Unit E: Plant Propagation

Lesson 6: Propagating Plants by Tissue Culture

Terms

- Auxins
- Callus
- Cytokinins
- Explants
- Plantlet
- Sterile agar medium
- Sterile technique
- Tissue culture

What Is Tissue Culture and Why Is It Important?

- ***Tissue culture*** is the practice of growing plant cells on artificial media
- It involves the culture or growing of small pieces of plant tissue
- It is performed on artificial medium under sterile conditions
- Foliage plants, pot plants and cut flowers can be propagated by this method

Advantages of Tissue Culture

- 1. Large numbers of plants can be produced from a single plant in relatively small space in a short period of time
  - This reduces growing space, labor and plant maintenance requirements

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Advantages Continued

- 2. Viruses and other systemic diseases are eliminated by propagating the quickly dividing cells of the shoot tip
- 3. The grower is able to produce plants with identical flowers
- 4. Horticultural cultivars can be improved by selecting plants, which vary slightly from the mother plant
  - Examples are leaf shape, disease resistance, growth habit and flower color
- 5. The growth of identically engineered plant cells

What Process Is Used For Tissue Culture Propagation?

- The tissue culture propagation process can be defined in four main stages:
- First stage - small pieces of plant material, called ***explants***, are carefully removed form the parent plant
  - Explants are obtained from the actively growing part (shoot tips, sections of leaves, stems and roots, embryos, etc) of a desired plant

- The explants are cleaned and placed on sterile agar medium in glass bottles or test tubes
- The ***sterile agar*** medium is a gel that contains water, sugars, nutrients, and plant hormones to support and promote plant growth
- Tiny leaves, stems and roots make tissue culture possible

Removing explants

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- Stage two - the cells of the explants multiply in one of two ways:
  - The cells may form a ***callus***, which is a group of cells with no particular function
    - Supplied with the correct hormones in the medium, these callus cells can develop into a normal plant
  - The explant may produce many new explants if ***cytokinins***, hormones responsible for cell division and differentiation, are placed in the medium

Stage Two: Explant Multiplication

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- Cytokinins encourage the increase in the number of buds on the explants to six or more per shoot
  - Each bud is capable of becoming a plant and producing more buds
- Branching occurs as these buds develop into plant shoots, or ***plantlets***
  - These plantlets are divided and transferred to new containers
- In this way, a single explant can produce millions of plantlets in a year

- Stage three - the plantlets have developed and are ready for root formation
  - Shoots are transplanted to another medium containing ***auxins***, a hormone that induces the growth of roots
  - The plantlets are also given higher light intensity in preparation for stage four
- Stage four - the plantlets are removed form the glass container

- They are divided, planted in a sterile medium, and placed in a greenhouse
- Care must be taken during this transition to acclimatize the plant to their new environment

Tissue Culture Process Continued

- One of the most important aspects of tissue culture is sterile technique
- Sterile technique is the maintenance of an environment that is free of bacteria, fungi and viruses
  - Sterilization of the agar media is essential
  - In addition, the slightest air movement can stir spores of bacteria and fungi

- Special sterile work stations, called laminar hoods, are used when possible

- Cleaning of the plant before removal of the explant is usually accomplished by a brief soaking in a bleach solution, followed by a rinse in sterile water
- The tissue culture agar medium and other materials used to prepare and place the explant must be sterilized
  - This is usually done by an autoclave

- The autoclave uses pressurized steam to sterilize medium, glassware, and instruments

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- Cultures are transferred from one container to another at various stages in their development
  - This transfer must occur under sterile conditions to prevent contamination by microorganisms
  - Sterilized equipment must be used for each transfer

Summary

- Why is tissue culture important in the horticulture industry?
- What parts of a plant can be used in tissue culture?
- Define explant.
- Give two advantages for using tissue culture.
- What is a sterile agar medium?
- What is the first stage in the tissue culture propagation method?

Summary Continued

- What is a callus?
- What must be added to a callus in order for it to continue to develop?
- What is a plantlet?
- How do auxins help an explant?
- What are some practices of sterile technique?