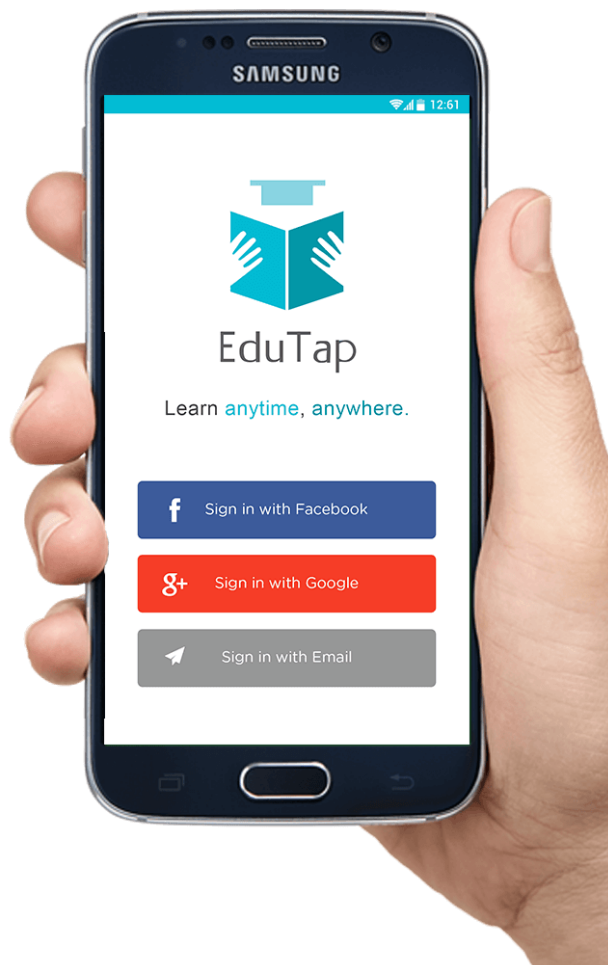


**AGRICULTURE**  
**CHAPTER**  
**HORTICULTURE**  
**SUMMARY SHEET**

**For NABARD Grade A/B 2019**

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## 1 HORTICULTURE

The term Horticulture is derived from the Latin words: "*hortus*" meaning **garden** and "*cultura*" meaning **cultivation**.

Horticulture may be defined as the **science and technique of production, processing and merchandizing of fruits, vegetables, flowers, spices, plantations, medicinal and aromatic plants.**

## 2 Branches of Horticulture

The following are the branches of horticulture

<b>Pomology</b>	Cultivation of fruit crops
<b>Olericulture</b>	Cultivation of vegetables
<b>Floriculture</b>	Cultivation of flower crops
<b>Plantation crops</b>	Cultivation of crops like coconut, arecanut, rubber, coffee, tea etc.
<b>Spices crop</b>	Cultivation of crops like, cardamom, pepper, nutmeg etc.
<b>Medicinal and aromatic plants</b>	Cultivation of medicinal and aromatic crops
<b>Post-Harvest</b>	Post-harvest handling, grading, packaging, storage, processing, value addition, marketing etc. of horticulture crops.

## 3 Types of fruits

On basis of Temperature

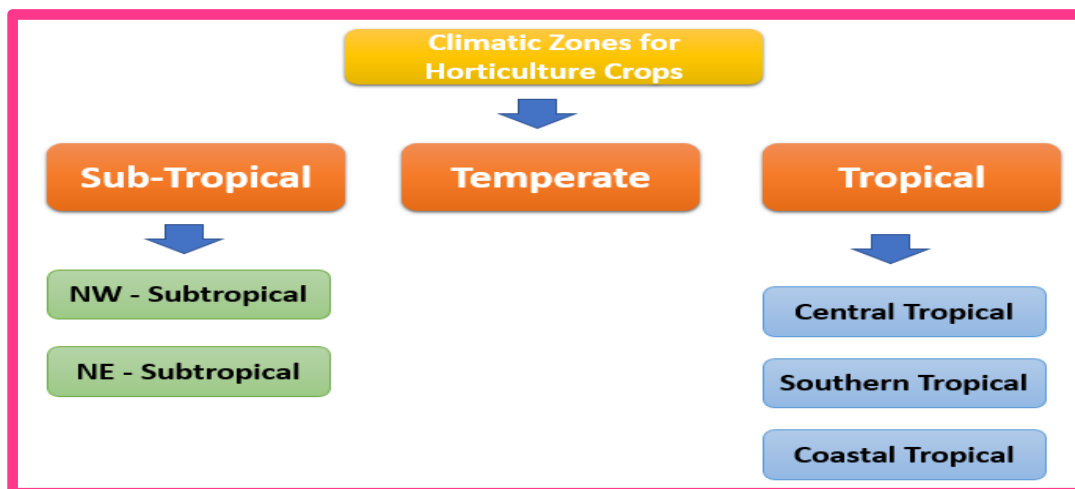
Tropical	Mango, Banana, Papaya, Sapota, Pineapple, Coconut, Cashew, Arecanut, Breadfruit, Jackfruit and Avocado.
Subtropical	Guava, Grape, Citrus, Date palm, Phalsa, Pomegranate, Litchi and Loquat.
Temperate	Apple, Pear, Peach, Plum, Quince, Apricot, Walnut, Almond, Strawberry and Cherry.
* However, this choice is not very rigid as some tropical crops which can be grown in subtropics and vice versa.	

#### 4 Important fruit and their classification on basis of temperature

<b>Mango</b>	:	Tropical and sub tropical.
<b>Citrus</b>	:	Subtropical but can be grown under temperate conditions.
<b>Grapes</b>	:	Temperate but can be grown under subtropical and tropical conditions.
<b>Peaches</b>	:	Temperate but low chilling varieties can be grown under subtropical conditions.
<b>Sapota</b>	:	Tropical but can be grown under subtropical conditions which are free from frost.
<b>Papaya</b>	:	Tropical and mild subtropical climate.
<b>Banana</b>	:	Tropical, can be grown under subtropical climate provided it is free from hot winds and frost.
<b>Almond</b>	:	Temperate but some low chilling varieties can be grown under subtropical climate.
<b>Apple</b>	:	Temperate but low chilling varieties can also be grown on lower hills.

#### 5 Horticulture zones of India

Majorly there are **3 Climatic zones for horticulture crops** which can be **sub divided into total six categories**:



#### 6 Nursery Layout

Rectangular	In this system, the plot is divided into <b>rectangles</b> instead of squares and trees are
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	planted at the <b>four corners of the rectangle</b> in straight rows running at right angles. Like square system, this system also facilitates the inter-culture in two directions.
Square	It is the most <b>commonly used method</b> and easy to lay out in the field. In this system, <b>plant to plant and row to row distance is the same</b> . The plants are at the <b>right angle to each other</b> , every unit of four plants forming a square.
Hexagonal	In <b>hexagonal system</b> , the trees are <b>planted in the corners of equilateral triangles</b> . Six trees thus form a hexagon with another tree at its center accommodates <b>15 percent more plants</b> .
Contour	This system is usually followed in the <b>hilly areas with high slopes</b> , but it is very much similar to the square/rectangular system. Bench terraces are used where the <b>slope is greater than 10 per cent</b> .
Quincunx	This system is exactly like the <b>square system</b> , but one additional tree is planted in the center of each square. The number of plants per acre by this system is <b>almost doubled</b> than the square system. Fruit trees like papaya, kinnow, phalsa, guava, peach, plum etc. can be planted as fillers
Triangular	In this system, <b>trees are planted as in the square system</b> but the plants in the <b>2nd, 4th, 6<sup>th</sup> and such other alternate rows are planted midway</b> between the 1st, 3rd, 5th and such other alternative rows. This system provides <b>more open space for the trees and for intercrop</b> .

## 7 Training & Pruning

Training can therefore be defined as 'an operation done to a plant by which it is made to develop a frame work or structure land this is spreading on pergola with or without pruning of plant pears and training is usually done when the plant / shrubs vines are young.

System of Training for Fruit Crops

- 1. Central Leader:** This system of training is adopted such types of trees which have a pronounced **apical dominance**.
- 2. Open Center:** In this system, the main stem is allowed to grow only up to a certain height by heading within a year of planting and all the subsequent vegetative growth promoted by lateral branches.
- 3. Modified Leader System:** This system stands **intermediate between the central leader and the open center**, combining the advantages of both the system.
- 4. Cordon system:** This is a system wherein espalier is allowed with the help of training on wires.
- 5. Training on pergola:** To support perennial vine crops **pergola is developed by a network of criss-cross wires** supported by RCC/angle iron poles on which vines are trained. This is common for **crops like grape, passion fruit, small gourd, pointed gourd and even peaches**.

## 8 Training on Basis of Height

Low Head Pruning	0.7m-0.9m
Medium head Pruning	0.9m-1.2m
High Head Pruning	More than 1.2m

## 9 Methods of Pruning:

- ✓ Thinning Out
- ✓ Heading Back
- ✓ Disbudding or Rubbing off
- ✓ Pinching and Topping

## 10 Technique of training and their timings

Sl. No.	Crop	Time	Technique
1	<b>Apple</b>	Late winter	Light thinning coupled with heading back.
2	<b>Peach</b>	Late winter (Dec-Jan)	A combination of thinning out and heading back.
3	<b>Plum</b>	Late winter (Dec-Jan)	A combination of thinning out and heading back.
4	<b>Grape</b>		
	<b>North India</b>	Late winter (Jan)	Heading back of cane.
	<b>South India</b>	Summer pruning (Aug)	Heading back to one or two buds which is almost thinning out.
		Winter pruning (Sept-Oct)	Heading back to cane.
5	<b>Mango</b>	After harvest	Thinning.
6	<b>Phalsa</b>		
	<b>North</b>	Late winter early spring	Heading back.
	<b>South</b>	Dec-Jan	Heading back.
7	<b>Ber</b>	Summer (April-May)	Heading back and thinning out of old branches.

## 11 TOP WORKING

It is a **technique or method of rejuvenation** where in the objective is to **upgrade seedling plantations of inferior varieties** with **superior commercial cultivars or hybrids** suitable for domestic or export market or the desired variety of the grower. Eg **Cashew tree**.

## 12 Maturity Indices of Fruits

Symptoms which indicate that fruits are ready to harvest

Mango	<ul style="list-style-type: none"><li>• Specific gravity of fruits ranges <b>between 1.01 to 1.02</b>.</li><li>• TSS reaches <b>11-15 Degree Brix</b>. (Degrees <b>Brix</b> (symbol °Bx) is the sugar content of an aqueous solution. One-degree <b>Brix</b> is 1 gram of sucrose in 100 grams of solution and represents the strength of the solution as percentage by mass)</li></ul>
Banana	<ul style="list-style-type: none"><li>• Pulp peel ratio reaches <b>1.2 - 1.6</b>.</li><li>• Days taken from shooting, i.e., <b>3.0-3.5</b> months.</li></ul>
Grape	<ul style="list-style-type: none"><li>• Grape is harvested when they reach a TSS of 16 to 24% depending on variety.</li></ul>
Papaya	<ul style="list-style-type: none"><li>• For long distance transport: When the skin colour changes from green to yellow to the extent of <b>6%</b>.</li></ul>
Pineapple	<ul style="list-style-type: none"><li>• For local market: When 25% of surface changes to yellow colour.</li><li>• For long distance: When all the eyes are still green and have no trace of yellow colour (75 - 80% maturity).</li></ul>
Jackfruit	<ul style="list-style-type: none"><li>• A dull, hollow sound is produced when the fruit is tapped by the finger, aromatic odour</li></ul>
Pomogranate	<ul style="list-style-type: none"><li>• The fruits are ready for harvest between <b>135-170</b> days after anthesis.</li></ul>
Citrus	<ul style="list-style-type: none"><li>• The International Standards Organization has set in <b>minimum juice content of citrus as follows</b>:<ul style="list-style-type: none"><li>• Washington navel oranges 30%</li><li>• Other orange varieties 35%</li><li>• Grape fruit 35%</li><li>• Mandarin orange 33%</li><li>• Lemons and limes 25%</li></ul></li></ul>

## 13 Agronomic practices and production technology of important fruits and vegetable

### MANGO

#### Field preparation

Dig pits of 1 m x 1 m x 1 m fill in with topsoil mixed with 10 kg of FYM and 100 g per pit.

#### Spacing

- Adopt any one of the following spacing depending on requirements.
- Under conventional system of planting: 7-10 m either way

- High Density Planting: 5m x 5 m (400 plants /ha)
- Double hedge row system: Adopt a spacing of 5m x 5m within double rows and 10m between successive double rows (266 plants/ha)

### Planting

Grafts are planted in the center of pit with ball of earth intact followed by watering and staking. The graft union must be 15 cm above the ground level.

### Growth regulators

- NAA @ 20 ppm is sprayed at flowering to increase the fruit retention.
- Spraying of 2% KNO<sub>3</sub> at mustard size will increase the fruit set and retention of fruits.
- Application of Paclobutrazol @ 10 g i.e. for non-bearing trees during first fortnight of September will induce flowering and fruit set yield during off years

### Important points

**Varieties:** Some of the important varieties of Mango are as follows-

<b>Alphonso</b>	<ul style="list-style-type: none"> <li>• Best export variety</li> <li>• Susceptible to SPONGY TISSUE</li> <li>• Grown in Maharashtra, Goa</li> </ul>
<b>Chausa</b>	Sweetest, LATE, variety grown in North India
<b>Banganpalli</b>	<b>Patented</b> variety of Andhra Pradesh
<b>Bombay Green</b>	EARLIEST variety of North India
<b>Kesar</b>	Good processing variety of Gujrat
<b>Langra</b>	North Indian variety with turpentine flavor
<b>Niranjan</b>	Off season variety
<b>Lal Sindhuri</b>	Ideal for long transport
<b>Fazli</b>	Bihar & west Bengal
<b>Dashahari</b>	UP

### Hybrid varieties

#### i) Amrapali:

- This hybrid is from a cross of **Dashehari x Neelum**.
- It is dwarf, regular bearing and late maturing variety.
- The variety is suitable for HDP, plants may be planted in a hectare.

#### ii) Mallika:

- It is from a cross of Neelum x Dashehari.
- Its fruit is large in size, oblong elliptical in shape
- Cadmium yellow in colour.



- iii) **Arka Aruna:**
  - It is a hybrid between Baganpalli and Alphonso.
- iv) **Arka Puneet:**
  - It is a hybrid between **Alphonso and Baganpalli**.
  - Fruits are medium sized having attractive skin colour with *red blush and free from spongy tissue*.
  - Excellent keeping quality.
- v) **Arka Anmol:**
  - This hybrid cross of **Alphonso and Janardhan Pasand**.
  - It is regular bearer and good yielder.
  - *Free from spongy tissue*.
- vi) **Arka Neelkiran:**
  - It is a hybrid between Alphonso and Neelum.
  - It is, regular bearing late season variety with medium sized fruits having attractive red blush free from spongy tissue.
- vii) **Ratna:**
  - This hybrid is from a cross of **Neelum x Alphonso**.
  - Tree vigorous, precautions, fruits are medium sized, attractive in colour and free from spongy tissue.
- viii) **Sindhu:**
  - It is from a cross of **Ratna x Alphonso**.
  - It is regular bearer, fruits medium sized, free from spongy tissue with high pulp to stone ratio and very thin and small stone.
- ix) **Au Rumani:**
  - It is from a cross of **Rumani x Mulgoa**.
  - It is precocious, heavy and regular bearing with large fruits having yellow cadmium skin colour.
- x) **Manjeera:**
  - This hybrid is from a cross of **Rumani x Neelum**.

### Disorders

- ✓ Alternate bearing
- ✓ Mango malformation
- ✓ Black tip
- ✓ Clustering (Jhumka)
- ✓ Spongy tissue

### Pest and Diseases

- ❖ **Mango hopper (*Amaritodus atkinsoni*)** Spray phosalone
- ❖ **Nut weevil (*Cryptorrhynchus mangiferae* and *C.gravis*)** General cleanliness in the orchard, destroying the adults in the bark crevices and holes and spraying with Fenthion 0.1%
- ❖ **Stem borer (*Batocera rufomaculata*)** Padding with monocrotophos

- ❖ **Fruit fly (*Dacus spp*)** Plough the inter spaces to expose pupae. Monitor with Methyl Eugenol traps.
- ❖ **Powdery mildew (*Oidium mangiferae*)** Apply sulphur dust
- ❖ **Anthracnose and stalk and end rot (*Collectotrichum gloesporioides*)** Spray Mancozeb
- ❖ **Sooty mould (*Capnodium sp*)** Spray Dimecron

### APPLE (*Malus pumila*)

Important Varieties of Apple

SEASON	Himachal Pradesh	J n K	Uttarakhand
Early season	Tydemans early	Irish Peach	Shanburry, Chaubatia princess
Mid-Season	Starkling Delicious, Red Chief, Red Gold	Jonathan, Rome Beauty, American Mother	Mcintosh, Cortland
Late season	Winter Banana, Granny smith	Lal Ambari, King Pippin, Yellow Newton	Rymer, Buckingham

### Root stocks of Apple

These stocks are used for propagation

Dwarf	M 9
Semi Dwarf	M 4, M 7
Semi Vigorous	MM 111
Vigorous	Merton 793

### Diseases:

- **Crown Gall** – *Agrobacterium tumefaciens* (Bacteria)
- **Fire Blight** – *Erwinia amylovora*
- **Apple Scab**- *Venturia subinaequalis* (Fungi)

### Banana (Apple of paradise)

#### Cultivars of Banana

Cultivars	Genome	Remarks
Dwarf Cavendish	AAA	Contributes to 58% of total Banana Production
Robusta	AAA	Semi Tall Plant
Grand Naine	AAA	Tall Mutant of Dwarf Cavendish
Rasthali	AAB	Table Banana
Poovan	AAB	Pink Pigmentation
Nendran	AAB	Used for Culinary Purpose
Red Banana	AAA	Grown in Kerala, Tamil nadu
Monthan	ABB	Used for Chips

❖ **Physiological disorders**

- ✓ Kottavazhai
- ✓ Hard lump
- ✓ Bunchy top
- ✓ Panama wilt
- ✓ Sigatoka leaf spot disease
- ✓ Moko wilt (*Pseudomonas solanacearum*)-Bacterial Disease
- ✓ Tip over or heart rot (*Erwinia carotovora*)- Bacterial Disease

• **Yield (t/ha/year)**

- Poovan – 40-50
- Monthan – 30-40
- Robusta – 50-60
- Dwarf Cavendish -50-60

**CITRUS**

All the edible fruits of citrus come under subgenus *Eucitrus* which can be divided into 5 horticultural groups.

**1. Acid group:**

- ❖ Acid lime: *Citrus aurantifolia*
- ❖ Tahiti or Persean lime: *Citrus latifolia*
- ❖ Rangpur lime: *C. limonia*
- ❖ Lemon: *Citrus limon*
- ❖ Rough lemon: *C. jambhiri*
- ❖ Citron: *C. medica* (Kidarankai in Tamil, used for pickling)
- ❖ Sweet lime: *Citrus limettoides*

**2. Orange group:**

- ❖ Sweet orange: *Citrus sinensis*
- ❖ Sour orange: *Citrus aurantium*
- ❖ Multiple leaf orange: *C. multifolia*
- ❖ Japanese summer grape fruit: *C. natsudaidai*

**3. Mandarin group: (loose jacket)**

- ❖ Coorg mandarin, Nagpur
- ❖ Santra and Kodai orange
- ❖ Japanese Satsuma mandarin: *C. unshiu*
- ❖ Willow leaf mandarin: *C. deliciosa*
- ❖ King mandarin: *C. nobilis*
- ❖ Kinnow mandarin: King x willow leaf
- ❖ Tangerine orange var Dancy
- ❖ Reticulata




**4. Pummelo and grape fruit group:**

- ❖ Pummelo: *C. grandis*
- ❖ Grape fruit: *C. paradisi*
- ❖ Kumquat: *Fortunella* sp.

**5. The fifth group consists of mainly hybrids of different citrus fruits with trifoliolate orange**

- ❖ (*Poncirus trifoliata*) and mainly used as rootstock.
- ❖ Citrange (*Poncirus trifoliata* x *C. sinensis*) var. Troyer, var. Carrizo
- ❖ Citrangor (*Citrange* x *C. sinensis*)
- ❖ Tangelo (*Tangerine* x grape fruit)
- ❖ Citrangequat (*Citrange* x kumquat)

**Major difference between three groups-**

Features	MANDARIN ( <i>Citrus reticulata</i> )	SWEET ORANGE ( <i>C. Sinensis</i> )	KAGZI LIME ( <i>C. aurantifolia</i> )
			
Varieties	Laddu, Coorg Kinnow- Cross between- <i>King sweet x Willow Leaf mandarins</i> developed by HB Frost, USA	Satgudi, Blood red, Pine apple, Mosambi, Valencia	Chakradhar-Seedless variety of acid lime Pramalini, Mithachikna, Sai sarbati- <i>Tolerant to Tristeza and canker</i>
Propagation	Root stock for propagation - Troyer citrange	Rangpur lime best root stock	Propagation by seeds
Other	Presence of Rind special	Pre-Harvest fruit Drop is a	Known as acid lime or sour


features	kind of fruit skin	major problem;	lime
Other features		T- budding or Patch Budding are most common method for sweet orange.	Indicator plant for Tristeza Susceptible to Citrus Canker




- ❖ **Mandarin orange:** The group of orange is otherwise called **Kamala orange**. Nagpur santra of Maharashtra, Coorg of Karnataka and Kodai orange of Tamil Nadu. This group is characterized by the loose skin of fruits.
- ❖ **Spacing:** 6 x 6 m pit size 75 cm<sup>3</sup> planting during May-June and September – October. **Yield:** 15-20 t/ha/yr.
- ❖ **Kodai Orange** (*Citrus reticulata*), **Nagpur Santra** (*Citrus reticulata*), **Coorg** (*Citrus reticulata*), **Sastuma Mandarin** (*Citrus unshiu*) (Japan), **King Mandarin** (*Citrus nobilis*)(USA), **Kinnow (King x Willow leaf)** - It is a hybrid between king and willow leaf mandarins.  
It was developed by Dr. H.B. Frost at citrus Experiment Station, California 1915
- ❖ **Karna khatta** (*Citrus karma*)  
It is extensively used as a root stock in North India used in T-budding.  
The February flowering is known as ambe bahar;  
June flowering as mring bahar and flowering as hast bahar.

### Physiological Disorder

- ❖ **Fruit Cracking**  
It is due to sudden changes in temperature and also due to moisture stress condition.
- ❖ **Granulation-**  
The juice vesicles become hard, enlarged and turn opaque grayish in colour.
- ❖ **Sunburn or sunscald**  
The portion that is exposed to sun develops yellow patches which turn brown
- ❖ **Citrus Decline**  
Citrus Die back due to copper deficiency
- ❖ **Little Leaf & Exanthema**  
Due to copper deficiency

### Insect & Pest

Physiological Disorder	Insect and Pest	Insect and Pest
<b>Granulation-</b> Due to high temp. and RH As a safety measure spray Lime	<b>Greening Disease – vector -</b> Diaphorina citri	

<b>Exanthema</b> - Due to deficiency of Copper	<b>Leaf Minor</b> - Phyllocnistis citrella (vector of citrus canker)	
<b>Yellow leaf Citrus</b> - Mo deficiency	<b>Lemon butterfly</b> - Papilo demoleus (Controlled by bagging of fruits)	
<b>Die Back</b> - Cu deficiency	<b>Fruit sucking Moth</b> (Othreis fullonica) only adult suck juice Moth is host on Tinospora weed	
<b>Little Leaf</b> - Cu deficiency		

## Papaya

### Important Points Related to Papaya

- ❖ Papaya is Polygamous plant i.e. Bearing some flowers with stamens only, some with pistils only, and some with both, on the same or different plants.
- ❖ It is **Tropical fruit**
- ❖ **Caricaxanthin** - Yellow Pigment in Papaya
- ❖ **Papain**- Enzyme present in papaya for marinating meat and meat products
- ❖ **Pepsin**-Dried latex of Papaya contains his enzyme
- ❖ Dioecious varieties of Papaya 10% male plants are planted
- ❖ **Carpine**- Utilized as Diuretic
- ❖ Propagation of plants by **seeds**
- ❖ Seed Rate for Gynodioecious (**Gynodioecy** is the evolutionary intermediate stage between hermaphroditism (exhibiting both female and male parts) and dioecy (having two distinct morphs: male and female variety) - **250-300gm/ha**
- ❖ Seed Rate for Dioecous) (Plant in which male and female reproductive parts occur in different plants) - **400-500gm/ha**.
- ❖ **Pusa Nanha** (important variety of dwarf papaya) Spacing is **1.25 x 1.25 sqm** used in high density planting with 6000 plants per hectare.
- ❖ **Frost**- the most limiting factor in papaya cultivation, also susceptible to Water logging.

### Important varieties:

Gynodioecous	Dioecous
Sunrise solo-pink flesh	Pusa nanha
Taiwan-red flesh	Pusa giant (used for canning)
Surya	Hatrasgold
Pusa delicious	
Pusa majesty, coorg honey dew	

#### Disease:

- ❖ Stem rot / Foot rot / damping off – *Pythium aphanidermatum*
- ❖ Powdery mildew – *Oidium caricae*
- ❖ Papaya ring spot – Papaya ring spot virus
- ❖ Leaf curl – Papaya leaf curl virus- Spread by whitefly *Bemisia tabaci*.
- ❖ Anthracnose – *Colletotrichum gloeosporioides*
- ❖ Foot Rot of Papaya (***Pythium aphanidermatum***)

#### Pomogranate (*Punica granatum*)

- **Origin-** Iran
- **Bahar treatment** (flower regulation) flowering season

a) Ambe bahar (Jan-Feb)

b) Mrig bahar (June-July)

c) Hasta bahar (Sep-Oct)

#### Process

- In this treatment, the irrigation is withheld 45 days prior to the flowering.
- This facilitates the shedding of leaves.
- **Spray Ethrel 2** to 2.5ml/lit of water for leaf shedding
- The trees are then medium pruned 40-45 days after withholding irrigation.
- The recommended doses of fertilizers are applied immediately after pruning and irrigation is resumed. This leads to flowering and fruiting.
- Among three bahars, ***hasta bahar is recommended*** as the bacterial blight incidence will be low and fruits will be good quality and are exported.

#### Varieties

<b>Jalore Seedless</b>	Rajasthan
<b>Ganesh</b>	Selection from Alandi variety, Maharashtra
<b>Arakta</b>	Suitable for Processing

<b>Mridula</b>	Cross of Ganesh x Gul-a-Shah
<b>Ruby</b>	Hybrid of 3-way cross from IIHR Bangalore ( <i>Don't confuse with Arka ruby which is a variety of Tomato</i> )
<b>Jyoti</b>	Bassein seedless x Dolka
<b>Dolka</b>	Gujrat
<b>Bhagwa</b>	Also known as Sinduri due to its bright red colour. It is leading variety of Pomogranate
<b>Amlidana</b>	Ganesh x Nanha
<b>Wonderful</b>	USA

### Propagation

- ❖ Stem cutting and Air layering (Gootee)

### Disease

- ❖ Bacterial Blight / Nodal blight/ Black spot -Caused by *Xanthomanas axonopodsi*

### Insect-Pest

- ❖ **Anar Butterfly** – *Virachola Isocrates* managed by covering fruits with butter paper.
- ❖ **Fruit fly**- *Batrocera zonata*

### Physiological Disorder

- ❖ **Fruit Cracking** due to Ca, B & K deficiency

## Grapes

### Important points

- ❖ **Tartaric acid** is present in grapes
- ❖ **Bower system** – training system of grapes
- ❖ **Hard wood cutting**- propagation method in grapes
- ❖ **Magnesium** – element that is universally deficient in grapes
- ❖ **NAA**- Chemical use to reduce post-harvest food drop
- ❖ **Thompson seedless**- and its clone occupies 55% area under grape cultivation

### Varieties

Varieties	Features
<b>Thompson seedless</b>	The <b>sultana</b> is a "white" (pale green), oval seedless grape variety also called the <b>sultanina, Thompson Seedless</b>
<b>Anab-e-shahi</b>	A variety of grape with seeds-black colour
<b>Arka Hans</b>	It is a cross between Bangalore Blue and Anab-e-Shahi,used for



	making white wine
<b>Arka Kanchan</b>	Arka Kanchan is a cross between Anab-e-Shahi and Queen of the Vineyard
<b>Muscat</b>	The <b>Muscat family of grapes</b> include over 200 grape varieties belonging to the <i>Vitis vinifera</i> species that have been used in wine production and as raisin and table grapes
<b>Arka trishna</b>	Cross between Bangalore Blue and Convent Large Black
<b>Dilkhush</b>	

The following are the examples of coloured/white seeded/seedless:

<b>Coloured seeded</b>	Bangalore Blue, Gulabi (Muscat)
<b>Coloured seedless</b>	Beauty Seedless and Sharad Seedless
<b>White seeded</b>	Anab-e-Shahi, Dilkhush (clone of Anab-e-Shahi)
<b>White seedless</b>	Perlette, Pusa Seedless, Thompson Seedless, and its clones Tas-A-Ganesh, Sonaka and Manik Chaman

**Important disease:**

- ❖ **Downy mildew**- plasmophora viticola
- ❖ **Powdery mildew**- erysiphe viti

**Important physiological disorder:**

- ❖ **Hen and chicken disease** - Boron deficiency
- ❖ **Berry drop** – improper pollination
- ❖ **Pink berry** - high temperature (common in Thompson seedless)

## Vegetables

Classification of vegetables **based on their life cycle**

Life cycle	Example
<b>Annual</b>	Tomato, brinjal, ladyfinger
<b>Biennial</b>	Cabbage, radish, carrot, cauliflower, onion
<b>Perennial</b>	Ginger, garlic

## Tomato

**Important points related to tomato**

- ❖ Seed rate -**350-400g/ha** for normal tomato and 100-150g/hac for hybrids
- ❖ Important varieties – **pusa ruby, arka vikas, pusa Gaurav, arka vikas, pusa sheetal, roma, hisar lalit (nematode resistant)**
- ❖ **Leaf curl** diseases is transmitted by white fly (*bemisia tabaci*)
- ❖ Major paste of tomato is fruit borer (*helicoverpa armigera*)
- ❖ **Red color** in tomato is due to lycopene
- ❖ Fruit cracking in tomato is due to boron deficiency
- ❖ **Blossom end rot (BER)** is due to calcium deficiency
- ❖ Flavr savr is biotechnologically develop tomato in 1994 by calgene company

### Brinjal

Long Varieties	Round Varieties	Oval varieties	Hybrids
Pusa purple long	Pusa Purple Round	Arka Navneet	Pant Rituraj
Pusa purple cluster	Pant Rituraj	Pusa Uttam	Pusa Bindu
Azad Kranti	Punjab Bahar	Dudhia	Pusa Upkar
Arka Keshev	Arka Kusumaker	BH-2(F1).	Pusa bhairav
Arka Shirish	T-3	Arka Navneet	Arka Navneet
Pusa Hybrid-5	Pusa Purple Round	Pusa Uttam	Arka neelkantha
Arka Keshev	Pant Rituraj	Dudhia	Arka Keshav

- ❖ Seed Rate- 200g/ha

### Important Insect-Pest

- ✓ **Shoot and fruit borer:** *Leucinodes orbonalis* - Cause Dead Heart
- ✓ **Hadda / spotted beetle:** *Henosepilachna dodecastigma*
- ✓ **Ash weevils:** *Myloccerus subfasciatus*
- ✓ **Brown leafhopper:** *Cestius phycitis*- Vector of Little leaf of Brinjal)

### Chilli

#### Important Points

- ❖ Seed Rate- **capsicum longum-1.0-1.5 kg/ha**, For **Capsicum annum- 250gm/ha**
- ❖ Red colour of chilli due to **Capcyanthin**
- ❖ Pungency in chilli is due to **Capsaicin**
- ❖ Major Pest iss Thrips (*Scirtothrips dorsalis*)
- ❖ Chilli mosaic virus transmitted by ***Bemisia tabaci***

#### Important Varieties

Long Pungent	Local Varieties	Vegetable Varieties	Hybrid Varieties
Pusa jwala	Bayadgi chilli	California wonder	Hyb-5-1-52
Sankeshwari	Walha	Arka mohini	Hyb-17-1-1
NP-46A	Malkapuri	Arka gaurav	
Bhaskar		Yolo wonder	
Arka lohit			

## Okra (Bhindi)

### Important Points Related to Okra

- ❖ Seed Rate- Varieties- 8kg/ha, Hybrid- 2.5 kg/ha
- ❖ Spacing- 45cm x 30 cm

### Important Diseases, Insect and Pest

#### Yellow vein mosaic virus

- ❖ Spray systemic insecticides like Methyl demeton or Dimethoate @ 2 ml / l to kill the insect vector, whitefly.
- ❖ Mylabris pustulata is pest of okra
- ❖ Yield 12-15 kg/ha
- ❖ **Important Varieties**

▪ Pusa sawani
▪ Varsha Uphar- White fly resistant
▪ Pusa Makmali
▪ Arka Anamika
▪ Prabhani Kranti- White fly resistant
▪ Pujab Padmini, Arka Abhey

## Cole Crops

Cruciferous vegetables are vegetables of the family Brassicaceae also commonly called as cole crops.

### Important points related to cole crops

- ❖ All cole crops are Protogynous (it can change from female to male)
- ❖ DBM-Diamond Black Moth (*Plutella xylostella*) is major pest of cole crop, particularly in Cabbage

- ❖ Club rot of Cauliflower is due to *Plasmodiphora brassicae* (@ Ph 5.7 club rot is 100%)
- ❖ Self- Incompatibility (Self-incompatibility (SI) is a general name for several genetic mechanisms in angiosperms, which prevent self-fertilization and thus encourage outcrossing and allogamy) is most common in Cruciferae Family
- ❖ Characteristics flavor of cole crops is due to **Di methyl tri sulphate**
- ❖ White rust is common in Crucifers caused by ***Albugo Candida***
- ❖ **Curd rot/soft rot of cole crops is due to *Erwinia carotovera***
- ❖ *Plusia orichalcea* - Cabbage semi looper

Cabbage	Cauliflower
❖ Seed rate- <b>500-750 gm</b>	❖ Seed rate- <b>450-700gm</b>
❖ Eatable part- <b>Head</b>	❖ Eatable part- <b>Curd</b>
❖ Anti-cancer compound-Indole 3 carbinol	❖ Scooping- Removal of Central portion of curd for earlier initiation of flower stalk in cauliflower
<p><b>Early varieties:</b></p> <ul style="list-style-type: none"> <li>❖ Golden Acre: It has compact and round head.</li> <li>❖ Pride of India: It is one week late than Golden Acre. Head weight is 1 to 2 kg.</li> <li>❖ Copenhagen Market It is late by one week than Pride of India.</li> </ul> <p><b>Late varieties:</b></p> <ul style="list-style-type: none"> <li>❖ Pusa Drumhead</li> <li>❖ Hybrid</li> <li>❖ Hari rani, Kaveri etc</li> </ul>	<p><b>Early Varieties</b></p> <ul style="list-style-type: none"> <li>❖ Pusa early synthetic</li> <li>❖ Pusa deepali</li> <li>❖ Pusa katki</li> <li>❖ Pusa sharad</li> <li>❖ Late Vriety</li> <li>❖ Pusa snow ball</li> <li>❖ Pusa himmjyoti</li> </ul> <div style="border: 1px solid blue; padding: 5px; display: inline-block; margin-left: 20px;">Self-Blanched Variety</div> <p><b>Blanching</b> - Retaining white colour of curd not becoming yellow</p>

❖ **Popular Disorders in Cauliflower**

Buttoning- Small curd	Nitrogen Deficiency
Hollow stem and curd	Excess Nitrogen
Whiptail	Mo deficiency
Riceyness - Velvety appearance of curds	Heavy Humidity, Nitrogen, temperature

## Cucurbits

Belonging to family to cucurbitace like Pumpkin, Cucumber, water melon, musk melon

<b>Pumpkin</b>	<b>Cucumber</b>	<b>Water melon</b>	<b>Musk melon</b>
Seed rate - 1kg/ha	2.5kg/ha	4-4.5 kg/ha	1.5 - 2kg/ha
Red pumpkin beetle- <i>Raphidopalpa foecicollis</i>	Pillow disease due to calcium deficiency	Bud necrosis-Aphids	Harvested <b>at full slip</b> stage except Hara madhu variety.
Fruit fly – <i>Batrocera cucurbitae</i>	Vector of cucumber mosaic virus-Aphid	Heavy dull sound when tapped indicates maturity	
<b>Varieties:</b> Arka chandan, Pusa viswas, Arka Suryamukhi, Arka chanada,	<b>Varieties:</b> Pusa sanyog, Japanese long green, Straight Eight and Poinsettee	<b>Varieties:</b> Sugar Baby and Arka Manik, PKM 1 <b>Hybrids:</b> Arka Jyoti and Pusa Bedana.	<b>Varieties:</b> Pusa Sharbati, Hara Madhu, Durgapura Madhu, Arka Rajhans and Arka Jeet.

<b>Bottle gourd</b>	<b>Cow pea</b>	<b>Cluster bean</b>	<b>Pea</b>
Seed rate - 3-6kg/ha	20-25 kg/ha	15-20 kg/ha	60-80kg/ha
Varieties - summer prolific Round, summer prolific long, Pusa Navven, Arka Bahar, Pusa Manjiri, Pusa Meghdoot	Pusa phalguni, Pusa Barsati, Pusa dofasali, Pusa Komal	Pusa Mausmi, Pusa sadabahar and Pusa Naubahar	<b>Early Variety:</b> Early Bejar, Arket.  <b>Mid-season:</b> Bonevilla, Jawahar.