheat sow up to 20 April. The crop sown
Effects of time of sowing or grain yield in summer mungbean alter this is risky due to the onset of monsoon at the time of maturity. During *kharif* the best time of sowing is the first fortnight of July.

**Method of sowing**

Sow the crop in rows at 22.5 cm apart in summer and 30 cm in *kharif*, keeping plant to plant distance at about 10 cm. The seed should be placed 4 to 5 cm deep. At the time of sowing field should have good soil moisture to obtain the proper plant stand. Under low moisture germination is affected adversely because of prevailing high temperature and low relative humidity. Although sowing can be done with *pora* or *kem* method, sowing done by seed-cum-fertilizer drill helps greatly to achieve uniform plant stand and efficient utilization of fertilizer.

**Intercropping**

In spring planted sugarcane, 1 or 2 rows of mungbean can be planted in between the sugarcane rows. Intercropping of mungbean can also be done in mentha, the newly planted poplar crop and in horticultural plants or orchards.
**Fertilizer**

Fertilizer application to the crop should always be done on the basis of soil test. On medium fertile soils 12.5 kg N and 40 kg P$_2$O$_5$ as basal dressing are recommended. Apply 28 kg urea (46% N) and 250 kg single superphosphate (16% P$_2$O$_5$). For phosphorus source, single superphosphate should be preferred as it contains sulphur also. Summer mungbean sown after potato in rice-potato-summer mungbean and maize-potato-summer mungbean systems can be raised without fertilizer. Similarly in maize-wheat-*kharif* mungbean system. *kharif* mungbean does not require fertilizers, if the preceding maize and wheat crops are applied recommended doses of nutrients.

**Weed control**

Weeds cause 30-40% losses in the grain yield. Weed control at proper time and with appropriate method is very essential to get higher yields. One or two hoeings at 25 and 40 days after sowing are recommended to keep the weeds under check. The use of wheel hand hoe is also quite effective in controlling weeds between the rows. However, due to high cost and non-availability of labour herbicide spray is preferred by farmers. A dose of 2.5 l/ha Stomp 30 EC (pendimethalin) as pre-emergence immediately after sowing or 2 l/ha Treflon 48 EC (trifluralin) or 1.5 l/ha Basalin 45 EC (fluchloralin) as pre-sowing should be sprayed on a well prepared seedbed using 500 l water/ha or 1.5 l/ha Stomp 30 EC plus one hoeing 25 days after sowing is effective to control weeds.

**Irrigation**

In summer season because of prevailing high temperature and low relative humidity 3 to 5 irrigations should be applied depending upon the soil and climatic conditions. The first irrigation should be given between 20 and 25 days after sowing while the last irrigation should be terminated about 50 days after sowing for synchronous maturity and higher grain yields. Irrigation is very essential during *kharif* particularly at flower initiation if the rain fails.
**Plant Protection Measures**

*a. Insect Pest Management*

**Thrips (Megalurothrips distalis)**

Thrips is very small insect found in the flower and causes flower drop.

For controlling thrips the crop must be sprayed at flower initiation stage with any one of the following insecticides:

- Rogor 30 EC (dimethoate) 250 ml OR
- Malathion 50 EC (malathion) 250 ml OR
- Metasystox 25 EC (oxydemelon methyl) 300 ml in 200-250 litres of water per hectare.

**Green jassid (Empoasca spp.), aphid (Aphis craccivora) and whitefly (Bemisia tabaci)**

These are the sucking insects and can be controlled by spraying the following insecticides:

- Malathion 50 EC (malathion) 950 ml OR
- Rogor 30 EC (dimethoate) 625 ml OR
- Metasystox 25 EC (oxydemeion methyl) 625 ml in 200 litres of water

**Bihar hairy caterpillar (Spilosorna obliqua)**

The caterpillars feed gregariously in scattered spots. Crushing under the feet or putting then in kerosenised water can kill the grown up caterpillars. In the case of severe infestation spray the crop with following insecticides:

- Thiodan 35 EC (endosulfan) 1250 ml OR
- Ekalux 20AF (quinalphos) 1250 ml OR
- Nuvan 100 (diechlorvos) 500 ml per hectare in 200-25.0 litres of water OR
- Dust 37.5 kg/ha of Diptrex 5% (trichlorphon).
Pod borer (Helicoverpa armigera)

In recent years, it has become a very serious pest and causes substantial damage to the crop. It feeds on leaves, buds, flowers, pods 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.

To control pod borer spray the crop with following insecticides:
- Ekalux 20 AF (quinalphos) 2.01 OR
- Thiodan 35 EC (endosulfan) 2.5 I using 200-2501 water/ha

Semi-loopcr (Anomis flava)
The larvae are green and form loop when touched. To control the semi-looper spray the crop with
- Thiodan 35 KC (endosulfan) 1250 ml OR
- Nuvan I00(dichlorvos)500:nl in 200-250 litres of water per hectare.

b. Disease Management

Mungbean yellow mosaic virus
The vector of this disease is whitefly (Bemisia tabaci). It is a very devastating disease due to which leaves become pale yellow and even infected pods turn yellow and produce shrivelled grains.

Control
Rogue out MYMV affected plains at early crop growth stage and bury them.

Mungbean crop free from and infested with MYMV
- Grow MYMV resistant varieties like SML 668 and ML 818. Follow control measures as given in insect pest control for whitefly.

**Cercospora leaf spot (CIS)**

It is caused by *Cercospora cruenta* and *C. canescens*. It is a seed-borne fungal disease due to which brown spots are formed on leaves. Central portion of the spot turns ash-grey and contains conidia and conidio-phores of the fungus.

**Control**

- Treat the seed with Captain or Thiram @ 3g/kg of seed.
  Grow disease resistant varieties SML 668, ML 613 and ML 818.
- Spray the crop with Dilhanc M-45 @ 875 g or Zineb 75 WP (dithane Z 78) @ 1.0 litre/ha using 200 litres of water.

**Anthracnose**

It is caused by *Colletotrichum tindemuthianum*. reddish brown spots are produced on leaves, branches, petioles and pods. These are somewhat elongated and sunken, coalesce and cover large area. To control this disease adopt measures as given in CLS.

**Harvesting and Threshing**

Harvest the summer crop when about 85% pods mature. Cut the crop with sickle or combine harvester. Threshing may be done after sun-drying the crop for 2-3 days.

**Seed Production**

Seed is a key to expand area under new varieties. With the help of AVRDC, Taiwan. "Seed Village Scheme" was introduced which proved very successful for seed multiplication of SML 668. Large quantity of seed is also being produced at the Punjab Agricultural University, Seed Farms. Other agencies like PUNSEED and Punjab Agrotech are also producing and distributing seed to farmers.
Threshing of mungbean

Seed production of mungbean in seed village scheme
Important Hints
Sow the recommended varieties.

Treat the seed with Captan or Thiram against seed-borne diseases and must apply *Rhizobium* culture where the crop is sown for the first time.

Sow summer mungbean from 20 March to 10 April after potatoes or *taría* and up to 20 April after the harvest of wheat. For *kharif* season 1-15 July is the proper time of sowing.

Apply fertilizers on the basis of soil test.

Use 37.5 kg/ha seed rate in summer and 30 kg/ha in *kharif* for bold seed size and 20 kg/ha for medium seed size varieties.

Control weeds at proper time.

Terminate last irrigation about 50 days after sowing in summer mungbean for achieving synchronous maturity. In *kharif* water stress should not occur during the reproductive phase.

Apply recommended insecticides with prescribed doses at proper time.
Wheat - Summer Mungbean - Rice System

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