

# PRECISION FARMING TECHNOLOGIES

## TOMATO

### i. Quality Seedling Production

#### Protected nursery

- ❖ The nursery area is covered with 50 per cent shade net
- ❖ The raised beds of 1m width and convenient length are formed
- ❖ The seedlings are raised in prostrays
- ❖ The sterilized cocopeat is used for raising seedlings @ 300 kg/ha is mixed with 5 kg of neem cake along with *Azospirillum* and Phosphobacteria each @ 1 kg.

#### Sowing

- ❖ About 100 g of hybrid tomato seeds is required to produce seedlings for 1 ha
- ❖ The seeds are mixed with *Azospirillum* @ 200 g/kg and are shade dried for half an hour.
- ❖ After 6 days, the germinated prostrays are individually placed on the raised beds inside the shade net.
- ❖ Watering is done by rose can everyday (twice/day) upto seed germination.
- ❖ Panchakavya spray @ 3% (30 ml/l) is done at 15<sup>th</sup> day of sowing.
- ❖ 19:19:19 + MN @ 0.5% (5g/l) solution is drenched at 18 days after sowing.
- ❖ The tomato seedlings of 25 - 30 days old are ready for transplanting.

### ii. Planting

- ❖ The main field is ploughed 4 times. Chisel and disc plough each one time and cultivator twice.
- ❖ FYM @ 25t /ha is applied before the last ploughing.
- ❖ 75% of the total recommended dose of super phosphate i.e. 1171.88 kg/ha is applied as basal dose.
- ❖ *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.

- ❖ Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- ❖ Before planting, the beds are watered using drip system for 8 to 12 hours.
- ❖ Pre-emergence weedicide spray of pendimethalin (Stomp) is applied @ 3 lit/ ha (1 kg a.i./ha) just before transplanting.
- ❖ Planting is done at a spacing of 90 x 60 x 60 cm in the paired row system
- ❖ One row of African marigold seedlings of 40 days old are planted simultaneously for every 16 row of tomato seedlings.
- ❖ Gap filling is done at 7<sup>th</sup> day after transplanting.

### **iii. Fertigation Techniques**

- ❖ For tomato F<sub>1</sub> hybrid, a dose of 200: 250: 250 kg of NPK / ha is applied throughout the cropping period through split application. The split dose is applied once in every three days through fertigation.

### **iv. Intercultivation**

- ❖ Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval for 6 times.
- ❖ Staking is done by using either bamboo or eucalyptus poles on 30<sup>th</sup> day after planting.
- ❖ Weeding is done on 30 and 60<sup>th</sup> days after planting depending upon the weed growth.
- ❖ Triacontanol 625 ml is mixed with 500 l of water (1.25 ppm) and sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.
- ❖ Planofix @ 125 ml in 500 l of water (0.25 ppm) is sprayed at 45, 60 and 90<sup>th</sup> DAP.
- ❖ Micronutrient mixture @ 1g / lit (0.1%) is sprayed for 2 times at 40<sup>th</sup> and 80<sup>th</sup> days after planting.
- ❖ 19:19:19 + MN @ 1% (10 g / lit) is sprayed at 60 days after planting.



**Staking for quality produce**

#### **v. Harvesting and Post harvest management**

- ❖ Harvesting of tomato fruits is carried out either at breaker stage or at half red depending upon the market preference. First harvest starts at 60 days after planting.
- ❖ Grading is done based on the size of the fruits. Three grades viz., uniform big sized fruits, small size and damaged and misshapen fruits and are packed separately in plastic crates.



**Graded fruits**

## BRINJAL

### i. Quality Seedling Production

#### Protected nursery

- The nursery area is covered with 50 per cent shade net
- The raised beds of 1m width and convenient length are formed
- The seedlings are raised in portrays
- The sterilized cocopeat is used for raising seedlings @ 300 kg /ha is mixed with 5 kg of neem cake along with *Azospirillum* and Phosphobacteria each @ 1 kg.

#### Sowing

- About 200 g of brinjal seeds is required to produce seedlings for 1 ha.
- The seeds are mixed with *Azospirillum* @ 200 g/kg and are shade dried for half an hour.
- After 6 days, the germinated portrays are individually placed on the raised beds inside the shade net.
- Watering is done by rose can everyday (twice/day) upto seed germination.
- Panchakavya spray @ 3% (30 ml/l) is done at 15<sup>th</sup> day of sowing.
- 19:19:19 + MN @ 0.5% (5g/l) solution is drenched at 18 days after sowing.
- The brinjal seedlings of 35 days old are ready for transplanting.

### ii. Planting

- The main field is ploughed 4 times. Chisel and disc plough each one time and cultivator twice.
- FYM @ 25 t /ha is applied before the last ploughing.
- 75 % of the total recommended dose of super phosphate i.e. 703.13 kg/ha is applied as basal dose.
- *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- *Pseudomonas fluorescens* or *Trichoderma viridi* @ 2.5 kg/ha along with 100 kg of FYM is applied before last ploughing.

- Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- Before planting, the beds are watered using drip system for 8 to 12 hours.
- Pre-emergence weedicide spray of pendimethalin (Stomp) is applied @ 3 lit/ ha (1 kg a.i./ha) just before transplanting.
- 35 days old seedlings are dipped in 0.5% solution of *Pseudomonas fluorescens* for 30 minutes and are transplanted at a spacing of 90 x 60 x 75 cm in the paired row system in the main field.
- One row of African marigold seedlings of 40 days old are planted simultaneously for every 16 row of brinjal seedlings.
- Gap filling is done at 7<sup>th</sup> day after transplanting.

### **iii. Fertigation techniques**

- For brinjal F<sub>1</sub> hybrid, a dose of 200: 150: 100 kg of NPK/ ha is applied throughout the cropping period through split application. The split dose is applied once in every three days through fertigation.

### **iv. Intercultivation**

- Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval for 6 times.
- Triacantanol 625 ml is mixed with 500 l of water (1.25 ppm), is sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.
- Planofix @ 125 ml in 500 l of water (0.25ppm) is sprayed at 45, 60 and 90<sup>th</sup> DAP.
- Micronutrient mixture @ 1 g/lit (0.1%) is sprayed for 2 times at 40<sup>th</sup> and 80<sup>th</sup> days after planting.
- 19:19:19: + MN @ 1 % (10 g/lit) is sprayed at 60 days after planting.

### **v. Harvesting and Post Harvest management**

- Harvesting of brinjal fruits is carried out at fully matured stage.
- The fruits are graded based on the size. The damaged and pest affected fruits are sorted out and then packed in the crates for market.





**Minimal flower drop and no fruit drop**



**Ready for packing**

# CHILLI

## i. Quality Seedling Production

### Protected nursery

- The nursery area is covered with 50 per cent shade net
- The raised beds of 1m width and convenient length are formed
- The seedlings are raised in portrays
- The sterilized cocopeat is used for raising seedlings @ 360 kg/ha is mixed with 5 kg of neem cake along with *Azospirillum* and Phosphobacteria each @ 1 kg.

### Sowing

- About 200 g of hybrid chilli seeds is required to produce seedlings for 1 ha.
- The seeds are treated with *Pseudomonas fluorescens* @10 g / kg of seed which is a biofungicide.
- The seeds are mixed with *Azospirillum* @ 200 g / kg and are shade dried for half an hour. About 50 g of *Azospirillum* is required for the seed treatment of 200g chilli seeds.
- After 6 days, the germinated portrays are kept in the raised beds inside the shade net.
- Watering is done by rose can everyday (twice / day upto seed germination).
- Panchakavya spray @ 3 % is done at 15<sup>th</sup> day of sowing (30 ml/ lit)
- 19:19:19 + MN @ 0.5 % solution are drenched using rose can or micro nutrient spray of 0.5 % is done at 18 days after sowing.
- The chilli seedlings of 35 days old are ready for transplanting



**35 days old seedlings**

## **ii. Planting**

- The main field is ploughed 4 times. Chisel and disc each at one time and cultivator twice.
- FYM @ 25 t/ha is applied before the last ploughing.
- 75% of the total recommended dose of super phosphate i.e. 375 kg/ha is applied as basal dose.
- *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- *Pseudomonas fluorescens* @ 2.5 kg/ha along with 50 kg of FYM and applied before last ploughing.
- Raised beds of 120 cm width are formed at an interval of 30 cm and the laterals are placed at the centre of the bed.
- Before planting, the beds are watered using drip system for 8 to 12 hours.
- Pre-emergence weedicide spray of Fluchloralin @ 1lit a.i. / ha or pendimethalin 1 lit a.i. / ha is done before transplanting.
- Planting is done at the spacing of 90 x 60 x 45 cm in the paired row system, using



- marked ropes at 45 cm spacing.
- 35 days old seedlings are dipped in 0.5 % solution of *Pseudomonas fluorescens* for 30 minutes and are transplanted in the main field.
  - One row of African marigold of 40 days old are planted simultaneously along with chilli seedlings in every 16 rows.
  - Gap filling is done at 7<sup>th</sup> day after transplanting.

### iii. Fertigation techniques

- For chilli F<sub>1</sub> hybrid, 120: 80: 80 kg of NPK/ ha is applied through out the cropping period. The splits are approximately once in every three days through fertigation.



**20 days after planting**

### iv. Intercultivation

- Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval is given as biofungicide.
- Weeding is done on 30<sup>th</sup> and 60<sup>th</sup> days after planting depending upon the weed growth.
- Micro nutrient mixture @ 500 g / ha (0.1%) is sprayed at 40<sup>th</sup>, 80<sup>th</sup> and 120<sup>th</sup> days after planting.
- Water soluble fertilizers 19: 19: 19: + MN and KN03 @ 1% are sprayed at 60 and 100 days after planting respectively.

- Triaccontanol 625 ml is mixed with 500 l of water (1.25 ppm), is sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.
- Planofix @ 125 ml in 500 l of water (0.25ppm) is sprayed at 45, 60 and 90<sup>th</sup> days after planting.

#### **v. Harvesting and Post harvest management**

- Harvesting of fully mature green chilli fruits is carried out at four days interval from 70 days after planting.
- Grading is done based on the size of the fruits and is packed in the crates. The small sized, curved and misshapen fruits are separated.



**90% plus first grade on sorting**

# PAPRIKA

## i. Quality seedling production

### Protected nursery

- The nursery area is covered with 50 per cent shade net
- The raised beds of 1m width and convenient length are formed
- The seedlings are raised in portrays
- The sterilized cocopeat is used for raising seedlings @ 360 kg/ha is mixed with 5 kg of neem cake along with *Azospirillum* and Phosphobacteria each @ 1 kg.

### Sowing

- About 200 g of paprika seeds is required to produce seedlings for 1 ha.
- The seeds are treated with *Pseudomonas fluorescens* 10 g / kg or *Tricoderma viridii* @ 4 g / kg of seed which is a bio-fungicide.
- The seeds are mixed with *Azospirillum* @ 100 g / kg and are shade dried for half an hour. About 50 g is required for the seed treatment.
- After 6 days, germinated portrays are kept in the raised beds inside the shade net.
- Watering is done by rose can everyday (twice / day upto seed germination).
- Panchakavya spray @ 3 % is done at 15<sup>th</sup> day of sowing (30 ml / lit)
- 19:19:19 + MN @ 0.5 % solution is drenched using rose can or micro nutrient spray of 0.5 % is done at 18 days after sowing.
- The paprika seedlings, of 35 days old are ready for transplanting and are transported to the main field.

## ii. Planting

- The main field is ploughed 4 times. Chisel and disc each at one time and cultivator twice.
- FYM @ 25t /ha is applied before the last ploughing.
- 75 % of the total recommended dose of super phosphate i.e. 703.12 kg / ha is applied as basal dose.

- *Azospirillum* and Phosphobacteria each @ 5 kg / ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- *Pseudomonas fluorescens* @ 2.5 kg / ha along with 100 kg of FYM and applied before last ploughing.
- Raised beds of 120 cm width are formed at an interval of 30 cm and the laterals are placed at the centre of the bed.
- Before planting, the beds are watered using drip system for 8 to 12 hours.
- Pre-emergence weedicide spray of Fluchloralin @ 1lit a.i. / ha or pendimethalin 1 lit a.i. / ha through high volume sprayer is done just before transplanting.
- 35days old seedlings are dipped in 0.5 % solution of *Pseudomonas fluorescens* for 30 minutes and are transplanted at the spacing of 90 x 60 x 45 cm in the paired row system in the main field.
- One row of African marigold of 35 days old are planted simultaneously along with paprika seedlings in every 16 rows.
- Gap filling is done at 7<sup>th</sup> day after transplanting.

### iii. Fertigation techniques

- For paprika F<sub>1</sub> hybrid, 250: 150: 150 kg of NPK/ ha is applied throughout the cropping period. The split doses are given approximately once in every three days through fertigation.

### iv. Intercultivation

- Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval is given as biofungicide.
- Weeding is done on 30<sup>th</sup> and 60<sup>th</sup> days after planting depending upon the weed growth
- Water soluble fertilizers 19:19:19 + MN and KNO<sub>3</sub> @ 1% are sprayed at 60<sup>th</sup> and 100<sup>th</sup> days after planting respectively.
- Triacantanol 625 ml is mixed with 500 l of water (1.25 ppm), is sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.

- Planofix @ 125 ml in 500 l of water (0.25ppm) is sprayed at 45, 60 and 90<sup>th</sup> days after planting.

#### **v. Harvesting and Post harvest management**

- Harvesting of fully mature green paprika fruits is carried out at four days interval from 70 days after planting.
- Grading is done based on the size of the fruits and is packed in the crates. The small sized, curved and misshapen fruits are separated.



**Paprika ready for harvest**



**First grade fruits**



## CAPSICUM

### i. Quality seedling production

#### Protected nursery

- The nursery area is covered with 50 per cent shade net
- The raised beds of 1m width and convenient length are formed
- The seedlings are raised in portrays
- The sterilized cocopeat is used for raising seedlings @ 300 kg/ha is mixed with 5 kg of neem cake along with *Azospirillum* and Phosphobacteria each @ 1 kg.

#### Sowing

- About 200g of capsicum seeds is required to produce seedlings for 1 ha.
- The seeds are treated with *Pseudomonas fluorescens* 10 g / kg or *Tricoderma viridi* @ 4 g / kg of seed which is a bio-fungicide.
- The seeds are mixed with *Azospirillum* @ 100 g / kg and are shade dried for half an hour. About 50g is required for the seed treatment.
- After 6 days, the germinated portrays are kept in the raised beds inside the shade net.
- Watering is done by rose can everyday (twice / day upto seed germination).
- Panchakavya spray @ 3 % is done at 15<sup>th</sup> day of sowing (30 ml/lit)
- 19:19:19 + MN @ 0.5 % solution is drenched using rose can or micro nutrient spray of % is done at 18 days after sowing.
- The capsicum seedlings, of 35 days old are ready for transplanting and are transported to the main field.

### ii. Planting

- The main field is ploughed 4 times. Chisel and disc each at one time and cultivator twice.
- FYM @ 25 t /ha is applied before the last ploughing.
- 75% of the total recommended dose of super phosphate i.e. 703.12 kg/ ha is applied as basal dose.

- *Azospirillum* and Phosphobacteria each @ 5 kg/ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- *Pseudomonas fluorescens* @ 2.5 kg /ha along with 100 kg of FYM and applied before last ploughing.
- Raised beds of 120 cm width are formed at an interval of 30 cm and the laterals are placed at the centre of the bed.
- Before planting, the beds are watered using drip system for 8 to 12 hours.
- Pre-emergence weedicide spray of Fluchloralin @ 1 lit a.i. / ha or pendimethalin 1 lit a.i. / ha through high volume sprayer is done just before transplanting.
- 35 days old seedlings are dipped in 0.5 % solution of *Pseudomonas fluorescens* for 30 minutes and are transplanted at the spacing of 90 x 60 x 60 cm in the paired row system in the main field.
- One row of African marigold of 40 days old are planted simultaneously along with capsicum seedlings in every 16 rows.
- Gap filling is done at 7<sup>th</sup> day after transplanting.

### **iii. Fertigation techniques**

- For capsicum F<sub>1</sub> hybrid, 250: 150: 150 kg of NPK/ ha is applied throughout the cropping period. The split doses are given approximately once in every three days through fertigation.

### **iv. Intercultivation**

- Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval is given as biofungicide.
- Weeding is done on 30<sup>th</sup> and 60<sup>th</sup> days after planting depending upon the weed growth.
- Water soluble fertilizers 19:19:19 + MN and KNO<sub>3</sub> @ 1% is sprayed at 60<sup>th</sup> and 100<sup>th</sup> days after planting respectively.
- Triacantanol 625 ml is mixed with 500 l of water (1.25 ppm), is sprayed on 15<sup>th</sup> and 30<sup>th</sup> days after planting.

- Planofix @ 125 ml in 500 l of water (0.25ppm) is sprayed at 45, 60 and 90<sup>th</sup> days after planting.

**v. Harvesting and Post harvest management**

- Harvesting of fully mature green capsicum fruits is carried out at four days interval from 70 days after planting.
- Grading is done based on the size of the fruits and is packed in the crates. The small sized, curved and misshapen fruits are separated.

## BHENDI

### i. Field preparation

- The main field is ploughed three times with Chisel, disc and cultivator plough each one time.
- *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- Well decomposed FYM @ 25 t /ha is applied before the last ploughing.
- 75% of the total recommended dose of super phosphate i.e. 468.75 kg/ha is applied as basal dose.
- The beds are leveled and the laterals are placed at the centre of the bed.

### ii. Seed treatment

- About 6 kg of bhendi F<sub>1</sub> hybrid seeds are required to cover 1 ha area.
- The seeds are mixed with 1 kg of *Azospirillum* culture and are shade dried for half an hour.

### iii. Sowing

- Sowing is carried out at the rate of one seed / hill. Ropes are marked at the interval of 45 cm and planting is done at three rows within the bed in the spacing of 60 x 45 x 45 cm in the paired row system.
- The beds are watered using drip system for 8 to 12 hours till field capacity.
- Pre-emergence weedicide spray of 1kg a.i. of Fluchloralin or 0.75 kg a.i. of metalachlor / ha on third day of sowing.
- Gap filling is done at 7<sup>th</sup> day of sowing.

### iv. Fertigation Techniques

- For bhendi F<sub>1</sub> hybrid, a dose of 200: 100: 100 kg of NPK/ha is applied throughout the cropping period through split application. The split dose is applied once in

every three days through fertigation. (75 % of the phosphorous is given as a basal dose at the time of last ploughing).

#### **v. Intercultivation**

- Drip irrigation is given @ 1 hour per day depending upon the soil type and climate
- Foliar spray of *Pseudomonas fluorescens* is applied @ 0.5 % at 15 days interval for 6 times.
- Weeding is done on 30<sup>th</sup> and 60<sup>th</sup> days after planting depending upon the weed growth
- Micronutrient mixture @ 1g/lit (0.1%) is sprayed for 2 times at 40<sup>th</sup> and 60<sup>th</sup> days after planting.
- 19:19:19: + MN @ 1% (10 g/lit) is sprayed at 60 days after planting.



**Healthy crop at bearing stage**

#### **vi. Harvesting and Post harvest management**

- Harvesting of bhendi fruits is carried out from 45 days after sowing. Fully matured tender fruits are harvested.
- Grading is done by separating the pest affected fruits and misshapen fruits.
- The fruits are packed in the crates and transported to the market.



## BIG ONION / BELLARY ONION

### i. Quality Seedling Production

#### Raised beds

- ✚ The seedlings of big / bellary onion are produced in raised nursery beds of one-foot height and convenient length.
- ✚ The beds are inoculated with Vesicular Arbuscular Mycorrhizae @1 kg / sq. metre

#### Seed treatment and seed rate

- ✚ 8-12 kg of onion seeds are required to broadcast for one hectare of land. The seeds are treated with *Pseudomonas fluorescens* @ 10 g / kg of seeds.
- ✚ The seeds are mixed with *Azospirillum* @ 100 g / kg and shade dried for half an hour.

#### Sowing

- ✚ Seeds are mixed with fine sand and are uniformly broadcasted on the beds
- ✚ After sowing, they are covered by thin layer of sand and then by paddy straw. The nursery is watered through rose can twice a day regularly.
- ✚ On tenth day copper oxy chloride @ 2 g/litre of water is sprayed to protect the seedlings from fungal infection.
- ✚ The seedlings are ready for transplanting in 45 - 50 days after sowing.

### ii. Field preparation and planting

- ✚ The field selected for planting should be ploughed thoroughly by using chisel plough, disc plough and cultivator.
- ✚ FYM @ 25 t/ha and 75 % of the total recommended dose of single super phosphate (285kg). *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @100 kg is applied before last ploughing.

- ✚ Along with biofertilizers 50 kg each of Zinc Sulphate and Ferrous Sulphate is applied before last ploughing.
- ✚ Raised beds of 1.2 meter width and 1 foot depth are formed for transplanting.
- ✚ Drip irrigation is done @ 8- 12 hours depending upon the soil condition to get field capacity.
- ✚ Transplanting is done in paired row system at the spacing of 15 cm between rows (of 7 rows with in the bed) and 10cm between plants.

### iii. After care

- ✚ Drip irrigation is done @ 1-2 hours per day depending upon the soil and climatic condition.
- ✚ **Weeding:** First weeding is done on 30<sup>th</sup> day after transplanting and thereafter as and when necessary.
- ✚ **Fertigation:** For big onion, 60: 60:30 kg of NPK / ha is applied throughout the cropping period. The splits are approximately once in every 3 days.

### iv. Harvesting and post harvest management

- ✚ The harvesting is done at 75 days to 160 days depending upon the varieties.
- ✚ The irrigation is stopped 15 days before harvesting and sprayed with 500 ppm of Maleic hydrazide. This will prevent sprouting of the bulbs in storage by which they can be stored even for 6-7 months.
- ✚ The correct time of harvest is one week after 50% top fell. After lifting the bulbs the tops should be cured in shade for 10-15 days before storage to remove field heat. Then proper sorting and grading is done.

## AGGREGATUM ONION OR SMALL ONION

### i. Preparatory cultivation

- ✚ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ✚ FYM @ 25t /ha is applied before the last ploughing.
- ✚ 75 % of the total recommended dose of super phosphate i.e. 285 kg/ha is applied as basal dose.
- ✚ *Azospirillum* and Phosphobacteria each @ 2 kg/ha along with FYM 50 kg and Neem cake @100 kg is applied before last ploughing.
- ✚ Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.

### ii. Planting design

- ✚ Bulbs are planted in paired row system @ 1500 kg/ha. Planting is done in rows of 20 cm spacing and 12 cm between plants. Planting is done at 6 rows in each bed.
- ✚ Irrigation is done after the transplanting or planting the bulbs. Complete wetting is necessary to maintain uniform moisture level.

### iii. After care

- ✚ Irrigation is done daily @ 1-2 hour depending upon the soil and climatic condition.

### iv. Harvesting

- ✚ After reaching the full maturity, depending upon the variety the crop is ready from 75 to 160 days.
- ✚ MH @ 500 ppm (500 mg / litre) is sprayed on 15 days before harvesting to avoid sprouting of the bulbs in storage, so that the bulbs are stored for 6-7 months.
- ✚ Onions are harvested one week after 50% top fall.
- ✚ After lifting the bulbs the tops are cured in shade for 10-15 days before storage and stored in well-ventilated room.

# CABBAGE

## i. Quality seedling production

### Protected nursery

- The nursery area is covered with 50 per cent shade net
- The raised beds of 1m width and convenient length are formed
- The seedlings are raised in prostrays
- The sterilized cocopeat @ 720 kg/ha is mixed with 10 kg of neem cake and *Azospirillum* and Phosphobacteria each @ 1kg. About 1.25 kg of the cocopeat medium is filled in each tray.

### Sowing

- ✚ About 250 g of hybrid cabbage seed is required for the production of seedlings for 1 ha. The seeds are treated in hot water @ 50°C for 30 minutes.
- ✚ The seeds are mixed with *Azospirillum* @ 100 g / kg and are shade dried for half an hour. About 25 g of *Azospirillum* is required for the seed treatment of 250 g cabbage seeds.
- ✚ Sowing of cabbage seeds in prostrays is done @ 1 seed per cell. The seeds are covered with cocopeat and is kept one over the other (8-10 Nos.) and covered with polythene sheet for 5 days or till germination starts.
- ✚ After 5 days when the seeds are germinated the prostrays are arranged on the raised beds inside the shade net nursery.
- ✚ Watering is done by rose can everyday (twice / day) upto seed germination.
- ✚ Panchakavya spray @ 3% (30 ml/lit) is done at 15 days after sowing.
- ✚ 9:19:19 + MN @ 0.5 % (5 g/lit) solution are drenched using rose can or micro nutrient spray of 0.5 % is done at 18 days after sowing.
- ✚ The cabbage seedlings are ready for transplanting in 25 days

## ii. Planting

- ✚ The main field is ploughed 4 times using chisel and disc each at one time and cultivator two times.

- ✚ FYM @ 25 t /ha is applied before the last ploughing.
- ✚ 75 % of the total recommended dose of super phosphate i.e. 588.93 kg is applied as basal dose.
- ✚ *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100kg is applied before last ploughing.
- ✚ Raised beds of 120 cm width are formed at an interval of 30 cm and the laterals are placed at the centre of the bed.
- ✚ Drip irrigation is done for 8 to 12 hours depending upon the soil moisture level and soil type.
- ✚ Pre-emergence weedicide spray of Fluchloralin @ 1 lit a.i./ha or Trifluralin 0.5 lit/ha through high volume sprayer is done just before transplanting. Ropes are marked at the interval of 45 cm and planting is done at the spacing 45 x 45 cm in the paired row system.
- ✚ Gap filling is done at 7<sup>th</sup> day after transplanting.



**Cabbage for double yield**

### **iii. Fertigation Techniques**

- ✚ Fertigation requirement for cabbage F<sub>1</sub> hybrid is 200: 125: 150 kg of NPK/ha is applied once in every three days throughout the cropping period.



#### iv. Intercultivation

- ✚ Carbofuron @ 33 kg/ha is applied at one week after transplanting to control nematodes.
- ✚ Foliar spraying with *Pseudomonas fluorescens* @ 0.5 % (5 g/lit) at 15 days interval is done for 6 times.
- ✚ Weeding is done on 30 DAP depending upon the weed growth.
- ✚ Micro nutrient mixture @ 21 g/lit (0.1%) is sprayed at 40<sup>th</sup>, 60<sup>th</sup> and 80<sup>th</sup> DAP.

#### v. Harvesting and Post Harvest Management

- ✚ Harvesting is done when the heads attain the full size and are firm.
- ✚ The harvested heads are packed in the collapsible crates and are transported to market without damage.



Uniform heads

## CAULIFLOWER

### i. Quality seedling production

#### Protected nursery

- The nursery area is covered with 50 per cent shade net
- The raised beds of 1m width and convenient length are formed
- The seedlings are raised in portrays
- The sterilized cocopeat @ 720 kg/ha is mixed with 10 kg of neem cake and *Azospirillum* and Phosphobacteria each @ 1kg.

#### Sowing

- ◆ About 250 g of hybrid cauliflower seed is required for the production of seedlings for 1 ha. The seeds are treated in hot water @ 50°C for 30 minutes.
- ◆ The seeds are then treated with bio-control agent *Pseudomonas fluorescens* @ 10g/kg of seed.
- ◆ The seeds are mixed with *Azospirillum* @ 100g/kg and are shade dried for half an hour.
- ◆ After 5 days when the seeds are germinated the portrays are arranged on the raised beds inside the shade net nursery.
- ◆ Watering is done by rose can everyday (twice / day) upto seed germination.
- ◆ Panchakavya spray @ 3% (30 ml/lit) is done at 15 days after sowing.
- ◆ 19:19:19 + MN @ 0.5 % (5g/lit) solution are drenched using rose can or micro nutrient spray of 0.5 % is done at 18 days after sowing.
- ◆ The cauliflower seedlings are ready for transplanting in 25 days.

### ii. Planting

- ◆ The main field is ploughed 4 times using chisel and disc each at one time and cultivator two times.
- ◆ FYM @ 25t/ha is applied before the last ploughing.
- ◆ 75% of the total recommended dose of super phosphate i.e. 586 kg is applied as basal dose.

- ◆ *Azospirillum* and Phosphobacteria each @ 2 kg/ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- ◆ *Pseudomonas fluorescens* @ 2.5 kg/ha along with 50 kg of FYM and applied before last ploughing.
- ◆ Raised beds of 120 cm width are formed at an interval of 30 cm and the laterals are placed at the centre of the bed.
- ◆ Drip irrigation at field capacity is done for 8 to 12 hours depending upon the soil moisture level and soil type.
- ◆ Pre-emergence weedicide spray of Fluchloralin @ 1 lit a.i./ha or Trifluralin 0.5 lit./ha through high volume sprayer is done just before transplanting. The soil should be moist while spraying.
- ◆ Ropes are marked at the interval of 45 cm and planting is done at the spacing of 60 x 45 x 45 cm in the paired row system.
- ◆ 40 days old seedlings are dipped in *Pseudomonas fluorescens* 0.5 % for 30 minutes and are transplanted in the main field.
- ◆ Gap filling is done at 7<sup>th</sup> day after transplanting.



**45 days old seedlings**

### **iii. Fertigation Techniques**

- ◆ Fertigation requirement for cauliflower F<sub>1</sub> hybrid is 200: 125: 125 kg of NPK/ha is applied once in every three days throughout the cropping period.

#### **iv. Intercultivation**

- ◆ Foliar spraying with *Pseudomonas fluorescens* 0.5 % at 15 days interval is done.
- ◆ Weeding is done on 30 DAP depending upon the weed growth.
- ◆ Micro nutrient mixture @ 250 g/ha (0.1 %) is sprayed at 40, 60 and 80 DAP.

#### **v. Harvesting and Post harvest management**

- ◆ Harvesting is done during morning or evening, when the curds attain the full size and are firm.
- ◆ The harvested curds are packed in the collapsible crates and are transported to market without damage.

## WATERMELON

### **i. Nursery preparation**

- ◆ Nursery for watermelon can be done either by polythene bags of 200 gauge, 10 cm diameter and 15 cm height size or through protrays under protected nursery.
- ◆ In poly bag nursery, the bags are filled with 1:1:1 ratio of red soil, sand and farmyard manure mixture and filled compactly.
- ◆ The seeds are treated with Carbendazim 2g/kg of seeds and sowing can be done by one seed per bag. A quantity of 3.5 kg of seeds would be required for one hectare.
- ◆ In protrays, each having 98 holes are used for raising seedlings. Well-decomposed cocopeat is used as media. Dibble the seed in each hole @ one per hole and keep the trays under shade net house for about 12 days. In the net house, water the seedlings twice a day using rose can. About 12 days old seedlings are transplanted in the main field.

### **ii. Field preparation**

- ◆ The land is ploughed thoroughly through chisel plough first followed by disc plough and cultivators.
- ◆ Farmyard manure @ 25 t/ha and 75 % of the phosphorous fertilizer (469 kg/ha) is applied before last ploughing. Application of *Pseudomonas fluorescens* @ 2.5 kg along with 50 kg of FYM is used as a bio control agent as well as growth promoter.
- ◆ Raised beds of 1.2 m width and 1 foot height are formed for sowing. Before sowing irrigation is done to completely wetting the field by minimum 8 hours to 12 hours depending upon the soil condition.

### **iii. Direct sowing or Transplanting**

- ◆ Use of Biofertilizers: *Azospirillum* and Phosphobacteria 2 kg / ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.

- ◆ Sowing: For watermelon or muskmelon the seeds are sown @ spacing of 1.5 m x 60 cm.
- ◆ Planting: Spread the lateral tubes in the centre of each bed. Irrigate the beds by operating the drip system continuously for 8-12 hrs. Spray pre-emergence weedicide (Pendimethalin @ 1kg a.i./ha) just before planting. Plant the seedlings in the holes made at 60 cm distance.

#### **iv. Fertigation**

- ◆ For watermelon / muskmelon a dose of 200: 100: 100 kg NPK/ha is applied throughout the cropping period through split application.



**At vegetative stage**

#### **v. Inter cultivation**

- ◆ Irrigation: Drip irrigation is given for one hour per day.
- ◆ Thinning: Thin the seedlings @ 2 per hill, 15 days after sowing.
- ◆ Weeding: A shallow hoeing is done 20 days after sowing and the plants are earthed up



- ◆ Hormone spraying: In watermelon, to increase the female flowering 250 ppm of ethereal (2.5 ml/10 lit of water) is sprayed 15, 22, 29 & 36 days after sowing
- ◆ Cushion for fruits: Provide paddy straw or dried grass cushions for each fruit to avoid direct contact with soil.

#### **vi. Harvest**

- ◆ In general, the fruits are harvested when they attain 5-8 kg fruit weight and good shape and size.
- ◆ A fully ripe fruit on thumping pressure gives a flat dead sound, while an unripe fruit gives a metallic sound. When the fruit is ripe, the tendril nearest to fruit becomes dry.
- ◆ The yield ranges from 45 - 60 tonnes/ha and packed in uniform sized cardboard boxes with label.

## MUSKMELON

### i. Nursery preparation

- Nursery for muskmelon can be done either by polythene bags of 200 gauge, 10 cm diameter and 15 cm height size or through protrays under protected nursery.
- In poly bag nursery, the bags are filled with 1:1:1 ratio of red soil, sand and farmyard manure mixture and filled compactly.
- The seeds are treated with Carbendazim 2g / kg of seeds and sowing can be done by one seed per bag.
- 1000 - 1500g seeds are required to sow one hectare land depending upon the varieties / hybrids.
- In protrays, each having 98 holes is used for raising seedlings. Well-decomposed cocopeat is used as media. The sterilized cocopeat @ 250 - 300 kg/ha is mixed with 5 kg of neem cake along with *Azospirillum* and Phosphobacteria each @ 1 kg. Dibble the seed in each hole @ one per hole and keep the trays under shade net house for about 12 days. In the net house, water the seedlings twice a day using rose can. About 12 days old seedlings are transplanted in the main field.

### ii. Sowing or Planting system and population maintenance

- The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- FYM @ 25 t/ha is applied before the last ploughing.
- 75 % of the total recommended dose of super phosphate i.e. 469 kg/ha is applied as basal dose.
- *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100kg is applied before last ploughing.
- Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- Before planting, the beds are watered using drip system for 8 to 12 hours.

- Direct sowing or transplanting is done at a spacing of 1.5 m along the laterals and 30 cm interval in the raised bed single row system, using ropes marked at 30cm spacing.
- Gap filling is carried out within 7 days after sowing or transplanting.

### **iii. Fertigation Techniques**

- For muskmelon F<sub>1</sub> hybrid, a dose of 200:100:100 kg of NPK/ha is applied throughout the cropping period through split application. 75 % of the phosphorous is applied during last ploughing as a basal dose. The split dose is applied once in every three days through fertigation.



**Planted in raised beds**

### **iv. Inter cultivation**

- Irrigation: Drip irrigation is given for one hour per day.
- Weeding: A shallow hoeing is done 20 days after sowing and the plants are earthed up
- Two more hand weedings are done to encourage the growth.
- Cushion for fruits: Provide paddy straw or dried grass cushions for each fruit to avoid direct contact with soil. In addition to this close the fruits through the ownleaves to avoid sun scorching.
- During fruit maturation, 19-19-19 + MN 5g/litre of water followed by Potassium sulphate @ 5 g/litre of water is sprayed to encourage the fruit maturation.



**At flowering stage**

**v. Harvest**

- The fruits are harvested when they attain 2 kg fruit weight and good shape and size
- The cardboard boxes of 10 kg capacity are used for packing the fruits of 5-7 and labeling is done with full information like variety or hybrid name, name of the farmer, market address, harvest date, grade, weight of the fruit and boxes etc.



**Packing in cardboard boxes**

## ASHGOURD AND PUMPKIN

### **i. Quality seedling production**

- ◆ Seed Rate: 1 kg seeds will be required to sow pumpkin in one hectare.
- ◆ Seed treatment: The seeds are mixed with 500g of *Azospirillum*. The seeds are shade dried for half an hour. The seeds are treated with Thiram 2 g/kg of seeds or Carbendazim 2 g/kg of seeds.
- ◆ Nursery raising: In Hi-tech horticulture, the 12 days old healthy seedlings obtained from shade net houses are used for planting. The seedlings are raised in trays having 98 holes. Well decomposed cocopeat is used as media. Only one seed has to be sown per hole. Regular watering should be done twice in a day. About 12 days old seedlings are transplanted to the main field.

### **ii. Field preparation**

- ◆ The field selected for planting should be ploughed thoroughly by using chisel plough, disc plough and cultivator. FYM @ 25 t/ha and 75 % of total recommended dose of Single Super Phosphate (140 kg/ha) should be applied.
- ◆ Use of biofertilizers: *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.

### **iii. Fertigation**

- ◆ For Pumpkin, a dose of 60:30:30 kg NPK/ha is applied throughout the cropping period through split application. In phosphorous, 75% of the phosphorous is applied as super phosphate as basal dose.

### **iv. Inter cultivation**

- ◆ Weeding: Weeding and hoeing are done 2-3 times once in 15 days.
- ◆ Growth Regulators: Etherl is used to increase female flowers; the recommended



concentration is 250 ppm (2.5 ml etherel in 10 lt of water). The first spray has to be given when there are two true leaves (15 days after sowing). This is repeated once in a week for 3 more times.

#### **v. Harvest**

◆ Harvest starts from 85 – 90 days after sowing. Fully matured fruits have to be harvested after the skin colour has turned completely brown from green colour and the pedicel (Fruit stalk) separates from the vine. The yield varies from 20-30 t/ha.



**Fruits ready for harvest**



## **BITTER GOURD**

### **i. Quality seedling production**

Bitter gourd is a direct sown vegetable but polythene bag nursery is more advantageous to get early marketing and to avoid more gap fitting.

#### **Polythene bag nursery**

- ⇒ A 200 gauge poly bags of 10cm diameter x 10cm height is used for sowing the seeds
- ⇒ The seeds of 1.8 kg are required to cover one hectare and the seeds are mixed with 500g of *Azospirillum* and are shade dried for half an hour.
- ⇒ The seeds are treated with Thiram @ 2 g / kg of seeds to avoid any pathogenic attack
- ⇒ A potting mixture contains 1:1:1 ratio of topsoil, sand and well-decomposed farm yard manure is used as media and sowing is done by only one seed per hole. Then the poly bags are kept under shade net house or partial shade for about 15 days. Regular watering should be done twice in a day. About 15 days old seedlings are transplanted to the main field.

### **ii. Field Preparation**

- ⇒ The field selected for planting should be ploughed thoroughly by using chisel plough (once), disc plough (once) and cultivator four times.
- ⇒ FYM @ 25 t/ha and 75 % of total recommended dose of (470 kg/ha) Single Super Phosphate is broadcasted before last ploughing.
- ⇒ *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @100 kg is applied before last ploughing.
- ⇒ Form the raised beds of 4 feet width (120 cm) at rate of 1m heights is formed along the laterals.
- ⇒ Spread the lateral tubes in the centre of each bed. Irrigation is done in the beds by operating the drip system continuously for 8 - 12 hrs.

- ⇒ Spray pre emergent weedicide of Pendimethalin @1 kg a.i./ha just before planting.
- ⇒ Planting or sowing is done at the holes made at 2m distances.

### **iii. Fertigation**

- ⇒ For Bitter gourd, a dose of 200:100:100 kg NPK/ha is applied throughout the cropping period through split application.
- ⇒ Fertigation is done once in every third day from date of sowing or transplanting.

### **iv. Inter cultivation**

- ⇒ Staking: is necessary to layout a horizontal spreading surface by providing eucalyptus poles, casuarinas poles or bamboo stakes along with wire ropes so that the vine can be spread eventually.
- ⇒ A pandal or single line staking system is normally followed. The seedlings when starts producing tendrils should be staked with poles using banana fibre or threads so as to enable them to reach panda1.



**Under pandal system**

- ⇒ Weeding is carried out at 2-3 times depending upon the weed growth. The earthing up is done to form the beds by 2-foot width and 1 foot height so as to facilitate easy drainage and anchorage to the growing vine.
- ⇒ Growth Regulators spray of Ethereal 250 ppm (2.5 ml in 10 lit of water) is done four times from 15<sup>th</sup> day after sowing at weekly intervals.
- ⇒ Micronutrients spray is done @ 1 g per litre of water from 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> days after sowing.

#### **v. Harvest**

- ⇒ Harvesting is done from 45-50<sup>th</sup> day after transplanting or 60 - 65 days after sowing and harvest is done before the seeds are matured.
- ⇒ Harvesting is continued once in 5-7 days and a total number of 8-10 harvests can be made. Average yield of 10- 15 tonnes is recorded depending upon the varieties or hybrids.

## **BOTTLE GOURD**

### **i. Field preparation**

- The field selected for planting is free from clots and brought into fine tilth using chisel plough (once), disc plough (once) and cultivator (four times).
- FYM @ 25 t/ha, 75 % of total recommended dose of Single Super Phosphate (470 kg/ha), *Azospirillum* and Phosphobacteria each @ 2 kg/ha, *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.
- Four foot width broad beds at 1 foot height are formed along the laterals using broad bed former.

### **ii. Seed treatment**

- A quantity of 3 kg seeds is required to sow one hectare.
- The seeds are mixed with 500g of *Azospirillum* and the seeds are shade dried for half an hour.
- The seeds are treated with Thiram 2g/kg of seeds or Carbendazim 2g/kg of seeds.

### **iii. Nursery raising**

- In Hi-tech horticulture the bottle gourd is planted by its 15 days old healthy seedlings raised in shade net houses. The seedlings are raised in protrays having 98 holes or in polythene bags.
- Well-decomposed cocopeat is used as media. Dibble the seed in each hole @ one per hole and keep the trays under shadenet house for about 15 days. In polythene bags pot mixture is used as a growing medium. Regular watering should be done twice in a day. About 15 days old seedlings are transplanted to the main field.

### **iv. Planting or Direct sowing**

- The lateral tubes are spread in the centre of each bed and irrigate the beds by operating the drip system continuously for 8-12 hrs.

- Spray pre emergence weedicide (Pendimethalin @ 1kg a.i./ha just before planting). Planting the seedlings or sowing is done in the holes made at 60 cm distance.

#### **v. Fertigation**

- For Bottle gourd, a dose of 200:100:100 kg NPK/ha is applied throughout the cropping period through split application.
- Fertigation is done for every third day after transplanting or direct sowing.

#### **vi. Inter cultivation**

- Weeding and hoeing is done 2-3 times once in 15 days.
- Staking is done during rainy season to avoid rotting of fruits and is used to avoid direct contact of fruits with soil.

#### **vii. Harvest**

- Harvesting is made when the fruits attain sufficient size.
- It starts from 50<sup>th</sup> day after sowing to 120 days depending upon the varieties or hybrids.
- The average yield is 25-30 t/ha.



**Tender fruits**

## **RIBBED GOURD**

### **i. Field preparation**

- \* The field selected for planting should be ploughed thoroughly by using chisel plough (once), disc plough (once) and cultivator (four times).
- \* FYM @ 25 t/ha and 75 % of total recommended dose of single super phosphate (470 kg) is applied during last ploughing.
- \* *Azospirillum* and Phosphobacteria each @ 2 kg / ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- \* *Pseudomonas fluorescens* @ 2.5 kg/ha is applied during last ploughing.

### **ii. Sowing**

- \* A quantity of 1.5 - 2 kg of seeds is required to sow one hectare.
- \* The seeds are mixed with 500g of *Azospirillum* and are shade dried for half an hour. The seeds are treated with thiram 2g/kg of seed to protect from the diseases.
- \* The pits of the size 45 X 45 X 45 cm can be dug at spacing of 2m in row spaced at 1.5 m
- \* *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.
- \* Sowing: Five seeds are sown in each pit. After germination of seeds, 3 healthy seedlings are left and two seedlings are removed. Instead of direct sowing, the seeds can be sown in poly bags @ 1 seed / bag and 15 days after germination. They can be planted @ 2 seedlings per pit.

### **iii. Fertigation**

- \* For ribbed gourd, a dose of 250: 100: 100 kg NPK/ha is applied throughout the cropping period through fertigation tank.
- \* The fertilizers are applied once in three days.



#### **iv. Inter cultivation**

- \* Irrigation: is done 1 - 2 hours per day through drips depending upon the climate and soil condition.
- \* Staking: is necessary to layout a horizontal spreading surface by providing bamboo stakes or cross wire so that the vine can be spread. The seedling when start-producing tendrils should be staked with thin bamboo poles using banana fibre so as to enable them to reach pandal.
- \* Weeding and hoeing are done 2-3 times once in 15 days.
- \* Ethrel @ 250 ppm (2.5 ml in 10 litres of water) is sprayed when the seedlings are in two true leaf stage. This is repeated once in a week continuously for 3 times.

#### **v. Harvest**

- \* Harvesting of ribbed gourd is carried out from 55 - 60 days after sowing and is continued once in 5-7 days and a total of 8.10 harvests are done.
- Grading is done by separating the disease affected and misshaped fruits. The fruits are packed in the crates and transported to the market.



**Harvested gourds**

## GHERKIN

### i. Field preparation

- ⊗ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ⊗ FYM @ 25 t/ha is applied before the last ploughing.
- ⊗ 75 % of the total recommended dose of super phosphate i.e. 350 kg/ha is applied as basal dose.
- ⊗ *Azospirillum* and Phosphobacteria each @ 2 kg/ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- ⊗ Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.

### ii. Sowing

- ⊗ The field is completely wetted through drip irrigation for 8-12 hours depending upon the soil condition.
- ⊗ Sowing is done at a spacing of 22.5 cm distance at the centre of the beds along the laterals.

### iii. Fertigation

- ⊗ The recommended dose of fertilizers in gherkin is 150:75:100 kg of NPK/ ha and is applied every third day after sowing starting from 3<sup>rd</sup> day.
- ⊗ 75% of the phosphorous fertilizer is applied as a straight fertilizer during last ploughing.

### iv. Intercultivation

- ⊗ Irrigation is done through drips @ 1 - 2 hours a day depending upon the soil moisture level.
- ⊗ Weeding is done on 15<sup>th</sup> days after sowing followed by 30<sup>th</sup> and again at 45<sup>th</sup> days after sowing.

- ☼ Staking is done through bamboo or eucalyptus or casuarinas or areca poles and tied the vines through thick jute threads.
- ☼ During summer, picking is done during early morning or late evening to avoid sun scorching



**Staking with casuarinas poles**

#### **v. Harvest**

- ☼ First harvest is done between 30<sup>th</sup> and 35<sup>th</sup> days after sowing.
- ☼ Harvesting is done every day since, the grading is very important and price is fixed only by the grade of the fruit.
- ☼ The smallest sized fruit fetches the highest price while the biggest one gets lowest price.
- ☼ Harvested fruits are collected under shade on a clean surface or plastic sheet.
- ☼ The fruits are cleaned by separation of fruit stalk and flower heads.
- ☼ The fruits are sending immediately after harvest to the processing unit to avoid the poor quality fruits.

Grade code	Grade (No. of fruits/kg)	All fruits between	
		Biggest fruit	Smallest fruit
1	250+	4.0 g	-
2	150 / 250	6.6 g	4.0 g
3	120 / 150	8.3 g	6.6 g
4	80 / 120	12.5 g	8.3 g

## SNAKE GOURD

- i. Seed Rate:** A quantity of 1.5 - 2 kg seeds is required to sow one hectare.
- ii. Seed treatment:** The seeds are mixed with 500g of *Azospirillum*. The seeds are shade dried for half an hour. The seeds are treated with Thiram 2g/kg of seeds.
- iii. Nursery raising:** The snake gourd seeds are sown in protrays containing well decomposed cocopeat medium. Only one seed has to be sown per hole. Then the trays kept under shade house. Regular watering should be done with the help of rose can. About 12 days old seedlings are transplanted to main field.
- iv. Field preparation:** The field selected for planting should be ploughed thoroughly by using chisel plough, disc plough and cultivator. FYM @ 25 t/ha and 75 % of total recommended Single Super Phosphate (470 kg/ha) should be applied.
- v. Use of biofertilizers:** *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.
- vi. Planting:** The lateral tubes spread on the raised beds with a size of 4 ft wide at 5 ft distance. Then irrigate the beds by operating the drip system continuously for 8-12 hrs. Plant the seedlings in the holes made at 60 cm distance.
- vii. Fertigation:** For snake gourd a dose of 75:100:100 kg NPK/ha is applied throughout the cropping period through split application.
- viii. Inter cultivation:**  
**Staking:** It is necessary to lay out a horizontal spreading surface by providing bamboo stakes and cross wire so that the vine can be spread evenly. The seedlings when starts producing tendrils should be staked with bamboo poles and banana fibre so as to enable them to reach pandal.

**Weeding:** Weeding and hoeing should be done 2-3 times. When the vines covered the full pandal weed growth is arrested and not necessary for weeding.

**Growth Regulators:** Spray Etherel 100 ppm (1 ml in 10 lit of water) four times from 10 to 15 days after sowing at weekly intervals.

**ix. Harvest:** Snake Gourd comes to harvest from 60-75 days and it can be continued once in 5 - 7 days and a total number of 8 - 10 harvest can be made. Grading is done by separating the pest and disease affected fruits and misshapen fruits. The fruits are packed in the crates and transported to the market.

## CUCUMBER

### i. Field preparation

- ☆ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ☆ FYM @ 25 t /ha is applied before the last ploughing.
- ☆ 75 % of the total recommended dose of super phosphate i.e. 350 kg/ha is applied as basal dose.
- ☆ *Azospirillum* and Phosphobacteria each @ 1 kg/ha along with FYM 50 kg and Neem cake @100 kg is applied before last ploughing.
- ☆ Raised beds of 120 cm width (4 feet) are formed at an interval of 30cm (1 feet) and the laterals are placed at the centre of each bed.

### ii. Sowing

- ☆ About 2 kg of seeds would be required to sow 1 hectare.
- ☆ **Seed treatment:** The seeds are mixed with 500 g of *Azospirillum* and are shade dried for half an hour. Before sowing, the seeds have to be treated with 4 g of Thiram.
- ☆ The beds are wetted through drip irrigation for 8 - 12 hours depending upon the moisture level in the soil.
- ☆ The seeds are sown at the interval of 60 cm distance at the centre of the bed along the laterals.
- ☆ The seeds are sown in polybags @ one seed per bag to be used for gap filling at the day of germination.
- ☆ Pre emergence weedicide spray of Fluchloralin 1 kg a.i. or Metalachlor 0.75 kg a.i./ha on third day of sowing.

### iii. Fertigation

- ☆ For cucumber F<sub>1</sub> hybrid, 150:75:75 kg NPK/ha is applied throughout the cropping period. In this ratio, 75% of the phosphorous is applied as a basal dose.
- ☆ The fertilizers are applied once in every third days.



#### **iv. Intercultivation**

- ☆ Weeding: and hoeing is done twice or thrice at fortnightly intervals depending on the weed growth. Earth up is done after weeding at 30<sup>th</sup> and 45<sup>th</sup> days of sowing.
- ☆ Etherel @ 2.5 ml/10 litres of water for 4 times at weekly interval from 15<sup>th</sup> day after sowing can be done to increase female flower production.

#### **v. Harvest**

- ☆ Harvesting can be done from 45 days after sowing.
- ☆ The tender fruits are harvested on 8<sup>th</sup> - 10<sup>th</sup> day after flowering and it can be done once in 5 - 7 days.
- ☆ About 8 - 10 harvests can be made and the yield of tender fruits is 8-10 tonnes/ha from 80 - 90 days.



**Harvesting of tender fruits**



**For sorting and grading**

## FRENCH BEANS

### i. Field preparation

- ☞ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ☞ FYM @ 25 t/ha is applied before the last ploughing.
- ☞ 75 % of the total recommended dose of super phosphate i.e. 633 kg/ha is applied as basal dose.
- ☞ Rhizobium and phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.
- ☞ Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.

### ii. Sowing

- ☞ The beds are wetted through drip irrigation for 8-12 hours depending upon the soil moisture level.
- ☞ Pre-sowing application of Basalin @ 2 lit/ha is done to avoid the weed problem for 20 -25 days.
- ☞ In bush types, the seeds are sown in the paired row raised bed system at the 30 x 30 x 15 cm in the hills while in plains the seeds are sown in 30 x 30 x 45 cm
- ☞ In pole types, the seeds are sown in the paired row raised bed system at the spacing of 120 x 30 x 20 cm.
- ☞ For bush types a quantity of 85 kg of seeds are required to sow one hectare while in pole types 30 - 40 kg of seeds are required.
- ☞ The seeds are treated with *Rhizobium* culture using jaggery or rice kanji as an adhesive to form a coating of the bacterial culture on the seed surface.

### iii. Fertigation

- ☞ For French beans 135:135:135 kg NPK/ha is applied throughout the crop period. 75% of the phosphorous is applied in the form of straight fertilizer as a basal dose.
- ☞ The fertigation is done once in every third days.

#### iv. Intercultivation

- ☞ **Irrigation:** is given @ hour per day through drip irrigation.
- ☞ **Weeding** is done at 30<sup>th</sup> day after sowing and again at 45<sup>th</sup> and 60<sup>th</sup> day depending upon the weed growth. Immediately after every weeding earth up is done.
- ☞ **Staking** is done at 20<sup>th</sup> day of sowing. Each row of planting is staked separately with poles.

#### v. Harvest

- ☞ The green pods are harvested when they are tender and fleshy before the formation of fibre.
- ☞ For dry beans, the fully matured seeds are harvested by removing the entire plant and threshing the pods after drying.
- ☞ The yield of tender pods per hectare is 9 - 10 tonnes in bush type and 12 - 15 tonnes in pole types.
- ☞ The grain yield varies from 1.5 - 2.0 tonnes per hectare.



**Pole beans**



**Bush beans**

# BEETROOT

## **i. Field preparation**

- The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- FYM @ 25 t/ha is applied before the last ploughing.
- 75 % of the total recommended dose of super phosphate i.e. 810 kg/ha is applied as basal dose.
- *Rhizobium* and phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.
- Raised beds of 120 cm width (4 feet) are formed at an interval of 30cm (1feet) and the laterals are placed at the centre of each bed.

## **ii. Sowing**

- Sowing is done in paired rows at the spacing of 30 x 30 x 10 cm as four rows in each paired row in raised bed system.
- The seeds of 6 kg are required to sow in one hectare.
- Immediately after sowing the beds are completely wetted through drip irrigation for 8 - 12 hours depending upon the soil condition.

## **iii. Fertigation**

- A dose of 120:160:100 kg/ha is applied through fertigation.
- 75% of the dose of phosphorous is applied as straight fertilizer (single super phosphate) as basal dose.

## **iv. Inter cultivation**

- Irrigation is done through drip system for 1 - 2 hours depending upon the soil moisture level.
- Weeding and hoeing is done at early stage of the crop at 15<sup>th</sup> days after sowing and then earth up to cover the swollen roots.

- Thinning is done twice to maintain the plants at desired spacing. And filling is done to maintain optimum plant population.

#### **v. Harvest**

- Harvesting is done from 70 to 120 days depending upon the varieties.
- Harvesting is done by uprooting the entire plants and the tops are removed after washing.
- The yield of roots is about 25 - 30 t/ha.



**Beetroot**

# RADISH

## **i. Field preparation**

- ❖ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ❖ FYM @ 25 t/ha is applied before the last ploughing.
- ❖ 75% of the total recommended dose of super phosphate i.e. 500 kg/ha is applied as basal dose.
- ❖ *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is applied before last ploughing.
- ❖ Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.

## **ii. Sowing**

- ❖ Sowing is done in raised beds at the spacing of 30 x 15 x 10 cm in paired row system. A total of 10 rows is accommodated in one bed.
- ❖ About 10 kg of seed is required to sow one hectare.
- ❖ After sowing the seeds, the beds are completely wetted through drip system for 8 -12 hours depending upon the soil moisture condition.

## **iii. Fertigation**

- ❖ In radish a dose of 50:100:50 kg of NPK/ha is applied through fertigation.
- ❖ The application is done once in every third day from date of sowing in between the fertigation time.

## **iv. Intercultivation**

- ❖ Weeding is done by hoeing at early stage i.e. 15<sup>th</sup> days after sowing of the crop and earth upto cover the developing roots.
- ❖ Removing the excess plants and fill the gaps if any to maintain optimum plant populations does thinning.



**v. Harvest**

- ❖ The roots will attain the harvestable maturity in about 7 weeks after sowing.
- ❖ The entire plant is uprooted, the tops are removed and after washing, the roots are graded according to the size and marketed.

## TAPIOCA

### i. Preparation of planting material

- ❖ The setts are prepared from the middle portion of fully matured plants free from cassava mosaic disease.
- ❖ Each sett should have 8 - 10 nodes and 15 cm long.
- ❖ While cutting the setts there should not be any mechanical damage and the cut end should be uniform.
- ❖ The setts are dipped in Carbendazim 1g in one lit of water for 15 minutes before planting. About 20,000 setts are required for one hectare.
- ❖ The basal ends of the setts is dipped in a solution of *Azospirillum* culture and Phosphobacteria culture each @ 30 g per lit of water for 20 minutes.
- ❖ For rainfed conditions, the setts are treated with a mixture of Potassium chloride @ 5 g per lit and micronutrients viz., ZnSO<sub>4</sub> and FeSO<sub>4</sub> each @ 0.5 % for 20 minutes.

### ii. Field preparation

- ❖ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ❖ FYM @ 25 t/ha is applied before the last ploughing along with 75 % recommended dose of super phosphate @ 422 kg/ha.
- ❖ *Pseudomonas fluorescens* @ 2.5 kg/ha is applied before the last ploughing.
- ❖ *Azospirillum* and Phosphobacteria each @ 2.5 kg/ha along with 50 kg of farmyard manure and 100 kg of neem cake is broadcasted before last ploughing.
- ❖ The field is irrigated at field capacity level @ 8 - 12 hours depending upon the soil and climatic condition
- ❖ Pre emergent weedicide of Pendimethalin @ 1 kg a.i./ha is applied just before planting
- ❖ Planting is done in each raised bed in the paired row system at spacing of 60 cm (between rows) x 90 cm (between setts in each row) in the alternate method. The gap filling is done within 20 days of planting.

### iii. Fertigation

- ❖ For tapioca, a dose of 90:90:240/ha is applied through out the cropping period as split application. Irrigate the field through drip system daily for one hour.

### iv. Inter Cultivation

- ❖ Weeding: First weeding is carried out at 30 DAP. Subsequent weeding should be done at regular interval depending upon the weed growth.
- ❖ Thinning is done by leaving two shoots per plant at 60 DAP.
- ❖ Micronutrient spray of 1 %  $\text{FeSO}_4$  + 0.5 %  $\text{ZnSO}_4$  at 60 and 90 DAP is applied.

### v. Harvest

- ❖ Yellowing of leaves, dropping of 50% of leaves, cracking of soil around base of the plant are the maturity indices. Irrigation is done on the previous day of harvest and dug out the tubers without any damage. The stems are stored under the shade and used as a planting material.



**Tapioca**

# POTATO

## **i. Seed tuber selection and tuber treatment**

- Potatoes are normally grown from tubers. Seed tubers from disease free field or locality are collected.
- A tuber with at least one eye viz., adventitious bud, or small whole tuber is used as planting materials.
- After cutting the seed tuber is cured by storing 10°C to 15°C and 85 -95 % relative humidity for 4 -6 days to allow the suberization and wound periderm formation, which avoids the entry of bacteria from soil.
- The seed tubers are treated with 25 ppm GA<sub>3</sub> for one hour and dried in the shade. After drying, the tubers are filled in gunny bags and kept in vertical position in well-ventilated dark room for 10 days so as to encourage sprouting.
- Before planting the tubers are dipped in stable bleaching powder solution.

## **ii. Planting system and population maintenance**

- The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- FYM @ 25 t/ha is applied before the last ploughing.
- 75% of the total recommended dose of super phosphate i.e. 1171.88 kg/ha is applied as basal dose.
- *Azospirillum* and Phosphobacteria each @ 2 kg/ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- The beds are wetted with drip irrigation for 8 - 12 hours depending upon the soil condition.
- About 1500 to 2000 kg of seed tuber is required for one hectare.
- The seed tubers are planted at a spacing of 60 x 30 x 20 cm in a paired row raised bed-planting system.
- Gap filling is done within a week.

### **iii. Fertigation techniques**

- For potato, 120: 240: 120 kg NPK/ha is applied throughout the cropping period in every once in three days interval.
- 75% of the phosphorous in the recommendation is applied as super phosphate as a basal dose.

### **iv. Intercultivation**

- A pre- emergence weedicide such as Linuran @ 0.5 kg/ha in 900 litres of water, or Nifen 2 l/ha in 900 litres of water is sprayed just after planting and immediately the field is irrigated.
- Twenty to twenty-five days after planting, the stolens arise from the lower nodes.
- These stolens bend downwards and enter into the soil and at their tips tuberisation starts 35 days after planting.
- This is the stage when the plants are to be earthed up. Immediately after earthing up, the field has to be irrigated. The earthing prevents greening effect of sunrays on exposed tuber which actually affects market quality of tubers.
- It also prevents frost damage to tubers. The second earthing up is given 30 days after first earthing up.
- Drip irrigation is given just after planting to keep optimum soil moisture. Further drip irrigation is given everyday @ 1 hour per day depending upon the soil type and climate.



**Crop at vegetative stage**

#### **v. Harvesting and post harvest management**

- Irrigation is withheld 15 - 20 days ahead of the normal harvest date and haulms are removed. It facilitates prolonged storage life through skin hardening of tubers.
- Tubers are dug out 20 days after the haulms removal and heaped under shade.
- Then the tubers are sorted out by removal of cut, bruised and pest and disease attacked tubers.
- The tubers are graded according to size such as big, medium, small and miniature sized.



**Crop at tuber development stage**



# TURMERIC

## **i. Field preparation**

- \* The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- \* FYM @ 25 t/ha is applied before the last ploughing.
- \* 75% of the total recommended dose of super phosphate i.e. 281 kg/ha is applied as basal dose.
- \* *Azospirillum* and Phosphobacteria each @ 2 kg/ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- \* Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- \* The beds are wetted for 8 - 12 hours through drip irrigation depending upon the soil moisture level.

## **ii. Rhizome treatment and planting**

- \* Mother rhizome of about 2000 kg of rhizomes is required for 1 ha
- \* The rhizomes are treated with 10 kg each of *Azospirillum* and Phosphobacteria.
- \* The rhizomes are treated with Carbendazim for 30 min before planting.
- \* The treated rhizomes are planted in the raised beds in three rows spaced at 45 cm. The spacing between plants within the row is 15 cm.

## **iii. Fertigation**

- \* Fertigation is done for the recommended dose of 150:60:108/ha of NPK and is applied through out the cropping period at once in three days.
- \* 75% of the recommended dose of phosphorous (281 kg/ha) is applied as basal dose.

## **iv. Intercultivation**

- \* Weeding is done at 30 days after planting and then whenever necessary.
- \* The raised beds are earthed up twice on 60<sup>th</sup> and 120<sup>th</sup> DAP.

- \* Micronutrients of 375 g each  $\text{FeSO}_4$ ,  $\text{Zn SO}_4$ , borax and urea dissolved in 250 lit of water. Spraying is done twice at 60 and 90 DAP.



**Healthy crop**

#### **v. Harvesting**

- \* Lodging of plants, yellowing and drying of leaves are the signs of maturity.
- \* The rhizomes are pulled out without any damage and stored the seed rhizome in sand media under partial shade.



**Harvested rhizomes**

## CORIANDER

### i. Seed rate and treatment

- ◆ 10 kg of seeds is required to sow one hectare and the seeds are split into two before sowing.
- ◆ The seeds are treated with *Azospirillum* @ 1.5 kg/ha and shade dry for an hour
- ◆ Seed treatment with *Trichoderma viride* @ 4 g / kg of seed is done to control wilt disease.

### ii. Field preparation and sowing

- ◆ The main field is ploughed 4 times with Chisel and disc plough each one time and cultivator twice.
- ◆ FYM @ 25 t /ha is applied before the last ploughing.
- ◆ 75% of the total recommended dose of super phosphate i.e. 200 kg/ha is applied as basal dose.
- ◆ *Azospirillum* and Phosphobacteria each @ 2 kg/ ha along with FYM 50 kg and Neem cake @ 100 kg is applied before last ploughing.
- ◆ Raised beds of 120 cm width and 30 cm height are formed through broad bed former.
- ◆ Raised beds of 120 cm width (4 feet) are formed at an interval of 30 cm (1 feet) and the laterals are placed at the centre of each bed.
- ◆ Sowing is done in lines of 15 cm spacing in the raised beds. Hence 8 lines are formed in one single bed.
- ◆ The beds are wetted after sowing, through drip irrigation system for 8-12 hours depending upon the soil moisture level.
- ◆ The seeds are germinated 8-12 days after sowing.
- ◆ Immediately after the observation of gaps, gap filling is done to maintain the population.

### iii. Fertigation

- ◆ A dose of 60:40:60 kg of NPK/ha is applied through fertigation.

- ◆ 75% of the Phosphorous is applied as basal dose during last ploughing.
- ◆ Fertigation is done in once in three days.

#### **iv. Intercultivation**

- ◆ Weeding is done once on 20<sup>th</sup> day after sowing.
- ◆ Thinning is done on 30 days after sowing.

#### **v. Harvesting**

- ◆ First harvest of leaves is done on 20 – 25 days after sowing followed by 30<sup>th</sup> and 45<sup>th</sup> days after sowing.
- ◆ The plants are pulled from the soil adhering soil pesticides is cleaned with using water and packed in gunny bags.



**Coriander**



## BANANA

Banana grows well in well-drained loamy soils and the best season differs with varieties and places e.g. the best season of planting is,

Wet lands: Feb -April: Poovan, Rasthali, Monthan, Karpooravalli and Neypoovan

April - May: Nendran and November -December

Garden lands: January -February and November- December

Padugai lands: January - February and August - September.

Hill Banana: Lower palani hills - April- May

Sirumalai - June – August

### i. Selection of planting material

- ✓ The sword suckers of 1.5 - 2.0 kg weight are selected for planting.
- ✓ The suckers are selected only from the mother plots free from diseases, nematodes and other pests
- ✓ In tissue culture plants, of 45 days old, well hardened and virus indexed plants with 5 -6 leaves are selected.



**Tissue culture planting materials**

### ii. Sucker treatment

- ✓ The pseudo-stem is cut leaving 20 cm from the corm
- ✓ The roots and superficial damaged portion of the corm is trimmed.

- ✓ The corms are dipped for 5 min in carbendazim 0.1% (1g/lit) to avoid any diseases.
- ✓ Pralinage is done with 40 g of Carbofuran 3G granules per sucker (Dip the corm in slurry solution of 4 parts clay plus 5 parts water and sprinkle Carbofuran to control nematodes).
- ✓ Alternatively, the corms are dipped with 0.75% Monocrotophos and shade dried for at least 24 hrs and plant and then planting is done.

### **iii. Main field preparation and planting**

- ✓ Ploughing is done at four times using chisel plough (one time), disc plough (one time) and cultivator (three times).
- ✓ The raised beds are formed at 60 cm width along the lateral lines.
- ✓ The pits of 45 cm<sup>3</sup> size is dig out along the raised bed at 1.8 m intervals.
- ✓ The pits are filled with top soil mixed with 10 kg FYM, 250 g Neem cake, 20 g Furadon, and 220 g super phosphate.
- ✓ *Azospirillum* and Phosphobacteria each at 20 g per pit is applied during planting and at 5<sup>th</sup> month after planting.
- ✓ At the time of planting 25 g of *Pseudomonas fluorescense* is applied in each pit.
- ✓ Pre emergence weedicide of Fluchloralin @ 2 lit per ha is sprayed through high volume sprayer.
- ✓ Spacing and No. of Plants:  
Dwarf Cavendish, G9, Robusta - 5' x 7'; Others - 5' x 8'
- ✓ A total of nearly 3000 plants are accommodated in one hectare.
- ✓ Planting is done at the centre of the pit cover the pit with top soil and pressed gently.
- ✓ Sowing of Sun hemp on 45<sup>th</sup> day after planting and incorporated it after about a month. This operation reduces nematode build up.

### **iv. Fertigation**

For banana, a dose of 200:300 g of NK/plant is applied throughout the cropping period through split application and phosphorus alone is applied as basal dose at the time



of planting. The split doses of N & K are applied once in every three days through fertigation. Water requirement - 25 lit per plant (normal density); 40 lit per plant (2 suckers / pit); 50 lit per pit (3 suckers/pit).



**100 per cent crop stand**

#### **v. Intercultivation**

- ✓ Spade digging and earthing up of plants are done after applying 20 g of Furadan + ½ kg Pungam oil cake at 3 MAP.
- ✓ Spade digging followed by earthing up is done at 4, 6 and 8 months after planting.
- ✓ Desuckering and removal of diseased and dried leaves should be done for 6 times (based on sucker growth).
- ✓ Apply 20 g furadon at 4<sup>th</sup> month after planting.
- ✓ Spray zinc sulphate (0.5%), ferrous sulphate (0.2%), copper sulphate (0.2%) and borax (0.1%) at 3, 5 and 7<sup>th</sup> month after planting.
- ✓ Remove male bud - one week after opening of last hand.
- ✓ Propping - one month after shoot emergence.
- ✓ Intercropping: Inter crops like onion, leafy coriander, beetroot; tomato (variety only) can be grown. Inter cropping should be completed within 90 days of planting of banana. Nematode repelling species like Sun hemp or marigold can be grown and incorporated with soil at maximum vegetative stage.



### **Propping for support**

- ✓ Post shooting nutrient spray: Urea 1% and potassium sulphate 1.5% is sprayed after last hand opening and again sprayed at once after a month.
- ✓ Bunch cover: The fruit bunches are covered with ventilated (4%) polythene sleeves (200 x 150 cm), within 15 days of last hand opening.



### **Uniform bunch bearing**



## vi. Harvest

- ✓ The fruit bunches are harvested when the angularity of fruits disappears.
- ✓ Duration and bunch weight:

Cavendish	-	12 months	-	25 to 30 kg
Ney poovan	-	11 months	-	12 kg
Rasthali	-	13 months	-	12 kg
- ✓ For fruit ripening, the fruit bunches are sprayed with ethrel 5000 ppm (5ml/lit) with sodium hydroxide pellets.



**Harvested bunches**

## ROSE

Rose prefers fertile, well-drained sandy loam or clay loam soils with a pH of 6.0 - 7.5 and grown well in sunny, open and protected by hedge, fence or building against strong winds. It is quite away from shade or from the under ground roots of trees.

### **i. Planting material preparation**

- The common rootstock used in rose are *Rosa bourboriana*, *R. multiflora* and *R. indica odorata*.
- Roses are commonly propagated by 'T' or shield budding on the rootstock.
- The best time for budding is from November to February and after union of buds, budding starts growing. The upper portion of rootstock is cut into installments to separate the plants.
- High success can be obtained by treating the cuttings and with 1000 ppm of IBA so that in one year plants are ready for planting.

### **ii. Field preparation and Planting**

- The field selected for planting roses is ploughed thoroughly by using chisel plough, disc plough and cultivator.
- FYM @ 25 t/ha and 75 % of total recommended dose of single super phosphate is applied as basal dose. ,
- *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is mixed and applied before last ploughing.
- The raised beds are formed at the width of 4 feet to the height of 1 foot and the laterals are placed at the centre of the beds.
- Before planting, the beds are watered using drip system for 8 - 12 hours depending upon the soil moisture condition.
- Before planting weedicide spray of Glyphosate is applied @ 8 ml/l in the completely wetted moist soil by using high volume sprayer.
- Planting is done at a spacing of 90 X 60 X 45 cm in the paired row system.
- Gap filling is done at one month after planting.

### **iii. Fertigation technique**

- For rose a dose of 178: 178:356 kg of NPK/ha/year applied through out the year as split application through fertigation tank.

### **iv. Intercultivation**

- Pruning: It is the most important and technical aspect of rose growing. The best time of pruning is the period when the activity of rose plant is the least and plant is dormant to near dormant stage. Cut back the vigorous past season shoots to half the length. Remove all the weak, diseased, criss-cross and unproductive shoots. Protect the cut ends with Bordeaux mixture + carbaryl as a paste.
- Disbudding: Remove the side branches, which arise from auxillary buds to get blooms of better size.
- Feed the rose plants with 100g of neem cake and 100g of bone meal per plant during 3<sup>rd</sup> month after planting. Repeat the above feeding once in 3 months.
- Weeding is done on 30<sup>th</sup> and 60<sup>th</sup> day after planting depending upon the weed growth.

### **v. Harvesting and post harvest management**

- Flowers are harvested in the early morning at tight bud stage.
- 20 flowers per bunch packed in corrugated board sheet.
- Precooling is done for 4 hours at 6 -8°C.
- Storage at 2-5°C



**Roses at tight bud stage**



## CHRYSANTHEMUM

### i. Planting material preparation

- ❖ Planting season: February - March.
- ❖ Chrysanthemum is mostly propagated through terminal cuttings and root suckers.
- ❖ 10 – 15 bags of root suckers are required to plant 1 ha.
- ❖ Sucker treatment: The suckers are treated with 0.3% captan or 0.2% brassicol to avoid rotting.
- ❖ For easy rooting, root suckers are dipped in seradix 1 or 25 ppm NAA.

### ii. Field preparation and Planting

- ❖ The field is ploughed thoroughly by using chisel plough, disc plough and cultivator.
- ❖ FYM @ 25 t/ha and 75 % of total recommended dose of single super phosphate is applied as basal dose.
- ❖ *Azospirillum* and Phosphobacteria 2 kg/ha and *Pseudomonas* 2.5 kg/ha along with FYM 50 kg and neem cake @ 100 kg is mixed and applied before last ploughing.
- ❖ The raised beds are formed at the width of 4 feet to the height of 1 foot and the laterals are placed at the centre of the beds.
- ❖ Before planting, the beds are watered using drip system for 8 - 12 hours depending upon the soil moisture condition.
- ❖ Two root suckers with a length of 15 cm is planted in one hill at the interval of 30 cm and planting is done at two rows with in the bed with spacing of 90 x 60 x 30 cm in the paired row system.

### iii. Fertigation

Recommended dose of 125:120:25 kg NPK/ha was applied throughout the cropping period as per the fertigation schedule.

#### **iv. After care**

Weeding is done thrice depends upon the weed growth earthing up is done along with weeding.

#### **Pinching and disbudding**

- ❖ To encourage more number of branches, pinching is done.
- ❖ Disbudding is done to obtain the quality flowers

#### **v. Harvest**

Fully opened flowers are picked in late hours of the day when dew has dried up. Soon after harvest, flowers are packed in baskets.



**Chrysanthemum**

## MARIGOLD

### i. Nursery raising

Protray nursery is essential as the seeds of F<sub>1</sub> hybrids are more costly. In order to raise nursery for dwarf hybrids, a total number of 800 protrays are required. Treat the seeds with captan @ 3 g/kg of seeds. For dwarf hybrids 75,000 seeds are required/ha and for tall hybrids about 55,000 seeds are required. Fill the Protrays with coir compost @ 1.25 kg/tray. Sow the seeds @ a single seed per hole.

- Stake the protrays one above other for 3 days and cover with polythene sheet. Spread the trays on 4<sup>th</sup> day on the raised beds under the shade net house (50 % shade net on the roof of 50 mesh insect proof nylon net on four sides)
- Regularly water the seedlings twice in a day using a rose can.
- Drench the seedlings with 19: 19: 19 (5g/l) on 15<sup>th</sup> day (if needed) + COC (2g/l).
- Transplant the seedlings at 25<sup>th</sup> days after sowing.

### ii. Main field preparation

Plough the main field with cheisel plough, disc plough each one tie followed by cultivator twice. Apply FYM @ 25 t/ha and 75 % of recommended dose of super phosphate as basal dose. Apply *Azospirillum* and phosphobacteria each 2 kg/ha along with FYM 50 kg + neem cake 100 kg/ha. From the raised beds using bed former at a width of 2 feet and leave 1 feet for furrow spacing in between the beds.

### iii. Spacing and population

- ❖ For straw yellow hybrids - 3 rows per bed (45 X 30 cm) - 74,000 plants/ha
- ❖ For golden yellow orange - paired row system (60 X 30 cm) - 55,000 plants/ha
- ❖ For varieties - paired row system - (60 X 30 cm) - 55,000 plants/ha

#### **iv. Transplanting**

- ❖ First wetting is done by continuously pouching the drip system for 8-12 hrs.
- ❖ Spray pre emergence herbicide (Stomp) @ 3 l/ha just before planting.
- ❖ Transplant 25 days old seedlings at the above mentioned spray.
- ❖ Fill the gaps if any within a week

#### **v. Fertigation**

For African marigold, a dose of 90:90:75 kg NPK/ha is applied throughout the cropping period in split application.

#### **vi. Inter cultivation**

Weeding is done on 30<sup>th</sup> and 60<sup>th</sup> days after planting

#### **vii. Harvest**

Pick the flowers once in three days starting from 60 days after planting



**Dwarf hybrid**





**Harvest in plastic bags**

## **CHINA ASTER**

### **i. Soil and climate**

It comes well in well-drained loamy soil and cooler climate.

### **ii. Propagation**

- It is propagated through seeds.
- Seed rate: 2 -3 kg/ha

### **iii. Main field preparation**

- The main field is ploughed by using chisel and disc plough and cultivator.
- FYM @ 25 t/ha is applied before the last ploughing.
- 75 % of the total recommended dose of super phosphate is applied as basal dose (950kg)
- Raised beds of 120 cm width are formed at an interval of 30 cm and the 4 laterals are placed at the centre of each bed.

### **iv. Seed sowing**

- The seeds are sown directly on the raised beds.
- From the lines of 2 cm depth by using small sticks at 15 cm distances along the length of the bed (7 lines per bed).
- Sow the seed in the lines and gently close the lines by sand and cow dung mixture.

### **v. Population**

- Every bed would consist 7 rows of aster at the spacing of 15 cm.
- The excess plants are thinned out so that the spacing between the plants within a row is 15 cm.



#### **vi. Fertigation**

- For aster, a dose of 100:200:200 kg NPK/ha is applied through the cropping period in split application as per the schedule given in annexure.
- Irrigate the field every day for one hour through drip system.

#### **vii. Intercultivation**

- Weeding is done on 30th and 60th day after planting.
- Pinching of main shoot at one month after planting for enhancing side shoots.
- At flowering stage increase the duration of irrigation for enhancing uniform opening of flowers (for 1-5 hrs every day as against one hour for early phases of crop growth).

#### **viii. Harvesting and post harvest management**

- For cut flowers, the flowers are harvested along with the main stem.
- For loose flowers, individual flowers are harvested with stalk.
- $\text{Al}_2(\text{SO}_4)$  at 0.2 % + sucrose 0.2 % increases the vase life upto 8 days.



**Aster at blooming stage**

## **GOLDEN ROD**

### **i. Propagation method**

- It is propagated through suckers.

### **ii. Sucker treatment**

- To avoid rotting the sucker are treated with 0.3 % Captan or 0.2 % Brasicol.
- For early rooting, root suckers are dipped in saradix-1 powder or 25 ppm of NAA.

### **iii. Planting**

- Two root suckers with a length of 10-15 cm is planted in one hill.
- The suckers are planted directly on the raised beds at 15 cm between the rows. In a single bed, 7 rows of plants are maintained.
- Plant to plant spacing is 15 cm.
- Two months after planting the crop would cover the entire land.



**Field full of golden rod**



#### **iv. Fertigation**

- For golden rod a dose of 150:175:150 kg NPK/ha is applied through the cropping period in split application.
- Irrigate the field every day for one hour through drip irrigation.

#### **v. Inter cultivation**

- Weeding is done on 15<sup>th</sup> and 45<sup>th</sup> day after planting.
- Application of GA<sub>3</sub> 25 ppm once in 15 days interval for 3 times after 30 day after planting for enhancing the flowering and increase the length of flower stalk

#### **vi. Harvesting**

1<sup>st</sup> harvest is made after 120<sup>th</sup> day after planting and continued at weekly intervals on whenever it is required. This practice is repeated for 2 years.



**Bunch for sale**