

# Principle and Practices of Fruit Crop Production

Class 9

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**Technical and Vocational Stream**

**Learning Resource Materials**

**Principle and Practices of Fruit Crop Production**

**(Grade 9)**

**Secondary Level**

**Plant Science**



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*Krishi Master Nepal*

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# UNIT 1 : Introduction

## A. Objectives

This unit will enable the students to:

- Define the meaning of horticulture with their branches
- Describe the importance and scope of horticulture
- Explain the types of Fruit crops

## B. Content Elaboration:

### 1. 1. Meaning and Definition of Horticulture and its branches

The term, horticulture is derived from two latin words i. e. *hortus* means garden and *cloure* means cultivation. Horticulture is considered both an art and a science. It is an art because it is rooted in ancient times and involves practices that are basis for our social culture. The design and placement of different horticultural plants in formal garden is an art which give an aesthetic sense. Bonsai culture has been developed which is an art and is admired by thousands of people. The raising of plants in such system and maintaining them properly involve scientific principles and techniques; therefore it is a science too.

*Horticulture is the branch of agriculture science which deals with the production, management and marketing of fruits, vegetables, floriculture etc.*

### 1. 2. Main Branches of Horticulture

#### 1. Pomology

It deals with the production, management and care of different fruit crops.

#### 2. Olericulture

It deals with practice and cultural management required for successful production of vegetable crops and their seeds.

#### 3. Floriculture

It is another important branch of horticulture in which flowering plants are usually deals for flower production.

#### 4. Post Harvest Technology

It deals with the practice and methods used in prolonging shelf life of flowers, fruits, vegetables, species and plantation crops.

### **1. 3. Importance and Scope of Horticulture**

**The importance of Horticulture are as follows**

**a. Economic importance**

Horticultural crops are cultivated by adopting high technology which produce high quality fruit that always gets high price in the market. The price of fruits is always higher than cereals and another agronomic crops.

**b. Nutritional importance**

It provides all human nutrition like protein, vitamins, carbohydrates, fats, minerals.

**c. Industrial Importance**

Various processed products like jam, jelly, liquors, etc. are prepared from different types of fruits and plantation crops; for this purpose industries are needed.

**d. Environmental Importance**

Fruit trees absorb CO<sub>2</sub> and other harmful gasses dust from environment. It also helps to prevent soil from erosion and landslide and conserve soil.

**e. Medicinal Importance**

Many fruits and plantation crops have got medicinal value. They are used to manufacture medicines. E. g. Papaya, Amala, Guava

**f. Religious Importance**

Most of the fruits are used to worship gods and goddess.

**g. Aesthetic Importance**

Orchards are also sometimes a feature of large gardens, where they serve an aesthetic as well as a productive purpose.

**The Scope of Horticulture are as follows**

- a. Nepal has a great climatic variation from east to west and north to south. Due to this climatic variation, different types of horticultural crops can be cultivated in different regions of the country.
- b. The production in remote areas are organic in nature due to unavailability of inorganic inputs as well as farmer economic condition. At present, there is a huge market for organic products.
- c. Ginger of Nepal are very popular in Nepal, Pakistan and Bangladesh. **1. 4.**

#### **Types of Fruit Crops found in Nepal**

##### **a. Tropical Fruits**

- Tropical zone comprises terai and inner terai. The altitude ranges from 70650masl.
- Large number of fruit crops are produced in this zone.
- Mango, Litchi, Pineapple, Jackfruit, Banana, Papaya are common in this Zone.
- Similarly, Bayer, Amala, Pomegranate etc are produced in Semicommercial scale.

##### **a. Sub-Tropical Fruits**

- Sub-Tropical zone mainly covers the mid hills of the country.
- The altitude ranges from 650 to 1450 masl.
- Sub-Tropical zone is suitable for citrus species i. e. sweet orange, mandarin orange, lemon etc.

##### **b. Warm-Temperate Fruits**

- Warm-Temperate zone cover upper part of mid-hills.
- The altitude ranges from 1450-2100 masl.
- Peach, plum etc are major corps for this region.
- Pear has been selected as commercial fruit in this region.

##### **c. Temperate Fruits**

- Temperate zone covers from the high hills to mountains.

- The altitude ranges from 2100-3000 masl.
- Apple and nuts (i. e. wall nuts, ground nuts) are grown for commercial purpose.

### **A. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

### **B. Assessment**

#### **Very Short Questions**

1. Define Horticulture.

#### **Short Question**

1. Write any two importance of horticulture in Nepal.

### **GLOSSARY**

**Cereals:** A grain used for food, for example rice, wheat, maize etc.

**Masl:** Meters above sea level

## **UNIT 2 : Climate**

### **A. Objectives**

Upon the completion of this unit, the students will be able to:

- Explain the environmental factors affecting fruit production

- Describe the role of climate on fruit crop distribution in Nepal

## **B. Content Elaboration**

### **2. 1. Environmental Factors affecting fruit crop production**

All crops require suitable environmental condition for people growth and development. There are various environmental factors without which plant cannot survive. They cannot produce optimum yield in absence of those factors.

Some of the environmental factors affecting fruit production are as follows:

#### **Temperature**

Temperature is one of the most important environmental factors for crop growth. Every fruit crop requires well defined range of temperature for proper growth and development. Increase and decrease in temperature may cause adverse effect for fruit production. High temperature destroys protoplasm of cell which retards the growth of plant. It increases the rate of temperature and plant may wilt. Due to high temperature fruit and flower may drop. High temperature may cause sun borne and sun scald disease.

Low temperature kills the buds, blossoms, inflorescences and terminal part of most of the fruit trees. It also causes bark and trunk splitting. If there is cold yellowing of leaves and blacking fruits are observed in banana.

#### **Light**

It is also one of the most important factors of environment. Plant absorbs different intensities of light for its growth and development. Flowering, fruiting quality of fruits also depends upon the intensity and duration of light absorbed by plants. Plants exposed to sunlight give better quality of fruits. Light also plays an important role for the process of photosynthesis. It also plays an important role in colour development.

#### **Rainfall and Humidity**

Optimum atmospheric humidity and rainfall is also important factor of environment for proper growth and development of fruit crops. High humidity with increasing temperature favours the growth and development of certain fruits like papaya, banana, etc. Low atmospheric humidity may cause disease infection and insect pest infection.

## **Wind**

Strong wind damages the shoots. Crops and trees with shallow roots are uprooted. Cold wind causes chilling injuries.

## **Snow**

With the snow cover, diseases that over-winter on leaves, such as leaf spot, leaf scorch, and powdery mildew on strawberries, downy mildew on grapes, and apple scab will be more prevalent in snow. With a prolonged snow melt, there is a good chance that soils will be saturated for extended periods of time and create conditions conducive for the development of soil borne root rots caused by *Phytophthora*, *Pythium*, or *Verticillium* wilt, particularly when they have been planted on soils that are not well drained. With the heavy snow pack that has accumulated, especially in areas with high drifts, there is a risk of limb breakage in fruit trees.

## **Hailstorm**

Hail can injure fruit's shoots, and limbs. The extent of the injury usually depends on the size and shape of the hail and the duration of the event. Injury can range from torn or shredded leaves and small dents that don't break the fruit skin to effects so severe that an entire crop is lost due to physical damage. In some cases, replacement of trees is necessary, especially when young trees have significant bark injury. Fungicide protection of injured tissues may be necessary immediately after a hailstorm to prevent fungal colonization of wounds.

## **2. 2. Role of climate on fruit crop distribution in Nepal**

Rising temperatures and an uncertain rainfall challenges for distribution of fruit crops in Nepal. Similarly, strong wind as well as hail storm are also responsible for the fruit crop distribution in Nepal.

### **A. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

### **B. Assessment**

#### **Very Short Questions**

1. List any two environmental factors affecting fruit production.

2. What do you mean by hailstorm?

### Short Questions

1. How does temperature affect fruit production?

### Long Question

1. How do the environmental factors affect fruit production? Explain.

### GLOSSARY

**Temperature:** It is the degree of hotness or coldness of a body.

**Snow:** It is an atmospheric water vapor frozen into ice crystals and falling in light white flakes or lying on the ground as a white layer.

**Humidity:** A quantity representing the amount of water vapor in the atmosphere or in a gas.

**Hailstorm:** A storm that produces hail (balls of ice that fall like rain)

## UNIT 3 : Home Garden

### A. Objectives

Upon the completion of this unit, the students will be able to:

- Define home garden and kitchen garden
- Differentiate between home garden and kitchen garden

### B. Content Elaboration

#### 3. 1. Definition of Home Garden, difference between Home garden & Kitchen garden

##### Home Garden

- An ornamental garden specially prepared just for the beautification of a residential house, can ideally be called as a home garden

- It includes different designs and techniques for perfect beautification
- Home garden is the art of organizing and enriching outdoor space with plants and structures for aesthetic and practical purposes **Kitchen Garden**
- A limited area available near the house is called kitchen garden. The main purpose of the kitchen garden is to provide the family with fresh vegetables
- In Kitchen garden desired crops can be cultivated for consumption
- It involves growing and caring for plants in the ground

### **3. 2. Criteria of Selection of fruit crops for home garden**

Growing fruit trees in the home garden can be a very interesting and challenging hobby. There are several things should be considered for the selection of fruit crops for home garden.

#### **Location within the garden**

Fruit trees should be carefully located in the garden for maximum exposure to full sunlight. Wet spots or poorly drained areas should be avoided as well as windy corners or areas where snow accumulations may be excessive. Fruit trees will grow well on a wide range of soil types if the soil is adequately drained. If possible, use tile under-drains to improve the natural drainage. Ridging and elevating the fruit tree area above the lot level improves depth of rooting and water movement in heavy soils.

#### **Soil management**

The soil should be thoroughly prepared before planting. Ploughing or digging up the soil and incorporating organic matter is helpful. Well-rotted manure, compost, or peat moss will improve the soil structure and increase the moisture-holding capacity. After planting, other organic matter such as old straw, hay, lawn clippings, sawdust and wood shavings may be applied as a mulch under the tree.

#### **Buying fruit trees**

Well-grown, one-year-old trees are preferable to poorly-grown, two-year-old trees. One-year-old trees should have a well-grown main stem, while two-year-old trees should be well branched. Both should have good fibrous root systems. Peach and cherry trees are normally planted as one-year-old branched trees.

#### **Choice of Cultivars**

There are several fruit cultivars for home garden use, however not all nurseries will carry a large supply of different cultivars. Start with some of the common commercial cultivars, but may wish to try lesser known cultivars that may have a special purpose, such as good freezing attributes, or some other special quality.

### **C. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

### **D. Assessment**

#### **Very Short Questions**

1. Define home garden

#### **Short Questions**

1. Differentiate between home garden and kitchen garden

### **GLOSSARY**

**Ornamenta I:** A plant grown for its attractive appearance.

## **UNIT 4 : Orchard Management**

### **A. Objectives**

Upon the completion of this unit, the students will be able to:

- Define orchard
- Describe about the factors that should be considered while establishing orchard

### **B. Content Elaboration**

#### **4. 1. Introduction of Orchard**

##### **Definitions**

- Orchard is a piece of land where fruit crops are grown commercially ●  
Orchard refers to an area where intensive cultivation of fruit crops is done

- Orchard is an area where fruit crops like mango, citrus, papaya, banana etc. are cultivated
- Orchard is an enclosed area where a fruit or group of fruit trees is grown
- Orchard management refers to growing of fruit plants in an orderly manner and maintains them for successive economic returns
- Orchard management refers to the principle and practices adopted for cultivation of fruit crop on a piece of land with maximum income

## **4. 2. Factors to be considered while establishing orchard**

### **i. Climate and Weather**

It is the most important requirement for orchard establishment. Suitable weather conditions, relative humidity, rainfalls, nature of wind, velocity are most important factors. Therefore, the site for orchard should be selected where there is full exposure of light and humidity.

### **ii. Soil types and soil fertility**

Soil should be clay loam. The soil should be fertile with proper drainage facility. The pH should be 6.0-8.0. The selected land should not be sloppy because there is maximum chance of soil erosion which reduces the fertility of soil.

### **iii. Irrigation Facility**

The site should be selected where there is good facility of water for irrigating plants. It is recommended to select where there is availability of lake, river or irrigation channel.

### **iv. Soil Water Conservation**

Surface runoff should be taken in consideration while establishing an orchard to conserve soil erosion. Similarly, the area should be free from crusts or breakdown of structure, all of which will increase infiltration and so help the water conservation.

### **v. Inputs availability**

Timely application of inputs like fertilizers, insecticides, pesticides are essential for proper growth and development of fruits in the orchard so the area selected for the orchard should be easily accessible to the inputs.

#### **vi. Availability of labour**

The orchard requires regular and effective management to attain maximum production. Therefore, it should be selected in such place where the farm labour is easily available at any time as well as cheaper.

#### **vii. Transportation Facilities**

When the produce is ready to harvest then first and foremost thing after this is transport to sell our products. So, the area selected should be facilitated with road and transportation facility.

#### **viii. Market and Storage facilities**

Before establishing an orchard market place should be determined so that we can sell the products whenever its ready. Most of the fruits are perishable in nature. Therefore, the storage facilities should also be considered for prolonging the shelf life of the fruits.

### **C. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

### **D. Assessment Very Short Questions**

1. Define orchard.
2. What do you mean by orchard management?

### **Short Questions**

1. List any four factors that should be considered while establishing an orchard.

### **Long Question**

1. What are the factors that should be considered while establishing an orchard. Explain in briefs.

## **GLOSSARY**

**Climate:** The weather conditions prevailing in an area in general or over a long period.

**Weather:** The state of the atmosphere at a particular place and time as regards heat, cloudiness, dryness, sunshine, wind, rain, etc.

## UNIT 5 : Plant Growth and Development

### A. Objectives

Upon the completion of this unit, the students will be able to:

- Define different technical terms related to plant growth and development
- Explain about the dormancy, its causes and methods of breaking dormancy

### B. Content Elaboration

Growth is the quantitative change in the plant part due to cell division. E. g. length of plant, number of leaves, weight of the body.

Development is the qualitative change in the plant from initiation of growth to the death of plant. It is due to the differentiation of cells into the various tissues.

### 5. 1. Brief introduction

#### Germination

It is defined as the steps beginning from imbibition of cell until the seedling is self-sustaining. The process of germination takes place in two ways i. e. Epigeal & Hypogeal.

#### Dormancy

It is the inability of viable embryo to germinate or inability of seed to germinate when it is viable as well as favorable climatic condition. The causes of dormancy

are different i. e. due to hard seed coat; due to presence of inhibitor in seed like ABA, Alkaloids etc.

### **Methods of Breaking Dormancy**

There are different methods of breaking dormancy:

#### **a. Scarification**

The process of rupturing seed coat by mechanical method or by treating seed with chemicals or hot water is called scarification. In mechanical scarification, dormancy is broken by hammering or rubbing, threshing and cracking the hard seed coat. Dormancy is also broken by soaking the seed in hot water having 50-55<sup>0</sup>C for 20-30 minutes. This is practice on those seed having hard seed coat.

#### **b. Alternating temperature**

Dormancy of positively photoblastic can be broken by alternating the temperature at 15<sup>0</sup>C and 25<sup>0</sup>C.

#### **c. Light**

Dormancy of positively photoblastic seeds can be broken by exposing them to light.

#### **d. Stratification**

It is the process of breaking dormancy by treating the seed with medium to low temperature for certain period of time.

#### **e. Germination stimulating compounds**

Different germination stimulating compounds like potassium nitrate, gibberellins, etc. are used to break the dormancy of seeds. Seeds are treated with these compounds.

### **Juvenility**

It is the stage of vigorous just after the germination and before flowering. Physiologically, it's a period when plant develops its morphological character i. e. leaves, stems, roots, bark etc. but flowering is not induced.

### **Maturity**

A stage of plant development which is capable of flowering is called maturity. The period of maturity varies depending upon the species and growth habit. Plant may be determinate or in determinate type. In determinate type, growth occurs for a period of time and then stops. The plant apex or branch is terminated by a floral bud. But in indeterminate type growth is continuous and growing points are terminated by vegetative buds.

### **Flowering**

After a wide range of physiological and morphological change the vegetative premodium of the plants is converted into floral premodium and the then flowering occurs.

### **Fruiting**

Fruiting is a process that takes place after fertilization of flowers. After fertilization, gamete formation takes place which is followed by formation of zygote. This process of zygote formation is called fruiting.

### **Fruit Ripening**

The qualitative change at the end of growth period which makes a fruit edible is called Fruit Ripening. Fruit ripening takes place after the maturation of fruits and when the fruits reach its maximum size. Ripening is also called as degradation process. During ripening, chemical change takes place for eg: starch turns to sugar; chloroplast are disintegrated which results loss of greenness of fruit.

### **C. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

### **D. Assessment**

#### **Very Short Questions**

1. Define Germination.
2. Define fruiting.

#### **Short Questions**

1. What do you mean by Juvenility and maturity?

## Long Questions

1. Define dormancy. What are the methods of breaking dormancy?

## GLOSSARY

**Vigorous:** Strong, healthy, and full of energy.

# UNIT 6 : Plant Growth Regulators

## A. Objectives

Upon the completion of this unit, the students will be able to:

- Define Plant Growth Regulators.
- Explain the types of PGRs.
- Describe the uses of PGRs in fruits.

## B. Content Elaboration

### 6. 1. Meaning and definition of Plant Growth Regulators

Plant Growth Regulators are organic substances other than plant nutrients which promote and inhibit the physiological process of the plant.

Plant hormones are organic or synthetic substances produced by plant which regulates the plant physiological process.

### 6. 2. Types of PGRs

There are five broad classes of plant growth regulators (PGR) they are:

1. Auxins
2. Gibberellins
3. Cytokinins
4. Ethylene, and
5. Abscisic acid

### 6. 3. Importance and Commercial uses of PGRs in fruit crops Auxins

It is characterized by capacity to induce elongation in plant cell.

For example:

IBA: Indole Butaric Acid

IAA: Indole Acetic Acid

NAA: Nephthalene Acetic Acid

### Uses

- Helps in root initiation.
- Responsible for photoperiodism.
- It causes apical dominance.
- It controls abscission.
- It helps in seed germination and breaking of dormancy.
- It helps in the development of fruit even in absence of pollination which is called parthenocarpy.

### Gibberellins

Gibberellins may be defined as a compound that stimulates cell division and cell elongation.

### Uses

- It promotes stem elongation and cell division ● It promotes seed germination.
- It maintains balance between internode, growth and leaf development.
- It helps in breaking dormancy.

### Cytokinins

They are substances which mainly act on cell division and may have little or no effect on elongation of plant cell.

### Uses

- It stimulates cell division
- It promotes the DNA, RNA synthesis.
- It stimulates root initiation.
- It helps in breaking dormancy of lateral buds.

- It inhibits protein degradation.
- It increases the shelf life of leafy vegetables.
- It breaks the dormancy of light sensitive seeds like lettuce, tobacco etc.

### **Ethylene**

A plant hormone that is responsible for fruit ripening is called ethylene.

### **Uses**

- It results in the ripening of fruit.
- It helps in seed germination and breaking of seed dormancy.

### **Abscisic Acid**

It is also called stress hormone because the production of hormone is stimulated by drought, water logging and other adverse environmental conditions.

### **Uses**

- It induces dormancy of buds towards the approach of winter.
- It helps in prolonging dormancy of buds, storage organs and seeds; also known as dormin.
- Abscisic acid promotes abscission of flowers and fruits.
- It promotes flowering in some short day plants like strawberry.
- Promotes rooting in many stem cuttings.

### **C. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

### **D. Assessment**

#### **Very Short Questions**

1. Define PGR
2. Write the name of any two PGRs

#### **Short Questions**

1. What are the types of PGR ?

#### **Long Questions**

1. Write any five uses of PGR in fruit production.

## **GLOSSARY**

**Photoperiodism** : The response of an organism to seasonal changes in day length.

**Parthenocarpy** : The development of a fruit without prior fertilization.

# **UNIT 7 : Cultivation of Fruit Crops**

## **A. Objectives**

Upon the completion of this unit, the students will be able to:

- Classify fruit crops
- Describe the detailed cultivation practices of different fruit crops

## **B. Content Elaboration**

### **7.1. Introduction to Fruit Crops**

“An apple a day keeps the doctor away” is a popular adage which shows the importance of fruit crops for the human diet. It is a matter of common knowledge that a diet rich in fruits and low in saturated fats is healthy and protective against cardiovascular diseases and certain cancers.

A fruit is the fleshy edible part of a perennial plant associated with development of the flower.

### **7.2. Classification of Fruit Crops**

Fruits are classified as follows:

#### **1. Tropical Fruits**

Fruits that are suitable for growing from 70-650 masl. Mango, Litchi, Pineapple, Jackfruit, Papaya, Banana etc are commercially cultivated as tropical fruits.

#### **2. Sub-Tropical Fruits**

Fruits that are suitable for growing from 650-1450 masl. Citrus species (i. e. mandarin, sweet orange) are commercially cultivated as sub-tropical fruits.

### **3. Warm-Temperate Fruits**

Fruits that are suitable for growing from 1450-2100 masl. Peach, plum, pear etc. are cultivated as warm-temperate fruits.

### **4. Temperate Fruits**

Those fruit crops that are grown from 2100-3000 masl. For e. g. apple, nuts etc.

## **7.3. Cultivation Practices of some common Fruit Crops**

### **Tropical Fruits**

1. Mango
2. Litchi
3. Banana
4. Papaya

### **Sub-Tropical Fruits**

1. Mandarin Orange
2. Sweet Orange
3. Lime
4. Lemon
5. Pomegranate
6. Kiwi

### **Temperate Fruits**

1. Apple
2. Pear
3. Straw berry

## **Tropical Fruits**

### **Mango (*Mangifera indica*)**

**Family:** Anacardiaceae

**Origin:** Indo Burma Region

Nutritive Value and Use

- Mango is rich source of vitamin A and carbohydrates
- Ripe fruits are used for preparing candy, Frooti, cold drinks, juice, toffee etc.
- Unripe fruits are used to prepare pickles, chutnies etc.

#### **Varieties**

##### **Early Varieties**

1. Bombay Green
2. Bombay yellow
3. Himsagar
4. Suvarnarekha

##### **Mid varieties**

1. Amrapali
2. Maldah
3. Krishnabog
4. Mallika
5. Alphanso 6. Dasahari

##### **Late varieties**

1. Chausa
2. Culeattia
3. Cippa
4. Neelam

#### **Climate and Soil**

It is a tropical fruit but it can be cultivated at the altitude ranging 1100 *masl*. There should not have high humidity, high rainfall, frost during flowering and fruiting. The temperature between 24<sup>0</sup>C-27<sup>0</sup>C is ideal for its cultivation. It can be grown best with annual rainfall of 75cm.

It can be cultivated in fertile loam soil with good drainage capacity. pH 5. 5-7. 5 is considered best for mango cultivation.

### **Propagation**

Grafting is a popular method of propagating in mango. Vegetative methods are inarching, veneer grafting, epicotyl grafting or stone grafting.

### **Planting**

In a well prepared land, sapling should be planted in a pit size 1x1x1m<sup>3</sup> at spacing of 5-12m depending upon the varieties.

### **Manure and Fertilizer**

Application of manure and fertilizer depends upon the soil fertility status, irrigation facility, variety and age of the plant. Generally, recommended dose of manure and fertilizer is 10Kg FYM, 300 g Nitrogen, 160 g Phosphorus and 400g Potassium.

Full dose of phosphorus and potassium and half dose of nitrogen is applied during Jestha-Ashoj. Remaining half dose of nitrogen is applied during Kartik.

### **Irrigation**

Irrigation should be done depending upon the moisture condition of the soil. Generally, it is done in 10-15 days interval in winter and 5-10 days interval in summer. Irrigation is necessary during flowering and fruiting stage. It is done by adopting ring method of irrigation.

### **Training and Pruning**

It is an important practice during the first to few years after planting. The unwanted diseased and dried branches are removed.

### **Harvesting and Marketing**

Fruits are rarely allowed to ripe on the trees. When the fruit is fully matured and change its colour, it is harvested manually. After harvesting, mangoes are cleaned,

graded and packed. Generally, wooden baskets are used for packaging along with straw.

## **Yield**

The yield of mango depends upon the various factors. Generally, 12-20 fruits are harvested from 5 years old plant. 400-500 fruits are harvested from 10 years old plant. If properly managed, 1500-2500 fruits are harvested from 20 years old plant.

## **Physiological Disorder**

### **1. Alternate Bearing/ Irregular Bearing/ Biennial Bearing**

It is common disorder of mango. It refers to the heavy fruiting in one year followed by no fruiting or less fruiting in next year. It is due to various causes such as genetic, physiological, environmental, nutritional and poor management of orchard. Management practice of alternate bearing is planting of regular bearing varieties, pruning, application of recommended dose of manure and fertilizer and adopting suitable cultural practices.

### **2. Fruit Drop**

It is the major problem in mango. It is due to the poor pollination, high wind velocity, hail-storm, poor soil moisture or due to various diseases, insects and pests. It can be controlled by proper management of orchard i. e. using of wind breaks, regular irrigation during fruiting time, control of disease, insect pests in time.

### **3. Black Tip of mango**

It is also common problem of mango. The distal end of the fruit become yellow at first and finally turn into black. Fruits ripen before it matures and becomes unmarketable. It is caused by gasses emitted from brick kiln. (Gasses like  $\text{Ca}_2$ ,  $\text{SO}_2$ , Carbon dioxide, ethylene etc. Deficiency of Boron causes this symptoms. It can be controlled by raising the length of brick kiln so high spraying Borax @ 0.6% i. e. before flowering, during flowering and after flowering.

### **4. Mango Malformation**

It is of two types i. e. they are vegetative malformation and floral malformation. Vegetative malformation are common in nursery seedlings and floral malformation affects bearing trees. In vegetative malformation, bunchy top, compact leaves are

formed at apex of shoot which looks like broom. Floral malformation affect product and productivity. The exact causal agent of this disorder is unknown but several hypothesis have been put forward. It include the environmental factors, imbalance hormone, viruses, fungus and mites. It can be managed by adopting phytosanitary, use of anti malfermins like ascorbic acid, glutathione etc.

### **1. Spongy Tissue**

The spongy tissue, a ripening disorder, is often described as soft centre, white corky tissue or internal breakdown in Alphonso mango.

## **Diseases of Mango**

### **2. Powdery Mildew**

Appearance of grayish whitish powder on flower buds, fruitlets and rachis of panicles, which later becomes dark brown. *Control*

Wettable Sulphur at 0. 2% at pre-bloom, full-bloom and post bloom stages.

### **3. Anthracnose**

The disease affects the tender parts of the trees and the symptoms varies according to plant part affected. *Control*

Spray Bordeaux mixture thrice a year in Feb, April and September.

### **4. Sooty Mould**

The fungus developed on the honey dew secreted by the hoppers on the leaves, twigs and inflorescence forming black encrustations. *Control*

Apply wood ash, saw dust in affected parts.

## **Insect Pests of Mango**

### **1. Mango Hopper**

- Both adults and nymph suck the sap
- Hoppers are mostly active during the flowering and fruiting period *Control*

Spraying with malathion 0/5% or endrin 0. 04% or Nuvacron 0. 04% once at the time of panicle emergence and then again at fruit set stage.

### **Mango Mealy Bug**

- The female can be identified by their flat shape, covered with white mealy powder
- The nymphs suck juices from young shoots, panicles and flowers pedicles
- The affected parts dry up resulting reduction of yield

#### ***Control***

- Destroy eggs by digging around the trunk during summer (May-June)
- Use of adhesive/sticky/slippybands around the tree trunk about 30-45 cm above the ground level during December
- Spraying Carbary 0.2% or Nuvacron 0.04%.

### **Mango Stem Borer**

- They make hole in the stem and trunk
- Leaves and stems get dry in severe attacks. Later whole plant may get dry

#### ***Control***

- Adopt clean cultivation
- Use wire to kill the insect that stay inside the hole

### **1. Mango stone Weevil**

- Larva feed upon the pulp of the mango and reach up to the stone of the fruit
- The adult feed upon pulp of fruit which make the fruit unmarketable ***Control***
- Destroy the affected fruits
- Adopt clean cultivation
- Apply malathione @ 2ml/l of water at 15-20 days interval for 2-3 times

### **2. Leaf Cutting Weevil**

- They cut the tender leaves of the plant

- They attack severely in young plants than older plants

### **Control**

- The affected leaves are destroyed
- Apply malathione @ 2ml/l of water

## **Papaya (*Carica papaya*)**

**Family :** Caricaceae

**Origin :** Mexico

### **Nutritive value and Use**

It is a rich source of vitamin A and minerals. Unripe fruits are used as vegetables also. Ripe fruits are consumed directly and also used in making jam, jelly, candy etc.

### **Varieties**

Solo

Honey Dew

Singapore Pink

Pusanaha

Washington

### **Climate and soil**

It is tropical fruit. It can be grown commercially at the altitude of 1000 masl. The optimum temperature required for its proper growth and development lies between 20°C - 27°C. The annual rainfall required for its cultivation is 1000 - 2000mm.

A well drained sandy loam soil having high organic matter is suitable for its cultivation. pH of the soil should be 6.0 - 7.0.

### **Propagation**

It is propagated by seed. Seeds are sown in polybag or directly sown in a well prepared nursery bed at 15x20cm spacing. The seedling becomes ready for transplanting when plant attains height of 15 - 20 cm and have 4-5 leaves.

## **Manure and Fertilizer**

The recommended dose of compost, Nitrogen, phosphorus and potassium should be:

**Compost:** 25kg per plant per year

**N:P:K:** 250:250:400 g/plant/year.

## **Irrigation**

Irrigation is required at 5-6 days interval in summer and 10-15 days interval in winter by adopting ring method.

## **Training and Pruning**

Dried, diseased and unwanted leaves are removed as required.

## **Harvesting and Marketing**

For local market, half yellow colour fruits are harvested. For distant market, mature green fruits are harvested. After harvesting, fruits are cleaned, graded and packed in a bamboo or wooden basket and transported to the market.

## **Yield**

A young tree yield about 70-120 fruits per plant up to 4 years. Later becomes unproductive after 4 years.

## **Insect Pest of Papaya**

### **1. Aphid**

- Adult and nymph suck the sap from tender leaves and shoots.
- The plant become unproductive when aphids attacks.
- It also transmit several viral disease.

### **Control**

- Spray Delfin @ 2ml/lit of water
- Adopt clean cultivation

### **2. Scale Insect**

- Adult and nymph suck the sap from leaves and tender part.
- Yellow discoloration is seen on the affected part.
- Later on the infected part dry out and yield is reduced. **Control**
- Spray Delfin @ 2ml/lit of water
- Adopt clean cultivation

### 1. Mites

- They make white spots on ripe fruits and also affect the leaves

#### **Control**

- Spray sulphur dust @ 0.6g/lit of water

### Diseases of Papaya

#### 1. Collar Rot ( Stem Rot)

**Causal Organism : Fungus**

**S. N. : *Pythium aphanidermatum***

#### Symptoms

- Water soaked patches appear on the collar region of the plant
- Later on the patches appear in large size and cause rotting of tissue. The plant fall and die in severe condition.

#### **Control**

- Avoid water logging condition in field
- Uproot and destroy the affected plant
- At the initial stage, scrap the infected part and apply Bordeaux paste.

#### 2. Anthracnose

**Causal Organism: Fungus**

**S. N. : *Colletotrichum gloeosporioides***

#### Symptoms

- Small black spots appear on the leaves and fruits
- The spots increase in size, penetrating and rotting the internal flesh
- The affected leaves fall pre-maturely

**Control**

- Collect and destroy infected leaves and fruits
- Spray Mancozeb @ 0.2% at 10 days interval

**3. Leaf Curl**

**Causal Organism:** Leaf curl virus

**Vector:** white fly

**Symptoms**

- Curling and bending of leaves takes place which cause reduction in the leaves size
- The leaf margin rolled downward and the affected leaves become zigzag
- Later on defoliation takes place

**Control**

- Collect and destroy the infected part of the plant ● Adopt suitable method to control vectors

**Litchi (*Litchi chinensis*)**

**Family:** Spaindaceae

**Origin:** China

**Nutritive value and Use**

Litchi is a rich source of vitamin, protein and minerals. Ripe fruits are consumed fresh and also used in making squash, jam, jelly, candy etc.

**Varieties**

1. Early Bedona
2. Muzaffarpur

3. Culcuttia china
3. Shahi
4. Purbi
5. Desi

### **Climate and Soil**

It can be cultivated at the altitude of 800-1000m from masl. It requires temperature about 15<sup>0</sup>C -30<sup>0</sup>C. It requires annual rainfall about 1500 mm.

Loam to sandy loam soil having high organic matter is ideal for litchi. pH ranges from 5. 5-6. 5.

### **Propagation**

Litchi is propagated by seed, air layering and cutting. Air layering is a popular method of propagation.

### **Planting**

It is planted in well prepared land. Sapling should be planted in a pit size of 1x1x1m<sup>3</sup>. Spacing is maintained about 8-10m. **Manure and Fertilizer**

FYM 20kg per plant per year is sufficient for litchi cultivation.

Nitrogen: 100g per plant per year

Phosphorus: 200g per plant per year

Potassium: 250g per plant per year

### **Irrigation**

Irrigate the plant at 7 days interval in summer and at 15 days interval in winter.

### **Harvesting and Marketing**

Generally, litchi matures at 50-60 days after fruit set. The fruits are harvested when they are ripe. After harvesting, they are cleaned, graded, and transported to the market.

### **Yield**

The matured plant gives 4000-5000 fruit per plant per year. Generally, it yields about 7-8 ton/ha.

### **Insect Pest of Litchi**

#### **1. Litchi of fruit borer or Nut borer**

- It is a serious pest of litchi
- Newly hatched caterpillar bore into the fruit and feed on the developing seed
- Hole made by caterpillar facilitates the entry of pathogen which causes fruit rot

#### **Control**

- Collect and destroy the affected part
- Spray Rogor @ 0.05% at 10-15 days interval

#### **2. Litchi Red Bug**

- The adult and nymph suck the sap from tender parts, leaves, flowers, fruits.
- It causes premature fruit drop.
- If the pest attacks the fruit in mature condition, it causes drying of fruits.

#### **Control**

- Adopt clean cultivation
- Spray Rogor @ 2ml/l of water during flowering stage at 10 days interval

#### **3. Bark eating Caterpillar**

- This insect attacks more in rainy seasons
- The larvae feed on the bark of the plant
- Later on make hole in the trunk of the plant and damage internally

#### **Control**

- Use petrol to kill the insect inside the hole

- Use wire to kill the insect

## Diseases of Litchi

### 1. Anthracnose

**C. O:** Fungus

**S. N:** *Colletotrichum gloeosporioides*

#### Symptoms

- The green and succulent organs like leaves, tendrils and even fruits are affected by this disease
- The disease is identified by gray spot on affected part which later changes into black spot

#### Control

- Adopt clean cultivation
- Affected part should be collected and destroyed
- Apply Copper Oxchloride @ 0.03% or 0.3g/l of water

### 2. Red Rust of litchi

**C/O:** Algal Parasite

#### Symptoms

- Algal growth is developed on tender leaves
- Cottony mass is developed on the lower surface of the leaves then on developing leaves brown spot are seen
- The leaves become hardy in nature
- Finally the affected parts turn into brick colour or dark gray colour

#### Control:

- Spray Sulphur and lime during Kartik-Mangsir and Chaitra – Baisakh

## **Banana (*Musa paradisiaca*)**

**Family:** Musaceae

## Nutritive value and Use

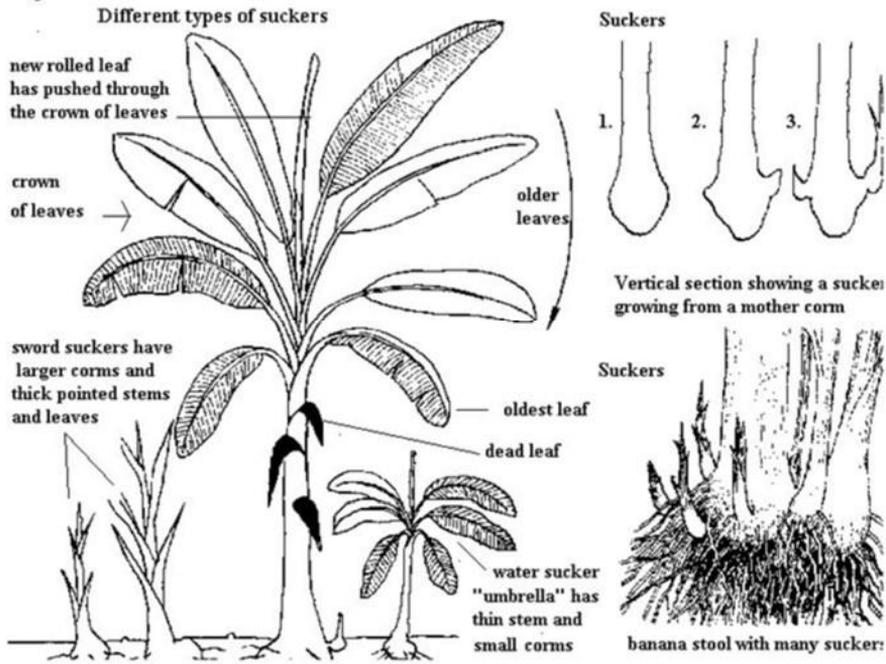
It is a rich source of vitamin and minerals. Ripe fruits are consumed fresh and are also used to prepare jam, jelly, candy, juice etc.

## Varieties

1. Chine Champa
2. Malbhog
3. Robusta
4. William
5. Dwarf Cavendish
6. Climate and Soil

It can be cultivated in tropical and subtropical region. It can be cultivated up to an altitude of 1600 masl. The ideal temperature is 22<sup>0</sup>C -27<sup>0</sup>C but it can be cultivated within the temperature range of 18<sup>0</sup>C -30<sup>0</sup>C. It require 2000-4000mm annual rainfall

It can be cultivated in wide range of soil but the loam and sandy loam is ideal. The soil should have high organic matter with good drainage facility. The soil pH should be 6. 5-7. 5. Alkaline soil is not suitable for banana cultivation. **Propagation**



Banana is propagated by suckers. There are two types of suckers i. e. water suckers and sword suckers. Water suckers have broad leaf whereas sword suckers have pointed (narrow). Sword suckers are suitable for planting because they grow quickly and give maximum production.

### Planting

Suckers are planted in a pit. If the suckers are tall, about 30cm then it should be cut from the upper part. The spacing is maintained about 2.5x3m for tall variety and 1.8m x1.8m for dwarf variety.

### Manure and Fertilizer

Generally, young plant of banana requires 20 kg FYM and 200 g Nitrogen, 150 g Phosphorus, 250 g Potassium. Application of Furadon is recommended in borer infection field.

Full dose of phosphorus and FYM is applied during final field preparation. NPK is applied in two split doses i. e. first dose is applied at final land preparation and remaining half is applied during fruiting stage.

### Irrigation

Irrigation is necessary during flowering stage. In winter irrigation is done at 15-20 days interval. In summer irrigation is done at 7 days interval. Water logging condition is avoided from the base of the plant.

### **Harvesting and marketing**

It is harvested when all the fruits become fully mature. The fully matured fruits shows light green colour. After harvesting cleaning and grading is done and transported to the market.

### **Yield**

Yield of the banana depends upon the soil fertility status and variety of the crop. Average production per hectare is 15-40 tons.

### **Insect pest of Banana**

#### **1. Banana weevil**

- The adult mainly damages the plant
- They make tunnels in the stem or rhizome
- This tunnel creates bacterial infection
- The affected plant becomes yellow and falls down even in slow wind velocity

#### ***Control***

- Uproot the infected plant and destroy it properly
- Adopt clean cultivation
- Remove the unwanted plant from the orchard
- Spray Malathion @ 2ml/l of water at 15-20 days interval

### **Banana Aphid**

- The adult and nymph suck the sap from the tender part of the plant
- The affected part reduces in size and decrease the overall production ***Control***
- Remove the affected plant parts
- Spray Rogor @ 2-3ml/l of water at 15 days interval

## Diseases of Banana

### 1. Fungal Disease

#### a. Leaf Spot

C/O: Fungus

S. N: *Sercosporamusae*

#### Symptoms:

- It infects the younger leaves
- Yellow spots are seen on the lower surface of the leaves **Control**
- Avoid water logging condition ● Spray Fungicide (Diathane M-45)

#### b. Banana

C/O: Fungus

S. N: *Fussarium oxysporum* var. *bubens*

#### Symptoms

- This is soil borne disease and develops under acidic soil, wet condition and high humidity
- Yellowing of leaves takes place and the leaves hang around the pseudo stem
- Cracking and discolouration of vascular bundles are major symptoms of this disease

#### Control

- Grow disease resistant plants or cultivar
- Destroy the affected plant part
- Select the suckers from the disease free area
- Apply lime @ 1 Kg per pit during its planting ● Spray Bavistin @ 1-2 g/l of water in infected plant

**c. Anthracnose**

**C/O:** Fungus

**Symptoms**

- Small brown spots are developed on the fruits
- Later on the spots turn into black
- The affected fruits become yellow
- In severe condition, the fruits become black and start to wrinkled

**Control**

- Prevent the plant from injury
- Spray Bavistin @ 1-2 g/l of water

**1. Bacterial Disease**

**a. Moko Disease**

**C/O:** Bacteria

**S. N:** *pseudomonas solanacearum*

**Symptoms**

- Wilting of plant takes place. Petals of the leaves break down from pseudo stem
- The leaves get shattering and the fruits ripe before it matures

**Control**

- Adopt clean cultivation
- Use resistant varieties
- Spray Streptocidine @ 1g/l of water at 15 days interval

**2. Viral Disease**

**a. Bunchy top**

Generally, growth of the plant stops and leaves emerge closely. The leaves get crowded. The fruits become smaller

## **Control**

- Adopt clean cultivation
- Use suitable pesticide to control the vectors
- Properly destroy the affected plants

## **Sub-Tropical Fruits**

### **Mandarin Orange (*Citrus reticulata*)**

**Family:** Rutaceae

**Origin:** South East Asia

Nutritive value and Use

It is a rich source of vitamin C and minerals. It is rich in citric acid. Ripe fruits are consumed as fresh and also used to prepare jam, jelly, candy etc.

#### **Varieties**

1. Koorg
2. Kamala
3. Nagpuri
4. Sutsuma
5. Pokhara beauty

#### **Climate and Soil**

It is a sub-tropical fruit. It can be cultivated up to an altitude of 700-1500 masl. The ideal temperature is 15<sup>0</sup>C -25<sup>0</sup>C. It requires 1200-1500mm annual rainfall.

It can be cultivated in loam and sandy loam. pH should be 5.0-6.5.

#### **Propagation**

Most of the mandarin cultivars are propagated through seeds. Generally, TBudding and grafting (Veneer) is practiced for mandarin cultivars.

#### **Planting**

In a well prepared land, sapling should be planted in a pit size of  $1 \times 1 \times 1 \text{m}^3$ . The spacing is maintained about 5-6m. It is planted either by square system or Rectangular system.

### **Manure and Fertilizer**

- 50 kg FYM/plant/yr.
- 870g Nitrogen/plant/yr.
- 540g Phosphorus/plant/yr.
- 830g potassium/plant/yr.

### **Irrigation**

Irrigation is required during flowering and fruiting stage. Sudden heavy irrigation during flowering and fruiting may cause flower and fruit drop. It requires irrigation at 7-10 days interval in summer and 15-20 days interval in winter.

### **Training and Pruning**

It is necessary practice in mandarin. Diseased, damaged, crowded, overlapped branches are removed. Best time for pruning is after harvesting during late winter.

### **Flowering and Fruiting**

Flower takes place in the month of Jestha-Ashar. The fruitlets develops in the month of Bhadra-Ashoj

### **Harvesting and Marketing**

Fruits are harvested when rind colour changes from green to orange and then yellow. The harvested fruits are cleaned, graded and transported to the market.

### **Yield**

It yields about 10-12 tones/ha.

### **Insect Pest of Mandarin Orange**

#### **1. Aphid**

- The adult and nymph suck the sap from tender parts of the plant, leaves, flowers and fruits

- It causes the stunted growth of plant and reduction in yield

### **Control**

- Adopt clean cultivation
- Spray Rogor @ 1-2 ml/l of water
- Use lady bird beetle to control the population of aphid

### **1. Scale insect**

- They suck the sap from tender parts of the plant, leaves, flower and fruit.
- The affecteds part get damaged which results premature fruit drop and defoliation.

### **Control**

- Adopt clean cultivation
- Spray the rogor @ 1-2 ml/l of water

### **2. Citrus Psylla**

- They suck the sap from the tender parts of the plant, leaves,flowers and fruits
- They create honey dew on the leaves in which shooty mould is developed

### **Control**

- Establish nursery about 1300m height
- Destroy the secondary host i.e. Kamini flower of this insect
- Spray Rogor @ 2-3ml/l of water

### **3. Leaf Miner**

- Very small larva bore in the tissue of the leaves and make zig-zag tunnel
- Feed on the chlorophyll internally due to which the tunnel looks silver colour

### **Control**

- Spray tobacco based pesticide
- e. g. Soak 250 tobacco in 400 liter of water and mix with 30g surf. Keep it whole night and filter it.
- Now add one part of this solution in a part of water and spray at 10 days interval
- Apply Rogor @ 2-3 ml/l of water

#### **4. Stem Borer**

- The larva feed on the stem and trunk of the plant
- They make tunnel internally
- Leaves fall on severe condition

#### **Control**

- Adopt clean cultivation
- Use wire to kill the insects inside the tunnel

#### **5. Lemon butterfly**

- Female lays eggs on the fruit
- After hatching larva feed on the pulp of the fruit causing rooting and dropping of fruits

#### **Control**

- Collect and destroy the affected and falling fruits
- Destroy the larva and eggs of the insect
- Spray Desis @ 2ml/l of water
- Use Feromon traps consisting of cotton soaked in methyl eugenaol and 2-3 drops of malathion

#### **6. Lemon bug**

- Larva feed on the tender part of the plant like shoots, leaves, fruits and damage the nursery plant

#### **Control**

- Adopt clean cultivation

- Spray Rogor or Endosulfan @ 2ml/l of water

## **Disease of Mandarin Orange**

### **1. Die-Back**

**C/O:** Fungus

**S. N:** *Colletotrichum gloeosporioides*

#### **Symptoms**

- The leaves becomes yellow in initial stage and turn into dark colour and start to fall with beginning of summer
- Die-back of twig starts leading to dry and finally the plant die

#### **Control**

- Remove dead twigs or affected part from the plant
- Spray Carvendazim@ 1g + 2 g Gaucho/l of water

### **2. Phytophthora rot (Root rot, Crown rot, gummosis)**

**C/O:** Fungus

**S. N:** *Phytophthora parasitica*

*P. citrophthora*

#### **Symptoms**

- Dark discolouration of bark is developed, water soaked spots developed which causes stem rot, rootlet rot and finally defoliation
- In advance stage bark cracking and oozing of gums takes place

#### **Control**

- Avoid water logging condition at the base of the plant
- Scrap the affected part

### **3. Citrus Canker**

**C/O:** Bacteria

**S. N:** *Xanthomonas citri*

## Symptoms

- It is a serious disease in citrus fruits
- It affects the quality of fruit and reduces market value
- Water soaked with round spots are seen on the leaves and stems as well as in fruits
- The spots increase slowly and turn into brownish on the leaves, stems and fruits

## Control

- Remove and destroy the infected part of the plant
- Spray 42 ordeaux mixture @ 1% on cut portion
- Streptocyclin @ 1g/l of water initially

## 4. Citrus Greening

C/O: Bacteria

S. N. : *Liberibacteria asiaticus*

## Symptoms

- Initially vein and veinlet turn yellow and then interveinal chlorosis is observed
- Leaves become leathery, small, pair in mass and bend downward of seasonal flowering
- Die-back symptoms is another major symptoms of this disease
- Division of cloves are not in equal proportion and seeds are not viable
- It is transmitted by citrus phyla

## Control

- The infected parts are destroyed
- Spray Diemethoade @ 2-3ml/l of water to control the vector citrus phyla
- Apply Bordo pest in cut portion
- Spry Streptocyclin @ 1g/l of water after pruning

## 5. Powdery Mildew

C/O: Fungus

S. N: *Oidiumtingitanum*

### Symptoms

- White powdery mass appears on the twigs and leaves
- Fruits drop before it matures
- The affected leaves die in later stages

### Control

- Destroy the affected plant part
- Spray Bavistin @ 1-2g/l of water at 20 days interval but in severe infection spray 8-10 days interval

## 6. Tristeza Virus

### Symptoms

- It is a serious disease of citrus family
- It cannot be controlled easily
- Initial symptom are seen like development of small leaf like green in colour, small fruit with sour test
- At later stage, the plants wilt and die

### Control

- Destroy infected plant part
- Spray Di-methoate @ 2-3 ml/l of water to control sucking pest **Sweet**

### **Orange (*Citrus sinensis*)**

**Family:** Rutaceae

**Origin:** South-East Asia

Nutritive Value and Use

It is rich source of vitamin C and minerals. It is rich in citric acid. Ripe fruits are consumed as fresh and also used to prepare jam, jelly, candy etc.

### **Varieties**

1. Novel orange
2. Jaffa
3. Pineapple
4. Malta blood red
5. Hamlin
6. Satgudi
7. Valencia
8. Mausambi

### **Climate and Soil**

It is a sub-tropical fruits. It can be cultivated up to an altitude of 600-1400 masl. The ideal temperature is 15-25<sup>0</sup>C. It require 1200-1500mm annual rainfall.

It can be cultivated in loam and sandy loam. pH should be 4. 5-7. 5.

### **Propagation**

Most of the mandarin cultivars are propagated through seeds. Generally, TBudding and grafting (Veneer) is practiced for mandarin cultivars.

### **Planting**

In a well prepared land, sapling should be planted in a pit size 75x75x75 cm<sup>3</sup>. The spacing is maintained about 6-7m. It is planted by adopting square or rectangular method of planting. It should be planted before onset of monsoon or end of monsoon.

### **Manure and Fertilizer**

- 50 kg FYM/plant/yr.
- 870g Nitrogen/plant/yr.
- 540g Phosphorus/plant/yr.
- 830g potassium/plant/yr.

## **Irrigation**

Irrigation is required during flowering and fruiting stage. Sudden heavy irrigation during flowering and fruiting may cause flower and fruit drop. It requires irrigation at 7-10 days interval in summer and 15-20 days interval in winter.

## **Training and Pruning**

Modified leader system is adopted. 4-6 well spaced branches are allowed to grow up to 3-4m. The diseased, dried and unwanted branches are removed. The best time for this operation is after harvesting during late winter.

## **Flowering and Fruiting**

Flower takes place in the month of Jestha-Ashar. The fruitlets develops in the month of Bhadra-Ashoj

## **Harvesting and Marketing**

Fruits are harvested when rind colour changes from green to orange and then yellow. The harvested fruits are cleaned, graded and transported to the market.

## **Yield**

It yields about 10-12 tones/ha.

## **Insect Pest of Sweet Orange**

### **1. Aphid**

- The adult and nymph suck the sap from tender parts of the plant, leaves, flowers and fruits
- It causes the stunted growth of plant and reduction in yield **Control**
- Adopt clean cultivation
- Spray Rogor @ 1-2 ml/l of water
- Use lady bird beetle to control the population of aphid

### **2. Scale insect**

- They suck the sap from tender parts of the plant, leaves, flower and fruit
- The affected part get damage which result premature fruit drop and

defoliation

### **Control**

- Adopt clean cultivation
- Spray the rogor @ 1-2ml/l of water

### **3. Citrus Psylla**

- They suck the sap from the tender parts of the plant, leaves, flowers and fruits
- They create honey dew on the leaves in which shootmould is developed

### **Control**

- Establish nursery about 1300m height
- Destroy the secondary host i. e. kamini flower of this insect
- Spray Rogor @ 2-3 ml/l of water

### **4. Leaf Miner**

- Very small larva bore in the tissue of the leaves and make zig-zag tunnel
- Feed on the chlorophyll internally due to which the tunnel looks silver colour

### **Control**

- Spray tobacco based pesticide
- e. g. Soak 250 tobacco in 400 liter of water and mix with 30g surf. Keep it whole night and filter it
- Now add one part of this solution in a part of water and spray at 10 days interval
- Apply Rogor @ 2-3 ml/l of water

### **5. Stem Borer**

- The larva feed on the stem and trunk of the plant
- They make tunnel internally

- Leaves fall on severe condition

### **Control**

- Adopt clean cultivation
- Use wire to kill the insects inside the tunnel

### **6. Lemon butterfly**

- Female lays eggs on the fruit
- After hatching larva feed on the pulp of the fruit causing rooting and dropping of fruits

### **Control**

- Collect and destroy the affected and falling fruits
- Destroy the larva and eggs of the insect
- Spray Desis @ 2ml/l of water
- Use Feromon traps consisting of cotton soaked in methyl eugenaol and 2-3 drops of malathion

### **7. Lemon bug**

- Larva feed on the tender part of the plant like shoots, leaves, fruits and damage the nursery plant

### **Control**

- Adopt clean cultivation
- Spray Rogor or Endosulfan @ 2ml/l of water

### **Diseases of Sweet Orange**

#### **1. Die-Back**

**C/O:** Fungus

**S. N:** *Colletotrichum gloeosporioides*

### **Symptoms**

- The leaves becomes yellow in initial stage and turn into dark colour and start to fall with beginning of summer

- Die-back of twig starts leading to dry and finally the plant die

### **Control**

- Remove dead twigs or affected part from the plant
- Spray Carvendazim @ 1g + 2 g kauchol/l of water

## **2. Phytophthora rot (Root rot, Crown rot, gummosis)**

**C/O:** Fungus

**S. N:** *Phytophthora parasitica*

*P. citrophthora*

### **Symptoms**

- Dark discolouration of bark is developed, water soaked spots developed which cause stem rot, rootlet rot and finally defoliation
- In advance stage bark cracking and oozing of gums takes place

### **Control**

- Avoid water logging condition at the base of the plant
- Scrap the affected part

## **3. Citrus Canker**

**C/O:** Bacteria

**S. N:** *Xanthomonas citri*

### **Symptoms**

- It is a serious disease in citrus fruits
- It affects the quality of fruit and reduce market value
- Water soaked with round spots are seen on the leaves and stems as well as in fruits
- The spots increases slowly and turn into brownish on the leaves, stems and fruits

### **Control**

- Remove and destroy the infected part of the plant
- Spray 49 ordeaux mixture @ 1% on cut portion
- Streptocyclin @ 1g/l of water initially

#### 4. Citrus Greening

**C/O:** Bacteria

**S. N. :** *Liberibacter asiaticus*

##### Symptoms

- Initially vein and veinlet turns yellow and then interveinal chlorosis is observed
- Leaves become leathery, small, pair in mass and bend downward of seasonal flowering
- Die-back symptoms is another major symptoms of this disease
- Division of cloves are not in equal proportion and seeds are not viable
- It is transmitted by citrus phyla

##### Control

- The infected parts are destroyed
- Spray Diemethoade @ 2-3ml/l of water to control the vector citrus phyla
- Apply Bordo pest in cut portion
- Spry Streptocyclin @ 1g/l of water after pruning

#### 5. Powdery Mildew

**C/O:** Fungus

**S. N:** *Oidium tingitanum*

##### Symptoms

- White powdery mass appears on the twigs and leaves
- Fruits drop before it matures
- The affected leaves die in later stages

## Control

- Destroy the affected plant part
- Spray Bavistin @ 1-2g/l of water at 20 days interval but in severe infection spray 8-10 days interval

## 6. Tristeza Virus

### Symptoms

- It is a serious disease of citrus family
- It cannot be controlled easily
- Initial symptoms are seen like development of small leaf like green in colour, small fruit with sour test
- At later stage, the plants wilt and die

### Control

- Destroy infected plant part
- Spray Di-methoate @ 2-3 ml/l of water to control sucking pest **Lime** (*citrus aurantifolia*)

**Family:** Rutaceae

**Origin:** South East Asia

### Nutritive Value and Use

It is rich source of Vitamin C, minerals and citric acid. The juice is used in making cold drinks, squash, lemon tea etc. The rind is used to make pickles.

### Variety

- |                    |                  |
|--------------------|------------------|
| 1. Maxican         | 2. Banaras local |
| 3. Terhathum local | 4. Rampur-01     |
| 5. Rampur-10       | 6. Rampur -101   |
| 7. Rampur-76       | 8. Rampur-94     |

### Climate and Soil

It is tropical, sub-tropical fruit. It can be cultivated at the altitude of 1000-1500 masl. The optimum temperature is about 10-35°C.

It can be cultivated in loam and sandy loam. pH should be 6.5-7. Rainfall should be 1000-2000mm.

### **Propagation**

It can be propagated by seed. Now-a-days air layering and veneer grafting are also practiced. **Planting**

In a well prepared land sapling should be planted in pit size 1x1x1m<sup>3</sup>. The spacing is maintained about 5-6m. It can be planted by square or rectangular method of planting.

### **Manure and Fertilizer**

- 50 kg FYM/plant/yr.
- 870g Nitrogen/plant/yr.
- 540g Phosphorus/plant/yr.
- 830g potassium/plant/yr.

### **Irrigation**

Irrigation is most important during flowering and fruiting stage. It requires irrigation at 10 days interval during summer and at 20 days interval during winter. Irrigation is not required in those areas where annual rainfall is above 1000-1400mm. Lack of irrigation may cause fruit drop, small size fruit and wrinkled fruit.

### **Training and Pruning**

It is an important operation in citrus group. Diseased, dried, unwanted and overlap branches are removed. Suckers should be removed.

### **Flowering and Fruiting**

Flowering takes place in the month of Baisakh-Jestha. The fruitlets develop in the month of Shrawan-Bhadra.

### **Harvesting and Marketing**

Fruits are harvested when rind becomes matured and green. The harvested fruit are cleaned, graded and transported to the market.

### **Yield**

It yields about 3-7 MT/ha. About 2000-4000 per plant per year.

### **Insect Pest of Lime**

#### **1. Aphid**

- The adult and nymph suck the sap from tender parts of the plant, leaves, flowers and fruits.
- It cause the stunted growth of plant and reduction in yield.

#### **Control**

- Adopt clean cultivation
- Spray Rogor @ 1-2 ml/l of water.
- Use lady bird beetle to control the population of aphid.

#### **2. Scale insect**

- They suck the sap from tender parts of the plant, leaves, flower and fruit.
- The affected part get damage which result premature fruit drop and defoliation.

#### **Control**

- Adopt clean cultivation.
- Spray the rogor @ 1-2ml/l of water.

#### **3. Citrus Psylla**

- They suck the sap from the tender parts of the plant, leaves, flowers and fruits.
- They create honey dew on the leaves in which shootymould is developed.

#### **Control**

- Establish nursery about 1300m height.

- Destroy the secondary host i. e. kamini flower of this insect.
- Spray Rogor @ 2-3ml/l of water.

#### 4. Leaf Miner

- Very small larva bore in the tissue of the leaves and make zig-zag tunnel.
- Feed on the chlorophyll internally due to which the tunnel looks silver colour.

#### Control

- Spray tobacco based pesticide.  
e. g. Soak 250 tobacco in 400 liter of water and mix with 30g surf. Keep it whole night and filter it.
- Now add one part of this solution in a part of water and spray at 10 days interval.
- Apply Rogor @ 2-3 ml/l of water

#### 5. Stem Borer

- The larva feed on the stem and trunk of the plant.
- They make tunnel internally.
- Leaves fall on severe condition.

#### Control

- Adopt clean cultivation.
- Use wire to kill the insects inside the tunnel.

#### 6. Lemon butterfly

- Female lays eggs on the fruit.
- After hatching larva feed on the pulp of the fruit causing rooting and dropping of fruits.

#### Control

- Collect and destroy the affected and falling fruits.
- Destroy the larva and eggs of the insect.

- Spray Desis @ 2ml/l of water.
- Use Pheromon traps consisting of cotton soaked in methyl eugenaol and 2-3 drops of malathion.

## 7. Lemon bug

- Larva feed on the tender part of the plant like shoots, leaves, fruits and damage the nursery plant.

### Control

- Adopt clean cultivation.
- Spray Rogor or Endosulfan @ 2ml/l of water.

## Disease of Lime 1.

### Die-Back

C/O: Fungus

S. N: *Colletotrichum gloeosporioides*

### Symptoms

- The leaves become yellow in initial stage and turn into dark colour and start to fall with beginning of summer.
- Die-back of twig starts leading to dry and finally the plant die.

### Control

- Remove dead twigs or affected part from the plant.
- Spray Carvendazim @ 1g + 2 g kauchol/l of water.

## 2. Phytophthora rot (Root rot, Crown rot, gummosis)

C/O: Fungus

S. N: *Phytophthora parasitica*

*P. citrophthora*

### Symptoms

- Dark discolouration of bark is developed, water soaked spots developed which cause stem rot, rootlet rot and finally defoliation.
- In advance stage bark cracking and oozing of gums takes place.

#### **Control**

- Avoid water logging condition at the base of the plant.
- Scrap the affected part.

### **3. Citrus Canker**

**C/O:** Bacteria

**S. N:** *Xanthomonas citri*

#### **Symptoms**

- It is a serious disease in citrus fruits.
- It affects the quality of fruit and reduce market value.
- Water soaked with round spots are seen on the leaves and stems as well as in fruits.
- The spots increases slowly and turn into brownish on the leaves, stems and fruits.

#### **Control**

- Remove and destroy the infected part of the plant.
- Spray 55ordeaux mixture @ 1% on cut portion.
- Streptocyclin @ 1g/l of water initially.

### **4. Citrus Greening**

**C/O:** Bacteria

**S. N. :** *Liberibacter asiaticus*

#### **Symptoms**

- Initially vein and veinlet turns yellow and then interveinal chlorosis is observed.

- Leaves becomes leathery, small, pair in mass and bend downward of seasonal flowering.
- Die-back symptoms is another major symptoms of this disease.
- Division of cloves are not in equal proportion and seeds are not viable.
- It is transmitted by citrus phyla.

### **Control**

- The infected parts are destroyed.
- Spray Diemethoade @ 2-3ml/l of water to control the vector citrus phyla.
- Apply Bordo pest in cut portion.
- Spry Streptocysin @ 1g/l of water after pruning.

### **5. Powdery Mildew**

**C/O:** Fungus

**S. N:** *Oidium tingitanum*

### **Symptoms**

- White powdery mass appears on the twigs and leaves.
- Fruits drop before it matures.
- The affected leaves die in later stages.

### **Control**

- Destroy the affected plant part.
- Spray Bavistin @ 1-2g/l of water at 20 days interval but in severe infection spray 8-10 days interval.

### **6. Tristeza Virus**

### **Symptoms**

- It is a serious disease of citrus family.
- It cannot be controlled easily.

- Initial symptoms are seen like development of small leaf like green in colour, small fruit with sour test.
- At later stage, the plants wilt and die.

### **Control**

- Destroy infected plant part.
- Spray Di-methoate @ 2-3 ml/l of water to control sucking pest. **Lemon**  
(*Citrus limon*)

**Family :** Rutaceae

**Origin :** Nepal and India

### **Nutritive Value and Use**

It is a rich source of Vitamin C and minerals. The juice is used in making cold drinks, squash, lemon tea etc. It is also used in making pickles. It is one of the most important flavoring agents in drinks, sweet products etc.

### **Varieties**

- |                 |                 |
|-----------------|-----------------|
| 1. Nepali amilo | 2. Suraka round |
| 3. Assam amilo  | 4. Elaichi      |
| 5. Nepali round | 6. Nimbu        |

### **Climate and Soil**

It is a tropical to sub-tropical fruit. It can be cultivated up to an altitude of 700-1400 masl. The ideal temperature is 10-35°C. It requires 1000-2000mm annual rainfall.

It can be cultivated in loam and sandy loam having high OM. pH should be 5-7.

Soil should have proper drainage facility.

### **Propagation**

It is commonly propagated by seeds. Generally, T-Budding and veneer grafting are the popular methods of asexual.

### **Planting**

The sapling should be planted in pit size 75x75x75 cm<sup>3</sup>. The spacing should be maintained about 5-6m. It can be planted by adopting square or rectangular system of planting.

### **Manure and Fertilizer**

- 50 kg FYM/plant/yr.
- 830g Nitrogen/plant/yr.
- 540g Phosphorus/plant/yr.
- 540g potassium/plant/yr.

### **Irrigation**

Irrigation is most important during flowering and fruiting stage. It requires irrigation at 10 days interval during summer and at 20 days interval during winter. Frequent irrigation is necessary from the planting time. Irrigation is done according to the soil moisture status and climate.

### **Training and Pruning**

It is an important operation in citrus group. Diseased, dried, unwanted and overlap branches are removed. Suckers should be removed.

### **Flowering and Fruiting**

Flower takes place in the month of Baisakh-Jestha. The fruitlets develops in the month of Shrawan-Bhadra.

### **Harvesting and Marketing**

Fruits are harvested when rind colour changes from green to straw yellow. The harvested fruit are cleaned, graded and transported to the market.

### **Yield**

It yields about 5-7 Mt/ha. About 200-300 fruits per plant.

### **Insect Pest of Lemon**

#### **1. Aphid**

- The adult and nymph suck the sap from tender parts of the plant, leaves, flowers and fruits.
- It causes the stunted growth of plant and reduction in yield.

#### **Control**

- Adopt clean cultivation
- Spray Rogor @ 1-2 ml/l of water.
- Use lady bird beetle to control the population of aphid.

#### **2. Scale insect**

- They suck the sap from tender parts of the plant, leaves, flower and fruit.
- The affected parts get damaged which result premature fruit drop and defoliation.

#### **Control**

- Adopt clean cultivation.
- Spray the rogor @ 1-2ml/l of water.

#### **3. Citrus Psylla**

- They suck the sap from the tender parts of the plant, leaves, flowers and fruits.
- They create honey dew on the leaves in which shooty mould is developed.

#### **Control**

- Establish nursery about 1300m height.
- Destroy the secondary host i. e. kamini flower of this insect.
- Spray Rogor @ 2-3ml/l of water.

#### **4. Leaf Miner**

- Very small larva bore in the tissue of the leaves and make zig-zag tunnel.

- Feed on the chlorophyll internally due to which the tunnel looks silver colour.

### **Control**

- Spray tobacco based pesticide.
- e. g. Soak 250 tobacco in 400 liter of water and mix with 30g surf. Keep it whole night and filter it.
- Now add one part of this solution in a part of water and spray at 10 days interval.
- Apply Rogor @ 2-3 ml/l of water

### **5. Stem Borer**

- The larva feed on the stem and trunk of the plant.
- They make tunnel internally.
- Leaves fall on severe condition.

### **Control**

- Adopt clean cultivation.
- Use wire to kill the insects inside the tunnel.

### **6. Lemon butterfly**

- Female lays eggs on the fruit.
- After hatching larva feed on the pulp of the fruit causing rooting and dropping of fruits.

### **Control**

- Collect and destroy the affected and falling fruits.
- Destroy the larva and eggs of the insect.
- Spray Desis @ 2ml/l of water.
- Use Pheromon traps consisting of cotton soaked in methyl eugenaol and 2-3 drops of malathion.

### **7. Lemon bug**

- Larva feed on the tender part of the plant like shoots, leaves, fruits and damage the nursery plant.

### **Control**

- Adopt clean cultivation.
- Spray Rogor or Endosulfan@2 ml/l of water.

### **Diseases of Lemon 1.**

#### **Die-Back**

**C/O:** Fungus

**S. N:** *Colletotrichum gloeosporioides*

#### **Symptoms**

- The leaves become yellow in initial stage and turn into dark colour and start to fall with beginning of summer.
- Die-back of twig starts leading to dry and finally the plants die.

#### **Control**

- Remove dead twigs or affected part from the plant.
- Spray Carbendazim @ 1g + 2 g kauchol/l of water.

### **2. Phytophthora rot (Root rot, Crown rot, gummosis)**

**C/O:** Fungus

**S. N:** *Phytophthora parasitica*

*P. citrophthora*

#### **Symptoms:**

- Dark discolouration of bark is developed, water soaked spots developed which cause stem rot, rootlet rot and finally defoliation.
- In advance stage bark cracking and oozing of gums takes place.

#### **Control**

- Avoid water logging condition at the base of the plant.

- Scrap the affected part.

### 3. Citrus Canker

C/O: Bacteria

S. N: *Xanthomonas citri*

#### Symptoms

- It is a serious disease in citrus fruits.
- It affects the quality of fruit and reduce market value.
- Water soaked with round spots are seen on the leaves and stems as well as in fruits.
- The spots increases slowly and turn into brownish on the leaves, stems and fruits.

#### Control

- Remove and destroy the infected part of the plant.
- Spray Bordeaux mixture @ 1% on cut portion.
- Streptocyclin @ 1g/l of water initially.

### 4. Citrus Greening

C/O: Bacteria

S. N. : *Liberibacter asiaticus*

#### Symptoms

- Initially vein and veinlet turn yellow and then interveinal chlorosis is observed.
- Leaves become leathery, small, pair in mass and bend downward of seasonal flowering.
- Die-back symptoms is another major symptoms of this disease.
- Division of cloves are not in equal proportion and seeds are not viable.
- It is transmitted by citrus phyla.

## **Control**

- The infected parts are destroyed.
- Spray Diemethoate @ 2-3ml/l of water to control the vector citrus phyla.
- Apply Bordo pest in cut portion.
- Spray Streptoclylin @ 1g/l of water after pruning.

## **5. Powdery Mildew**

**C/O:** Fungus

**S. N:** *Oidium tingitanum*

### **Symptoms**

- White powdery mass appear on the twigs and leaves.
- Fruits drop before it matures.
- The affected leaves died in later stages.

### **Control**

- Destroy the affected plant part.
- Spray Bavistin @ 1-2g/l of water at 20 days interval but in severe infection spray 8-10 days interval.

## **6. Tristeza Virus**

### **Symptoms:**

- It is a serious disease of citrus family.
- It cannot be controlled easily.
- Initial symptoms are seen like development of small leaf like green in colour, small fruit with sour test.
- At later stage, the plant wilt and die.

### **Control:**

- Destroy infected plant part.

- Spray Di-methoate @ 2-3 ml/l of water to control sucking pest.

### **Pomegranate (*Punica granatum*)**

**Family:** Punicaceae

**Origin:** Iran

#### **Nutritive Value and Use**

It is a rich source of Iron, Vitamin and minerals. Fruits are consumed fresh and also making juice, wine, squash etc. It possesses medicinal value and used in increasing blood level during Leprosy. Its rind helps in controlling dysentery.

#### **Variety**

- |                 |           |
|-----------------|-----------|
| 1. Paper Shell  | 2. Badana |
| 3. Kandhori     | 4. Dolkha |
| 5. Moshquat red | 6. Kabul  |

#### **Climate and Soil**

It can be cultivated between altitudes of 500-1850 masl. It requires temperature about 13-35<sup>0</sup>C but ideal temperature is 18<sup>0</sup>C which provides quality fruits having high juice level. It require about 500-600 mm annual rainfall. It can tolerate drought and frost condition. High humidity during fruiting stage decreases the quality of fruits.

Loamy to sandy loam is best soil for its cultivation. pH should be 6-7.5. The soil should have proper drainage facility. It can be cultivated in alkaline soil also.

#### **Propagation**

It can be propagated by seed but it is not popular one. It can be easily propagated by semi-hard wood cutting and mound layering before the onset of monsoon.

#### **Planting**

In a well prepared land sapling should be planted in a pit size of 60x60x60 cm<sup>3</sup>. The spacing should be maintained about 4-5m. It can be planted by adopting square or contour system before onset of monsoon or end of monsoon.

#### **Manure and Fertilizer**

- The recommended dose of manure and fertilizer are:

- 10 Kg FYM/plant/yr.
- 100g Nitrogen/plant/yr.
- 25g Phosphorus/plant/yr.
- 25g Potassium/plant/yr.

### **Irrigation**

It requires more irrigation during its early years of planting. Irrigation is more essential during flowering and fruiting stage. Less soil moisture may cause flower and fruit drop and cracking of fruits. Generally, irrigation is done at 15-20 days interval depending upon the soil moisture condition. Heavy irrigation may cause less flowering.

### **Training and Pruning**

The diseased, dried, unwanted and overlapped branches are removed. The suckers are also removed. The main trunk should be cut at the height of 1m which helps to develop lateral branches. 3-5 lateral branches are kept.

### **Flowering and Fruiting**

Flower takes place in the month of Chaitra-Baisakh. The fruitlets develop in the month of Ashad-Shrawan.

### **Harvesting and Marketing**

Fruits get mature at 5-7 months of flowering. Fruits are harvested when they are fully mature. Fruits are harvested when its colour turns from green to red. It gives metallic sound. After harvesting fruits are cleaned, graded, packed and transported to the market.

### **Yield**

It yields about 3-4 tons per hectare. In properly managed orchard of 3-4 years gives about 200-250 fruits per plant.

### **Insect Pest of Pomegranate**

#### **1. Fruit borer**

- It is a serious pest of pomegranate.

- Newly hatched caterpillar bore into the fruit and feed on developing seed.
- Hole is made by caterpillar which facilitates the entry of pathogen that leads to fruit rot.

### **Control**

- Collect and destroy infected fruits.
- Bagging of fruits is done with butter paper after spraying Dimethoide @ 0.05%.

### **2. Fruit sucking moth**

- Moth punctures fruits and suck the juice.
- Pathogens may enter from puncturing part which cause fruit rot.

### **Control**

- Collect and destroy the infected fruits.
- Harvest matured fruits earlier.
- Generate smoke in an orchard during night.

### **3. Thrips**

- They suck the cell sap from the tender parts of leaves, flowers and fruits which causes yellowing of leaves, fruit drop.
- Flower drop and yield is reduced.

### **Control**

- Adopt clean cultivation.
- Spray Rogor @ 2-3ml/l of water.

## **Diseases of Pomegranate**

### **1. Leaf spot**

**C/O:** Fungus

**S. N:** *Cercospora punicae*

### **Symptoms**

- Light brown to dark spots are seen on the leaves.
- In severe infection leaf drop takes place.

### Control

- Adopt clean cultivation.
- Spray Captan @ 2g/l of water at 10-15 days interval.

## 2. Fruit Rot

**C/O:** Fungus

**S. N:** *Colletotrichum gloeosporioides*

### Symptoms

- Black spots are seen on the lower part of the fruit.
- The spots cover about half portion of the fruit at 7-10 days of infection.
- Finally the infected portion of fruit get rot and the fruit drop takes place.

### Control

- Apply Mencozeb @ 2g/l of water at 10-15 days interval.
- Apply 2 g Kauchio and 1g Bevistin in 1 lit. of water and spray. **Kiwi**  
(*Actinidia delicosa*)

**Family:** Actinidiaceae

**Origin:** China

### Nutritive Value

It is a very delicious fruit that contains minerals and vital vitamins such as Vitamin C. It also contains vitamin E and an enzyme that acts as a meat tenderizer.

### Varieties

- |           |            |
|-----------|------------|
| 1. Tomori | 2. Matuwa  |
| 3. Khohi  | 4. Allison |
| 5. Bruno  | 6. Hayward |
| 7. Monty  |            |

## **Climate and Soil**

Kiwi can be grown upto an altitude of 1000-3000 masl. It require 1500mm annual rainfall. It cannot tolerate drought condition so there should be moisture in soil.

It can be cultivated in a soil having high organic matter and pH 6. 5-7. 5. All kinds of soil is suitable for kiwi cultivation except sandy soil but sandy loam is ideal.

Water logging condition is not suitable for its cultivation.

## **Propagation**

It can be propagated by seed, cutting, grafting, root cutting, veneer grafting, side grafting and tongue grafting.

## **Planting**

It is planted in a pit size of 2x3x2 feet.

Maintaining the spacing of about 6m plant to plant and 5m row to row. But for high density variety like Hayward, spacing should be maintained 7-8m

## **Manure and Fertilizer**

- Recommended dose of FYM is 30 kg up to 2-5 years of planting.
- Nitrogen 120g upto 2-5 years of planting.
- Phosphorus 60g upto 2-5 years of planting.
- Potash 60g upto 2-5 years of planting.
- And from 5 years of planting it requires 800:600:800 g NPK.
- If possible 500g bone meal should be given.

## **Irrigation**

Maximum moisture losses due to transpiration. It requires maximum irrigation during early stage of planting. It is a shallow rooted plant so more irrigation is required. In a well-established orchard, irrigation is done at 7-10 days interval.

Irrigation is most necessary during flowering and fruiting stage.

## **Training and Pruning**

It requires training to give suitable shape. The diseased and unwanted branches should be removed to manage the fruiting branches. It requires pruning twice in a year.

### **Fruiting**

It starts fruiting after three years of planting but it gives commercial production after 5 years of planting.

### **Harvesting and marketing**

Mature fruits are harvested manually. Generally, fruits become ready to harvest after 220 days of flowering. Fuzz are removed when it matures. Fruits get wrinkled if not harvested in properly matured stage. After harvesting fruits are cleaned, graded, packed and transported to the market.

### **Yield**

Generally, it yields about 50-100kg from 7-8 years old plants. Average production per hectare is 25-30 tons.

### **Insect Pests of Kiwi**

#### **1. Leaf Roller**

- They lay egg on upper surface of the tender leaves.
- After hatching, the larvae feed on the leaves and skin of the tender fruits.
- Later on the shape of the fruit get deteriorate.

#### **Control**

- Proper pruning is adopted.
- In severe infection spray Endosulfan @ 2-3 ml/l of water.

#### **2. Greedy scale insect**

- They suck the cell sap from tender stem, leaf, vein and tender fruits.
- The fruits become unfit for consumption.

#### **Control**

- Adopt clean cultivation.

- Spray Rogor @ 2-3ml/l of water

## 2. **Passion vine hopper**

- They suck the sap of the vine and deposit honey dew on the fruit.
- Shooty mould growing on this sticky substance which makes the fruit unmarketable.

### **Control**

- Destroy the alternative host of the insect.
- Spray Bavistin @ 2-3gm/l of water.
- Adopt clean cultivation.

## **Diseases of Kiwi 1.**

### **Root Rot**

**C/O:** Fungus

### **Symptoms**

- The disease is developed in water logging condition.
- The roots of the fruit tree get rot and wilting of plant takes place.

### **Control**

- Avoid the water logging condition.
- Cultivation should be done in proper manner, avoid injury during inter cultural operation.
- Apply Mancozeb in injured part.

## 2. **Crown Gall**

**C/O:** Fungus

**S. N:** *Agrobacterium tumefaciens*

### **Symptoms**

- It is a common disease in nursery.

- It is identified by the whitish brown gall on the stem near the soil surface.
- The gall increases in size and changes into black colour in severe infection.

#### **Control**

- Destroy the affected seedlings.
- Treat the soil before establishing nursery bed.
- Don't use the same soil for many years to produce seedlings.

### **3. Bacterial Blossom Rot**

**C/O:** Bacteria

#### **Symptoms**

- The petals change into brown colour from white and drop before flowering.
- It affects pollination.
- If the fruiting takes place then, fruits becomes small and shape is deteriorated.

#### **Control**

- Adopt clean cultivation.
- No any chemicals are recommended for its control.

### **Temperate Fruits**

#### **Apple (*Malus domestica*)**

**Family:** Rosaceae

**Origin:** South East Asia

#### **Nutritive value and Use**

It is a good source of vitamin, fiber and minerals. Ripe fruits are directly consumed and it is also used to prepare jam, jelly, candy, ice-cream, wine etc.

#### **Varieties**

- |                    |                     |
|--------------------|---------------------|
| 1. Red delicious   | 2. Golden delicious |
| 3. Royal delicious | 4. Rome beauty      |
| 5. Jonathan        |                     |

### **Climate and Soil**

It can be cultivated at an altitude of 1500-3000m from mean sea level depending upon the variety. The annual rainfall lies between 400-500mm. It requires temperature about 15-21<sup>0</sup>C for proper growth and development. It also requires 250-1400 hours of chilling temperature below 7. 2<sup>0</sup>C during winter season to break dormancy.

It can be cultivated in sandy loam and sandy clay soil having pH range of 6-7. The soil should have proper drainage facility.

### **Propagation**

It is commercially propagated by tongue grafting or T-Budding.

### **Planting**

The sapling are planted in well prepared land at spacing of 6-8m depending upon variety. The pit size should be 60x60x60 cm<sup>3</sup>. The sapling should be planted in the month of Poush-falgun.

### **Manure and Fertilizer**

The recommended dose of manure and fertilizer per plant per year is given below:

Age of Plant (Yrs)	FYM/compost (Kg)	Nitrogen (g)	Phosphorus (g)	Potassium (g)
1	10	70	35	70
2	20	140	70	140
3	30	210	105	210
4	40	280	175	280
5	50	350	210	350

6	60	420	245	420
7	70	490	280	490
8	80	560	315	560
9	90	630	350	630
10	100	700	385	700

### **Irrigation**

Moisture stress mainly affects the fruit production. Insufficient moisture causes flower and fruit drop. Younger plants are irrigated twice a week depending upon moisture of the soil. Bearing plants are irrigated once a week in summer.

### **Training and Pruning**

The apple tree is trained by modified leader system in which main stem is allowed to grow up to 1.5-2.5m then headed back to height of 1.2-1.5m to facilitate lateral branch growth. After then, diseased, dried, crowded, overlapped branches are removed.

### **Harvesting and Marketing**

The fruits are harvested when it is attained full size and colour changes from green to red colour and flesh becomes firm. After harvesting, the fruits are cleaned, graded and packed in wooden crate or in plastic crate. After packing, they are transported to the market.

### **Grading:**

<b>Size of fruit</b>	<b>Grading criteria</b>
Fruit having <b>80mm</b> in diameter or above	<b>Very large fruit</b>
Fruit having <b>75mm</b> in diameter	<b>Large fruit</b>
Fruit having <b>70mm</b> in diameter	<b>Medium fruit</b>
Fruit having <b>65mm</b> in diameter	<b>Small fruit</b>

Fruit having 60mm in diameter or less	Very small fruit
---------------------------------------	------------------

## **Yield**

It yields about 10-12 ton per hectare.

## **Insect Pest of Apple**

### **1. San Jose Scale**

- They suck the sap from leaves, stem and bark of the tree which cause serious damage.
- It attacks on masses overlapping in layers.

### **Control**

- Destroy affected part.
- Spray Rogor @ 1.5-2.5 ml/l of water.
- Adopt clean cultivation.

### **2. Woolly apple aphid**

- On the aerial part white woolly mass is seen.
- They suck sap from stem, twigs and roots resulting gall formation.
- The affected plants remain stunted.

### **Control**

- Adopt clean cultivation.
- Spray Rogor @ 2-3ml/l of water
- Application of Carbofuran @ 30-5g per tree at 5cm depth in the root zone for non bearing trees.

### **3. Apple fruit moth**

- Moth lays eggs on the skin of the fruit.
- After hatching, caterpillars enter into the flesh of fruit and make tunnel on fruit.

## Control

- Adopt clean cultivation.
- Destroy affected parts.
- Spray Rogor @ 1.5-2.5ml/l of water
- Provide smoke at night time in moth affected areas.

### 4. Stem and shoot borer

- The larvae bore into branches, stem and tree trunk just under the bark.
- The affected parts get dry and die.
- They affect more on Aerial part of the plant.

## Control

- Destroy the affected parts.
- Use petrol or insecticide in the hole to kill the insect.
- Use wire to kill the insect inside hole.

## Disease of Apple

### 1. Apple Scab

C/O: Fungus

S. N: *Venturia inaequalis*

## Symptoms

- The brownish encrustation is seen on the leaves, stem and fruits resulting into water soaked lesions.
- It causes defoliation of leaves and rotting of leaves.
- Due to attacks the plant fails to develop fruit and tree become weak and the yield decreases.
- The developed fruit may crack.

## Control

- Adopt proper pruning so that all branches should get proper amount of light intensity.
- Adopt clean cultivation.
- Spray Mencozeb @ 2-3 g/l of water at 14 days interval.

## 2. Powdery mildew

C/O: Fungus

S. N: *Podosphaera leucotricha*

### Symptoms

- The powdery mass appears on the leaves, young shoots, fruits and flowers.
- It causes stunted growth, dropping of flowers and fruits.

### Control

- Destroy the affected plant parts.
- Spray Sulphur @0. 2% at 12-15 days interval during bud development stage.

## 3. Crown Gall or Hairy root

C/O: Fungus

S. N: *Agrobacterium tumefaciens*

### Symptoms

- Excessive fibrous roots develop which looks like broom usually pea size.
- Galls are developed in the root zone which change into big size (i. e. 6 inch in diameter).
- The galls are in brownish colour in initial stage which later on change into black colour.
- The galls may be elongated, rounded or irregular in shape.

### Control

- Root injury is avoided.

- Establish nursery in disease free areas.
- Provide proper drainage facility.

#### 4. Collar Rot

C/O: Fungus

S. N: *Phytophthora cactorum*

##### Symptoms

- In the infected plant, the collar region near to the ground level turns into brown, soft and spongi.
- The affected plant remains stunted, leaves become yellow or brown and leaves dropping takes place.
- The disease kills the plant at later stage.

##### Control

- Adopt proper weeding.
- Drench the soil with copper oxychloride @ 4-5 g/l of water.

#### 5. Fruit Rot

C/O: Fungus

S. N: *Penicillium expansum*

##### Symptoms

- Water soaked lesions appears on infected fruit.
- Later on increases in size and fruit rot takes place.

##### Control

- Deep the fruits in Carbendazim @ 0. 1% after harvest. **Pear (*Pyrus cummunis*)**

**Family :** Rosaceae

**Origin :** China

**Nutritive value and Use**

Pear is a rich source of Vitamin C and minerals. Rape fruits are consumed fresh and also used in making Jam, jelly, candy, juice etc.

### **Varieties**

- |             |            |
|-------------|------------|
| 1. Shinko   | 2. Kousi   |
| 3. Housi    | 4. Harping |
| 5. Bretlett | 6. Chojuro |
| 7. Nelis    | 8. Gola    |

### **Climate and Soil**

It can be cultivated up to an altitude of 1200-200 masl. It requires temperature about 15-20°C. Rainfall should be 500-1000 mm.

Loamy to sandy loam soil is suitable for pear cultivation. It requires pH about 5.5-6.5. The soil should have proper drainage facility.

### **Propagation**

Generally, it can be propagated by seed and vegetative propagation. T-Budding and tongue grafting is practiced for commercial cultivation.

### **Planting**

The sapling should be planted in a pit size of 1x1x1m<sup>3</sup>. The spacing should be maintained about 5-10m depending upon the variety and soil fertility status. It is planted by adopting square or contour system of planting. It should be planted before the onset of monsoon or end of monsoon.

### **Manure and Fertilizer**

- FYM: 15 Kg/plot/year
- Nitrogen: 330g/plot/year
- Phosphorus: 150g/plot/year
- Potassium: 90g/plot/year

### **Irrigation**

Irrigation is done at 7 days interval in summer and at 15 days interval in winter. Irrigation should be applied on the basis of moisture stress of the soil.

## **Training and Pruning**

Training is done by adopting Open Center system. Pruning is done to remove undesirable branches, weak branches, diseased, infected branches and dry branches. Pruning is done after harvesting.

## **Flowering and Fruiting**

Flowering takes place in mid of summer. Fruitlet develops in Jestha-Ashar.

## **Harvesting and Marketing**

Fully matured fruits are harvested for fresh consumption and matured green fruits are harvested for canning and for distant market. After harvesting, fruits are cleaned, graded and transported to the market. For local consumption, fruits are harvested at slightly later stage because overall quality of the fruits are good when hanging on trees.

## **Yield**

It yields about 10-15 tons per hectare. If it is managed properly, it yields about 100-200kg/plant.

## **Insect Pest of Pear**

### **1. Pear Aphid**

- Adult and nymph suck the sap from leaves and from the tender part of the plants.
- It causes upward curling of leaves.

### **Control**

- Destroy affected part.
- Adopt clean cultivation.
- Spray Rogor @ 2-3ml/l of water.

### **2. Plum hairy caterpillar**

- The larvae feed on the leaves in the initial stage but in later stage they also attack on fruits.
- They scrap outer coat of the fruit which turn black and becomes hardy.

## Control

- Adopt clean cultivation.
- Destroy affected part.
- Spray Endosulfan @ 2-3ml/l of water.

### 3. Bark eating caterpillar

- The caterpillar causes damage by boring into the stem and branches.
- It attacks mainly in older orchard.

## Control

- Adopt clean cultivation.
- Destroy affected parts.
- Spray Rogor @ 2-3ml/l of water

### 4. Paper Wasp Mode of Action

- They damage ripe fruits by feeding upon them ● They destroy the flower.

## Control:

- Remove over ripe and damaged fruits.
- Spray Carbaryl @ 2-3g/l of water.
- Harvesting should be done as soon as they ripe.

## Diseases of Pear

### 1. Pear Scab

C/O: Fungus

S. N: *Venturia inaequalis*

## Symptoms

- Brown to black encrustations are seen on leaf and fruits.

- Fruits and leaves start to detach from the plant.
- The disease is more severe in those areas where heavy rainfall occurs during spring season (Chaitra-Baisakh).

### **Control**

- Adopt clean cultivation.
- Spray Bavistin @ 2-3ml/l of water.
- If not controlled after using Bavistin, spray sulphur fungicide @12ml/l of water.

## **2. Crown Gall or Hairy root**

**C/O:** Fungus

**S. N:** *Agrobacterium tumefaciens*

### **Symptoms**

- Excessive fibrous roots develop which looks like broom usually pea size.
- Galls are developed in the root zone which change into big size (i. e. 6 inch in diameter).
- The galls are in brownish colour in initial stage which later on change into black colour.
- The galls may be elongated, rounded or irregular in shape.

### **Control**

- Root injury is avoided.
- Establish nursery in disease free areas.
- Provide proper drainage facility.

## **1. Collar Rot**

**C/O:** Fungus

**S. N:** *Phytophthora acaetorum*

### **Symptoms:**

- In the infected plant, the collar region near to the ground level turns into brown, soft and spongi.
- The affected plant remains stunted, leaves becomes yellow or brown and leaves dropping takes place.
- The disease kills the plant at later stage.

### **Control**

- Adopt proper weeding.
- Drench the soil with copper oxychloride @ 4-5 g/l of water.

### **Strawberry (*Fragaria ananassa*)**

**Family:** Rosaceae

**Origin:** France

### **Nutritive Value and Uses**

Strawberry is a delicious fruit taken fresh in several ways. Good source of vitamin C and manganese. Strawberries have anti-inflammatory or anticancer properties. It also makes excellent ice cream and Jam on account of its rich aroma.

### **Varieties**

1. Royal Sovereign
2. Srinagar
3. Dilpasand 4. Katrain

### **Climate and Soil**

Strawberry thrives best in temperate climate. It is a short day plant, which requires exposure to about 10 days of less than 8 hours sunshine for initiation of flowering. In winter, the plants do not make any growth and remain dormant. The exposure to low temperature during this period helps in breaking dormancy of the plant. In spring when the days become longer and the temperature rises. The plants resume growth and begin flowering.

Strawberry requires a well-drained medium loam soil, rich in organic matter. The soil should be slightly acidic with pH from 5.7 to 6.5. At higher pH root formation is poor. The presence of excessive calcium in the soil causes yellowing of the

leaves. Strawberry should not be cultivated in the same land for a number of years. It is preferable to plant it in green manured field. Alkaline soils and soils infected with nematodes should be avoided.

### **Propagation**

Propagation is done by means of runners that are formed after the blooming season. The plants may be allowed to set as many runners as possible but not allowed to set any fruits. All the plants with good root system should be utilised to set a new plantation. Given the best attention and care, a single plant usually produces 12 to 18 runners.

### **Planting**

The land for strawberry planting should be thoroughly prepared by deep ploughing followed by harrowing. Strawberry can be planted on flat beds. It can be planted on raised beds. In irrigated areas, plantings on ridges is advised. The planting distance should be 45 cm from plant to plant and 60 to 75 cm. from row to row. In the hills, Transplanting is done in March-April, September-October. But in the plains, the months of January-February may be utilised for this purpose

### **Manure and Fertilizer**

- FYM: 50 tons/ha
- Nitrogen: 84-112 kg/ha
- Phosphorus: 56-84 kg/ha
- Potassium: 56-112 kg/ha

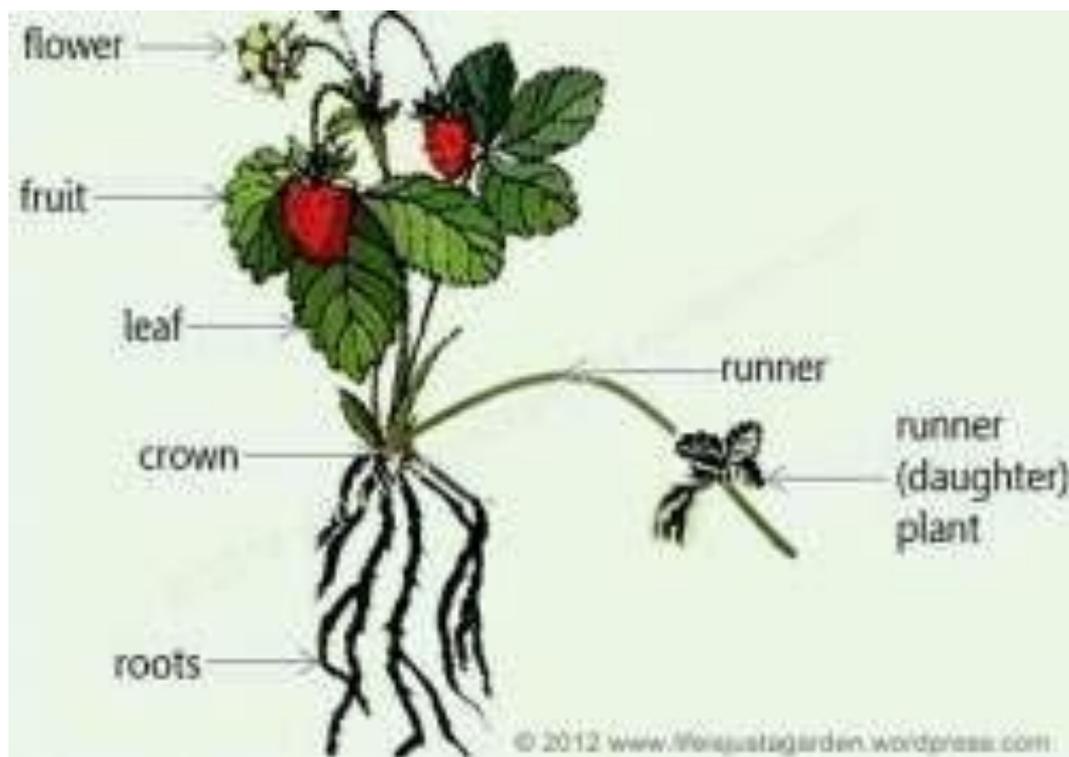
The nitrogenous fertilizer be applied in two doses (Three weeks after planting and again at the time of flowering) and potash at the time of flowering only.

### **Irrigation**

Since strawberry is relatively shallow-rooted, it is susceptible to conditions of drought. During September and October, irrigation should be given twice a week if there is no rain. It may be reduced to weekly intervals during November. In December and January, irrigation may be given once every fortnight. When fruiting starts, the irrigation frequency should again be increased. At this stage frequent irrigation gives larger fruits.

### **Training and Pruning**

Allow runners to grow and develop until the empty space between the row is about a foot to a foot and a half wide. Keep the middle of the rows empty by either moving runners or pruning them. *Prune* the strawberry runners until there are four to six runners left to each plant. This allows the plant to develop in a controlled way, yet permits it to keep enough food and nutrients to produce the berries. Do not let any new runners develop from the daughter plant. Do not cut the daughter plant from the mother plant.



### **Harvesting and Marketing**

The fruit ripens during late February to April in the plains and during May and June at high elevations. For local market the fruit should be harvested when they are fully ripen, but for transport to distant markets, it should be harvested when they are still firm and before colour has developed fully all over the fruit. Harvesting should be done preferably daily. Since fruit is highly perishable, it is packed in flat shallow containers of various types (cardboard, bamboo, paper trays etc. ) with one or two layers of fruits. Harvesting should be done early in the morning in dry conditions. Washing the fruit bruises it and spoils its luster.

Usually the fruit is picked in the early morning and sent to the market in the afternoon of the same day or is picked in the late afternoon, stored overnight in a cool place, and sent to market the following morning.

### **Yield**

The yield varies according to season and locality. A yield of 20 to 25 tons per hectare is excellent, though yields upto 50 tons per hectare have been reported under ideal conditions.

### **Insect Pest of Strawberry**

#### **1. Red spider mites**

##### **Control**

- The mites can be controlled with 0.05 per cent Monocrotophos + 0.25 per cent wettable sulphur.

#### **Cutworms**

##### **Control**

- The cut worms can be controlled by dusting the soil before planting with 5 per cent chloradane or Heptachlor dust at the rate of 50 kg per hectare and mixing it thoroughly in the soil by cultivator.

### **Disease of Strawberry**

- The two commonest diseases of strawberry are red stele, caused by the fungus *Phytophthora fragariae* and black root rot.
- The remedy for the former lies by growing resistant varieties like stelemaster and for the latter to maintain the vigour of the plants and rotate strawberry with other crops like legume vegetables (beans, peas etc).
- Strawberry also suffers from virus diseases known as yellow edge, crinkle and dwarf.
- Raising of strawberry nursery in the hills helps to check these.
- Strawberry also throws some chlorotic plants, which result from genetic segregation. These should not be confused with virus affected plants and should be rogued out.

#### **A. Learning process and support materials**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

## **B. Assessment**

### **Very Short Questions**

1. Give the scientific names of mango and litchi.
2. Write the names of any four temperate fruits.

### **Short Questions**

1. Write any four varieties of apple and pear.

### **Long Questions**

2. Write about the insect-pest and diseases of Citrus fruits.

## **GLOSSARY**

**Propagation:** It is the reproduction or spreading of plant.

**Irrigation:** The supply of water to land or crops to help growth of the plants.

**Training:** Training is a practice in which tree growth is directed into a desired shape and form.

**Pruning:** Pruning is the proper and judicious removal of plant parts such as shoots, spurs, leaves, roots or nipping away of terminal parts etc. to correct or maintain tree structure and increase its usefulness.

**Harvesting:** It is the process of gathering a ripe crop from the fields.

# **UNIT : 8 Harvesting and Postharvest Handling of Fruits**

## **A. Objectives**

Upon the completion of this unit, the students will be able to:

- Define harvesting and post harvesting.
- Describe about post-harvesting techniques.

## B. Content Elaboration

Postharvest loss in fruits are very high (20-40%). Improper handling and storage cause physical damage due to breakdown of tissue. Mechanical losses including cracking, bruising, cutting, microbial spoilage by fungus and bacteria.

Physiological losses include change in respiration rate, transpiration rate, pigments, and organic acids.

### 8.1. Maturity Judgment of Fruits

The maturity indices of fruits are given below:

Maturity Indices	Fruits
Peel Colour	Citurs, papaya, pineapple, grapes, mango, guava etc.
Pulp colour	Mango, papaya, apple etc.
Shape	Banana, mango, litchi, pineapple etc.
Size	Citrus, apple, mango etc.
Ease of separation from plant	Grapes, mango etc
Aroma	Jackfruit, guava, apple
Specific gravity	Mango, pineapple, guava etc.
Firmness	Apple, pears etc
Juice content	Citrus species
Acidity	Citurs, pineapple and mango
Total soluble sugar	Grape, sweet orange, papaya and pineapple

## **8.2. Harvesting and Harvesting Techniques**

Harvesting should be done during cooler part of the day. The harvested products should be shifted to shade as soon as possible. Harvesting during rainy period may create favorable condition for multiplication of micro organisms which cause damage to the fruits. Harvesting during hot period increase the heat of the products which cause wilting. Shriveling care during harvesting is necessary because injury may cause during harvesting which later turn into black or brown patches and make them unattractive. Many fruits are harvested unripe for their safe handling, transportation and marketing but they must be mature for proper ripening.

## **8.3. Post Harvest Handling Techniques**

The harvested crop should be handled, stored, and consolidated in a manner that ensures that the harvested fruits does not degrade. In general, do not fill or stack sacks or other harvest containers to levels that will result in compacting of harvested materials, as this may cause physical damage as well as temperature build-up and overheating. Protect the harvested fruits from contact with birds, rodents, insects, and other animals, as well as dirt, dung, smoke, and exhaust. Protect the harvested fruits from exposure to the elements as appropriate. In most cases the material should be protected from direct sunlight, rainfall, freezing, etc. , except where such exposure is required for a specific purpose such as sun-drying or bletting.

**Some post harvest techniques are as follows**

### **Canning**

The process of storing food stuff in a container and sterilize them for long storage is known as canning.

Fruits are canned when the raw materials are easily available in excess amount.

The products should be sold in off season to get better returns.

### **Bottling**

Bottles are very good container for home preservation of fruits. They can be used for several times and lasts for many years if handled carefully. Filling of food stuff in a a bottles and sterilize them by heat for long storage is called bottling.

The food stuff looks attractive through the glass donot develop metallic flavor.

### **Drying**

Drying is the process of removal of moisture of food stuffs under the influence of natural energy source like sun and wind. In sun drying, there is no possibility of temperature and humidity control.

### **Dehydration**

Dehydration means the process of removal of moisture of food stuff by the application of artificial heat under controlled condition. In dehydration, temperature, humidity and air flow are in controlled condition. The initial temperature of dehydrator is usually 43°C which gradually increases to 66-71°C in case of fruit.

### **Storage**

The production pattern, dietary habits, economic consideration wants long period storage in large quantities. To store fruits, low temperature and high humidity are required. Different structures are used for storage of fruits. They are stored in cool and dry rooms, storage in pits, cold storages etc.

### **Marketing**

Marketing is necessary in order to get return from the products. There is a demand for preserved products but these are not available in small town due to lack of shopkeepers in stocking such items. To sell products in time there must be marketing channel for immediate supply of the products.

#### **A. Learning process and support materials:**

The learning process includes the participation of student in group work, presentation and skill development, written methods etc.

#### **B. Assessment**

##### **Very Short Questions**

1. Define postharvest.
2. Define canning.

##### **Short Questions**

1. What do you mean by canning and bottling?

##### **Long Questions**

1. Explain harvesting techniques.

## **GLOSSARY**

**Postharvest:**It deals with the practice and methods used in prolonging shelf life of flowers, fruits, vegetables, species and plantation crops.

**Maturity:** It is the stage of fully development of tissue of fruit only after which will ripen normally.

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