

## **PINNEAPPLE**

(*Ananas comosus* L. Merr.)

### **Time of planting :**

April to October. However, it can be planted in winter with irrigation.

### **Planting and Population :**

Planting is done in two-row beds. In each bed plant at 60 cm from row to row and at 30 cm from plant to plant. Distance between row of two adjacent beds should be 90 cm. This will accommodate about 44,000 plants/ha.

### **Plant Protection :**

Leaf spot : This can be controlled by spraying Mancozeb 75 WP (2g/lit).

## **BANANA**

(*Musa* spp. Colla)

### **Planting :**

Planting is generally done in pits. Double planting (2 plants/pit) with a spacing of 1.8 m x 1.8 m for Jahaji gives higher yield.

**Size of Pit** : 45 cm x 45 cm x 45 cm.

Spacing : Dwarf cultivars : 1.8 x 1.8 m

Dwarf cultivars : 1.4 x 1.4 m

(Without ratooning is practised)

Medium tall cvs. : 2.1m x 2.1m

Tall cvs. : 2.4 m x 2.4m

High density planting :

Jahaji : 1.0m x 1.2m x 2m (6250 plants/ha)

Bar Jahaji : 1.2m x 1.8m (4629 plants/ha)

Malbhog : 1m x 1.2m x 2m (6250 plants/ha)

**Time of Sowing** : March – May

**Weeding** : Remove weeds as and when required. Diuron @ 3 kg/ha or Gramaxone @ 1.5 kg/ha should be applied to check weed growth.

Grow one crop of cowpea and incorporation in soil followed by hand weeding at 30 days interval upto shoot stage.

**Bunch Covering** : White polyethylene bunch covering is suitable measure to overcome

### **Plant Protection :**

1. Corm borer and Nematodes : Healthy corms free from nematodes should be selected as planting materials. In case of infected suckers, the infected portions should be scraped out with a sharp knife. In such corms, carbofuran (furadon) granules should be applied @ 40 g per corm after dipping in mud slurry.

2. Pseudostem borer : Spray 0.1% Malathion 50 EC. Apply Carbofuran 3 g granules in soil @ 10 g per stool.

3. Fruit scaring beetle : Spray 0.1% Malathion 50 EC on the bunches immediately after emergence or application of 0.05% Monocrotophos @ 30ml/plant. Bagging of bunch with muster cloth or blue polyethylene before fruit set and remove after 60 days of fruit setting.

4. Bunchy Top : To check the spread of the disease, the aphid vector should be controlled by spraying Rogor or Dimecron @ 1 ml/lit. (3 lit/25 plants) Uproot and burry the infected plants.
5. Panama disease or Banana wilt: Soil drenching with 1.0% Bordeaux mixture or 0.05% Bavistin is effective.
6. Sigatoka leaf spot : Spraying of Carbendazim at first appearance followed by 4 sprays at 30 days interval.

**ASSAM LEMON**  
(*Citrus limon* L. Burmf)

**Planting :**

Before monsoon, pits of 0.5m x 0.5m size with a spacing of 3m x 3m are prepared and refilled with soil-manure mixture (1:1) and then allowed to settle. The time of planting is May to August.

**Orchard Management :**

Weeding should be done frequently at monthly intervals. Paddy straw or black polyethylene can also be used as mulch for controlling weeds.

To produce off-season crops, 15cm pruning after the harvest of main crop with a single spray of cycocel at 3000 ppm is recommended. Three irrigations at 15 days interval @ 15 lit/plant combined with black polythene (50 micron) mulching 1<sup>st</sup> week of November is effective in producing off-season crop (1<sup>st</sup> week of March).

**KHASI MANDARIN**  
(*Citrus reticulata* Blanco)

**Planting :**

Before monsoon, pits of 0.75m x 0.75m size with a spacing of 5m x 5m are prepared and then refilled with soil-manure mixture (1 : 1) and then allowed to settle.

The time of planting is May to August.

The plant is set at the centre of the pit and the soil around is compacted. Mulching with dry leaves should be done. Plants should be irrigated regularly at fortnightly intervals during dry periods.

**Orchard Management :**

Weeding should be done from the month of April, first by hoeing followed by spray of Glyphosate a.i. @ 1 kg/ha after 60 days followed by another hand weeding after 60 days of chemical spraying.

**Plant Protection for Citrus :**

(1) Trunk borer : It is a very damaging insect pest of mandarin orange in Assam. The grub bores hole into the tree trunk near the base and makes tunnel through the pith upward and the plant eventually dies. Prophylactic smearing of Sevin or Monocrotophos or Quinolophos with lime and water (1:1:25) should be applied upto one metre from the base of the tree during March/April which prevents the adult from laying egg. Once the hole is made, it should be spiked with wire to kill the grub and then the hole should be cleaned and plastered with wet soil. Alternatively to kill the insect the hole should be plugged with cotton/cloths soaked in insecticides like Nuvan (0.07%) or Dimecron (0.05%) and then plastered with mud to have an airtight condition. Proper pruning and training are also essential to minimize the infestation.

(2) Shoot borer : The shoot borer damages mostly young and new shoot of the plant. The grubs bore into the tip of the new shoot and make tunnels through the pith of the branch from top to bottom and the shoot dies due to infestation. The insect starts damaging from March to October. The insect can be controlled by pruning and burning the infested branches. Then smear Bordeaux paste with Nuvan in the cut portion. The insect can also be controlled by giving regular spraying with Monocrotophos (0.04%) or Phosphomidon (0.03%) starting from March to October at an interval of 20 days.

(3) Bark eating caterpillar : The insect damages the bark of the plant and as a result the flow of nutrients is stopped and ultimately the plant dies. It is a serious pest in neglected and old orchards. Removal of webbing followed by painting or spraying with monocrotophos 0.04% on the infested portion of the bark can control the insect.

(4) Leaf miner : The larvae usually mine the undersides of new leaves making serpentine mines which are silver coloured because of entrapped air. Due to mining the leaves become distorted, curled and defoliation occurs during severe attack and the plant becomes stunted in growth. Two sprays with Monocrotophos (0.4%) or Phosphomidon (0.03%) during flushes have been found effective in controlling the insect. First spray should be given during initiation of new flush and the second after 20 days of the first spray.

(5) Lemon butterfly : The caterpillars feed on the leaves and defoliate the branches. Hand picking of larvae, with spraying with Sevin (0.1%) may be helpful in controlling the insect.

(6) Fruit sucking moth : The insect sucks the juice of the fruit and the fruits drop within few days. Destruction and disposal of fallen fruits and baiting with Malathion 50 EC (0.1%) with molasses (1%) and fruit juice help in controlling this insect.

(7) Scales, mealy bugs, aphids and psylla : These are sap sucking insects, Scales are brown tiny insects and are immobile. While sucking plant sap mealy bugs secrete honey dews on which sooty mould develops. Mealy bugs also cause fruit drop. The aphids infest the lower surface of the tender leaves, shoots and young fruits due to which the infested twigs are curled and the plant becomes sickly. The nymphs psylla suck the cell sap from tender shoot, leaves and flowers causing curling, defoliation and drying of twigs.

To control these insects spray Monocrotophos (0.025%) or Phosphomidon (0.035%) or Malathion (0.1%). Repeat the treatment and when necessary.

(8) Gummosis or phytophthora foot rot : Phytophthora disease produces symptoms of declining health of citrus trees causing rotting of rootlets, girdling of the tree trunk and defoliation. The first symptoms are dark staining of the bark followed by olive brown in colour with a water soaked appearance. In advanced stage, the bark cracks, strips off lengthwise as in dries and gum starts exuding particularly in the late spring resulting into yellowing and die back. At the early stage, the affected portion should be scraped with a little extra healthy tissue without injuring the wood and then smear Bordeaux paste or Bordeaux paint (1:2 linseed oil).

(9) Wither tip : Wither tip or dry-up twigs from top to the bottom is a serious problem in citrus. Pruning followed by spraying of 1% Bordeaux mixture after harvest of the fruit control this disease. Twig blight or wither tip or dry-up twigs can be effectively managed by pruning in the month of January/February followed by two sprays with Coper Oxy Chloride (COC) @ 3g/litre at 30 days interval or Pruning followed by one spray with COC @ 3g/litre + one spray after 30 days with Carbendazim @ 1g/litre.

(10) Scab : The scab lesions appear as minute water soaked round spots which enlarge slightly, turn brownish and then corky on fruit, leave and young twigs. Removal of infected leaves, twigs, fruit and spraying of Bordeaux mixture (1%) or Copper oxychloride 50WP (0.3%) or Mancozeb 75WP (2g/l) have been found effective in controlling the disease.

(11) Canker : It is a bacterial disease. The canker lesions appear as minute water soaked round spots, enlarge slightly, turn brownish, corky which can be controlled by 1% Bordeaux mixture or Streptocyclin 100 ppm + Copper Oxychloride 0.3% spraying during new flushes.

(12) Greening : The infected plant shows chlorosis of leaves, thickening of leaf blade, shortening of twigs internodes, off-season blooming, leaf shedding and die-back. To control this disease, insect vector psylla should be first controlled (see psylla control).

#### **Other Maladies :**

1. Zine deficiency : Zine deficiency is considered as the most wide spread and damaging micronutrient deficiency of citrus. Deficiency symoptom develops only in the new growth. The leaves are small sized, chlorotic crowed on shoot stems giving a bunched appearance, mottling, twig die-back and ultimately the tree starts declining. It can be controlled effectively by foliar spray of 0.4 to 0.6% Zinc sulphate during new flushes.

2. Moss: Remove the mosses mechanically by rubbing with gunny bag.

3. Loranthus : The group of parasitic plants should not be allowed to developed on branches. It should be controlled by efficient purning.

4. Fruit drop. Spray 10 ppm Planofix (1 ml in 4.5 lit water) or 2,4-D @ 25g/100 lit of water immediately after flowering and again after one month.

Suggestions for Improvement of Citrus-Decline

- 1) Proper drainage should be provided to drain out the excess water from the root-zone.
- 2) For vegetative propogation the mother plants should be ascertained of their freeness from virus and mycoplasma diseases.
- 3) It is advisable to establish new orchard with budded plants on resistant root stocks.
- 4) Regular manuring of both non-bearing and bearing tress is essential.
- 5) Foliar feeding of micronutrients is essential as a regular practice.
- 6) Cultural practices like regular weeding, intercropping with only short duration, shallow rooted legume crops upto pre-bearing stage are suggested.
- 7) Pruning of dead and dried twigs, removal of plant parasites like loranthus etc. are desirable practices.
- 8) Soil working near root zone should confine only upto 10cm soil depth.
- 9) Applicatiion of Bordeaux paste may be practiced regularly to a height of about 50cm of the trunk from the ground level.
- 10) Pest and disease control measures should be followed strictly.

### **COCONUT**

*(Cosos nucifera L)*

#### **Time of Planting :**

March-April under high land condition.

September-October under low land condition.

**Weeding** : Light ploughing or harrowing twice a year in February-March and September-October.

**Plant Protection :**

White Ant : Apply 5% malathion powder @ 200 g per 7.5 sq. m. in nursery and 100 g per pit during planting.

Rhinoceros beetle : Apply 5% Malathion dust mixed with equal quantity of sand at the axil of leaves of the crown.

Red palm weevil and Mealy bug : Spray Endosulfan 35 EC @ 1 m/lit.

Teratheba and Betrachedra SPP : Clean the palm twice a year before and after monsoon and spray Rogor 30 EC 1 ml/lit.

Crown rot : Apply 25 g Borax in a trench of 15 cm width and 10cm depth at a distance of 1 to 1.75m away from the trunk. In acute cases repeat the application after three months of first application.

Stem bleeding : Scrape out the infected portion completely and apply Bordeaux paste or coal tar. Chiselling out of the infected portions followed by wound dressing with Tridemorph (1 ml/litre) or Carbendazim (1 g/litre) and finally application of hot coaltar will manage the stem bleeding disease of coconut.

Spindle rot : Spray 1% Bordeaux mixture immediately after emergence of seedlings.

Ganoderma disease :

1. Drainage should be improved.
2. Recommended dose of fertilizer should be applied.
3. When disease symptoms are observed, isolate the diseased palm by digging a trench 60 cm deep, 30 cm wide and 1 m away from the trunk and drench the trench with 0.2% Captan.
4. Application of 5 kg Neem cake per palm in addition to organic matter.
5. Apply 1.5 to 2 kg Sulphur powder around the palm.
6. Palms showing initial disease symptoms should be treated with 0.3% Captan or 0.2% Carboxin three times at monthly interval with 10 liters of solution per palm.
7. Strict phytosanitary measures should be taken by removing the diseased palm along with roots and burying them completely.
8. Grow one row of banana plant as a disease resistant crop in between two rows of coconut.
9. Soil drenching with 1 g copper sulphate + 1.5 g Aurofungin solution in 100 ml of water.

Bud rot : Clean the affected portion and apply 1% Bordeaux mixture.

Leaf blight : Remove the older affected leaves and spray 1% Bordeaux mixture.

Immature nut shedding :

1. Apply recommended dose of fertilizer per year.
2. Apply pesticides and fungicides against pests and diseases.
3. Irrigate the palms during dry months to prevent formation of abscission flowers at weekly interval for a month after fruit set.

## **JACK FRUIT**

(*Artocarpus heterophyllus* Lam)

**Sowing :** Freshly extracted seeds should be shown in situ during fruiting season.

### **Plant Protection :**

1. Shoot and trunk borer : Application of Savin 50% @ 4 gm per litre of water by spray in flowering season.
2. Fruit rot : Spray Indofil M-45 (Dithane M-45) as prophylactic measure.

## **MANGO**

(*Mangifera indica* Linn)

**Time of Planting :** During monsoon.

### **Plant protection :**

- 1) Stem borer : Plug with kerosene dipped cotton.
- 2) Mango hopper : Spray 0.1% Malathion.
- 3) Red Ants : Apply 5% Malathion dust with sulphar in 2:1 ratio.
- 4) Pulp weevil : (i) Spray 0.1% Malathion or Deltamethrin @ 0.1% or Endosulfan @ 0.01% at per size fruit.  
(ii) Cultural practices like clean cultivation light hoeing and smearing & lime on the base of trunk.  
(iii) Combined treatment of cultural practices and spraying of Deltamethrin @ 0.1% or Endosulfan 0.01%.
- 5) Pink disease and anthracnose : Spray copper fungicide @ 0.4%.
- 6) Fruit Fly : Spray 0.1% Malathion or bait spray of Carboryl/(0.2%) + molasses (0.1%) at egg layering stage.
- 7) Mango malformation : Deblossom affected panicles and spray 200 ppm NAA.

**Fruit drop :** Spray 2, 4-D @ 10 ppm twice at full bloom and again after two months of 1<sup>st</sup> spray.

## **PAPAYA**

(*Carica papaya* Linn.)

**Time of planting :** April to June.

**Planting Distance :** Prepare pits of 45cm x 45cm x 45cm size at a spacing of 1.8m x 1.8m. Plant 4 seedlings per pit in case of dioecious type and 1 seedling per pit in case of hermaphrodite type.

### **Plant Protection :**

- (1) Mosaic and leaf curl : Rogue out affected plants. Control the aphid vector using Malathion or Rogor 0.1% spray.
- (2) Collar rot and foot rot : Maintain good drainage and spray 1% Bordeaux mixture in the collar region of plant.

**Nematode :** Apply 0.5g Furadon 3 G per nursery polybag and 25g plant in field condition.

## **LITCHI**

(*Litchi chinensis* Sonn.)

**Time of Planting** : August to September.

### **Plant Protection :**

- (i) To control bats and birds during fruit ripening, the tree should be covered with birdproof nets.
- (ii) Leaf curl or “Erinose” is caused by the mite which should be controlled by spraying Kelthane 1.5ml or Rogor 2ml/lit of water.
- (iii) Fruit cracking : Spray 2,4,5-T or NAA at 35-100 ppm.

## **GUAVA**

(*Psidium guajava* Linn)

**Time of Planting** : May to June.

### **Plant Protection :**

1. Fruit fly : Spray Malathion 0.1% and burn the infected fruits.
2. Wilt : Drench the soil with Captan 50 WP (0.3%) and spray the plant with Carbendazim 50WP at an interval of 15 days in the early stage of infection.

## **SAPOTA**

(*Achras zapota* Linn.)

**Time of Planting** : Early monsoon.

### **Plant Protection :**

- (1) Stem borer : Plug with kerosene dipped cotton.
- (2) Scale insects Spray Malathion (30 ml in lit. of water)
- (3) Leave spot : Monthly spray of 0.2% Dithane z-78..
- (4) Sooty mould : Spray starch solution (100 g in 18 liters of water)

## **ARECANUT**

(*Areca catechu* Linn.)

**Planting Time** : Spring/Autumn

### **Weeding :**

Remove weeds by hand hoe twice a year, once after pre monsoon and once after monsoon.

### **Disorder :**

**Phula Tamul** : In Arecanut cultivation, the phenomenon of the soft/leathery kernel, i.e. lack of proper hardening of kernel associated with moisture stress in the endosperm in ripe and mature fruit may be termed as phula tamul. This condition of fruit is generally found in the first bunch of the palm which ripens earlier and gets ready to be harvested in the beginning of the harvesting season (Late March to Early April). The incidence is observed when the palm experiences scanty or irregular rainfall during the fruit development period.

**Control** : Providing irrigation to the arecanut plants especially during the dry months with proper drainage facilities followed by improved cultural practices are some of the remedial measures to be adopted.

**Nut Splitting :**

It is considered to be a physiological disorder. Improvement of drainage in area of high water table is known to help in minimizing the incidence. Spraying of Borax at the rate of 2g/l per palm during the early stage of the problem also reduces the splitting.

Pencil tip : Apply adequate manures and fertilizers regularly and improve cultural practices.

**Plant Protection :**

Bud rot – Same as Coconut

Ganoderma – Same as Coconut.

**Band disease :**

- (i) Improve the soil condition by loosening hard soil strata present and providing good drainage.
- (ii) Apply powder mixture of copper sulphate and lime in equal quantities @ 225g per palm twice a year at the base of the affected palm.

**BETELVINE**

(*Piper betle* Linn.)

**Planting Season and Raising of Seedlings :**

Land for planting the betelvine setts should be fully pulverized and soil treatment should be given with Formalin solution (4%) which should be sprinkled at the rate of 3 liters per sq.m. of soil and covered with polythene sheet or moist gunnybag for 24 hours. Planting should not be done for 15-20 days following formalin treatment.

Before planting, drench the soil with Mancozeb 75 WP 0.2% uniformly by means of a rose can. Lines are made for planting and cuttings obtained from disease free garden and treated with a solution consisting of Bordeaux mixture 0.5% and Streptomycin 500 ppm for half an hour before planting. In Assam, the cuttings are planted during May to August.

**Plant Protection :**

1. Phytophthora leaf and root rot: Apply four drenches and eight sprays of Bordeaux mixture @ 1.0% and 0.5% respectively. From June to September Drenching and spraying should be done at monthly and fifteen days interval.

2. Bacterial leaf spot: Give four sprays of Streptomycin (1.0%) along with Bordeaux mixture (0.5%) at 20 days interval after initiation of the disease.

1. Anthracnose: Give four spray of Bordeaux mixture @ 0.5% at 20 days interval after initiation of the disease.

2. Biocontrol of *Phytophthora* and basal rot of betelvine: Apply 500kg de-oiled mustard oil cake at quarterly interval cultured with *Trichoderma harzianum* at the root region of the vines.

## CASHEW

(*Anacardium occidentale*)

### Planting season

Planting of softwood grafts is usually done during monsoon (June to August).

### Planting

While planting the grafts, the polythene bag has to be removed carefully without disturbing the ball of earth. A portion of soil is scooped out from the centre of the filled pit and grafted plant is placed in such a way that the graft joint remain above the soil level. The base of the plant should be covered with topsoil and pressed gently and a stack should be placed near the graft plant to prevent wind damage. The polythene sheet used during grafting should be removed at planting time to avoid constricted growth at the grafting point.

### Plant Protection

Cashew is most commonly attacked by Tea mosquito bug .(*Helopeltis antonii*), cashew stem and root borer.

**Tea mosquito bug (*Helopeltis antonii*):** This insect causes maximum damage to the new flushes, flowers and young fruits by sucking cell sap. If extreme infestation occurs, the leaves show scorching effect which drastically reduces the yield of the crop. The occurrence and build up of the insect coincide with the new flushes, flowering and fruit setting after cessation of monsoon.

The insect is controlled by spraying insecticide viz., Monocrotophos and Carbaryl at different times. The first spray of Monocrotophos @ 0.05% (1.5ml/l) at the time of new vegetative flush, which is followed by Carbaryl @ 0.1% (2g/l) at flowering stage. This is followed by another third spray of Carbaryl at the same rate at the time of fruit setting.

**Cashew stem and root borer :** The grub of this insect causes extensive damage to the old plantations. Young plantations are also not spared. The grub makes irregular tunnels inside the trunk and feed on the bark. Infested plants show falling off of fruss near the base of trunk as these are expelled out by the grub. Unattended old plants are mostly attacked. The mature roots are attacked by the grub of the insect. It is a high flier. Grubs are medium to large in size (5cm x 15cm length). Extensive feeding results in death of the plants within a period of 1 to 3 years.

To save the plants from the grub attack, the infested part is carefully chiseled out to find the grub inside the trunk hidden in tunnels and then physical removal is mostly done with prophylactic swabbing of Carbaryl 1.0% solution. Examination of exposed roots and collar region is most essential to detect insect infestation.

## CAULIFLOWER

(*Brassica oleracea* L. var botrytis)

### Time of Sowing :

1. Early : From mid July to first week of August (Matures by October).
2. Mid : From first week of September to last week of October (Matures by Dec - January).
3. Late : Upto first week of November (Matures by Feb - March).

### For North Brahmaputra Zone :

Early – Last week of August

Late Mid – First week of November

Late – Late week of November

**Spacing :** (Row to Row x Plant to Plant)

Early : 45cm x 45cm

Mid : 60cm x 60cm

Late : 45cm x 45cm

**Plant Protection :**

1. Caterpillars and other leaf eaters : Spray Malathion 50 EC 0.15% (@1.5 ml/lit of water).
2. Field-criket, cutworm, red and other soil insects : Apply Malathion 5% dust @ 20 kg/ha.
3. Black rot : Drench the soil with 100-200 ppm (0.1-0.2g) solution per lit of Agrimycin or Streptomycin after transplanting.

**Seed Production of Early Cauliflower :**

**Time of Sowing :** Second fortnight of July.

**SPROUTING BROCCOLI OR BROCCOLI**  
(*Brassica oleracea* var. *italica*)

**Time of Sowing :** Same as cauliflower.

**Spacing :** ( Plant to Plant x row to row )  
45 cm x 75 cm.

Thinning should be done in direct seedling crops.

**Plant Protection :** Same as in cauliflower.

**CABBAGE**  
(*Brassica oleracea* L. var *capitata*)

**time of Sowing :**

First week of September to last week of November.

**Spacing :**

(Row to Row x plant to plant) – Early maturity : 60 cm x 30 cm

Late maturity : 60 cm x 60 cm.

**Plant Protection :** Same as for Cauliflower.

**KNOLKHOL**  
(*Brassica caulorapa* L var. *gongyloides*)

**Time of Sowing :**

First week of September to last week of November.

**Spacing :** 30 cm x 25 cm (Row to Row x plant to plant).

**Plant Protection :** Same as for Cauliflower.

**Harvesting :**

Harvesting should be done when knobs are fully matured before they become tuff, weedy and stringy.

## **TOMATO**

*(Lycopersicon esculentum Mill)*

**Time of Sowing :** October – November.

**Spacing :** (Row to row x plant to plant)  
50cm x 30cm (for both the determinate and semi determinate variety)  
75cm x 30cm (for indeterminate variety)

**Time of planting for hill zone :** To escape the leaf curl virus planting should be done in October.

### **Plant Protection :**

(1) Late blight : Against late blight 0.25 solution of Mancozeb 75 WP (2g/l) (Mancozeb 72% a.i.) should be used at the following rates with volume sprayer.

Early stage (1<sup>st</sup> month) 600 l of water/ha.

Mid stage (2<sup>nd</sup> month) 800 l of water/ha.

Late stage (3<sup>rd</sup> month) 1000 l of water/ha.

Depending upon weather conditions particularly on cloudy weather Mancozeb 75 WP (2g/l) should be sprayed as prophylactic measure. Alternatively, Dithane Z-78 @ 0.25% (25 g in 10 l. of water) can be used. If disease appears, spraying should be done at an interval of 7 to 10 days depending upon weather condition. While spraying care should be taken to cover the lower sides of the leaves.

(ii) Metaxyl 8% (2.5 g/lit) followed by Mancozeb 75 WP (2g/l) in alternate application [3 sprays with Metaxyl 8% (2.5 g/lit) and 3 sprays with Mancozeb 75 WP (2 g/l)] at an interval of 12 days. The first spray should be given between 10-15<sup>th</sup> December. Use sticker Triton (0.5 ml/l.) in spray solution during rainy weather.

(iii) 1% Bordeaux mixture (10 g CuSo<sub>4</sub> + 10g lime + 1l water) is also effective in controlling blight in tomato.

(2) Wilt : (i) Bacterial wilt : (a) Drench soil with 100 ppm Streptomycin. Grow resistant varieties. Apply oil cake.

(b) Apply : "Asafoetida – Turmeric powder mixture (1 g Asafoetida + 5 g turmeric powder in 10 l of water) to drench the soil 3 times i.e. at 15 , 30 and 45 days after transplanting.

(i) Fungal wilt : Drench soil with Captan 50 WP 0.3%.

## **BRINJAL**

*(Solanum melongena L.)*

### **Time of Sowing :**

First week of September to October for winter crop and January to February for spring crop.

**Spacing :** 75 cm x 60 cm (Row to Row x Plant to Plant).

### **Plant Protection :**

1. Fruit and shoot borer : (a) Apply Phorate or Furadon granule @ 2.5 g/plant at 20 days after transplanting. (b) Apply Deltamethrin (Decis 2.8 EC) @ 1 ml/l or Malathion

50 EC @ 2 ml/l (c) Growing of garlic as intercrop or boarder crop reduces the infestation.

2. Bacterial wilt : Soil dranching with 100 ppm of Streptomycin should be done.

1. Fungal wilt : Soil drenching with Captaf 0.3% should be done.

2. White blight (white mould) : Spray Bavistim 0.05% (0.5 g/l.)

3. Nematods :

i) Sebuphos @ 0.6 g a.i./m against root knot nematode.

ii) Seedling root-dip treatment in monocrotophos or Carbosulfan @ 0.05% or 6 hours.

iii) Carbofuran, diazonon or phorate 500 ppm for 30 minutes root dip tdreatment.

## PEA

(*Pisum sativum* L.)

### Time of Sowing :

The optimum time of sowing is mid October.

### Plant Protection :

#### A. Insect Pests :

Insecticide Common Name	Trade name%	Concentration ml/1 of water		Insect pest pest
Dichloravos	Nuvan 100 EC	0.05	0.5	pod borer
Malathion	Malathion 50 EC	0.1	2.0	Leaf Miner Aphid

#### B. Disease:

Disease	Fungicides	Dose/ Ha	Cencen- tration	Mode of application
1	2	3	4	5
1. Wilt (i)	Carbendezim Benomyl 50WP or	2g/kg of seeds	seed	treatment
	Cceptan 50 WP or Thiram	3 g/ha of seeds		-do-
(ii) Carbandezim 50WP		-	0.1%	Drenching the soil in localized patchbes.
2. Rust Tridemorph (Calixin) or Mancozeb 75 WP		500-700ml in 500-700 l. of water 1.0-4 kg in 500-700 l. of water.	0.1%  0.2%	As soon as disease appeared -do-
3. Pow-Wet. Sulphur dry (Thiovit) mildew		2.5 to 3.5 kg in 500-700 L. of water	0.5%	-do-

(hexasul)	500-700 ml in		
Starsul or	500-700 l. of	0.1%	-do-
Tridemorph	water		
(Calixin)			
Wet. Sulphu	500-700 g in	0.1%	-do-
(karathane) or	500-700 l. of		
	water.		
(Sulfex)	1.0-1.4 kg in	0.2%	-do-
	500-700 l.		
	of water.		

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**French bean**  
(*Phaseolus vulgaris* L.)

**Time of Sowing** : October-March.

**Seed Treatment** : Seeds should be treated with Captan 50 WP @ 3 g/ha seeds.

**Spacing** : 45 cm x 30 cm (Row to Row x plant to plant).

**Plant Protection :**

Aphid, Jassid and Beetles : Spray Malathion 50 EC 0.2% (@ 2.0 ml/l of water).

Anthracnose, Root rot and Wilt : Treat the seeds with Captan @ 2-3 g/kg before sowing, Spray Bavistan or Benlate on the crop.

Leaf spot : Spray the crop with Mancozeb 75 WP (2g/l) twice at 15 days intervals starting at one month after sowing.

Bacterial Blight : Treat the seeds with Streptomycin sulphate @ 2.5 g/kg.

Mosaic : Prophylactic measure should be taken against aphid vector by spraying Rogor or Monocrotophos.

**DOLICHOS BEAN**  
(*Dolichos lablab* L.)

**Sowing Time** : July-August.

**Seed Treatment** : Seeds should be treated with Captan 50 WP @ 3 g/kg seeds.

**Spacing** : 1.25 m x 75 cm (Row to Row x Plant to Plant).

**Plant Protection :**

1. Aphids, Jassids and Beetles : Spray Malathion 50 EC @ 0.2% or 2.0 ml/lit. of water.

2. Yellow mosaic : Prophylactic measures should be taken against insect vector.

**SPINACE BEET**  
*Beta vulgaris* Roxb. Var. benghalensis

**Time of Sowing** : Second week of September to December.

**Seed Treatment :**

Seeds should be treated with Captan 50 WP @ 3g/kg of seed.

**Spacing** : Seeds should be directly sown in lines spaced at 20cm and seedlings are thinned out to 5-7cm within rows of 10-12 days after emergence.

**Plant Protection :**

Leaf spot : Prophylactic measure through seed treatment.

**RADISH**  
(*Raphanus sativus* L.)

**Time of Sowing :**

August-September (Early varieties)

October-November (Late varieties)

**Seed Treatment :** Seeds should be treated with captan 50 WP @ 3 g/kg seed.

**Spacing :**

Directly sown either on ridges spaced at 45cm or in flat beds with 20cm row spacing and seedlings are thinned out to 10cm within rows 10-15 days after emergence.

**Plant Protection :**

Aphid : Spray Malathion 50 EC @ 2ml/l of water.

**CARROT**  
(*Daucus carota* L.)

**Time of Sowing :**

Beginning of October to November.

**Seed Treatment :**

Prior to sowing, the seed should be well rubbed to remove the fine hairs. The seeds should be soaked in water for 24 hrs. dried under shade and to be treated with Captan 75 WP @ 3 g/kg seeds. Seed treatment with 0.1% Boron in the form of Sodium -borate for 24 hours improve the yield.

**Spacing :**

Seeds should be sown at a depth of 1.5 cm in lines spaced at 30 cm on flat bed and seedlings are to be thinned out to 10 cm within row at 10-15 days after emergence.

**Plant Protection :**

1. Cut worm and leaf blight : Apply a mixture of 10 ml of Malathion 50 EC and 25 g of Mancozeb 75 WP in 10 lit. of water.

2. Nematode : Apply oil cake @ 300-400 kg/ha.

**CUCUMBER**  
(*Cucumis sativus* L.)

**Sowing Time :** March – April (Climbing summer crop)

November – December (Ground training spring crop).

(March sowing reduces fruit fly infestation in hill zone of Assam).

**Spacing :**

(Row to Row x Plant to Plant)

1.5 m x 1.2 m (for ground trailing)

1.2 m x 75 cm (for summer crop).

**RIDGE GOURD**  
(*Luffa acutangula* (Rob.)L.)

**Sowing time :** January-May

**Spacing :** (Row to Row x Plant to Plant)  
1.5-2.5m x 60cm – 1.2m

**SPONGE GOURD**  
(*Luffa cylindrica* Reom)

Other (Agro-techniques are same as in Ridge ground).

**SNAKE GOURD**  
(*Trichosanthes cucumerina* L.)

**Sowing Time :** April-June.

**Spacing :** 2.0-2.5 m x 0.75-0.09 m (Row to Row x Plant to Plant).

**BITTER GOURD**  
(*Momordica charantia* L.)

**Sowing Time :**

Early : October-November (Ground trailing)

Mid : February-March

Late : June-July.

**Spacing :**  
1.5 – 2.5 m x 60 cm – 1.2 m (Row to Row x Plant to Plant).

**ASHGOURD**  
(*Benincasa hispida* (Thumb) Cogn.)

**Sowing Time :** February-April.

**Spacing :** 2.0m x 1.0 m (Row to Row x Plant to Plant).

**BOTTLE GOURD**  
(*Lagenaria siseraria* (Mol.) Standl.)

**Sowing Time :**

Spring : February – March

Summer : June – July

Winter : October – November

Keyarilao : September.

**Spacing :**  
(Row to Row x Plant to Plant)  
1.5.-2.0 m x 1.0-1.5 m (Spring)  
2.0-3.0 m x 1.0-1.5 m (Summer)

## **PUMKIN**

(*Cucurbita moschata* Duch ex poir)

### **Sowing Time :**

January – April (For summer harvest)  
Sept. – October (For spring harvest).

### **Spacing :**

(Row to Row x Plant to Plant)  
2.5-3.0 m x 0.9-1.0 m (Spring)  
2.5-3.0 m x 1.0-1.5 m (Summer).

## **WATER MELON**

(*Citrullus lanatus* (Thumb.) Matsumura and Nekai)

### **Sowing Time :**

Early : January – February  
Late : June – July.

**Spacing :** 2.5m m x 2.0 m (Row to Row x Plant to Plant).

## **MUSK MELON**

(*Cucumis melo* L.)

**Sowing Time :** January – mid March.

**Spacing :** 1.5-2.0 m x 0.6-1.2 m (Row to Row x Plant to Plant)

## **CHOW-CHOW/CHAYOTE**

(Popularly know as squash among the people of Assam)  
*Sechium edule* (Jack) Swartz.

**Spacing :** 2-3 m x 1-2 m.

### **Planting Time :**

September – November (for irrigated crop)  
January – February (for rained crop).

## **SPINE GOURD**

(*Momordica dioica* Roxb.)

**Planting Time :** February – March.

### **Planting Method :**

Tubers are planted in the field in trench method. 30-35 deep trenches are made and filled with FYM. Large size tubers (80-100 g) should be placed in furrows at a depth of 8-10 cm maintaining a spacing o 1 m x 1 m.

**POINTED GOURD**  
(*Trichosanthes dioica* Roxb.)

**Planting Time :**  
January – February.

**Spacing :**  
2.0 m x 2.0 m (Row to Row x Plant to Plant).  
80 cm mid portion of cutting should be buried in soil and 10 cm to be kept exposed on either ends.

**PLANT PROTECTION FOR CUCURBITS**

1. Fruit fly : Epilachna beetle, aphid Red pumpkin beetle and Black pumpkin beetle : Spray Malathion 50 EC 0.2% (2 ml/lit.) with 1% molasses.
2. Cutworm : Incorporate Malathion 5% dust in the soil around the plant.
3. Mite : Spray Karathane WP 0.5% (0.5 g/lit.) or Kelthane 0.1% (1 ml/lit.) of Malathion 50 EC 0.2% or Monocrotophos 40 EX 0.1%.
4. Powdery mildew : Spray Karathane WP 0.5% or Bavistin 0.1%.
5. Lowly mildew : Spray 1% Bordeaux mixture or Zincs 0.3%.
6. Fusarium root rot : Pre-sowing seed treatment with Captan 50 WP @ 5 g/kg of seeds.
7. Anthracnose : Spray Zincs 0.2% or Difolatan 0.15%.

**OKRA**  
(*Abelmoschus esculentus* (L.) Moench.)

**Sowing Time :**  
Mid January – July.

**Spacing :** (Row to Row x Plant to Plant) 30 cm x 15 cm (spring/summer crop)  
45 cm x 30 cm (Rainy season crop)

**Seed Treatment and Method of Sowing :**  
Pre sowing soaking of seeds in water for 24 hrs, enhance germination. Seeds should be directly sown in the pit and to be covered with sand and/or FYM.

- Plant Protection :**
1. Fruit and shoot borers and Jassids : Apply Deltamethrin (Decis 2.8 EC) @ 0.5 ml/lit. or Dichlorvos 100 EC @ 0.5 ml/lit of Malathion 50 EC @ 2 ml/lit. Waiting period after the treatment is 3 days.
  2. Cut Worm : Apply Malathion 58 Dust @ 20 kg/ha.
  3. Yellow vein Mosaic : (a) Prophylactic measure should be taken against the insect-vector by spraying systematic insecticide like Rogor or Metasytox. The first spray should be given within 20 days after emergence of seedlings and altogether 5-6 sprays are required to get a disease free crop. (b) Grow the crop early in the season so as to escape the incidence of YVM which generally intensifies with the increases of the vector (white fly) population beyond April (c). To get highest yield and low incidence of YVM February and March sowing is the best.
  4. Root knot nematode : Carbofuran 3g @ 1 kg @ 1 kg a.i/ha as spot application.

## **COWPEA**

*(Vigna unguiculata (L) Walp)*

**Sowing Time** : March-April.

**Seed Treatment** : Dry seed treatment should be done with Captaf @ 2.0 g/kg seed.

**Spacing** :

70 cm x 30 cm (Row to Row x Plant to Plant).

**Plant Protection** :

Caterpillar and Aphid : Spray Malathion 0.1-0.15 % (@ 1-1.5 ml/lit. of water with a spray volume of 500-700 lit. for 1 ha.)

## **ONION**

*(Allium cepa L.)*

**Sowing time** :

Last week of September – mid October.

**For Hills Zone** : Transplanting of seedlings should be done in the last week of October(25<sup>th</sup> October).

**Spacing** 20cm x 10 cm (Row to Row x Plant to Plant).

**Plant protection** :

1. Thrips : Spray Malathion 50 ec. 0.2 % (@ 2.0 ml./lit. of water with a spray volume of 370 lit./ha)

## **GARLIC**

*(Allium sativum L)*

**Sowing time** :

September – October.

**Spacing** : 15cm x 5-7 cm (Row to Row x Plant to Plant).

**Plant protection** :

Same as in onion.

## **CHILLI**

*(Capsicum annuum L. var. acuminatum)*

**Time to Sowing** :

December-January.

**Seed Rate** :

600-700 g/ha 3-4 g of seeds should be sown per 10 sq.m.

**Method of Sowing or Planting** :

1. Direct Sowing : Seeds should be sown thinly in lines spaced at 40-45 cm and seedlings are thinned out to proper spacing later on.
2. Transplanting : 4-5 weeks old seedlings are to be transplanting in the field.

**Spacing** :

(Row to Row x Plant to Plant) :45 cm x 45 cm.

**Plant Protection** :

1. Fruit rot or Anthracnose disease: Spray Captan 50 WP 0.2% (@ 2 g/lit. of water) or Dofolatan 0.2%.
2. Root knot Nematode : Neem oil cake : Mustard oil cakes and cattle manure application reduces infestation.

## **CAPSICUM**

(*Capsicum annuum* L.var. *grossum*)

(The other cultivation practices are same as that of chilli).

## **GINGER**

(*Zingiber officinale* L.)

**Planting Time :** March-April.

**Spacing :**

25 cm x 15x0 cm (Row to Row x plant to Plant).

To be planted in shallow pit.

**Plant Protection :**

1. Shoot borer and leaf roller : Spray Rogor 0.05%.
2. Rhizome (soft) rot : (a) Drainage system should be improved. (b) Prophylactic measure should be taken through treatment of seed rhizome with Mancozeb 75 WP (2g/l) or Metalaxyl & Mancozeb 75 WP formulation 0.3% before storage or planting. (c) The affected areas should be drenched with 0.3% Mancozeb 75 WP (2g/l) or Captafol.
3. Leaf spot : Apply 1% Bordeaux mixture or 0.2% Thiram.

## **TURMERIC**

(*Curcuma longa* Linn.)

**Planting Time :** April.

**Spacing :** 45 cm x 25 cm (Row to Row x Plant to Plant).

Rhizomes are to be planted in furrows at 10 cm depth.

**Plant Protection :**

1. Mites, Leaf roller and shoot borer : Spray Dimecron 0.06% (0.6 ml/lit. of water)
2. Taphrina and Collectorichum leaf spot : Apply 1% Bordeaux mixture or Zincs or Mancozeb 75 WP (2g/l). Spraying should be done at 15 days interval starting at the first appearance of the disease
3. Rhizome rot : Same measure as in Ginger.

## **BLACK CUMIN**

(*Nigella sativa* L.)

**Sowing Time :**

Mid October- November.

**Seed Treatment :**

Seeds should be soaked in water for 24-36 hours followed by drying in shade. Dry seed treatment should be done with Captan 50 WP @ 3 g/kg of seed.

**Spacing :** Seed should be directly sown in lines spaced at 30 cm and seedlings are thinned out to 10 cm within row at 35-40 days after sowing.

**Plant Protection :**

1. Cut worm and Fruit borer : Apply Metasystox or Rogor 0.1% ( 1 ml/lit. of water) or Dimecron 0.05% (0.05 ml/lit. of water).
2. Stem rot : Apply copper Oxychloride 50 WP or Mancozeb 75 WP (2g/l.) at an interval of 15-20 days.

## **CUMIN**

(*Cuminum cyminum* L.)

**Sowing Time** : February-March

**Seed Treatment** : As in Black cumin.

**Method of Bowing and Spacing** :

Seed are sown on rows spaced at 50 cm, in finally prepared and irrigated beds. Thinning should be done afterwards to maintain a plant spacing of 10 cm within row.

## **FENNEL**

(*Foeniculum vulgare* Mill)

**Sowing Time** : October-November.

**Seed Treatment** :

Seed should be treated with Captaf @ 2 g/kg seed.

**Spacing** : Same as in Black cumin.

## **FENUGREEK**

(*Trigonella foenum graecum* L.)

**Sowing Time** : Mid October-November.

**Spacing** :

Directly sown in rows spaced at 30 cm and seedlings are thinned out to 10 cm within the rows at 35-40 days after sowing.

**Seed Treatment** :

Seed should be treated with captaf @ 2 g/ka seed.

Seed yield 6-15 g/ha (Provided no leaf cutting is made.)

## **MINT**

(*Mentha arvensis* L.)

**Treatment** :

The Stolen should be treated with 0.1% solution of Dithane M-45 for 5-10 minutes before planting against root rot.

**Plant Protection** : (Cumin, Fennel, Fenugreek and Mint).

1. Powdery mildew : Can be controlled by spraying wettable sulphur @ 1 kg/ha or Karathane @ 500 ml/ha in 625 lit. of water. The spray should be repeated after 10-15 days. Dusting the crop with 20-25 kg sulphur dust/ha would also control the disease.
2. Blight : At the time of flowering the crop should be treated with Indofil Z-78 or Fytolan or Difolaton @ 600-1000 g/ha, Indofil Z-78 can be mixed with Karathane to control both blight and powdery mildew.
3. Wilt : Runner or sucker treatment with Bavistin @ 2 g/kg of planting materials.
4. Termite : Soil application of Malathion 5% dust @ 25 kg/ha at the time of field preparation.
5. Aphid : Spraying 625 ml Malathion in 625 lit, of water/ha is recommended. Spray should be repeated at 10-15 days interval according to need.
6. Other pests like stink bug and leaf eating caterpillar are seen feeding on the crop but not that seriously which need control.

**BLACK PEPPER**  
(*Piper nigrum* L.)

**Time of Taking Cutting :** March.

**Time Required for Rooting and New Shooting :** 2 to 3 months.

**Time of Planting in the Main Field :** May/June.

**Spacing :** 3 m x 3 m.

**Pit Size :** 50 cm x 50 cm x 50 cm.

**Plant Protection :**

1. Pollu beetle : The grubs feed on tender berries and make them hollow. Endosulfan 35 EC or quinalphos 25 EC or Dimethoate 30 EC @ 1 ml/lit. of water should be sprayed in July and October.
2. Marginal gall forming thrips : It attacks the leaves and makes crinkles. Malathion 50 EC @ 1 ml/lit. of water should be sprayed.
3. Quick wilt : In monsoon, infection appears 25-30 cm above ground level and the vine dies within 10-12 days. Spray 1% Bordeaux mixture before onset of monsoon on the ground up to 1 m of the vine,.

**POTATO**  
(*Solanum tuberosum*)

**Time of Planting :**

The optimum time for planting is mid October to mid November. In case of Kufri Sindhuri planting may be extended up to first week of December.

**Seed treatment :**

In case of cut seeds, the pieces are to be dipped in Mancozeb (Indofil M-45) @ 5g in 1 litre of water for about 10 minutes. Benomyl (Benlate) 0.1% solution may be used if other chemicals are not readily available. After treatment seeds are to be spread thinly and dried under shade for 48 hours, or should be covered with moist gunny bags for 2-3 days for suberization.

**Seed Rate :**

The seed requirement is 22.5-23 q/ha when size of the tubers are about 2.5 cm in diameter (about 25 g) and planted with an intra row spacing of 15 cm. Intra row spacing is increased with bigger size tuber.

**Plant Protection :**

**A. Pests :**

In areas where infestation of red ants and other soil insects are common, application of Phorate 10% granules (Thimet 10 G) @ 15 kg/ha or Malathion 5% dust @ 40 kg/ha in the soil at the time of earthing up should be done to control insects efficiently. Local potato variety Lalpahari: is relatively tolerant to red and cutworm.

Application of mustard oil cake @ 150 kg/ha at the time of earthing up reduces red and white ant infestation to a greater degree.

**B. Disease :**

I. Against late blight, six sprayings with Mancozeb 75%. (Dithane M-45) @ 0.25%(2.5g/l) at an interval of 12 days.

OR

II. Ridomil MZ-27 (64% mancozeb +8% metalaxyl (2 g/l) followed by Dithane M-45 (2.5g/l) in alternate application (3 sprayers with Ridomil MZ-27 and 3 with Dithane M-

45) at an interval of 12 days give very good control if used at the following rates with high volume sprayers.

Early stage : (1<sup>st</sup> month) 600 l of water/ha.

Mid stage ; (2<sup>nd</sup> month) 800 l of water/ha.

Late stage : (3<sup>rd</sup> month) 100 l of water/ha.

The first spray should be give between 10-15<sup>th</sup> December. Use of sticker Triton (0.5ml/l) will be essential in the spray solution for spraying during rainy weather.

Depending upon weather conditions particularly on cloudy weather Dithane M-45 should be sprayed as prophylactic measure. Alternatively, Zineb (Dithane Z-78) @ 0.25% (25 g in 10 l of water) can be used. If disease appears spraying should be done at an interval of 7 to 10 days depending upon weather conditions. While spraying, care should be taken to cover the lower sides of the leaves.

**N.B :** (i) In flood prone areas under low land situation of North Bank Plains Zone cropping system of Rice-Fallow-Potato is recommended.

(ii) Under medium land, medium rainfall, flood free situation, inter cropping of potato and pea is recommended for Sonitpur district.

(iii) Inter cropping pea in between every two rows of potato grown with, mulches with usual doses of fertilizer is recommended for potato.

## **SWEET POTATO** (*Ipomoea batatas* L.)

### **Planting Season :**

The rainfed crop of sweet potato is generally planted in May-June and a second crop is raised in September-October (to be harvested in 105 days after planting). As an irrigated crop it can also be grown in October-November or even later.

### **Planting Material and Planting :**

a) Propagation of this crop is done by means of vine cuttings. In the main field, cutting of 20 to 25 cm length are planted on ridges at a distance of 20 to 30 cm between vines. While planting, the central part of the cuttings is buried deep in the soil exposing the two cut ends. About 50,000 to 62,000 cuttings are required to cover a hectare. Care should be taken so that there is sufficient moisture in the soil at the time of planting for the early establishment of the cutting. Since sweet potato is susceptible to water logging, proper drainage facilities should be provided.

(b) Adopt 2 tier planting of deep bulking type (x-5) in between two rows of shallow bulking type (cross-4) at 30 cm x 15 cm spacing.

### **Plant Protection :**

Weevil-Sweet potato weevil is the most serious pest. It damages vines and tubers by tunneling through them.

1. Dip the vine cuttings in submition (1 ml/lit.) solution for 10 minutes before planting to reduce the infestation.

2. In case severe infestation, spray Malathion (2ml/lit.) or Dimecron (0.5 ml/lit.) 3-4 times at 25 days interval commencing after one month of planting depending upon intensity of attack.

Seed and-Malathion 5% dust @ 20 kg/ha should be incorporated in the soil at the time of soil preparation.

## **TAPIOCA**

*(Manihot esculenta Crantz)*

### **Planting Material :**

Tapioca is propagated from cuttings obtained from mature healthy stems having 2-3 cm diameter. Discard the basal 10 cm and the top one third and use the remaining portion, Prepare the cuttings of about 15-20 cm length giving a slanting cut towards lower and or cutting using hacksaw or knife.

### **Spacing :**

Planting is done in a square alignment with a spacing of 90 cm x 90 cm , 1646 setts/bigha are required for planting.

### **Time and method of planting :**

April-May is the best planting time for Assam. Cuttings are planted vertically (after smoothening the lower portion) and basal 4 to 6 cm is buried inside the soil. Flat, ridge or mound method of planting can be adopted considering the soil type, topography and water table.

### **Plant Protection :**

Tapioca is not affected by any serious pest and disease. The important ones attacking the crop are mentioned below :

Spider, mites and scale insect occur during dry season which feed on leaf sap causing blotching, curling and leaf shedding and can be controlled by spraying kelthane (2ml/lit.). The two important diseases of tapioca are "Cassava mosaic" and "Cercospora leaf spot". The mosaic disease is apparently transmitted by the insect vector Bemisia sp. (white fly). As a rule only stem cutting from healthy plants should be used for planting to minimize the spread. The diseased plants should be uprooted and destroyed when the symptoms are visible. Spraying 0.03% Dimethoate (Rogor) 3 to 4 times at monthly intervals in the first 4 months of the crop controls the vector and thereby checks the spread of the disease. Leaf spot disease can be controlled by spraying Bavistin 0.1% or Mancozeb 75 WP (2g/lit.).

## **COLOCASIA**

*(Colocasia esculenta Schott)*

### **Time and method of planting :**

April-June is the best planting time for Assam, Planting is done on well prepared land in pits filled up with burnt earth, ashes and rubbish. When plants grow to about 30 cm height, the soil around is lessened and earthing up is done.

### **Plant Protection :**

Colocasia blight is a serious disease which can be controlled by using Mancozeb 75 WP (2g/lit.) at an interval of 14 days. The spraying should be started 1-2 months after planting.

In the endemic areas of red and other soil insects apply Malathion 5% dust @ 20 kg/ha in the soil at the time of preparation.

## **SMALLER YAM**

*(Dioscorea esculenta Burk)*

**Planting Material :** Select good, healthy and medium sized tubers of 100-150 g.

### **Method of Planting :**

Tubers are planted at the center of the mound (one tuber/mound) in an upright position keeping the proximal end of tuber 5-7 cm below the soil surface.

**Plant Protection :** Yam Scale : It usually infests the corms both the field and under storage condition. Avoid planting the tubers infested with scales. As a prophylactic measure, dip the planting material in Nuvacron solution (1.25 ml in 1 lit of water) for 10 minutes before planting .

**GREATER YAM**  
(*Dioscorea alata* L.)

**Planting Season :**  
Planting is done from March to May.

**Planting Material :**  
Divide the whole tuber into pieces weighing 250-300 g each. Dip the cut pieces in cowdung slurry and allow to dry under shade before planting.

**Method of Planting :**  
Plant the out pieces in the prepared pits with mounds keeping buds facing upward and cover these with soil.

**Plant Protection :** Same as in Smaller Yam.

**WHITE YAM**  
(*Dioscorea rotundata* Poir.)

**Planting materials :**  
Divide the whole tuber in to spices weighting 250-300g each. Preferably use the head and/or tail or tips and dip them in cowdung slurry or smear in wood ash and dry under shade before plaiting.

**Planting Season :**  
Planting is done from March to May.

**Method of Planting:**  
Plant the out pieces in the prepared pits with mounds keeping buds facing upwards and cover them with soil, put 3-5 cm mulch over the mounds.

**Plant Protection :**  
Same as in smaller yam.

**ELEPHANT FOOT YAM**  
(*Amorphophallus campanulatus* Blume.)

**Planting season and Method of Planting :**  
Start the cultivation in the month of March to April. It can also be planted up to August bud planting later than the middle of August will effect the size and yield of corm.

**Planting Material and Planting :**  
Select good corms free from mealy bug infestation. Cut the corms into pieces of 1kg size each with a central bud. Dip the pieces in cowdung slurry. Dry it in shade for 2-3 days.  
Plant the corn vertically in the prepared pit and cover it with soil.

**Plant Protection :**  
Corms are usually attacked by mealy bugs in field and storage condition. Avoid planting corms infested with mealy bugs.

As a prophylactic measure, dip the planting material in Nuvacron solution (1.25 ml in 1 lit. of water) for 10 minutes

The comprehensive package of practices for various hybrid varieties of vegetables, as per IAHS Company leaflet, is given below :

VEGETABLE	TOMATO	CABBAGE	CAULIFLOWER	BRINJAN	CAPSICUM	CUCUMBER	OKRA
SHOWING & TRANSPLANTING	Throughout the year except the heavy rain periods	Throughout the year except the heavy rain periods, Kavery can tolerate very high temp.	June-July. These varieties are heat tolerant	September-November Long-13 can be grown year round	August-October January February	March-April	January
SEED RATE	150 g	300 g	300 g	200 g	375 g	375 g	3500 g
SPACING	45cm x 57cm 75cm x 75cm 60cm x 90cm	45cm x 30cm 45cm x 60cm	45cm x 30cm 45cm x 60cm	60cm x 90cm 90cm x 90cm	30cm x 60cm 45cm x 60cm	120cmx60cm	30cm x 60cm 45cm x 60cm