

Introduction

Basics in plants and types

By

Dr. A.Sujatha

Department of Botany

M.V.R College (UG & PG Courses)

Gajuwaka, Visakhapatnam

Importance of plants



Why are plants important?

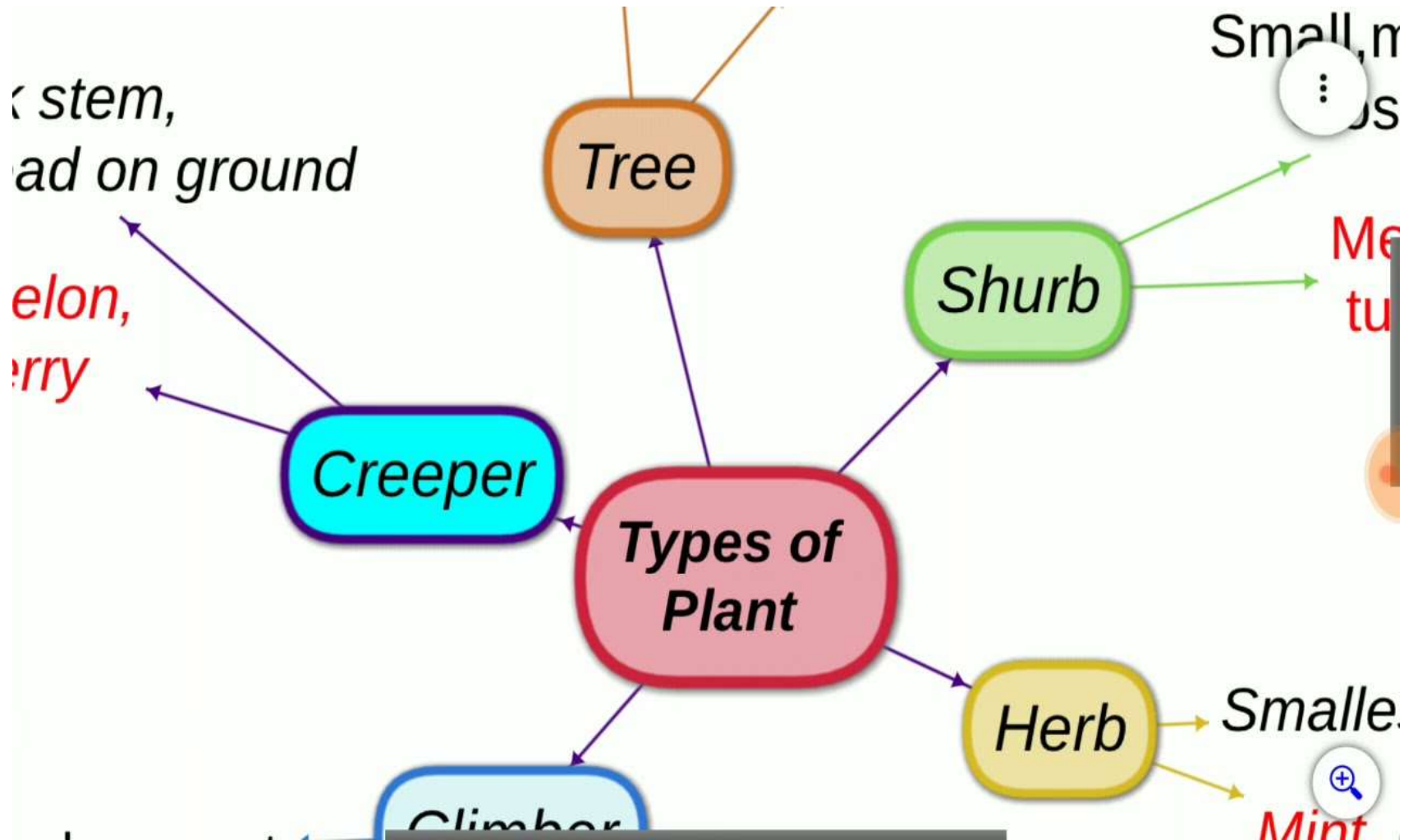
The Importance of Plants

Why are plants important?

- Plants provide oxygen
- Plants provide food
- Plants are used in medicines
- Plants give us building materials
- Plants are used in our clothing
- Plants provide fuel
- Plants provide us with beauty and pleasure



Types of plants



Plant classification

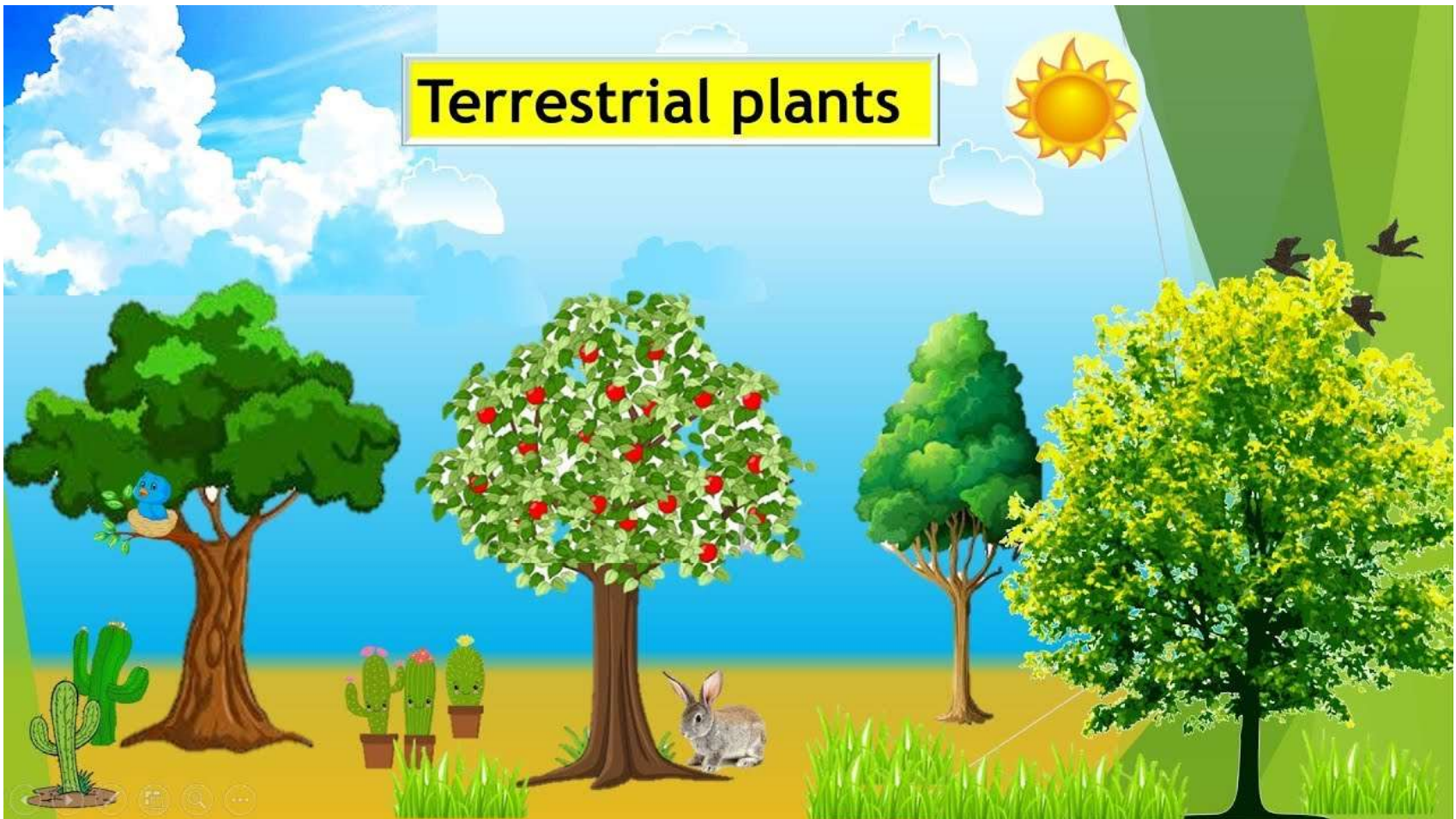
- Based on:
 - I. The environment where they live.
 - II. How the plants live?
 - III. Their life cycle.

Plant types

I .The environment where they live.

1. A **terrestrial plant** is a **plant** that grows on land.
2. An **aquatic plant** (living in water)
3. An **Epiphytic plant** (living on trees)
4. **Lithophytic** (living in or on rocks).

Terrestrial plants



Aquatic plants



Epiphyte

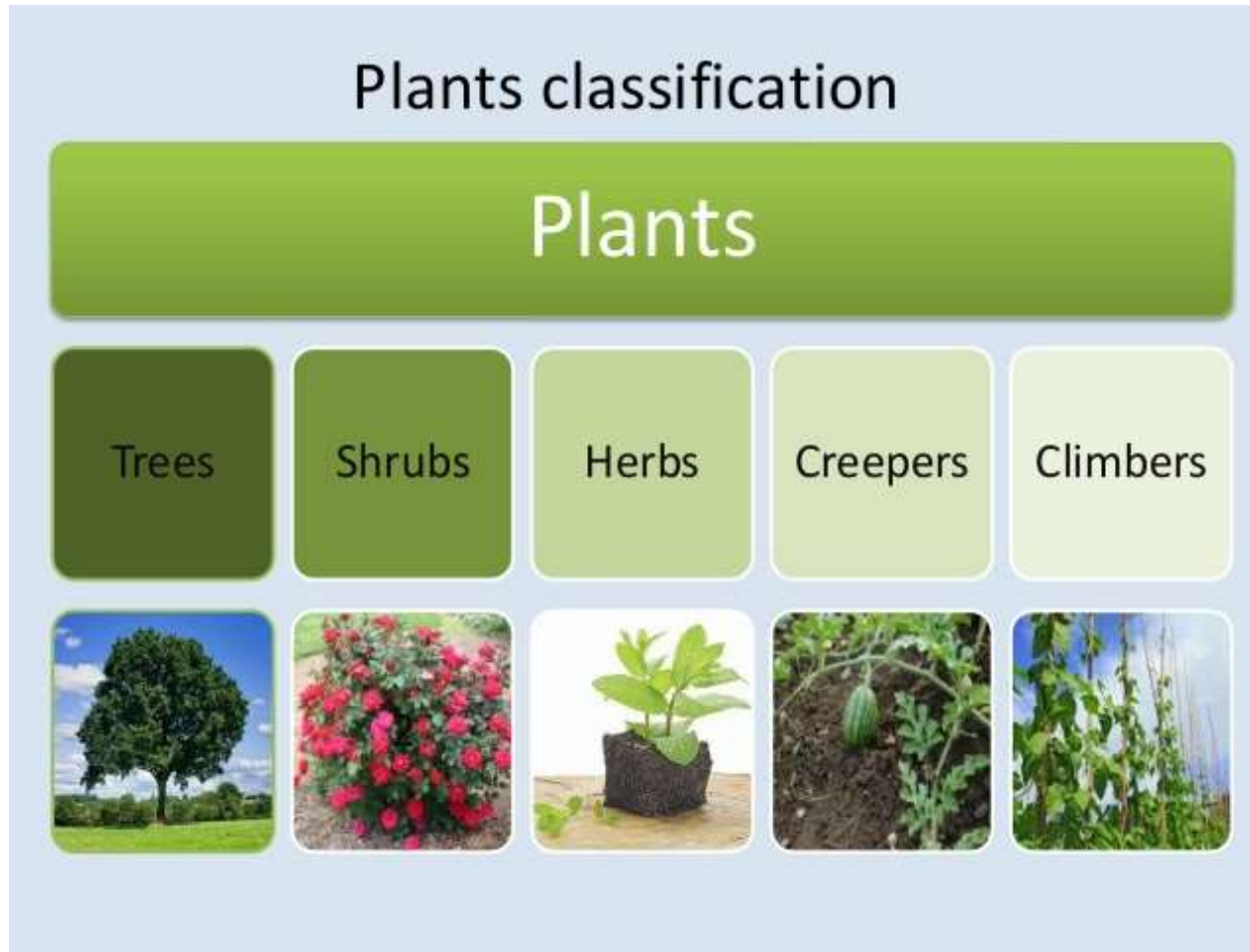


Lithophytes



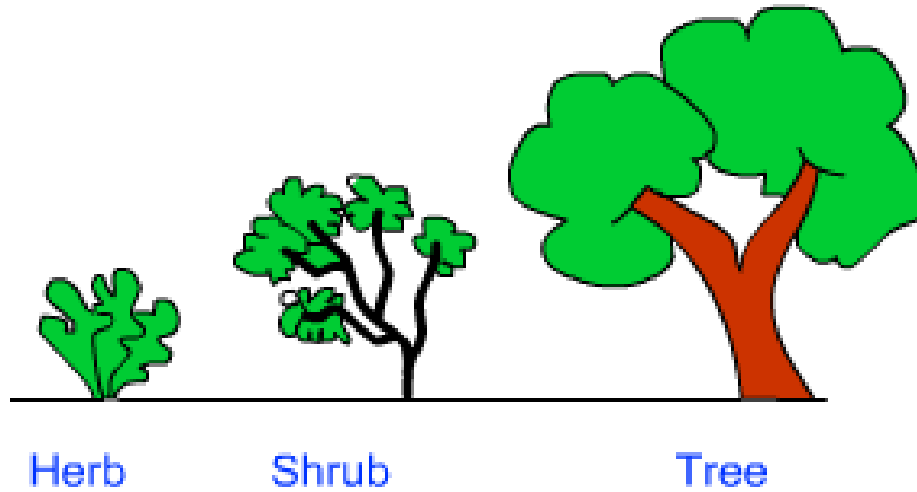
Plant types

II. How plants live?



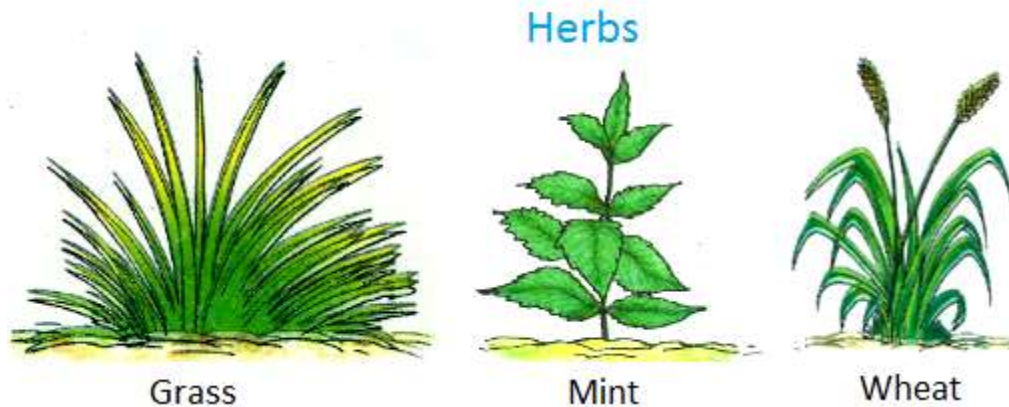
Based on the growth habit, plants are broadly categorised into five groups. Herbs, Shrubs, Trees, Climbers and Creepers.

Plant types



Herbs

- The herb is a short-sized plant with soft, green, delicate stem without the woody tissues.
- **Tomato, wheat, paddy, grass and bananas.**



Herbs



Tomato



Wheat and paddy



Bananas



Shrubs

- Shrubs are medium-sized, woody plants taller than herbs and shorter than a tree.
- Their height usually ranges between 6m to 10m tall.
- **Rose, Jasmine, Lemon, Tulsi, Henna**

Shrubs



Rose



Tulsi

Shrubs

Rose and Jasmine



Shrubs



Orange and Lemon

Trees

- Trees are big and tall plants.
- They have very thick, woody and hard stems called the trunk.
- This single main stem or the trunk gives rise to many branches that bear leaves, flowers and fruits.
- The life-span of the trees are very large. i.e., for several years.
- **Banyan, Mango, Neem, Cashew, Teak, Oak**

Trees

Trees.



poplar



Oak tree



Apple tree



Orange
tree



Mango



Neem

Creepers

- Creepers, as the name suggests, are plants that creep on the ground.
- They have very fragile, long, thin stems that can neither stand erect nor support all its weight.
- Watermelon, Strawberry, Pumpkin, Sweet potatoes.



Creepers

Pumpkin, Watermelon and strawberry



Climbers

Climbers are much more advanced than creepers.

Climbers have a very thin, long and weak stem which cannot stand upright, but they can use external support to grow vertically and carry their weight.

Pea plant, Grapevine, Sweet gourd, Money plant, etc.



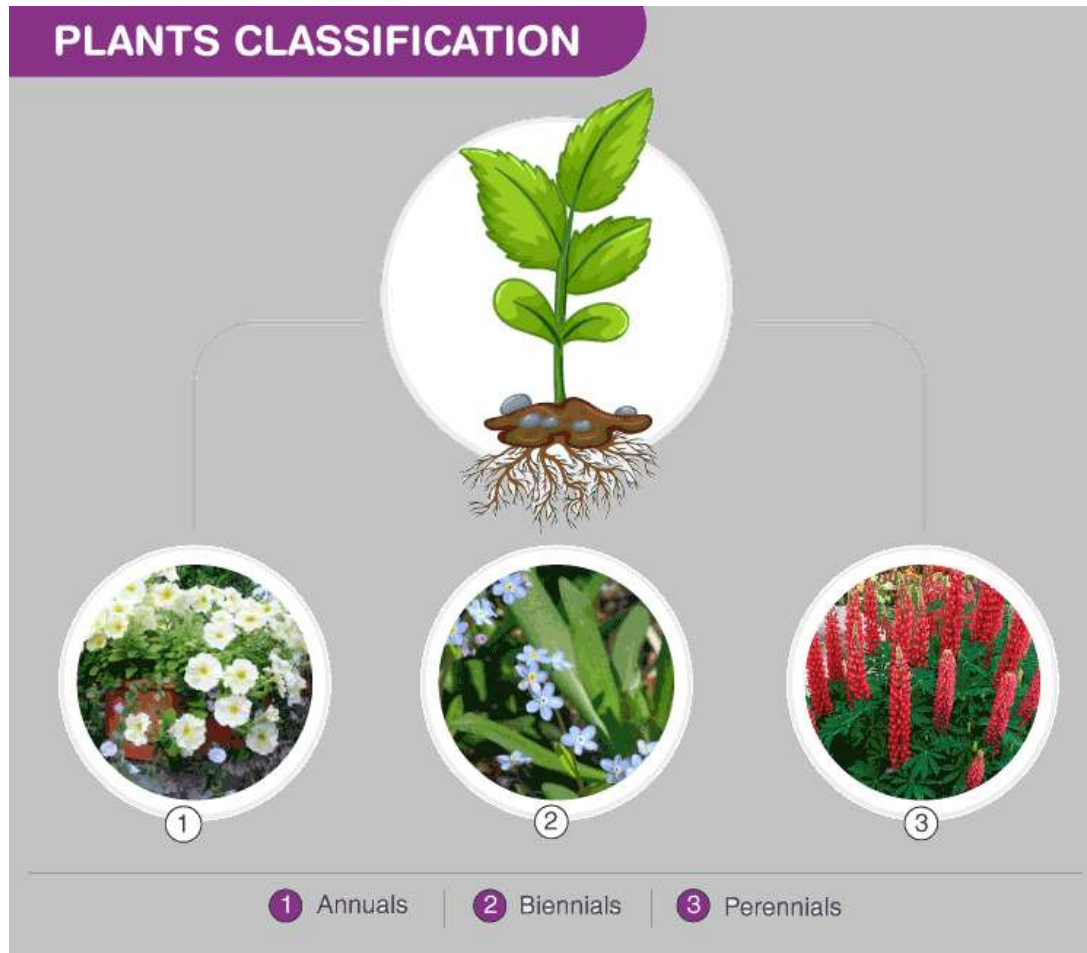
Climbers

Pea plant, Grape vine, Money plant



Plant classification

Based on their life span



Classification based on life cycle



Classification of Plants by Lifecycle

Classification of Plants by Lifecycle

- | | |
|-------------|--|
| Annuals: | Complete their lifecycle in one year. |
| Biennials: | Complete their lifecycle in more than one year, but less than two. |
| Perennials: | Complete lifecycle in more than two years. |

Annuals



Classification of Plants by Lifecycle

Annuals

- Plants which complete their lifecycle in one year.
- Some examples of annuals are:
 - Corn
 - Wheat
 - Annual flowers

Biennials

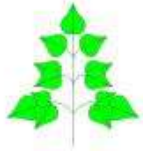


Classification of Plants by Lifecycle

Biennials

- Plants which complete their lifecycle in more than one year, but less than two.
- Energy is stored by the plant during its first year and used during the reproductive stage in the second year.
- Some examples of biennials are:
 - Celery --Parsnip --Parsley
 - Asparagus --Sugar beets

Perennials



Classification of Plants by Lifecycle

Perennials

- Plants which grow for more than two years.
- The plant continues to develop during and after the reproductive phase.
- Some examples of perennials are:
 - Bermuda grass
 - All shrubs
 - All trees

Annuals

- Annuals are plants that complete their life cycle in one year.
- They germinate, grow, bear fruits and die off within an year.
- Generally, all herbs and plants belonging to the grass family exhibit this type of life cycle.
- Mustard, watermelon, corn, lettuce, wheat, rice are a few examples of annual plants.

Biennials

- Biennials are plants that complete their life cycle in two years.
- They germinate, develop a root system, stem and leaves in the first year.
- Later in their second year, they yield flowers and bear fruit.
- A few herbs are also classified as biennials, including spinach, carrot, cabbage, petunias, radish, onions, etc.

Perennials

- Perennials are plants which complete their life cycle in more than two years.
- Once they grow, they start to bear flowers, produce fruits, seeds and the cycle continues for a longer period of time.
- They do not die after bearing fruits but renew their parts, season after season.
- Along with a few shrubs, trees are all classified into perennials.
- For Eg., tomatoes, ginger, banana, mango, coconut, palm, banyan, etc

A close-up photograph of a dense field of green clover leaves. The leaves are vibrant green and covered with numerous small, clear water droplets, suggesting a recent rain or dew. The background is dark, making the green leaves stand out. A semi-transparent black horizontal band runs across the middle of the image, containing the text "THANK YOU" in white, bold, sans-serif capital letters.

THANK YOU

SKILL DEVELOPMENT COURSE

PLANT NURSERY



Dr.A.Sujatha, Department of Botany, M.V.R college, Gajuwaka,
Visakhapatnam



UNIT-1: INTRODUCTION TO PLANT NURSERY

Lesson 5 : BIS - 2008 related to plant nursery



CONTENTS

- 1. Introduction**
- 2. General quality standards for nursery plants.**
- 3. Provisions mentioned in BIS specific to nursery.**
- 4. Present status of adoption of nursery act by different states in India**
- 5. Quality propagules production:**
 - What are propagules?
 - Steps to produce quality propagules.
 - The criteria which assures quality of propagules
- 6. Good Practices :**
 - Fruit/Pod/Seed Collection
 - Seed Extraction from fruits
 - Seed Storage



OBJECTIVES OF THE LESSON

1. To understand general quality standards for nursery plants.
2. To know the provisions mentioned in BIS specific to nursery and the present status of adoption of nursery act by different states in India.
3. To understand production of good quality propagules and good practices



INTRODUCTION

1. Different systems and standards of nursery are available for controlling the quality measures.
2. Since plant nursery is a highly localized occupation and the cultural practices varies from region to region.
3. The nursery produced plants are marketed to different parts with in the country and some times outside the country.
4. It is, therefore, necessary to define and assign certain common minimum standards to facilitate trade in these products and to win the confidence of the consumers within the country and outside.
5. This draft Indian Standard (Part 1) (**Doc: FAD 22 (1949) C**) is first in a series of **Indian Standards on Good Agricultural Practices (GAP)** to be developed.



NURSERY PLANTS



1. **The shoot and root development of nursery plant** should be in proper ratio.
2. **Color of leaf, morphology of leaf** should be in proper standard in accordance to variety and species.
3. Nursery plants should have a **vigorous (strong and healthy) growth**.
4. The nursery plants should be **free from weeds and disease and pest** .
5. **The graft union** should be healthy and the size of scion and rootstock should be equal.
6. **After shifting and transporting, seedling** should not show



PROVISIONS MENTIONED IN BIS SPECIFIC TO PLANT NURSERY.



TABLE: PROVISIONS IN BIS SPECIFIC TO PLANT

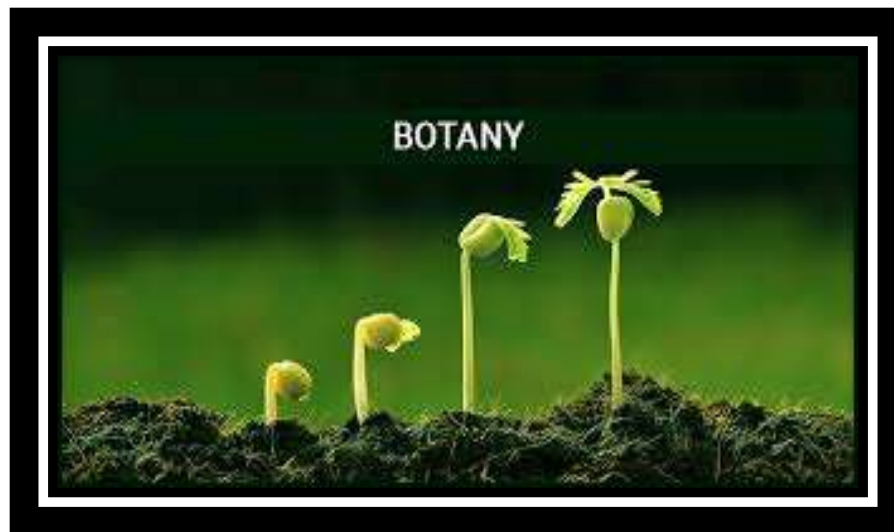
Item	Level	India GAP requirements-related to plant nursery	Compliance (following a rule) criteria
1. Propagation	Minor	a) Has the recommended technology in plant nursery followed, in raising seedlings in the open or protected conditions? b) Is the source of technology documented?	a) Verify for quality control systems. b) Documentation should be maintained to verify the claim
2. Nursery protection	Minor	a) Are the preventive measures against pests and diseases taken? b) Are crop protection treatments applied in the nursery? c) Is a record of approved products and treatment methodology used during seedling growth in the nursery maintained?	a) Check if the planting material is protected against pests and diseases in the nursery before release. b) Documentation should be maintained to verify the claim
3. Stock scion compatibility	Recognition/ critical	Is the selection of root stock and scion appropriate and graft compatible.	a) Check the records for appropriate age and growth of the stock & scion used and the % of compatibility.

PRESENT STATUS OF ADOPTION OF NURSERY ACT BY DIFFERENT STATES IN INDIA



1. At present, there is no legislation to regulate production and sale of seedling and vegetative propagules by nurseries.
2. A mechanism to ensure the quality of planting material needs to be developed through registration and quality control.
3. **States where some system of registering/monitoring exists for nurseries or process has been initiated:**
Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Haryana, Karnataka, Kerala, Tamil Nadu.
4. **States where some nursery registration act exists:**
Punjab, Maharashtra, Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Orissa

QUALITY PROPAGULES PRODUCTION



WHAT ARE PROPAGULES?

- Propagule is the plant material used for the purpose of plant propagation.
- Propagules may be stem, root, leaves, bulbs, cuttings, grafts, layers, seeds etc.




STEPS TO PRODUCE QUALITY PROPAGULES.



The following are the steps to produce quality propagules:

Seeds/Vegetative propagules:

1. Seeds should be collected from seed orchard (intensively managed plants especially for the production of superior seeds).
 2. If no seed orchard is available for the species, selection of candidate plus tree CPT (a tree which is tested and proved to produce superior offspring) has to be done and seed should be collected from the Candidate Plus Trees (CPTs) only
 3. Well mature pod/fruits should be collected just prior to falling and seeds should be extracted as early as possible without damage to the seed.
 4. Generally fresh seeds to be used for seedling raising.
- 

6. In case of vegetative propagules fresh scion or buds should be collected from the identified mother plant and used for grafting or budding within 12 hours..
7. The seedling germination or grafting/budding success percentage needs to be increased by following appropriate pre-sowing treatments of seeds and growth regulator treatment of vegetative propagules.
8. Follow the standardized propagules management practices by placing them in nursery beds or under shade net house.





Vegetative Propagation Methods

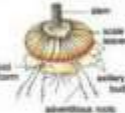
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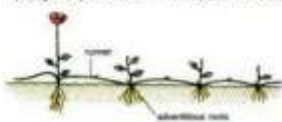
Vegetative propagation by roots of Datura and sweet potato



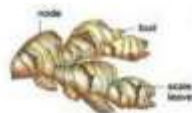
Vegetative propagation by bulb in onion



Vegetative propagation by corm in Gladiolus



Vegetative propagation by runner in strawberry



Vegetative propagation by rhizome in ginger



Vegetative propagation by stolon



Vegetative propagation by sucker in Chrysanthemum



Vegetative propagation by tuber in potato



Vegetative propagation by cutting in Chrysanthemum



**The criteria which assures quality of
propagules**



PLANTING MATERIAL PRODUCTION OF SOME IMPORTANT PLANT SPECIES

Tree	Propagation method	Quality standards
Neem	Seed	1 year old
Teak	Seed	1 – 2 cm diameter and 3 – 4 months old
Banana	Sucker	2-3 months old seedling
Brinjal	Seed	4 -5 weeks old, 12-15 cm tall, 6-8 leaf stage
Citrus	Grafting	1-2 years old graft, 75-90cm
Guava	layering	6-9 months old
Grape	Cutting/grafting	15-20 cm long, 3-4 buds

**2. SEED EXTRACTION FROM
FRUITS**

3. SEED STORAGE

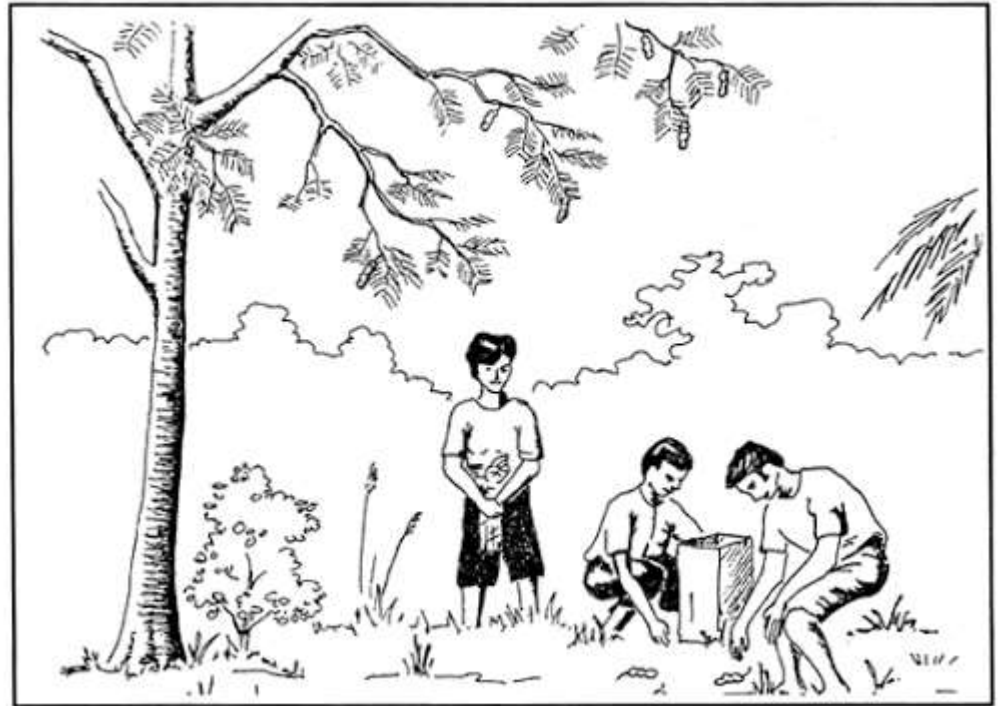
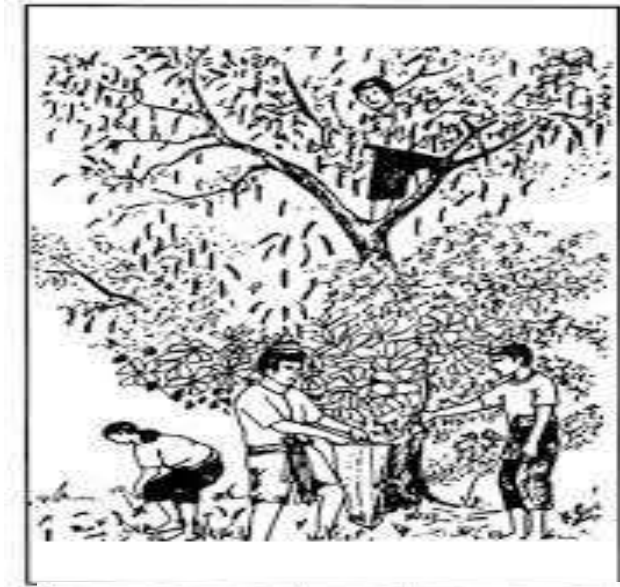


GOOD PRACTICES OF FRUIT/POD/SEED COLLECTION

1. Fruit/pod/seed collected directly from trees is of high quality because they are healthy and not been exposed to soil moisture or soil microorganisms.
2. Seeds should be collected from a lot to assures broad genetic base.
3. If seed extraction and processing can not be conducted immediately, place sacks or containers of seed in a dry and cool room with good air circulation.
4. Place the sacks or containers on a shelf or rack to facilitate air movement.
5. Sacks may also be hung from the ceiling.



SEED COLLECTION



Exposed to soil moisture or soil microorganisms.

Fruit/pod/seed collected directly from trees

GOOD PRACTICES OF SEED EXTRACTION FROM FRUITS

1. Mature fruits should be processed for seed extraction.
2. Fruits that are undeveloped or infected with insects and disease should be discarded.
3. Proper extraction methods should be conducted carefully to avoid damaging seed.
4. Normally, 2-3 days of drying is enough. Rubbing and crushing the fruits will expedite seed extraction.
5. Some common tools used during extraction include sacks, tarps, trays, buckets, tanks and sandpaper (or other abrasive material).
6. Many species have wings pod/seeds that should be removed. Most wings can be detached by crushing or rubbing the seed. Large, firmly attached wings can be removed by hand and discarded

GOOD PRACTICES OF SEED EXTRACTION FROM FRUITS



GOOD PRACTICES OF SEED STORAGE

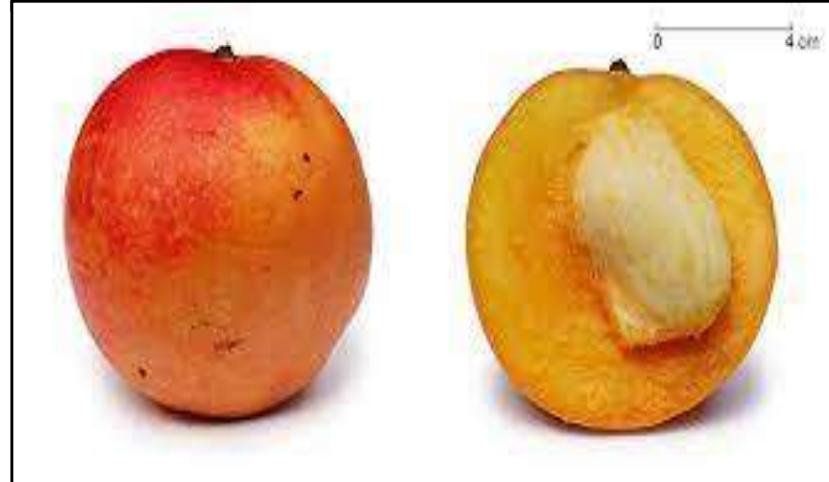
- If seed is to be sown immediately after extraction and cleaning, no further processing is required.
- But, if it is to be stored, even for a short period, the seed of most species require drying in order to maintain viability during storage.
- Whether seed requires drying or not depends on the type of seed, whether it is recalcitrant or orthodox.
- Recalcitrant seeds are seeds that do not survive drying and freezing, thus they cannot be stored for long time. Eg.: Mango, Jack fruit.
- Orthodox seeds are seeds that can survive drying and freezing and can be stored for long time. Eg. Peas, Corn, Tomatoes



TYPES OF SEEDS



Orthodox seeds



Recalcitrant seeds

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SKILL DEVELOPMENT COURSE



PLANT NURSERY



Unit-1: Introduction to plant nursery

Lesson 5 : BIS - 2008 related to plant nursery

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4. The nursery plants should be **free from weeds and disease and pest** .
5. **The graft union should be healthy and the size of scion and rootstock should be equal**.
6. **After shifting and transporting, seedling should not show symptoms like leaf drying, yellowing, stress, etc.**

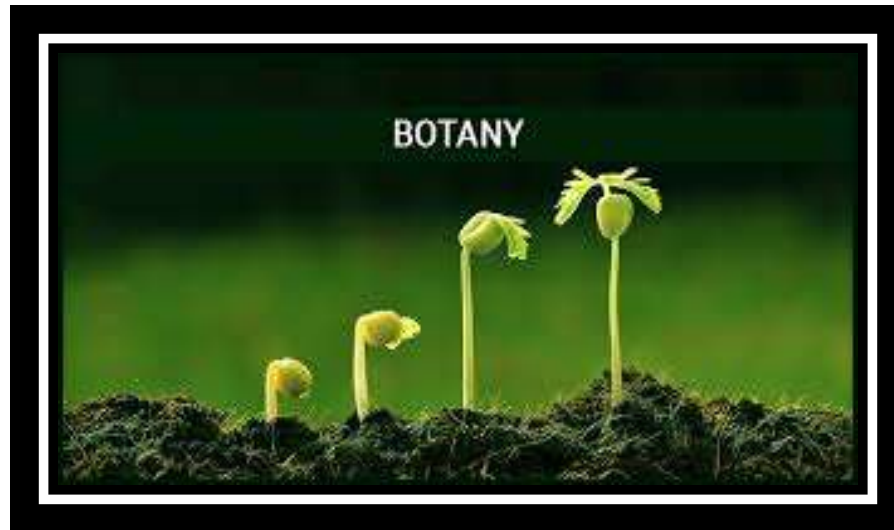
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4: Status of adoption of nursery act by different states in India

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3. Well mature pod/fruits should be collected just prior to falling and seeds should be extracted as early as possible without damage to the seed.
4. Generally fresh seeds to be used for seedling raising.
5. If seed has the viability period it can be stored and used.

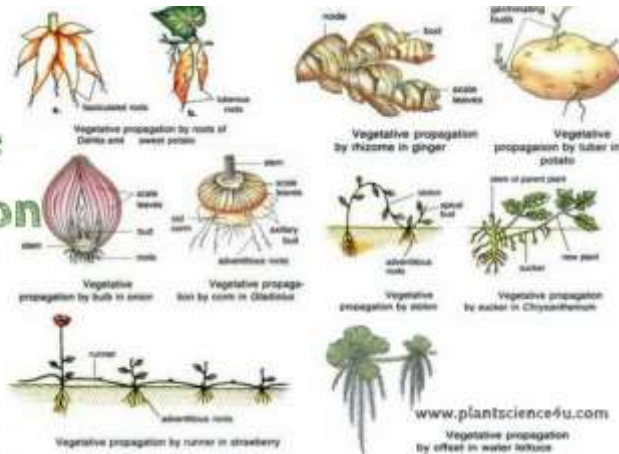
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Seeds

Vegetative Propagation Methods

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vegetative propagules



The criteria which assures quality of propagules

- Planting material production of some important plant species

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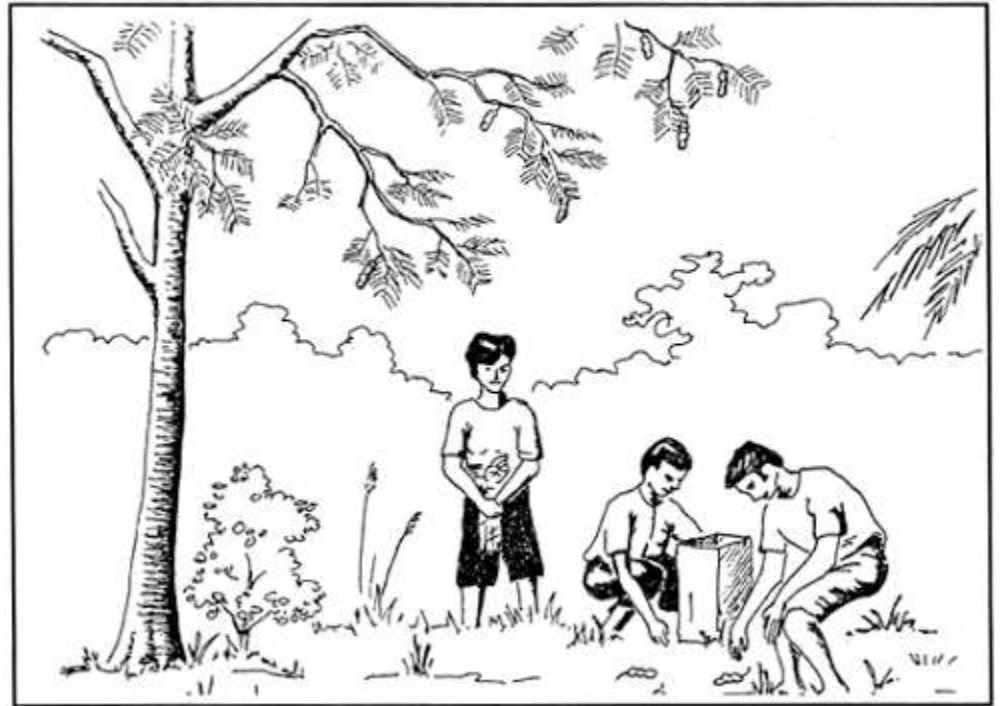
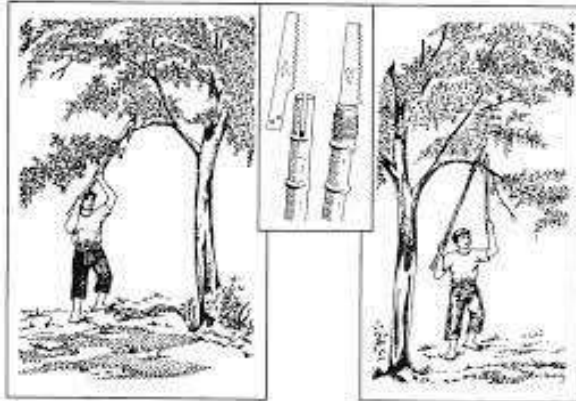
Good Practices : For

- 1. Fruit/Pod/Seed Collection**
- 2. Seed Extraction from fruits**
- 3. Seed Storage**

Good Practices of Fruit/pod/seed collection

1. Fruit/pod/seed collected directly from trees is of high quality because they are healthy and not been exposed to soil moisture or soil microorganisms.
2. Seeds should be collected from a lot to assures broad genetic base.
3. If seed extraction and processing can not be conducted immediately, place sacks or containers of seed in a dry and cool room with good air circulation.
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Seed collection



Exposed to soil moisture or soil microorganisms.

Fruit/pod/seed collected directly from trees

Good Practices of Seed Extraction from fruits

1. Mature fruits should be processed for seed extraction.
2. Fruits that are undeveloped or infected with insects and disease should be discarded.
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4. Normally, 2-3 days of drying is enough. Rubbing and crushing the fruits will expedite seed extraction.
5. Some common tools used during extraction include sacks, tarps, trays, buckets, tanks and sandpaper (or other abrasive material).
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Good Practices of Seed Extraction from fruits



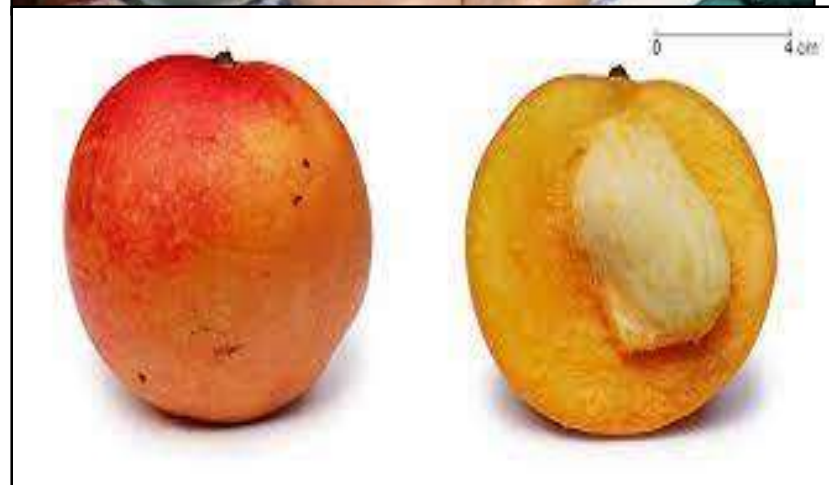
Good Practices of seed storage

- If seed is to be sown immediately after extraction and cleaning, no further processing is required.
- But, if it is to be stored, even for a short period, the seed of most species require drying in order to maintain viability during storage.
- Whether seed requires drying or not depends on the type of seed, whether it is recalcitrant or orthodox.
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- Orthodox seeds are seeds that can survive drying and freezing and can be stored for long time. Eg. Peas, Corn, Tomatoes

Types of seeds



Orthodox seeds



Recalcitrant seeds

INTRODUCTION

- For carrying out day-to-day routine cultural operations in the nursery, various tools, implements and accessories are required.
- Some tools are simple and are used for simple operations, whereas for carrying out specific operations, special types of equipments are required.



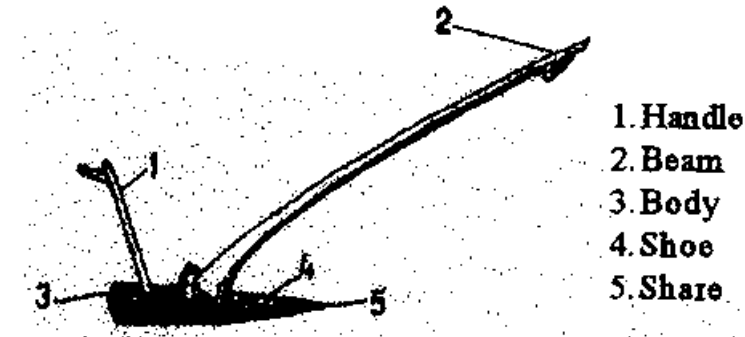
TOOLS FOR LAND PREPARATION AND OTHER BASIC WORKS



Kudali:

It is a simple but important tool used for digging of soil, pits or any basic digging work prior to preparation of nursery beds.

It has a metal (iron) blade attached to a wooden handle. It is operated manually.



Garden fork:

Garden fork is used for breaking of soil clods and separation of medium size soil during preparation of nursery bed or fields.



Weeding fork:

It loosens the soil and helps in weeding also.

It consists of a long handle with a blade of handle teeth. It is drawn manually with the help of handle to collect the weeds and cobs of plants etc.



Crow bar:

It is an iron rod with one end pointed and other as a wedge shaped.

It is used for digging out large or hand boulders from and digging of pits.

It is also used for breaking hard soil pan



Hand leveler:

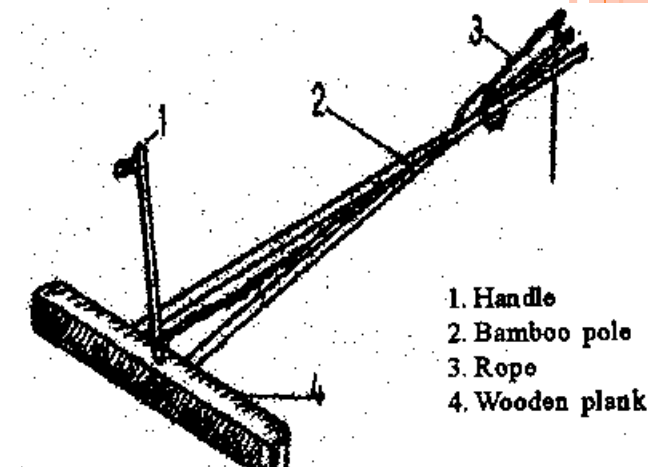
It consists of narrow rectangular metal blade attached to long wooden handle

Shovel:

It has iron blade of spoon shape and wooden handle and is used for within field transport of dug out soil required for leveling of field for preparation of nursery beds.

Trowel (Khurpi):

It is of shovel shape but small in size with iron blade and wooden handle. It can be made in many shapes as per local designs and requirements. It is used for hoeing, weeding and nursery plants and also for transplanting seedlings.



Pick-Axe:

It is made of carbon steel. Pick axe has two edges with provision of axial hole for attachment with handle. One edge of pick –axe is pointed and another is broadened. Pick axe is used for digging hard, compact and stony soils

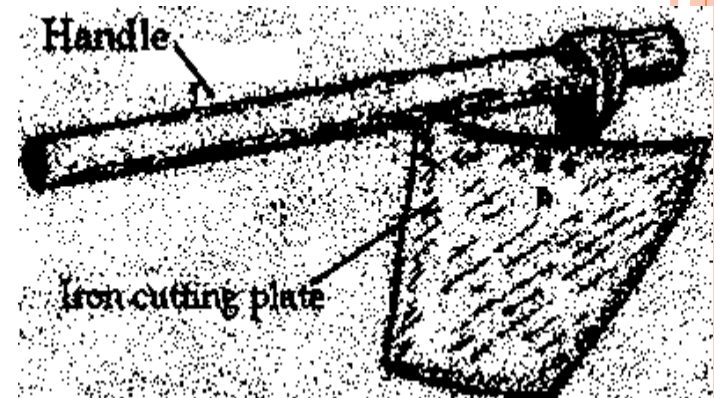


Axe:

Iron blade, fastened to wooden handle. It is used for felling trees and cutting branches.

Spade:

It is used for lifting and turning the soil. Also used for digging the pit, preparing channel for irrigation and drainage lines.



Hoe-cum-Rake:

It is of rectangular shape metal blade with fork like fore edge.

It is used for digging, hoeing, earthing, leveling and collecting weeds

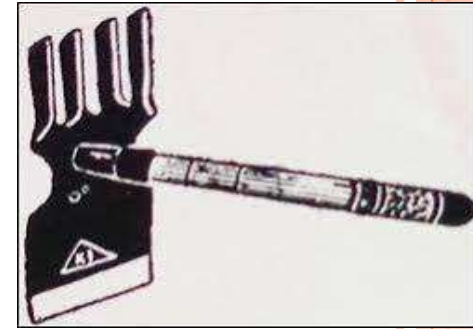
Furrow opener:

It is used for opening narrow and shallow furrow after sowing seeds in nursery.

Bill Hook (Darat):

It is made of iron curved at the far end or used for cutting hardy branches of plant and other woody shrubs in the field.

Sickle: It is used for cutting grass and leafy vegetables.



Wheel-Barrow:

It is manually operated small trolley, used for carrying nursery plants, compost, fertilizers, leaf litter, horticultural produce, stones etc. from one place to another place. It can be designed into different shapes according to requirement.



Cultivator:

It is a tractor drawn implement used for tilling the soil efficiently.

A hand driven small cultivator is more popular.

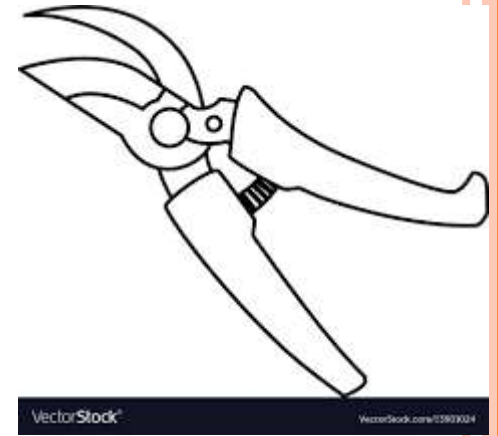
It can plough upto $\frac{1}{2}$ to 1 feet depth.



Secateurs:

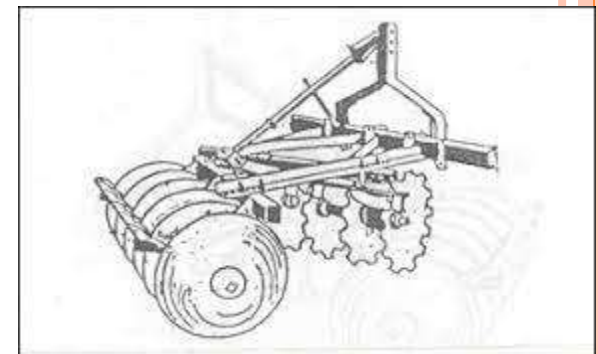
Secateurs are considered as the most important tool for a propagator or a nurseryman.

It is used for removing scions, lopping off the rootstock, preparation of scion sticks, removal of undesirable shoots/sprouts from the stock and training and pruning operations. The blades of secateurs should be of high quality carbon blade for giving smooth cuts to the stock and scions.



Disc harrow:

It is used for pulverizing the soil. It is also used for turning crop residues, weeds and other debris in the soil. It is used for deep ploughing and turning of soil.



GRAFTING AND BUDDING TOOLS

Knife:

1. Knives having combined blade for grafting and budding purposes.
2. A grafting/budding knife has a straight 7.5cm long blade and strong long handle.
3. It has a spatula at the end of a handle, which is used for lifting the bark during budding operation.
4. Sometimes knife has two parallel double blades, used specially for lifting or removing the patch of a bud from the budwood.
5. Generally these knives have either a folding or fixed blade. The blade of knife should be made from high carbon steel and should always be very sharp.



○ Pruning saw:

1. Several types of saws are required for performing different operations involved in propagation of horticultural plants.
2. The commonly used are crescent saws, tapered saws and straight saws.
3. All of them have long and widely set teeth to facilitate pruning or cutting of green wood.
4. Its blades should be narrow so that it can pass through the narrow or closely spaced branches.

Grafting machines

Many machines have been developed and commercially used for the preparation of scion sticks and bud wood for budding and grafting operation in many developed countries .



Ladders:

- In propagation work, ladder is required for operations like cutting of bud wood, training of vigorous plants, performing layering operations and top working of declining plants. In general, step ladder or straight ladder or hook ladders are used for such operations in the field of propagation

Tying and wrapping materials:

- It is essential to hold scion and stock firmly together to have successful graft/bud union. For this purpose a suitable tying or wrapping material is required. Generally polyethylene tapes/strips, waxed string and cloth, raffia fibre and rubber strips are used for this purpose. In addition, adhesive tapes similar to surgical adhesive tapes but lighter in weight are also used by commercial nursery men.

Grafting wax:

- Wax is used by propagator to seal the graft union for preventing moisture loss and desiccation of cells at cut surface and to prevent the decay of wood by way of checking the entry of pathogens (Fig.16.5). Waxes are of two types i) Hot wax ii) Cold wax.



Labels:

Labels are used for proper labeling of plants, before sale. Labels may be made of paper, card board, wooden, celluloid, aluminum and plastic etc.

Pots:

Pots of different shapes and sizes are used in nursery.

They may be of clay, metal or plastic usually 10cm, 15cm or 20cm for single specimen.

Pots are of different types, tube pots, $\frac{1}{4}$ size, $\frac{1}{2}$ size, $\frac{3}{4}$ size and full size, thali and urn .

These are used for potting ornamental plants, fruit plants, saplings etc. Iron pots/ plastic pots are used for irrigation purpose also.

Spray-pumps:

To spray protective material i.e. insecticides/pesticides/fungicides to eliminate the infection of pathogens or insects, spray pumps are very important tools.

Pumps are of different shapes, size and types.

Commonly used sprays are knap-sack sprayer, rocker sprayer, foot sprayer, hand sprayers or power sprayers .

Depending upon the volume of nursery and specific purpose different types of sprayers are put in operation.



Chain saw:

- It operates using fuel (petrol/kerosene). It aid to cut wood logs of bigger size and lopping of branches and shoots.

Chain weeder:

It is operated by petrol/diesel/kerosene. It is used to slash the weeds on large scale.

Rose can:

A tubular pipe with rose i.e. fitted into the can through which water is sprinkled over the nursery beds until the germination of seeds and to avoid splashing of seeds from the nursery beds due to loose pipe irrigation and flood irrigation.



Iron pan:

- It is made of iron and used for transporting pot mixtures, potted plants through head load from one place to another for short distance.

Hose pipe:

- This is available in convenient length. Irrigation to nursery plants is made possible to any extent.

Pruning shear:

- It is made of iron fitted with wooden handle. It is used to prune unwanted branches, collection of scion, trimming of the edges and hedges and topiary work.

Scythe:

- It is long knifed, fitted with wooden handle. It is used for slashing of weeds.



INTRODUCTION

- For carrying out day-to-day routine cultural operations in the nursery, various tools, implements and accessories are required.
- Some tools are simple and are used for simple operations, whereas for carrying out specific operations, special types of equipments are required.



TOOLS FOR LAND PREPARATION AND OTHER BASIC WORKS

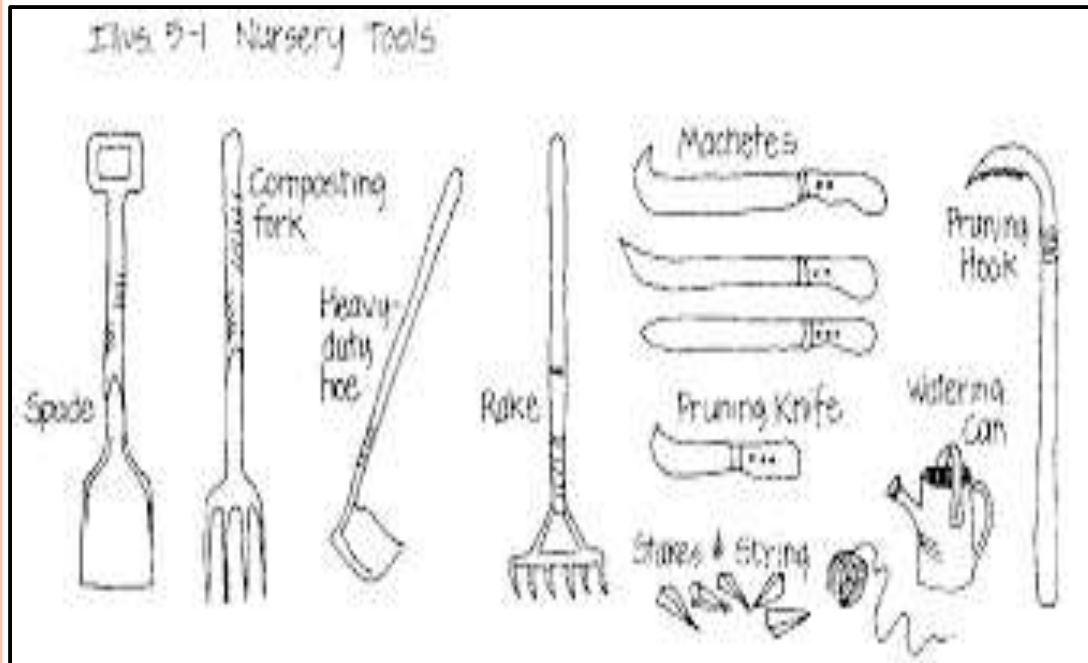


TOOLS

- Axes, crow bar, wheel barrows, boxes, plastic buckets, watering cans, wire cutters, digging forks, hammer, nails, hoes, hand pruning knives, budding knives, respiratory masks, sprayers, saws, scissors, secateurs, budding and grafting knives, budding and grafting tape, germination trays, khurpis, iron pan, spade, fork etc.



PLANT NURSERY TOOLS



CONTAINERS

- Containers made up of polythene (bags, pots, root trainers), clay (pots) or iron material.
- Polybags are the cheap containers.
- Root trainers are user friendly, easy to handle and transport.
- *A root trainer container is an aid to the cultivation of young plants and trees in nurseries. Many pot designs train the roots.*
- *One example is a truncated plastic cone in which a seedling is planted.*
- *There is a drainage hole at the bottom and the main tap root tends to grow towards this.*



POTS



POLY BAGS



ROOT TRAINERS



SKILL DEVELOPMENT

Plant nursery



UNIT – 2: NECESSITIES FOR NURSERY

Lesson 1: Nursery beds



CONTENTS

I. Introduction

II. Types of seedbeds

1. Flat or level seedbed

2. Raised seedbed

3. Sunken seedbed

III. Preparation of nursery seedbed.

IV. Seedbed treatment

V. Precautions to be taken during preparation



I. INTRODUCTION

- **What is a nursery bed?**

Plant nursery seedbed is a land, which is made free from weeds, stumps, stones, pebbles etc and it is used for sowing of seeds to raise seedlings and multiplication of different plants through asexual means.



II. TYPES OF NURSERY SEEDBEDS

Based on preparation nursery beds three types.

1. Flat or Level seedbed
2. Raised seedbed
3. Sunken seedbed



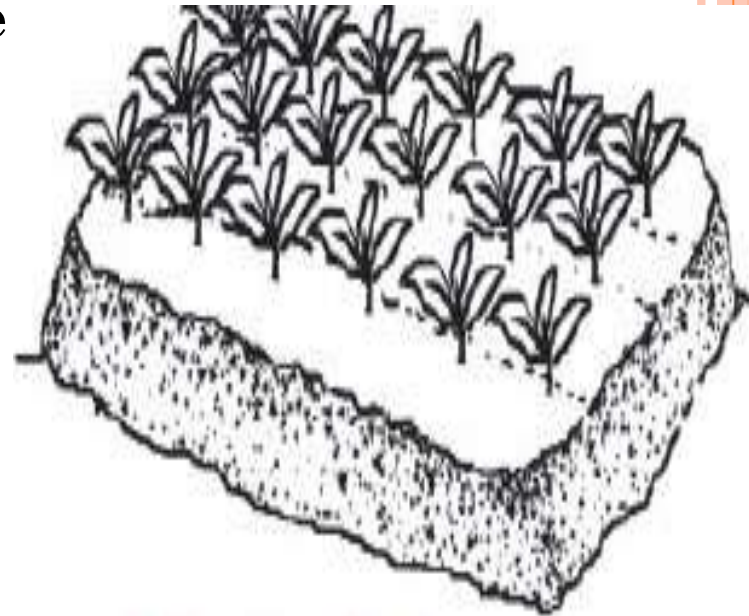
1. FLAT/LEVEL SEEDBED

1. This type of bed is prepared during non-rainy season (summer and winter) so that there is no water logging.
2. Usually a flat bed is 1-meter wide and has length according to the slope of the bed.
3. Irrigation channels are prepared between the rows of the beds through which each bed is connected. These also acts a drainage channels in case of heavy rain or excess irrigation.
4. Adequate drainage provision is made and preference for sandy or sandy loam soil is given when preparing a flat bed.



2. RAISED SEEDBED

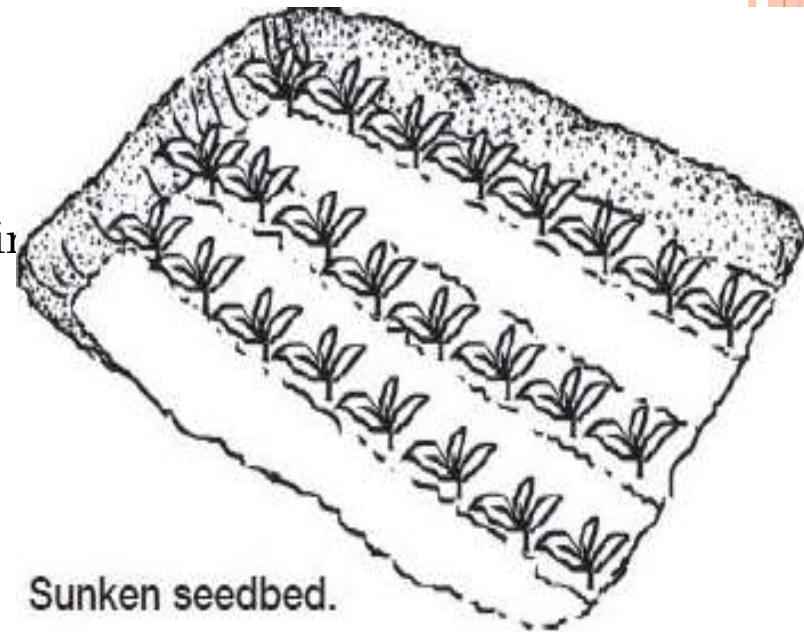
1. Raised type seedbed is prepared during the rainy season.
2. This type of bed is prepared about 15cm high from the ground level. The width is kept at 1 – 1.5 meters and length 3 – 5 meters. This enables good drainage during rains and checks water stagnation.
3. A space of 3 – 4 cm is left between two beds in order to carry out cultural practices smoothly.



Raised seedbed.

3. SUNKEN SEEDBED

1. The soil of the bed is prepared in dry and windy areas.
2. In dry areas, the bed is kept 10 – 15 cm. below the ground level, which helps in conserving water.
3. Sunken bed facilitates the deposition of irrigation water or rain water for a longer time.
4. In case of water scarcity, this type of bed helps to conserve the moisture.
5. Such a bed can be easily irrigated during dry season.
6. A sunken bed provides protection to the seedlings in high wind conditions as they are covered.



Sunken seedbed.

RAISED BEDS VS SUNKEN BEDS

RAISED BEDS VS FLAT SEEDBEDS



GARDENING PROS & CONS

RAISED BEDS vs. SUNKEN BEDS



Raised beds vs in-ground garden Pros & Cons



III PREPARATION OF SEEDBED



SEEDBED PREPARATION

- Soil of seedbed needs to be loose, smooth and without large clumps. Large clumps, uneven depth would make plant depth random.
- Loose soil provides aeration and space for root growth
- Seedbed preparation is done by secondary tillage through use of harrow and cultivators.



STEPS IN SEEDBED PREPARATION

1. Removal of debris: e.g. Insect eggs, disease spores, stones etc. are removed
2. Leveling: it is done for achieving even drainage
3. Breaking up the soil: Compacted soil broken up by digging followed by disking.
4. Soil improvement: Compost, decomposed organic matter are added
5. Fertilizing: If soil is deficient in any nutrients it can be added manually.

IV SEEDBED TREATMENT

- For raising healthy seedlings, soil must be treated for making it pathogen and pest free.
- Methods of treatment:
 1. Soil solarization: most suited
 2. Formalin solution treatment
 3. Application of fungicide: e.g. Captan, Thiram
 4. Use of insecticides: e.g. Chloropyriphos @ 2ml/liter of water
 5. Fumigation: use of methyl bromide

SOIL SOLARIZATION



V. PRECAUTIONS TO BE TAKEN DURING PREPARATION

1. The nursery bed is used for germination of seeds and for rooting of cuttings in the soil.
2. Nutrition, sufficient moisture and aeration are important factors that effect the growth.
3. Nursery bed must be prepared in fertile soil rich in organic matter content, having adequate drainage and aeration.
4. Excess irrigation in sunken or flat beds may lead to rotting of seeds, seedlings and damping off incidence.
5. Watering of the bed depends on the type of soil. Sandy soil needs frequent watering. Soil having more water retention capacity do not require frequent irrigation.
6. Soil borne infections caused by nematodes, insect-pest and pathogens may be avoided by treating the soil either by physical (solarisation) or chemical (formalin, fungicide, insecticide, bio - agents) way.
7. The width of the nursery bed must not be more than 1 meter and the length must be according to the slope of the soil, so that when irrigated, the water reaches every corner of the bed and the whole bed gets irrigated.



An illustration of a man with a mustache, wearing a pink dhoti and a yellow shawl, sitting in a meditative pose on the ground. He is holding a green plant in his hands. The background is a soft, light green, suggesting a garden or forest setting. There are green leaves and a brown branch at the top, and a white daisy flower and a red ladybug in the bottom left corner.

Thank you

Unit 2

Lesson 5

Sowing methods of seeds and planting material

Introduction

- Sowing or seeding is an art of placing seeds in the soil to have good germination in the field. A perfect seeding gives correct amount of seed per unit area, correct depth at which seed is placed in the soil and correct spacing between row-to-row and plant to plant

Methods of sowing

There are different methods of sowing such as

1. Traditional method
2. Broadcasting
3. Dibbling
4. Drilling
5. Seed dropping behind the plough.
6. Transplanting
7. Hill dropping
8. Check row planting

1. Traditional Method

1. A funnel-shaped tool is used to sow the seeds traditionally.
2. The funnel is filled with seeds and the seeds pass through two or three pipes with sharp ends.
3. These ends enter into the soil and the seeds are placed there.

2. Broadcasting

- Broadcasting is the most common and oldest methods of seed sowing, where the seeds are just spread on the soil. Then seeds may or may not be covered with soil. Broadcasting may be done manually with hands or through mechanical spreader.

3. Dibbling

1. Holes are made in the seedbeds and the seeds are placed in it.
2. The seedbeds are then covered. The holes are made at definite depths.
3. A dibbler is used for dibbling. It is a conical instrument that makes proper holes in the seedbed.
4. This method is usually used to sow vegetables

4. Drilling

1. The seeds are dropped into furrow lines in a continuous flow and are then covered with soil.
2. This is done either mechanically or manually.
3. The proper amount of seeds are sown at proper depths and proper spaces.
4. Drilling can be done in the following ways:
 - a) Sowing behind the plough
 - b) Bullock-drawn seed drills
 - c) Tractor-drawn seeds drills

5. Seed dropping behind the plough

1. This method is commonly used in villages to sow a variety of food crops such as maize, peas, wheat, barley, and gram.
2. Seeds are dropped in furrows behind the plough by a device known as malobansa.
3. It comprises of a bamboo tube with a funnel-shaped mouth.
4. It needs two men to drop the seeds. One handles the bullocks and the plough and the other drops the seeds.
5. However, this method consumes a lot of time and is labour-intensive.

6. Transplanting

1. In this process, the seedlings are first planted in nurseries and then planted in the prepared fields.
2. It is usually done to grow vegetables and flowers.
3. A transplanter is used for the purpose.
4. But, this process is time-consuming.

7. Hill dropping

- In this method, seeds are dropped at fixed spacing and not in a continuous stream. Thus the spacing between plant to plant in a row is constant.
- In case of drills, the seeds are dropped in continuous stream and the spacing between plant to plant in a row is not constant

8. Check row planting

1. The seeds are planted along straight parallel furrows.
2. A check row planter is used for the method.
3. The row-to-row and plant-to-plant distance is uniform.
4. A machine used for check row planting is called check row planter

Precautions while Sowing the Seeds

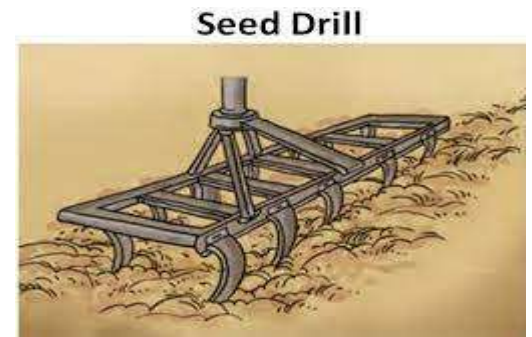
There are a few necessary precautions, which need to be followed while sowing the seeds.

- The seeds should be disease-free.
- Seeds must be planted at correct distances from each other.
- Seeds should be sown such that all the crops should get an equal amount of light, nutrients, and water.
- Seeds should be sown at correct depths. They should neither be placed at the top of the soil so that it is blown away by wind and animals, nor should it be sown too deep into the soil such that it does not germinate.

UNIT 2

Lesson 5

Sowing methods of seeds and planting material



INTRODUCTION

What is sowing?

- Sowing or seeding is an art of placing seeds in the soil to have good germination in the field.
- A perfect seeding gives correct amount of seed per unit area, correct depth at which seed is placed in the soil and correct spacing between row-to-row and plant to plant.



METHODS OF SOWING

There are different methods of sowing such as

1. Traditional method
2. Broadcasting
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5. Seed dropping behind the plough.
6. Transplanting
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8. Check row planting

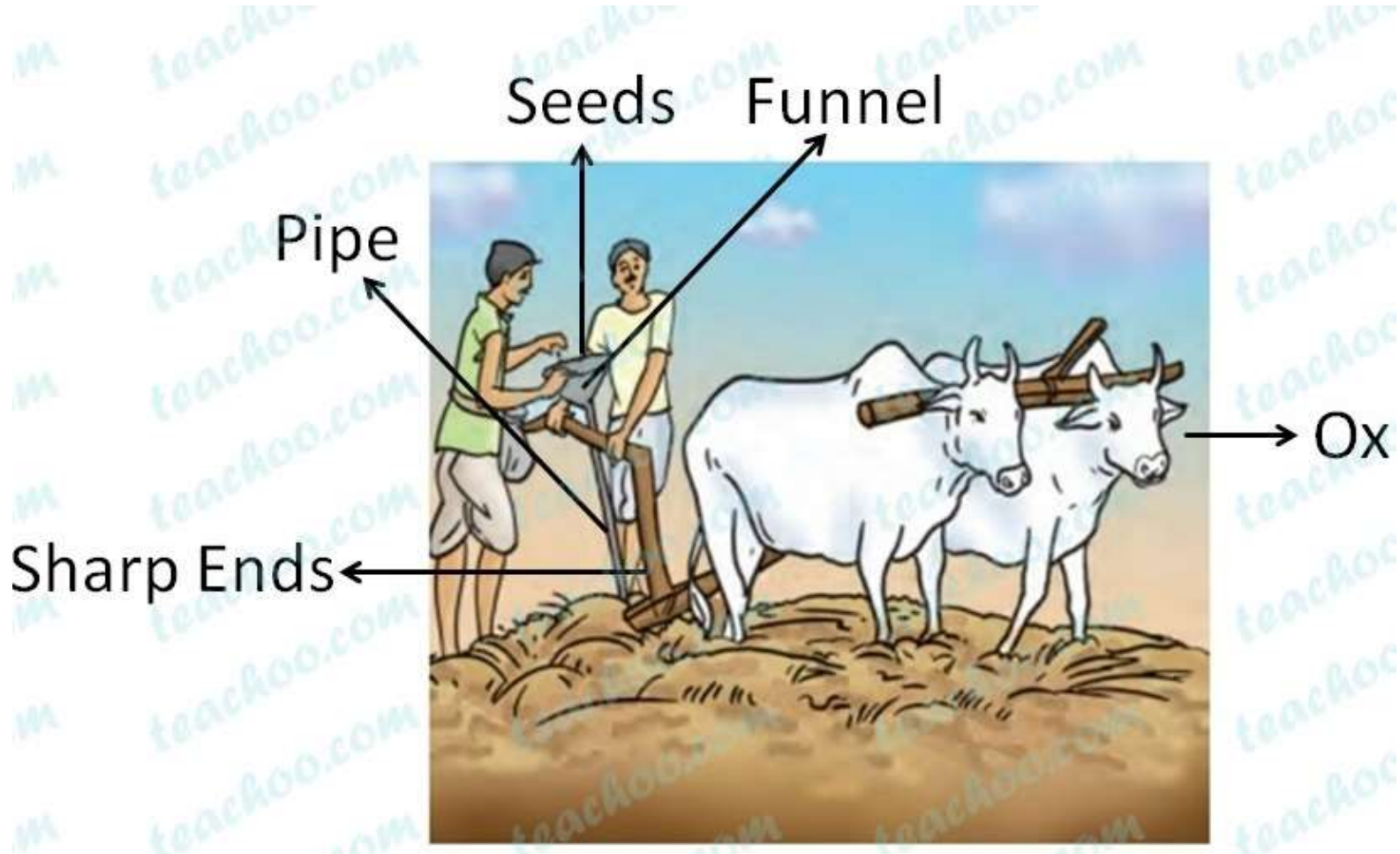


1. TRADITIONAL METHOD

1. A funnel-shaped tool is used to sow the seeds traditionally.
2. The funnel is filled with seeds and the seeds pass through two or three pipes with sharp ends.
3. These ends enter into the soil and the seeds are placed there.



TRADITIONAL METHOD OF SOWING SEEDS



2. BROADCASTING

1. Broadcasting is the most common and oldest methods of seed sowing, where the seeds are just spread on the soil. Then seeds may or may not be covered with soil.
2. Broadcasting may be done manually with hands or through mechanical spreader



BROADCASTING & COVERING THE SEED WITH DE ANKING



ADVANTAGES AND DISADVANTAGES

1. Advantages of Manual Broadcasting :-

- Manual method is cheap.
- It takes less time than other methods.
- This method is suitable only for small seeded and crops where plant to plant distance is small or does not matter.

2. Disadvantages of Broadcasting

- In this method the Seed distribution is uneven.
- Some of the Seeds are not be covered by soil.
- The density and depth of seeds are uneven.
- The germination of seed is Non-uniform.
- Crop stand is affected by uneven distribution.



3. DIBBLING

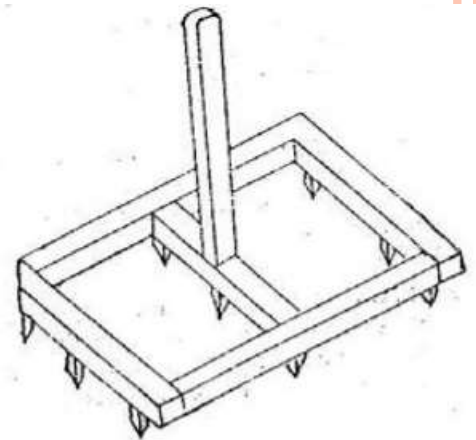
1. Dibbling is the process in which seeds are placed in holes or pits made on seed beds, at equal predetermined distances and depths, and cover them with soil.
2. This procedure is done by dibbler, planter or manually.
3. Dibbler is a conical instrument used to make proper holes in the field.
4. Small hand dibblers are made with several conical projections made in a frame.



DIBBLING



Dibbler



ADVANTAGES AND DISADVANTAGES OF DIBBLING

1. Advantages of Dibbling :-

- Less seeds are required.
- Germination is rapid and uniform .
- Seedling vigor is good.

2. Disadvantages of Dibbling :-

- It is time consuming.
- More labor is required
- This method is costly.



4. DRILLING

1. Drilling consists of dropping the seeds in furrow lines in a continuous flow and covering them with soil.
2. In this method the seed is dropped into holes either manually (or) using a machine (seed drill or seed-cum fertilizer drill).
3. A **seed drill** is a device used in agriculture that sows **seeds** for crops by positioning them in the soil and burying them to a specific depth. ... The **seed drill** sows the **seeds** at the proper **seeding** rate and depth, ensuring that the **seeds** are covered by soil.
4. The number of rows planted may be one or more.
5. Drilling can be done by sowing behind the plough, bullock brawn seed drills or tractor drawn seed drills.

DRILLING- SEED DRILL



bullock brawn seed drills



tractor drawn seed drills



ADVANTAGES AND DISADVANTAGES

1. Advantages of Drilling

- The quantity of seed required is less.
- During drilling Manures, fertilizers and amendments can applied with seeds.

2. Disadvantages of Drilling

- More time consuming.
- More labor required.
- Cost is high.



5. SOWING BEHIND COUNTRY PLOUGH

1. It is very common method used in villages.
2. It is used for seed like maize, gram, peas, barley etc.
3. In this method a man drops seeds in the furrow behind the plough.
4. Sowing can be done with a device called malobansa.
5. It consists of a baboo tube provided with a funnel shaped mouth.
6. One man drops the seed through the funnel and other handles the plough and the bullocks.
7. It is a slow and laborious method.



5. SOWING BEHIND COUNTRY PLOUGH



6. TRANSPLANTING

1. In this process, the seedlings are first planted in nurseries and then planted in the prepared fields.
2. It is usually done to grow vegetables and flowers.
3. A transplanter is used for the purpose.
4. This process is time-consuming.



TRANSPLANTING



7. HILL DROPPING

- In this method, seeds are dropped at fixed spacing and not in a continuous stream.
- Thus the spacing between plant to plant in a row is constant.
- In case of drills, the seeds are dropped in continuous stream and the spacing between plant to plant in a row is not constant



HILL DROPPING - MANUAL



HILL DROPPING - MECHANICAL



8. CHECK ROW PLANTING

1. It is a method of planting, in which row – to- row and plant –to –plant distance is uniform.
2. In this method seeds are planted precisely along straight parallel furrows.
3. The rows are always in two perpendicular directions.
4. A machine is used for check row planting called check row planter.



CHECK ROW PLANTING



PRECAUTIONS WHILE SOWING THE SEEDS

There are a few necessary precautions, which need to be followed

while sowing the seeds.

1. The seeds should be disease-free.
2. Seeds must be planted at correct distances from each other.
3. Seeds should be sown such that all the crops should get an equal amount of light, nutrients, and water.
4. Seeds should be sown at correct depths. They should neither be placed at the top of the soil so that it is blown away by wind and animals, nor should it be sown too deep into the soil such that it does not germinate.

STAY HOME STAY SAFE



9/19/2022

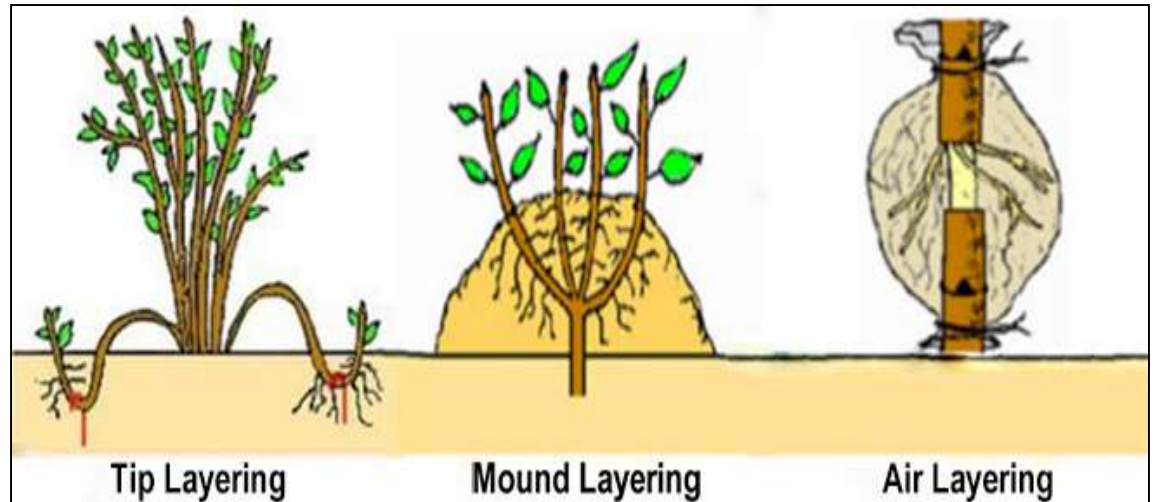
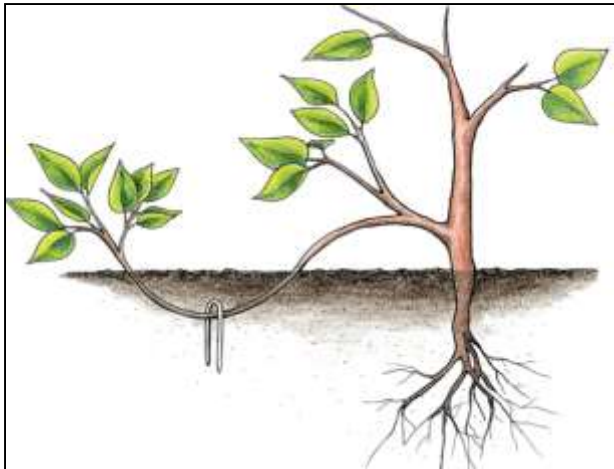
M.V.R Degree and PG college, Gajuwaka

Thank you

Unit 2

Lesson 4

- **Outlines of vegetative propagation techniques to produce planting material**



Contents

1. What is propagation?

2. Propagation types

1. Sexual propagation(Seed propagation)
2. Asexual propagation(vegetative propagation)
3. Micropropagation (tissue culture)

What is propagation?

Propagation is defined as multiplication (or) production of plants.

Propagation- types

Propagation is done by two techniques.

1. Sexual means of propagation (seed propagation)
2. Asexual means of propagation (vegetative propagation)

1. Sexual means of propagation (seed propagation)

I. Sexual propagation(seed propagation)

1. Sexual propagation is also called seed propagation since new plants are developed from seeds.
2. It's an old, easy, simple and effective technique for ornamentals or flowering plants, vegetables, fruits and medicinal plants.
3. This type of propagation allows for diversity in plant species and creates new varieties of plants.

1.1. Advantages of Sexual Plant Propagation

There are many advantages of sexual propagation.

Six important advantages are:

- 1. Easy and cheap:** It is the easiest and least expensive method of plant propagation.
- 2. Long life span:** Seedling trees are harder and have longer life span.
- 3. Difficulty: Plants** which are difficult to propagate by vegetative method e.g. papaya, coconut, etc. can only be

4. **Root stock and scion production:** The rootstocks and scion, for budding and grafting are obtained by means of sexual propagation.
5. **Resistant to diseases:** Sexually propagated plants are more resistant to pests and disease.
6. **Polyembryonic varieties** (give rise to more than one seedling from one seed) can be propagated by seed.

1.2. Disadvantages of Sexual Plant Propagation

1. **Late bearing:** Seedlings take more time to bear fruits.
2. **Cannot improve the quality:** Quality of existing plants cannot be improved by sexual propagation.
3. **Plants propagated sexually are large in size, thus the cost of manuring, pruning and spraying increases.**
4. **Due to cross pollination and segregation, there is no assurance about genetic purity of plant.**
5. **Identification of sex in seedling is not possible.**

Asexual reproduction

2. Asexual (or) Vegetative propagation

1. Asexual propagation is also called vegetative propagation since vegetative parts of the plant are used for developing a new plant.
2. Vegetative parts of plants such as leaves, stems, and roots are used for propagation.
3. These plants may be taken from single mother plant or other plants.
4. The vegetative methods most often used to produce trees are cuttings, layering, grafting and micro-propagation.

Vegetative propagation - Types

Asexual propagation or vegetative propagation is of two types.

1. Natural vegetative propagation
2. Artificial vegetative propagation

Natural vegetative propagation

- Natural vegetative propagation occurs when plants grow and develop naturally without any human interference. New plants develop from the roots, stem and leaves of the parent plant.

1. Roots: New plants emerge out of swollen, modified roots known as tubers.

Buds are formed at the base of the stem.

2. Stem: Runners grow horizontally above the ground.

Buds are formed at the nodes of the runners.

3. Leaves: Leaves of few plants get detached from the parent plant and develop into a new plant.

4. Bulbs: Bulbs have an underground stem to which the leaves are attached.

These leaves are capable of storing food.

The centre of the bulb contains an apical bud that produces leaves and flowers.

Shoots are developed from the lateral buds.

Artificial vegetative propagation

In this method plant propagation involves human interference.

The most common types of artificial vegetative propagation are:

1. Cutting
2. Grafting
3. Layering
4. Division
5. Budding
6. Suckering
7. Tissue culture/ micro propagation

Cutting

- Cutting is an artificial vegetative propagation.
- In this process of cutting the vegetative part of the plant (leaf, stem, and root) is cut and then planted again to regenerate the whole plant.
- On the basis of plant part used and relative positions on a plant cutting is 4 types.
 - i. **Stem cutting**
 - ii. **Root cutting**
 - iii. **Leaf cutting**
 - iv. **Leaf bud cutting**

Stem cutting

- A stem cutting is any cutting taken from the main shoot of a plant or any side shoot growing from the same plant or stem.
- The shoots with high carbohydrate content usually root better.
- Broadly there are four types of stem cuttings.
 - a). **Hard wood cutting**
 - b). **Semi-hard wood cutting**
 - c). **Soft wood cutting**
 - d). **Herbaceous cutting.**

a). Hard wood cutting

- Cutting from mature and lignified stem of shrubs and trees are called as hardwood cuttings.
- Hardwood cuttings are prepared during dormant season, usually from **one-year-old shoots of previous** season's growth.
- Eg. A number of deciduous fruit plants like grape, kiwifruit, pomegranate, mulberry, plum, olive, gooseberry etc.

b). Semi-hard wood cutting (green wood cutting)

- Semi-hard wood cuttings are those made from woody, broad-leaved evergreen species with partially matured wood.
- These types of cuttings are mostly used in evergreen fruit plants.
- Eg. Mango, guava, lemon, jackfruit some shrubs and shrubby ornamental plants.

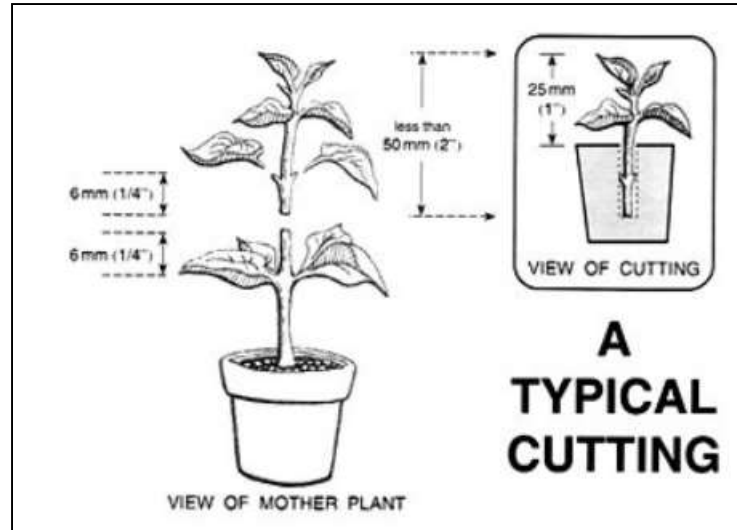
c). Soft wood cutting

- In this method cuttings are prepared from the soft succulent new spring growth species which are **4 to 6 months old.**
- Eg. Ornamental plants, Lilies etc

d). Herbaceous cutting

- In this method cutting is taken from succulent herbaceous green house plants.
- Only 2 to 3 months old tender shoots are used.
- Eg. Chrysanthemum, Cactus etc

A typical stem cutting



9/19/2022

Dr.A. Sujatha, Department of Botany, M.V.R
College, VSP

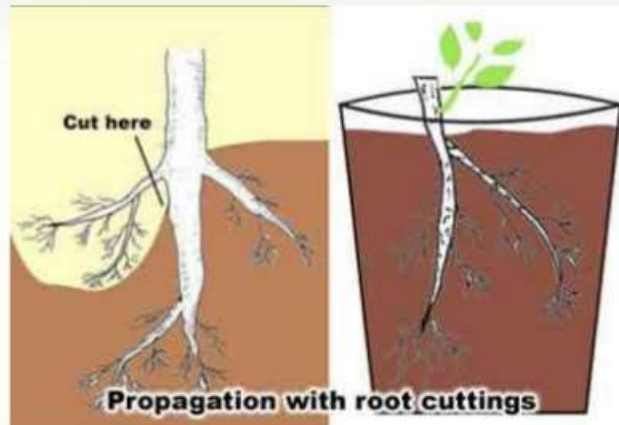


ii). Root cutting

- Propagation by means of root cuttings is also a simple and cheap method of vegetative propagation in species, which are difficult-to-propagate by other methods.
- In general, the plants, which produce suckers freely, are easily propagated by root cuttings.
- For preparation of root-cuttings, roots which are of 1cm thickness and 10-15 cm long are cut into pieces.
- The best time for taking root cutting is late winter or early spring, when roots are well supplied with stored food material.
- Eg. Apple, pear, peach

Root cutting

II. Root cutting



Ex: Brahmi



iii) Leaf cutting

- Certain plants with thick and fleshy leaves have the capacity to produce plantlets on their leaves.
- In leaf s, the leaf blade with or without petiole and axillary bud is used for starting a new plant.
- Adventitious roots and shoots form at the base of the leaf and form a new plant.
- Eg. Bryophyllum, Begonia etc

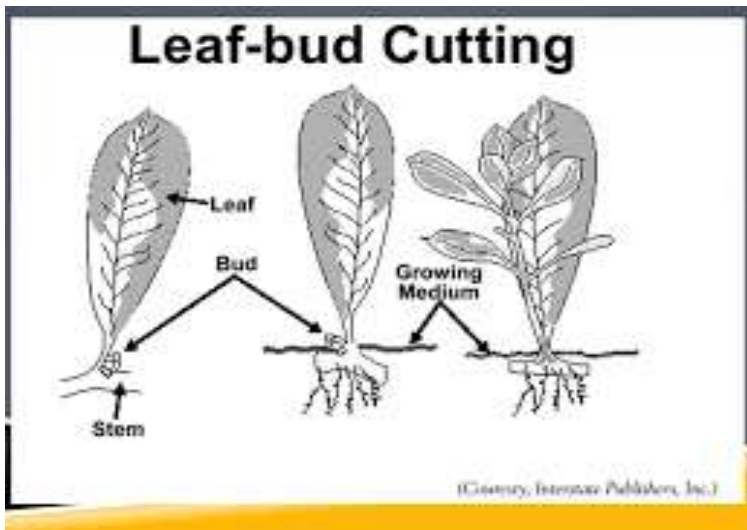
Leaf cutting



iv). Leaf bud cutting

- A leaf bud cutting consists of a leaf blade, petiole and a short piece of stem with attached axillary bud of actively growing leaf.
- Leaf bud cutting should preferably and be prepared during growing season because buds if enter into dormancy may be difficult to force to active stage, thereby inhibit the rooting in such cuttings.
- Eg. Black raspberry, Black berry, lemon etc.

Leaf bud cutting



Grafting

- Grafting involves cutting a twig of one plant (scion) and joining it with the stem of another plant (root stock) in such a manner that they form a unit and function as one plant.
- It is a bit of a complex process but allows to bring the desired character to new plants. We have to follow sterile conditions while doing the process.

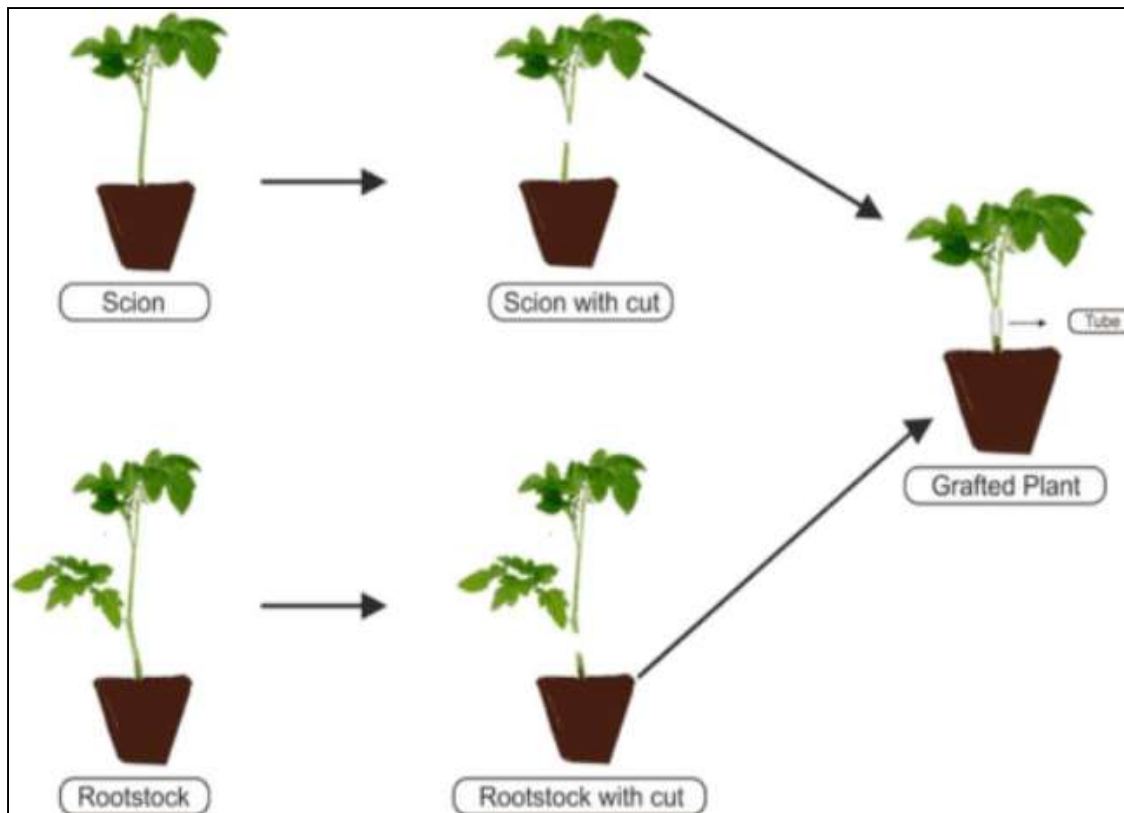
Grafting types

Grafting is of three main types (Detached scion grafting, Approach grafting, Repair grafting).

They are again subdivided into several types. The main grafting types are:

- Cleft grafting
- Bark grafting
- Whip or tongue grafting

Grafting



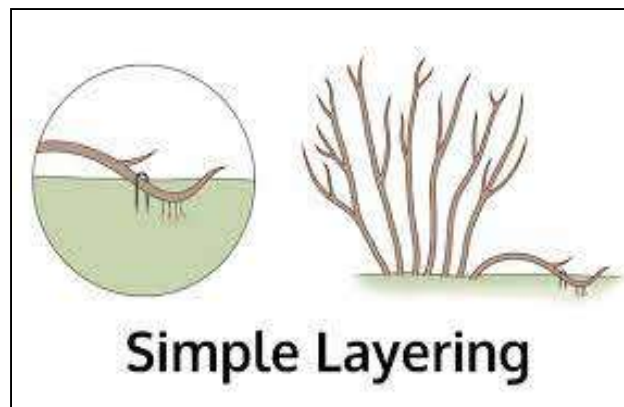
Layering

- In this technique, the attached and bent branch of the plant is covered with soil and allowed to root.
- After the emergence and development of roots that specific part of the plant is cut and allowed to grow as a new plant. Layering are of different types:
 1. **Simple layering: Eg. grapes**
 2. **Compound layering : Eg. Grapes**
 3. **Tip layering:..Eg. blackberries, raspberries**
 4. **Mound layering: apple, pear, quince, currants, gooseberry and other fruit crops.**

a). Simple layering

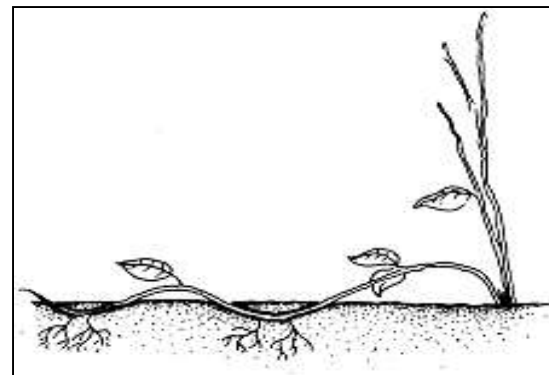
Bend the low growing and flexible stem of the plant to be layered to the ground and cover the part touching the ground with soil.

Eg. Grapes



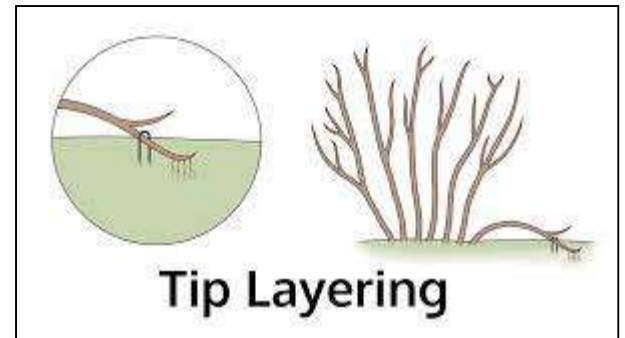
b). Compound layering

- It is a modification of simple layering in which one-year-old branch is alternatively covered and exposed along its length.
- The stem is girdled at different points in the underground part.
- Eg.: Muscadine grape



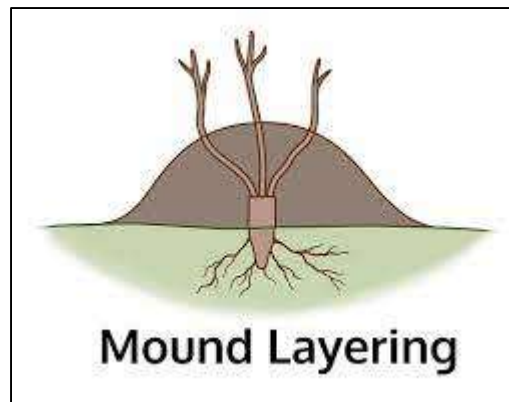
c). Tip layering

- In this method, insert the new shoot tip in a hole in the ground, which is 3 to 4 inches deep.
- Cover the shoot with soil, leaving 3 to 4 leaves above the soil.
- Eg. Blackberries, Raspberries



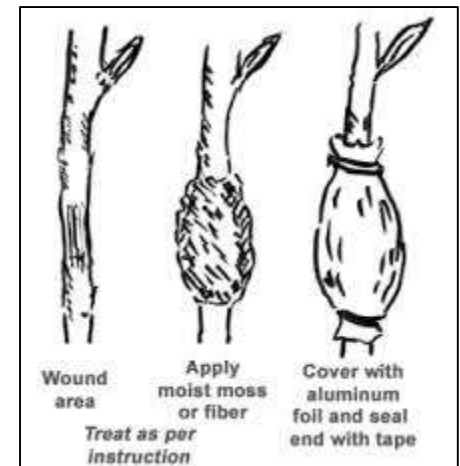
d). Mound layering

- It is a method of propagation in which the shoots of plants are cut back to the ground and soil or rooting medium is mounded around new sprouts/shoots to stimulate roots to develop at their bases.
- Eg. Apple, Pear, Gooseberry and other fruit crops.



e). Air layering

- Monocot plants: In these plants the stem of the plant is slit below a node and the slit is kept open using a toothpick.
 - But for dicot plants, 1 inch ring of the bark of the plant is removed.
 - Cover the wound with wet sphagnum moss and wrap it up with plastic then aluminum foil.
 - When a good amount of roots appear, cut the plant below the moss ball and plant them.
- Eg. :Croton house plants, Oleander, Rubber plant.



3.3.4. Division

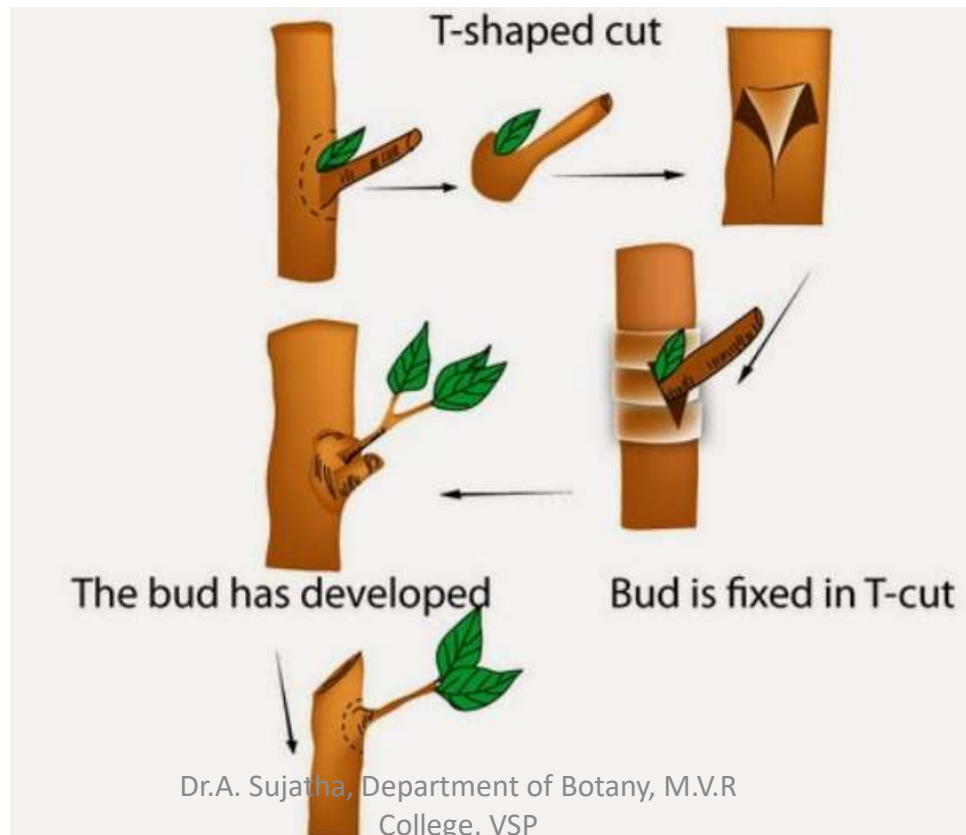
- This is a suitable technique for perennials (plants that live for more than two years).
- It involves dividing the plant by digging and moving it to an already prepared site.
- This helps the plant to rejuvenate and reduce water and nutrient competition.

Division



Budding

- In this method, a cut is made in the rootstock and a single bud with little or no wood is inserted into it in such a way that they unite and grow as a new plant.

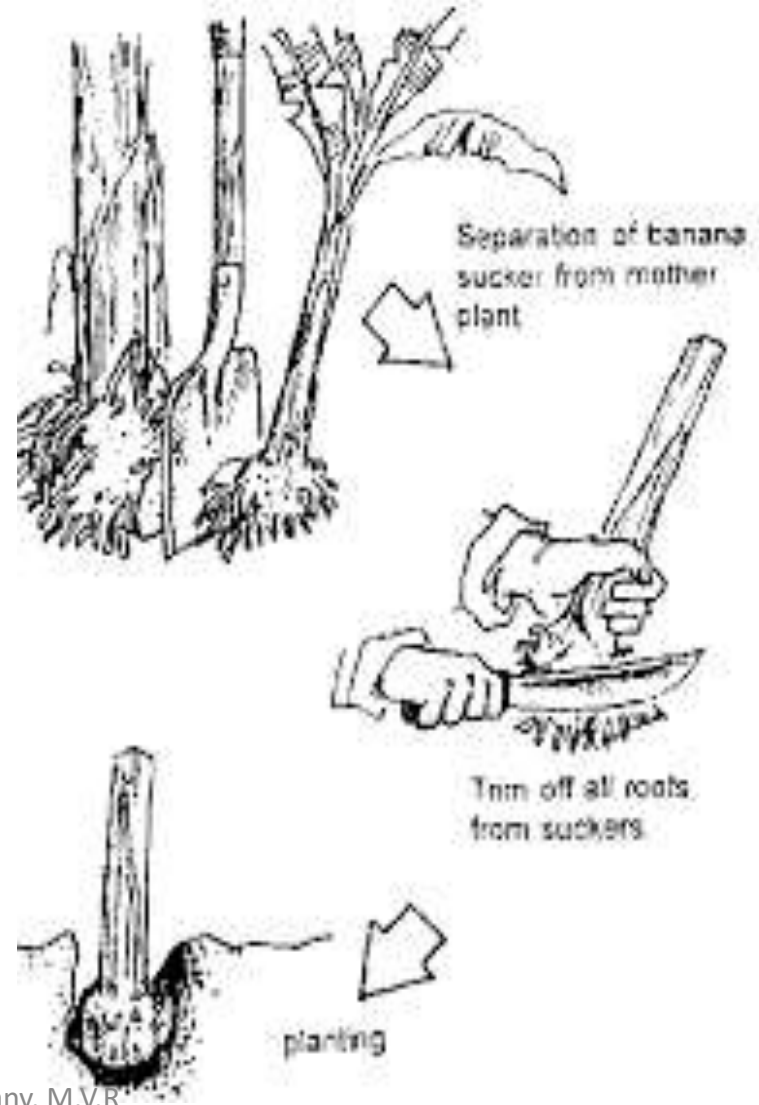


Methods of budding

- Methods of budding may be
 1. **T- budding or shield budding:** cut is in the shape of letter “T” Eg. Fruit trees (citrus) and ornamental plants (rose)
 2. **Inverted T- budding:** In heavy rainfall areas, cut is made in the shape of inverted “T”.
 3. **Patch budding:** A patch of bark is removed from the stock plant and is replaced with a patch of bark of the same size containing a bud from the desired plant. Eg: Pecan nut and walnut.
 4. **Ring budding:** A ring of bark is removed from the stock plant and is replaced with a ring of bark of the same size containing a bud from the desired plant. Eg: Ber plant.
 5. Double budding and Top budding.

Suckering

1. Suckers attach to a parent plant and form a dense, compact mat.
2. Since too many suckers can lead to smaller crop size, excess numbers are pruned or cut out and removed.
3. Mature suckers are cut away from a parent plant and transplanted to a new area where they sprout new plants.



Advantages and Disadvantages of Asexual Plant Propagation

1. Advantages of Asexual Plant Propagation

1. Plants propagated by this method are **true to type** and uniform in growth, yield and quality of fruits
2. Some fruits such as banana, pineapple, seedless guava and seedless grape varieties can only be propagated through vegetative means
3. Vegetative propagated fruit tree comes into bearing earlier than seed propagated plants.
4. Plants produced are of manageable size and have uniform fruits making harvesting easy
5. Some diseases can be avoided in susceptible varieties by grafting them on a resistant rootstock.

Disadvantages of Asexual Plant Propagation

1. Plants propagated by this method are not hardy and fall easy prey to adverse conditions of soil, climate, diseases, pests, etc.
2. It is difficult and more expensive method of propagation in some plants like papaya, coconut, etc.
3. Plants are generally not so vigorous and long lived as seedling plants and they require special skill for

Micro propagation

Tissue Culture

What is micro propagation?

- **Micro propagation** is the artificial process of producing plants vegetatively through **tissue culture or cell culture techniques**.

(OR)

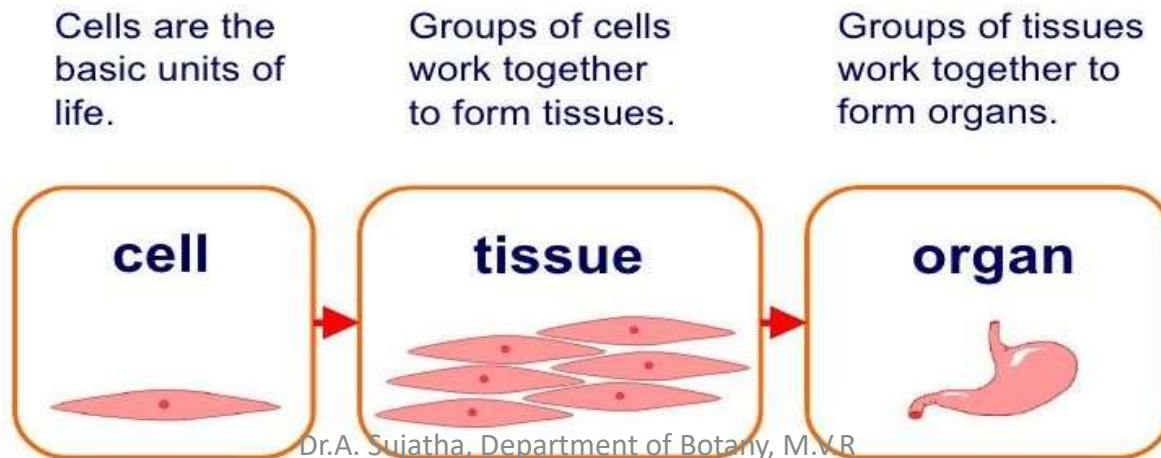
- **Micro propagation** refers to the *in vitro* multiplication and/or regeneration of plant material under aseptic and controlled environmental conditions to produce thousands or millions of plants for transfer to the field.

in vitro?

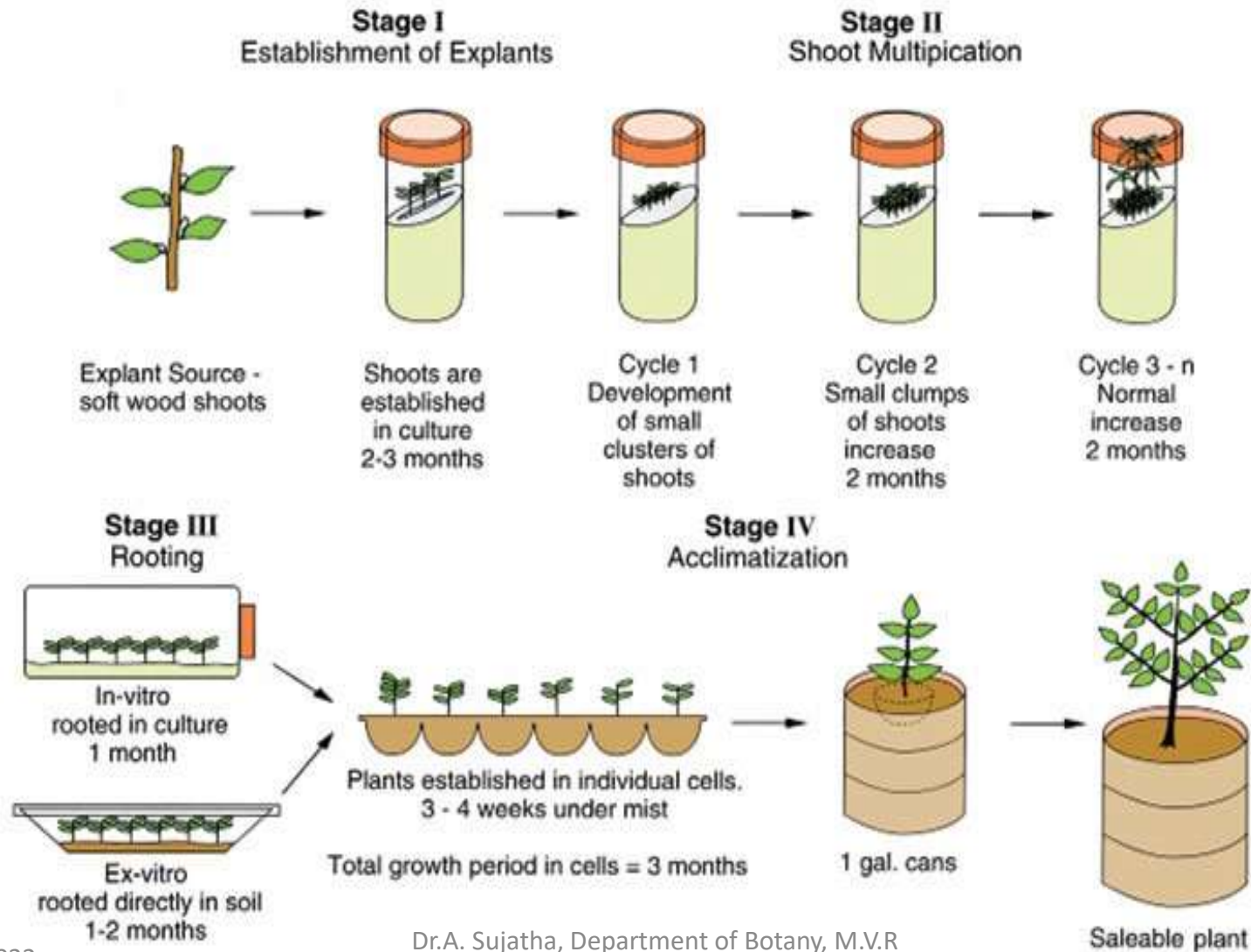
- Process taking place in a test tube, culture dish, or elsewhere outside a living organism.

What is a cell and tissue?

- **Cells** are the smallest, structural and functional unit of an organism, which is characteristically microscopic.
- **Tissue** is a group of **cells** that have similar structure and that function together as a unit.



Micro propagation - stages



Micro propagation -Tissue Culture

- Plant Tissue Culture is a process that uses plant material in a growing medium to grow new plantlets under controlled and sterile conditions (*in vitro*).
- This is the most recent and advanced technique
- The plant material is miniature plant tissues called **explants** grown aseptically in test tubes.
- It is extensively used for commercial purposes to produce clones of plants or mass produce plants.
- It also provides several advantages over the other methods.

Plant tissue culture



Advantages of tissue culture technique

1. It allows for the production of clones or exact copies of the mother plant.
2. Plants with desired traits or characters can be grown using this technique.
3. It is beneficial in propagating plants without seeds.
4. It allows the production of plants in a shorter period of time compared to traditional techniques.
5. Plants that are difficult to grow by traditional methods can be grown by this method.
6. Disease-free plants can be produced.
7. Mass production of plants is possible with this technique.
8. Enhance productivity.
9. Easy transportation of plants.

Disadvantages of tissue culture

- Tissue Culture can require **more labor and cost more money**.
- There is a chance that the propagated plants will be **less resistant to diseases** due to the type of environment they are grown in.
- While the success rate is high if the correct procedures are followed, **success with the tissue culture is not a guarantee**.
- There is still a chance that the process triggers a secondary metabolic chemical reaction, and the new explants or cells' growth gets stunted, or even die off.

6. Repairing of damaged portion of plant is possible by asexual methods through grafting .
7. Inferior quality crown of the existing plants can be improved.
8. It is possible to grow multiple varieties on the same plant.
9. Number of plant per hectare is more due to its small canopy and restricted growth
10. Vegetative propagation helps in rapid multiplication with modern techniques like tissue culture.

4. Hybridization in these plants is not possible because there is no variation in the progeny; these methods are not suitable for development of a new variety
5. The required propagation structures for this method are: green house, mist chamber with cooling pad, polytunnels/screen house, tissue culture room with temperature and light control.
6. The required hardware are root trainers, other containers, grafting machine, secateurs, cutting knife, scissors and vermiculite.

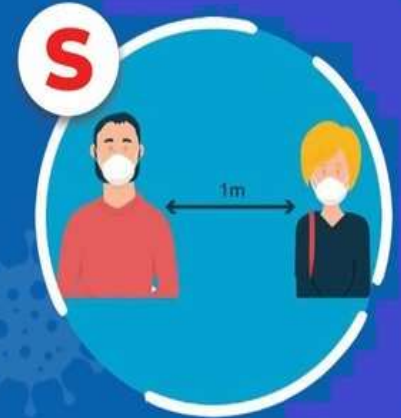
మీ ఇంటి నుండి బయటకు వచ్చినపుడు S M S తప్పక పాటించండి



Sanitize



Mask



Social Distance

తరచుగా శానిటైజర్/సబ్బుతో గాని చేతులను శుభ్రపరుచుకోండి, ఇంటి నుండి బయటకు వెళ్ళినపుడు తప్పక మాస్క్ ధరించండి మరియు కనీసం 6 అడుగులు సోషల్ డిస్టెన్స్ (భౌతిక దూరం) పాటించండి.



Thank you