UNIT 1 : INTRODUCTION TO COMMERCIAL NURSERY MANAGEMENT

UNIT STRUCTURE

1.1 Learning Objectives

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1.1 LEARNING OBJECTIVES

After going through the unit, you will be able to –

- Recognize the nursery trade in India.
- Assess the scope of commercial nursery.
- Define nursery.
- Justify the need for nursery management.
- Identify different nursery management practices.
- Describe different types of ornamental/flowering plants.
- Name different ornamental plant species.

1.2 INTRODUCTION

Demand for horticultural crops more particularly the ones bearing fruits and flowers and ornamental purposes is increasing in both urban and rural areas of the country. To meet the growing demand, the need for good

maintaining varieties of flowering, fruit and ornamental plants. However, there are very few agencies that would provide some basic cultivation and management tips for the proper management of their plants.

There are also no special facilities available for transporting the nursery plants from place to place. To meet the local demand, there is always a big scope for the establishment of nurseries locally.

Nursery business has ample scope for self employment with a minimum capital investment. There exists a great potential of nursery industry for self employment and entrepreneurship development to meet the ever increasing demand of planting materials of horticultural crops.

The production and productivity of fruit plants depends upon the availability of quality planting material which in turn largely depends upon the nurseries and nursery activities. The number of genuine and quality fruit and ornamental plants varieties produced by Agricultural Universities, State Departments of Horticulture and Research Institutions is grossly insufficient to meet the increasing demand of large number of growers throughout the country more particularly in Assam. For this reason, most of the fruit growers, orchardists are depending on private nurseries and nurserymen for their requirement of fruit and ornamental plants. Thus, there is a good scope to prosper for the nurserymen, who can supply genuine and high quality plant material of different fruit and ornamental plants produced on sound scientific lines. Such high quality planting material could be produced by careful planning, establishment and management of nurseries.

1.5 DEFINITION OF NURSERY

Nursery is a place where plants and planting materials are raised and maintained in healthy condition for final planting or for sale.

Nursery is one of the important components of fruit/ornamental crop production. The advantages of having a nursery are:

- Healthy and well rooted planting materials free from diseases, pests and nematodes are produced.

seeds and other planting materials is easy and convenient way for ensuring better germination and root development. The planting material of horticultural crops is multiplied under nursery conditions with proper care and management for raising healthy, vigorous and an disease free seedlings/saplings. Most of the fruit and tree speices are slow growing. They are multiplied in nursery for better seed germination and plant survival. It becomes convenient to utilize various budding and grafting tools under nursery conditions. Most of the fruit crops are multiplied and propagated under nursery conditions. Besides, the shrubs and herbs of ornamental nature are multiplied under nursery conditions for their faster growth and development.

- **Care of progeny block.** Collecting and the raising of the genuine planting materials/varieties and their proper care in the progeny block is most important in nursery management. Since the quality of planting material affects the production, it is necessary to collect the basic material from a genuine and reliable source. Efforts should be made to identify nodal centers for the supply of elite planting material of important ornamental plants in our country. In recent years, several multinational and industrial houses have entered into floriculture business and are producing quality plant material. The planting materials of those elite varieties are supplied from these institutions in small quantities to the users for future multiplication.
- **Multiplication of planting materials.** It is a major activity in a commercial nursery. The major considerations would be the propagation method and its seasonal variations for the success and quality of the final produce, rootstock to be used, and specifications for the scion / bud wood including its genuineness and seasonality of availability.
- **Inputs management in nursery production.** Identification of the inputs necessary for each stage of production and development of specifications and requirements for each input

challenges. Integrated pest management (IPM) combining chemical, cultural and biological control techniques needs to be adopted to address the pest problems. Good sanitation and plant health reduce the pest and disease problems. In nursery beds usually fungal diseases like damping off and foliar diseases like anthracnose, blight, leaf spot and mildews are serious problems. Their control is possible only through adopting an integrated approach of cultural, mechanical, biological and chemical measures right from management of seed source to final uprooting of seedlings.

- Cleanliness which makes nursery attractive to buyers and workers is another important aspect of nursery management.
- Nursery labour management
- Marketing of nursery produces.

1.7 DIFFERENT TYPES OF FLOWERING/ ORNAMENTAL PLANTS

ANNUALS : Annuals are the plants that live for a year or less. Annuals are also known as seasonal flowering plants which flower only for three to four months. They are normally grown through seeds. They grow, flower, and make more seeds and die, within a year. Annuals are great for creating instant effect and adding color to the garden. Planting annuals also gives the option of changing the layout of the garden after a year. Most annuals are tender and some of them like phlox look beautiful and are excellent as borders and hedges. Examples of Annuals are Asters, Dianthus, Bachelor button, Phlox, Balsam, Basil, Cosmos, Petunias, Marigold, Salvias etc.

BIENNIALS : A plant that takes two years to grow from seed to fruition, bloom and die or a plant that lasts two years is a biennial. These are also seasonal flowering plants that flower only in the second year of planting. After blooming, they don't perform well the following year or become untidy and then die. To have blooms year after year with biennial flowers, it is necessary to plant seeds every year. Examples of biennials are Foxglove,

older branches and need only infrequent maintenance pruning. Prune only the dead, diseased or damaged wood or to correct a poor shape. Flowering trees can be pruned after flowering or fruition.

CREEPERS AND CLIMBERS :

Creepers : These plants can be grown along the top of the compound wall or as a cover for walls, or at the entrance as an arch. There are varieties of creepers available like, Bignonia venusta, allamanda, passiflora (fashion flower), Jacquemontia. Even Bougainvilleas can be a good creeper.

Climbers : These are the plants with soft stems that grow only with a support. They rely on something else for support; another plant, a wall or ***trellis***. Different types of climbers have devised many crafty ways to hold on to whatever they grasp. Examples are Clerodendrum thomsoniae (Bleeding Heart), Cissus rhombifolia (Grape Ivy), Jasminum multipartitum (Starry Wild Jasmine), Clematis montana (Clematis) etc.



Trellis. A light frame made of long narrow pieces of wood that cross each other, used to support climbing plants.

BULBS : A bulb is a specific stem structure which is planted beneath the soil and stays underground. Roots grow down from it, and the stem and the leaves grow up from it. Most bulb plants have a dormant (resting) period during which there is no growth visible. Bulb plants grow, flower, and then the leaves remain for sometime and disappear completely until next year. They are easy to grow and guaranteed to bloom. Examples are: Daffodils, Tulips, Bluebells etc.

Bulb plants can be **Real bulbs**: Formulated in layers, with an outer scale (onion, tulip, lily). **Corms:** Appears like a bulb on the exterior, different structure inside (crocus, gladiolus). **Tubers and Tuberous Roots**: Bulb stems or roots with food stores which look like a potato (Potato, Dahlia, Tuberous begonia).

1.8 SOME POPULAR ORNAMENTAL PLANT SPECIES

ANNUALS : Antirrhinum, China aster, Ageratum, Arctotis, Carnation, Calendula, Pansy, Petunia, Phlox, Sweet pea, Cosmos, Zinnia, Coreopsis, Gaillardia, Dianthus, Chrysanthemum, Calendula, etc.



CHECK YOUR PROGRESS

Q.1. Write about the scope of commercial nursery?

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Q.2. What are the reasons for the growing demand for flowering, fruit and ornamental plants?

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Q.3. Define nursery.

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Q.4. What are the things that a nurseryman should know for the management of a nursery?

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1.9 LET US SUM UP

- There is now a tremendous interest among the public for acquiring, maintaining varieties of flowering, fruit and ornamental plants, particularly in big cities and towns. The emergence of an affluent society, growth and spread of the large cities with huge residential areas for families and public recreation areas, can be cited as some of the factors for the mass production of ornamentals which are very much in demand now a days. However, there are only a few agencies to meet the growing demand for those materials/nursery plants.

1.11 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1. Nursery raising technique is the income generating process for small to medium land holders. Nursery business has tremendous scope for self employment with a minimum capital investment. There is an increasing demand of planting material for both domestic gardens and for commercial growing. Hence there exist a great potential of nursery industry for self employment and entrepreneurship development to meet the ever increasing demand of planting materials.

Ans. to Q. No. 2. The emergence of a more affluent of people in society, growth and spread of the large cities with huge residential areas for families and public recreation areas etc are some of the reasons for the growing demand.

Ans. to Q. No. 3. Nursery is a place where plants and planting materials are maintained in healthy condition for final planting or for sale.

Ans. to Q. No. 4. A nurseryman should necessarily be a professional who should be fully conversant with different varieties of crops, seeds, plant propagation techniques of different varieties of plants, handling of plant material and marketing.



1.12 MODEL QESTIONS

Q.1. Define a nursery.

Q.2. Write briefly about the nursery trade in India.

Q.3. What are the reasons for the increasing demand for nursery products?

Q.4. How to procure the progeny for a nursery? List a few popular ornamental crops.

2.2 INTRODUCTION

In the previous unit (unit 1), we have discussed the nursery trade in our country, demand for the nursery plants and planting materials and importance of nursery management for a commercial nursery. Also, the different popular ornamental and flowering plants that are commonly raised in nursery have been mentioned. The production of the good quality flowering, fruit or ornamental plants depends upon the availability of quality planting material which in turn largely depends upon the nurseries and nursery activities.

In this unit, we shall discuss about the planning for establishment of a nursery and the different facilities to be developed in the nursery to carry out various nursery activities.

2.3 SELECTION OF SITE

2.3.1 Location

The selected site for establishing a nursery should preferably be located in an established nursery area. By doing so, one can share the experiences of fellow nurserymen and thereby many mistakes can be avoided in planning, management and marketing of the nursery stock.

The selected site should preferably be near the highway or at least connected with a good motorable road, which facilitates easy and economic transport of inputs and nursery plants to the users, orchardists and fruit growers. The selected site should also have electricity and communication facilities. These facilities will improve the production as well as marketing.

2.3.2 The Soil

The success of any nursery depends mainly upon the nature of soil and the abundant supply of good quality water. Before

2.4.1 Fence

Prior to the establishment of a nursery, a good fence with barbed wire must be erected all around the nursery to prevent the trespass of animals and theft. The fence could be further strengthened by planting a live hedge with thorny fruit plants (like Assam Lemon). This also adds beauty in bearing and also provides additional income through sale of fruits and seedlings.

2.4.2 Roads and Paths

A proper planning for roads and paths inside the nursery will not only add beauty, but also make the nursery operations easy and economical. This could be achieved by dividing the nursery into different blocks and various sections. But at the same time, the land should not be wasted by unnecessarily laying out of paths and roads. Each road/path should lead thecustomers to a point of interest in the nursery area.

2.4.3 Progeny Block

Progeny block is the block of plants where true-to-type mother plants of superior varieties are maintained in the nursery according to the requirement. The nursery should have a well maintained progeny block or mother plant block/scion block planted with those varieties which are in good demand. The grafts/layers/ rooted cuttings/seedlings should be obtained preferably from the original breeder/research institutes from where it is released or from a reputed nursery. One should remember that the success of any nursery largely depends upon the initial selection of the progeny plants or mother plants for further multiplication. Any mistake made in this aspect will result in a loss of the reputation of the nursery. A well managed progeny block or mother plants block will not only create confidence among the customers but also reduces the cost

2.4.6 Seed Beds

In a nursery, this component is essential to raise the seedlings and rootstocks. These are to be laid out near the water source, since they require frequent watering and irrigation. Beds of one meter width of any convenient length are to be made. A working area of 60 cm between the beds is necessary. This facilitates sowing of seeds, weeding, watering, spraying and lifting of seedlings. Irrigation channels are to be laid out conveniently. Alternatively, sprinkler irrigation system may be provided for watering the beds .Sprinkler irrigation helps in uniform germination and seedling growth.

2.4.7 Nursery Beds /Poly bag

The raising of seedlings/rootstocks in poly bags requires more space compared to nursery beds but the mortality rate of seedlings/rootstocks is greatly reduced after transplanting. Further, uniformity in the growth of the seedlings/rootstocks can be maintained when raised in poly bags. Nursery bed area should also have a provision to keep the grafted plants in trenches of 30 cm deep and one meter wide so as to accommodate 500 grafts/layers in each bed. Alternatively, the grafts/ layers can be arranged on the ground in beds of one meter wide with 60 cm working place in between the beds. Such beds can be irrigated either with a rose fitted to a flexible hosepipe or by overhead micro sprinklers.

2.4.8 Potting Mixture and Potting Yard

For achieving better success in respect of nursery plants, a good potting mixture is necessary. The potting mixtures for different purposes can be prepared by mixing fertile red soil, well rotten FYM, vermicompost, leaf mold, oil cakes etc. in different proportions. The potting mixture may be prepared well in advance by adding sufficient quantity of super phosphate for better decomposition and

Q.3. How does topography affect the commercial nursery?

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2.5 STRUCTURES FOR NURSERY

2.5.1 Shade Houses

Shade houses are the houses constructed to provide shade to the nursery plants. Shade houses in nurseries in tropical and subtropical regions offer many advantages like direct raising of seedlings in bags, protecting the grafts from hot summer months, effective irrigation through upside down overhead micro sprinklers. The shade houses made with shade nets (25 % , 50% or 75%) for regulation of shade are particularly very useful in arid regions where the humidity is very low during summer months.

2.5.2 Greenhouse and Poly Houses

Greenhouse is a framed or inflated structure constructed using glass or plastic material in which growing environment is controlled suitably to raise the planting materials. Poly house is a structure made up of wooden or iron frame with plastic film (200 micron thickness) as roofing materials. Grafting and budding of various fruit species under poly houses or low cost green houses with natural ventilation will enhance the percentage of success and help in faster growth of grafts due to favorable micro climate conditions of poly house.

2.6 STANDARD ROOTSTOCKS

A rootstock is a plant raised for grafting and budding operations. Following are the advantages of rootstock :



2.7 LET US SUM UP

- The selected site for establishing a nursery should be located in an established nursery area. The selected site for nursery should preferably be near the highway or with good connectivity with a good motorable road.
- The soil for nursery should be light to medium in texture with good fertility and sufficient water holding capacity along with good drainage. A soil pH of 6.0 to 7.0 is most suitable for any nursery. Salinity in soil and irrigation water leads to salt injury resulting in nutritional deficiencies, marginal browning of leaves and in acute cases death of the plants especially in summer months. The topography of the land for nursery should be plain with about one per cent slope.
- Planning may be done in consultation with an experienced horticulturist or a nurseryman. Prior to the establishment of a nursery, a good fence with barbed wire must be erected all around the nursery to prevent damage by animals. A proper planning for roads and paths inside the nursery will not only add beauty, but also make the nursery operations easy and economical.
- Progeny block is the block of plants where true-to-type mother plants of superior varieties are maintained in the nursery according to the requirement.
- The nursery should have provision of sufficient quantity of irrigation water. There should be adequate provision of seed bed, poly bag nursery, workshed, pot nursery, office-cum-store etc. The office building in the nursery may be constructed at a place which offers better supervision of the nursery as well as facilities to receive customers
- Shade houses are the houses constructed to provide shade to the nursery plants. Greenhouse is a framed or inflated structure constructed using glass or plastic material in which the growing environment is controlled suitably to raise the planting materials. Poly

if planned and laid out properly which impresses the customers easily.

Ans. to Q. No. 4. The infrastructures required for a nursery consist of fence, roads, paths, wells, generators, pipelines, office cum store, shade house, green house/poly house and progeny block.

Ans. to Q. No. 5. Progeny block is the block of plants where true-to-type mother plants of superior varieties are maintained in the nursery according to the requirement.

Ans. to Q. No. 6. A well managed progeny block or mother plants block will not only create confidence among the customers but also reduces the cost of production and increases the success rate of grafting/budding/layering because of the availability of fresh scion material throughout the season within the nursery itself and there will not be any lag period between separations of scion and graftage.

Ans. to Q. No. 7. The grafts/layers/rooted cuttings/seedlings should be obtained preferably from the original breeder/research institute from where it is released or from a reputed nursery and these should be collected and maintained in the progeny block.

Ans. to Q. No. 8. Green house is a framed or inflated structure constructed using glass or plastic material in which growing environment is controlled suitably to raise the planting materials. Poly house is a structure made up of wooden or iron frame with plastic film (200 micron thickness) as roofing materials

Ans. to Q. No. 9. A standard rootstock is a plant raised for grafting and budding operations By utilizing the standard rootstocks, one can produce uniform planting material with uniform fruit qualities.

Ans. to Q. No. 10. The rootstock which will produce uniform and quality planting materials should be maintained in the nursery.

UNIT 3 : TOOLS AND IMPLEMENTS FOR NURSERY

UNIT STRUCTURE

3.1 Learning Objectives

3.2 Introduction

3.3 Types of Tools for different Nursery activities

- 3.3.1 Soil digging
- 3.3.2 Weeding and intercultural operation
- 3.3.3 Watering
- 3.3.4 Pruners
- 3.3.5 Sprayers and Dusters
- 3.3.6 Other Garden Tools and Implements

3.4 Pots and Pans

- 3.4.1 Earthen Pots
- 3.4.2 Seed Pans
- 3.4.3 Wooden Tubs and Other Containers

3.5 Seedling Trays

- 3.5.1 Protrays

3.6 Plant Supports and Tying Materials

- 3.6.1 Plant Supports
- 3.6.2 Tying Materials
- 3.6.3 Labels
- 3.6.4 Potting Misture

3.7 Let Us Sum Up

3.8 Answers to Check your Progress

3.9 Model Questions

3.1 LEARNING OBJECTIVES

After going through this unit, you will be to:

- Name the different tools and implements used in a nursery.
- Identify the different tools and implements used in a nursery.

Crow bar : It is an iron rod pointed at one end and the other end is wedge shaped. It is mainly used for making deep holes as well as for digging pits and also spanning operations.

3.3.3 Watering

Watering Can : Watering cans are made of galvanized iron sheet and their capacity varies from two to two and half gallons. Water cans are fitted with rose or spreader over the nozzle which is very useful for wide distribution of water. Now a days water cans made up of plastic and light in weight are available.

Syringe : This is usually 40-50 cm long, brass narrow cylinder fitted with a mouth having many pores. This is used for sprinkling water on the foliage plants.

Hosepipe : Hosepipes are required to draw water from the pipe lines. Usually, rubber or polythene hose pipes are used in nurseries. The hoses usually have smooth or corrugated outer surface having one or two rows of threads which are embedded in the rubber. Polythene pipes are light and easy to handle.

3.3.4 Pruners

Secateurs : It is a very useful handy tool for pruning of branches up to moderate thickness. Generally, it is used for preparing stem cuttings (hard wood, semi hardwood and herbaceous) needed for propagation.

Knives : Different types of knives are required in a nursery like budding knife, grafting knife, pruning knife, garden knife etc.

3.3.5 Plant Protection Implements

Numerous insects and diseases attack the nursery plants and may cause heavy damage. Proper care must be taken to control them in time. Effective insecticides and fungicides are now easily

Bucket or Stirrup sprayers : These are simple to use and the parts can be easily detached for quick and efficient cleaning. With the help of the long delivery hose, spraying can be done very conveniently.

Dusters : Among the hand rotary dusters, the "Orient" brand is the most recommended one. This is a well balanced duster to rest comfortably on shoulder and is very easy to operate and the hopper capacity is 5 kg.



CHECK YOUR PROGRESS

Q.1. Name a few important operations carried out in a nursery.

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Q.2. What are the tools that are used for soil digging?

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Q.3. For what operations is a Secateurs used?

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Q.4. What tool is generally used for sprinkling water on foliage plants?

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Q.5. What is a budding and grafting knife?

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Q.6. Name the tools used for spraying of materials in the nursery?

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or camouflaged with red colour by sounding. Pots made with clay soil and which are well baked last longer than those made with sand or loamy soils. Different sizes of pots are available depending on the use.

Four inches (10 cm) pots are suitable for small annual seedlings.

Six inches (15cm) for small palms, ferns, etc.

Eight inches (20 cm) pots are used for single specimen plants of annuals.

Ten inches (20 cm) pots are for big container plants and are also best for tall palms.

Fourteen to eighteen inch pots should be placed in semi-permanent position as they should not be moved frequently.

Plastic pots are also available which are durable and easy to handle. As the water does not evaporate from the sides, watering should be done carefully and very light compost should be used in such pots.

3.4.2 Seed Pans

The seed pans are shallow pots, used for raising seedlings and growing shallow rooted annuals and ferns. Boxes are often used for raising of seedlings. The size may vary from 25 to 40 cm in diameter.

3.4.3 Wooden Tubs and other Containers

Oil cans cut into half and charred inside to remove the oil are more long lasting than wooden tubs, unless these are prepared from seasoned teak wood. Pots made of cement are also useful for growing perennial plants in permanent or semi permanent positions.

3.6.2 Tying Materials

These vary from raffia and specially prepared garden twist to local twines of cotton, jute or hemp, coir, jute and nylon rope can be used to tie the large plants.

Galvanized wire should be carefully used as it is liable to cut the stem of plants and cause damage. Whatever the tying material used, it should be loosely tied to allow a little ply between the stake and the stem.

3.6.3 Labels

Labels are required to tag plots/varieties/plants or the rootstocks. Among the different types of labels, *viz*., paper, card board, wooden, celluloid, aluminium and plastic are common. The aluminium, plastic labels are preferred. Paper or card board labels are for temporary use. Wooden labels painted with white paints will last longer but are gradually becoming outdated. Aluminium labels will retain the writing clearly. Now a days plasticlabels are becoming very popular and are widely used in different forms and shapes.

3.6.4 Potting Mixture

A suitable potting mixture should possess crumb structure with well drained and rich with nutrients and free from toxic and harmful organisms. Generally loam pit and sand are the basic ingredients along with composts and leaf mould for mixtures. The ratio of mixture is decided by the method of propagation. For seedlings and cuttings a mixture of sand, loam and peat in the proportions of 2:1:1 and for potted plants and containers a mixture of sand, loam and peat in the proportions of 1:2:1 are recommended.



3.7 LET US SUM UP

- The activities done in the nursery include breaking of soil clods, weeding, planting and removal of nursery plants, manuring, watering and different plant protection operations. To carry out the operations different types of tools and implements are used. Kudal (Kur)is used for digging soil, braking soil clods, making beds etc. Garden fork is used for breaking soil clods and preparing nursery plants. Weeding fork loosens soil and takes out the weeds. Khurpi is widely used for various operations like weeding, earthing up, making small holes etc. Crow bar is mainly used for making deep holes as well as for digging pits.
- For watering the plants watering can, syringe and hose pipes are used. Water cans are made of galvanized iron sheet and the capacity varies from two to two and half gallons. Now a days plastic and light-weight cans are also available. Syringe is used for sprinkling water on the foliage plants.
- Secateurs is a very useful, handy tool for the pruning of branches up to moderate thickness and for preparing stem cuttings (hard wood, semi hardwood and herbaceous) which are needed for propagation. Budding and grafting knife is used for performing grafting and budding operations in the nursery.
- Hand sprayers, Knapsack sprayers and Bucket or Stirrup sprayers are used for the spraying of materials on the plants in the nursery. Among the hand rotary dusters, the “Orient” brand is the most recommended one.
- Garden rakes are useful for collecting stones and brick bats in a beaten out bed, scarifying the grass surface, gathering leaves together, etc. Wheel barrow is used for carrying materials like soil, manures, pots, etc. and for collecting nursery refuses. Shovel is often used to handle the manures, fertilizers, soil, sand and leaf molds, etc.

Ans. to Q. No. 8. Earthen pots, Seed pans and wooden tubs and other containers are pots and pans used.

Ans. to Q. No. 9. The portrays provide independent area for each seed to germinate, help in proper germination, eliminate the mortality rate., ensure uniform and healthy growth of the seedlings, help in optimum utilization of media, water and space. They are easy to transport and economical.

Ans. to Q. No. 10. Tying materials vary from raffia and specially prepared garden twist to local twines of cotton, jute or hemp. Ccoir, jute and nylon rope can be used to tie the large plants.

Ans. to Q. No. 11. a) Garden rake, b) Wheel barrow, c) Shovel, d) supporting



3.9 MODEL QUESTIONS

Q.1. Write briefly about the implements used for performing the following operations:

a) Weeding and intercultural operations

b) Spraying of chemicals

c) Irrigation of nursery plants

Q.2. Write briefly about the following:

a) Pots and pans

b) Tying materials

c) Plant support.

4.2 INTRODUCTION

In the previous units, we have discussed the planning and layout of a commercial nursery and various tools and implements which are used to carry out the different nursery operations. Multiplication is the main activity in a nursery as the objective of the nursery is to produce quality planting materials of various crops. Horticultural plants are propagated by different techniques. Therefore, for managing a commercial nursery, the nurseryman should be well acquainted with the proper method of multiplication for particular crops.

In this unit, we shall discuss the various techniques of propagation by which multiplication of the plants can be done successfully and scientifically.

4.3 DEFINITIONOF PROPAGATION

Plant propagation is the perpetuation or increase in number of plants. In simple words, it is the multiplication of plants.

Primarily, propagation or multiplication is done by two methods-Seed propagation or Sexual propagation and Vegetative propagation or Asexual propagation.

4.4 SEED PROPAGATION

Seed propagation is nothing but the multiplication of plants by using seeds. From the seeds, the seedlings will arise and these are transplanted in the main field. Certain fruits, almost all the vegetables and flowers are propagated by seeds.

It is the primary and easy method of multiplication for raising the seedlings. However, the seedlings are not uniform. Most of the seeds germinate immediately but some seeds having dormancy may germinate late. The viability of seeds is known in seed propagation. Pre-sowing treatments are necessary for enhancing germination.

Seed propagation is mainly employed for the production of healthy seedlings for planting in certain fruit crops like papaya, mango, acid lime, etc. But it is widely adopted for the raising of root-stock seedlings for budding or grafting purpose in many fruit crops.

In certain fruit crops, fresh seed is sown in the well prepared raised beds or polybags as they lose viability very soon (*e.*g., citrus, papaya, jack, jamun, *etc.*), while in certain fruit crops, the seeds are sown after the dormant period is over (*e.*g. sitaphal). Presoaking of certain seeds in GA_3 100-200 ppm solution results in rapid and increased germination. Seed treatment with fungicides like bavistin, captan or mancozeb protects seedlings against collar rot and damping off.

Seed Beds : Raised seed beds of about one meter wide and of any convenient length are to be prepared and drenched with copper oxychloride (0.3%) or captan 0.2% solution a day before sowing. This is done to kill the harmful microbes present in the soil. Sowing has to be done thinly in lines at 1-2 cm depth (depending on the seed size and rooting behaviour) and covered with soil. Irrigations are to be done with a fine rose till the seedlings are about 2-4 leaf stage.Then they should be transferred to poly bags or earthen or plastic bags of suitable size or to the secondary beds preferably in the evening times followed by watering.

Appropriate plant protection measures should be adopted by prophylactic sprays with suitable insecticides and fungicides. Good cultural practices like weeding, watering and control of pests and diseases will produce healthy and vigorous seedlings.

Procedure for Raising Seedlings : Vegetables and seasonal flowers are grown in the field by direct sowing or by transplanting the seedlings. Good planting material in the form of seeds or seedlings is one of the important factors that plays a vital role in successful horticultural production.

Most of the winter season vegetables and flowers are grown by transplanting of seedlings. Good quality seedlings are the

When the seedlings are 15-20 days old the shade is to be removed and the frequency of irrigation is gradually reduced to harden the seedlings. The seedlings are ready for transplanting when they are 30-40 days old or 10-15 cm in height or at 3-4 true-leaved stage. In order to ensure the proper establishment of the costly seedlings, transplanting at a 2-3cm plant to plant spacing is to be done in a second nursery bed when the seedlings are at 1-2 leaf stage. Providing shade in the secondary nursery bed for 4-5 days immediately after transplanting is a must.

Shade management : Shade management is very important for the hardening of the nursery plants prior to transplanting. Adjustment of shade for the hardening purpose usually commences 45 days prior to transplanting. The sequence of operation is usually as follows:

- 45 days to transplanting – reduce shade to 30%
- 20 days to transplanting – reduce shade to 15%
- 5 days to transplanting – reduce shade to 0%



CHECK YOUR PROGRESS

Q.1. What is seed viability?

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Q.2. Why is shade gradually removed before transplanting the seedling?

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Q.3. Name three chemicals that are used for seed treatment.

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4.5.1 Propagation by Cuttings

Propagation by cuttings is one of the most important practices in the nursery. A cutting is a part of a plant which will first produce roots and then eventually a new plant which is quite true to the parent plant. A cutting may be a piece of stem, a leaf or part of a leaf, a piece of root, or even a scale of a bulb. The success in the propagation by cuttings depends upon factors such as conditions of the mother plants, part of the tree from where the cuttings are made, time of the year, care at the time of planting and after care. Cuttings can be made during spring- summer (February to June) season when active cell division is taking place.

A) Root Cuttings : Propagation by means of root cutting is very simple and easy. It can be practised in many plants like guava, apple, pear, cherry, persimmon, rhododendron etc. In root cuttings, adventitious shoots are regenerated. Plants which produce suckers freely in nature can easily be propagated by root cuttings.

The adventitious shoots develop mostly at the proximal end of the root, that is, the portion nearest to the crown of the root generally forms shoots. Hence, it is essential to maintain correct polarity at planting. The proximal end of the root cutting should always be kept above the soil when vertical planting is done.

Root cuttings are generally taken in early or late winter or early spring when the roots have sufficient reserve carbohydrates.

B) Stem Cuttings

- **Herbaceous cuttings :** The herbaceous cuttings usually consist of the terminal leafy portion of stems of herbaceous plants like Dahlia, Chrysanthemum, Carnation, Sweet potato etc. In general 7.5 to 12.5 cm long terminal portions of moderately vigorous shoots are

two year old shoot is also used. It is a common practice to give the top cut 1 or 2 cm above a node and the basal cut slightly below a node. A number of fruit plants like grape, fig, mulberry, gooseberry, olive, pomegranate etc. are propagated by hard wood cuttings.

C) **Leaf cuttings :** Certain plants with thick and fleshy leaves can reproduce themselves from leaf cuttings. Adventitious roots and an adventitious shoot develop on the leaf cutting. Many ornamental plants like *Bryophyllum, Sansevieria, etc*. can be propagated by leaf cuttings.

In *Bryophyllum*, well developed leaves are placed flat on the rooting medium and partially covered with the rooting medium. New plants soon arise from foliar embryos in the notches of the leaf margin. In case of Sanserieria, 5 to 10 cm long leaf sections are planted at the propagating frames maintaining the polarity. Within a month a new plant develops at the base of the leaf cutting.

D) **Leaf bud cuttings :** A leaf bud cutting consists of a leaf blade, petiole and a small piece of stem containing a dormant vegetative bud at the leaf axils. Many species such as Camellia, Rhododendron, Blackberry etc. can be easily propagated by means of leaf bud cuttings. The leaf bud cutting with about 1.0-1.5 cm of stem portion bearing a leaf with the axillary bud is usually taken. The stem portion of the cutting can be treated with auxin for better rooting. New shoots will develop soon and the axillary bud will sprout and develop quickly to form a complete new plant.





weeks the roots are developed which are visible through the polythene covering. Then a half way cut should be given to the rooted layers on the parent branch at least 15 days prior to their permanent removal from the mother plant. At the time of separation, a few leaves or small shoots are retained. It is also advisable to plant these rooted layers in nursery for close attention rather than to plant them directly in field. These layers can be planted in the fields during the following year in February or September–October.



Fig. 4.3 : Air Layering

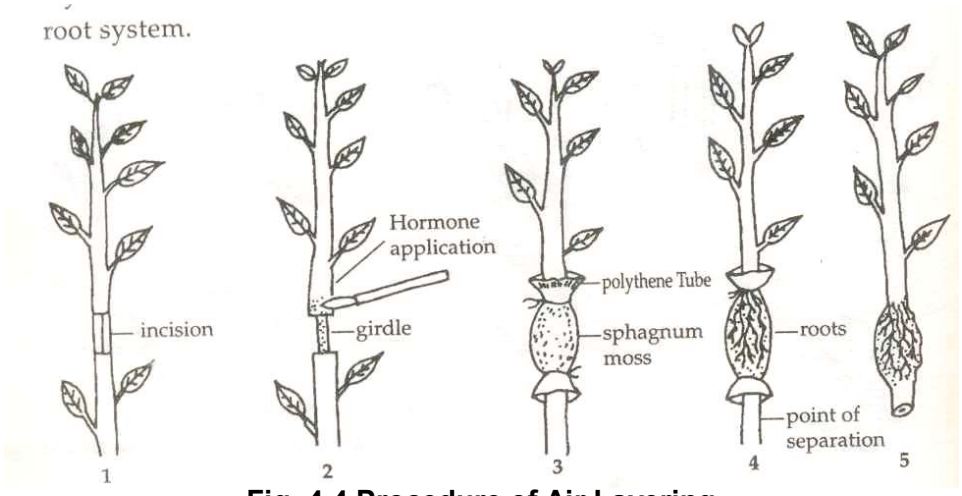
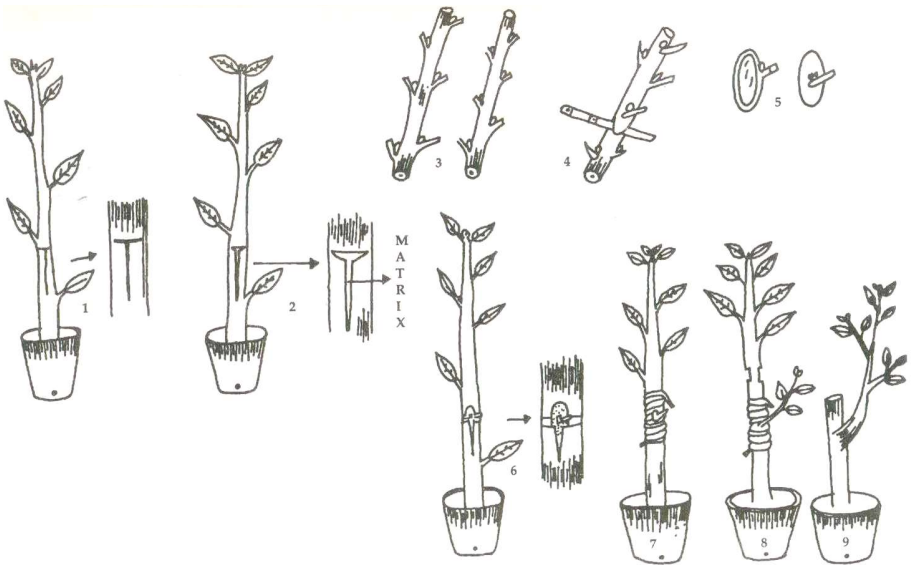


Fig. 4.4 Procedure of Air Layering

4.5.3 Propagation by Budding

The process of connecting a scion, which is a bud, with the rootstock in a manner that they may unite and grow successfully as one plant is called budding. The material involved is only one bud or a single cluster eye of buds. Most of the fruit crops are commercially propagated by this method. The rootstock for budding should be vigorous and ripened (basal bark brown) and pencil size to one inch thick.

There are different types of budding viz., Shield or "T" budding, Chip budding, Patch budding etc.asshown in the following illustrations.



1. T-Shaped incision made on the root stock
2. Flap of bark lifted on stock
3. Scion bud stick
4. Removal of Bud wood
5. Bud woods
6. Insertion of bud wood into matrix of stock
7. Bud joint bandaged
8. Scion bud sprouting
9. Growing budded plants

Fig. 4.6 : Procedure of Shield or 'T' Budding

4.5.4 Propagation by Grafting

Grafting is a technique of propagation in which the scion and the rootstock are connected in such a manner that they unite and subsequently grow and develop into a successful plant .The new plant is known as a graft.

The four basic requirements for successful grafting are:

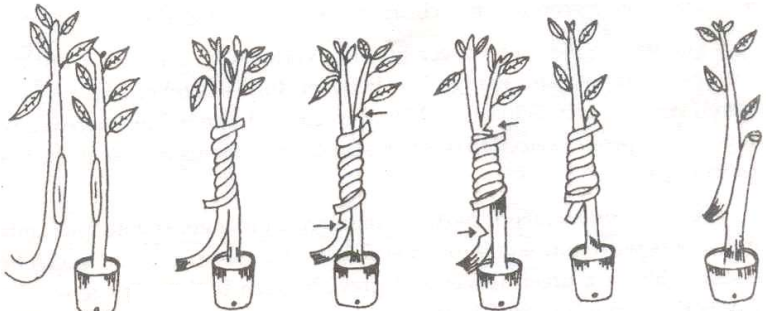
(i) Compatibility between stock and scion,

(ii) Age of the parts joined together,

(iii) Wounding to expose cambium or other meristematic tissues and

(iv) Anchorage of the parts.

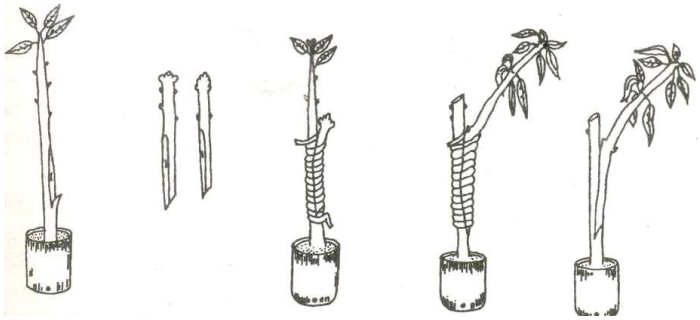
There are different types of grafting viz., Approach grafting, Veneer grafting, Epicotyle grafting, Soft wood grafting etc. The following illustrations will high light these different types of grafting.



(A) (B) (C) (D) (E) (F)

A. Operated scion and stock with uniform slice of bark removed, B. Scion shoot and rootstock tied together, C. Separation of graft making first cuts, D. Second cuts made, E. Separated graft, F. Bandage removed

Fig. 4.9 : Procedure of Approach Grafting (Inarching)



(A) (B) (C) (D) (E)

A. Prepared rootstock, B. Prepaird scion, C. Scion grafted on stock, D. Deheaded stock and sprouted scion, E. Graft bandage remnoved

Fig. 4.10 : Procedure of Veneer Grafting

Q.7. What type of plants can be propagated by root cuttings?

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Q.8. State true or false:

(i) Most of the fruit crops are propagated by cuttings.

(ii) Root cutting is generally taken in early or late summer.

(iii) Dahlia is propagated by herbaceous cuttings.

(iv) Alamanda is propagated by hard wood cuttings.

(v) Semi hardwood cuttings should be 7.5 – 15cm long.

(vi) Bryophyllum is propagated by leaf bud cuttings.

(vii) A leaf bud cutting consists of a leaf blade, petiole and a small piece of stem.

Q.9. What are different methods of layering?

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Q.10. What is the difference between budding and grafting?

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4.5.5 Propagation by Specialized Vegetative Structures

A) Bulbs : A bulb is a short, modified, underground stem surrounded by usually fleshy modified leaves that contain stored food for the shoot within. Most of the bulbous plants like tulip, daffodil, onion, bulbous iris, tuberose etc. as they reach maturity, produce buds in the axil of the scales. These buds continue to grow forming daughter bulbs. These daughter bulbs can be separated from the mother plants at the end of the growing season and used as propagating materials.

D) Corms : A corm is a solid underground base of a stem having nodes and internodes and is enclosed by dry scale like leaves. The gladiolus, crocus, freesia and water chestnut are examples of corm forming plants.



Fig. 4.17 : Corms

Bulbous Plants

The term bulbous refers to plants that include true bulbs but also the plants that grow from tubers,corms and rhizomes.These are the storage organs that enable bulbous plants to cope with growing conditions and long period of dormancy during which time there is often nothing or little of the plant that is visible on ground.

E) Runners : Runners are the specialized aerial stems arising in the leaf axils of plants having rosette crowns. New plants arise from the nodes at interval along these runners. From these runners, more new runners may arise, thus developing a natural clonal multiplication method. A typical runner producing plant is strawberry.



Fig. 4.18 : Runners

Table 4.1 : Propagation techniques of some horticultural crops

Sl. No.	Crops	Commercial propagation techniques
1	**Fruits**	
1.1	Banana	Sword sucker
1.2	Pineapple	Sucker, slip and crown
1.3	Mango	Veneer grafting
1.4	Papaya	Seed
1.5	Guava	Air layering
1.6	Litchi	Air layering
1.7	Assam lemon	Semi hard wood cutting
1.8	Khashi Mandrin	T-budding
1.9	Coconut	Nut
1.10	Arecanut	Nut
1.11	Cashewnut	Soft wood grafting
2	**Vegetables**	
2.1	Cabbage	Seed
2.2	Cauliflower	Seed
2.3	Knolkhol	Seed
2.4	Tomato	Seed
2.5	Brinjal	Seed
2.6	Carrot	Seed
2.7	Radish	Seed
2.8	Pointed gourd	Root cutting
2.9	Spine gourd	Tuber
2.10	Bottle gourd	Seed
2.11	Cucumber	Seed
2.12	Chilli	Seed
2.13	Capsicum	Seed
2.14	Ridge gourd	Seed
2.15	Beans	Seed
3	**Flowers**	
3.1	Marigold	Seed
3.2	Dahlia	Herbaceous cutting

Seed propagation is common for most of the vegetables, herbaceous ornamental annuals and ornamental trees.

- Seed propagation is mainly employed for the production of healthy seedlings for planting in certain fruit crops like papaya, mango, acid lime, etc. but it is widely adopted for raising of rootstock seedlings for budding or grafting purpose in many fruit crops. A root stock is a plant raised for performing grafting and budding operations, where scion is inserted from another plant/variety.
- Sowing is done thinly in lines at 1-2 cm depth in seed beds depending on the size of the seed. The seeds are treated with Captaf or Thirum or Brassicol @ 3g/kg of seeds before sowing.The beds are drenched with copper oxychloride (0.3%) or captan 0.2% solution a day before sowing. Irrigations are done till the seedlings are about 2-4 leaf stage and then transferred to polybags or earthen or plastic pots of suitable size preferably in the evening times and then watered. Vegetables and seasonal flowers are grown in the field by direct sowing or by the use of transplants. To protect the tender seedlings from heavy rain and scorching sunshine overhead shade is provided .When the seedlings are 15-20 days the shade is removed. The seedlings are ready for transplanting when they are 30-40 days old or 10-15 cm in height or at 3-4 true-leaved stage.
- In vegetative propagation, different parts of the plants and different methods are adopted for propagating plants. A cutting is a part of a plant which will produce roots and eventually, a new plant quite true to the parent plant. A cutting may be a piece of stem, a leaf or part of a leaf, a piece of root, or even a scale of a bulb. Propagation by cuttings is one of the most important practices in nursery.
- Root cutting is very simple and easy, and can be practiced in plants like guava, apple, pear, cherry, persimmon, rhododendron etc. and adventitious shoots are regenerated.
- Cuttings made from soft, succulent, non- lignified new growths of some woody plants are known as soft wood cuttings. Cuttings made from the past season's growth or wood that has become mature and

4.8 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1. Capacity of seeds to germinate under favourable condition is called the seed viability.

Ans. to Q. No. 2. For hardening the seedlings

Ans. to Q. No. 3. Bavistin, Captan and Mancozeb

Ans. to Q. No. 4. (a) True, (b) True, (c) False, (d) True**,** (e) True

Ans. to Q. No. 5. A cutting is a part of a plant which will produce roots and ,eventually, a new plant quite true to the parent plant.

Ans. to Q. No. 6. Condition of the mother plant, part of the tree from where the cuttings are made, time of the year, care to be taken while planting and after care.

Ans. to Q. No. 7. Guava, apple, pear, cherry, persimmon, rhododendron etc.

Ans. to Q. No. 8. (i) True, (ii) False, (iii) True, (iv) False, (v) True, (vi) False, (vii) True

Ans. to Q. No. 9. Air layering, Ground layering and Trench layering

Ans. to Q. No. 10. Budding is the process of connecting a bud (scion) and rootstock in a manner that they unite and grow successfully as one plant. Grafting is a technique of propagation in which scion and rootstock are connected to develop as a plant.

Ans. to Q. No. 11. Bulb, Corm, Suckers, Rhizomes, Runner, Offset

Ans. to Q. No. 12. Rhizome

Ans. to Q. No. 13. Tulip, daffodil, onion, bulbous iris, and tuberose

Ans. to Q. No. 14. (a) Seed propagation, (b) root stock, (c) Runners, (d) offset

4.9 FURTHER READINGS

- *Propagation of Tropical and Subtropical Horticultural Crops*. T. K. Bose, S. K. Mitra, M. K. Sadhu and P. Das.

UNIT 5 : PROPAGATION OF SOME IMPORTANT FLOWER CROPS

UNIT STRUCTURE

5.1 Learning Objectives

5.2 Introduction

5.3 Propagation of Chrysanthemum

- 5.3.1 Propagation by Seeds
- 5.3.2 Propagation by Suckers
- 5.3.3 Propagation by Terminal Cuttings

5.4 Propagation of Dahlia

- 5.4.1 Propagation by Seeds
- 5.4.2 Propagation by Division of Tubers
- 5.4.3 Propagation by Cuttings

5.5 Propagation of Bulbous Ornamental Plants by Corms and Bulbs

5.6 Propagation of Gladiolus

5.7 Propagation of Tuberose

5.8 Let Us Sum Up

5.9 Further Readings

5.10 Answers to Check Your Progress

5.11 Further Readings

5.12 Model Questions

5.1 LEARNING OBJECTIVES

After studying this unit, where propagation technique of four important flower crops is described,, you will be able to:

- State the importance of two important flower crops *viz.*, Chrysanthemum and Dahlia
- Name the different methods of propagation used for multiplication
- Explain the method of propagation
- Recognize the importance of commercial bulbous ornamental plants

The flowers occur in various forms and can be daisy-like, decorative, pompons or buttons. Chrysanthemum is a complex hybrid which is grown from seeds and segregates into many diverse flower forms.



Fig. 5.1 : Chrysanthemum flowers

Chrysanthemum can be propagated by three methods. These are:

(i) Propagation by seeds

(ii) Propagation by suckers and

(iii) Propagation by terminal cuttings.

5.3.1 Propagation by seeds

Seeds are used for propagation of annual and single type of chrysanthemum and also for the development of hybrid varieties.

5.3.2 Propagation by suckers

Suckers and terminal cuttings are used for propagation of large and decorative varieties and florist's chrysanthemum. Suckers are the side branches which arise from the underground portion of the stem and grow horizontally below the ground level up to some distance and then come out and produce green leaves at their tips. Cuttings are the pieces of the above ground portion of the stem.

5.4.1 Propagation by seeds

Dwarf bedding single dahlias is usually grown from seeds. Seeds are sown in October-November and in March-April in hills. Seedlings are transplanted in beds or pots after about a month of sowing. However, plants are not true to the type.

5.4.2 Propagation by division of tuber

The double decorative cactus, pompon and other types of dahlia are generally raised from tubers. When flowering is over, the mother plant is headed back 15-20 cm above the ground level. After 7 days of heading back, the tubers are lifted out and dried in partial shade for 3-4 days. Then tubers are treated with fungicide and insecticide and stored in some earthen pot or floor covered with sand. However, for commercial purposes, tubers are kept in cold storage at a temperature of 7-10°C.

For planting the tubers are brought out from the cold storage during July-August (±15 days). Tubers are divided before planting. Each tuber should have some portion of crown for the development of sprouts, eyes/buds.

5.4.3 Propagation by cuttings

After the tubers have sprouted and the young shoots have come out and attained a height of 10-15 cm, small terminal stem cuttings can be taken to raise new plants. Cuttings can be taken periodically from July to September.

The size of a cutting should be 8-10 cm long. The cuttings should be solid. The lower leaves are removed and a slanting cut is given at the base just below a node. Then, the cut ends are dipped into a rooting hormone like Seradox or Rootex and then planted in rooting media i.e., pure sand, sand, peat moss, vermiculite etc.



Fig. 5.3 : Gladiolus flowers

5.6 PROPAGATION OF GLADIOLUS

Gladiolus is propagated by corms and cormel**.** A corm is a swollen base of stem axis having distinct nodes and internodes enclosed by dry, scale-like leaves. In the mature corm, the dry leaf bases persist and enclose the corm. At the apex of the corm a growing point exists that will develop into leaves and flowering shoot.

Corms of 5-7 cm diameter are first dehusked and dipped in 0.2% solution of Bavistin for 5 minutes and dried under shade. The corms should be planted at a depth of 5-7 cm maintaining a distance of 20 cm from corm to corm and 40 cm from row to row. Cormels are planted at closer spacing after dipping them overnight in water.

In some cases, large corms are divided into small sections, each containing a bud and a portion of root zone. The sections should be treated with fungicide solution (Dithane M-45, 0.2 per cent) before planting.

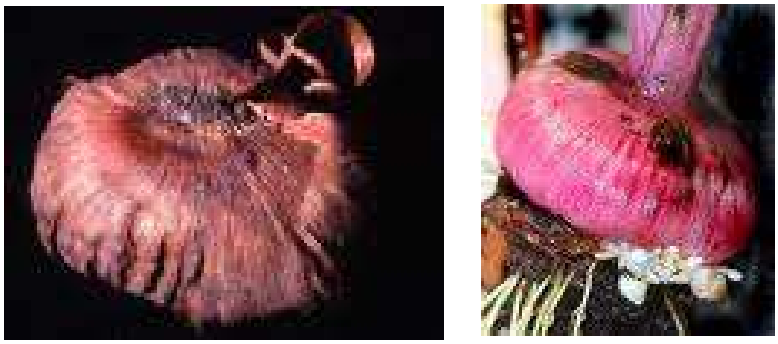


Fig. 5.4 : Gladiolus Corm

Q.6. What is a bulb? Give the examples of a crop propagated by bulb.

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Q.7. How is gladiolus propagated by corm?

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Q.8. How is tuberose propagated by bulb?

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Q.9. Fill in the blanks.

(a) _____ ornamental plants are those plants which produce bulbs or similar underground storage organs.

(b) A _____ is a swollen base of stem axis having distinct nodes and internodes enclosed by dry scale like leaves.

(c) _____ is propagated by corm.

(d) A _____ is a specialized underground organ consisting of a short, fleshy, usually vertical stem.

(e) _____ is propagated by bulbs and division of bulbs.



5.8 LET US SUM UP

- Chrysanthemum and Dahlias are valued for attractive flowers of various types and colours.
- There are mainly three methods of propagation of chrysanthemum *viz.,* by seeds, suckers and terminal cuttings. Seeds are used for the propagation of annual and single type of chrysanthemum and also for the development of hybrid varieties. Suckers and terminal cuttings are used for propagation of large and decorative varieties and florist's chrysanthemum.
- In Chrysanthemum, 5-7 cm terminal cuttings are detached from the mother plants with the help of a sharp blade. Root primordia appear

- Tuberose can also be multiplied by division of bulbs. Large bulbs are cut into 2-3 vertical sections, each 2 cm or more in diameter. Each section of bulb should contain a bud and a part of the basal plate, planted vertically in the soil after treating with fungicide.

5.9 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1. Chrysanthemum and Dahlias are valued for attractive flowers of various types and colours.

Ans. to Q. No. 2. There are mainly three methods of propagation of chrysanthemum *viz.,* by seeds, suckers and terminal cuttings.

Ans. to Q. No. 3. Dahlia is commonly propagated by seeds, division of tuber and cuttings.

Ans. to Q. No. 4. (i) 5-7 (ii) 36 (iii) 8-10 cm

Ans. to Q. No. 5. A corm is a swollen base of stem axis having distinct nodes and internodes enclosed by dry, scale-like leaves. In the mature corm, the dry leaf bases persist and enclose the corm. At the apex of the corm a growing point exists that will develop into leaves and flowering shoots. Example: Gladiolus.

Ans. to Q. No. 6. A bulb is a specialized underground organ consisting of a short, fleshy, usually vertical stem axis bearing as its apex a growing point or a flower primordium enclosed by stick fleshy scales. Examples: Tuberose.

Ans. to Q. No. 7. Gladiolus is propagated by corms and cormels. Corms of 5-7 cm diameter are first dehusked and dipped in 0.2% solution of Bavistin for 5 minutes and dried under shade. The corms should be planted at a depth of 5-7 cm maintaining a distance of 20 cm from corm to corm and 40 cm from row to row.

Ans. to Q. No. 8. Tuberose is propagated by bulbs and division of bulbs. The bulbs should preferably be spindle shaped. Large

UNIT 6 : PROPAGATION BY TUBERS, RHIZOMES AND THEIR DIVISIONS

UNIT STRUCTURE

6.1 Objectives

6.2 Introduction

6.3 Propagation by specialized organs/structures

- 6.3.1 Tuber
- 6.3.2 Rhizome
- 6.3.3 Suckers

6.4 Let Us Sum Up

6.5 Further Readings

6.6 Answers to Check your Progress

6.7 Model Questions

6.1 LEARNING OBJECTIVES

After reading this unit, you will be able to:

- Discuss the methods of propagation by specialized vegetative structures
- Describe the methods of production of planting materials by using tubers, rhizomes and suckers.

6.2 INTRODUCTION

In the previous unit, we have discussed how some flower crops and bulbous ornamental crops are propagated by different specialized vegetative structures/organs. There are some plants which are propagated asexually by using plant parts produced in the plants. For those plants it is very essential for the nurserymen to know the procedure of production of planting materials by using plant parts like tubers, rhizomes and suckers. The success of production of planting materials of such important horticultural crops largely depends on the knowledge of propagation.

Propagation of Banana and Pineapple :

- **Banana :** Banana is propagated by suckers .In banana ,two types of suckers are produced *viz.,* (i) sword suckers and (ii) water suckers.

  Sword suckers are the suckers which have the narrow leaves and the base of the pseudostem (the stem of banana is not a true stem which is formed by tightly packed leaf sheaths) is broad.

  Water suckers are the suckers which have the broad leaves and the pseudostem is cylindrical.

  For propagation, only sword suckers are used. Sword suckers 3-4 months old and 2-2.5kg weight are used for the propagation of banana. The sucker is cut at a height of 30 cm from the rhizome. The dry leaf sheaths on the pseudostem should be removed and the roots on the rhizomes should be cut before planting. Suckers should be treated with Furadon @ 40g per sucker to control the nematode infestation.



(A) (B) (C) (D)

(A) Sword sucker (B) Water sucker (C) Leaves of sword and water suckers (D) Sword sucker after preparation for planting

Fig. 6.1 : Suckers of Banana

- **Pineapple :** Pineapple is propagated by suckers to get early fruiting. It can also be propagated by slip or crown After harvesting the fruit, the suckers should be separated from

Q.8. Write briefly about the procedure of propagation of pineapple by suckers.

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Q.9. Fill in the blanks:

a) A _____ is a swollen, modified stem structure that functions as an underground storage organ.

b) A _____ is a specialized stem structure in which the main axis of the plant grows horizontally at or just below the ground surface.

c) Sword suckers are the suckers which have the _____ leaves.

d) Water suckers are the suckers which have the _____ leaves.

e) Suckers should be treated with _____ @ 40g per sucker to control the _____ infestation.

f) Pineapple is propagated by _____ to get early fruiting.



6.4 LET US SUM UP

- A tuber is a swollen, modified stem structure that functions as an underground storage organ Eyes or buds are present on the surface of the tubers. For propagation, either the whole tuber is planted individually or cut into sections each containing one or more buds or eyes and planted. Dahlia, Caladium etc are propagated from tuber.
- A rhizome is a specialized stem structure in which the main axis of the plant grows horizontally at or just below the ground surface. Rhizomes produce roots on its lower surface and extend shoots above the ground. Canna and Heliconia are propagated by rhizomes. The individual sections of rhizomes of Canna and Heliconia should be

and extends shoots above the ground. The stem appears segmented as it is composed of nodes and internodes.

Ans. to Q. No. 3. Cana, Heliconia

Ans. to Q. No. 4. Sword suckers are the suckers which have the narrow leaves and the base of the pseudostem is broad. Water suckers are the suckers which have the broad leaves and the pseudostem is cylindrical.

Ans. to Q. No. 5. For propagation of banana, only sword suckers are used.

Ans. to Q. No. 6. Sword suckers 3-4 months old and 2-2.5kg in weight should be used for propagation.

Ans. to Q. No. 7. Suckers should be treated with Furadon @ 40g per sucker to control the nematode infestation.

Ans. to Q. No. 8. After harvesting the fruit, the suckers are separated from the mother plants and the tip of the leaves is cut. After that, the suckers are dipped in Indofil M-45 solution of 0.2% for 10-15 minutes before planting as a preventive measure for heart rot disease.

Ans. to Q. No. 9. (a) tuber, b) rhizome, c) narrow, d) broad, e) Furadon, nematode, f) suckers .



6.8 MODEL QUESTIONS

Q.1. Give examples of crops which are propagated by tubers and rhizomes.

Q.2. How are banana and pineapple propagated?

Q.3. What are the treatments to be given to the planting materials of banana and pineapple?