Unit 2

Nursery Management

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Introduction

A nursery is a place where rooting of planting materials or germination of seeds can be obtained in a better way, under favourable growing conditions. In a nursery, seeds germinate effectively and seedlings give better stand in field. The period required for germination and establishment of seedlings can be easily utilised in a nursery and skipped in the preparation of land or harvest of previous crop in the field. This results in early growing of the crop. Flowering crops are mostly raised by seeds, cuttings, layer and grafting. In vegetatively propagated crops, root stocks are raised by seeds, or cutting. All these require care and can be grown well in a nursery under supervision.

A nursery may be established for a short term on a required site so that all planting requirements are at hand. This is called a 'temporary nursery', which is target-oriented for a particular project. Commercial nurseries are raised with a target of selling planting material with high profit margin. Such nurseries are individual establishments where quality planting material is prepared. A nursery requires almost all necessary farming inputs. An ideal nursery should have quality rooting media, skilled labour and specialised nursery structures. It involves preparation of land for

planting and its maintenance, fertility and productivity, maintenance of mother plants, requirement of various farming and specialised nursery tools, equipment and their maintenance, crop protection measures, etc.

Session 1: Nursery and its Importance

Importance of nursery

- Wastage of small and expensive hybrid seeds is reduced considerably due to better care and management.
- Germination percentage can be improved by providing ideal condition in a comparatively smaller place.
- The management of seedlings can be done in a better way with minimum care, cost and maintenance as the nursery area is small. Flowers with very small growth are difficult to grow without first raising the nursery.
- By selecting vigorous and healthy seedlings in the nursery for transplanting, better and uniform crop growth can be obtained in the main field through better survival chances.
- The duration of the crop is reduced in the main field by at least a month due to the raising of seedlings, which saves land and labour of the main field and also gives enough time for harvesting of the previous crop.
- The control of insect pests, diseases and weed is easy in a nursery.
- Nurseries offer great opportunities of employment to semi-skilled, skilled and unskilled human resources.

Types of nursery

Nurseries are classified on the basis of duration, plant produce and structure used.

On the basis of duration

Temporary nursery

This type of nursery is established for an ongoing project of landscaping, forest, hilly regions or in natural garden

in a particular season. It may also be called 'nursery on site'. As the name indicates, it exists for a short period or up to the completion of the targeted project. Temporary nursery fulfils the seasonal requirement of landscaping. Seedlings produced in a temporary nursery are according to target and utilised fully, and not for any type of sale. Seedlings are raised only for a season and as soon as the seedlings are transplanted, the role of nursery is over. Therefore, it is also called 'seasonal nursery'. There are several advantages with some underlying disadvantages of a temporary nursery. Initial investment in such a nursery is very low. It eliminates transportation, so first of all, the cost of transportation is reduced; secondly, transitional shock to the seedlings is negligible. Creation of extra infrastructure is not required. The prepared plants are according to the task and utilised completely. Wastage of seedlings due to mortality is minimum.

Permanent nursery

These nurseries are established with a view to supply planting material continuously wherever required. As the name indicates, it consists of a permanent infrastructure with availability of all required inputs. Permanent nursery may also be called 'commercial nursery', where quality planting material is produced for sale. The reputation of the nursery depends on the quality planting material produced. Permanent nursery comprises office, store, mother blocks, nursery beds, protected structures, irrigation source, electricity, transportation facilities, packing yard, manure, cattle and machinery shed. It has a record of sale and purchase, history and record of mother plants and record of produced planting material. It requires skilled workers, supervisors or managerial staff permanently. The tools and equipment required for cultivation and propagation of plants and chemicals that are necessary for raising and development of planting material is of prime importance. It is an individual enterprise and serves as a profitable source of income to the owner. Permanent nursery requires a planned outline and management. The initial capital requirement is high.

On the basis of type of plants produced

Ornamental nursery

Seedlings, root stock and scion material of ornamental plants is raised and conserved for further use. This nursery includes mother block of ornamentals, which serve for scion material in layer age, budding and grafting. Raised and flat beds of the nursery occupy seedlings of different annuals, perennials and root stocks of ornamentals. Separate block of nursery consists of vegetative and reproductive phase of bulb and tuber crops. Cuttings of different climbers and creepers are planted for rooting separately. Ornamental nursery also has many indoors and outdoor potted plants. Block of seedlings of cut flowers and loose flowers, seasonal, bonsai, climber and creepers are managed individually.

Vegetable nursery

In this nursery, planting materials, like seedlings of all vegetables, rooted cuttings (asparagus, sweet potato), seedlings raised from rhizomes (ginger) and tubers (potato), bulb (onion, garlic) for seed purposes are raised and conserved.

Fruit plant nursery

In this nursery, seedlings and cuttings of root stocks, budded plants, grafts, layers and cuttings of fruit trees are raised and conserved for further use. This nursery has mother block of different fruit crops used as scion material.

Forest nursery

Different species of trees and climbers planted in forests and used in social forestry are mostly propagated by seeds. Seedlings of big trees, like margosa, gulmohar, *amaltas*, *kanchan*, tamarind, *aonla*, prosofis, oak, eucalyptus, etc., are commonly found in a forest nursery.

On the basis of structure used in nursery

Open field nursery

These nurseries are established in open areas without any permanent structures. Usually raised, flat or

sunken seed beds are prepared. These are vulnerable to natural environmental conditions.

Hi-tech nursery

Such a nursery established under protected structures, can be successfully raised.

Thatched-roof

In this type of nursery, thatched roof is constructed over the nursery beds. This protects the seedlings from damage from extreme wind, rain, temperature or hot sun, etc. It is less costly but not very effective.

Shade-net

Such a nursery is raised under shade-net houses. To give different amount of shade based on the crop requirement, shade-nets of different colours and mesh size are used as covering material.

Poly-tunnel

The nursery is covered with plastic material to form a tunnel. It is a miniature structure, which produces greenhouse-like effect. Besides being not very expensive, it is easy to construct and dismantle. The seedlings are protected from cold, wind, storm, rain and frost. Due to modified conditions, there is better germination and plant growth.

Greenhouse/polyhouse

It is a frame covered structure with polyfilm or shade-nets so that plants can be grown under partially or completely modified environment. Such structures are provided with adequate ventilation and may have temperature and humidity controlling devices. Seedlings are raised inside the structure on raised beds, or in plug-tray, used for hardening of seedlings and tissue-cultured plants.

Nursery inputs

Plant Growth Regulators (PGRs)

It is a complex organic compound other than nutrients, which applied in minute quantities, is able to promote

or inhibit growth. The use of plant growth regulators is being enhanced to manipulate flowering, growth and yield of flowering plants.

Classes of Plant Growth Regulators

Some of the Plant Growth Regulators are as follows:

Auxins

In a plant, auxins are synthesised in the apical portion of stem and root. Auxins control growth through cell enlargement and influence developmental responses, such as apical dominance. Indole acetic acid (IAA), Indole butyric acid (IBA), Naphthalene acetic acid (NAA), 2,4-Dichlorophenoxyacetic acid (2,4-D) are some examples of auxin (Table 2.1).

Cytokinins

Cytokinins help in the transport of amino acids in plants. They promote cell division and senescence.

Gibberellins

They control cell division and elongation in plant shoots, for example, GA_3.

Ethylene

It is a gaseous hydrocarbon and known as a 'ripening hormone', for example, ethephon, ethrel.

Abscisic acid

It is, generally, considered as a 'growth inhibitor'. Because of its effects on growth inhibition or senescence, it is also involved in metabolic activities of plant viz., abscission of leaf, response to environmental stress and fruit ripening.

Application of PGR

Growth regulators are applied in very low concentrations, i.e., in parts per million (ppm). (one milligram in one litre of water gives 1 ppm solution).

Formulation of PGR

Growth regulators may be applied in powder form or paste form or as spray solution.

Table 2.1: Plant Growth Regulators application in flower crops

S. No.	Name of PGR	Crop	Concentration (ppm)	Mode of action
1.	Auxins (IAA or NAA)	• Dahlia • Orchids	>100 500	• Delays flowering • Promotes root growth
	IBA	• Balsam • Bougainvillea	5 1000–3000	• Increases shoot length • Induces rooting
	2,4-D	• Gulmohar	8000–12000	• Induces root initiation
2.	Cytokinin	• Orchids	500	• Enhances shoot growth
3.	GA3	• Antirrhinum • Chrysanthemum • Dahlia • Gladiolus • Petunia • Rose • Tuberose	25 100–400 100–150 100–200 500 100–400 100–200	• Induces early flowering • Increases plant height, internodal length and flower stalk length • Induces flowering and weight • Improves corm yield • Improves germination percentage • Improves stem length and quality • Improves bulb yield
4.	Etherel	• Gladiolus	1000	• Breaks corm dormancy
	Ethephon	• Carnation	600–800	• Promotes branching
5.	Benzyladenine	• Chrysanthemum	600–1000	• Breaks apical dominance
6.	B-Nine	• Geranium	1000–5000	• Increases adventitious roots
7.	MH	• Bougainvillea	1000–5000	• Encourages compact bushy growth
8.	TIBA	• Marigold	5–25	• Causes more branching

Practical Exercises

Activity

Visit a nursery

Material required: Pen, pencil, notebook, practical file, etc.

Procedure

1. Visit a nearby nursery and note down the following:
   - Type of nursery
   - Area of nursery
   - Site of nursery
   - Types of plant grown in nursery
   - Infrastructure of nursery — manpower, structures, tools and equipment, etc.
2. If any query, please discuss with the nursery owner.

Check your Progress

Fill in the Blanks

1. A place where seedlings or planting material is raised under controlled conditions is known as_____.
2. A type of nursery established for an ongoing project of landscaping is_____.
3. Temporary nursery is also known as _____ nursery.
4. Permanent nursery may also be called a _____ nursery.
5. Commercial nursery supplies _____ continuously, whenever required.

Multiple Choice Questions

1. Nursery raising _____overall period of the crop in the main field.
   (a) reduces (c) maximises
   (b) optimises (d) None of the above
2. Temporary nursery is _____.
   (a) for seasonal planting
   (b) nursery on site
   (c) for planting in forest and hilly regions
   (d) All of the above
3. Nursery established under protected structure is known as _____.
   (a) hi-tech nursery
   (b) technical nursery
   (c) low-cost nursery
   (d) All of the above
4. Cytokinins are hormones that help in _____.
   (a) cell division
   (c) cell elongation
   (b) ripening
   (d) cell enlargement
5. Complex organic compounds applied in minute quantity to promote or inhibit the growth of the plant are _____.
   (a) PGRs (c) organic fertiliser
   (b) micro-elements (d) macro-elements

Subjective Questions

1. Do you think nurseries are important?
2. What are the different kinds of nurseries? Describe the benefits of one of them.
3. Why are Plant Growth Regulators used?

Match the Columns

A	B
1. Auxins	(a) Ethephon
2. Cytokinins	(b) GA3
3. Gibberellins	(c) Kinetin
4. Ethylene	(d) NAA

SESSION 2: GROWING MEDIA AND NURSERY BED PREPARATION

Growing medium

The material in which plants grow in a pot is known as potting material and is commonly called the 'growing medium' or 'potting medium'. The selection of the type of potting material is important as the growth of plants completely depends on it. The main function of the growing medium is to supply nutrients, air and water to the roots of the growing plants. It supports the plant physically and holds it in an upright position and allows growth against the gravitational force. For the above two functions, it is necessary that the medium facilitates the growth of root within it. It is, therefore, desirable that an ideal growing medium is porous and allows aeration. It must have a good water-holding capacity so that frequent irrigation is not required. It should support and favour the growth of the plant and must be free from toxins, ailments and insect pests. The growing medium should respond well to the application of manures and fertilisers, as well as, pesticides. It should be light in weight, easily available and have a suitable pH level. The chemical composition, as well as, physical structure of the medium favours the growth of the plant.

Types of growing media

Different types of growing media are used for the propagation of plants.

Garden soil

Light and sandy soils are ideal growing media, while loamy, silt or clayey soils are not preferred due to poor aeration and stickiness. The soil contains both organic and inorganic matters. Soil is a common, universal, easily available and comparatively cheaper medium used in a nursery.

Sand

Large particle size makes this medium more porous, aerated and well-drained. The water-holding capacity of this medium decreases with an increase in the size of particle. The usual size of sand is 0.05–2.0 mm. Quartz sand is a useful growing medium but it lacks in nutrient content. It is relatively inexpensive and heavy. Generally, it is mixed with soil and used as a well-drained porous medium.

Compost

It is decomposed organic matter used with soil. Dropped leaves, twigs, grass clippings, cattle feed waste, and farm animal excreta are some of the common ingredients that are used for the preparation of compost. All these are allowed to decompose in a pit prepared at the farm. Compost contains major and minor nutrients that plants need for growth.

Fig. 2.1: Sphagnum moss

Sphagnum moss

It has excellent water-holding capacity and can hold water many times its weight. It is commonly used as rooting medium in air layering. It is comparatively costly and not available easily (Fig. 2.1).

Fig. 2.2: Peat

Peat

Peat consists of residues from a marsh swamp. It comprises some organic nitrogen. It helps in fast vegetative growth. It is commonly used for growing newly rooted cuttings or newly germinated seeds (Fig. 2.2).

Fig. 2.3: Coir peat

Coir peat

It is obtained from coir fibre dust. It is acidic in nature and has a pH of about 5.0. It has a high water retention capacity (Fig. 2.3).

Vermiculite

It is chemically hydrated magnesium aluminium iron silicate. It is produced by heat treatment of

mica. It is porous and light in weight. It has a good water-holding capacity (Fig. 2.4).

Fig. 2.4: Vermiculite

Perlite

It is a natural mineral of volcanic origin, which is light weight. The pH is usually neutral to slightly alkaline (Fig. 2.5).

Saw dust

These are the by-products of saw mills. It is easily available and cheap. It is poor in nutrient content but can be used after the addition of nitrogen (Fig. 2.6).

Fig. 2.5: Perlite

Fig. 2.6: Saw dust

Potting mixture

For potting of rooted cutting and young seedlings: 1 or 2 part sand + 1 part loamy soil + 1 part peat moss or leaf mould

For potting general container grown nursery stock: 2 part sand + 4 part loamy soil + 2 part peat moss or leaf mould + 1 part well rotted FYM

Nursery bed and its importance

A nursery bed is a well-prepared piece of land used for raising seedlings or rooting planting material. It acts as a temporary place for the development of young seedlings. Seedlings are transplanted at a definite stage of growth from nursery bed to the main field. Nursery bed is a small plot of 1-metre width where the seeds are sown closely width-wise.

There are several advantages of raising the seedlings in the nursery bed.

(i) Due to the small size of a plot, it becomes convenient to look after the germinated seeds and the coming seedlings.
(ii) Favourable conditions can be provided efficiently in a relatively small area.
(iii) Precautionary measures against diseases and pests can be undertaken easily.
(iv) Raised bed avoids water stagnation and provides aeration to roots, enabling their fast growth and better establishment of seedlings.
(v) Due to intense care, the percentage of seed germination improves.
(vi) Seed wastage due to washing away and wrong placement is checked.
(vii) The time period required for the preparation of seedlings in a nursery proves to be a bonus for the preparation of the field or late harvesting of the previous crop.

Site selection for nursery

Location

Ideally, a nursery, should be located in a pollution-free environment. It should be away from brick kilns, smoke emitting industries and heavy traffics. Non-concrete roads deposit a lot of dust on plants. It must be ensured that adequate sunlight is available in the nursery but the plants must be protected against severe heat.

Topography of land

The topography of land at the nursery site must be even to facilitate intercultural operations. If it is undulating, it must be levelled. In hilly areas, the land may be divided into levelled terraces.

Soil

It must be preferably loam or sandy loam with large quantity of organic matter. The pH of the soil needs to be slightly acidic to neutral and must not be alkaline or saline. The soil should have good drainage and proper water retention capacity. Aerated, porous, fertile and productive soils are preferable.

Water

Quality water in adequate quantity must be available at the site for irrigation. The nursery must be near to a natural source of water. The water should be free from harmful salts, toxins or salinity.

Drainage

The nursery site should be free from waterlogging. Water must not be allowed to stagnate for a long duration as it affects gaseous exchange and leads to poor development of roots. Proper drainage facilities must be provided at the site.

Transportation and marketing

The nursery site should be connected with approach roads or railway. It would be convenient to locate the nursery near a market. If the market is far, it will result in high transportation cost and the plants are likely to be damaged.

Labour

As nursery work is labour-intensive and requires skilled labour, the availability of skilled labour in the vicinity is important.

Protection from wind and animals

The nursery must be protected by a strong fencing to avoid grazing animals and thieves. Suitable plants are planted as windbreak in the south-west direction to avoid losses from strong wind.

Preparation of nursery bed

Nursery beds can be prepared in three ways.

Sunken beds

This type of nursery bed is prepared in dry and windy areas. As the name suggests, a sunk of 10–15 cm deep is prepared from the ground level. Sunk facilitates the deposition of irrigation water or rainwater for longer time. In areas facing water scarcity or shortage, this type of bed helps to conserve moisture. Sunken bed

provides protection to the seedlings during heavy winds (Fig. 2.7).

Flat beds

These are prepared on the surface of land to the field level. Bunds are created all round to stop the irrigation water inside. These are made in nursery for raising seedlings during summer and winter season. In rainy season, water may be stagnated and cause rotting of seedlings. Sandy loam or friable soils are preferred for the preparation of flat bed. Flat bed is one-metre-wide, and its length is according to the length of the slope. Water channels run in between providing irrigation water.

Preparation of flat bed

Mark an area for the preparation of a flat bed. The surface of the marked bed is dug off. Make it fine and loose. Manure, FYM or compost is incorporated according to the size of the bed. Some pesticide, like phorate 10D, is also added to avoid termites. Seeds after treatment with suitable fungicides, generally, thiram @3g/kg, are sown to check soil-borne infections.

Raised beds

In this type of a nursery bed, soil is raised to a height of 15–20 cm above the surface. Hence, it is called 'raised bed'. Layers of soil are placed over the surface of field so that it forms a bedding of soil. The raised height facilitates the drainage of water and provides aeration to the roots of developing seedlings. These beds are preferred during the rainy season to avoid water stagnation. Raised beds are also prepared in soil with poor drainage as height improves both aeration and drainage. Raised bed minimises the risk of damping-off and increases the chances of survival of seedlings during the rainy season.

Preparation of raised bed

The surface of the soil is dug out and brought to fine tilth. Then, the soil all around the bed is pulled over to raise the surface. This automatically creates a trench around the bed, which is later used for irrigating the

bed. Manure and fertilisers are added at this time. These beds are also enclosed with bunds. The width of the bed is one metre to facilitate intercultural operations. Raised beds are about 10–12 cm above the ground level and the length may vary according to the slope of soil. Spacing of 30–50 cm is kept between two rows of the bed to facilitate intercultural operations. Treated seeds are sown width-wise in rows or sometimes by broadcasting method. Initially, these beds are watered with sprinkling water or using a watering can, so that the seeds sown are not dispersed. Once the seedlings are well-rooted and reach the ground level, the bed can be irrigated through trenches of the bed attached.

Precautions to be taken during preparation of nursery beds

(i) Nursery beds are, generally, used to germinate the seeds sown or for rooting the cuttings planted in it. Besides nutrition, moisture and aeration are important factors that affect the growth of seedlings.

(ii) Nursery bed should be prepared in fertile soil rich in organic matter content with good drainage and aeration. Soil having more water retention capacity does not need frequent irrigation.

(iii) Excess of irrigation in sunken or flat bed may lead to rotting of seeds, seedlings and damping-off incidence. Watering of the bed depends on the type of soil. Sandy soils need frequent watering.

(iv) Soil-borne infections of nematodes, insects pests and pathogens may be avoided by treating the soil.

(v) Generally, the width should not be more than one metre and the length should be according to the slope of the soil so that when irrigated water reaches each corner of the bed, the whole bed gets irrigated.

(vi) Seedlings are tender and succulents and are prone to heat shock, so the beds should be prepared in the site receiving partial shade. In tropical and subtropical India, direct sunlight facing site should be avoided.

Application of manures and fertilisers

Manures

It releases nutrients gradually. When applied, manures are likely to fulfill the leached amount of nutrients from the soil over a period of time. Besides this, it improves soil texture, which improves drainage and aeration. It is, therefore, recommended to thoroughly mix rotten Farm Yard Manure (FYM) at the time of land preparation. During the preparation of nursery beds, the soil is thoroughly mixed with 5–10 kg of rotten FYM per square metre area.

Fertilisers

Basal application

Application of fertiliser at the time of nursery bed preparation and/or at sowing of seeds is called 'basal application' or 'basal dressing'. In this method, fertilisers are spread uniformly across the nursery bed and mixed with soil. This method is suitable for phosphatic and potassic fertilisers.

Top dressing

Broadcasting of fertilisers, particularly nitrogenous fertilisers, in readily available form to growing plants in standing crop is called 'top dressing'.

Foliar feeding

It is another method of fertiliser application to nursery crops, particularly for vegetable and flowering plants. Only nutrients, like nitrogen, or micronutrients can be applied through foliar application. If a crop suffers due to deficiency of micronutrients (Fe, Mn, Zn and Cu) deficiency symptoms appear on plants, it can be corrected by foliar feeding. It requires certain

precautions, like low concentration of nutrients and availability of sufficient foliage.

Protection of seedlings

Soil treatment

Soil or any planting medium used for nursery may be contaminated by pests. The presence of pests in the medium causes huge losses to the crop in a nursery or infection may be carried to the field through seedlings or adhering medium on the roots. It is, therefore, advocated that the medium used for the nursery must be free from infections or infestations. Different methods adopted for soil treatment are as follows:

Solarisation of soil

In this method, temperature of the soil or medium is raised so high (47° C and above) that infested or incubated pests get controlled or destroyed. It is a physical method that utilises the energy of the Sun to increase the temperature. It is, generally, followed in tropical and subtropical India, where the Sun is too hot during summers.

Procedure

First of all, dig out the soil at the site where the beds are to be prepared. Remove stones, pebbles and weeds. Crush the clods and bring it to fine tilth. Wet soil conducts heat better than dry soil, so irrigate the area thoroughly. Cover the site with a black polythene film of 200 gauge thick and make the covering airtight by covering the margins with compressed wet mud. This rases the temperature of the soil upto 47° C or above. Within 5–6 weeks, the soil is free from any infection or infestation. A nursery bed may be prepared at the treated site or soil may be used for filling pots or polybags.

Steam treatment

This method is followed in advanced countries and is not common in India. Hot steam is diffused in the soil to control soil-borne pests. The nursery bed is covered with a polythene sheet to make it airtight. Hot steam is supplied mechanically for at least 4–6 hours continuously to kill the pests.

Chemical treatment

Formalin

Commercial formaldehyde is available in liquid form. It is an effective fumigant, highly toxic to organisms of plant and animal origin. Sterilisation of the soil of nursery bed is carried out at a dilution of 0.25%. Beds of desired size are prepared and diluted solution of formalin is drenched at the rate 4–5 litres per sq m area. The solution percolates up to a depth of 15–20 cm. The poisonous fumes penetrate the soil and make it germ-free. The emitting fumes can be retained at the site for 48 hours by covering the treated area with a thick polythene sheet. Remove the cover after 48 hours of treatment. The bed is kept open for 7–8 days prior to seed sowing. Immense precaution is needed while application. Gloves, masks and goggles must be worn by an applicator to avoid direct contact with fumes.

Fungicides

In nurseries, soil-borne pathogens are responsible for diseases, like wilt, rots and damping-off. Inoculums in the soil may be eliminated by adding or drenching fungicides into the soil. Fungicides, like *captan* and *carbendazim*, can be applied to the soil by either method — dry application at the rate 5g per sq m or drenching 4–5 litre of 2.5–3% solution of fungicides to control soil-borne pathogens.

Insecticides

Larvae of many insect pests, inhabiting soil may be a severe problem to nursery plants. These pests can be checked by the application of insecticides in the soil.

Biological method (bio-agents)

Certain biological agents, like *Trichoderma spp.*, are found effective against wilt causing and rotting fungi present in the soil and *Pseudomonas* control fruit or stem rot. These bio-agents are used at the rate 10–25g/sq m and are mixed well in the soil while preparing the beds. Seeds should be sown 2–3 days after the application of bio-agents.

Seed treatment

Seed treatment with fungicides has been found to be effective against seed-borne, as well as, soil-borne pathogens. Fungicides, such as *bavistin* or *thiram*, are applied at the rate of 2.5–3 g/kg seed not only to prevent seed-borne infections but also to provide protection against soil-borne infections.

Practical Exercises

Activity 1

Demonstrate the preparation of a raised bed.

Material required: Measuring tape, spade, garden rack, watering can, seeds, etc.

Procedure

1. Measure the area of bed to be prepared and mark with the help of stake or lime.
2. Surface soil of the marked area is dug out and brought to fine tilth.
3. Weed and plant residues are collected with the help of garden rack.
4. Soil around the bed is pulled over to raise the height to 15–20 cm.
5. The width of the bed is one metre to facilitate intercultural operations.
6. Spacing of 30–50 cm is kept between two rows of the bed.
7. Treated seeds are sown width-wise in rows or broadcast.
8. Irrigate the bed with a rośe watering cane.

Activity 2

Demonstrate soil treatment by solarisation.

Material required: Spade, garden rack, polythene film of 200 guage, etc.

Procedure

1. First dig out the soil at the site where the beds are to be prepared.
2. Remove stones, pebbles and clumps of weeds.
3. Crush the clods and bring it to a fine tilth.

4. Irrigate the bed thoroughly.
5. Cover the bed with a 200 guage thick black polythene film.
6. Make the covering airtight by covering the margins with compressed wet mud.
7. This raises the temperature of the soil up to 47° C or above.
8. After 5–6 weeks, observe the weed population.

Check your Progress

Fill in the Blanks

1. In water scarcity or shortages, _____ bed helps to conserve moisture.
2. Level beds are commonly known as _____.
3. In raised bed preparation, the soil is raised upto a height of _____ cm.
4. Seed treatment prevents _____ and _____ infections.
5. Ideal soil types as growing media are _____ and _____.
6. Clayey soil is not a desirable medium due to _____ and _____.

Multiple Choice Questions

1. Micro-nutrients can be applied through _____.
   (a) deep placement
   (b) top dressing
   (c) foliar feeding
   (d) basal dressing
2. The usual size of sand is from _____.
   (a) 2.0 to 2.5 mm
   (b) 0.05 to 2.0 mm
   (c) 2.5 to 3.0 mm
   (d) 3.0 to 3.5 mm
3. Dilution of formalin applied for the sterilisation of soil in nursery is _____.
   (a) 0.25% (b) 2.50%
   (c) 25.0% (d) 0.025%
4. _____, a biological agent, is effective against soil-borne fungi.
   (a) *Fusarium spp.*
   (b) *Trichoderma spp.*
   (c) *Sclerotinia spp.*
   (d) *Trichogramma spp.*

Subjective Questions

1. What is a growing medium? List its types.
2. Why do you think nursery beds are required?
3. Describe the different methods of fertiliser application in a nursery.
4. What is soil solarisation?

Match the Columns

A	B
1. Organic matter	(a) Sphagnum moss
2. Micro-nutrient	(b) Compost
3. Good water-holding capacity	(c) Peat
4. Residue from marsh swamp	(d) Fe, Mn, Zn
5. Hydrated magnesium aluminum	(e) Soil solarisation
6. Volcanic origin	(f) Vermiculite
7. Control of soil-borne pests	(g) Perlite

SESSION 3: SEED SOWING AND PLANTING MATERIAL

Methods of seed sowing

Broadcasting

After the preparation of a nursery, spread the seeds on nursery beds and cover them with finely sieved rotten FYM or compost. This method has some disadvantages, as seeds cannot be placed at equal distance. This might require a large number of seeds in comparison to other methods of seed sowing.

Line sowing (shallow trenches on bed)

It is the best method of sowing seeds in a nursery. Sowing in lines improves germination and quality of seedlings. In this method, each seed gets independent space, and hence, grows healthy and vigorously. In this method, the diseased seedlings and weeds can be managed easily.

Procedure

On a levelled bed, shallow trench of certain depths are made with the help of a stick width-wise, with the

required spacing. This depends on the size of the seeds. Small seeds are sown at shallow depth and at low spacing between rows and vice-versa. Seeds are, generally, sown at a depth of 3–4 times of its diameter. They are placed singly at equidistant points in rows. Small seeds are mixed with sand for even distribution. The trenches are, then, covered with fine soil. The beds require light irrigation from sowing till transplanting by means of a sprinkler or a water can. Mulching of seed beds by polyethylene sheet, paddy straw, etc., helps in quick and uniform germination of seeds. Mulches should be removed immediately after the germination of seeds.

Fig. 2.7: Seed sowing in pro-trays

Seed sowing in plug trays

High value and hybrid seeds are preferred to be sown in plug trays (pro-trays) instead of open field nursery beds. Pro-trays are made of soft plastic having shallow plugs. These plugs are filled with planting medium. Coco peat, a by-product of the coir industry having a high water-holding capacity, is commonly used as a medium in pro-trays (Fig. 2.7).

Procedure

Small depressions (0.5 cm) are made at the centre of the plugs with fingertips for the sowing of seeds. The seeds are placed in the depressions and covered. Water is sprinkled by a water can to maintain moisture.

Rooting of cuttings

Many ornamental plants are commercially propagated by asexual means of reproduction. Planting of rooted stem cutting (*duranta*, croton, *acalefa*, etc.), leaves (*bryophyllum*) or roots (begonia) are important methods in most commercial ornamental crops. Some plants are propagated by grafting and budding, and root stocks needed for this are raised by planting the stem cutting. So, rooting of cuttings is another important method involved in vegetative propagation of

ornamental plants. Cuttings are planted on raised beds, flat beds or on the side of ridges, for rooting. For budding and grafting purpose, poly bags of requisite sizes are used for rooting of root stock. Cuttings treated with hormones induce fast rooting. Sand or sandy loam is supposed to be a good rooting medium due to adequate aeration and drainage.

Potting, depotting and repotting

Potting

It refers to the transferring of plants from seed bed or polyethelene bags to pots containing potting mixture. Potting of plants involves various steps.

(i) Selection of the pot
(ii) Filling the pot with potting mixture
(iii) Placing the plant
(iv) Watering and staking the plant
(v) Placement of the pot

Pots

Ornamental plants are grown in a variety of pots, depending on the choice and availability. Clay, cement, ceramic, plastic and other kinds of pots are used for growing house plants. However, clay pots are most popular, easily available, highly porous and cheaper. Selection of the appropriate size of pots is significant. The size of the plant and its growth habit are to be considered before selecting a pot. For specimen plant display, the pot size should be of at least 30 cm diameter.

Potting mixture

An effective potting mixture must be light in weight and have good water-holding capacity. It allows drainage and helps in supplying adequate nutrition to plants. It must be ensured that the mixture is free of insect pests and diseases. For ferns and bulbous plants, the medium needs to be highly porous, comprising coarse sand, light garden soil and leaf mould. Neem cake and bonemeal may also be used in small quantities as nutrients.

Procedure

(i) Filling of pot

Selection of a pot is made according to the size and growing habit of a plant to be potted. Drainage hole at the base is made to ensure the drainage of excess water. The drainage hole is covered with pieces of earthen tile so that the rooting medium does not flow out with water. Large crocks of 3–5 cm size should be placed at the bottom of the pot to avoid clogging of the drainage hole. A thick layer of coarse sand is placed over it, and finally, the remaining pot is filled with the potting mixture. The pot must have 2.5 cm space from the brim for holding water.

Fig. 2.8: A potted plant

(ii) Planting

A healthy rooted cutting or a plant with well-established root intake is carefully dug out from the nursery bed. It is, then, placed with the root ball of soil in the centre of the potting mixture. Fill the pot with the potting mixture all round the ball of soil. Press the mixture around the stem firmly and make it compact. Potting of deciduous house plants is done in February–March, whereas evergreen plants in July–August (Fig. 2.8).

Precautions

- Care must be taken that the root ball of plant is not pressed too hard as it will break and damage the roots.
- Water the plant gently with a sprinkler can, immediately after planting.
- Place the potted plant in a cool shady place for settlement.
- Stake the plant with a bamboo stick, if the stem is long or weak.

Depotting

It is the removal of a plant from a pot for planting on ground soil, bed or in another pot. As roots are sensitive and prone to injuries, care needs to be taken while depotting a plant. It is better to depot the plant along with the soil attached to the root system. This soil, if needed, can be removed carefully after depotting.

Fig. 2.9: A depotted plant

Procedure

The pot must be watered before depotting. The pot is lifted by one hand, the palm of the other hand spread over the top of the soil holding the stem between the second and third finger, and the thumb along the side of the pot. The pot is then turned upside down. If necessary, a gentle tap is given on the rim of the inverted pot against a solid base or on the edge of bench to loosen the earth ball. The whole earth ball, with intertwining roots of the plant, will come out as a single piece and kept outside carefully. Before transferring the plant in a new pot, the lower old and finer roots along with some old potting mixture are removed (Fig. 2.9).

Repotting

It is transferring or transplanting a plant from one pot to another. It is the planting of a depotted plant into another pot. Repotting is done with the following objectives:

(i) Changing the existing small old pot or exhausted potting mixture to a new one.

(ii) For healthier growth of house plants, repotting and transplanting of established plants is done once in a year.

(iii) Repotting facilitates pruning of overgrown roots, which in turn ensures better survival of the plant.

(iv) Bigger size of the pot provides a larger space for root development.

Fig. 2.10: Plant ready for repotting

Procedure

Depending upon the plant type, repotting is done in February–March or just before the onset of monsoon. Cut the decayed, dead, dried or twisted roots neatly with sharp secateurs (see Fig. 3.6). The excess and old soil is gently removed from all round. The pot is filled with fresh potting mixture, and then, watering is done. Place the plant in a new pot at the same depth in the soil at which it was in the old pot.

Nursery plants: Care and maintenance

Plant handling

Nursery plants need care and maintenance when raised from root stock or by tissue culture technique. It is important to provide nursery plants with suitable conditions to ensure their growth and development. The following activities have been executed for the production of good quality planting material.

Shading

To protect the young plant in the nursery from intense heat and heavy rains, shade-nets or polythene nets are used.

Thinning

It is a way of regulating plant population in rows and lines. During this operation, unhealthy, weak, diseased and damaged plants are pulled out to allow healthy plants to grow. It is normally performed when seedlings form few true leaves. It allows sunlight and air to reach each and every plant.

Watering

The nursery bed must be irrigated with the help of a water can. After the plants are well-established, watering should be done as per the requirement of the plants.

Weeding

Weeds compete for nutrients and soil water, which results in poor quality seedling growth. They also

prevent air circulation and may harbour insects and disease-carrying organisms, and hence, nursery beds should be free from weeds. Hand weeding or hand hoeing is the most common practice to remove weeds on emergence. Pre-emergence herbicides can also be sprayed on the nursery beds as basal dressing soon after seed sowing to control weeds.

Hardening of plants in nursery

Hardening of seedlings is nothing but withholding of water to nursery beds for few days before removing them for transplanting. Hardening of seedlings is necessary to prepare them for withstanding transplanting shock. It is also practised in situations where preparation of land is delayed and the seedlings become over-sized.

Table 2.2: Common insect pests and diseases in a nursery

Diseases and pests	Characteristics and symptoms	Control
Damping-off	Rotting of seedlings at collar portion and collapse at later stage	Soil sterilisation with formalin 2%, Copper oxychloride 2g/l drench, or *Carbendazim* 2g/l
Leaf spot	Small to big black or brown-coloured spots on leaves	Spraying of mancozeb 3g/l
Leaf miner	Leaf mining insect that produces serpentine (snake-like) white shining lines on leaves	*Triazophos* 0.25 ml/l
Aphids	Small green, brown or black sap sucking insects, which secrete honey dew that attracts ants and sooty mould	*Dimethoate* 2 ml/l Neem oil 2–4 ml/l
Thrips	Tiny black or yellow-coloured sap sucking insects, which infest young portions of plants and flowers	*Spinosad* 0.2 ml/l *Dimethoate* 2 ml/l Neem oil 2–4 ml/l

Practical Exercises

Activity 1

Demonstrate potting of a plant.

Material required: Pot, potting mixture, crocks, plant, root shear, etc.

Procedure

Filling of pot

1. Select a suitable pot considering the plant to be potted.
2. Drainage hole is covered with pieces of earthen tile.
3. A thick layer of coarse sand is placed over it.
4. The remaining portion of the pot is filled with a potting mixture.
5. The pot should have 2.5 cm space from the brim for holding water.

Planting

1. A healthy rooted cutting or a plant with well-established roots is carefully dug out from a nursery bed.
2. The plant is placed with the root ball of soil in the centre of the potting mixture.
3. Fill the pot with the potting mixture all round the ball of the soil.
4. Press the mixture around the stem firmly and make it compact.
5. Irrigate the pot immediately after planting.

Activity 2

Demonstrate depotting of a plant.

Material required: Potted plant, root shear, etc.

Procedure

1. Before depotting, the plant must be watered in excess and water is allowed to settle down.
2. Without damaging, carefully remove the plant from the pot.
3. The ball of the root with soil around it comes out of the pot.
4. The plant slipped off is held in the hand, and then, it is made upright.
5. Excess soil is removed without injuring the root system, and then, used for further planting.

Check your Progress

Fill in the Blanks

1. The best method of sowing seed in a nursery is _____.
2. High value annual seeds are preferred to be sown in _____.
3. An ideal potting medium should have good _____capacity.
4. A common and serious disease of a seedling at the nursery stage is known as_____.
5. Rooted stem or roots cutting commercially are an important method of _____.
6. Transferring a plant from one pot to another is termed as _____.

Multiple Choice Questions

1. Seeds are, generally, sown at a depth of 3–4 times of its _____.
   (a) radius (b) diameter
   (c) length (d) width
2. Potting mixture should _____.
   (a) supply adequate nutrition
   (b) have good drainage
   (c) have good water-holding capacity
   (d) All of the above
3. Damping-off is, generally, favoured by _____.
   (a) high sunlight
   (b) high temperature
   (c) low temperature
   (d) high humidity
4. Transplanting from one pot to another is termed as _____.
   (a) depotting (b) potting
   (c) repotting (d) transplanting

Subjective Questions

1. What are the different methods of seed sowing?
2. How are seeds sown in plug trays?
3. What is potting? Demonstrate the method of potting.
4. Explain the hardening of plants in a nursery.
5. Describe the common nursery insect pests and diseases. How can they be controlled?

Match the Columns

A	B
1. Nursery insect pests	(a) Thinning
2. Seed treatment	(b) Acalefa
3. Regulating plant population	(c) Thrip
4. Stem cutting	(d) Damping-off