AGRONOMY PRACTICES OF WATERMELON:

INTRODUCTION:

Botanical Name- *Citrullus lanatus thunb*
Family- Cucurbitaceae
Chromosome number- 2n=22
Origin- Tropical Africa
Watermelon is an important cucurbitaceous vegetable in India. It is an excellent desert fruit and its juice contain 92% water along with proteins, minerals and carbohydrates.
In Japan, cubic shape watermelon are popular, they grow watermelon in glass box and give cubic shape.

IMPORTANT POINTS:

- Watermelon is a climatric fruit
- Toxic substance present in watermelon is Serotonin.
- Pigment present in watermelon is Anthocyanin and Lycopene.
- Bitter principal is Cucurbitacin present in watermelon.
- Fruit contains 95% water and 160mg/100 gm of Potassium.

IMPORTANCE OF WATERMELON:

- The fruits contain 95% water, 0.2% Protein, 0.3% minerals, 3.3% CHO and 160 mg potassium per 100 gm fresh weight. It is also a rich source of iron.
- The seed kernels are also used in various sweets and other delicious.
- The fruit is used as an expectorant, diuretic and stomachic and is allaying thirst.
- Watermelon is rich in amino acid called citrulline that may help move through your body and can lower blood pressure.

SEASON:

Watermelon is a warm season crop, sown widely across India in the month of November to December in the south and January-February in the north.

AREA AND PRODUCTION:

West Bengal, Uttar Pradesh, Andhra Pradesh, Odisha, Karnataka, Rajasthan are the major growing watermelon states in India.

CLIMATE:

Watermelon is a warm season crop, which requires dry weather with abundant sunshine for quality fruit production. Temperature range of 24-27^{o}C are considered optimum for the growth of the vines.

SOIL:

Watermelon grows well in deep fertile and well-drained soil. It gives best result when grown on sandy or sandy loam soil. Soil having poor drainage capacity is not suited for watermelon cultivation. pH of soil should be in between 6-7

SOWING METHOD:

For sowing different methods of planting like furrow method, pit method and hill method can be used depending upon climate and season.

Furrow Method- Sowing is done on either side of the furrows. Sow 3-4 seeds at a time and keep plant to plant distance of 60-90cm.

Pit Method- Sow 4 seeds in pit. For that make pit of 60*60*60cm at a distance of 2-3.5m between two rows 0.6-1.2m between plants. Fill pit with well decomposed cow dung and soil. After germination keep only one seedling.

Hill Method-

Similar to pit method. In this, pit of 30*30*30cm pits are made at distance of 1-1.5m. Two seeds are sown per hill.

SEED RATE:

For sowing one acre land, seed rate of 1.5-2kg is required.

LAND PREAPRATION AND MANURING:

Soil should be well drained and fertile for watermelon cultivation. The pH of soil should be 6-7. Plough land and bring to fine tilth.
Watermelon can be direct seeded or transplant in nursery and then transplanted to main field. The soil should be amended with compost or manure before planting.

Nursery Preparation- Watermelon nursery can be prepared in two ways-

Polythene bags- Fill 200 gauge polythene bags (10cm and 15cm height) with a 1:1:1 ratio of red soil, sand and farmyard manure.

Seedling Trays- Use seedling trays to raise seedlings. Fill the portrays with the same 1:1:1 mixture.

Transplant the seedlings to the main field when they are about 12 days old.

SEED TREATMENT:

Before sowing treat seed with Carbendazim @2gm/kg of seeds. After chemical treat seeds with Trichoderma viride @4gm/kg of seeds. Dry seeds in shade and then do sowing immediately.

Water Management-

Apply irrigation, every week in summer season. At time of maturity give irrigation only when needed. Avoid over flooding in watermelon field. At time of applying irrigation, should not wet the vines or vegetative parts, especially during flowering and fruit set. Avoid frequent irrigation in heavy soil as it will promote excessive vegetative growth. For better sweetness and flavor, stop irrigation or reduce watering 3-6 days before harvesting.

NUTRIENT MANGAEMENT:

Apply Farm Yard Manure or well decomposed cow dung @8-10 ton/acre. Apply Nitrogen @25kg, Phosphorus @16kg and Potash @15kg in form of Urea @55kg, single Super Phosphate @100 kg and Murate of Potash @25 kg per acre.

Apply whole amount of Phosphorus, Potash and one third amount of Nitrogen before sowing seed. Apply remaining dose of nitrogen near vines base. Avoid touching it and mixed well in soil during initial growth period.

When crop is of 10-15 days old, for good growth of crop along with good quality, take spray of 19:19:19 + Micro nutrients @2-3gm/L of water.

Prevent flower drop and increase yield up to 10% take spray of humic acid @3ml+MAP (12:61:00) @5gm/L of water at flowering stage.

After 55 days of sowing spray 13:00:45 @100 gm + Hexaconazole @250ml/150 L of water for fast development of fruits and protection against Powdery Mildew.

PRUNING & THINNING:

Pruning and Thinning are essential practices in watermelon cultivation to improve fruit quality and yield. Pruning involves removing of certain parts of the plant to direct energy towards fruit development, improving fruit size and quality.

Begin Prune when vines start to spread, typically a few weeks after planting. Cut off smaller, less productive vines to focus on the main vine. Each plant should have only 2-3 fruits. Remove any additional small or misshapen fruits early on.

Thinning- Thinning is the process of reducing number of plants per unit area to decrease competition for nutrients, water and light. Perform thinning when plants have 2-3 true leaves, usually a few weeks after germination. Ensure proper spacing between plants, ideally,

watermelon plants should be spaced about 6-8 feet apart, depending on the variety and growth habit. Keep the healthiest and most vigorous seedlings, removing any that are weak or stunted.

WEED MANAGEMENT:

Keep bed weed free during early stage of growth. In absence of proper control measures, weed can cause yield loss of 30%. 15-20 days after sowing carry out intercultural operations. Depending upon severity and intensity of weeds, two or three weeding are required.

NUTRITIONAL DEFICIENCIES AND THEIR MANAGEMENT:

1. **Nitrogen Deficiency-**
   Symptoms- Yellowing of older leaves, Growth is stunted, poor fruit setting.
   Management- Use Urea @2%
2. **Phosphorous Deficiency-**
   Symptoms-
   Reddish Purplish Color of older leaves, Poor root growth.

Management- Soil application of recommended dose of phosphorus should be applied at the time of sowing or planting.

3. **Potassium Deficiency-**
   Symptoms-
   Older leaves turn into thick green color, burning of leaf margins. Leads to yield loss, fruit development is less. Young leaves are wavy.

Management- Foliar spray of K_2SO_4 @1%

4. **Sulphur Deficiency-**
   Symptoms- Plant growth is reduced. Leaves showing yellowing and pale green color symptoms. Older leaves shows small, sunken

dots all over the leaf blade and light brown blotches at the margin.
Management- Foliar spray of K_2SO_4 and $CaSO_4$ 1% twice at fortnightly interval

5. **Calcium Deficiency-**
   Symptoms- Symptoms seen on growing tips of plant, leaves curl upward. Flower buds are failed to develop, youngest leaves will remain small and deformed.
   Management- Foliar spray of Calcium Sulphate twice at weekly intervals.

6. **Boron Deficiency-**
   Symptoms- Curling of leaves, irregular formation of leaves and fruits, flower and fruit dropping.

Management- Foliar spray of Borax @0.2%

PHYSIOLOGICAL DISORDERS:

1. **Hollow Heart-**
   Caused by- Hallow heart is caused by Poor Pollination.
   Symptoms- Hallow heart affected fruits are tend to be in triangular in shape. Seedless watermelon are more likely to prone to this disorder. It is more common on fruits that is set early in season. Cracks and hollow space develop inside the fruit.

Management-

- Grow less susceptible varieties
- Use Pollinizer variety to overcome this disorder
- Pesticides application need to be managed to protect pollinating insects.

2. **Internal Rind Necrosis-**
   Caused by- The cause of rind necrosis is unknown but bacterial infection is reported to cause rind necrosis.
   Symptoms- Symptoms are brown corky, mealy textured spots on the rind which may enlarge to form a large bands of discoloration that rarely extend into the flesh.
   Management- There is no chemical control for this. Avoid planting watermelon in rind necrosis affecting field. Choose varieties that are less susceptible to this disorder. Avoid excessive nitrogen fertilization to the crop. Use drip irrigation for more precise irrigation.

3. **Ozone Injury-**
   Caused by- Ozone Injury in watermelon is caused by exposure to elevated levels of ozone in atmosphere.
   Symptoms- Small dark spots, chlorosis, yellowing and even necrosis of plants can lead from Ozone injury. The extent of injury depends on the concentration of Ozone, the duration of exposure and the susceptibility of the watermelon variety.

Management-

- Choose ozone-tolerant varieties of watermelon, as some cultivars are more resistant to ozone injury than others.
- Maintain adequate soil moisture, as drought stress can exacerbate ozone damage.
- Ensure proper fertilization, especially with potassium, which can help improve plant resilience to ozone stress.
- Implement crop rotation to maintain overall plant health and reduce stress on watermelon plants.
- Use anti-oxidants or chemical protectants, which can mitigate ozone damage by protecting the plants cellular structure.

4. **Splitting-**

   Caused by- Main cause of splitting is excessive water usage in watermelon plants.

   Symptoms-

   - Appearance of cracks on the surface of watermelon. These cracks can vary in size and depth.
   - Watermelon sometime take an irregular shape or distorted shape.
   - In severe cases, juice may leak from the cracks, indicating significant internal damage.
   - Some watermelon may exhibit premature signs of ripening around the split areas.

   Management-

   - Provide consistent watering especially during dry periods. If possible use drip irrigation for watering.
   - Apply mulch around the base of the plants retain soil moisture and maintain even temperature.
   - Provide balanced fertilization, focusing on calcium and other essential nutrients.

INSECT PEST AND THEIR MANAGEMENT:

1. **Whitefly-**
   Pest stage of attack- Nymph and adult
   Stage of occurrence- Vegetative and flowering stage
   Symptoms of damage-
   - Feeding activity of nymph and adult may leads to yellowing, downward curling, drying of leaves.
   - They also cause sooty mould development due to honeydew secretion causing restricted photosynthesis.
   - In severe infection, leaves may drop prematurely.

Management-

- Set up yellow sticky trap @4-6/acre
- Foliar application of Azadirachtin 300ppm @5-10ml/L of water
- Foliar application of Thiamethoxam 25% WG @0.5gm/L of water
- Application of Imidacloprid 17.8%SL @1-2ml/L of water

2. **Thrips-**
   Pest stage of attack- Larva and adult
   Stage of occurrence- Vegetative, flowering and fruiting
   Symptoms of damage-
   - Thrips feeds on leaf surface and suck the plant juice causing small silvery, white or stippling spots on the leaves.
   - Under severe infestation, the leaves turn yellow, wither and become deformed.
   - Growth is stunted
   - Also feeds on flowers of the plant that leads to premature death of flowers.

   Management-
   - Set up yellow sticky trap @4-6/acre

- Application of Azadirachtin 1000ppm @2ml/L of water
- Foliar application of Fipronil 40%+ Imdiacloprid 40%WG @0.5gm/L of water.
- Application of Thiamethoxam 25% WG @0.5gm/L of water

3. **Aphids-**

   Pest stage of attacking- Nymph and Adult
   Stage of occurrence- Seedling, Vegetative and flowering
   Vector – Watermelon Mosaic Virus
   Symptoms of damage-
   - Small, pear shaped, soft bodies insect can be seen on leaves and stems of the plants.
   - Aphids feeds on tender shoots and under surface of leaves by sucking the leaf sap causing curling and crinkling of the leaves.
   - Black sooty mould development due to honeydew secretion on the leaves.
   - Leads to stunted growth and reduce the photosynthetic activity of plant.

   Management-
   - Set up yellow sticky trap @4-6/acre
   - Application of Azadirachtin 5% EC @0.5ml/L of water
   - Application of Profenofos 40%+ Cypermethrin 4% EC @2ml/L of water
   - Application of Thiamethoxam 25% WG @0.5gm/L of water

4. **Leaf Miners-**

   Pest Stage of Attack- Larva

Stage of Occurrence- Vegetative, flowering and fruiting

Symptoms of damage-

- Leaf Miners create winding, snake like-tunnels on the leaves as they feed on the leaf tissue.
- Infested leaves turns yellow to brown
- Under severe infestation, leaves may drop off from the plant
- Leads to stunted growth of the plant and reduce the plant vigor

Management-

- Set up Yellow sticky trap @4-6/acre
- Application of Azadirachtin 1000ppm@2.5ml/L of water

5. **Cutworms-**

Pest Stage of attack- Larva

Stage of occurrence- Seedling

Symptoms of damage-

- Cutworms feeds on the stems of young watermelon plants, cutting them at or near the soil length. This cause plant to die or wilt.
- They also feeds on leaves causing irregular holes or notches in the foliage.

Management-

- Application of Emamectin Benzoate 5% SG @0.5gm/L of water.
- Application of Chlorpyriphos 50%+ Cypermethrin 5% EC @2ml/L of water

6. **Armyworms-**

Pest Stage of Attack- Larva
Stage of Occurrence- Early Vegetative and Flowering
Symptoms of damage-

- Armyworms eat the soft tissue between the veins, leaving a lace-like appearance.
- Armyworms also eat stems and vines causing wilting and reduced plant vigor.
- In severe infestations, armyworms feed on fruit, causing irregular holes and leading to rot and secondary infections.

Management-

- Rotate crops to disrupt the life cycle of armyworms.
- Remove weeds and crop residues that can harbor larvae.
- Encourage beneficial insects such as parasitic wasps, lady beetle, that feed on armyworm.
- Use Pheromone trap @6-7/acre
- Application of Chlorantraniliprole @0.5ml/L of water

7. **Red Pumpkin Beetle-**

Pest Stage of attack- Larva and adult
Stage of occurrence- Seedling or Vegetative
Symptoms of damage-

- Complete destruction of seedling due to adult feeding
- Leaves shows riddled holes due to beetles beetles infestation
- Rotting of stems and roots
- Scars and holes can be found on fruits

Management-

- Foliar application of Profenofos 40% +Cypermethrin 4% EC @2ml/L of water
- Application of Dimethoate 30%SC @3ml/L of water

8. **Fruit fly-**
   Pest Stage of attack- Maggots
   Stage of occurrence- Fruiting
   Symptoms of damage-
   - Small punctures marks can be seen on the surface of watermelon fruits
   - Larvae also feeds on the flesh of the fruit
   - Can cause rotting and premature dropping of fruits
   - Infected fruits become distorted and malformed

Management-

- Set Pheromone lure@6-8/acre
- Application of Azadirachtin 1000ppm @3ml/L of water
- Application of Deltamethrin @3ml/L of water
- Application of Fipronil 40% + Imdiacloprid 40% @0.5ml/L of water

9. **Leaf Eating Caterpillars-**
   Pest Stage of Attack- Larva
   Stage of Occurrence- Vegetative
   Symptoms of damage-
   - Caterpillars feed on the young and tender leaves of watermelon plants which results in holes in leaves.
   - They fold the leaves and scrap the epidermal layer of leaves
   - Under severe infestation, it can cause defoliation of leaves thus reducing plant growth and vigor.

Management-

- Application of Azadirachtin 1500ppm @3-5ml/L of water
- Application of Profenofos 40% + Cypermethrin 4% SC @2ml/L of water.
- Application of Emamectin Benzoate 5% SG @0.5ml/L of water

10. **Serpentine Leaf Miner-**

Pest Stage of Attack- Larva

Stage of occurrence- Vegetative, flowering and fruiting

Symptoms of damage-

- This insect create winding, snake-like tunnel on the leaves as they feed on the leaf tissue.
- Leaves turns yellow to brown in color.
- Under severe infestation, leaves dry up and fall off from the plant.
- It leads to stunted growth of the plant and reduce overall vigour of the plant

Management-

- Set up yellow sticky trap @4-6/acre
- Application of Azadirachtin 1000ppm @2ml/L of water
- Application of Imdiacloprid 17.8% SL @2ml/L of water

DISEASES AND THEIR MANAGEMENT:

1. **Anthracnose-**

Causal Organism- *Colleotrichum orbiculare*

Symptoms-

- Small circular or irregularly shaped spots appear on leaves, stems and fruits that are dark brown and black in color.
- The spots may have water soaked appearance and may be surrounded by yellow halo.
- In severe infestation, leaves drop prematurely.
- Infected fruits may show sunken lesions, cracks and rot.

Management-

- As a preventive measure, treat seeds with Carbendazim @2gm/Kg of seeds

- Spray Mancozeb @400gm/200 L of water

2. **Downy Mildew-**
   Causal Organism- *Pseudoperonospora cubensis*
   Symptoms-
   - Yellowish angular spots appear on the upper surface of leaves.
   - As the disease progresses, a white or grayish powdery fungal growth appears on the underside of the leaves.
   - These spots later turn to brown to black, Later the leaves wilt and die.
   - It causes stunted growth of the plant

Management-

- Application of Metalaxyl 4%+ Mancozeb 64% WP @1-1.5gm/L of water.

3. **Verticillium Wilt-**
   Causal Organism- *Verticillum dahlia*
   Symptoms-

- Leaves shows chlorosis, curling
- Stunted growth of the plants
- Under severe infestation, plants starts to wilt
- Sunken canker appears on fruits

Management-

- Use disease resistant varieties.
- Remove infected plants and destroy them
- Avoid planting watermelon in the same field for at least 4-5 years.
- Cover the soil with clear plastics tarps during the hottest months to raise soil temperature and kill the pathogen.

- Use drip irrigation instead of overhead irrigation to reduce soil moisture and the potential spread of the fungus.

4. **Fusarium Wilt-**
   Causal Organism- *Fusarium oxysporum*
   Symptoms-
   - Leaves turning a dully gray color and wilting during the heat of the day.
   - Older leaves tend to wilt first
   - In severe infestation, leaves may drop off and can even cause death to the plant.
   - Brown striking can be seen in the vascular tissue of the lower stem and spread into the vines.
   - Affected fruits are misshapen and they tend to crack or sunburn at age.

Management-

- Use good sanitation practices
- Plant resistant varieties
- Treat seeds with Trichoderma viride @10gm/kg of seeds
- Soil drenching of Carbendazim 50% @2gm/L of water

5. **Angular Leaf Spot-**
   Causal Organism- *Pseudomonas syringae*
   Symptoms-
   - Brown spots angular in shape with yellow halos.
   - Young spots are water soaked.
   - Older spots have holes in center.
   - Stems, petioles and fruits develop water soaked spots that covered with white crust.

Management-

- Use disease free clean seeds for propagation.
- Remove sources of inolcum such as dead leaves and plants.
- Use drip irrigation instead of overhead irrigation.
- Remove and destroy infected fruits and vines at the end of the season.
- Application of Zineb 75% WP @600-800gm/acre

6. **Powdery Mildew-**
   Causal Organism- *Erysiphae*
   Symptoms-
   - White, powdery spots or patches on leaves, stems and young growing parts of the plant. Later, it may grow spread rapidly and cover the entire surface.
   - The white powdery spots may gradually turn yellow and become necrotic.
   - The affected leaves may curl or become distorted
   - In severe infestation, plants may die prematurely.

Management-

- Application of Azoxytrobin 23%SC @1-1.5ml/L of water
- Application of Carbendazim 50% WP @0.5gm/L of water

7. **Alternaria Leaf Spot-**
   Causal Organism- *Alternaria cucumerina*
   Symptoms-
   - Small, circular, irregularly shaped spots appear on leaves that are initially water soaked, then turn brown or black as they dry out.
   - The spots may have yellow halo and may merge to form larger lesions.
   - The infected leaves may become distorted, wilt and eventually die.

Management-

- Application of following fungicides-
  Trichoderma viride @2ml/L of water
  Propiconazole 25% EC @1ml/L of water
  Mancozeb 75% WP @2gm/L of water

8. **Bud Necrosis-**
   Causal Organism- It is caused by Tomato Spotted Wilt Virus (TSWV)
   Symptoms-

- Yellowing and bronzing of leaves , especially younger leaves
- Small, dark brown or black spots or rings may develop in leaves
- The new growth or bud may become stunted and show black necrotic spots.
- It results in floral decay.
- Fruit surface also shows such symptoms and become discolored.
- In severe infestation, plants may die

Management-

- Remove and destroy all the affected plants
- Use healthy and disease free seeds
- Application of Tebuconzaole 38% SC @250ml/acre

9. **Bacterial Fruit Blotch-**
   Causal Organism- *Acidovorax citrulli*
   Symptoms-
   - Dark-reddish brown spots may develop along the leaf veins.
   - Dark green to brown, water- soaked spots on fruits
   - The flesh underneath the spots may become soft, watery and discolored.
   - Infected fruits may develop a sour smell and ooze a sticky-tan colored substance.

Management-

- Application of Trichoderma viride @10gm/L of water
- Application of Copper oxychloride 50% WP @2.5gm/L of water

10. Gummy Stem Blight-

Causal Organism- *Didymella bryoniae*

Symptoms-

- Brown-black, water soaked lesions appear on stems which later become dry and wilt.
- Irregular tan to brown blotches appears on leaves which may lead to wilting and blight of foliage.
- The development of gummy, reddish brown substance on the surface of lesions
- Premature defoliation of plants.

Management-

- Application of Azoxytrobin 23% SC @1ml/L of water
- Application of Metalaxyl 8% + Mancozeb 64%WP @1.5-2.5gm/L of water
- Seed treatment of Metalaxyl 35% WS @6-7gm/kg of seeds.

HARVESTING:

If tendril near stem gets dried also whitish color of fruit which touch to ground get yellowish then assume that fruit is read for harvesting. On thumping melon it it sounds hollow (usually as a dull or thud) then it is ready for harvest and immature fruit sounds dense. Don't pick immature fruits as they ripe only when attached to vine.

To harvest fruit, cut stem 1'' from fruit with a pair of sharp pruners or knife. Fruit can be stored in a cool humid environment.

YIELD:

Average yield of watermelon is found to be 16-17tonn/acre and for hybrids it is around 20-22tonn/acre.