



Module-2

Notes

5) Miscellaneous nurseries: - In such type of nurseries plants with great economic value, rare and medicinal, herbal plants are propagated. In this nursery plants like geranium, rose, calendula, and marigold are propagated.

Planning of nursery

One has to decide which type of nursery is to be started. At the same time the durations and type of plants propagated should be finalized.

Selection of site

Site is the basic requirement of a nursery. Site is a place upon which one can produce seedlings of plants.

Qualities of a good site are:

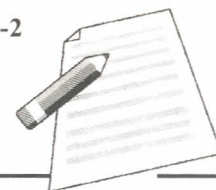
- 1) Nearness of road
- 2) Near a habitat
- 3) Suitable climate
- 4) Neither shady nor exposed area
- 5) Sufficient sunlight
- 6) Good irrigation facilities
- 7) Good soil condition
- 8) Good transport facility

Management of nursery –

Nursery plants require due care and attention after having either emerged from the seeds or have been raised from other sources like rootstock or through tissue culture technique. Generally they are grown in the open field under the protection of mother nature where, they should be able to face the local environment.

It is the duty & main objective of a commercial nursery grower to supply the nursery plants with suitable conditions necessary for their development & growth. This is the major work of management in the nursery which includes all such operations right from the emergence of young plantlet till they are fully grown-up or are ready for uprooting & transplanting in the main fields.

- 1) **Potting the seedling:** - Before planting of sapling in the pots, the pots should be filled up with proper potting mixture. Now a days different size of earthen pots or plastic containers are used for propagation. For filling of pots loamy soil, sand and compost can be used in 1:1:1 proportion. Sprouted cuttings, bulbs, corms or polythene bag grown plants can be transferred in earthen pots for further growth. All the necessary precautions are taken before filling the pots and planting of sapling in it.
- 2) **Manuring & Irrigation:** - Generally sufficient quantity of nutrients is not available in the soil used for seedbed. Hence, well rotten F.Y.M / compost and leaf mould is added to soil. Rooted cuttings, layers or grafted plants till they are transferred to the permanent location, require fertilizers. Addition of fertilizers will give healthy & vigorous plants with good root & shoot



system. It is recommended that each nursery bed of 10 X 10m area should be given 300 gm of ammonium sulphate, 500 gm of Single super phosphate and 100 gm of Muriate of potash.

Irrigation either in the nursery beds or watering the pots is an important operation. For potted plants hand watering is done & for beds low pressure irrigation by hose pipe is usually given. Heavy irrigation should be avoided.

- 3) **Plant protection measures:** - Adoption of plant protection measures, well in advance and in a planned manner is necessary for the efficient raising of nursery plants. For better protection from pest and diseases regular observation is essential.

Disease control in seedbed:-

The major disease of nursery stage plant is "damping off". For its control good sanitation conditions are necessary. Preventive measures like treatment with 50% ethyl alcohol, 0.2% calcium hypo chloride and 0.01% mercury chloride is done. These treatments are given for 5 to 30 minutes.

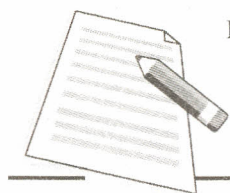
Some of the seed treatment are as follows:

- i) **Disinfection** – The infection within the seed is eliminated by use of formaldehyde, hot water or mercuric chloride.
- ii) **Hot water treatment** – Dry seeds are placed in hot water having a temperature of 48°C – 55°C for 10-30 minutes.
- iii) **Protection** – In dry seed treatment organo mercuric and non-mercuric compounds like agallal, aretan –6, and tafasan-6. For this the seeds are shaken within the seed container. While in wet method, the seeds are immersed for certain period in liquid suspension.
- iv) **Soil treatment** – Soil contains harmful fungi, bacteria, nematodes and even weeds seeds, which affect the growth and further development of plant. These can be eliminated by heat, chemical treatment. For that soil is disinfected by heating to the temperature of about 60°C for 30 minutes.
- v) **Chemical treatment** – the chemicals like formaldehyde, methyl bromide, chloropicrin, vapam are used.

Other diseases like rust, powdery mildew, leaf spot, bacterial blight, yellow vein mosaic are also observed. For control of these diseases Bordeaux mixture, Carbendazime, Redomil can be used. *Tricoderma viridi* a bio-fungicide can also be tried out.

- 4) **Weed control:** - Weeds compete with plants for food, space and other essentials. So timely control of weeds is necessary. For weed control weeding, use of cover crops, mulching, use of chemicals (weedicides) are practiced. Pre-emergence weedicides like Basaline or post-emergence weedicide like 2, 4-D and Roundup are useful.
- 5) **Measures against heat and cold:** - The younger seedling is susceptible to strong sun and low temperature. For protection from strong sun, shading with the help of timber framework of 1 meter height may be used. Net house and green house structures can also be used.

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6) **Packing of nursery plants** – Packing is the method or way in which the young plants are tied or kept together till they are transplanted. So they have to be packed in such a way that they do not lose their turgidity and are able to establish themselves on the new site. At the same time, good packing ensures their success on transplanting.

For packing baskets, wooden boxes, plastic bags are used. In some parts of the country banana leaves are also used for packing the plants with their earth ball. This is useful for local transportation.

7) **Sale management** – In general the main demand for nursery plants is during rainy season. A proper strategy should be followed for sale of nursery plants. For that advertisement in local daily newspapers, posters, hand bills, catalogue and appointment of commission agents can be followed.

8) **Management of mother plants** -

Care of mother plants is necessary so as to get good quality propagules and scion.

- A. Labeling and records
- B. Certification
- C. Irrigation
- D. Fertilization
- E. Pruning
- F. Protection from pests and diseases

Collection and development of new mother plants

Fruit Nurseries



INTEXT QUESTIONS 8.7

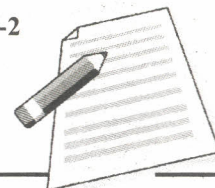
Match the followings:

A

- 1) Disinfection
- 2) Temporary nursery
- 3) Mother plants
- 4) Permanent nursery

B

- a) Mango nursery
- b) Formaldehyde
- c) Tomato seedlings
- d) Guarantee of quality

*Notes*

8.10 WHAT YOU HAVE LEARNT

Propagation is an important technique of multiplying useful plants. We can propagate plants by sexual or by asexual means. Both the methods have certain advantages and disadvantages. So we must select proper method according to our needs and situation. Seed propagation is the simple way of multiplying plants but for plants which do not set fertile seeds we must practice vegetative types of propagation. vegetative methods of propagation are cutting, Layering, grafting, budding and tissue culture. For propagation, medium is an essential factor. We should use proper medium for particular method of propagation and for particular plant. In this lesson we have also studied the nursery and its management. Growing seedlings under proper supervision and care is the prime objective of the nursery. For this we must follow the nursery techniques.



8.11 TERMINAL QUESTIONS

1. State the prime reasons for asexual propagation.
2. Which are the methods of vegetative propagation?
3. State characteristics of good medium.
4. State the difference between cutting and layering.
5. Name different types of cutting and layering.
6. Explain advantages of grafting.

8.12 ANSWER TO INTEXT QUESTIONS

8.1

1. Endangered
2. asexual
3. seeds

8.2

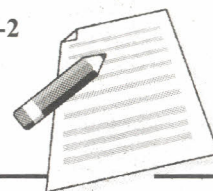
1. vegetative
2. tissue culture
3. citrus

8.3

1. water holding.
2. neutral
3. soil

8.4

1. succulent

*Notes*

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ADVANCE TECHNIQUES IN AGRICULTURE

9.1 INTRODUCTION

Various improved techniques are practiced in Agriculture for increasing production and quality of crops. Improvements in plant variety, seed production, seed treatments are some techniques related to seed quality and have direct effect on yield of the crop. Growth hormones are used for various purposes in crop plants. They improve crop growth, flower and fruit production, fruit set, total yield and quality of crop plants. Tissue culture is a technique used for faster multiplication of Plants. Different cropping systems help in maintaining soil conditions and checking pests and diseases. Likewise learning and applying these advance techniques will help us to improve our agriculture.

9.2 OBJECTIVES

After reading this lesson, you will be able to:

- Understand various types of seed treatments to improve germination and to protect the seed and seedling from pest and diseases.
- Learn tissue culture techniques so as to get knowledge of modern agriculture.
- Learn types and effects of growth hormones and practical uses of growth hormones in agriculture.
- Study different cropping systems and the benefits of different cropping systems.

9.3 SEED TREATMENT

Seeds of many crops after procurement can be sown in the field straight away but others may need some treatment before sowing. This may be with some specific objectives as mentioned below:

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- I) Control of disease:- Cotton and groundnut seeds are treated with mercuric compounds for control of seed borne fungi. Paddy seed is treated with organo mercurial fungicide like Agrosan to safeguard against blast disease. Bajri seed is dipped in 20% brine solution for removing the fungi causing ergot disease.
- II) Convenience in sowing:- Cotton seed is rubbed with thick cow dung slurry and dried before sowing so that fibres do not entangle with one another. Cotton seeds is also treated with sulphuric acid to remove the fuzz altogether. Coriander seed is split under slight pressure for even germination. Very small seeds e.g. bajri, ragi or tobacco are mixed with fine sand, ash or fine earth for obtaining an even stand of the crop.
- III) Quicker germination: - Indigo and Lucerne seeds having hard seed coat may be lightly pounded with a wooden pestle. Paddy and cotton seed may be soaked in plain water for a few hours to hasten their germination.
- IV) Protection against white ants:- Some seeds of vegetable crops may be treated with some kind of repellent material like camphor or kerosene so that the strong smell will keep the white ants away.
- V) Protection against insect pests: - 10 E.C. endrin (without water) is sometimes sprayed on CSH 1 hybrid Jowar seed just before sowing, so that some of the insects which eat the treated seeds will die and further damage will be reduced.
- VI) Increased nitrogen fixation by legumes: - Seeds of soyabean, berseem and groundnut may be treated with slurry containing suitable Rhizobial culture for better nodulation and increased nitrogen fixation.
- VII) Inducing earliness: - By giving vernalization treatment to the seed the maturity period of a long duration crop is shortened. In this process, the seed is soaked in water and incipient germination is induced in the form of awakening of the dormant embryo and commencing the changes favouring germination in the endosperm. After this stage, the seeds are put in cold storage for periods varying with different kinds of seeds, so that their germination power remains intact but only the process of germination is temporarily halted. Thus the plants spend part of the vegetative period or phase in the form of sprouted seed and seed so treated is as if a dormant plant. The period from sowing to flowering is thus greatly reduced and with such suitable adjustment a long duration variety can be made to flower early. This method is useful to plant breeders and not for ordinary cultivators.
- VIII) Inducing variation: - For inducing variation in its original morphological and general structure of seed, plant breeders give X-ray treatment to the seeds e.g. Production of sharbati Sonora wheat which is a mutant isolated from gamma ray treated material of Sonora 64, having all the good characters of Sonora and in addition an amber coloured grain instead of red colored one of Sonora 64 and more protein and lysine percentage in the grains.

Seeds and cuttings are treated with chemicals like colchine, gibberlic acid, indole acetic acid, seradix as growth promoting substances (hormones). Similarly chemicals like thio urea are used for breaking the dormancy of seed potato tubers and making them fit for planting. Treatment with maleic hydrazide is recommended for stopping the growth of sprouts from potato tubers and thereby reducing losses due to sprouting.



INTEXT QUESTIONS 9.1

Match the followings:

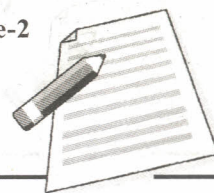
A

1. Paddy Seed
2. Cotton seed
3. Lucerne seed
4. Vegetable crop seeds
5. Hybrid Jowar

B

- I. Kerosene
- II. Hard seed coat
- III. Agrosan
- IV. Endrin
- V. Sulphuric acid

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9.4 TISSUE CULTURE

Definition:-

1. Developing a new seedling in a laboratory under controlled condition from a cell, tissue or piece of any plant part is called tissue culture.
2. The technique of separation of cells or tissues or organs of a plant and growing them aseptically in suitable glass container and in sterile nutrient medium under controlled conditions of temperature and light is called tissue culture

The tissue culture technique is used for multiplying certain plants in a great number. This technique particularly used after identification of growth hormones responsible for root and shoot growth. Dr. Morvel (1960) used this technique for the first time and formulates complete procedure of tissue culture. Dr. Murashige and Skoog in 1975 developed standard medium for tissue culture and used that technique successfully for fruit crops.

Requirements of plant tissue culture

Well equipped laboratory is an essential requirement of tissue culture. The laboratory should have the following facilities:

1. Preparation of media
2. Storage and cleaning facilities
3. Aseptic condition of working
4. Controlled environmental conditions for growth and development of cultures.
5. Examination of the culture and keeping records.

The important aspects of tissue culture are:

1. Aseptic condition:- The complete aseptic condition is essential for tissue culture, sterilization of glass ware, working tables, medium and plant material is essential.

Chemicals like mercuric acid, sodium hypochloride are used. Use dry heat ($180^{\circ}\text{C} - 300^{\circ}\text{C}$), use of steam heat (120°C) 15 lb pressure for 20 minutes, ultra filtration, ultra violet light, use of antibiotics are the methods of sterilization.

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2. Equipments (glassware) cylinders, beaker, funnels, Petri dishes, pipettes, oven, autoclave, filter, inoculation hood, laminar flow chamber, spirit lamp, acclimatizers, forceps, gloves, apron, refrigerator, balance, pH meter, cartridge, microscopes, automatic shaker, etc. are the equipments required for tissue culture.
3. Nutrient Medium: - the medium should contain inorganic salts, vitamins, sucrose, growth hormones (auxins, cytokinines). The medium is solidified with 0.5-1.0% agar. Murashige and Skoog standard medium is used for tissue culture.

Methodology of tissue culture

The methodology of tissue culture has following steps:

a) Selection of plant material:-

Cultivar is selected and explant is separated. A tip of shoot meristem is normally taken as explant. Explant is cleaned and sterilized with chlorinated water.

b) Preparation of synthetic nutrient medium:-

A nutrient medium contains carbohydrates, amino acids, salts, vitamins, growth hormones, agar etc.

c) Sterilization of culture medium:-

The medium is sterilized to prevent infection and to make the medium of the aseptic. It is sterilized in autoclave at 120° C for 20 minutes.

d) Inoculation:-

The sterilized explants carefully transferred to the test tube or suitable container and put on the culture medium with the help of sterilized forceps. This is known as inoculation of explant.

E) Incubation:-

The inoculated cultures are transferred to another room where light and temperature are strictly controlled. It is called culture room.

f) Subculture:-

The callus can be cut into a number of segments and sub cultured by putting them in different test tubes containing culture media.

g) Organogenesis:-

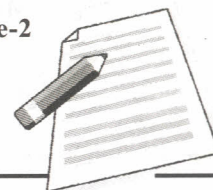
By adding appropriate concentration of auxins and cytokinines to the basal medium, the callus can be induced to differentiate into root and shoot and then to develop in to a new plantlet.

h) Transplanting:-

When the plantlets are old enough, they are transferred to soil in the pots and kept covered to maintain the humidity. This is called transplanting.

i) Field cultivation:-

After hardening and when the plantlets are established in the pot they are transplanted in field for cultivation.

**Important applications of tissue culture:**

- a. Mass multiplication of commercially important plants by micro propagation.
- b. Production of disease free plants.
- c. Production of haploid and double haploid plants through anther culture.
- d. Industrial production of secondary metabolites.
- e. Induction and isolation of mutants.
- f. Protoplast culture used for production of clones, Somatic hybrids and direct DNA uptake.
- g. Production of soma clonal variations.
- h. Transfer of germplasm through synthetic seeds.
- i. Production of difficult to propagate plants.
- j. Overcoming dormancy of seeds.
- k. Obtaining the whole plant from isolated cells.
- l. Induction of polyembryony.
- m. Preservation of germplasm (Gene bank).
- n. Culture of hybrid embryos.

Terminology:-

1. Totipotency: - the property of cell to regenerate and to develop it into a new plant under ideal condition is known as totipotency.
2. Clone: - A group of plants multiplied vegetatively from a single plant.
3. Callus: - It is an unorganized mass of thin walled cell or a tissue in which the cells are loosely arranged and undifferentiated.
4. Culture: - It is the method of growing of cells tissues organs on nutrient medium under aseptic conditions. E.g. cell culture, embryo culture, protoplast culture, anther culture.
5. Organogenesis: - Formation of an organ such as root, shoot from the callus is called organogenesis.
6. Cultivar: A plant selected for tissue culture is called cultivar.
7. Explants: - The protoplast, cell, tissue or organ of the plant used for tissue culture is called explants.
8. Plantlets: - The plant obtained through the tissue culture technique is called as plantlet.

Plant Growth Regulator:- A organic substance which when applied in very small quantity to plant's part either accelerate, retard or modify the physiological process of plant.

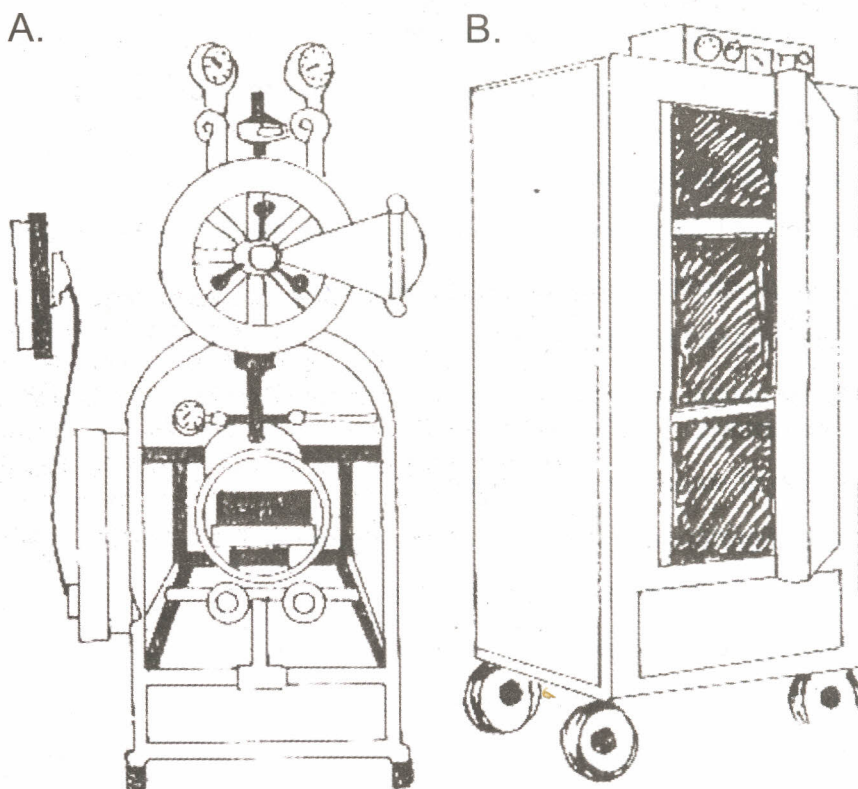


Fig-9.1: A : Autoclave, B : Climatizer



INTEXT QUESTIONS 9.2

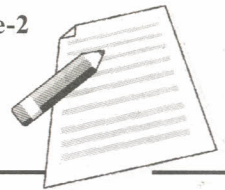
A) Fill in the blanks:

1. The tissue culture technique is used for _____ certain plants in a great number.
2. The medium is solidified with _____ agar.
3. A tip of shoot _____ is normally taken as explant.
4. The sterilized explants carefully transferred to the test tube is known as _____ of explant.
5. When the plantlets are established in the pot they are _____ in field for cultivation.

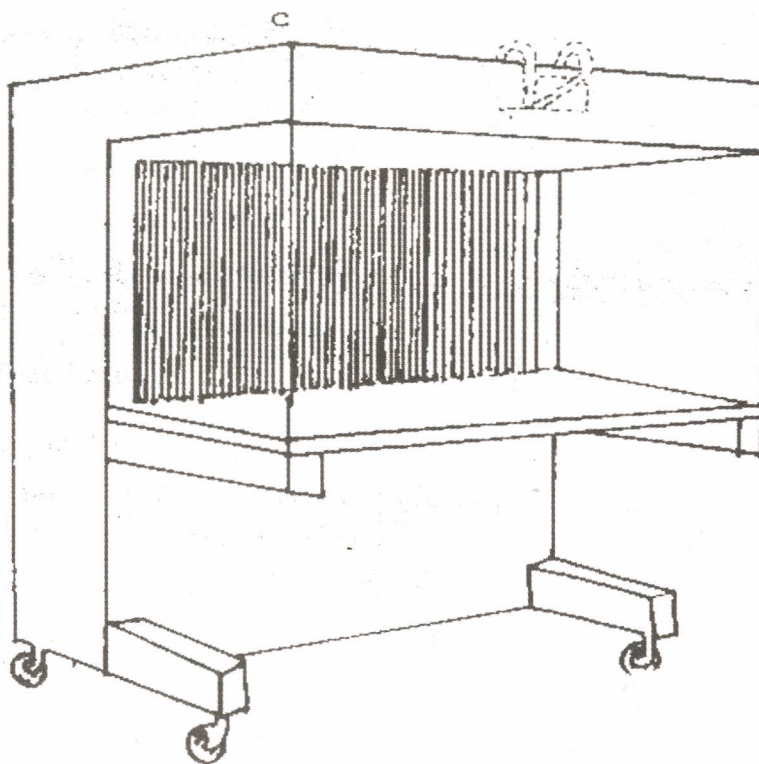
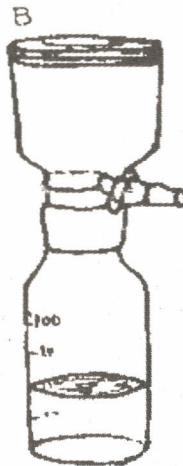
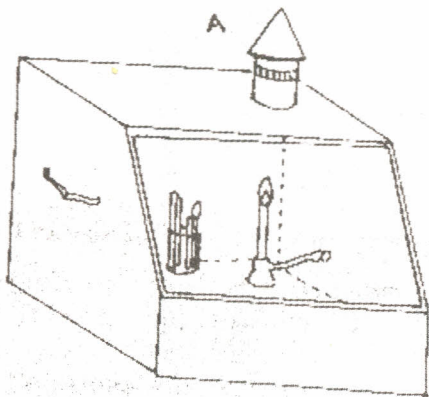
9.5 GROWTH HORMONES

Plant growth substances play major role in growth and development of plants. To grow in length tissue must receive growth substances. Growth substances normally control plant growth, modify growth and physiological activities.

Plant hormones:-These are organic substances synthesized by the plant which regulate, retard or modify plant physiological activities. They can move within the plant from the site of synthesis to the site of action.

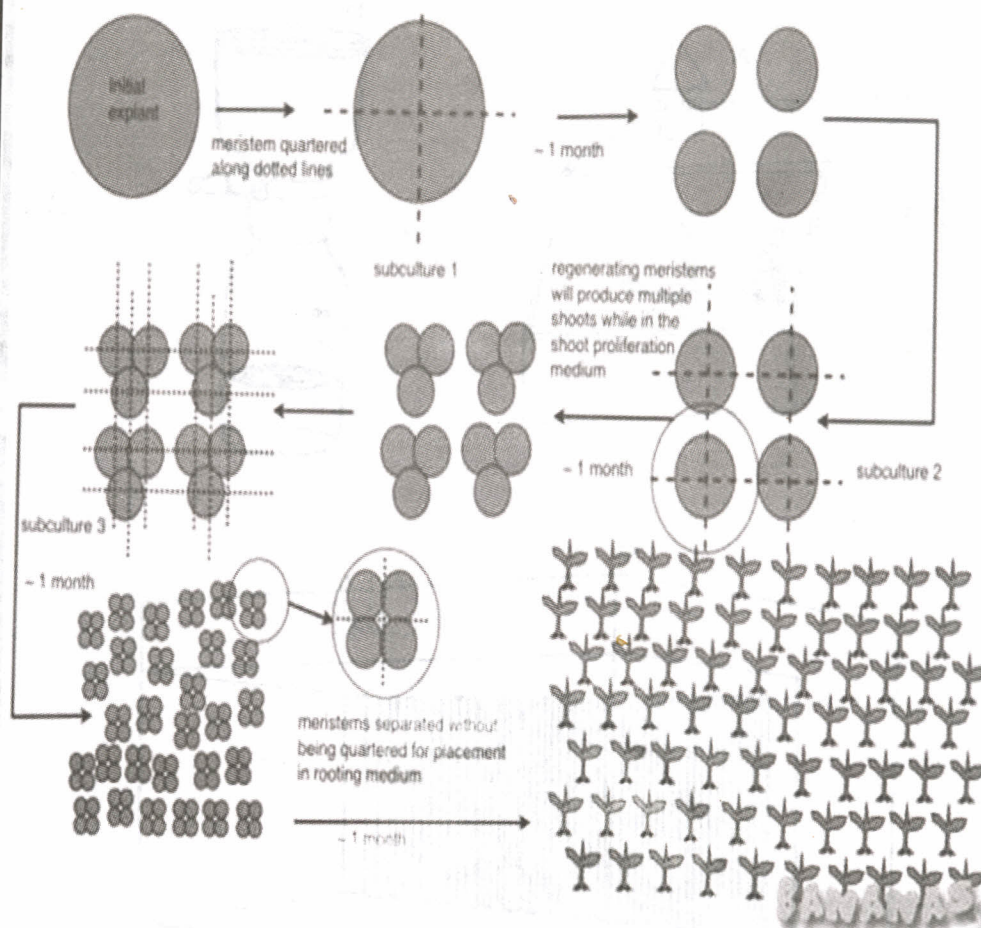


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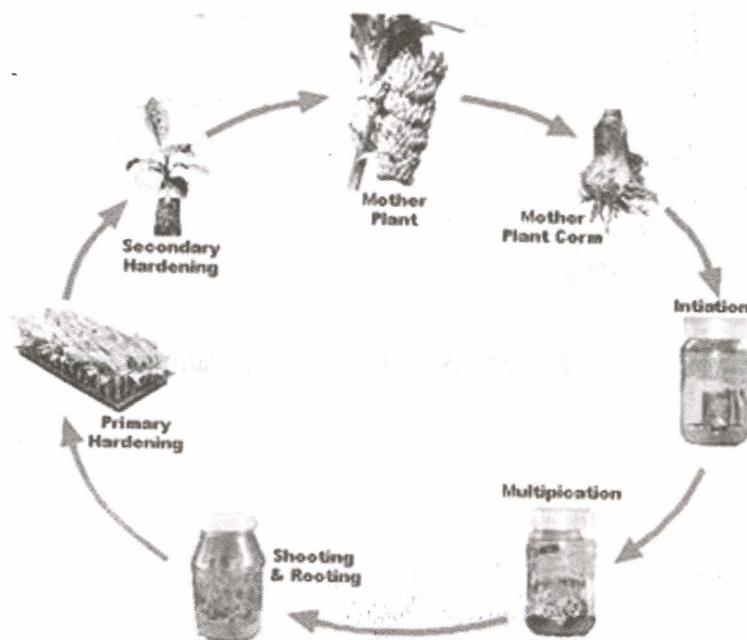


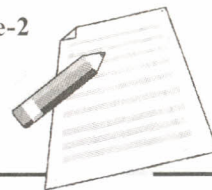
A : Inoculation hood, B : Milipore Filter, C : Laminar Flow Chamber.

Diagrammatic Representation of Tissue culture.



Tissue Culture technique in Banana



**Mainly there are five categories of growth regulators:-**

- 1 Auxins:- These are organic acid and their derivative, naturally occur in the apical bud, embryo and anthers of the plant. Natural auxin is IAA. Auxins are responsible for cell division, cell enlargement, root promotion and flower initiation. Synthetic auxins are available in the form of IBA, NAA, 2,4-D
- 2 Gibberellins :- Gibberellins are first time identified from the fungus gibbrella. The natural occurrence is in the immature seed. Gibberellins are responsible for cell enlargement and sex modification. These are available in the form of GA1 - GA63 but most common type is GA3.
- 3 Cytokinines : Natural occurrence is in the form of zeatin. Coconut water is rich source of cytokinines. Synthetic form available is kinetin. Cytokinin action is cell division and cell elongation.
- 4 Ethylene: - It is known as ripening hormone. Ethylene trigger the ripening but not participate in ripening. Ripe fruits are source of ethylene. The synthetic form is Ethrel or Ethephon.
5. Inhibitors: - Plants contain many inhibitory substances which inhibits the processes like seed germination and shoot growth. Absciscic Acid (ABA) is usually present in the mature and scensising tissues. Synthetic forms are malic hydrazide (MH), cycocel.

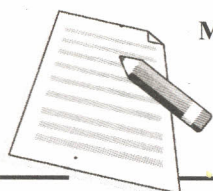
Uses of growth hormones:

- To promote rooting of cutting.
- To terminate the dormancy of seed and to increase germination percentage.
- Control of flowering.
- To control excessive vegetative growth.
- To increase number of female flowers.
- To improve fruit set and fruit development.
- To induce parthenocarp.
- To control fruit drop.
- To control fruit ripening process.
- To impart attractive colour to fruit.
- To avoid spoilage of fruits and vegetables during storage.
- To control weed.
- To propagate plants by tissue culture.

Methods of application of growth regulator

1. Lanolin paste:- This technique is most commonly used for laboratory experiments to obtain clue for theoretical and practical significance of a

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particular compound on a physiological process. Lanolin is soft fat prepared from wool and is a good solvent for growth regulators. The paste is prepared with the fat and the growth regulator in a suitable preparation, sticks firmly and growth regulator does not dry out and remain in constant contact with the treated organ.

2. Immersion into dilute or concentrated solutions:- Stock solutions are made by dissolving growth regulator in a small volume of 95% ethanol or methanol or absolute alcohol. Then it is diluted to an appropriate strength. The cuttings or seeds are soaked for 10 to 24 hours in dilute solution. Dipping in concentrated solution is recommended for rapid action. The treatments are known as prolonged soaking and quick dip method. In quick dip method cuttings are immersed for few seconds.
3. Spraying technique:- This method has been used on large scale for various purposes, as it is easy to practice. The dilute solution is sprayed on the leaves with sprayers. The effectiveness of the application depends on the ability of growth regulator to penetrate through the leaf cuticle in to the mesophyll cells. For proper response, right concentration and spray at right stage is necessary. If properly done, single spray may be sufficient. In some cases two applications are necessary. Growth regulators can also be injected into the fleshy parts with the help of hypodermic needles. The injection technique is used to study the effect of growth regulator on a particular organ.
- 4 Dust method (Powder method):-

This is one of the simplest methods. The required quantity of chemical is dissolved in an absolute alcohol and mixed in right proportion with a carrier substance like talc, chemical or bentonite. This is considered by some growers as an easier and quicker method of application. It is useful for propagation through cutting and layering.

- 5 Aerosol and vapour method:-

These methods are becoming popular in case of many green house plants for promoting fruit setting, parthenocarp and control of fruit drop. The Aerosol method is based on preparation of auxin solution in a solvent of low boiling point, usually a gas under pressure in a cylinder. The solution when released into the green house from the container through nozzle the auxin is suspended in green house atmosphere as mist. The mist may persist for five hours and the entire plant is subjected to auxin action. For application of the vapour method, the active compound should be movable. It is vaporized over an electrical hot plate and the vapour is then spread to green house by electric fan. After vaporization, the green house is kept closed for 10 -15 hours. During this time the auxins are absorbed by the plants. Two successive applications at an interval of few days are found more effective than single treatment.

- 6 Soil application:-

Considerable success has been claimed in the effectiveness of auxin as herbicides. When applied promotion of fruit setting in male sterile varieties of tomato has recorded by soil application. Dilute solutions of active compounds are added to the soil and they are absorbed by the roots and transported to the desired parts.



INTEXT QUESTIONS 9.3

A) Fill in the blanks:-

1. _____ are first time identified from the fungus gibberella.
2. _____ is known as ripening hormone.
3. The organic substances synthesized by the plant which either regulate retard or modify plant physiological activities are known _____.
4. Coconut water is rich source of _____.
5. _____ is usually present in the mature and senescing tissues.

9.6 CROPPING SYSTEMS

Cropping systems: - cropping system may be defined as the order in which the crops are cultivated on a piece of land over fixed period.

The productivity of land is maintained or even increased through proper soil management practices. Much can be done to keep the soil in proper condition by establishment of crop rotations suited to the needs of the farm.

Crop Rotation: - It may be defined as more or less systematic recurrent succession of crops on the same land.

Advantages of crop Rotation: -

1. Overall increase in the crop yield due to maintenance of proper physical condition of the soil and its organic matter content.
2. Inclusion of crops having different feeding zones and different nutrients help in maintaining a better balance of nutrients in the soil.
3. Diversification of crops reduces the risk of financial loss from unfavorable prices in the market, unfavorable weather conditions and damage due to pests and diseases.
4. It helps in more even distribution of labour.
5. Regular flow of income over the year.
6. Incidence of weeds, insects and diseases is reduced and can be kept under control.
7. Proper choice of crops in rotation helps to prevent soil erosion.
8. It supplies various needs of the farmers and his cattle.

Some Examples of crop rotations are:

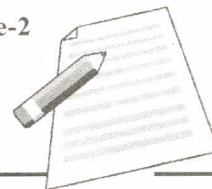
Cotton – Jowar

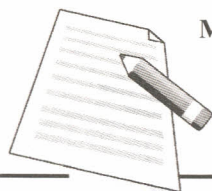
Cotton – Jowar – groundnut

Cotton – Bajri

Cotton- wheat or Rabi Jowar or gram

Jowar mixed with pulse





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Notes

Sugarcane – cotton

Sugarcane – Rabi Jowar sannhemp

Rice - wheat- rice

Wheat- maize - sugarcane

- i. Monoculture: - One major crop (Rice) which is grown on the same land year after year is known as monoculture or single crop system.

The reasons for monoculture are:

- i) Cultivators holdings are very small and fragmented and no choice to cultivate many crops.
- ii) Main article of diet.
- iii) Most of the area under rice is low lying subject to water logging and mainly fit for rice and jute.
- iv) Track receives heavy rainfall and climatic conditions make the growing of any other crop almost impossible.

Fallow in rotation: - In scarcity areas where rainfall is very low only two crops are taken in three years as against one crop every year. This results in increasing the yield of crop in succeeding year.

Multiple cropping: - In single cropped irrigated areas double and triple cropping is being followed and there is possibility of taking even four crops in a year.

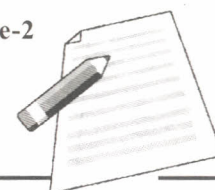
An ideal system of multiple cropping should include such crops which should produce minimum problems of soil exhaustion and pest build up while ensuring maximum production or maximum returns per unit input to the farmer.

Mixed cropping: - Age old practice followed under dry as well as irrigated farming, instead of growing several crops in separate fields by devoting one field to crop, the crops proposed to be grown are raised together in the same field. The cereal crops are usually mixed with legumes e.g. Jowar or Bajri mixed with Tur, Udid, Mung, matki or kulthi.

Wheat is mixed with peas, gram or mustard. Cotton is mixed with Tur or Jowar. Many other mixtures are also common in which oilseeds, pulses, fibre crops and vegetable crops are included. Usually mixtures consist of only two crops one main and other subsidiary crop, but mixtures of three or four crops are also common.

Objectives of mixed cropping:-

- i) Get handy instalments of cash returns in irrigated crops.
- ii) Better distribution of labour throughout the year.
- iii) Utilize available space and nutrients to the maximum extent possible.
- iv) To safe guard against the hazards of weather, disease and pests.



Intercropping: - In this cropping system intercrop is grown in between rows of the major crop, without affecting the plant population as well as yield of the major crop or growing two crops simultaneously with distinct row arrangement. In this system, in addition to yield of major crop some extra intercrop yield is obtained. Therefore intercrop is the bonus crop in this system e.g. intercropping of groundnut or vegetables in sugarcane or pulse or oilseed crops sorghum (Jowar) or pearl millet (bajra).



INTEXT QUESTIONS 9.4

Match the followings:

A

- i. Crop Rotation
- ii. Monoculture
- iii. Fallow in rotation
- iv. Multiple cropping
- v. Mixed cropping

B

- a) Two crops in three years.
- b) Four crops in a year.
- c) Usually mixture consists of two crops.
- d) One major crop
- e) Systematic recurrent succession of crops.

9.7 WHAT YOU HAVE LEARNT

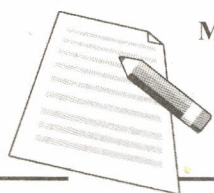
Seed treatment is done for control of disease, convenience in sowing, quicker germination, protection against insects and pests, inducing earliness and variation. Tissue culture is a technique of separation of cells or tissues or organs of a plant and growing them in vitro, under aseptic and controlled conditions to give rise to new individuals. Auxins, gibberellins, cytokinines, ethylene and inhibitors are important types of growth regulators. Monoculture, crop rotation, fallow in rotation, multiple cropping, mixed cropping, intercropping are the different cropping systems, which help in maintaining soil conditions and controlling pests and diseases on crop plants.



9.8 TERMINAL QUESTIONS

1. What are the different objectives of seed treatment?
2. Define tissue culture and write the requirements of plant tissue culture.
3. Write in brief the methodology of tissue culture.
4. Write the uses of growth hormone.
5. Write the objectives of mixed cropping.

Module-2



Notes

9.9 ANSWER TO INTEXT QUESTIONS

9.1

1. Agrosan
2. Sulfuric acid
3. Hard seed coat
4. Kerosene
5. Endrin

9.2

1. multiplying
2. 0.5-1.0%
3. Meristem
4. Inoculation
5. Transplanted

9.3

A) Fill in the blanks

1. Gibberellins
2. Ethylene
3. Plant hormone
4. Cytokinines
5. Abscises Acid (ABA)

9.4

1. Systemic recurrent succession of crops
2. One major crop
3. Two crops in three years
4. Four crops in a year
5. Usually mixture consist of only two crops

SUGGESTED ACTIVITIES

- a. Visit to tissue culture laboratory and seedling establishments units.
- b. Visit to model agricultural farm for studying the cropping systems.
- c. Collect information on commercially used growth hormones.



GREEN HOUSE AND POLYHOUSE

10.1 INTRODUCTION

Green houses and polyhouses are protected structures useful for cultivation of certain crops. These structures are erected for protection of crops from adverse climatic conditions and for growing crops irrespective of their growing season. Different types of green houses and polyhouses are used in temperate and tropical areas.

10.2 OBJECTIVES

After reading this lesson, you will be able to:

- learn about polyhouse structures, material used and method of cultivation.
- study advantages of green house cultivation.
- study crops grown under covers and their methodology.

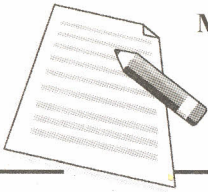
10.3 STRUCTURE OF GREEN HOUSES

G.I. pipes or steel angles are used to make frames of Green House. Design and layout of the frame varies according to crop, climatic conditions and cost etc.

Following points should be considered while designing frame:

- 1 Frame should be light in weight.
- 2 Use easily available material (Bamboo or wood could also be used).
- 3 Frame should be even from all sides.
- 4 Slope of roof should be such that water will not fall on crop or stagnate on the roof.
- 5 It should be possible to change the sheet, if required.
- 6 There should be sufficient ventilation.

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Notes

Types of green houses:

1. A frame type
2. Lean to type
3. Even span type
4. Gothic Arch
5. Connect with gutter system
6. Geodesic home

The material used for covering roof:

1. Glass
2. Plastic
 - A) Sheet Plastic:-Polyethylene, Polyvinyl chloride, Polyester, Polyvinyl Florida.
 - B) Rigid Plastic:-Polyvinyl chloride, fibre glass reinforced Plastic, Acrylic, Poly carbonate.

U.V stabilized polyethylene film of 200 micron thickness is most widely used.



INTEXT QUESTIONS 10.1

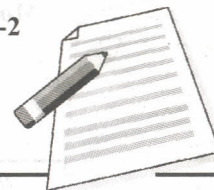
Fill in the blanks:

1. Design and layout of frame varies according to crop, _____ and cost etc.
2. Slope of roof of polyhouse should be such that water will not _____ on the roof.
3. Most widely used cover for roof of polyhouse _____ polyethylene film of 200 micron thickness.

10.4 CLIMATE CONTROL IN GREEN HOUSE

The important factors which are required to be controlled in polyhouses are as follows.

1. Ventilation
2. Increasing or decreasing inside temperature
3. Control of CO₂
4. Control of light intensity
5. Humidity
 - 1 Ventilation: - It is necessary for proper air circulation in the green houses. For natural circulation keep the sides of green house open. Exhaust fan may also be used for dragging air out.



- 2 Temperature Control: - Use of fan and pad method, exhausting hot air out, use of screen and using water sprinklers / foggers temperature could be controlled.
- 3 CO₂ control: - CO₂ enrichment by trapping natural CO₂ up to 1500-2000 ppm.
- 4 Control of light intensity:- Using UV stabilized sheet and shade net light intensity is controlled up to 30000 to 60000 lux.
- 5 Humidity control: - Relative Humidity inside the green house should be 50-80%. It is controlled by using air circulation, using sprinklers and controlling evaporation.

**INTEXT QUESTIONS 10.2**

Fill in the blanks

1. Exhaust fan is used for _____ out of the green house.
2. CO₂ enrichment is done by _____ CO₂.
3. _____ inside the green house should be 50-80 percent.

10.5 SELECTION OF SITE FOR GREEN HOUSE/ POLYHOUSE

Any type of land could be used for green houses. The site should be away from industrial area to avoid pollution injury to plants. Shade of building or trees around polyhouses is also harmful. The site should be at reasonably at high level from the ground. Nearness to cities or probable markets is preferred. Sufficient water supply, labour availability, electricity supply are the other factors of prime importance. There should be a direct approach road.

Advantages of green house/ polyhouse technology

Let us study the advantages of green house/ poly house technology:

- 1 Crops can be grown under adverse climatic conditions when it is not possible to grow them in open fields.
- 2 Certain crops can be grown round the year in a particular place for continuous supply.
- 3 Production of uniform quality crops.
- 4 Productivity is 8 to 10 times higher than the crops grown in open fields.
- 5 Management of insect pests, diseases and weeds is easier under these structures.
- 6 These structures are ideally suited for small farmers and unemployed youth from rural areas.
- 7 Organic farming is easier under these structures.
- 8 Any type of land can be used for erection of these structures.
- 9 Raising of nursery for developing seedlings of difficult to multiply plants.

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Notes

- 10 Precise irrigation and fertilization is possible.
- 11 Export oriented production is possible under these structures.

Crops grown in green houses

Following crops can be grown on green houses:-

Vegetables:- Cherry tomato, Capsicum, Pea, Lettuce, Broccoli, Celery, Zucchini, Squash.

Fruits: - Strawberry, muskmelon, grapes

Flowers crops: - Rose, Gerbera, Carnation, Liliun, Anthurium, Statice.



INTEXT QUESTIONS 10.3

Fill in the blanks:

1. The site of the polyhouse should be reasonably at _____ from the ground level.
2. The greenhouse structures are ideally suited for _____ from rural areas.
3. Raising of nursery for developing seedlings of _____ plants.
4. The site of polyhouse should be away from _____ area to avoid pollution injury to plants.

Meaning:-

- 1 Glass house: - Glass is used for covering roof and sides of a frame.
- 2 Polyhouses: - Polythene sheet is used for covering the frame.
- 3 Green house: - A structure in which the temperature is higher than outside because of CO₂ trapped under the roof.
- 4 Poly tunnel: - A tunnel like frame covered with polythene sheet.
- 5 Shade house: - A frame covered with shade nets to protect plants from direct sunlight (75% 60% or 50% shading effect)

10.6 WHAT YOU HAVE LEARNT

Green houses and Polyhouses are protected structures. These are useful for cultivation of certain crops in adverse climatic conditions. Different types of green houses and polyhouses are used in different regions viz. frame type, lean to type, even span type etc. Crops grown in green houses are cherry tomato, capsicum, gerbera, rose, carnation, etc. In green houses and polyhouses productivity of crops is 8 to 10 times higher than the crops grown in open fields and management of pests, diseases and weeds is easier. These structures are suitable for small farmers and unemployed youth from rural areas.

**10.7 TERMINAL QUESTIONS**

1. Which points are considered in designing frame of green houses?
2. Write the different materials used for covering roof of green houses.
3. Explain the factors which are essential to be controlled in green houses.
4. Write the advantages of green house / polyhouse technology.
5. Enlist the different crops grown in green houses.

10.8 ANSWER TO INTEXT QUESTIONS**10.1**

- 1 climatic condition
- 2 Stagnate
- 3 UV stabilized

10.2

- 1 drag
- 2 by trapping natural
- 3 Relative humidity

10.3

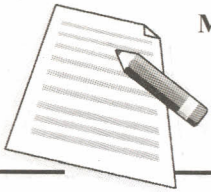
- 1 high level
- 2 unemployed youth
- 3 difficult to multiply
- 4 industrial area

SUGGESTED ACTIVITY

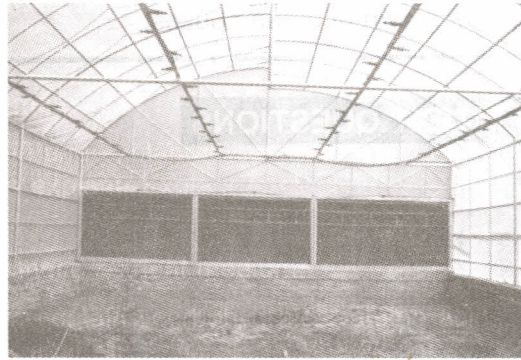
Visit green houses which are growing different horticultural crops at different stages.

Module-2*Notes*

Module-2



Notes



A wide variety of greenhouses

