

नया आगाज़

आज समय की माँग पर
आगाज़ नया इक होगा
निरंतर योग्यता के निर्णय से
परिणाम आकलन होगा।

परिवर्तन नियम जीवन का
नियम अब नया बनेगा
अब परिणामों के भय से
नहीं बालक कोई डरेगा

निरंतर योग्यता के निर्णय से
परिणाम आकलन होगा।

बदले शिक्षा का स्वरूप
नई खिले आशा की धूप
अब किसी कोमल-से मन पर
कोई बोझ न होगा

निरंतर योग्यता के निर्णय से
परिणाम आकलन होगा।

नई राह पर चलकर मंज़िल को हमें पाना है
इस नए प्रयास को हमने सफल बनाना है
बेहतर शिक्षा से बदले देश, ऐसे इसे अपनाए
शिक्षक, शिक्षा और शिक्षित
बस आगे बढ़ते जाएँ
बस आगे बढ़ते जाएँ
बस आगे बढ़ते जाएँ.....





BASIC HORTICULTURE-II

Student Handbook

(Class XII)



Central Board of Secondary Education

2, Community Centre, Preet Vihar, Delhi-110092

Basic Horticulture - II for Class XII

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PREFACE

Horticulture has now become as lifeline of a large population in the world. Even in India, we talk largely about horticulture. Horticulture consists of several branches but fruit cultivation (Pomology), vegetable cultivation (Olericulture) and flower cultivation (Floriculture) are the major branches of horticulture. We need fruits, vegetables and flowers in our daily life. It is a known fact that we are the 2nd largest producers of fruits and vegetables in the world. However, our productivity is dismally low than several other countries of the world primarily because horticulture sectors is encountered with several problems, and to tackle these problems, several technologies have been standardized by the scientists.

Considering the importance of horticulture, CBSE has introduced foundation course in horticulture entitled '**Basic Horticulture-II**' for class XII students with the following objectives:

- This is a basic course on horticulture, which will enlighten the students with the new areas in horticulture and development of skills in different areas of horticulture. Major topics covered in this course are business opportunities in horticulture, principles of preservation and processing, syrups and brines, urban horticulture, weeds of horticultural crops and their management, methods of propagation of horticultural crops and planting material for horticultural crops.
- After studying this course, students will get an idea about several opportunities, which horticulture can offer to them in their future life. Students can also think of joining this sector in their future life and can develop themselves as successful entrepreneurs in the area of horticulture.
- This course has been developed with the aim to sensitize the students about nursery raising, newer techniques of plant propagation, so that they can think of joining hands in nursery business or they can think of choosing horticulture as one of the subjects for their higher studies.
- This course has been designed to provide entry level job skills to the students, which will help to meet the human resource requirements in horticulture sector.

Vineet Joshi, IAS
Chairman, CBSE

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भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक ¹[संपूर्ण प्रभुत्व-संपन्न, समाजवादी, पंथ-निरपेक्ष, लोकतंत्रात्मक गणराज्य] बनाने के लिए तथा उसके समस्त नागरिकों को:

सामाजिक, आर्थिक और राजनैतिक न्याय,

विचार, अभिव्यक्ति, विश्वास, धर्म और उपासना की स्वतंत्रता,

प्रतिष्ठा और अवसर की समता प्राप्त कराने के लिए,

तथा उन सबमें व्यक्ति की गरिमा और ²[राष्ट्र की एकता और अखंडता सुनिश्चित] करने वाली बंधुता बढ़ाने के लिए

दृढ़संकल्प होकर अपनी इस संविधान सभा में आज तारीख 26 नवंबर, 1949 ई. (मिति मार्गशीर्ष शुक्ला सप्तमी, संवत् दो हजार छह विक्रमी) को एतद्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।

भारत का संविधान

भाग 4क

नागरिकों के मूल कर्तव्य

अनुच्छेद 51क

मूल कर्तव्य- भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह -

- (क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वजों और राष्ट्रगान का आदर करे;
- (ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;
- (ग) भारत की संप्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण बनाए रखे;
- (घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;
- (ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभाव से परे हो, ऐसी प्रथाओं का त्याग करे जो महिलाओं के सम्मान के विरुद्ध हों;
- (च) हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्व समझे और उसका परिरक्षण करे;
- (छ) प्राकृतिक पर्यावरण की, जिसके अंतर्गत वन, झील, नदी और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणिमात्र के प्रति दयाभाव रखे;
- (ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;
- (झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;
- (ञ) व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत प्रयास करे, जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई ऊँचाइयों को छू सके; और
- (ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य को शिक्षा के अवसर प्रदान करे।

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a ¹**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the ²[unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS i CONSTITUTION.**

1. Subs. by the Constitution (Forty-Second Amendment) Act. 1976, sec.2, for "Sovereign Democratic Republic (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-Second Amendment) Act. 1976, sec.2, for 'unity of the Nation (w.e.f. 3.1.1977)

THE CONSTITUTION OF INDIA

Chapter IV

A Fundamental Duties

ARTICLE 51 A

Fundamental Duties. It SHALL be the duty of every citizen of India

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) To promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement.
- *(k) a parent or guardian to provide opportunities for education to his child or as the case may be ward between the age of six and fourteen years.

CONTENTS

Chapter - 1

BUSINESS OPPORTUNITIES IN HORTICULTURE 1-5

Chapter - 2

PRINCIPLES OF PRESERVATION AND VALUE ADDITION
OF HORTICULTURAL PRODUCE 6-20

Chapter - 3

SYRUPS, BRINES AND FOOD COLOURS 21-30

Chapter - 4

URBAN HORTICULTURE 31-39

Chapter - 5

WEEDS OF HORTICULTURAL CROPS AND THEIR
MANAGEMENT 40-53

Chapter - 6

METHODS OF PROPAGATION OF HORTICULTURAL
CROPS 54-74

Chapter - 7

PLANTING MATERIAL FOR HORTICULTURAL CROPS 75-92

Practical 1

EXERCISE 1.1: VISIT TO ORNAMENTAL GARDENS

Objective :

- To get acquainted with different styles and types of gardens developed
- To get knowledge about different types of ornamental plants used in different gardens.

Delivery schedule : 01 period

Student's expectations/ Learning objectives:

- To study different styles of gardening
- To acquire knowledge of ornamental plants for use in different gardens
- To get knowledge of developing different features in garden

Pre-learning required: Knowledge about different types of gardens and ornamental plants.

Handouts/material required/equipment's & tools: Paper sheet and pen to note down the instructions, transport facility for visiting different gardens.

Introduction:

Several ornamental gardens have been developed in different parts of the country in cities and other places of historical importance during various regimes. Historical gardens developed had set different styles of gardening. These gardens have been influenced by the environmental factors, topography, vegetation, construction material, people, their customs and the purposes of using these gardens. Primarily these gardens are grouped into two styles as Formal and Informal gardens. The key features of such gardens are given below:

Formal gardens:

- First plan is made on paper and then land is selected accordingly
- Land is leveled
- Symmetrical design
- Geometrical: Square, rectangular, circular beds and borders

- Roads and paths cur at right angle
- Balance is symmetrical as same feature replicated on both sides of central axis
- Hedges, edges and topiary are trimmed
- Trees can be selected as individual feature
- Mughal, Persian, Italian, French, Chinese and American gardens
- The famous Mughal gardens developed in India are in Kashmir (Nasim bagh, Nishat garden, Shalimar garden, Chasma-e- Shahi, Achabal, Bijbehara, Verinag, etc.); Mughal garden Pinjore, Mughal garden at Rashtrapati Bhavan, New Delhi.



Informal gardens:

- Plan is forced to fit the land
- Main aim is to capture natural scenery
- Land is not leveled
- Asymmetrical design
- Non-geometrical beds and borders

- Untrimmed hedges, edges and topiary
- Individual plants are not selected as feature
- Japanese, Chinese, English gardens
- Informal gardens developed in India are at Brindavan, Mysore; Budhajayanti Park, New Delhi and Roshnara Park, New Delhi.



To get acquainted with the prevailing commercial floriculture activities in the state in general and region in particular, the important flower nurseries, commercial production units in government sector, progressive flower growers and florist wholesale and retail shops will be visited. The students will be exposed to the practical capsules for getting maximum quality and problems associated in commercial floriculture. The detailed information with reference to important cut flowers, pot plants, cut greens, planting material and seed production of ornamentals being grown will be given.

Procedure:

- i) Students will be taken to the nearby or important gardens of the region/ state/ country for making them familiar with different styles and types of gardens.
- ii) Important flowers and ornamental plants in the garden will be identified and their use in gardening will be explained.

- iii) The use of infrastructure in gardens will be explained.
- iv) Any insect-pests or diseases infesting flower crops and ornamental plants will be identified and their remedy will be suggested at the spot to the students and growers.
- v) Development of different features in the garden will be explained on the spot.

Precautions:

- i) Maintain the proper discipline during the visit.
- ii) Don't argue on unnecessary point with the officers/ officials of the gardens.
- iii) Avoid confrontation on any issue with your classmates, the gardeners, tourists visiting the garden.

Exercise: Prepare diary of all events of the tour. Take photographs of important garden features and paste on the tour report to be submitted.

EXERCISE 1.2: VISIT TO AN ORCHARD

Objective :

- Acquaintance with features of an orchard and different aspects of orchard establishment.

Delivery schedule : 01 period

Student's expectations/ Learning objectives:

- Studying the features of an orchard
- To know about different fruit crops grown in an orchard
- Points to be remembered while establishing an orchard.

Pre-learning required: Knowledge about establishment of an orchard

Handouts/material required/equipment's & tools: Paper sheet and pen to note down the instructions and pictures of different fruit plants.

Introduction:

Indian topography and agro climates are well suited for horticultural crops, which are considered ideal for achieving sustainability of smallholdings, increasing

employment, improving environment, providing an enormous export potential and above all achieving nutritional security. Furthermore, horticulture has the potential for improvement of wastelands as well as arid and semi-arid areas. Most of the horticultural crops need comparatively less water compared to field crops and provide higher employment opportunities, better nutritional security as well as healthy environment. Fruit production is profitable. Farmers involved in fruit production usually earn much higher income as compared to cereal producers. Cultivation of fruits allows for productive employment where the labour/ land ratio is high, since fruit production is usually labour intensive. Increasing fruit production contributes to commercialization of the rural economy and creates many off-farm jobs. It also provides ample opportunities for sustaining large number of agro-industries, which generate substantial employment opportunities. It is indeed important for students to know about different fruit crops, their nomenclature, at what time we plant them, how do we plant them, what are their important insect- pests and diseases and their management, what are the edible parts of different fruits and how do we harvest and market them.

Features of an ideal orchard

Orchard is a piece of land cultivated with fruit crops and related horticultural crops.

1. **Store and office building:** It should be in the centre of the orchard for easy and proper supervision of work by the manager. For easy approach of labours to take any implements and tools needed for their work, to take the inputs like herbicides, weedicides, pesticides, fungicides, fertilizers etc., to the field. In the store room, racks should be provided to keep the herbicide or weedicide, pesticide and fungicide. Wooden plank (flat piece of timber) is arranged on the floor to keep fertilizer bags. The garden implements and tools are arranged in the racks. Storage bins are also kept in stores for storing the seeds and produces.

In the office, racks are used to keep records and registers related to orchard management such as stock register, produce register, muster roll, attendance register, tree register etc.

2. **Wells and water tanks:** It should be located at convenient places in different parts of the orchard atleast one well for 2 to 4 hectares. Water tanks are used to store water. From the well the water is lifted and stored in the tank and used for irrigation. Wells and water tanks are connected with irrigation channels of concrete nature or pipes. From the tank, irrigation channels are used to take water to the field.

3. **Separate blocks:** For each fruit crop, a separate block should be allotted. Fruits ripening at the same time should be grouped together. In deciduous fruit trees (sheds leaves during winter such as apple, pear, plum, peach), there are certain varieties which need pollen from another variety to set fruits. The trees which provide pollen are called pollinizers. For example in apple, Golden Delicious, Tydeman Early Worcestor, Lord Lambourne and Granny Smith are pollinizers. Every third tree in third row should be planted with a pollinizer or every fourth tree in every fourth row should be planted with pollinizer.
4. **Irrigation channels:** Two types of channels viz., concrete and mud channels are laid out in the orchard. Concrete channel reduces water loss through seepage and maintenance is easy as compared to mud channel. Weed growth is very less or negligible in concrete channel. Channel should be laid along the gradients for most economical conduct of water. For every 30 m length of channel, 7.5 cm slope should be given.
5. **Roads and foot paths:** These two components should occupy minimum space for the economy of transport. The metal road in the main areas are advantageous because it is easier for the movement of vehicles like tractor or lorry to carry fertilizers, pesticides and harvested produces, planting materials like seedlings, layers, grafts, cuttings, etc. In the centre of road the height should be more than at the sides. There should be a gentle slope from the centre towards the edge of the road, so that there won't be any stagnation of water during rainy season.
6. **Fruit trees:** Short growing fruit trees should be planted at the front and tall at the back for easy watch and to improve the appearance of the orchard. Short growing fruit trees are guava, pomegranate, annona and aonla. Tall growing fruit trees are avocado, mango, sapota and litchi.

Evergreen trees such as papaya, sapota, mango and oranges should be in the front area and deciduous ones like apple, pear, peach, plum, apricot and almond behind the evergreen trees. Fruits attracting birds and animals should be close to the watchman shed, so that watchman can protect them to the extent possible.

7. **Manure pit:** Manure pit is essential to dump the waste plant materials after the harvest of the produce. This will enable to supply considerable quantity of organic manure to the farm. This should be located in a corner of the orchard.

8. Fencing: It may be live fence or artificial ones. Live fence is economical and cheaper compared to other. Suitable plants for fencing are *Agave*, *Prosopis juliflora*, *Pithecolobium dulce* etc. These crops are planted closely in 3 rows which serve as good fence. In artificial fencing, stones or concrete pillars are planted at regular spacing (4 or 5 feet) and they are connected by barbed wire. Trees used for fencing should be drought resistant, easy to propagate from seed, quick growing, have dense foliage, should withstand severe pruning and should be thorny.
9. Wind breaks: These are rows of tall trees planted close together around the orchard. These are essential to resist wind velocity which cause severe loss particularly moisture loss from the soil through evaporation and fruit drop. Wind breaks are efficient in reducing the velocity of wind thereby minimize the damage to the fruit crops by wind. Wind breaks are planted in area where there is heavy wind. Its effectiveness is maximum for a distance of about 4 times as great as its height but has some effect over twice about that distance. For effective control, wind break should be planted in double rows and the trees are alternately placed. Wind break should be of tall growing nature. The spacing between wind break and first row of fruit tree should be similar to that of the space between fruit trees. It is advantageous to dig a trench of 90 cm deep at a distance of 3 m from the wind break trees and prune and cut the roots of wind break exposed and again fill up the trenches. This has to be repeated for every 3 or 4 years in order to avoid the competition between wind break and fruit trees for moisture and nutrition. Some specific characters of wind break are erect nature, tall and quick growing, hardy and drought resistant, mechanically strong framework and dense nature to offer maximum resistance to wind. Some of the common windbreaks are *Casuarina equisetifolia*, *Polyalthia longifolia*, *Eucalyptus globules*, *Grevillea robusta* and *Azadirachta indica* etc.
10. Layout of an orchard: Arrangement of plants in a particular system of planting depending upon its vigour, growth habit and spacing requirement is known as layout. While laying out an orchard, the factors to be considered are system of planting, tree vigour, spacing, water requirement, cultural operations like training/pruning etc. Proper layout of the orchard would facilitate easy supervision, management and planning for future expansion. Cultivation of perennial and annual crops of fruits, vegetables and to some extent flowers should also be taken into account while making layout.

Points to be remembered while establishing an orchard

- The orchard should be established in such a location where the soil, climate and other physical facilities required for successful growing of crops and marketing of the produce are available.
- The selected site, if uncultivated, should be cleaned by uprooting the existing trees and bushes and leveled properly after deep tillage. If the land or site is in a hill area, the prepared land should be divided into terraces depending upon the topography of the land and then leveled within the terraces.
- The leveled land should be divided proportionately for growing crops and for roads, paths, building etc. Minimum / optimum space should be allotted for each feature. Roads & Paths should occupy only 10% of the total area, provided with convenience, economy in transport and supervision. The farm office should be located at the center of an orchard, which should be easily approachable by road.
- Drainage and irrigation channels should be kept concealed as much as possible which could save water from seepage and evaporation. Irrigation channels should be well spaced so that it could cover all the plots.
- While planting the fruit trees, evergreen fruits should be planted in the front and deciduous trees at the back.
- Trees should be grouped according to their height, irrigation requirement and nature of growth.
- Fruit trees that attract birds should be planted near watch and ward.
- Self-sterile or self-incompatible fruit trees requiring pollinizer should be planted mixed with pollinizer variety or the same should be side grafted on the fruit trees themselves to ensure optimum fruit set.
- While planting the trees, proper spacing should be adopted to accommodate inter-crops. Apart from this, vigour of tree and fertility of the soil should also be considered.
- Under semi-arid conditions, in-situ planting of rootstock can be taken up which facilitates grafting of desired scion at later stage of crop growth.
- Windbreaks should be planted at the rear end of the orchard. Trees suitable for this purpose should be tall growing, amenable for pruning and evergreen in growth. For example, *Eucalyptus*, *Casuarina*, Silver ok etc.

- Fencing the orchard with barbed wire or concrete wall or live-fence should be done well in advance to the planting of fruit trees.
- Nursery area should be located under shade, near water source and office building and should be easily accessible for transport of seedlings and raw materials like potting mixture, sand etc.

Observe about the features existing in the orchard visited by you and compare with the features of an ideal orchard. Record your observations in the data sheet. Ask the caretaker of orchard about the cultural practices being following to establish and maintain orchard of a particular fruit crop, fertilizers and plant protection measures being adopted and the problems faced in maintaining the orchard. Record your observations in the data sheet.

Exercise 1: Visit a model orchard and study its features. Record your observations and prepare a check list of features present in the orchard.

Exercise 2: Study of different aspects of orchard establishment and record your observations in the given data sheet.

Datasheet-1

Information about fruit plants growing in an orchard

Particulars	Fruit crops in orchard				
	1	2	3	4	5
Name of the variety					
Spacing and No. of plants/ha					
Layout system adopted					
Training system adopted					
Fertilizer application : Name(s) of fertilizer used , Dose applied, Time and method of application					
Blooming period initiation, Proportion of pollinizers, Peak flowering time i.e. full bloom)					

Time of harvesting					
Weed control: weedicide and dose used					
Nutrient deficiencies observed, if any					
Disease and insect-pest management,					
Any other particular cultural practice followed					
Constraints in orchard management, if any					

EXERCISE 1.3: **VISIT TO A VEGETABLE FARM**

Objective :

- Acquaintance with different aspects of vegetable farm, raising of different vegetables, their cultural practices and identification

Delivery schedule : 01 period

Student's expectations/ Learning objectives:

- Studying the features of vegetable farm
- To know about different vegetables crops grown in a vegetable garden
- Cultivation practices adopted to grow vegetables

Pre-learning required: Knowledge about different vegetable crops

Handouts/material required/equipment's & tools: Paper sheet and pen to note down the instructions, forceps, hand lens, and pictures of different vegetables.

Introduction:

Cultivation of vegetables occupies an important place in agricultural development and economy of the country. Vegetable farming gives higher yield per unit area within the shortest possible time which ultimately increases the income. Several vegetables

are exported to foreign countries which provide an opportunity for earning foreign exchange. In addition, vegetables play an important role in the balanced diet of human beings by providing not only the energy-rich food but also promise supply of vital protective nutrients like minerals and vitamins that is why the vegetables have been reckoned as a protective food. It is indeed important for children to know about different vegetable crops, their nomenclature, at what time we grow them, how do we grow them, what are their important insect-pests and their control measures, what are the consumable parts of different vegetables and how do we harvest and market them.

Features of an ideal vegetable garden

- 1. Proper sunlight:** Vegetables are sun loving crops and grow their best with 6-8 hours or more of direct sunlight. Leafy greens can manage to grow under less sun light while lettuce prefers cool weather and continue to grow throughout the summer if shaded by taller plants.
- 2. Assured irrigation facility:** Ideal vegetable garden should be close to the source of water. Vegetables need water at regular intervals. If there is erratic water supply, vegetable crops exhibit various kinds of problems like poor crop stand, poor growth, cracking of fruits, improper fruit setting or prone to cultural problems like blossom end rot.
- 3. Soil with good fertility status:** Soil is the most important factor in any garden and perhaps more so in a vegetable garden. Vegetables are short duration crops and have very high yield potential. They complete their entire life cycle by producing flowers and fruits and hence, they are very heavy feeders. A rich soil not only supports them to grow strong but also protect them from disease and pest problems. Therefore, the soil in the vegetable garden should be rich in organic matter and fertility status. Compost and composted manure can be added in spring and/or fall.
- 4. Proper drainage:** One final consideration while selecting land for vegetable garden is that the area should have provision of proper drainage and run-off. Vegetables do not sustain under water logging conditions.
- 5. Manure pit:** Manure pit is essential to dump the waste plant materials after the harvest of the produce and converting it to vermicompost or any other compost. This enables to supply considerable quantity of organic manure to the farm. This should be located in a corner of the vegetable garden.

6. **Protection from stray animals:** Proper fencing of the vegetable garden is essentially required to protect the crops from stray animals and also from theft.
7. **Store and packing house:** The store house and packing house should be in the centre of the vegetable garden for easy approach to the workers. They can take the implements, tools or inputs like herbicides, pesticides, fungicides, fertilizers etc., to the field and also bring back the harvested produce for hydrocooling, sorting and packing to the market. In the store room, racks should be provided to keep the chemicals. Wooden plank (flat piece of timber) is arranged on the floor to keep fertilizer bags. The garden implements, tools and packing material etc. are arranged in the rack.
8. **Roads and foot paths:** These two components should occupy minimum space for the economy of transport. The metal road in the main areas is advantageous because it facilitates the movement of vehicles like tractor or lorry to carry fertilizers, pesticides and harvested produce etc.
9. **Cropping plan:** A comprehensive plan of different vegetables to be grown in the vegetable garden should be made well in advance keeping in view the principle that early the crop more shall be the price.



A planned vegetable garden

Ideal agronomic practices to be followed in vegetable garden:

You know the importance and necessity of different agronomic practices which are adopted to raise a healthy vegetable crop. So, it is imperative to understand the cultural practices which have been adopted to raise different vegetable crops in the

vegetable garden. You should have curiosity to inquire about the following aspects which determine the success of vegetable cultivation.

- Suitable variety/hybrids of different vegetable crops
- Reliable source for the procurement of vegetable seed
- **Optimum sowing or planting time:** It determines the environmental conditions at planting, flowering and fruit development stage and thus has direct impact on the successful cultivation of vegetable crops.
- **Proper spacing:** The closer planting results in overcrowding which ultimately hinder the access to proper sunlight and aeration and plants become more vulnerable to the attack of diseases and insect-pests.
- **Nutrient management:** The balance use of organic and chemical fertilizers enhances soil fertility and crop productivity.
- **Management of weeds , diseases and insect-pests at appropriate growth stages:** It is very essential as either of these may cause losses to crop yield to the tune of 30-60 per cent
- **Optimum irrigation at critical growth stage:** Irrigation at critical growth stages like flower initiation, fruit set and fruit development etc. are very crucial to exploit maximum production potential of different vegetable crops as they cannot withstand prolonged dry conditions.
- **Harvesting at proper stage:** Appearance, colour, tenderness and crispness determines the harvesting stage of a particular vegetable crop to fetch high premium in the market.
- Post-harvest handling of vegetable crops.

Ask the gardener about the cultural practices he is following to raise a particular vegetable crop, chemical fertilizers and plant protection measures he is adopting and the problems he is facing in managing the garden. Make your observations in the data sheet.

Exercise 1: Visiting vegetable farm and studying various agronomic practices to raise vegetable crops in data sheet.

Practical 2

IDENTIFICATION OF MAJOR FRUIT CROPS OF OUR COUNTRY

Objective :

- Imparting knowledge for the identification of major fruit crops on the basis of different morphological characters at different plant growth stages

Delivery schedule : 03 period

Student expectations/Learning objective:

- To demonstrate different characteristic features of major fruit crops for their easy identifications

Pre-learning required: Names of major fruit crops and knowledge about classification of fruit crops

Handouts/material required/equipment's & tools: Forceps, hand lens, paper sheet, pen to note down the instructions and pictures of different fruit crops.

Introduction:

Most fruit crops are perennial trees, shrubs, or vines. Trees are large woody plants which generally produce a single main stem or trunk, where the renewal growth occurs at the shoot tips in the canopy. The latter is an important distinction between trees and shrubs, since large shrubs can be trained to a single stem, but tends to produce new growth from the base or crown. Vines are woody plants that are trained to have a single trunk at the base, but use twining stems or tendrils to support the canopy. Vines rarely have large trunks like trees since they support themselves by climbing on taller plants in nature, or on trellises in cultivation. As a result, vines spend little of their energy on supportive wood, while growing very tall and maximizing leaf exposure to sunlight.

Fruit plants can be identified by observing certain distinguishing morphological characteristics. The keen and frequent observations on vegetative and reproductive parts of plant help in easy and clear identification. It is essential to know the different parts of the plants before undertaking the identification as these forms the basis of distinguishing characters. In this practical you will learn how to identify a fruit crop

keeping in mind their characteristic morphological features. The important distinguishing characters of major fruit crops have been discussed here under which may help the students in distinguishing them even at early stages of their growth. It takes time and exposure to learn to identify fruit plants.

Procedure:

Step 1: Critically observe the morphological characteristics of the specimen. To identify plants, look for morphological features such as leaves, flowers and fruits.

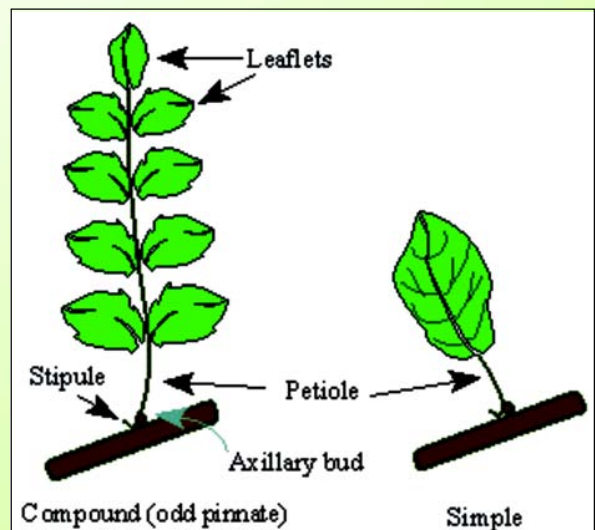
i) Plant:

- Tree
- Shrub
- Vine

ii) Leaf characteristics:

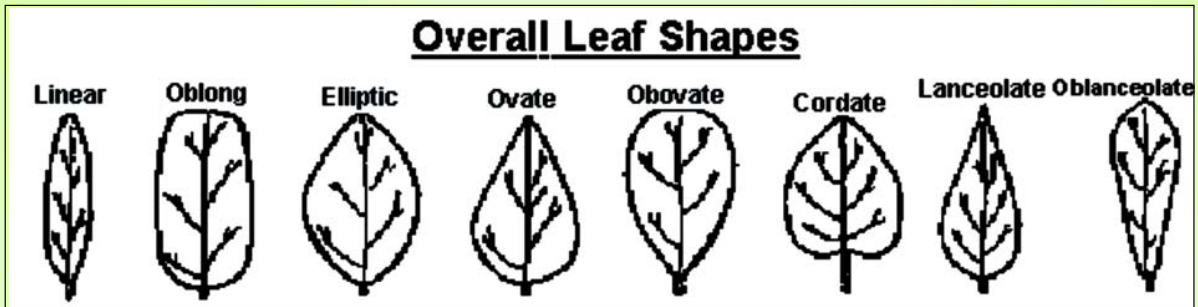
- Shape of leaf- long narrow or ovate or lanceolate
- Presence or absence of pubescence
- Type of leaf - simple or compound leaf, petiolated or sessile
- Presence or absence of leaf sheath
- Leaf margins: serrated or smooth
- Texture of leaf- smooth or rough.

Leaves take many forms, being compound if composed of two or more leaflets or simple if just a single leaf blade. The compound leaf having a single terminal leaflet, and an uneven number of leaflets is termed "odd pinnate", whereas compound leaves lacking the single terminal leaflet are "even pinnate".



Compound and simple leaves and their associated parts.

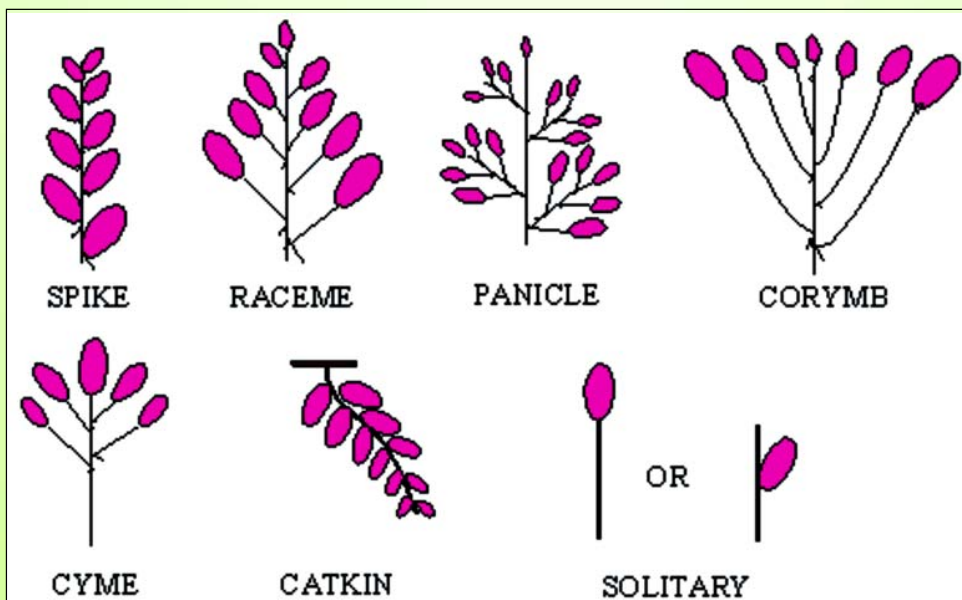
Characterizing the foliage is a great way to start the process of identifying a plant. Several terms are used to describe the overall shape, tip, and margins of leaves or leaflets.



Pictures for leaf margins & leaf tips

iii) Flower:

- An inflorescence is a cluster of flowers, and there are several terms for specific inflorescences.
- Generally, there are two types of inflorescences, determinate and indeterminate. In a determinate inflorescence, the top-most flower is the most mature, and generally opens first, whereas the top-most flower in an indeterminate inflorescence is the least mature and last to appear. The most common inflorescence types in fruit crops are indeterminate (spikes, racemes, panicles, umbels, corymbs), with the cyme being the most common determinate inflorescence.



Different inflorescence types commonly found in fruit crops

iv) Fruit

- Colour
- Size
- Shape

Step 2. Draw the sketch of each plant.

Step 3. Record the observations with respect to plant, leaf, inflorescence and fruit characteristics in the data sheet.

Step 4: Use chart of morphological features of fruit crops

EXERCISE 2.1: IDENTIFICATION OF TROPICAL FRUIT CROPS OF OUR COUNTRY

Tropical fruits are the fruits grown in tropical areas /zone i.e. the zone which comprises regions having hot and humid climate in summer and mild in winter. The most commercial fruits are mango, banana, cashew nut, sapota, pineapple, papaya, pomegranate, grapes etc. This zone includes the regions of Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, southern districts of Madhya Pradesh and West Bengal. The distinguished morphological characters of sub-tropical and tropical fruits are described below:

Mango (*Mangifera indica*)

Family: Anacardiaceae

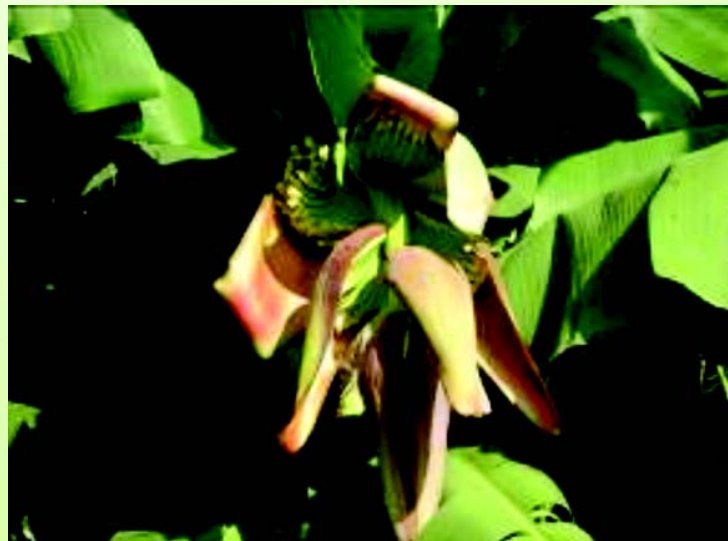
- The tree is medium to large, evergreen, with an open or dense symmetrical canopy.
- Leaves are simple, Lanceolate shaped and leathery in texture with prominent mid and lateral veins.
- The inflorescence is a much branched panicle bearing both male and hermaphrodite flowers
- The fruit is a fleshy drupe with variable shape (nearly round, oval or ovoid-oblong), size (60 g to 2.3 kg) and colour (greenish-yellow, yellow with a red or purple blush or completely red.
- The skin is tight, thick and smooth. The flesh is yellow to orange with few to many fibers.
- The single seed is large, flat and in a woody, fibrous husk.



Banana (*Musa acuminata* x *M. balbisiana*)

Family: Musaceae

- Pseudostem is composed of tightly clasp leaf sheaths, slightly swollen at base; suckers freely produced.
- The leaves of banana plant are very large, blunt, wide and long, arranged in a spiral, and sometimes tattered along the edges.
- Bracts and flowers are inserted independently on peduncle. Basal flowers are generally female only and male flowers are on distal hands. The flower bud is reddish-purple, large and pointed.
- Fruits are long, finger-like, and slightly curved, with a smooth, yellow skin and soft, creamy-white pulp. There are no seeds in edible types. The fruit are arranged in clusters, called hands, of 6-25 or more bananas.



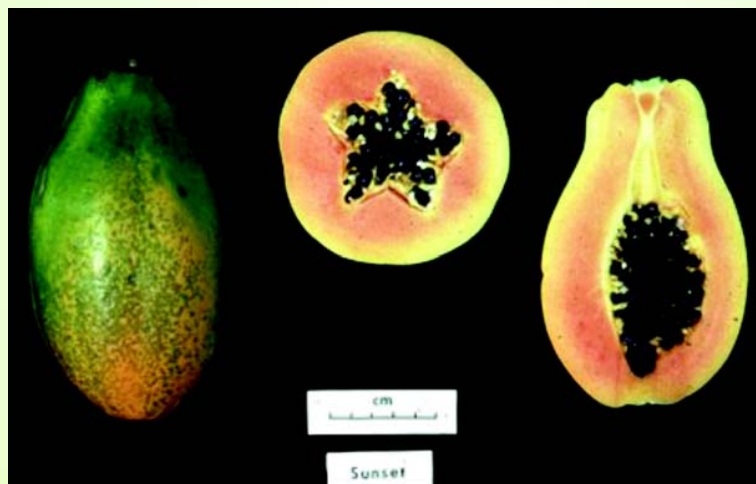
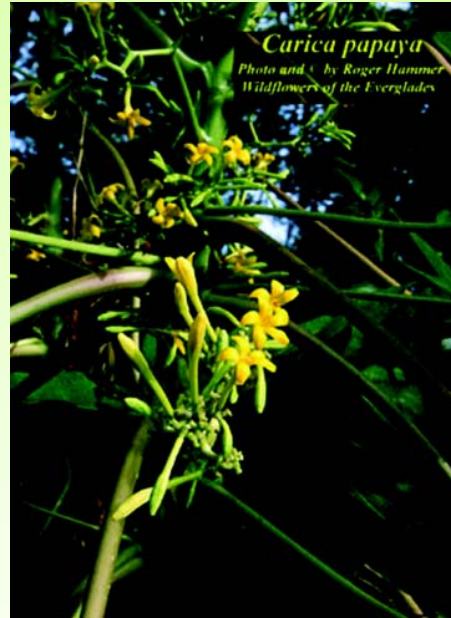


Papaya (*Carica papaya*)

Family: Caricaceae

- Papaya is a small, single-stemmed, evergreen, quick growing plant.
- Trunk is erect, unbranched (generally) with hollow soft wood.
- Pal-like leaves are large, deeply lobed margins with long petioles.
- Flowers are borne singly (usually female and hermaphrodite) or in large clusters (male) in leaf axils and colour ranges from yellow to white.
- Fruits are spherical to oblong in shape, fleshy berry with central cavity.
- The skin is thin and yellow or yellowish-green at maturity.
- The flesh is yellow, deep orange, pinkish or deep red depending on cultivars.
- The center of the fruit is a large cavity lined with soft, black, pea-sized seeds.



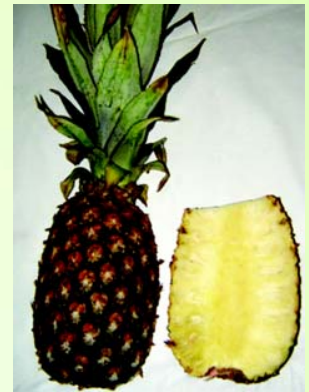


Pineapple (*Ananas comosus*)

Family: Bromeliaceae

- Pineapple plants are herbaceous and perennial with dense rosette leaves. The stem is short and thick, 15-25 cm long, narrow at the base and wider at the top with short internodes.
- The leaves are long and narrow and are arranged in a right-or-left-handed spiral on a short stem, forming a rosette. The number of leaves ranges from 35 to 60, and there is a bud in every leaf axil. The leaves either have smooth edges with a few spines just below the tip or have spines all along the margins. The tip is elongated, ending in a finer point. The upper leaf surface is green and the lower is silvery-white.

- The pineapple fruit grows on a stalk in the center of the rosette of leaves. The pineapple is a multiple fruit. (i.e. Fruits formed when a cluster of flowers produces numerous fruit that mature into a single mass.) The pineapple is oval to cylindrical in shape, topped by a leafy crown.
- The skin is golden yellow at maturity and has numerous scales.
- The flesh is whitish-yellow, juicy and sweet, around a central fibrous core. Seeds are absent.



Grapes (*Vitis vinifera*)

Family: Vitaceae

- Grape is a woody vine that uses tendrils to attach to supports.
- Leaf shapes vary with type and cultivar but are usually large, roundish to heart-shaped, often lobed, with serrate margins.
- Grapes grow in bunches or clusters.
- Fruit may be green, red, purple, or yellow when ripe.
- Individual grapes are round or oval, thin-skinned and juicy. Seeds are few or absent, small, round and often pointed at one end.





Sapota (*Achras zapota*)

Family: Sapotaceae

- It is evergreen tropical fruit plant. The branches appear in whorls.
- Leaves are elliptic to obovate and light to deep green.
- Flowers are solitary appear in leaf axils.
- Fruit is a drupe, egg or round shaped. The skin of the fruit is slightly tough resembling potato skin in appearance. Each fruit contains 3 to 5 or more black shining seeds.



EXERCISE 2.2: IDENTIFICATION OF SUB-TROPICAL FRUIT CROPS OF OUR COUNTRY

Sub-tropical fruits are the fruits which are commercially successful in sub-tropical zones i.e. where the temperate occasionally goes below freezing points but not as a rule below 25° F. The overall climate is hot and comparatively dry, whereas, the

winters are less cold. The chief fruits are sweet orange, mandarin, grapefruit, lime, lemon, litchi, grape, guava, phalsa, fig, pomegranate, avocado etc. The tropical fruits like Mango and Banana can also be grown in this zone whereas, the low chilling cultivars of Pear, Peach, Plum, and Almond of temperate zones can also be grown in sub-mountainous tracts of sub-tropical zone. The chief regions of sub-tropical zone are Punjab, Haryana, Uttar Pradesh., north districts of Bihar, West Bengal, Madhya Pradesh, Rajasthan, and Assam.

Mandarin (*Citrus reticulata*)

Family: Rutaceae

- Trees are medium-sized and upright in growth.
- Leaves are lanceolate in shape with narrowly-winged petiole.
- Fruits are medium-sized, globose in shape, sweet in taste, segments easily separable, core open at maturity, loose skinned, orange in colour, rind thin, rind and segments easily separable, usually 10-14 segments in each fruit. Seeds are pointed with light green cotyledons.

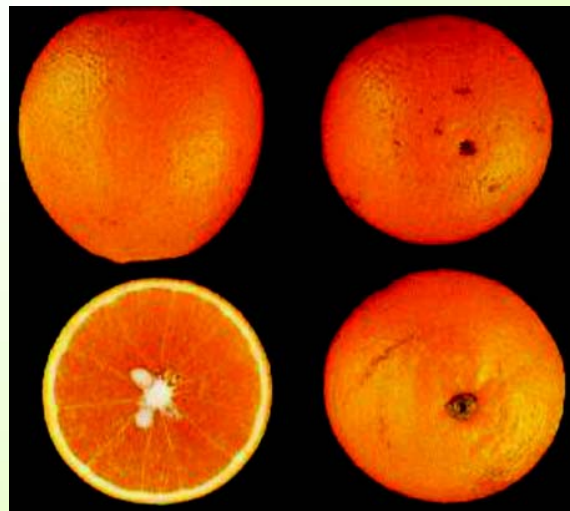


Sweet Orange (*Citrus sinensis*)

Family: Rutaceae

- Sweet orange is a medium-large evergreen citrus tree.
- Leaves are ovate with blunt-pointed leaf apex and have rather narrowly winged petiole.

- Fruit are subglobose to oval in shape, orange-coloured, tight skinned with solid central core and have a somewhat coarse rind.
- The flesh colour is usually orange and sweet.
- Seeds are with whitish cotyledons.



Lemon (*Citrus limon*)

Family: Rutaceae

- Lemons are medium-sized spreading thorny citrus trees. The new flushes are pigmented.
- Leaves are not dark green and leaf margins are subserrated. Petioles are medium-sized and narrowly winged.
- Flower buds are pigmented and the pistil is densely dotted with oil glands.

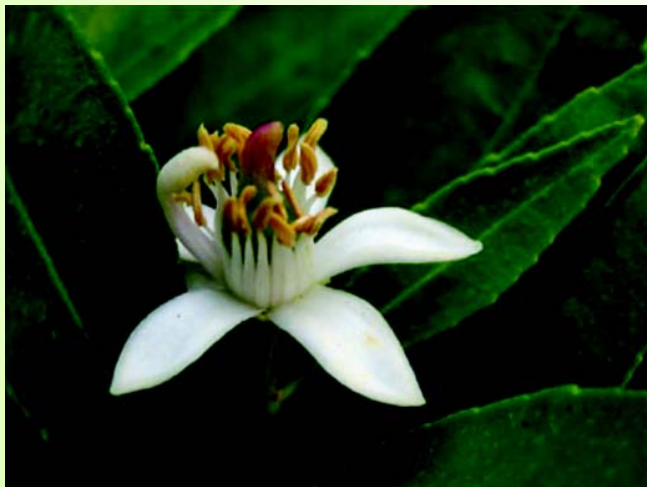
- Fruits are oval to elliptic with pointed nipple. Fruit surface is smooth, light yellow and core solid; juice abundant and acidic. Seed cotyledons are white.



Kagzi Lime (*Citrus aurantifolia*)

Family: Rutaceae

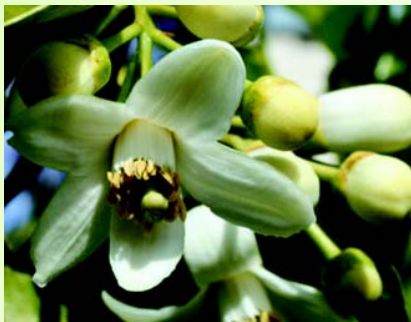
- Tree is small, bushy with small but sharp spines.
- The leaves are small with narrowly-winged petioles.
- The flowers are yellowish white with a light purple tinge on the edges. Flowers and fruits are small.
- Fruits round to oval, maturing irregularly throughout the year, greenish yellow in colour and thin skinned. Core solid at maturity, flesh greenish in colour and juice highly acidic.
- Seeds are small, smooth and cotyledons whitish.



Grapefruit (*Citrus paradisi*)

Family: Rutaceae

- The grapefruit tree is round-topped spreading citrus tree.
- Leaves are large with winged petioles.
- The flowers of grapefruit are white and fragrant.
- The fruit is large but subglobose in shape. Rind surface and fruit flesh are yellowish in colour. Fruits are highly juicy, sweet with bitter aftertaste. The central core opens at full maturity. Seeds big but smooth-surfaced and white inside.



Pummelo (*Citrus grandis* / *C. maxima*)

Family: Rutaceae

- The pummelo tree is spreading, round-topped, almost thornless citrus tree.
- Leaves are large with broadly-winged petioles. Lower surface of leaves is pubescent, particularly the main vein.
- The flowers of pummelo are very large, crowded in short axillary racemes.
- The fruits are large-sized, subglobose to pyriform in shape, with thick and spongy rind. Fruits are sweet and moderately juicy. Rind thick, smooth with large oil glands. Seeds are very large, coarsely veined and white within.



Guava (*Psidium guajava* L.)

Family: Myrtaceae

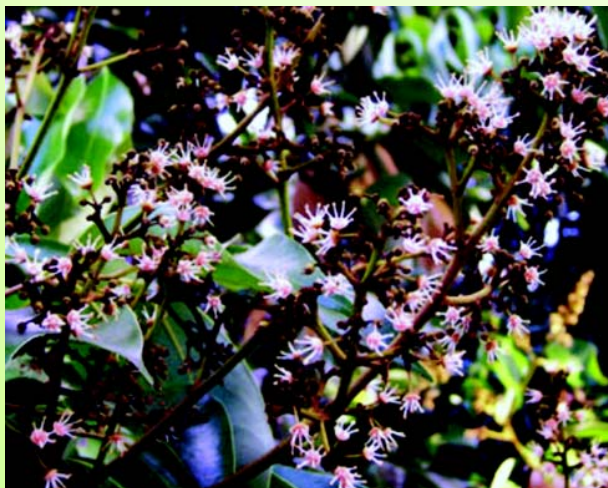
- The guava is a large shrub or a small spreading tree that may grow up to 10 m in height with a fairly thin trunk. The bark of the trunk is attractive with smooth, greenish or reddish brown or multi-coloured bark peeling annually in thin flakes.
- The leaves are simple, opposite, oval almost and light green in colour. Veins are prominent on soft under surface and markedly depressed on upper surface.
- Guava flowers are white borne in leaf axils of new growth.
- Guava is a berry with few to many small brown seeds. The fruit is very variable in size and other characteristics depending on cultivar. Fruit shape ranges from round, ovoid to pear-shaped.
- The peel color ranges from green to yellow and flesh color may be white, yellow, pink or red. Fruit peel thickness may be thin or thick and depends upon cultivar.
- There is a wide range in flavor and aroma, ranging from sweet to highly acid and strong and penetrating aroma to mild and pleasant.



Litchi (*Litchi chinensis*)

Family: Sapindaceae

- Trees are medium to large, much branched, round topped, evergreen reaching up to 10m or more in height with short stocky trunk. Bark is grayish brown and rough.
- Leaves are compound, alternate consisting of 4-7 oblong leaflets, glossy dark green above and grayish brown under surface. New leaves are a bronze red.
- Flowers are greenish-white to yellow panicles borne in terminal clusters.
- Litchi fruits are one-seeded nuts, usually develop in bunches and vary in shape and size. The fruits are usually oval in shape. The fruits have a thin leathery shell (pericarp) which turns bright-red when the fruit is ripe.
- The sweet, juicy flesh is white, translucent and surrounds a large, oval, dark, shiny seed.



Pomegranate (*Punica granatum*)

Family: Punicaceae

- It is a deciduous shrub or tree. Branches are slender and somewhat thorny.
- Leaves are dark green, glossy, simple, opposite or in whorls, small and somewhat narrow, oblong to oval, clustered on short branchlets.
- Blooms are a flaming orange-red, to 2.5 inches in diameter with crinkled petals and numerous stamens. Flowers are borne solitary or in small clusters.
- Pomegranate fruits are berries, brownish red to purple-black, to 5 inches, with a protruding calyx at the blossom end. The skin is leathery.
- The flesh is a juicy, edible, reddish pulp surrounding numerous, small, dark seeds.



Ber (*Zizyphus mauritiana*)

Family: Rhamnaceae

- Indian jujube is thorny shrub or small tree. It sheds its leaves in summer after the harvest of the fruits.

- Leaves are alternate, simple, obtuse, broadly oval to rounded-elliptical, slightly equal to the base, densely tomentose underside and have stipular thorns.
- Flowers are small, greenish-cream, fragrant, and borne in the leaf axils.
- Fruit is drupaceous, persistent lower part of calyx often evident, ellipsoid to subglobose, greenish yellow to golden yellow in colour.



Fig (*Ficus carica*)

Family: Moraceae

- Leaves are simple, large, thick, bright to dark green, with three to five lobes; shiny above but dull or fuzzy below.
- The fruit are somewhat "pear-shaped," with a wide, flat bottom narrowing to a pointed top. When the fruit ripens, the top may bend, forming a "neck."
- Figs can be brown, purple, green, yellow or black, and vary in size.
- The fruit is fleshy with an "eye" leading to a cavity inside. The skin is slightly wrinkled and leathery.

- The fig flowers develop inside the fruit and cannot be seen. Seeds are either absent or inconspicuous.



Loquat (*Eriobotrya japonica*)

Family: Rosaceae

- The tree is symmetrical, evergreen and has a hairy dense crown.
- The ten to twelve inch long leaves are alternate, simple, oblong, leathery, and dark glossy green on the upper surface, rusty-coloured beneath.
- The flowers are white, with five petals, and are produced in stiff panicles of three to ten flowers. The flowers have a sweet aroma that can be smelled from a distance.
- The fruits are borne in clusters, commonly round, oval or pyriform, golden yellow and fuzzy skinned. The fruit skin thick but slightly tougher. The dried flower can often be seen on the bottom of the fruit. There are a few large, shiny, dark seeds in the soft, tart, yellowish flesh.



Aonla (Emblica officinalis)

Family: Euphorbiaceae

- A deciduous tree, small to medium in size; its bark is usually light brown to black, coming off in thin strips or flakes, exposing the fresh surface of a different colour underneath the older bark; in most cases, the main trunk is divided into 2 to 7 scaffolds very near the base.
- Leaves are small sized, simple, closely set in pinnate fashion, making the branches feathery in general appearance. The leaves develop on the determinate shoots after the fruit-set.
- Flowers appear on newly emerged determinate shoots. Male flowers appear first in the form of clusters at the basal part of determinate shoots followed by female flowers in the axil of leaves at the distal end of same shoot
- Fruits, fleshy, almost depressed to globose, primrose yellow in colour.
- The stone of the fruit, six-ribbed, splitting into three segments, each containing usually two seeds; citron green in colour.



EXERCISE 2.3: IDENTIFICATION OF TEMPERATE FRUITS OF OUR COUNTRY

Temperate fruits are the fruits growing in the temperate regions. Temperate regions are the regions where the temperature falls below freezing point during the winter. The temperate trees shed their leaves during the cold season and enter the rest period. A definite chilling temperature is required to break the rest period or dormancy. In general, the temperate fruits are grown in the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand and North -Eastern states.

Apple (*Malus domestica*)

Family: Rosaceae

- Apple plant is deciduous without spiny branches. The growth habit of plants which may be with an upright to slightly spreading growth habit. Tree size varies greatly but is usually relatively small.
- Leaves are oblong to oval, alternate, pointed, with serrate margins, soft textured with fine fuzz giving a dull appearance.
- Floral buds are mixed buds borne terminally on spurs and terminally or laterally on long shoot, depending upon the cultivar, age and vigour of tree.
- The inflorescence is determinate having five flowers. Flowers are white or pink or carmine in cymes.
- Apple fruits are round to slightly elongated and red, yellow or green in color. The flesh is crisp, white, and juicy. They are often borne on short stems known as spurs. The blossom end of the fruit may have 4 (sometimes 2 or 3) distinct lobes. The skin is smooth with prominent lenticels, or may be covered with tan corky tissue known as russett. Seed are hard, small, ovoid, pointed at one end, black or brown and shiny. Papery membranes surround the seeds.





Pear (*Pyrus communis*; *Pyrus pyrifolia*)

Family: Rosaceae

- Pear trees have a very upright growth habit.
- Leaves are alternate, with serrate margins.
- Showy white flowers appear in spring either before or when leaves emerge.
- Pears may be oblong or nearly round. Typically the stem end is narrow, broadening at the base or blossom end.
- Fruit may be green, yellow, yellow with a red blush, or red.
- Like apples, the fruit are usually borne on short stems called spurs.
- The flesh is white, juicy and soft, with slightly gritty stone cells.
- The seeds and leaves are very similar to apple except that they lack fuzz and are smooth and shiny in appearance.





Peach (*Prunus persica*)

Family: Rosaceae

- The tree is deciduous, moderately small with a dense upright growth habit except when pruned to encourage spreading growth.
- Leaves are alternate, narrow and 4-8 inches long with finely serrated margins. They point downward and curve inward.
- Peaches are roundish, sometimes pointed at the blossom end, with a suture along one side. Peaches vary in size but are usually about the size of a tennis ball.
- The skin is fuzzy and its color ranges from yellow to red.
- Flesh color is yellow, or sometimes white.
- The stone or pit is large, deeply pitted, oval or pointed, and tan to brown in color.





Nectarine (*Prunus persica* var. *nucipersica*)

Family: Rosaceae

- Tree is deciduous, small to medium in size to 20 feet, similar to peach.
- Leaves are bright green, glossy, alternate, and long with toothed margins.
- Nectarines are generally the same size, shape, and color as peaches, just a peach without fuzz. Like peaches, they have a suture or crease. However, they may be a little smaller and slightly tarter than peaches.
- Skin color is mostly red with some yellow.
- Flesh is yellow to white, redder near the center. The stone or pit is oval and deeply pitted.





Plum (*Prunus domestica*; *Prunus salicina*)

Family: Rosaceae

- Tree medium to large, upright growth and deciduous.
- Leaves are alternate, serrate, sharp pointed, medium sized and glabrous.
- Flowers are produced three in a bud on one year shoot or on spur. Flowers perfect, solitary or raceme, usually white in colour.
- Plums closely resemble small nectarines in shape, although some may be oval instead of round. Like nectarines, they have a crease on one side.
- The flesh and skin colour vary greatly with cultivar (yellow, green, red, blue or purple) and unlike nectarines, the color is not mottled.
- The skin is smooth and thin; the stone is usually oval, pointed at one end, and slightly rough.

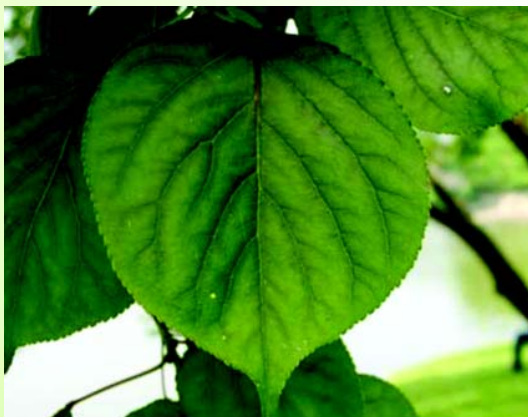




Apricot (*Prunus armeniaca*)

Family: Rosaceae

- The leaves are alternate, heart-shaped and sharp pointed with finely serrated margins. The new growth often has a reddish tint.
- Flowers are solitary, produced in clusters, on short spurs, with 5 petals and 5 sepals and erect stamens.
- Apricot fruits resemble small peaches in shape and appearance, usually being yellow or orange with a vertical dent along one side. The skin is smoother than a peach, but is finely fuzzy. The stone is oval, flat, and smooth with ridges along one edge.



Sweet Cherry (*Prunus avium*)

Family: Rosaceae

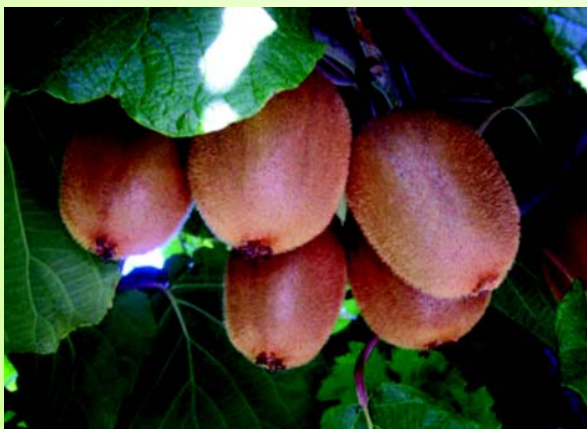
- Sweet cherry is a tall tree and branches are erect.
- Leaves are large, thin, pubescent beneath and serrated. The petioles are long having two or more swollen glands.
- The floral buds are borne on 2 year old shoot or at the base of 1 year old shoot and found only on lateral, simple flower buds. Flowers are white in colour, raceme on long pedicels and produced in clusters.
- The fruit is cordate in shape, has deep cavity and apex is rounded or pointed. The fruit colour of cherry varies with varieties and may be yellow, red or purplish black.
- The texture of the flesh is tender or firm, sweet and yellow or red or dark purple in colour.



Kiwi Fruit (*Actinidia deliciosa*)

Family: Actinidiaceae

- Kiwi fruit grows on a vigorous, woody, twining vine or climbing shrub reaching 30 feet.
- Its alternate, deciduous leaves are oval to nearly circular with long petioles. Young leaves and shoots are coated with red hairs. Mature leaves are dark-green and hairless on the upper surface, with prominent, light-colored veins below.
- The fragrant flowers have five to six petals, white at first, changing to buff-yellow.
- The oval fruit, about the size of a large hen's egg, has russet-brown skin densely covered with short, stiff brown hairs. The fruit has a soft texture, green flesh, edible black seeds and a unique flavor.





Pecan (*Carya illinoensis*)

Family: Juglandaceae

- Pecan trees grow seventy to 100 feet in height. Bark becomes gray, rough, and somewhat scaly on older trees.
- Leaves are odd-pinnately compound, with 11 to 17 leaflets, lanceolate, with serrate margins.
- Male and female flowers are on the same tree. The male flowers are in hanging catkins and the female flowers in spikes.
- Pecans develop inside a rough green husk that turns black and splits open at maturity.
- The nut is oblong, brown or tan with black streaks, smooth, thin-shelled, pointed and one to two inches long.
- The kernel is distinctively ridged.





Walnut (*Juglans regia*)

Family: Juglandaceae

- The trees are very large, ranging from 50 to 75 feet in height and width
- The leaves are 12 to 24 inches, alternate, and pinnately compound, having 15 or more lanceolate leaflets with serrate margins.
- Fruits develop in clusters inside a rough, green husk about the size of a tennis ball. The shell of the nut is nearly round, black, very hard, rough and deeply ridged. The nut (kernel) is contained inside the shell.



Strawberry (*Fragaria x annanasa*)

Family: Rosaceae

- The strawberry is a nearly stemless small plant. It forms stolons on which new plants develop.
- Leaves are compound, consisting of three rounded leaflets with deeply serrated margins.
- The strawberry flower is about an inch in diameter with five white petals and a yellow center.
- The fruit is bright red at maturity, somewhat cone-shaped or flattened cone-shaped, with numerous small, hard, brown seeds scattered on the outside surface in shallow depressions.
- The fruit is fleshy, with a prominent, green calyx at the stem end.



Persimmon (*Diospyros kaki*)

Family: Ebenaceae

- This deciduous tree can grow to about 30 feet when mature.
- The broad, stiff leaves are alternate, ovate, dark green and shiny above, lighter below, and leaf margins are often curled.
- The inconspicuous flowers surrounded by a green calyx, and may be white, cream-colored or pink-tinged.
- The persimmon fruit are round to oval, yellowish-green to orange or red in color, and may reach the size of a peach.
- Notice the dried calyx at the top of the fruit. This can help distinguish persimmons from apricots or tomatoes.
- They are sweet, slightly tart fruits with a soft to occasionally fibrous texture. Seeds are large, flat, dark and shiny, if present.



Practical 4

IDENTIFICATION OF MAJOR FLOWER CROPS OF OUR COUNTRY

Introduction :

Different flowers and plants are identified based upon the knowledge of morphology and anatomy. For describing flower crops, every part of it is to be studied in detail and compared with similar structures of other plant. Every plant part has a name and its study is called as **Phytography**. It is a branch of taxonomy or plant systematic. It deals with the descriptions of plants and their organs (parts). The main plant parts used for description of flowering plants are given below:

- Roots (position and morphology)
- Stem (Branching pattern, texture, shape, bark-surface, form, modifications, etc.)
- Buds (position, protectiveness, time of sprouting, etc.)
- Foliage (Leaf-simple/ compound, insertion, arrangement, parts, stalk, base, apex, shape, serration/ margins, incision, venation, surface/ texture, sap, duration, etc.)
- Inflorescence (type, size and number of flowers, duration, etc.)
- Flowers (shape, symmetry, completeness, parts, arrangement, insertion, union of floral parts, calyx- sepals, corolla- petals/ tepals, colour, shape, size, androecium- stamens, anthers, gynoecium- stigma, style, ovary, fragrance, duration, etc.)
- Fruits (type, shape, size, colour, fragrance, duration, etc.)
- Ovule/ Seed (shape, size, colour, number, duration, etc.)

EXERCISE 4.1: IDENTIFICATION OF MAJOR CUT FLOWER CROPS

Objective :

- To identify various cut flower crops based on primary morphological characters.

Delivery schedule : 1 period

Student's expectations/ Learning objectives:

- To get acquainted with different cut flower crops grown in India

Pre-learning required : Knowledge about various cut flowers.

Handouts/material required/equipment's & tools: Flower crops, hand lens and standard encyclopedia and books on Floriculture

Introduction:

When flowers are harvested with long stem usually containing few or many leaves for various uses indoor and outdoor are called as cut flowers. The main cut flower crops grown in India are given below:

Description of cut flower

Alstroemeria pelegrina (Alstroemeria)

Family: *Alstroemeriaceae*

It is a perennial, rhizomatous bulbous cut flower crop growing to over one meter. Shoots are leafy, light green and flowers borne in spike having 4 to 12 florets of various colours.

Anthurium andreanum (Anthurium)

Family: *Araceae*

Anthurium is a tropical cut flower, having dark green shining heart shaped foliage and brightly, heart shaped spathe of various colours.

Photograph



***Cymbidium* spp. (Cymbidium)**

Family: *Orchidaceae*

Cymbidium is the most popular genus grown for cut flowers. Plants are evergreen with fleshy roots and short pseudo-bulbs enclosed with linear leaves. Inflorescence is erect or pendulous, bearing long lasting flowers of varied colours. Lip is 3-lobed. Column is boat shaped.



***Dendranthema grandiflora* (Chrysanthemum)**

Family: *Asteraceae*

Plants are semi-woody, perennial, leaves single, serrated, dark green and inflorescence capitulum having two types of florets (tubular and ray), varied flower form in different colours.



***Dendrobium* spp. (Dendrobium)**

Family: *Orchidaceae*

Dendrobium is the second largest genus, but very popular cut flower after Cymbidium. Stem is elongate or with pseudo-bulbs. Leaves are one to several. Inflorescence is terminal or lateral with one to many flowers of varied colours.



***Dianthus caryophyllus* (Carnation)**

Family: *Caryophyllaceae*

Plants are herbaceous, perennial, stem with swollen nodes, leaves thick, dark green grass like and flowers with smooth or fringed petals of various colours.



***Gerbera jamesonii* (Gerbera)**

Family: *Asteraceae*

Plants are almost without stem, tender perennial herb. Leaves radical, with petiole, deeply lobed and dark green. Flower heads solitary, many flowered, daisy like in almost every colour.



***Gladiolus x gandavensis* (Gladiolus)**

Family: *Iridaceae*

Gladiolus leaves resemble sword and 6-8 number. Flowers called as florets are borne in spike. Florets open acropetally and are of almost all colours. Under ground plant-part is called as corm, which distinct nodes and internodes and covered with thin papery covering.



***Heliconia angustifolia* (Heliconia)**

Family: *Musaceae*

Dwarf plantain like plants with colourful foliage. Boat shaped bracts look very ornamental and available in red, yellow and orange colours.



***Lilium* spp. (Asiatic Lilium)**

Family: *Liliaceae*

Leaves are mostly shining and upward growing. Flowers are mostly dark coloured and with no or slight fragrance. Flowering is for extended period. Bulbs are almost white and small size.



***Lilium* spp. (Oriental Lilium)**

Family: *Liliaceae*

Leaves are less or no shining, broad shaped and growing almost parallel to ground. Flowers are mostly white or pink coloured with high fragrance. Flowering occurs during late autumn. Bulbs are yellowish tinged and of large size.



***Narcissus pseudonarcissus* (Daffodil)**

Family: *Amaryllidaceae*

Plants perennial, leaves linear and dark green. Flowers are borne on long stalk. Narrow perianth tube with six segments mainly of creamish white colour and a cup shaped corona in the centre of yellow, orange colour.



***Polianthes tuberosa* (Tuberose)**

Family: *Agavaceae*

Plants are leafy with long narrow, linear, grass like and mostly prickly. Flowering stalk called spike has single, semi-double and double flowers, creamy-white, tubular and highly fragrant.



***Ranunculus asiaticus* (Ranunculus)**

Family: *Ranunculaceae*

Plants are dwarf with finely cut dark green foliage. Flowers are turban shaped double in almost red, yellow, orange, white and scarlet colours. Tubers have claw shaped 3-5 flangs in dusty brown colour.



***Rosa hybrida* (Rose)**

Family: *Rosaceae*

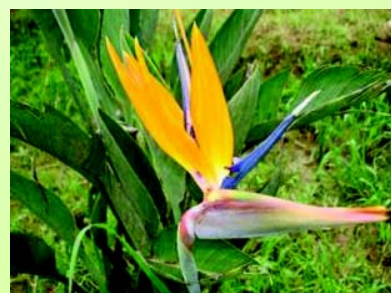
Plants are erect to climbing, stem prickly, leaves oddly pinnate and prickly. Flowers in cut flower varieties are many and almost all colours.



***Strelitzia reginae* (Bird of Paradise)**

Family: *Strelitziaceae*

Plants are perennial, herbaceous, thick stalked dark green foliage and long contractile roots. Flowers are yellow-orange with violet-blue centre and with flying bird shaped.



***Tulipa* spp. (Tulip)**

Family: *Liliaceae*

Plants have 3-4 strapped shape to lanceolate green leaves. Flowers are solitary having six to many tepals borne on a scape in almost every colour.



Exercise: Visit the commercial Floriculture farms/ nurseries/ Florist shops and identify different cut flowers being grown or sold based upon their distinguishable morphological characters.

EXERCISE 4.2: IDENTIFICATION OF MAJOR LOOSE FLOWER CROPS

Objective :

- To identify various loose flower crops based on primary morphological characters.

Delivery schedule : 1 period

Student's expectations/ Learning objectives:

- To get acquainted with different loose flower crops grown in India

Pre-learning required : Knowledge about various loose flowers.

Handouts/material required/equipment's & tools: Flower crops, hand lens and standard encyclopedia and books on Floriculture

Introduction:

When flowers are harvested without stem usually with small or no petiole for various religious and social functions are called as loose flowers. The loose flowers are used to offer in temples, mosques, churches, gurudwaras, making garlands, veni, gajra, corsage, etc. The main loose flower crops grown in India are given below:

Loose flower crop

Callistephus chinensis (China aster)

Family: *Asteraceae*

Plants are herbaceous, annual. Leaves are simple, serrated and light green. Flowers are single to double and in pink, purple, red, yellow and white colours

Chrysanthemum spp. (Annual chrysanthemum)

Family: *Asteraceae*

Plants are herbaceous with semi-woody base, annual, leaves simple, serrated/ lobed and flowers mainly in white and yellow tinge.

Crossandra undulaefolia (Crossandra)

Family: *Acanthaceae*

Dwarf evergreen shrub growing to two feet. Flowers are yellow to orange borne in dense bracted spikes.

Dendranthema grandiflora (Chrysanthemum)

Family: *Asteraceae*

Plants are semi-woody, perennial, leaves single, serrated, dark green and inflorescence capitulum having two types of florets (tubular and ray), globular to decorative flower form and mainly in white and yellow colours.

Jasminum sambac (Arabian Jasmine)

Family: *Oleaceae*

Plants are bushy to climbing. Leaves are sessile, opposite and light green. Flowers are single to double form, white and borne in clusters of 3-12 per cluster.

Photograph



***Nelumbo nucifera* (Lotus)**

Family: *Nymphaeaceae*

Plants are growing in ponds. Leaves are overtopping. Flowers are pink to red about 20-30 cm across growing above water.



***Nerium indicum* (Red kaner)**

Family: *Oleaceae*

Plants are tall, multi-branched, erect growing. Leaves are simple, thick, dark green and shining. Flowers are single to double borne in corymbs in pink, white and red colours



***Polianthes tuberosa* (Tuberose)**

Family: *Agavaceae*

Plants are leafy with long narrow, linear, grass like and mostly prickly. Flowering stalk called spike has single, semi-double and double flowers, creamy-white, tubular and highly fragrant.



***Rosa hybrida* (Rose)**

Family: *Rosaceae*

Plants are erect to climbing; stem prickly, leaves oddly pinnate and prickly. Flowers in loose flower varieties are many, borne in clusters and mostly in red, pink and white colours.



***Tagetes erecta* (African marigold)**

Family: *Asteraceae*

Plants are tall, stem green, foliage oddly pinnate, light green and flowers large, yellow to orange tinged.



Tagetes patula (French marigold)

Family: Asteraceae

Plant is dwarf, stem bronze, foliage oddly pinnate, dark green and flowers small, mainly red tinged.



Exercise: Visit the commercial Floriculture farms/ nurseries/ Florist shops and identify different loose flowers being grown or sold based upon their distinguishable morphological characters.

Observations:

S.No.	Name of the flower	Cut flower or loose flower or both	Plant characteristics	Flowers and inflorescence	Remarks
1					
2					
3					

Precautions:

- Do not damage the flower crops during identification.
- Carefully note the most distinguishable characters of flower crops identified.

