AGRONOMY PRACTICES OF BRINJAL:

INTRODUCTION:

Brinjal (*Solanum melongena)* is an important vegetable crop of subtropics and tropics in India. It's fruits are good source of calcium, phosphorus, iron and vitamins particularly vitamin 'B'. Brinjal is grown in an area of 0.72 million ha with production of 13.44 million tons and 18.70 tonnes/ha productivity.

Origin country of Brinjal is India and its secondary origin is in China.

The crop is grown extensively in warm climates mainly in India, Bangladesh, Pakistan, China and Philippines. It requires long growing season with high average day and night temperature.

There are several names by which the crop is known in India, but brinjal is the most familiar, Brinjal is also called 'Eggplant' or 'Aubergine'. It is a perennial but grown commercially as an annual crop.

A number of cultivars are grown in India, consumer preference being dependent upon fruit color, size and shape.

The type of fruit is Berry. It is a day neutral plant but thermo sensitive. Toxic pigment found in brinjal is Solasodine. Pigment which is responsible for its purple color is Anthocyanin. It is a self-pollinated plant. Inflorescence type is cyme. It is a dicot plant.

IMPORTANCE OF BRINJAL:

- Brinjal is low in calories and rich in fiber, vitamins and minerals making it a healthy addition to one's diet.
- Brinjal contains antioxidants that help reduce the risk of chronic diseases like heart disease and cancer. It also supports digestion and may help manage blood sugar levels.
- Brinjal cultivation can help improve soil health by cycling nutrients and organic matter, enhancing soil structure and fertility.
- Brinjal contains certain compounds such as solasodine, have anti-inflammatory properties. Consuming Brinjal may help reduce inflammation in the body, alleviating symptoms of inflammatory conditions like arthritis and asthma.
- Brinjal help regulate blood sugar levels, hence it is highly beneficial for diabetic patient.
- The Anthocyanin present in brinjal have been linked to cognitive benefits and brain health. These antioxidants may help protect brain cells from oxidative stress and age-related damage.

SEASON:

Brinjal can be cultivated throughout the year but best suited season is Rabi Season.

Rainy Season- June- July

Winter Season- October- November

Summer Season- February-March

STATES:

Major Brinjal Producing states are Andhra Pradesh, Maharashtra, Karnataka, Orissa, Madhya Pradesh, and West Bengal.

CLIMATE:

Brinjal is a warm season crop and requires a long warm growing season. It is very susceptible to frost. A daily mean temperature of 13^0-21^0C is most favorable for its successful production. The growth of the crop is severely affected when temperature falls below 17^{o}C.

SOIL:

Brinjal can be grown in almost all types of soil. But well drained clay loam is ideal for its cultivation. Wilt sick are not suitable. Well drained soil rich in organic matter with pH of 6.5-7.5

SEED RATE:

Use seed rate of 300-400gm/acre

SPACING:

For Row to Row distance the spacing should be 60 cm and for plant to plant distance the spacing should be 45cm.

LAND SELECTION AND PREPARTION:

The soil should be thoroughly prepared by ploughing 4-5 times before transplanting the seedlings. Bulky organic manures like well rotten cow dung or compost should be incorporated evenly on the soil. When the

field is well prepared and levelled, the beds of suitable size are made in the field before transplanting.

Nursery Management and Transplanting –

Brinjal seeds are sown on nursery beds to raise seedlings for transplanting in the field. Raised beds are necessary to avoid problem of water logging in heavy soils. In sandy soils, however, sowing can be taken up in flat beds. Raised beds of size 7.2*1.2m and 10-15 cm in height are prepared. About 70cm distance is kept between two beds to carry out operations of watering, weeding, etc. The surface of beds should be smooth and levelled. Well decomposed FYM or leaf mould may be mixed with the soil at the time of bed preparation. To avoid mortality of seedlings due to damping off, drenching of the beds with Bavistin @20gm/10L of water is effective.

Sowing should be done thinly in lines spaced at 5-7cm in distance. Seeds are sown at a depth of 2-3cm and covered with a fine layer of soil followed by light watering. The beds should be then covered with dry straw or grass or sugarcane leaves to maintain required temperature and moisture. The cover of dry straw or grass is removed immediately after germination is complete. The seedlings are ready for transplanting within 4-6 weeks of planting when they attain a height of 15cm with 2-3 true leaves.

SEED TREATMENT:

- Treat the seeds with Trichoderma viride @4g/kg or Pseudomonas fluorescens @10g/kg of seeds
- Treat the seeds with Azospirillum @40g/400g of seeds using rice gruel as adhesive
- In raised nursery beds, sow the seeds in lines at 10cm apart and cover with sand

- Transplant the seedlings 30-35 days after sowing at 60 cm apart in the ridges.

WATER MANAGEMENT:

In plains irrigation should be applied every third to fourth day during hot weather and every 7 to 12 days during winter. Irrigation is given before top dressing if there is no rain. The brinjal field should be regularly irrigated to keep the soil moist during frosty days.

NUTRIENT MANAGEMENT:

Brinjal is long duration crop with high yield potential. Higher fertility levels and better soil conditions have significant and positive effect on productivity. Under normal soil, 150 kg N and 100 kg P_2O_5 is optimum. For a balanced nutrition, 30-60 kg K_2O is included in fertilizer package of brinjal in most of the states. 1/3rd N, full P and full K should be applied as basal dose and remaining N in two split doses at 25 days and 45 days after transplanting.

WEED MANAGEMENT:

Remove the weeds by hoeing on 30th day of planting and earthing up. Depending upon the need, hoeing should be repeated once in a month. The herbicidal application should be done when there is sufficient moisture in soil.

The herbicide recommendation for brinjal is given as follows-

शाकनाशी	मात्रा	अनुप्रयोग का समय

फ्लोचलोरालीन	200-300 मिलीलीटर /एकड़ या 2-3 मिलीलीटर /लीटर पानी	बोने का पूर्व अवधारण
पेंडीमेथलीन	1000 मिलीलीटर /एकड़ या 8-10 मिलीलीटर /लीटर पानी	पूर्व-उद्भव
बुटाचलोर	500ग्राम /एकड या 3-3.5 ग्राम /लीटर पानी	पूर्व-उद्भव
ग्लाइफोसेट	500-600 मिलीलीटर / एकड या 10-15 मिलीलीटर /लीटर पानी	उत्थानान्त

NUTRITIONAL DEFICIENCIES AND THEIR MANAGEMENT:

1. **Nitrogen Deficiency –**

Symptoms-

- Plants remain stunted and unbranched and turn pale green.
- The leaves are markedly small in size and stiff in texture.
- Older leaves gradually start getting bleached from margin inwards to a pale white color and finally shed prematurely.
- The fruits are small in size, pale in color, maturing early.

Management-

- Apply 100 kg of nitrogen as basal dressing
- Spray 2% urea solution @20gm/L of water to the point of run off for proper growth and development

2. **Phosphorus Deficiency –**

Symptoms-

- Stunted growth of plants, but they remained normal green in color.
- Leaves are smaller in size and turn greyish green with patches and shed prematurely, resulting bare stem in lower parts of the plant.
- The fruits are small, pale in color and mature early.

Management-

Spray 1% super phosphate solution @10gm/L of water to the point of run off to resume fresh growth.

3. **Potassium Deficiency-**

Symptoms-

- Stunted growth of the plants
- Marked reduction in the number and size of leaves
- Brown patches appear on the leaves and necrotic lesions develops along the veins followed by defoliation

Management-

- Apply 50 kg of potassium in the form of Murate of Potash as basal dressing
- Spray 0.5% Potassium Chloride @5gm/L to the point of run off when deficiency is noticed

4. **Sulphur Deficiency –**

Symptoms-

- Leaves turn pale yellow in color

- Plant growth is retarded
- New leaves become narrow, more pointed and chlorotic

Management-

- Spray Wettable Sulphur @2gm/L of water
- Adding sulphur in inorganic forms in fertilizer containing magnesium, ammonium salts.

5. **Calcium Deficiency-**

Symptoms-

- The symptoms appear first on young leaves as chlorotic patches.
- Margins of young leaves become yellow
- The stems are thick and woody
- Pale brown sunken areas develop on the fruits

Management-

- Gypsum (calcium sulphate) @100kg/ha can be used where it is desirable to increase calcium levels in the soil without affecting soil pH.
- Calcium nitrate or calcium chloride @3gm/L solution can be sprayed to the point of run off.

6. **Magnesium Deficiency-**

Symptoms-

- Deficiency is likely on intensively cropped sandy soil if little organic manure is used
- Magnesium deficient plants are markedly stunted in growth

- At later stage, lower leaves develop characteristic interveinal chlorosis from margin inwards in a typical inverted 'V' shaped.
- Leaves immediately turned to yellow

Management-

- Spray magnesium sulphate @3gm/L of water to the point of run-off.

INSECT, PEST AND THEIR MANAGEMENT:

1. **Shoot and Fruit Borer-**

Symptoms of damage-

- Withering of terminal shoots and create dead hearts
- Bore holes on shoots and fruits plugged with excreta
- Shedding of flower buds
- Withering and drying of leaves

Management-

- Avoid Continuous cropping of brinjal crop
- Install pheromone trap @6/acre
- Encourage the activity of larval parasitoids: *Pristomeous testaceus, Cremastus flavoorbitalis*
- Neem seed kernel extract 5%
- Spray 2ml of Malathion 50 EC/L of water, Thiamethoxam 12.60% + Lambda-cyhalothrin 9.50% ZC @0.25ml/L of water
- Emamectin Benzoate 5% SG @0.4g/L of water
- Chlorantraniliprole 18.5%SC 0.3 ml/L of water.

2. **Stem Borer-**

Symptoms of damage-

- Top shoots of young plants droop and wither
- Older plants become stunted
- Fruits bearing is affected

Management-

- Light trap @1/acre to attract and kill adults
- Spray neem oil 2ml/L of water
- Spray 2ml Malathion 50EC/L of water.
- Emamectin Benzoate 5% SG @0.4g/L of water

3. **Hadda / Spotted Beetle-**

Symptoms of damage-

- Scrapping of Chlorophyll
- Skeletonization and drying of leaves
- Stunted growth of the mature plant
- The pest can lead to heavy defoliation and high yield loss

Management-

- Collect damaged leaves with grubs and egg masses and destroy them
- Shake plants to dislodge grubs, pupae, and adults and destroy
- Conserve natural enemies in brinjal ecosystem
- Spray Carbaryl 50 WP @3g/L of water

4. **Ash Weevils-**

Symptoms of damage-

- Notching of leaf margins
- Grubs feed on roots causing wilting of plants

Management-

- Collect and destroy adults
- Apply neem cake @200 kg/ha at the time of last ploughing
- In endemic areas, apply carbofuran 3G @6kg/acre on 15 days after planting.
- Spray 2ml Quinalphos 25EC 250 -300 L spray solution required/acre.

5. **Brown Leaf Hopper-**

Symptoms of damage-

- Reduction in size of leaves
- Excessive growth of branches general stunting of plants
- Plants become bushy
- Vector of little leaf of brinjal

Management-

- Remove infected plants and destroy them
- Before transplantation dip the seedlings in 0.2% Carbofuran 50 STD (Solution insect Vectors)
- Spray with 1.7ml of Dimethoate 50 EC/L of water

6. **Lace Wing Bug-**

Symptoms of Damage-

- Yellowing of leaves
- Affected leaves covered with exuviae and excreta.

Management-

Spray Dimethoate 30 EC @1.7ml/L of water or Methyl Demethon 25 EC @2ml/L of water

7. **Red Spider Mite-**
   Symptoms of Damage-
   - Attacks Ventral surface of the leaves, in a delicate webbing, yellowing of leaves.

   Management-

   Spray 3.5ml Dicofol 18.5 EC in a litre of water

8. **Root Grubs-**
   Symptoms of Damage-
   Grubs feeds on roots, withering of such affected plants, also leads to stunted growth, plant height, discoloration of plants.

Management-

Incorporate 8kg Phorate 10 G or 8 Kg Carbofuran 3 G to the soil/acre

9. **Aphids-**

Symptoms of damage-

- Infesting tender shoots and under surface of the leaves
- Curling and crinkling of leaves
- Stunted growth of the plant

- Development of black sooty mould due to excretion of honey dew.

Management-

- Remove the severely affected plants to prevent further spread of this pest
- Remove the alternate host in and around the brinjal field.
- Spray any one of the following insecticide-
  Acetamiprid 20 SP @1.5g/10 L of water
  Malathion 50 EC @1.25ml/L of water
  Imdiacloprid 200 SL @100ml/ha
  Dimethoate 30 EC @2ml/L of water

10. Bud Worm –

Symptoms of Damage-

Shriveling and shedding of flower buds.

Management-

Spray neem oil @2ml/L of water

11. Leaf Roller-

Symptoms of damage-

- Only Larvae causes damage to the leaves
- Initial symptoms appear as lengthwise rolled leaves where the larvae are located.
- The damage appears on the top parts of the plant.
- Rolled leaves can become brown, dry and wilt.
- Defoliation can occur in severe infestation.

Management-

- Leaf Roller can be controlled by using Biological Parasitic wasp called *Coltesia spp.*
- Handpick infested leaves and caterpillars
- Remove or destroy infested leaves, caterpillars and waste and burn them.
- Spray Carbaryl 0.1% or Malathion 0.05% to reduce the infestation.

12. Jassids-

Symptoms of Damage-

- The affected leaf will curl upward along the margins and turn to yellow color with burnt-up patches.
- Fruit yields are highly affected by this insect

Management-

- Seed treatment with Imidacloprid 70 WS @5gm/kg of seeds.
- Remove and destroy the affected plants.
- Spray any of the following insecticide –
  Chlorantraniliprole 18.5%SC @40-50ml/ acre
  Emamectin Benzoate 5% SG @80-100gm/acre
  Acetamiprid 20 SP @1.5g/10L of water
  Thiamethoxam 25%WG @80-100gm/acre
  Afidopyropen @2ml/L of water

DISEASES AND THEIR MANAGEMENT:

1. **Bacterial Wilt-**
   Causal Organism- *Pseudomonas solanacearum*
   Symptoms- The characteristics symptoms include wilting of the foliage followed by collapse of the entire plant. The wilting is characterized by dropping and slight yellowing of leaves and vascular discoloration. Drying of plants at the time of flowering and fruiting are also characteristic to the disease condition. The infected cut stems pieces when dipped in water, a white milky stream of bacterial oozes coming out which is the diagnostic symptom for bacterial wilt.

Management-

- Rouge out the infected plants and destroy them
- Seed treatment with Streptocycline for 90 minutes
- Spray Copper Oxychloride @3gm/L of water and repeat the spray at 20 days intervals.
- Crop rotation with cruciferous vegetables such as cauliflower, maize once in a year to reduce the disease incidence.

2. **Cercospora Leaf Spot-**
   Causal Organism- *Cercospora solani melongenae*
   Symptoms –
   - The symptoms are brown and irregular in shape. Concentric rings are present in them. Several spots may coalesce to form larger necrotic patches.
   - Fruits are also affected. Large, necrotic sunken spots develop on the fruit which turns yellow and drops.
   - Diseased crop debris in soil is the main source of primary inoculum.

Management-

- Spraying 1% Bordeaux mixture or 2g Copper Oxychloride 50 WP per litre of water effectively controls leaf spots.
- Seed treatment with carbendazim 50 WP @2g/kg of seeds followed by Trichoderma viridae @4g/kg of seeds 24 hours prior to sowing gives adequate control.
- Spraying Mancozeb 75% WP @3g/L of water to the point of run off effectively controls the disease.

3. **Alternaria Leaf Spot-**

   Causal Organism- *Alternaria melongenae*

   Symptoms –

   - The spots are brown and irregular in shape. Concentric rings are present in them. Several spots may coalesce to form larger necrotic patches.
   - Fruits are also affected. Large, necrotic sunken spots develop on the fruit which turns yellow and drops.

   Management-

   Spray 2gm Mancozeb 75 WP or 2 gm Chlorothaoloni 70 WP in a litre of water.

4. **Damping Off-**

   Causal Organism- *Rhizoctonia solani*

   Symptoms-

   Pre-Emergence Damping Off- The pre-emergence damping off results in seed and seedling rot before these emerge out of the soil.

Post- Emergence Damping Off – The post emergence damping off phase is characterized by infection of the young, juvenile tissues of the collar at the ground level. The infected tissues become soft and water soaked. The collar portion rots and ultimately the seedlings collapse and die.

Management-

- The seed should be treated with Thiram @2g/kg of seeds before sowing.
- Drench the base of the seedlings with 3 g Metalaxyl- MZ 72 WP or 0.1 % Copper Oxychloride @10gm/L of water.
- Application of bio- control agent Trichoderma viride in soil @1kg/acre is also found effective to control damping- off to considerable extent.
- Seed treatment with Carbendazim @2g/kg of seeds followed by Trichoderma viride @4g/kg of seeds 24 hours prior to sowing gives adequate control.

5. **Collar Rot-**

Causal Organism- *Sclerotium rolfsii*

Symptoms-

- The disease occasionally occurs in serious form.
- The Lower portion of the stem is affected from the soil borne inoculum.
- Decortications is the main symptom.
- Exposure and necrosis of underlying tissues may lead to collapse of the plant.
- Near the ground surface on the stem may be seen the mycelia and sclerotia.

Management-

- Seed treatment with 4 g of Trichoderma viride formulation per kg will help in reducing the disease.
- Spraying with Mancozeb 75% WP @2g/L of water.
- Collection and destruction of diseased parts and portions of the plant.

6. **Fruit Rot/Phomopsis Blight-**
   Causal Organism- *Phomopsis vexan*
   Symptoms-
   - The disease is present in one or other form from the seedling stage to fruit maturity.
   - In the seedbeds, it appears as damping off.
   - After transplanting, the leaves coming in contact with soil may get infected and show circular, grey to brown spots with light colored center.
   - Mostly the stem base is attacked and is characterized by constriction of the base or a grey dry rot.
   - The skin peels off and the inner tissues are exposed.
   - In strong wind, infected plants topple down due to breaking of the main stem.

Management-

- Avoid continuous cultivation of brinjal. A rotation of brinjal-Paddy- Generally will helps to check the disease development
- During summer deep ploughing should be given.

- Spray Mancozeb 75% WP @3gm/L of water in the early vegetative stage.

7. **Sclerotina Blight-**
   Causal Organism- *Sclerotinia sclerotiorum*
   Symptoms-
   - The infection may occur at any part of the foliage, mainly the stem or branches.
   - At the points of infection, a dry and discolored spot develops.
   - It gradually girdles the entire stem is also progresses up and down.

   Management-
   - Rotation of cropping pattern with crops like beetroot, onion, maize, paddy and ginger eliminate the fungal inoculum in the field.
   - Spraying Mancozeb 75% WP @2g per litre or Carbendazim 50%WP @2 g per litre controls the disease.
   - Incorporate Trichoderma enriched compost to the soil before planting (Trihoderma 4kg/acre).

8. **Tobacco Mosaic Virus-**
   Causal Organism- Tobacco Mosaic Virus
   Symptoms-
   - Affected plants show leaves with molting or mosaic pattern of light green and dark green areas.
   - Primary symptoms appear on newly formed young leaves as vein clearing, greenish yellow molting.

- Infection on young plants results in stunted growth, malformation, and distortion and puckering of leaves. Dark green blisters and sometime leafy growth appear on the dorsal side of the leaf.
- Immature leaf shows varying degree of yellowing molting and chlorosis. Various necrotic dark brown spots also develop resulting into mosaic scorch under hot sunny dry spell, damaging large areas of lamina.

Transmission-

- TMV is highly contagious and transmitted by sap. It is easily transmitted by mere contact of a diseased plant with a healthy one.
- Air-dried tobacco is a common source of new infection. Workers who chew or smoke natural leaf tobacco during nursery operations may spread the virus into the seedlings.
- Old stem and leaf trash of affected plants buried in the soil are the other sources of infection and spread.
- In the nurseries, the seedlings may get affected due to the presence of susceptible weed host.

Management-

- Keep the crop mosaic free
- Infected seedlings should be removed and destroyed.
- Workers should disinfect their hands with soap and running water before handling seedlings, weeding or doing other intercultural operations.
- In fields, showing high incidence of mosaic, rotation for 2 years should be followed.

9. **Brinjal Little Leaf-**

Causal Organism- Brinjal Little Leaf disease is caused by Mycoplasma like organism called Phytoplasma.

Symptoms-

- The leaves of the infected plants in the early stages are light yellow in color.
- The leaves shows reduction in size and are malformed.
- Infected plants bears large number of branches, roots than healthy plant

Management-

- Plant disease resistant varieties
- Remove and destroy infected plants
- Before transplantation dip the seedlings in 0.2% Carbofuran
- Spray with Dimethaoate 0.3%

10. **Root Knot Nematode-**

Causal Organism- *Meloidogyne incognita*

Symptoms-

- Presence of galls on the roots
- Plants wilt rapidly especially under dry growing conditions and are often stunted.
- Growth may be retarded and leaves may be chlorotic.
- In case where seedlings infestation has taken place, numerous plants die in the seed bed and seedlings do not survive transplanting.

Management-

- Only seedlings with root free of galls should be selected for transplanting.

- Application of *Pseudomonas fluorescens* @10gm/m^2 nursery.
- Crop rotation with *non*-host or resistant crops.
- Proper Weed Control
- Destruction of galled roots after harvesting
- Application of Carbofuran 3G@1kg/ha

11. Verticillium Blight-

Causal Organism- *Verticilum dahliae*

Symptoms-

- The disease attacks the young plants as well as mature plants.
- The infected young plants show Dwarfing and stunting due to the shortening of the internodes. Such plants do not flower and fruit.
- Infection after the flowering stage results in development of distorted floral buds and fruits.
- The affected fruits finally drop off.
- Presence of irregularly scattered yellow spots over the lamina of the affected plant.
- In case of heavy infestation, plants wilt and drop off from the plant.

Management-

- Crop rotation with Okra, Potato, and Tomato should be avoided.
- Soil application and foliar application with Benlate 0.1%

12. Anthracnose –

Causal Organism- *Colletotrichum melongenae*

Symptoms-

- Sunken lesions on fruit vary in size
- Upto 1.3 cm wide and may coalesce
- Tan colored ooze of fungal spores appear on lesions
- Fruit dries and become black and finally drops

Management-

- Collect and destroy infected plant from the field
- Harvest the fruits before they over ripe
- Spray Zinab @200-250gm/100 L of water

13. Early Blight-

Causal Organism- *Alternaria solani*

Symptoms-

- Symptoms can be seen on older leaves, fruits and stems.
- Grey and black spots can be seen on leaves
- As the disease get worse spots turns into yellow spots and fall off.
- Fruits may get sunburn
- Fruits started to rot and fall off

Management-

- Application of copper based fungicide
- Application of any of the following chemical-
  Azoxystrobin11%+Tebuconazole18.3% @2gm/L of water
  Mancozeb @2gm/L of water

14. Powdery Mildew-

Causal Organism- *Erysiphe polygonii*

Symptoms-

- Leaves are covered with patches of a whitish to grayish powdery growth.
- New growth appears contorted, curled, dwarfed and may turn yellow and fall off
- Powdery mildew is spread by wind and rain

Management-

- Avoid closer spacing by providing proper spacing between the crops.
- Remove and destroy all the debris from the field.
- Avoid same cropping for about 2-3 years
- Spray sulfur fungicide

HARVESTING:

- The first harvest starts from 55-60 days after transplanting.
- High yields will be produced if fruits are harvested before they reach full size, provided they are well colored and of good size.
- Fruits are harvested by hand at immature and mature sizes, while the skin is still glossy, but before the skin toughens and seeds become matured.
- The harvesting should be done early in the morning or in the late evening to protect the fruits from the heat of the day.
- Harvest can be made once in 5 days and as many as 15-20 pickings are made.

YIELD:

The average yield of brinjal per acre for normal varieties can range from about 10-25 tonns and for hybrid yield can goes up to 20-30 tonn/acre.