V Sugarcane		
Termites	Attack planted sets from cut ends or eye buds after germination the whole cane with roots may be spoiled	Mix neem cake in soil. Apply Endosulfan near roots.
Top borer	Larvae entering and traveling the whole distance of midrib, larvae bore into central yellow whorls of leaves. And attack on top nodes gives rise to side shoots from a bunchy top due to cessation of growth	Saw resistance variety apply 45 carbaryl or endosulfan or spray 5.05% monocrotophos
Early shoot borer	Larvae bores into stem of 1 to 3 month old crop and causes dead heart	Collection & destruction of affected tillers
Leaf hopper	Nymphs and adults remain on undersurface of leaves and suck the sap causing yellowing and withering of leaves sooty moulds develops due to honey dew.	Spray 0.05% Monocrotophos
Sugarcane white fly	Nymphs and adults suck the sap of leaves, sugar recovery is also affected	Spray 0.1% Malathion
Gurudaspur borer	Larvae enter the shoots and move upwards in spiral manner, make minute punctures on the rind from with in side and top whorl leaves dry up	Spray 0.07% Endosulfan
VI Cotton		
Cotton leaf roller	Caterpillars roll the leaves and feed within	Dust 10% Carbaryl
Spotted bollworm	Caterpillars bore into the top shoot and later into the green bolls, feed inside and may bore into buds & flowers	Endosulfan 35 EC 2.5 lit/ha
Pink boll worms	They bore into buds, flowers and bolls and feed inside	Heat treatment of seeds at $60^{o}C$. kills larvae
Cotton jassids	Small greenish leaf hoppers on the under side of leaves suck the cell sap	Sow resistant variety spray 0.02% Monocrotophos
Red cotton & dusky cotton bug	They suck the sap of leaves and bolls while later suck sap from immature seeds and strain the lint.	Endosulfan 4%
Cotton aphids	Nymphs and adults appear in colonies on tender portions of plants sucking the sap	Sow resistant variety spray 0.02% Monocrotophos
VII **Green gram, Black gram, Red gram, Cow pea**		
Stem fly	Same under jawar	
Hairy caterpillar	Same under jawar	
White fly	Larvae feed on lower buds, flowers and developing seed.	Spray 0.05% Monocrotophos or 0.07% Endosulfan

Notes

VIII) Turmeric		
Shoot borer	Bore into central shoot causing dead heart	Destroy affected shoots spray 0.04% Endosulfan
Rhizome fly	Plants are affected	Seed healthy seed material
IX) Peas		
Pod borer	Larvae bore into the pod and feed on seed	2 or 3 application of Carbaryl 1kg/ha
Stem fly	The place where the larvae and pupae are present, becomes swollen and start rotting	Crop should be sown in second fortnight of October
Leaf miner	Larvae makes tunnel is the leaves	i) Collection & destruction of attacked leaves ii) spray Chlorpyriphos 0.05%
X) Gram		
Cut worm, pod borer, caterpillar, stem fly	Same as Peas	
XI) Ground nut		
Ground nut leaf miner	Larvae feeds on leaves and attacked plants do not grow property insect remains active from July to Dec	Spray Demecron 100cc @ 1 ml / 4 lit of water
Aphids	Adults and nymphs feed on young shoots, growth of plant is stunted, flowers and pods are also infected	Spray Monocrotophos
Hairy caterpillar	Caterpillar feeds on lower surface of leaves and affected crop is completely defoliated	Collect egg masses and destroy them
XII) Safflower caterpillar, fly aphids, stem fly		
Same as Ground nut, peas		
XIII) Soyabean		
Pod borer	Larvae bore into the pod and feed on seed	2 or 3 application of Carbaryl 1kg/ha
Stem fly	The place where the larvae and pupae are present, becomes swollen and start rotting	Crop should be sown in second fortnight of October
Leaf miner	Larvae makes tunnel is the leaves	i) Collection & destruction of attacked leaves ii) spray Chlorpyriphos 0.05%
XIV) Sunflower		
Cutworms	Seedlings are cut at ground level in patches through out the field.	6 liter of Aldrin 30 EC
Caterpillars aphids, Jassids	damage is sporadic suck the cell sap	Endosulfan 35 EC or nuvan 100EC 500ml /ha and metasystox 25EC or Rogar 1 lit/ha

INTEXT QUESTIONS 6.2

Match the following:

A	B
1) Rice hispa	a) Cotton
2) Army worms	b) Sugar cane
3) Termites	c) Paddy
4) Spotted boll worm	d) Jowar

6.5 PESTS OF VEGETABLE CROPS

Sr. No.	Name of pest	Crops infested	Nature of damage	Control measures
1	Fruit borer and shoot borer	Tomato, Brinjal, okra	Bore in to tender shoots and fruits	Collect and destroy affected parts. Spray Nuvacron (15ml/10 lit)
2	Hoppers	Tomato, Brinjal, Okra, Cucurbits	Suck the sap from leaves	Spray Nuvacron (15ml/10 lit)
3	White fly	Tomato, chilli, okra	Suck the sap from leaves	Regular spraying of Dimethoate at fortnightly interval
4	Aphids	Tomato, chilli, okra	Suck the sap from leaves	Spray Dimethoate (30%) 1-2 ml / 1 water weekly
5	Mites	Brinjal, chilli, cabbage	Attack under side of leaf, cause leaf curl	Spray Dimethoate (1-2ml/l) dust lime sulphur.
6	Leaf beetles	Brinjal	Attack small plants and eat away leaves	Spray Malathion (2ml/l)
7	Red pumpkin beetles	Cucurbits	Adult beetle feeds voraciously on foliage	Weekly spray Malathion (2ml/l)
8	Fruit fly	Cucurbits	Lays eggs in the fruit, maggots eat the pulp.	Use pheromone traps using Methyl Eugenol
9	Cabbage butter fly	Cabbage	Caterpillar bores in cabbage head	Spray 50% Malathion 1ml / lit
10	Pod borer	Beans, peas	Damages developing pods and feeds as beans	Spray Fenvalerate 20% (1m/ 4l) at flowering stage

Module-2

Notes

Pests of flower crops

Sr. No.	Name of pest	Crops infested	Nature of damage	Control measures
1.	Aphid	Rose carnatio	Suck the sap from leaves, branches	Spray Metasystox
2.	Mites	Rose tuberose chrysanthe-mum	Suck the sap from leaves	Use Movrik, Pentak
3.	Leaf miner	Rose, aster	zigzag interveinal chlorosis	Spray Dichlorovos
4.	White fly	Rose	Suck the sap green-yellowish	Diazinon
5.	Thrips	Rose, carnation lilium, tuberose	Suck the sap from leaves	Nuvacron

INTEXT QUESTIONS 6.3

Match the followings:-

A	B
1. Fruit fly	a) Rose
2. Fruit borer	b) Tomato
3. Pod borer	c) Brinjal
4. Aphids	d) Cucurbits
5. Mites	e) peas

6.6 PESTS OF FRUIT CROPS

Sr. No.	Name of pest	Crops infested	Nature of damage	Control measures
1	Hoppers	Mango	Young ones and adults suck the sap from leaves and inflores-cence	Spray Cypermethrin (3m/10l), Fenvalrate (5ml) fenthoate, Quinolphos Dimethoate or Monocrotophos alternatively for 5 times
2	Stem borer	Mango, cashew	Caterpillar bore the bark and the wood. Stem dries up	Inject Dichlorovos (5m/l) from top most hole and seal all other holes.

3	Mealy bugs	Mango, guava, grape	Suck the sap from leaves, flowers, fruits resulting them weak appearance	Spray Monocrotophos
4	Shoot borer	Mango, cashew	Bores through twigs and infloresc-ence	Spray neem extract
5	Leaf Webber	Mango, cashew	Join the leaves (tender)	Collect and destroy affected leaves
6	Fruit borer	Pomegra-nate	Insert the fruit and bore it	Collect and destroy affected fruit / use light trap
7	Shoot hole borer	Pomegra-nate, grape, chiku,	Bore stem, root and branches	Spray Monocrotophos
8	Aphid	Pomegra-nate, grapes, banana, ber	Number of nymphs and adults, suck the sap from leaves, flowers	Spray Dimethoate or Monocrotophos
9	Thrips	Mango, pomegran-ate, citrus	Suck the sap and scrap the surface	Mix Methyl Dimeton 30ml. or Quinolphos 30ml. in 10 lit. water and spray
10	Fruit fly	Mango, guava	Maggots eat fruit pulp and fruit rots	Use pheromone trap
11	Bark borer	Guava, pomegran-ate, sapota	Bore the bark of stem	Apply Carbaryl 80gm/10lit. of water
12	Flea beetle	Grape	Eat new sprouts and made holes on leaves	Spray Malathion 10ml/10lit of water
13	Mites	Mango, grape	Suck the sap from leaves flowers, fruit	Spray Sulphur 25gh or Monocrotophos 15ml. /10lit. of water
14	Lemon butterfly	citrus	Caterpillar bite and chew leaf, voracious feeder	Use trap to collect adults
15	Fruit sucking moth	Citrus pomegranate	Adult moth suck the juice from fruit	Use light trap

INTEXT QUESTIONS 6.4

Match the followings

A	B
1. Bark borer	a) Citrus
2. Stem borer	b) Pomegranate
3. Fruit sucking moth	c) Cashew
4. Lemon butterfly	d) Mango

6.7 WHAT YOU HAVE LEARNT

Different field / horticultural crops are attacked by different pests causing reduction in the yield and quality of crop plants. Pest is an organism that causes any type of damage to the plant. Insects, mites, rodents, animals, birds are the different type of pests that attack the crop plants. The pests can be controlled by mechanical, physical, cultural, chemical and biological methods. Integrated pest management uses all the above methods along with natural extracts for pest control.

6.8 TERMINAL QUESTIONS

1) Define pest and explain the different type of pests on field / horticultural crops.
2) Enlist the pest control methods and explain any two of them.
3) Write a note on integrated pest management.
4) Write different pests attacking the crops Paddy, Wheat, Sugar cane with their symptoms and control measures.
5) Write different pests attacking the flower crops with their symptoms and control measures.
6) Write different pests attacking any three vegetable crops with their symptoms and control measures.
7) Write different pests attacking four fruit crops with their symptoms and control measures.

6.9 ANSWER TO INTEXT QUESTIONS

6.1

1) Segmented
2) 8
3) Pest
4) Insecticides or pesticides
5) Biological

6.2

Match the followings:

a) Paddy

b) Jowar

c) Sugar cane

d) Cotton

6.3

Match the followings:

a) Cucurbits

b) Brinjal

c) peas

d) Tomato

e) Rose

6.4

Match the followings:

a) Mango

b) Cashew

c) Pomegranate

d) Citrus

SUGGESTED ACTIVITIES

A. Prepare insect box of various pests occurring on vegetable crops.

B. Prepare insect box of various pests occurring on fruit crops.

C. Prepare insect box of various pests occurring on field crops.

7

WEEDS AND WEED CONTROL

7.1 INTRODUCTION

Weeds are the plants, which grow where they are not wanted. They grow in fields where they compete with crops for water, soil nutrients, light and space and thus reduce crop yields. They also harbour insects, pests and micro-organisms. Certain weeds release into the soil the inhibitors or poisonous substances which are harmful to the plants, human being and livestock. They increase the expenditure on labour and equipment, render harvesting difficult and reduce the quality and marketability of agricultural produce.

7.2 OBJECTIVES

After reading this lesson, you will be able to understand:-

- Characteristics of weeds.
- Damages caused by the weeds
- Weed control methods viz. preventive measures and control methods like Mechanical, Cropping, Biological & Chemical

7.3 DEFINITION AND CHARACTERISTICS OF WEEDS

Definition:

Any plant not sown in the field by the farmer and grow where they are not wanted is called a weed.

Weeds are like any other crop plants in size, form, morphological and physiological characters but possess the following characteristics on account of which they are considered as enemy of crops.

Characteristics of Weeds:

1) The weeds seed germinate early and the seedlings grow faster. They being hardy compete with the crop plants and deprive them of light, moisture and nutrients.

2) They flower earlier, run to seed in profusion and mature ahead of the crop. They are, therefore, difficult to control and it may be even impossible to eradicate some weeds completely.

3) They are unuseful, unwanted and undesirable.

4) They are harmful to crops, cattle and human-beings.

5) They can survive even under adverse conditions.

6) They are prolific and have a very high reproductive capacity.

7) Viability of seeds remains intact, even if they are buried deep in the soil.

8) The seeds may have special structures like wings, spines, hooks, sticky hairs etc. on account of which they can be easily disseminated over long distance.

9) Many weeds like doob are vegatatively propagated and spread rapidly all over the field even under adverse conditions.

Classification of Weeds

Weeds may be classified on the basis of:-

i) Life cycle

ii) Place of occurrence

iii) Plant family

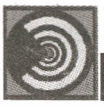
iv) Dependence on the other hosts

v) Soil types

The important classification of weeds is on the basis of life cycle.

Life cycle:- Weeds are classified according to the time required for the completion of their life cycle.

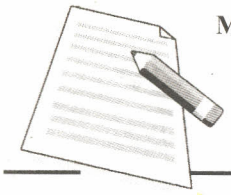
1) Annual Weeds:-	Kharif season weeds appear with the onset of monsoon and their life cycle finish when rainy season is over e.g.: hazardana.
2) Biennial Weeds:-	They take at least two seasons to complete, their life cycle.eg. Jangli Gobhi. These are found in temperate climate.
3) Perennial Weeds:-	They continue for more than two years, e.g. Lavala or motha, Kans, doob.



INTEXT QUESTIONS 7.1

Match the followings:-

1) Annual weeds	a) Doob
2) Biennial weeds	b) More than two years
3) Perennical weeds	c) Two season to complete life
4) Vegetative propagation	d) One season to complete life cycle



7.4 DAMAGES CAUSED BY WEEDS

Weeds are harmful in many ways. The damages caused by them are as under:

1. Reduction in crop yield:- Weeds compete with crops for water, nutrients and light. Being hardy and vigorous in growth habit, they grow faster then crops and consume large amount of water and nutrients, thus causing heavy losses in yields.
2. Increase in the cost of cultivation:- Tillage operations are done to control weeds and it is generally estimated that on an average about 30 percent of the total expenditure for crop production is on tillage operations and more labour is employed for weeding. This results in increasing cost of cultivation and reducing the margin of net profit.
3. The quality of field produce is reduced:- When the crop is harvested from a weedy field the seeds of weeds get mixed with the main crop which results in lowering the quality of the produce .e.g. seeds of weeds in wheat, gram etc. Similarly, bundles of many leafy vegetables like methi or palak contain green plants of weeds. They fetch lower prices in the market.
4. The quality of the livestock products is reduced. Certain weeds eg. Hulhul when eaten by milch cattle impart an undesirable flavour to milk. Similarly weeds like gokhru get attached to the body of the sheep and impair the quality of wool. Certain poisonous weeds like Datura may cause death of cattle if they are unknowingly eaten by cattle.
5. Weeds harbour insect, pests and diseases:- Weeds either give shelter to various insects, pests and diseases or serve as alternate hosts.
6. Weeds check the flow of water:- Weeds block drainage and check the flow of water in irrigation channels and field channels thereby increasing the seepage losses as well as losses through overflowing. The irrigation efficiency is also reduced.
7. Weed secretions are harmful:- Heavy growth of certain weeds like quack grass or motha lower the germination and reduce the growth of many crop plants. This is said to be due to the presence of certain phytotoxins in these weeds.
8. Weeds are harmful to human beings:- certain weeds cause irritation of skin, allergy and poisoning in human beings.
9. Weeds cause quicker wear and tear of farm implements; they get worn out early and cannot work efficiently unless they are properly sharpened or mended.
10. Weeds reduce the value of the land:- Agricultural lands which are heavily infested with perennial weeds like kans always fetch less price, because such lands can not be brought under cultivation without incurring heavy expenditure on labour and machinery.

Weed control Methods

Before adopting an appropriate method for effective control of weeds, it is essential to know about the weed seeds dispersal, mode of propagation, crop-weed competition. Nature has provided weeds either a number of devices that

help them to be disseminated widely. The agents which help the dispersal of weed seeds far and wide are water, wind and animals including man. Other means are impure seeds, sewage, sludge, organic manures, agricultural implements, birds, drainage water.

The weed control methods can be broadly classified as preventive and control methods. Preventive measures include all such measures through which the introduction of weeds into the crop fields could be avoided. Control methods include ways of their control and eradication after they have grown in the crop field.

Preventive Measures

Since weeds multiply at a much faster rate and are hardier than crop plants, they always have an upper hand if they are allowed to establish in the field. Therefore, it is difficult and costly to eradicate them.

The preventive measures are:

i) Use clean seeds which free from weed seeds.

ii) Use-well decomposed cow-dung or compost.

iii) Cut weeds before seeding.

iv) Remove weed growth.

Control Methods

They are classified as:

1. Mechanical methods
2. Cropping or cultural methods
3. Biological methods
4. Chemicals methods

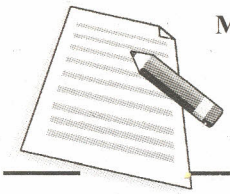
1 Mechanical Method

The most common ones are hand pulling, hand weeding, burning, flooding, ploughing, and harrowing etc. Pulling the weeds by hand or with the help of sickle is the oldest and most efficient method. Weeds can be easily uprooted after a good soaking irrigation or rain. This method is costly and time consuming.

2 Cropping or cultural methods

These include proper crop rotations so that neither annual nor perennial weeds have a free growth. Continuous cropping with the same cropping system leads to greater infestation of fallow helps in controlling the weeds effectively. Intertilled crops like cotton and crops like potato / groundnut which necessarily require digging of soil help in reducing the infestation of weeds.

Growing crops like sannhemp which have a very vigorous and leafy growth help in smothering the weeds. A suitable combination of mechanical methods and crop rotation is very effective method of weed control.



3 Biological Methods

Plant or animal enemies of the weeds maybe used for their destruction. The most notable example is control of prickly pear by using cochineal insects. The Kans grass is controlled by growing basket grass, the roots of which are supposed to excrete substances inhibitory to Kans. Presently, the biological control of weed is including the use of plant pathogens, nematodes, parasitic plants and other organisms.

Biological methods have been found to be very efficient and economical provided right type of predators, which even under starvation conditions will not feed upon cultivated crop are found out and introduced.

4 Chemical method of weed control

Any chemical that kills the plants or inhibits their growth is known as herbicide and the method of its application is called chemical method of weed control. Such chemicals may be classified as:) selective herbicides, and ii) Non-Selective herbicides. Each group is further divided into two groups viz. foliage applied herbicides are again grouped into two categories viz. contact & Tran located herbicides.

Non-selective herbicides are those chemicals which kill the entire vegetation of the treated area and hence they are applied only on waste lands like canal banks, roadsides etc.

Selective herbicides:- such chemicals kill only those plants for whom they have selectivity. They are as under:

A) **Foliage applied herbicides:-** These chemical are applied over the leaves or green foliage. They are:

   a) **Contact herbicides: -** They kill the plant parts which come in contact with the applied chemical. Weed killing efficiency depends upon their concentration, uniformity in coverage of spraying, stage of weed, weather conditions eg. Dicryl, potassium cynate, sodium arsenite.

   b) **Translocated herbicides:-** Such chemicals are absorbed by the treated foliage. When sprayed, they are translocated to the roots which are later destroyed. These are best for perennial weeds. They are also known as systemic herbicides eg. 2-4 D.

B) **Soil applied herbicides**:- They are used to keep the field completely free from plant growth.

   a) **Soil fumigants:-** They form vapour or gas and diffuse through soils. When applied, they kill all the plant growth. They have relatively short stability of few weeks after which the crop seed may be sown or planted in the treated field eg. Carbon-disulphide, methyl bromide.

   b) **Soil Sterilants:-** Such chemicals sterilize the soil and make it unfit for any vegetation for varying period of time depending on the nature and dose of the chemical used, soil type, organic matter content of the soil, rainfall etc. eg. Simazine and Atrazine.

C) **Aquatic Applications:-** Such chemicals are used by dissolving or emulsifying in water bodies viz canals, ditches, ponds, lakes etc. to control submerged aquatic weeds. eg. Aqualin, Endothal.

Methods of herbicide application

i) Pre-sowing treatment:- Application of herbicide before sowing or planting of the crop.

ii) Pre-emergence treatment:- In this method, the herbicide is applied after sowing or planting of the crop but before the emergence of the crop.

iii) Post emergence treatment:- In this method herbicide is applied after full emergence of crop plants.

iv) Directed application:- In widely spaced row crop, the herbicides are sprayed over the space left between the rows without treating the crop foliage or crop shoots. Non selective herbicides are applied in this method.

v) Band application:- In this method the herbicides are sprayed only over the crop rows and the inter row spaces can be given. Mechanical treatment. This method is adopted for expensive herbicides, which may not be used for overall application due to high costs. Normally soil applied herbicides are applied in this case.

INTEXT QUESTIONS 7.2

Match the followings:

A		B	
i)	Mechanical Method	a)	Form vapour or gas in soil
ii)	Biological	b)	Systemic Herbicides
iii)	Contact Herbicide	c)	hand Pulling
iv)	Translocated Herbicide	d)	Kill all the plants part
v)	Soil Fumigants	e)	Cochineal Insects

7.5 WHAT YOU HAVE LEARNT

A weed is a plant growing where it is not desired. They not only compete with crop plants for plant nutrients, moisture, space and sunlight but also interfere with agricultural operations increasing the cost of labour and tillage. And ultimately affect the yields and quality of farm produce adversely. Weed control methods are classified as preventive and control methods. Control methods are further classified as Mechanical, cropping or cultural method, Biological methods and chemical methods. Any chemical that kills the plants or inhibits their growth is called herbicide. These herbicides are classified as selective and non selective herbicides.

7.6 TERMINAL QUESTIONS

i) Define weed and write the characteristics of weeds.

ii) Write the damages caused by the weeds.

iii) Write the control methods of weeds

iv) Write the methods of application of herbicides.

v) Write about the selective and non-selective herbicides for Weed Control

7.7 ANSWER TO INTEXT QUESTIONS

7.1

1) One season to complete life cycle
2) Two season to complete life cycle
3) More than two years
4) Doob

7.2

i) Hand pulling
ii) Cochineal insects
iii) Kill all the plant parts
iv) Systemic herbicides
v) Form vapour or gas in soil

SUGGESTED ACTIVITY

Prepare weed album of different weeds occurring in crop plants.

8

PLANT PROPAGATION AND NURSERY

8.1 INTRODUCTION

Propagation is a way of multiplying plant species. It is being practiced for production and maintenance of plant seedling. These seedlings are used for commercial production. Various methods are used for propagating useful plants. Different plants are propagated by different methods with the main objective of multiplication of a particular plant species. For completing needs of growing population, multiplication of useful plant is very important. Hence, it is necessary to learn the methods of propagation and nursery techniques of raising different plants.

8.2 OBJECTIVES

After reading this lesson, you will be able to:

- understand techniques of propagation.
- learn different methods of propagation.
- acquire techniques of development and management of nursery.

8.3 PLANT PROPAGATION

We will define propagation as production of new individuals from a selected plant having all the characters of the original one.

Need of Plant Propagation

With the development of new techniques in plant breeding new varieties and better type of selected plants came in to cultivation. They have good characteristics and high yielding performance. Sexual method of propagation helps to produce superior plants by means of hybridization and selection. In sexual method of propagation there is variability in characters due to natural crossing of the plants. On the other hand asexual methods produce plant identical to that of mother plant in all characters.

So according to the need, method can be used to maintain their desirable characteristic. It can be done without any appreciable change by asexual reproduction and for formation of new varieties or for the transformation of desirable characters the sexual method of propagation can be employed.

The main objective of plant propagation is to obtain plants, which will be similar to the original plant. The proper method will give all characters of parent plant. It is therefore, important to select proper method of propagation.

If a plant group reproduces true to type seed the cultivar is known as line. The line is homozygous and if self-pollinated the seed will produce plant like mother plant. Many plants such as vegetables and flowering annuals are homozygous. Such plants give similar progeny like their mother plant. For cross pollinated and perennial plants, asexual methods of propagation are useful.

Nowadays plant propagation has been transformed into a large industry, which involves not only multiplication of plants for sale but also provides services and consultation.

Objectives of Propagation

Objectives of the propagation is as under:

1) To multiply the different species in large number.
2) To protect the plant species which are endangered.
3) To improve the characteristics and quality of the plants.
4) To produce quality and healthy plants on commercial base.

Selection of Propagation Method

Plant propagation method is selected on the following basis:

1) The selected method should be suitable and applicable to the particular plant.
2) The selected method should be cheap and easy.
3) The selected method should require minimum material and man power.
4) The selected method should be conventional and successful for particular species.

INTEXT QUESTIONS 8.1

A. Fill in the blanks:

1. Plant propagation helps in protecting _____ plant species.
2. For cross pollinated perennial plants _____ method is more suitable.
3. Seasonal plants are propagated by means of _____ .

8.4 PROPAGATION METHODS

Plants are propagated by two methods:

1. Sexual propagation or seed propagation.
2. Asexual or vegetative propagation by vegetative plant parts like root, stem, leaf etc.

Seed propagation

Seeds can be defined as a dormant plant which develops into a complete plant subjected to required environmental conditions.

Germination of seed –

The activation of the metabolic machinery of the embryo leading in the emergence of a new seeding plant is known as germination.

Germination is essentially a quickening of the growth of the embryo.

As germination proceeds, the growing points of the radical and plumule divide rather rapidly. Usually the radical emerges from the seed coat first, proceeds downward, and develops into the root system, the plumule proceeds upward and develops into the shoot system. Germination is entirely a food utilization process. Processes going on in seed during germination are:

1) Absorption of water;
2) Secretion of enzymes and hormones;
3) Hydrolysis of stored food into soluble form; and
4) Translocation of soluble foods and hormones to the growing points. These processes are either wholly, or in part influenced by the food reserves, hormone supply, water supply, oxygen supply and temperature level.

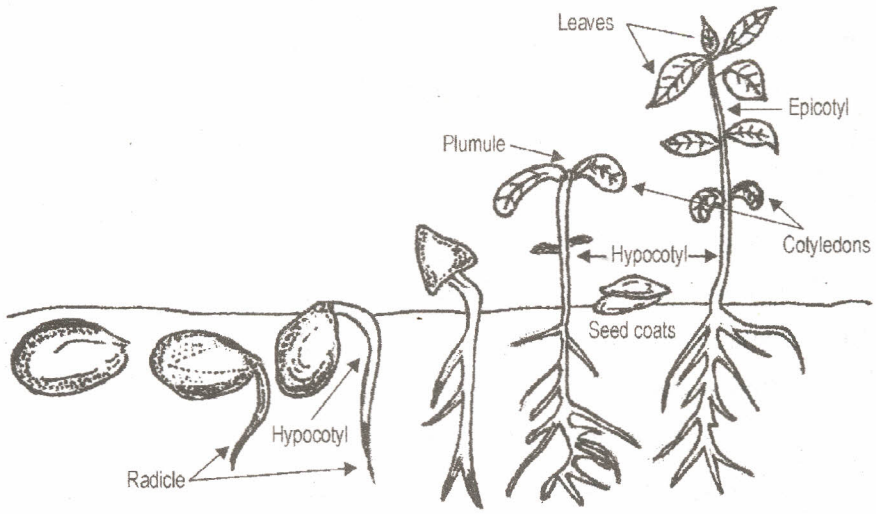


FIGURE- Germination of Seed

Advantages of Sexual Propagation :-

1) This is very simple and easy method of propagation.
2) Some species of trees, ornamental annuals and vegetables which cannot be propagated by asexual means should be propagated by this method. E.g. Papaya, Marigold, Tomato etc.
3) Hybrid seeds can be developed by this method.
4) New variety of crops are developed only by sexual method of propagation.

5) Root stocks for budding and grafting can be raised by this method.

6) The plants propagated by this method are long lived and are resistant to water stress.

7) Transmission of viruses can be prevented by sexual method.

8) Seed can be transported and stored for longer time for propagation.

Disadvantages of sexual propagation :-

1) Characteristics of seedling propagated by this method are not genetically true to type to that of their mother plant.

2) Plants propagated by sexual method requires long period for fruiting.

3) Plants grow very high, so they are difficult for intercultural practices like spraying, harvesting etc.

4) The plants which have no seeds cannot be propagated by this method. E.g. Banana, fig, Jasmine, Rose etc.

Asexual propagation

It is also called as vegetative propagation as it involves only vegetative parts without any sexual plant parts. The plant parts like leaf, stem, root and other root producing plant organs are used. The new individual propagated through this method is true to type. The commercially important fruit crops are propagated by vegetative method.

Types of vegetative propagation

1. Plants parts separated from mother plants.(Cuttings)

   Types of cuttings:

   A) Stem cutting:

      1) Hardwood cutting - Fig

      2) Semi hardwood cutting - Hibiscus

      3) Softwood cutting - Pilia

   B) Leaf cutting - Begonia

   C) Root cutting. - Curry leaf

2. Still attached to mother plant.

   A) Layering:

      1) Simple layering - Guava

      2) Tip layering - Goose berry

      3) Mound layering - Apple

      4) Serpentine layering - Jasmines

   B) Air layering (Gootee layering) -Thuja

   C) Suckers - Banana

   D) Runners - Straw berry

3. Separated modified parts from mother plants:
   A) Separation:
      1) Corm - Gladiolus
      2) Bulb - Tube rose
   A) Division of plant parts:
      1) Stem Tubers - Potato
      2) Tuberous roots - Asparagus
      3) Rhizome - Ginger
4. Grafting:
      1) Approach grafting / inarching - Sapota
      2) Stone grafting - Mango
      3) Side grafting - mango
      4) Root grafting -
      5) Bridge grafting -
      6) Butters grafting -
      7) Cleft grafting -
      8) Softwood grafting -
      9) Tongue grafting / whip grafting –
5. Budding:
      1) Shield / 'T' budding - Rose
      2) Patch budding - Ber
      3) Ring budding - Ber
      4) Flute budding
      5) Chip budding
      6) Forkert budding
6. Tissue Culture – Banana, Gerbera, Carnation

Advantages of Asexual propagation

1. The horticultural crops which donot produce viable seeds are propagated by vegetative method.
2. Most of the important fruit crops are cross pollinated and are highly heterozygous. When propagated through seeds, the progenies shows large variation, so vegetative propagation is remedy for these crops.
3. The asexual propagation method gives true to type plants.
4. The vegetative way propagated plants bear fruits early.
5. In case of fruit crops where root stocks are used, the root stocks impart insect or disease resistance to the plant.

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6. Vegetative propagation helps to alter the size of the plant. i.e. dwarfing effect. This helps for spraying, intercropping & harvesting of crops easy and economical.
7. By grafting method different variety of fruit crop can be grown & harvested.
8. Inferior quality fruit plants can be converted into good quality plants.
9. By means of bridge grafting a repairing of injured plants can be done.

Disadvantages of the vegetative propagation:

1. By vegetative propagation new variety can not be developed.
2. It is an expensive method of propagation and required specialized skill.
3. The life span of vegetatively propagated plants is short as compared to sexually propagated plants.
4. As all the plants are homozygous the whole plantation may get attacked by a particular pest or disease.
5. Viral diseases could be transferred through vegetative parts.

INTEXT QUESTIONS 8.2

A Fill in the blanks:

1. Asexual propagation is also known as _____ propagation.
2. In Banana _____ method of propagation is used on commercial scale.
3. Shield budding is practiced in _____ fruit crop.

8.5 PROPAGATION MEDIA

Propagation medium is a substance in which plant parts are placed for propagation. Propagation medium provides initial support and favourable conditions for generating seedlings.

For successful results of propagation by seed or by asexual means, quality media should be used.

Qualities of good medium

Good quality medium should have following characterstics:

1) The medium should be firm enough to hold propagating material.
2) It should not shrink excessively when dry.
3) It should be sufficiently porous, having ability to retain and supply sufficient moisture.
4) It should be well drained and free from weed seed.
5) The medium should have neutral pH or suitable pH (6 to 8) for plant propagation.
6) It should be free from diseases and high concentration of salts.
7) Propagation medium should supply nutrition to the propagules.

The different media commonly used for propagation are:-

1. Soil
2. Sand
3. Leaf Mould
4. Sphagnummoss
5. Vermiculite
6. Perlite
7. Coco peat
8. FYM
9. Saw dust
10. Soil mixture

INTEXT QUESTIONS 8.3

A Fill in the blanks:

1. A good medium should have good _____ Capacity.
2. Propagation medium should have _____ pH.
3. _____ is a medium used on large scale.

8.6 PROPAGATION BY CUTTING

Cutting is a method of vegetative propagation in which the portion of stem, leaf or root detached from mother plant induced to rooting and shooting in a proper medium.

Types of cutting:

1) Stem cutting-

a) Hard wood cutting : Pomegranate
b) Semi hard wood cutting : Hibiscus
c) Soft wood cutting : Colcous

2) Leaf cutting-

a) Leaf blade cutting : Bryophyllum
b) Leaf vein cutting : Begonia
c) Leaf edge cutting : Pepromia
d) Leaf bud cutting : Begonia

3) Root cutting- : Guava

Advantages of Cutting –

In this method rooting is induced after detaching parts from mother plant, so it is very necessary to have live cells of stem, leaf or roots up to rooting. For this purpose cuttings should be kept in proper environmental conditions.

1) This type of propagation does not require the special technique as like budding or grafting.
2) There is no problem of incompatibility with root stock which is always shown in budding and grafting.
3) In a little period of time we can get more than one feet high plant.
4) The genetical characteristics of plants propagated by cutting are true to type

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Limitations of Cutting –

1) Certain fruit plants have difficulty in rooting.
2) Possibility of mutation.
3) Success differs largely according to plant species and season.

INTEXT QUESTIONS 8.4

A Fill in the blanks:

1. Leaf cutting is followed in _____ plants.
2. _____ plants are difficult to root.
3. In softwood plants _____ cuttings are used.

8.7 PROPAGATION BY LAYERING

Layering is a method of propagation by which adventitious roots are caused to form on a stem while it is still attached to the parent plant.

Types of Layering:

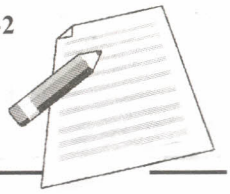
1) Tip layering
2) Simple layering
3) Trench layering
4) Compound or serpentine layering
5) Air layering Using sphagnum moss
6) Mound layering

Advantages of Layering:

1) The parent plant supplies the new individual with water and food, particularly carbohydrates and proteins, and hormones, particularly the auxins, until it makes its own food and hormones.
2) Comparatively bigger plant could be obtained through layering.
3) It is possible to avoid mutagenic effects in certain species that happened if propagated by cutting.
4) It is possible to generate few individuals of important species with minimum propagation facilities.
5) It is possible to propagate difficult to root plants vegetatively.

Disadvantages of Layering:

1) This method of propagation is limited to plants which form growing points readily.
2) It is difficult to produce large number of plants through this method. In other words, this method does not use propagation material economically.
3) This method is short but time consuming and little difficult in some cases. This method is laborious, cumbersome and expensive.



INTEXT QUESTIONS 8.5

A Fill in the blanks:

1. _____ medium is used for air layering.
2. Layering is _____ method as compared to cutting.
3. Layering has _____ success as compared to cutting.

8.8 PROPAGATION BY GRAFTING AND BUDDING

Grafting is an art of insertion of a scion into the stem of the root stock in such a way that union takes place and the combination continues to grow.

Budding is a type of grafting. Budding can be defined as an art of insertion of a single mature bud into the stem of the root stock in such a way that the union takes place and the combination continues to grow.

Advantages of grafting and budding :-

- The plants which can not be propagated by other vegetative means viz. cutting, layers, or division can be multiplied, preserved and perpetuated by grafting and budding.
- Grafting and budding can be very well adopted to convert inferior plant of established trees into superior one. Variety of the established plant can be changed by top working.
- Root stocks influence size and vigour of tree and quality of fruits.
- Root stocks impart disease resistance to the scion.
- Some root stocks are tolerant to saline and alkaline conditions and high moisture contents of the soil.
- Bridge grafting or buttress grafting helps to repair the damaged trunk or roots of the plant.
- Special form of plant growth obtained by grafting and budding.
- Novelty can be produced in nature by growing several types of flower or fruits on a single stock.
- Early induction of flowers and fruits.
- Budding and grafting are used for indexing the presence of virus disease. Virus susceptible stocks are used to detect the viruses. These are called indicator plants.

Disadvantages of grafting and Budding:

1) New varieties cannot be developed.
2) These are extensive methods of propagation. They require specialized skill.
3) The life span of grafted and budded plants is short as compared to seed propagated plants.
4) Spread of viral diseases may occur through this method.

Types of Grafting:

A) Scion attached methods –

These are the methods of grafting where in the scion is kept attached to the mother plant till the graft union takes place. Ex. Simple approach or Inarching.

B) Scion detached methods –

These are the grafting methods where in the scion is first detached from mother plant. These methods can be classified as under:

1) Veneer grafting
2) Saddle grafting
3) Wedge grafting
4) Stone grafting
5) Soft wood grafting

C) Methods of grafting on established trees-

These are the methods which can be successfully adopted to convert the inferior crown of the established plants into the superior or desired crown. These are as under:

1) Side grafting
2) Crown grafting
3) Top working

D) Methods of Renovation (Rejuvenation) -

These are the grafting methods which are adopted to rejuvenate the old trees having religious feelings or the plants injured deeply due to mechanical operation, pests, diseases at their trunks, root etc. These methods are:

1) Bridge grafting 2) Buttress grafting

Advantages of Budding:

1. Budding saves the propagation material.
2. Budding requires lesser equipments and raw material
3. Budding is useful in certain crops in which the grafting is cumbersome.
4. Budding is little bit faster for operation and success.

The methods of budding:

1. T-budding or shield budding -Rose
2. Patch budding
3. Forkert budding
4. Flute budding
5. Ring budding
6. Chip budding

INTEXT QUESTIONS 8.6

A Fill in the blanks:

1. _____ method of grafting is used for repairing injuries of plants.
2. _____ is a example of scion attached method of grafting.
3. In roses _____ method of budding is practiced.

8.9 NURSERY AND NURSERY MANAGEMENT

The importance of the best quality planting material as an initial investment is a well realized factor for persons engaged in Horticulture field. So nurseries have great demand for the production of plants, bulbs, rhizomes, suckers & grafts. But in general good quality & assured planting material at reasonable price is not available. So persons having a skill of propagation of plants can go for this avenue as an agro-business of future.

Definition of nursery

Nursery is a place where plants are grown, nurtured and sold out. Generally, various commercial crop growers require a good quality saplings or grafts of genuine type.

Types of Nurseries –

Nurseries are categorized in different ways.

According to time duration nurseries are classified in two types:

1) Temporary nursery – This type of nursery is developed only to fulfill the requirement of the season or a targeted project. The nurseries for production of seedlings of transplanted vegetables and flower crops are of temporary nature. Like wise temporary arrangement for growing forest seedlings for planting in particular area can also be done in temporary nursery.

2) Permanent nursery – This type of the nursery is placed permanently so as to produce plants continuously. These nurseries have all the permanent features. The permanent nursery has permanent mother plants. The work goes on continuously all the year round in this nursery.

According to type of plants produced nurseries are classified in to following types:

1) **Fruit plant Nurseries: -** In this nursery seedlings and grafts of fruit crops are developed.

2) **Vegetable nurseries: -** In this nursery seedlings of cauliflower, cabbage, brinjal and tomato are prepared.

3) **Flowers plants nurseries :-** The seedlings of flowering plants like gerbera, carnation, petunia, salvia, rose, chrysanthemum, coleus, aster, dianthus are developed in this nurseries.

4) **Forest nurseries: -** The seedlings of plants useful for forestation like pine, oak, teak, eucalyptus, casuarinas are prepared and sold.