Reference Text:

Plant Biology and Propagation
Text Pages: 8 – 12; 14 – 15; 18 – 21; 38 – 39; 44 – 45.

Objectives:

1. Be able to define plant biology terms or words that are important to plant propagation.
2. Be able to explain how particular concepts in plant biology are useful for plant propagation.
3. Be able to apply biological principles to different situations for plant propagation.

I. WHAT IS PLANT PROPAGATION?

A. Introduction

1. Plant Propagation (definition) -

2. Plant propagation has three parts:
   a. Knowledge of specific
   b. Knowledge of plant
   c. Knowledge of different plants, their growth

B. Sexual Reproduction of Plants

1. Seed propagation is the major method of reproducing
2. Planting seeds is

3. Advantages:
   a. Crops from seeds are somewhat
   b. Crops grown from seeds include woody (landscape or forest) plants, herbaceous plants (annual or perennial flowers), or field crops (such as corn or wheat)

4. Disadvantages:
   a. Plants can lose certain traits –
   b. Plants may lack uniformity
   c. Seed germination problems –

C. Vegetative Reproduction of Plants
   1. Plants are reproduced vegetatively due to
   2. Plants reproduced asexually are genetically
   3. Different types of asexual reproduction include cutting, grafting, budding,
   4. Drawback or problems will be discussed later

D. Cellular Basis for Propagation
   1. Cell physiology is important for propagation because
   2. Important terms:
a. Genotype -

b. Phenotype -

c. Phenotype results from genotypic expression affected by

3. The function of any plant propagation technique is to preserve a particular

E. Sexual Reproduction

1. Particular aspects of sexual plant reproduction are important for

2. Terms:

   a. Haploid -

   b. Diploid -

   c. Gametes -

      i. male - called

      ii. female - called

      iii. number of chromosomes - is

      iv. gametes provide the opportunity to interchange

   d. __________________ - special type of cell division in which diploid cells form haploid gametes

   e. Pollination -
f. __________________ - process of male gamete combining with female gamete to restore diploid number

g. Zygote -

i. diploid chromosome number

ii. rearranged and different combinations of genes from either

h. _____________ - genotype that has become more or less fixed when

i. Subspecies or botanical variety -

i. red maple (*Acer rubrum*) growing in Maine vs. those growing in Florida

ii. *Gleditsia triacanthose inermis* - lacks large thorns

iii. varieties reproduce naturally without help

F. Asexual Reproduction

1. Plant growth is important with regard to asexual reproduction of plants

2. Plant growth is defined as increase in size and

3. Growth is a result of cell

   a. Mitosis -

   b. Cell differentiation -
4. Meristems - regions where cells
   a. Primary meristems -
   b. Secondary meristems -
      i. secondary meristems - are called
      ii. ________________________________ - produces xylem and phloem
      iii. cork cambium -

G. Covering Wounds and Differentiation
   1. Plants GROW OVER wounds - they do NOT HEAL!
   2. Callus - cells produced in response to wounding and these cells
      a. Callus cells are relatively non-differentiated
      b. Callus cells are formed by
      c. Callus cells may undergo differentiation to form
   3. Adventitious - is a result of differentiation or dedifferentiation
      a. Appearing in an unusual or unnatural
      b. Examples: roots forming on stems (cuttings) or shoots forming on leaves (organogenesis)

H. Clones And Plant Characteristics For Cloning
1. **Clone** - a population of plants generated from a

2. **Cloning** - the process of propagating

3. **Questions:**
   a. If I take cuttings from one plant, am I cloning the plant?
   b. If I take seeds from the cuttings, am I still cloning the plant?

4. **Totipotency** - plants or plant parts can be cloned since in principle each cell has the potential to
   a. Plant parts or wound covering can lead to
   b. Totipotency also refers to a

5. **Competency** - the potential of a particular cell to

6. **Determined tissue** - groups of cells that have developed in a specific direction (differentiation) at a specific time and development becomes

I. **Causes of Change In Plant Phenotype**

1. The environment can cause change(s)

2. **Mutation** - genetic change resulting from a change in
   a. Mutations can be good or bad
   b. Clones can mutate
3. Epigenetic change - change in phenotype due to expression of different
   a. Examples:
      i. striking change: formation of leaves vs. stems
      ii. subtle change: English ivy mature leaf vs. juvenile leaf
   b. Epigenetic changes are important for

J. Plant Growth Regulators = Hormones (?)
   1. Defined as substances present in low concentration that can have
      a. Plant growth regulators (PGR) are the preferred name rather than
         phytohormones, since
      b. For example, auxin affects plants in

   2. Five types of growth regulators are well documented
      a. Auxins      b. Cytokinins      c. Gibberellins
      d. Ethylene    e. Abscisic acid

II. SUMMARY
   A. Plant propagation can be called applied biology since it requires an
      understanding of biological principles
      1. These principles are often different for sexual and asexual propagation
      2. Some principles such as totipotency and epigenetic changes are inherent in
         both types of propagation
   B. Expression of plant genes as influenced by the environment will affect plant
      growth and appearance
C. In this course, we will take advantage of plant biology and use it to multiply plants.

**Significance of Asexual Plant Propagation**

Text Pages: 594 – 601; 21 – 22; 159; 623 – 625

Objectives:

1. Be able to describe and explain the reasons for using asexual propagation.
2. Be able to distinguish and identify why asexual propagation would be the propagation method of choice in some situations.
3. Be able to summarize the significance of asexual propagation to the horticulture industry.
4. Be able to describe and summarize different types of asexual propagation.
5. Be able to describe and explain legal protection of cultivars.

I. ASEXUAL PLANT PROPAGATION

A. Introduction - sexual reproduction of plants has disadvantages including:

   1. Sometimes lacking

   2. May lose unique

   3. Germination problems

B. Other Reasons for Vegetative Propagation

   1. Fixing Genotypes:

      a. Save the unique features of the parent plant because

      b. Cloning is important for

         i. sexual reproduction causes an exchange of
ii. new gene combinations may result in

2. Combining Genotypes into a Single Plant:
   a. Clones are combined via grafting
   b. Examples: fruit trees
      i. certain roses are budded to
      ii. apple cultivars are grafted to clonal rootstocks

3. Facilitate Propagation - only method
   a. Vegetative propagation is necessary
   b. Examples:

4. Shorten Time to Flower:
   a. Some woody plants may require 5 to 10 years of
   b. Certain orchids and bulbs
   c. If plants grow from seeds, a long juvenile period may be detrimental

5. Control Developmental Phases of Growth:
   a. Juvenile plants may have
      i. desirable: juvenile English ivy –
      ii. undesirable: juvenile black locust (Robinia) –
b. Vegetative propagation can be used to

6. Know the Sex of Dioecious Plants:
   a. Dioecious (definition) - plants are separate
   b. If fruiting is important, the female plant
      i. a male plant is needed for
      ii. examples:
   c. For some species, female plants could or should
      i. examples:
      ii. ginkgo fruits have a particularly foul odor

7. Uniformity of Populations - cloning may not save money
   a. Desirable traits lead to
   b. Uniformity of the clone may decrease
   c. Asexual propagation is economically feasible when
   d. Uniformity increases yield

C. Significance of Asexual Propagation to the Horticulture Industry
   1. Exploit a single plant with
2. Millions of identically superior plants

3. Production practices can be standardized since

4. Eliminate diseases from species or
   a. Eliminating diseases is important since many species are
   b. Examples:

5. Monoculture is a liability of
   a. If a disease or insect found a clone particular susceptible,
   b. An environmental change
   c. Examples:
      i. T-blight in corn:
         ii. neighborhoods in Ohio heavily planted with silver maple
         iii. neighborhood elms attacked by Dutch elm disease
   d. Species diversity can help avoid monoculture problems

II. METHODS OF ASEXUAL PROPAGATION
   A. Introduction
      1. Apomictic seed production - seeds produced without
a. The embryo in the seed is a vegetative

b. Examples:

2. Cutting Propagation
   a. Types of cuttings include various plant parts:
      i.                                          ii.
      iii.                                         iv.
   b. Cuttings are very important in the nursery industry

3. Grafting
   a. Grafting techniques include:
   
   b. Grafting and budding are very important in the nursery industry

4. Layering
   a. Defined as
   
   b. Types of layering include:

5. Division
   a. Includes propagating
   
   b. These plant parts are considered

6. Tissue Culture
   a. Techniques are used commercially or in
b. Techniques for commercial tissue culture include:

   i. meristem-tip

   ii. axillary shoot proliferation

III. LEGAL PROTECTION OF CULTIVARS

A. Introduction

   1. Newly introduced cultivars can be legally protected so that the owner

   2. Several protection mechanisms exist

B. Patents

   1. Awarded by the U.S. Patent Office and is given for "new and

   2. Patents last 20 years

   3. A plant growing in the wild is not

   4. Propagation methods include only cutting, grafting,

C. Plant Variety Protection

   1. Awarded for a 20 year period

   2. Applies to seed propagated and

D. Trademarks

   1. Offers protection for a name that indicates the specific

   2. Nurseries obtain trademarks that indicate a specific
a. Examples:

   i. roses: Star® roses - 
   
   ii. geraniums: Patriot® geraniums - 

3. The trademark is distinct from the 

   a. Customer recognition 

   b. Example of cultivar name and trademark name:

      i. 'JACshaq 1791' – is the cultivar name 
      
      ii. Diana, Princes of Wales™ - is the trademark name 

4. Trademarks are granted for 10 years but can be renewed indefinitely 

E. Summary