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# UNIT 1 TYPES AND COMPONENTS OF NURSERY

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## 1.0 OBJECTIVES

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After going through this unit, you will be in a position to:

- explain the purpose of nursery raising designing,
- discuss different types of nurseries, their designing and structure,
- describe different types of greenhouses used for nursery raising, and
- planning and layout nursery.

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## 1.1 INTRODUCTION

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The nursery industry is literally a plant growing industry. It produces billions of plants every year making major contributions to the forestry vegetable, fruit, landscape, cut flower and park industries. There will always be a demand for quality planting material and, in turn, there will always be a need for reliable and reputed nurseries.



A nursery is a place, where seedlings, saplings, trees, shrubs and other plant materials are grown and maintained until they are placed in a permanent place. Establishment of a nursery is a permanent venture. Any mistake made initially can't be rectified in the later stage. Hence, the availability of quality planting material is the foundation on which a healthy crop is built. To raise plants in the nursery seems to be easy but to maintain them in good state is very difficult. Raising of seedlings and maintaining the young plants in the nursery is the continuous process. One must have full idea about sowing time, sowing depth etc. to raise them effectively. Similarly, knowledge about transplanting of seedlings, their handling and further management in the nursery and afterwards is equally important for raising quality material.

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## 1.2 MAIN ASPECTS TO BE CONSIDERED BEFORE RAISING NURSERY

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For growing high quality vegetables, flowers and fruits, it is of utmost importance that the seedlings should be healthy, vigorous and disease free as the seedlings are susceptible to a number of diseases, mainly viruses due to their delicate, succulent and highly tender nature. On the other hand some of the vegetable seeds are very costly particularly those of hybrid varieties which warrant urgent attention of the growers to raise the seedlings under protected conditions because every seed has its accountability owing to its cost, and the technological advancement has contributed to the growth of nursery industry by reducing costs and increasing reliability of high quality seedling production. By using multi-celled plastic trays, with individual cell size and by using artificial soil less media has made it possible for close and consistent control of seedling growth rate.

Raising nursery from seeds, provides an easy and convenient way to nourish tender and young seedlings in a well-managed, small and compact area for better germination of costly seeds.

### 1.2.1 Advantages of Modern Nursery Raising System

There are several advantages of modern nursery raising system in vegetables, flowers and fruits.

- i) complete possibility of raising virus free seedlings,
- ii) no problem of soil borne fungus or nematodes,
- iii) possibility of raising off season nursery,

- iv) reduced seed rate,
- v) vigorous root development of seedlings,
- vi) no or least mortality of seedlings,
- vii) no transplanting shock,
- viii) quick establishment,
- ix) large number of seedlings can be raised in small protected area,
- x) easy in handling,
- xi) possibility of transportation to long distances, and
- xii) lastly it can work as a small scale industry.

The demand for high quality planting material is steadily increasing due to interest in vegetable gardening, fruit tree cultivation, social forestry, agro-forestry and plantation crops. The need of setting up plant nurseries to meet the demand of the people has been felt by small and marginal farmers as well as by gardeners and farm house owners. In order to meet this demand, there is ample scope for introduction of small nurseries which will serve to augment the income of needy sections of rural society.

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## 1.3 TYPES OF NURSERIES

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Throughout the world, nurseries come in all types and sizes; many are small family businesses, sometimes just a small hobby business to supplement the family's normal source of income. At the other end of the scale are large commercial enterprises that employ skilled workers and require good management if it has to be a financially viable enterprise.

The nursery can be broadly classified on the basis of its size and business.

### 1.3.1 On the Basis of Size

- i) **Home Nursery** : It is a small area in the garden in which the new plants are raised to meet the demands of grower's own garden. The main objective of such a nursery is to provide the quality planting material. Usually, costly methods of nursery practices are followed in this type of nursery for raising various planting materials of high quality.
- ii) **Commercial Nursery** : The main aim of such a nursery is to earn money on the investment. Such nurseries have a large area and costly nursery practices are usually avoided. **These are of two types:**
  - a) **Rural Nursery**: This type of nursery is located in a village near some high way or near a railway station. Usually, the size of rural nursery is large because land and labor is not a problem in rural areas.
  - b) **Urban Nursery**: This type of nursery is located in a town or a city. The size of the nursery is usually small because the land is costly and not easily available.

### 1.3.2 On the Basis of Business

- i) **Wholesale Nursery :** In wholesale nursery, the plants are produced in large quantities for sale to retail outlets. These nurseries are usually located in rural areas.
- ii) **Retail Nursery :** The retail sellers purchase plants from wholesale nursery. The retail nursery is largely dependent on house owners for its trade; it is located near a town or a city. These nurseries also keep goods like fertilizers, seeds and tools etc. required for raising the home garden plants.
- iii) **Landscape Nursery :** These nurseries should be located near a populous town or city because urban people require the landscape plants for beautifying the land of their bungalows/houses.
- iv) **Mail Order Nursery :** It is a specialized whole sale nursery. It depends primarily on a catalogue display of the stock, which it offers for sale. Customers of distant locations order from the catalogue and receive the plants through mail or parcel service. Now-a-days customer use e-mail services for placing their orders to the mail order nurseries.
- v) **Agency Nursery :** The agency nursery sells its stock through agents or sales representatives. Such nurseries are highly specialized and are usually few in number.

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## 1.4 NURSERY STRUCTURES/COMPONENTS

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In a large nursery, certain structures are absolutely necessary which are described below:

### 1.4.1 Store-house

A store house is necessary for storing implements, fertilizers, sprayers and nursery stocks such as seeds, bulbs, corms, cuttings etc.

### 1.4.2 Potting and Packing Shed

Along with the store-house, potting and packing shed is constructed for the purpose of packing of nursery stocks and for potting during rainy season or hot weather. The length and the breadth of the shed will depend upon the volume of work.

### 1.4.3 Nursery Beds

These are raised boxes made of brick and mortar, provided with drainage holes at the bottom. The dimensions of the boxes are 60 cm high, 120 cm broad and the length may be as required but preferably not exceeding 10 meters. The boxes are first filled with broken bricks and corks for drainage and the top layers are filled with sterilized soil or compost.

### 1.4.4 Mist Chamber

This is a novel structure in a nursery where propagation of leafy soft-wood cuttings is done with great success. Many difficult to root plants and shrubs root successfully under mist.

The principal is to spray the cuttings with a minimum quantity of water to maintain the desired humidity level. This is best achieved by providing the cuttings a series of short bursts of spray, termed as intermittent spraying, rather than a continuous spray. Such intermittent spraying can be done easily by means of a high pressure pump and a time switch. In mist chamber, cuttings can be raised round the year, except during December - January and April - May in northern and eastern India respectively. In southern India it is possible to raise cuttings throughout the year. The ideal temperature range in a mist chamber is 22-35°C.

### 1.4.5 Cold Frames

Such frames may be permanent or movable. The permanent ones are constructed by masonry walls on the sides with slanting covering of one or more glass sashes. It should be made of light material so that they may be easily handled by single person.

### 1.4.6 Hotbeds

Heated frames are used for propagating cuttings and sowing seeds in the cold season. Hotbeds, heated by steam or electricity, are easy to operate and the temperature can be regulated according to need. But the conventional type of hotbed is quit useful. This consists of a bed of stable manure mixed with equal volumes of leaf-mould, compost, or peat. The beds are 45-60 cm larger in size on all sides than the frames covering it. The manure should be well pressed to bring the final depth to 60 cm. Generally, such beds are made on the surface but good light and well drained soil is needed for it. Sunken pits can also be prepared. Mixing of stable manures of farmyard alternatively with leaf manure, ensures a steadier and longer heat. No portion of manure is allowed to dry up. When the temperature becomes steady around 70-75°F, a layer of 10-15 cm well sifted soil is placed over the manure; the desired temperature of such beds lasts for 3-4 months.

### 1.4.7 Greenhouses

A greenhouse is quasi-permanent structure, covered with a transparent or translucent material, ranging from simple self-constructed designs to sophisticated pre-fabricated structures, wherein the environment could be modified suitable for the propagation or growing of plants. Materials used to construct a greenhouse frame may be wood, bamboo, and steel or even aluminum while the coverings can be of glass

or various rigid or flexible plastic materials. Greenhouse provides protection to plants against adverse environmental conditions and also prevents damages from insects and pests. Environmental conditions inside a greenhouse can be modified suiting to the growth of nursery plants. The extent of environmental/climatic modification will, however, depend on the design of greenhouse and is generally related with its cost. Higher the capability of greenhouse to modify its climate, higher will be the cost of its construction.

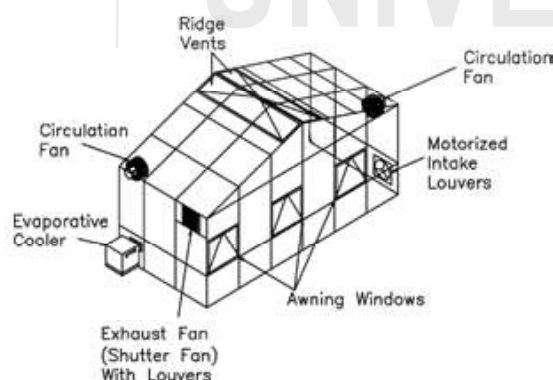


Fig.1: Typical greenhouse

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## 1.5 FACTORS ON WHICH ENVIRONMENT OF GREENHOUSE DEPENDS

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The aerial environment for the plant growth is largely determined by the following four factors:

### 1.5.1 Heat or Temperature

The way in which a greenhouse gets heated when exposed to sunlight is similar to heating of the earth's surface and its adjacent atmosphere. When solar radiation reaches the earth, a small portion is reflected back into the space while the remainder is absorbed at the surface raising its temperature. In the same way, when solar radiation reaches the greenhouse cover-surface, a small amount (normally 15-20 %) is reflected back from the surface while the remainder is transmitted to the interior. Plants, soil and other objects absorb most of this transmitted radiation and remainder is reflected. The absorbed radiation raises the temperature of absorbing surfaces and objects with the heat energy being immediately transferred to the greenhouse air by convection and evaporation thereby increasing the temperature and humidity. Thus, increase in temperature of the growing environment in a greenhouse during the day time is unavoidable, but it is also the most important function of a greenhouse. Enhanced temperatures accelerate plant growth, and allow sustained plant growth even when outside ambient temperatures are unfavorably low. However, during summers, inside temperatures rise higher than the optimum levels and, therefore, cooling/ventilation provisions are necessary.

### 1.5.2 Relative Humidity

Most plants seedlings grow better within the range of 75 - 85 % relative humidity (RH) of air. Low RH increases the evaporative demand on the plant, while high RH can depress this demand inhibiting the uptake of nutrients, particularly of calcium. In general, the RH inside the greenhouses is higher than outside, mainly due to transpiration load. Effective ventilation is required to control higher RH levels.

### 1.5.3 Light

In most parts of the country, solar radiation is not a limiting factor for plant growth. Light control inside the greenhouse can be affected conveniently either by shading or by supplementary lighting whenever required. Growers in northern India should, however, be careful in monitoring light levels in winters especially during prolonged foggy conditions. In peri-urban areas, particulate pollutants get deposited on the plastic roof thereby reducing the light transmission significantly. This problem is compounded during winters when it becomes necessary to wash the roof frequently, to maintain adequate light levels inside the greenhouse.

### 1.5.4 Carbon dioxide

Plants use carbon dioxide (CO<sub>2</sub>) from the atmosphere for photosynthesis. Greenhouses are, evidently, closed structures where crops utilize the CO<sub>2</sub> available in greenhouse air. The CO<sub>2</sub> in the greenhouse air keeps getting replenished with

the help of ventilation. However, under bright sunshine hours, greenhouse crops have been noticed to suffer from a lack of CO<sub>2</sub> availability. Carbon dioxide concentration inside the greenhouse in the early morning is always higher than outside. With sunrise and subsequent warming, this level quickly depletes and goes down the normal level during the day if adequate air exchanges are not maintained. Carbon dioxide enrichment is generally accomplished by burning suitable fuels like propane.

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### Check Your Progress Exercise 1

**Note :** a) Space is given below for answers.

b) Compare your answer with that given at the end of the unit.

1) What are the advantage of modern nursery raising ?

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2) Classify nurseries on the basis of business.

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3) Describe the mist chamber.

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## 1.6 TYPE OF GREENHOUSES

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Greenhouses are classified according to their shapes, which also determine their cost, climate control and use in terms of crop production. The greenhouses design and cost range from a simple plastic walk-in tunnel costing about Rs.100/- per sq. meter, to a climate-controlled, saw-tooth greenhouse with automatic heating, ventilation and cooling, costing more than Rs. 3000/- per sq meter. The selection of the greenhouse design should be determined by the local climatic conditions, grower's expectations, need, experience, and above all its cost-effectiveness for the nursery production system. Obviously, the cost of greenhouse is very important and may outweigh all other considerations. Simple design of greenhouse, as

shown in the **Figure-1**, can be used to grow nurseries round the year that would have low initial cost and would require minimum energy for operation. The following two types of greenhouses will be suitable:

- a) Naturally ventilated (saw-tooth type)
- b) Tunnel type with side ventilation (Plastic Low Tunnels)

### 1.6.1 Naturally Ventilated Greenhouses (Saw-tooth Type)

Saw-tooth design of greenhouse with 4 meter rain gutter height and side ventilation is best suited for regions of moderate climate where temperature variations occur within 10 to 40 deg Celsius during the year. No electricity is required for climate management inside these structures. Conducive climate can be achieved by manual regulation of ventilation.

Tunnel type greenhouses with side ventilation can be used for raising nursery and some vegetable crops almost round the year. Propagation of carnation and chrysanthemum can also be successfully done in these greenhouses using plug trays. There is a huge demand of these plants and can **accrue** substantial profits. Besides, growing seedlings of selected vegetables in off-season is also highly profitable.

### 1.6.2 Plastic Low Tunnels

These structures are laid in open fields to cover rows of plants with insect-proof net or transparent plastic film stretched over steel hoops of about 50 cm height spaced suitably along the rows. Insect net of 40 to 50 mesh or polyethylene film of 20-30 micron thickness are used. The main advantage of plastic covered tunnels in northern India is to grow seedlings in winters. In cold conditions, they conserve warmth, stimulate germination and early growth, protect plants from frost injury, and improve quality of the seedlings. Insect-proof nets on these tunnels are very effective to provide protection against pests and different vectors. These are low cost options for raising nurseries of desired standards. However, these are temporary structures and require good maintenance for their effectiveness.

### 1.6.3 Net houses

These structures can be classified in two distinct types based on the covering material and their purpose of use.

- i) **Shade net house** : Shade net houses use perforated plastic nets as covering material to cut down the solar radiation and prevent scorching or wilting of leaves caused by marked temperature increases within the leaf tissue from strong sunlight. These nets are available in different shading intensities ranging from 25-75 %. These structures are highly useful to moderate the micro-climate around the plants especially in summers. During winters, these provide protection against frost and chilly winds.

- ii) **Insect-proof net house** : These types of net houses are covered with insect-proof nylon nets in different intensities of perforations, ranging from 25 mesh to 60 mesh. Nets of 40 or higher mesh are





effective means to control entry of most flying insects and save crop from diseases. These structures ensure raising of nursery without the risk of vectors. Higher mesh size, however, reduces the air exchange of the structure. **Now-a-days, UV- stabilized nets are available which have a longer life.** These structures are low-cost options to minimize damage by insects and pests to the crop plants.

A bamboo - framed greenhouse is quite suitable for places where bamboo grows in plenty. Preference for local materials should be given if the construction is to be cost-effective in the long run. However, cellulose based materials are prone to termite which would shorten the life of the structure.

**A simple wooden framed, saw-tooth design of naturally ventilated greenhouse** for raising nursery or for crop production can be easily built with local artisan skills. These structures have superior ventilation and can be used for year-round production. Solid wooden poles are better than hollow bamboos for constructing a greenhouse.

Tunnel type greenhouses are easy to build in low cost. These may be of two types: (i) walk-in tunnel with no side ventilation and (ii) the raised arch with side ventilation. The walk-in tunnel has poor ventilation and, thus, of limited annual use with plastic cover. Its annual use can be enhanced by replacing the plastic cover with insect proof net during hot season. The raised arch structures have better ventilation and can be used almost year around for crop production.

**Tunnel type greenhouse with side ventilation** is quite suitable to grow vegetables and nursery. These can also be built with local skills to reduce the cost. Insect-proof net houses are low cost options to grow nurseries in plug trays. Such protective structures can be built at the cost ranging from Rs. 80 to Rs. 150 per sq meters. Except in rain and severe cold, these structures provide effective means to grow healthy and disease-free nursery. In northern Indian plains, these would not be suitable to raise nursery during high winters. The structures may be made from wooden poles, bamboos, steel or cement poles. The net used to cover the structure must be minimum of 40 mesh perforations. Low tunnels covered with plastic nets (40 mesh) are also useful in growing *in-situ* nurseries on large scale, especially in warm season. Sprinkles can be used to irrigate the nursery beds without uncovering the tunnels.




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## 1.7 PRE-REQUISITES FOR ESTABLISHMENT OF A NURSERY

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Following points should be kept in mind while establishing a nursery:

- 1) As far as possible, the nursery should be located in the important production areas.
- 2) The soil should be deep, fertile, well drained and free from soil borne pathogens.
- 3) The locality should have adequate supply of sweet water.
- 4) Climatic condition should be favorable for the plants to be propagated.

- 5) The site should be well connected by different means of communication and must be easily accessible.
- 6) Sufficient labour, budders and grafters should be available to handle different operations.
- 7) The materials like fertilizers, pesticides, growth regulators, grafting waxes, lanolin paste and other necessary equipments etc. should be readily available.
- 8) There should be sufficient provision for different propagation structures like glasshouses, net houses etc.
- 9) The nursery should have its own resources to provide parent material (mother plants) for propagation.

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## **1.8 WHY NURSERY IS NEEDED ?**

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- 1) The young plants can be easily maintained in the nursery. Similarly, it is easy to look after the young and tender seedlings in the nursery rather than in the field.
- 2) Propagation of plants by asexual means requires special skill and necessary care of plants before transplanting in the field, can be done easily in the nursery.
- 3) Many crop plants do not respond to direct seed sowing (cabbage, tomato, and papaya) in the field as compared to transplanting of seedlings raised in the nursery.
- 4) Cuttings of different horticultural plants for rooting are first planted in the nursery for better care and management.
- 5) For “hardening” of seedlings/grafts/layers etc., nursery is the right place for this treatment.
- 6) “Seasoning” of the seedlings against natural calamities is possible only in the nursery.

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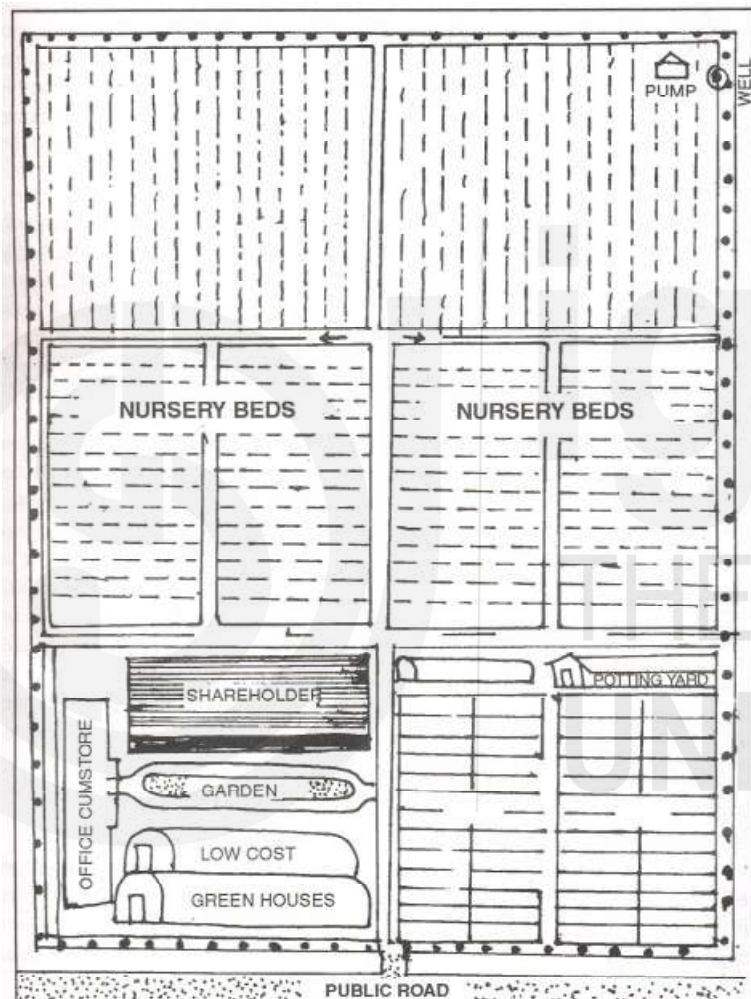
## **1.9 PLANNING AND LAYOUT OF THE NURSERY**

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The ideal “propagation environment” is at the heart of the nursery, and, therefore, the entire facility should be arranged with respect to it. Container nurseries should always be laid out to utilize the maximum sunlight in the propagation areas. Open growing compounds should be situated to receive maximum sunlight while receiving due protection from wind. They should not be located near large trees, buildings, or other obstructions that can cause shade during the major part of the day. As a general rule, a growing compound should be located at a distance of at least 2.5 times the height of the nearest object to the south, east, and west. Properly located shelterbelts can reduce adverse effects of wind. A well-designed wind barrier or a tree shelterbelt can significantly reduce heat losses of propagation structures, decrease the irrigation wind drift in shelter houses or open growing compounds, and provide protection from damaging storms. The most important steps for raising seedlings in the nursery are to select a proper site for seedbeds, seed sowing, care of seedbeds, care of seedlings and then transplanting of the seedlings. Growing of plants in the nursery seems to be easy in words but in reality it is a difficult job and can be done effectively and efficiently only after attaining some experience. Thus, it is considered as a specialized job because

one has to acquire fair knowledge about the plants to be raised. Similarly, one should have sufficient knowledge about the cultural requirements of the plants to be raised in the nursery.

Usually seeds of most vegetables (tomato, chillies, brinjal, cabbage, cauliflower etc.) and flowering annuals (daisy, calendula, zinnia, marigold, larkspur etc.) are sown about a month prior to their planting in the field. The seeds of tropical and sub-tropical fruits are sown during monsoon (June - July) or in the beginning of spring (February - March). Generally mango, kagzi lime and jack fruit seeds are sown during June - July while those of guava, ber and aonla, during February - March. Seeds of temperate fruits are generally available during June - October and their sowing should be done after their dormancy period is over.



The seeds are usually sown at a depth 3-4 times of their size. Sowing may be done a little deeper in light soils than in heavy soils. The seed sale depends on many factors, particularly on the species, purpose and spacing.

**Check Your Progress Exercise 2**

**Note :** a) Space is given below for answers.

b) Compare your answer with that given at the end of the unit.

1) What are the prerequisites for establishment of a nursery ?

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- 2) Why nursery raising is necessary, why not one can directly raise seedlings in a open field environment ?

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- 3) What are different types of low cost greenhouses ?

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### 1.10 LET US SUM UP

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In this unit, you have studied about the purpose of nursery raising, designing types of nursery used for seed germination. You have also learnt about different types of low cost greenhouses, their construction method and raising seedling of different horticulture crops. We have also discussed about the need of nursery, planning and layout of nurseries and the time when different flower, vegetable and fruits seeds should be sown in the nursery.

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### 1.11 KEY WORDS

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- Insect – proof net house** : Net house covered with insect proof nylon nets in different perforations ranging from 25 to 60 mesh.
- Mist Chamber** : It is a normal structure in a nursery where propagation of leafy soft-wood cuttings is done with great success.
- Shade Net House** : Greenhouse covered with shade net to cut down the solar radiation and prevent scorching and wilting of leaves caused by high temperature.

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### 1.12 FURTHER REFERENCES

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## 1.13 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

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### Check Your Progress Exercise 1

- 1) These are advantages of modern nursery raising system *viz.*
- complete possibility of raising virus free seedlings.
  - no problem of soil borne fungus or nematodes; possibility of raising off season nursery.
  - reduced seed rate (40-60 % compared with traditional system).
  - vigorous root development of seedlings which is not possible in traditional system.
  - no mortality after transplanting in main field.
  - no transplanting shock after transplanting in main field.
  - quick establishment of seedlings in the field after transplanting.
  - large number of seedlings can be raised in small protected area, and their raising in off-season is possible.
  - easy in handling and possibility for transportation to long distances.
- 2) On the basis of business:
- Wholesale nursery :** In wholesale nursery, the plants are produced in large quantities for sale to retail outlets. These nurseries are usually located in rural outlets.
  - Retail nursery :** The retail sellers purchase plants from wholesale nursery. The retail nursery is largely dependent on house owners for its trade; it is located near a town or a city. These nurseries also keep goods like fertilizers, seeds and tools etc. required for raising the home garden plants.
  - Landscape nursery :** These nurseries are located near a populous town or city because urban people require the landscape plants for beautifying their houses.
  - Mail order nursery :** It is a specialized whole sale nursery. It depends primarily on a catalogue display of the stock it offers for sale. Customers of distant locations order from the catalogue and receive the plants through mail or parcel service. Now-a-days customer use e-mail services for placing their orders to the mail order nurseries.
  - Agency nursery :** The agency nursery sells its stock through agents or sales representatives. Such nurseries are highly specialized and are usually few in number.
- 3) **Mist Chamber:** This is a novel structure in a nursery where propagation of leafy soft-wood cuttings is done with great success. Many difficult to root plants and shrubs root successfully under mist.

The principal is to spray the cuttings with a minimum quantity of water to maintain the desired humidity level. This is best achieved by providing the

cuttings a series of short bursts of spray, termed as intermittent spraying, rather than a continuous spray. Such intermittent spraying can be done easily by means of a high pressure pump and a time switch. In mist chamber, cuttings can be raised round the year, except during December - January and April - May in northern and eastern India respectively. In southern India it is possible to raise cuttings throughout the year. The ideal temperature range in a mist chamber is 22-35°C.

### Check Your Progress Exercise 2

- 1) Following point should be kept in mind while establishing a nursery:
  - i) As far as possible, the nursery should be located in the important production areas.
  - ii) The soil should be deep, fertile, well drained and free from soil borne pathogens.
  - iii) The locality should have adequate supply of sweet water.
  - iv) Climatic condition should be favorable for the plants to be propagated.
  - v) The site should be well connected by different means of communication and must be easily accessible.
  - vi) Sufficient labour, budders and grafters should be available to handle different operations.
  - vii) The materials like fertilizers, pesticides, growth regulators, grafting waxes, lanolin paste and other necessary equipments etc. should be readily available.
  - viii) There should be sufficient provision for different propagation structures like glasshouses, net houses etc.
  - ix) The nursery should have its own resources to provide parent material (mother plants) for propagation.
- 2)
  - i) The young plants can be easily maintained in the nursery. Similarly, it is easy to look after the young and tender seedlings in the nursery rather than in the field.
  - ii) Propagation of plants by asexual means requires special skill and necessary care of plants before transplanting in the field, can be done easily in the nursery.
  - ii) Many crop plants do not respond to direct seed sowing (cabbage, tomato, and papaya) in the field as compared to transplanting of seedlings raised in the nursery.
  - iii) Cuttings of different horticultural plants for rooting are first planted in the nursery for better care and management.
  - iv) For “hardening” of seedlings/grafts/layers etc., nursery is the right place for this treatment.
  - v) “Seasoning” of the seedlings against natural calamities is possible only in the nursery.
- 3) These low cost green house nurseries are natural ventilated green house, plastic low tunnels, net houses – insect proof net house and shade net house.