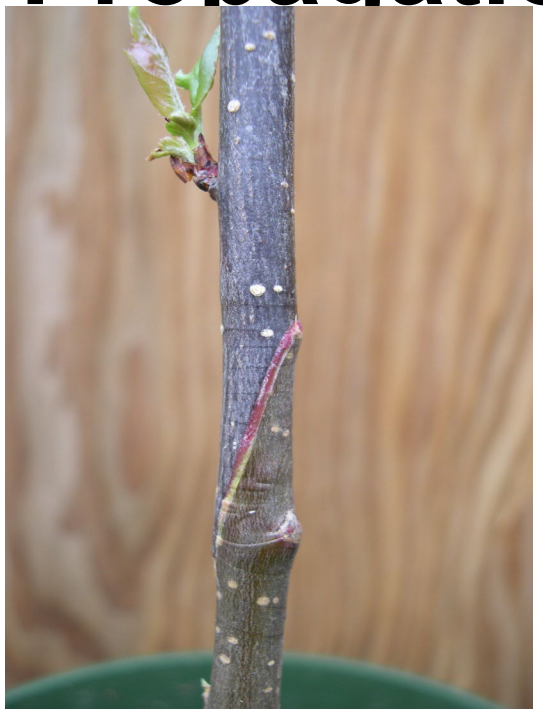
Plant Propagation

Megan Muehlbauer PhD
Hunterdon County Agricultural Agent

What is Plant Propagation?

- The *art* and *science* of multiplying plants while preserving their unique qualities
- In nature, plants propagate themselves in order to colonize new areas and/or to maintain survival of the species
- We attempt to maintain certain forms of plants (cultivars, ecotypes, etc.) that we find interesting or useful.
  - These forms wouldn't necessarily exist in nature



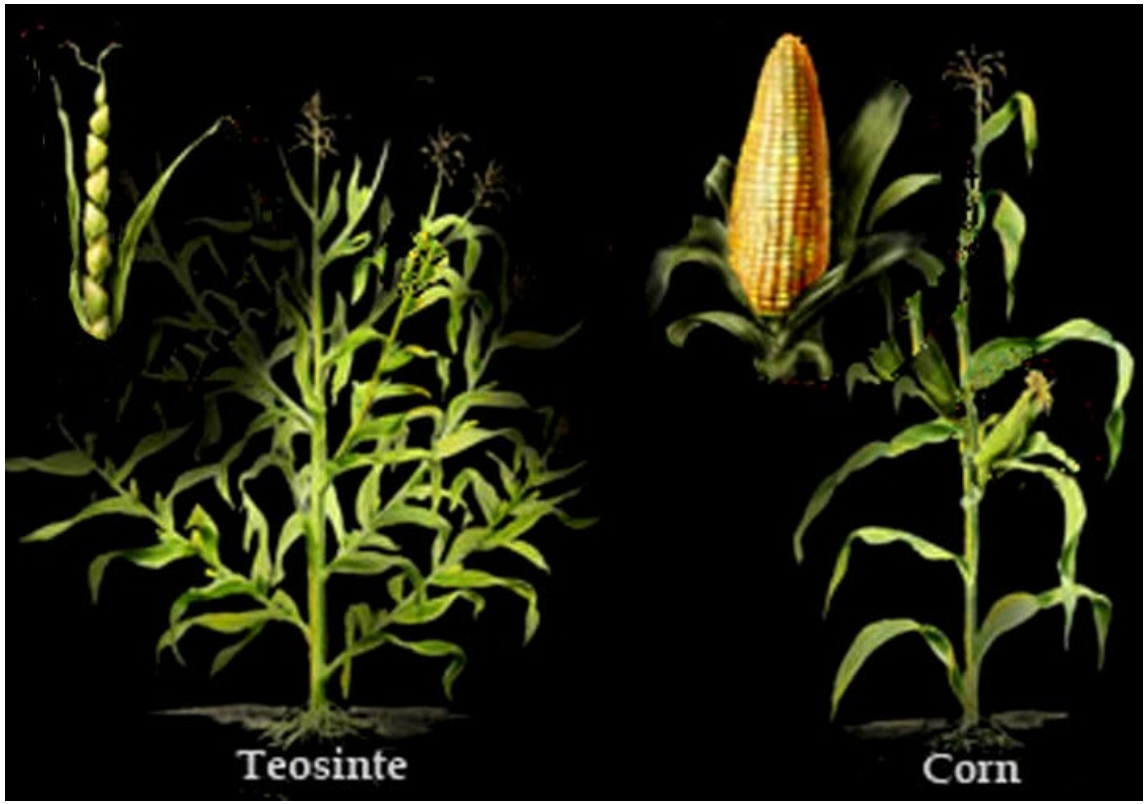
Splice graft to propagate
a red-leaf ornamental crab apple

Larkspur commonly self propagates

Weeping Cherry (grafted for habit)

Plant Propagation is an ancient science…

- Plant propagation played a large role in the development of modern human civilization
- It took humans the mental leap of understanding and controlling the reproductive process of plants to begin agriculture 10,000 years ago
- This included the saving and planting of selected seeds, which when combined with natural selection, lead to the development of improved plants suitable for productive agriculture from weedy species



http://www.mountainsofstone.com/images/Teosinte.jpg

What is a Cultivar?

- This term originates from the terms “cultivated variety”
- A cultivar must be clearly distinguishable by specific characteristics (morphological, physiological, etc.)
  - and it must retain these characteristics when propagated
- Different types of apples (*Malus domestica*) for sale in the grocery store are examples of cultivars that the public is familiar with
  - cultivars exist for nearly all other food crops and nursery stock, etc.

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Major Aspects of Propagation

There are three major aspects to plant propagation

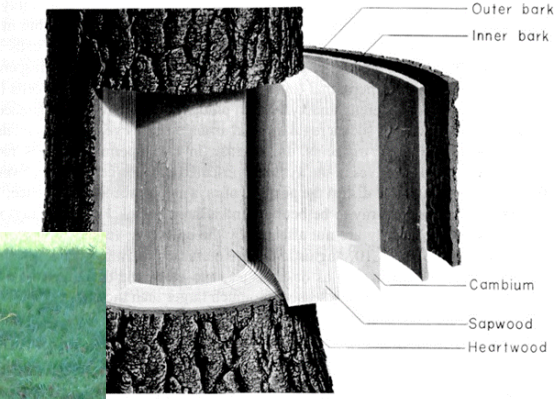
Each are essential to successfully propagating many different types of plants

How

* Knowledge of mechanical manipulations and technical skills
* This is the art of propagation that cannot be taught by reading and/or listening to lectures it is the skills learned by doing hands on plant propagating

Why

*Knowledge of plant growth and structure it is the science of plant propagation it deals with the underlying reasons for certain propagation procedures and why they are possible



The Plant

*Knowledge of specific plants and the particular methods by which those plants must be propagated a combination of art and science

*By mastering both the art and science, one can apply knowledge towards the propagation of new plants or to solving problems of poor propagation success

Ninth Edition

Hartmann and Kester's

Plant Propagation

Principles and Practices

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PROPAGATING PLANTS

REVISED NEW EDITION OVER 1,500 PLANTS

How to create new plants for free

EDITOR-IN-CHIEF **ALAN TOOGOOD**

Propagation:
Sexual vs. Asexual Reproduction

Plant propagation can be broken down into two categories:

Seed propagation

Asexual propagation (vegetative propagation)

Propagation By Seeds (Sexual)

Seed propagation is generally much cheaper and easier to perform than vegetative propagation, but it involves the process of meiosis

Leads to genetic recombination and variability in resulting seedlings (some exceptions)

Hazelnuts grown from seed

from same parent plant – same age– unknown pollen parents

Seeds = Meiosis = Genetic Recombination

- Pollination leads to haploid pollen and egg cells uniting (fertilization)
- haploid cells fuse to create new diploid zygote which contains a new combination of alleles

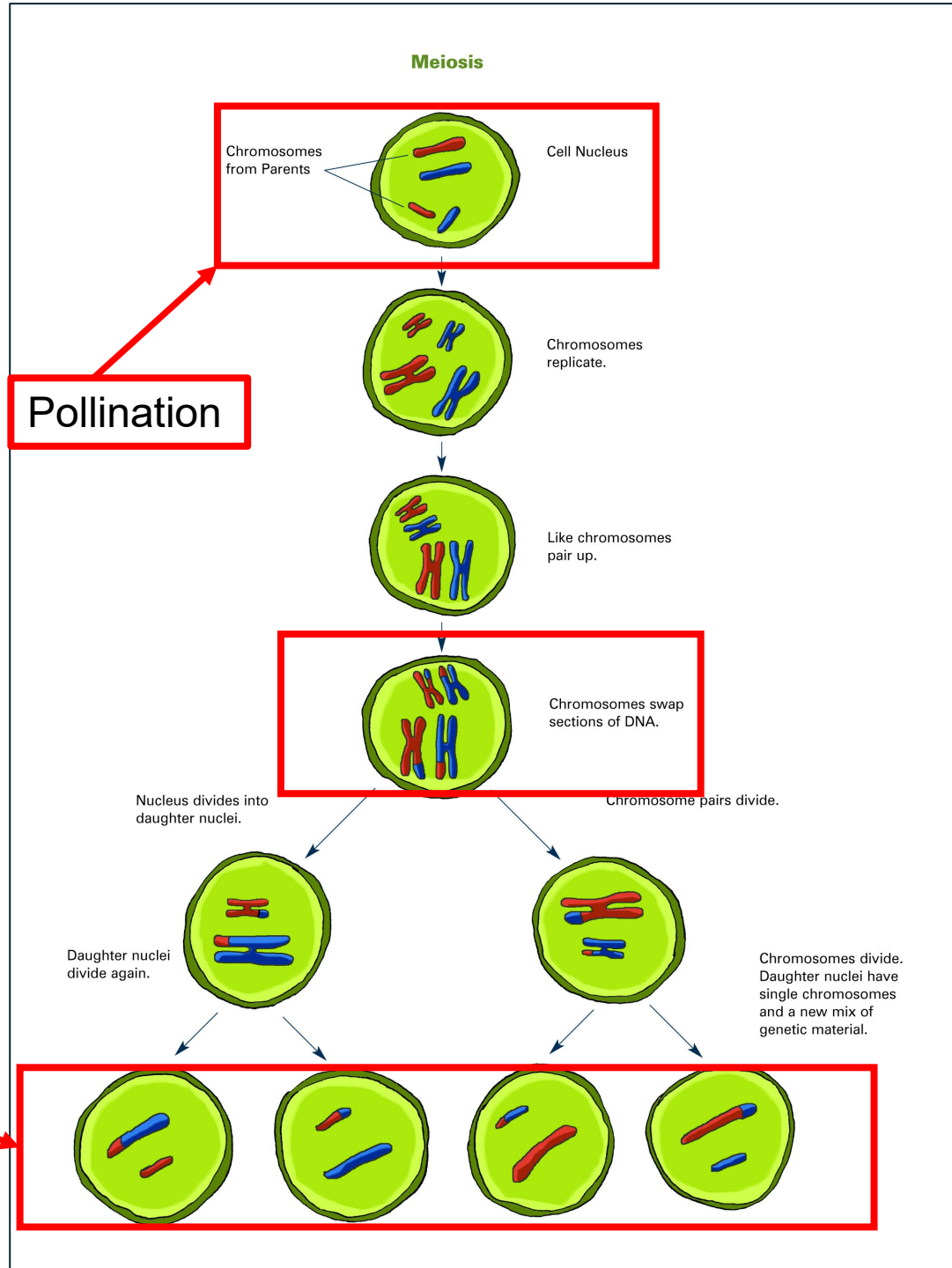
The early process of meiosis creates an exchanging of genetic information between pairs of chromosomes (crossing over)

- Later, one of each chromosome pair ends up in the resulting pollen and egg cells
- Assortment of chromosome partners occurs randomly
  - i.e. there are 2 pairs of chromosomes and one of each pair goes randomly to one gamete or to the other, a “shuffling of the

Daughter cells contain half the number of chromosomes as the parent cell (pollen/ovule)

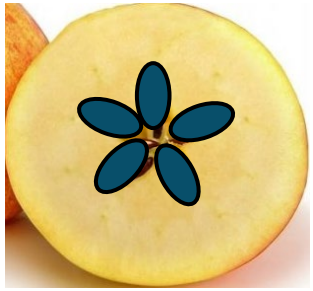
Every seed is genetically different

This recombining of gametes (sexual reproduction) leads ultimately to the variability seen in seed propagated plants



Apple seedlings predate grafting (asexual propagation)

X



Vegetative Propagation

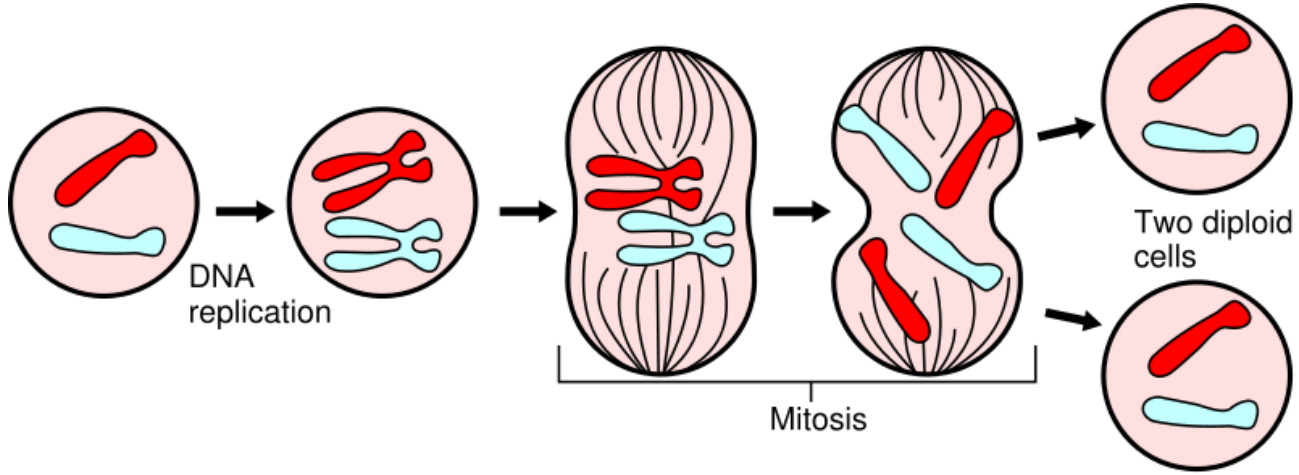
Asexual propagation (vegetative propagation)

There are many ways to do this!

The result is exactly the same copy of the parent plant
Retaining the parent plants characteristics

Vegetative (asexual) propagation

- Vegetative propagation relies on mitosis
- Mitosis does not lead to recombination
- However, plants vary tremendously by species and cultivar as to how easy or complicated it is to propagate them asexually



Asexual propagation

varies but same principle applies – cloning a plant and retaining its characteristics

- Rooting cuttings***
  - Stem, leaf, root
- Layering
  - Simple, mound, trench, air
- Grafting & budding
  - T-bud, chip bud, splice graft, whip and tongue graft, cleft graft, etc.
- Bulb Propagation

  Bulb Splitting, budding off, scaling, stem bulbs
- Micropropagation/tissue culture
  - Cell culture, meristem culture, etc.

Rooted Cutting

A portion of stem, leaf, or root from a parent plant, which when placed under favorable environmental conditions, is induced to form new roots and/or shoots, resulting in progeny identical to the parent

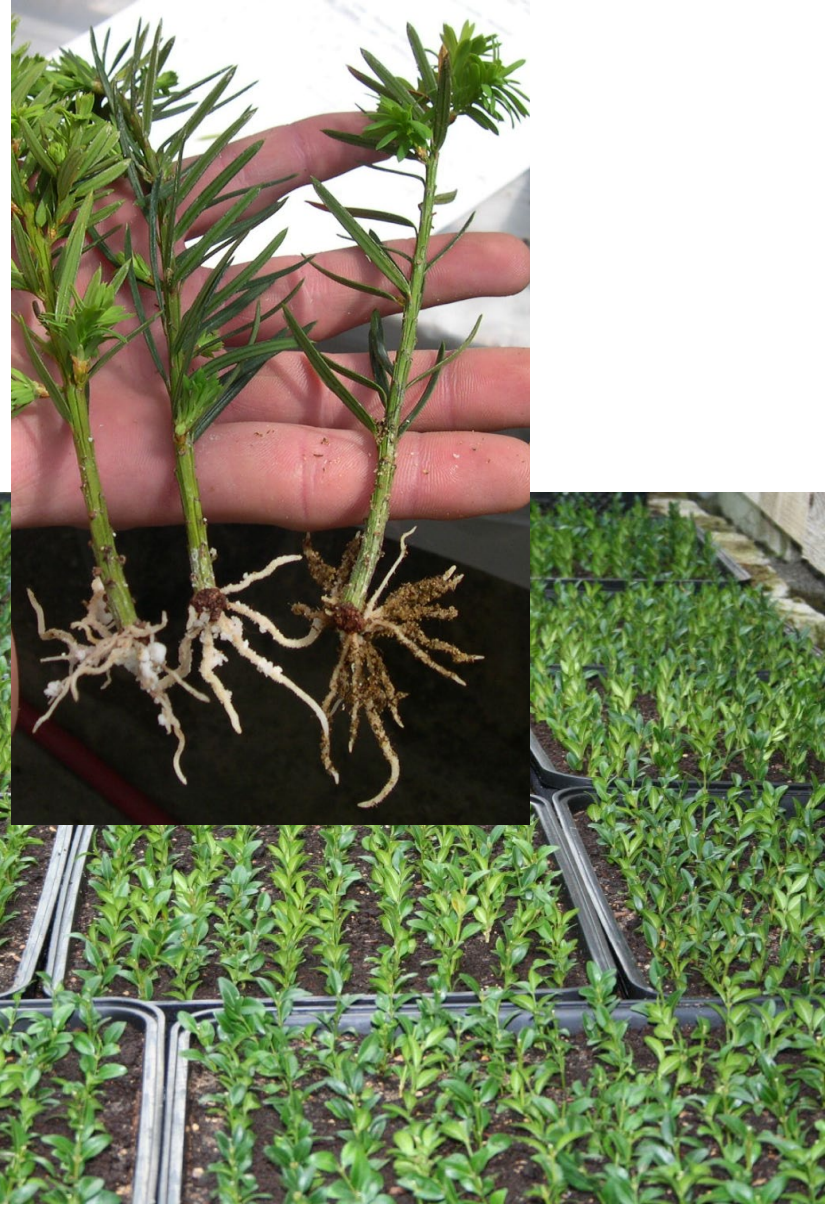
Benefits of propagation by cuttings

- As with all the various propagation methods, propagation by cuttings has its benefits and limitations
- Cuttings are technically simple compared to other asexual techniques
- Almost anyone can be trained to select, prepare, and stick cuttings
  - Grafting and micropropagation/tissue culture requires more skills, equipment, and training

Rooted holly cuttings

Benefits

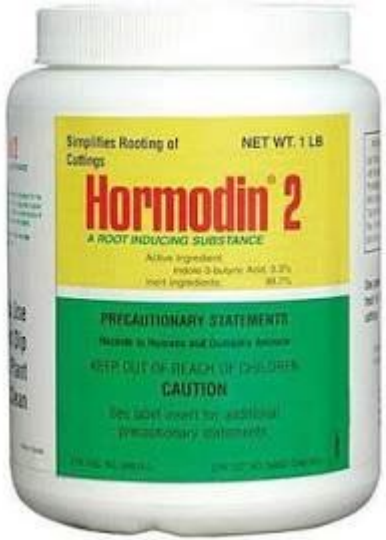
- Cuttings are a more efficient use of space than grafting or layering (although, not more efficient than micropropagation)
- Cuttings are usually the least expensive method of cloning plants – if plants can be propagated this way, they generally are
- Compared to grafting- cuttings generally produce a more uniform crop and they also avoid the problems of graft incompatibility

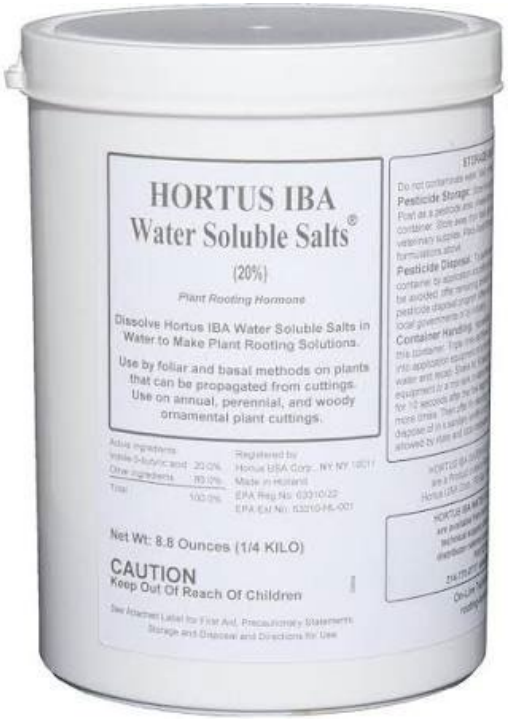


Plant Growth Hormones

Auxins (NAA, IBA)- root formation

Cytokinin (BA, TDZ)-shoot formation





Stem cutting

- Stem cutting – piece of stem with one or more vegetative buds
- To restore a complete plant from a stem cutting, only new roots need to form
- Vegetative buds already exists, which contain all the preformed meristematic regions to form the shoot

101 of Taking Cuttings

Generally cuttings are taken in late spring through early fall

7.5-15 cm long with leaves at apical end

If leaves are very large trim them back (lowers transpirational water loss)

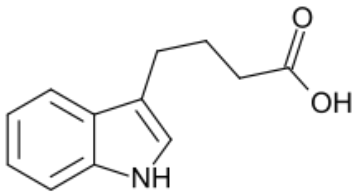
Take cuttings in morning when leaves and stems are turgid

Take cuttings and place in a moist plastic bag, and out of sun until they are being stuck

Stick in a moistened tray of growing medium

Dipple first as to not damage the stem

Rooting can be accelerated by bottom heat, wounding, or hormone treatment.



IBA (Auxin)

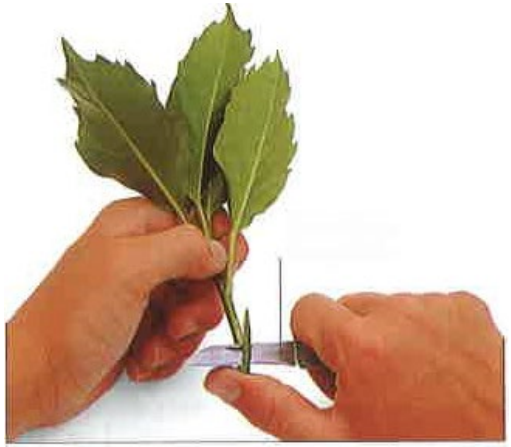
Undifferentiated cells (callous)

Steps to Taking Cuttings

Cut just above a node

Store in a humid bag

Trim up the cuttings



Wound the basal end

Dip in rooting hormone

Dibble soil and stick cutting

1:1 peat moss to pearlite

Steps to Propagating Succulents

Select suitable material

~mature/ripe

Remove leaf from stem

Allow wound to callous ~leave in a warm dry place for a few days

Prepare rooting media

Pot cuttings

~leave in partial sun

~keep them damp

Leaves will root after 2-4 weeks

New tiny plantlets will form at the base

Grafting

The art of connecting two pieces of living tissue together so they unite and develop as one

Scion wood

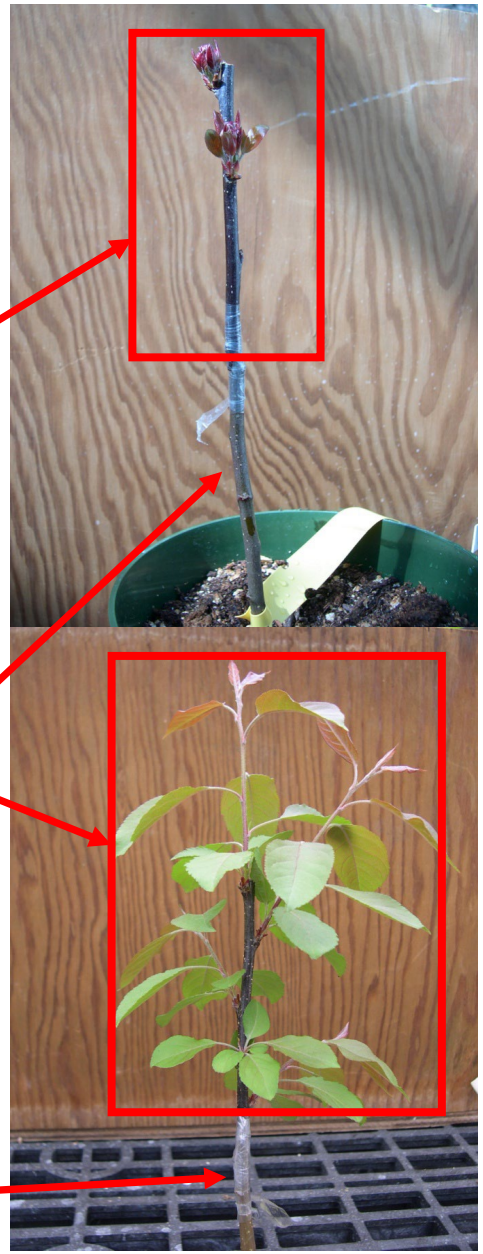
The piece of stem with one or more buds that forms the upper portion of shoot on a grafted plant

The genotype you want to multiply

Rootstock

(also referred to as the stock or understock) forms the lower portion of the grafted plant includes the root system and perhaps (depending on the placement and type of graft) the trunk and part of the scaffolding branches

The rootstock may be a seedling, rooted cutting, layer, or micro-propagated plant



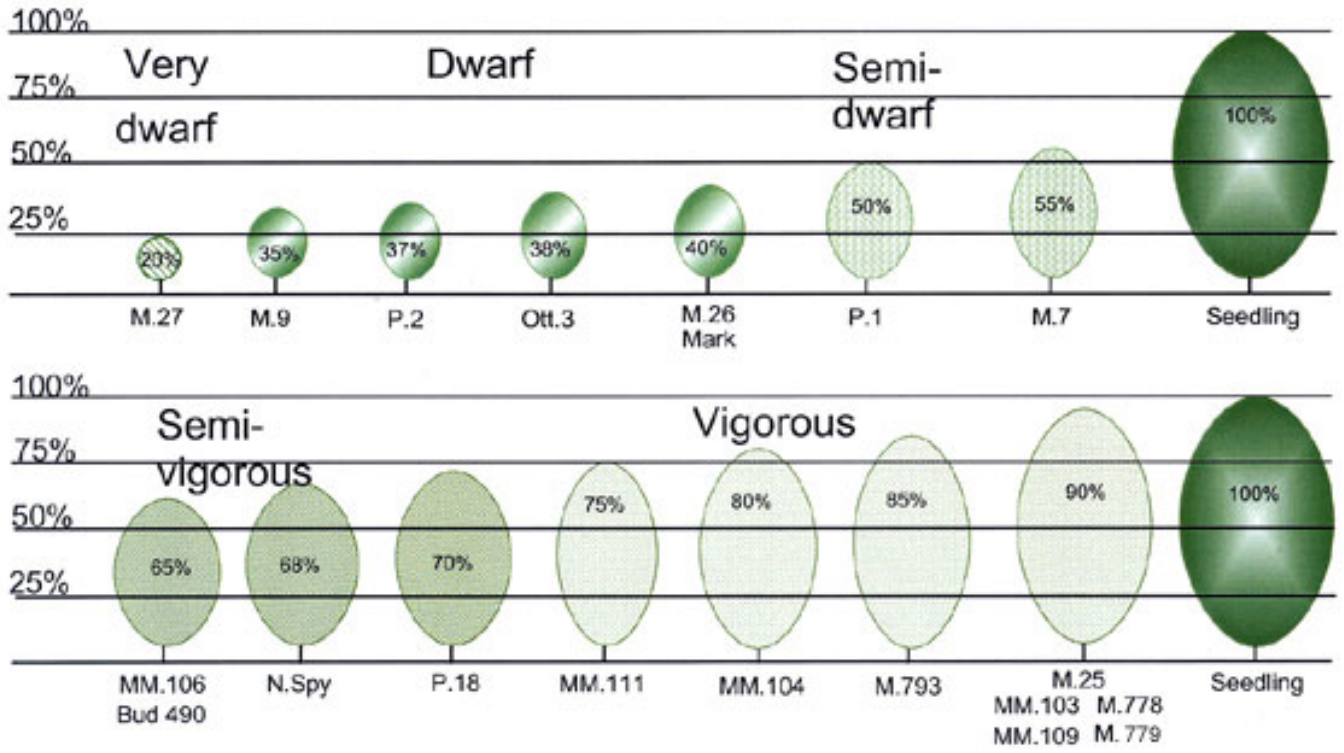
Side veneer graft

Splice graft

Reasons for grafting

Obtain the benefits of particular rootstocks

- Dwarfing habit
- Disease resistance
- Tolerance to different biotic and abiotic stresses



Apple rootstock have been developed to let you predict the size of the tree
Smaller trees are easier to harvest and more can be planted per acre: higher yields per acre!

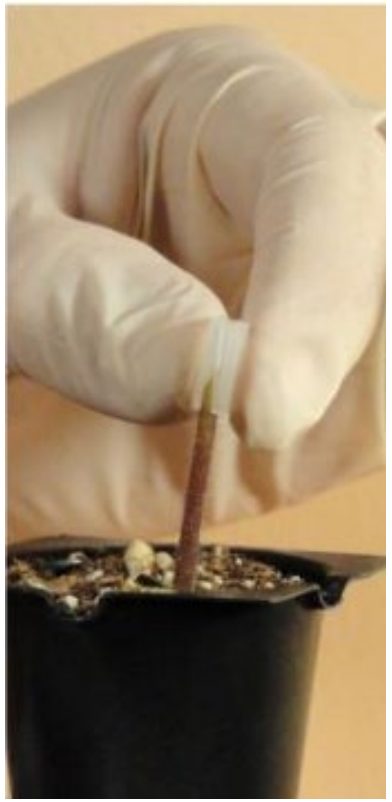
Tomato Grafting

Rootstocks can aid in providing resistance to a number of diseases:

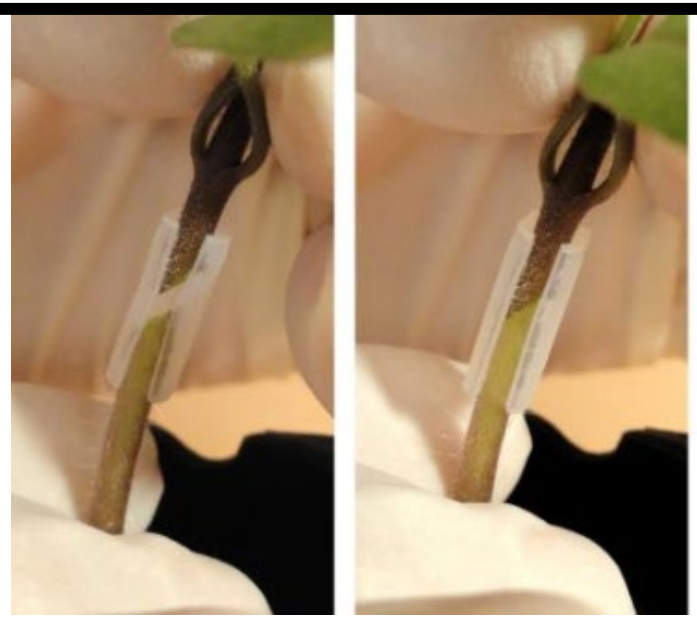
- Verticillium wilt
- Fusarium Wilt
- Southern Blight

They can help enhance yields

Trim 80-90% of leaves off of scion (same diameter as stem)
Cut rootstock just below cotyledons



Ensure scions stem diameter matches rootstock diameter and attach clip to rootstock

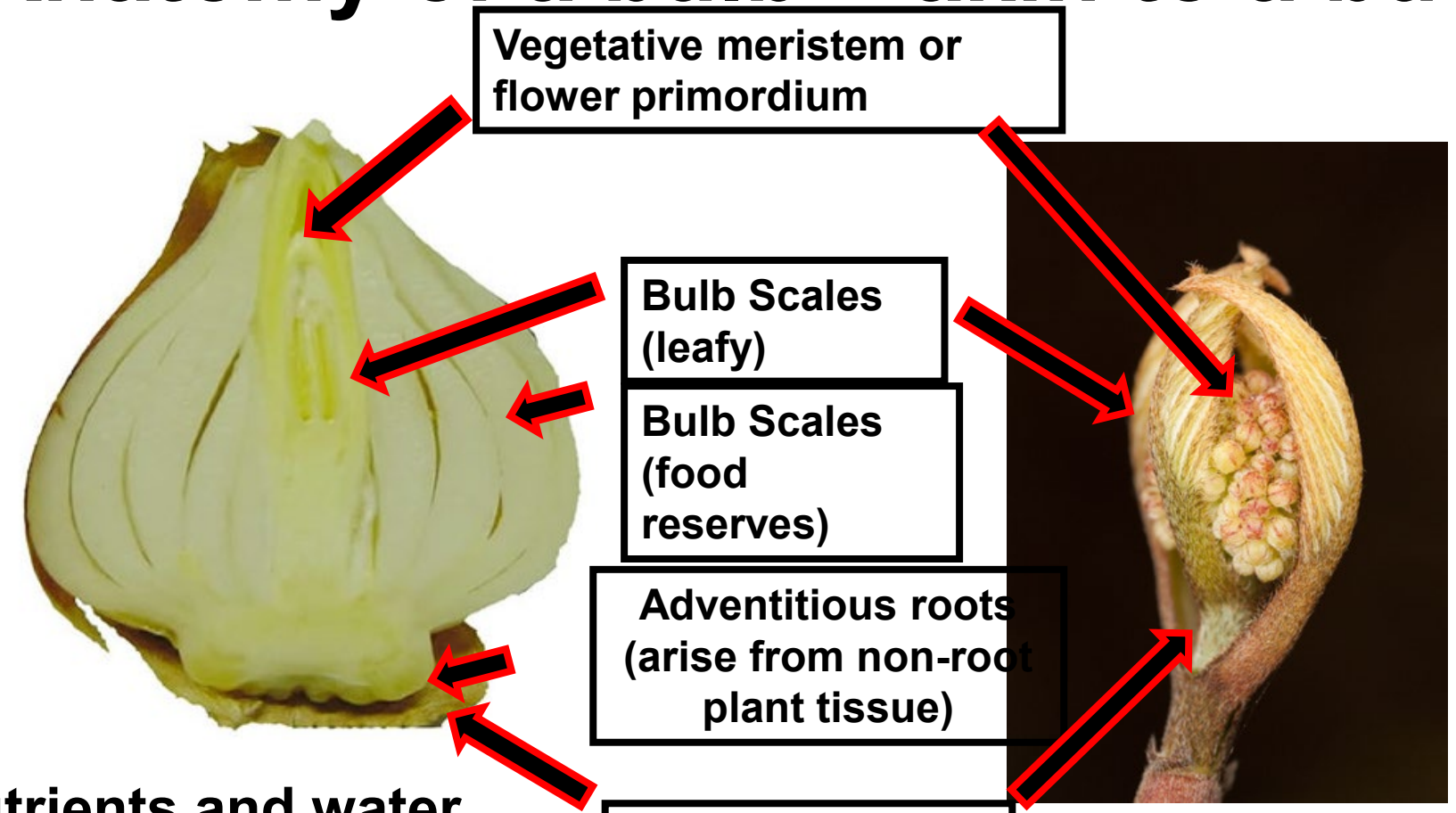


Slide scion into clip making sure there is good surface contact with rootstock.

Place under low light in a humidity chamber!

Bulbs

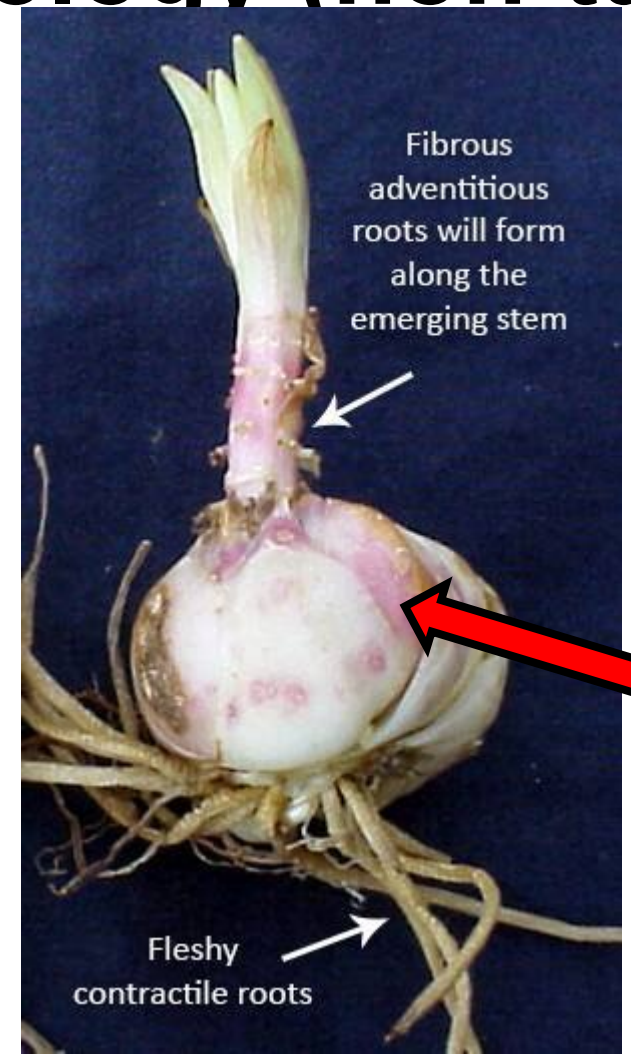
Anatomy of a bulb ~ akin to a bud



Store food nutrients and water during adverse weather conditions

Sense and respond to changes in the environment

Lily Phenology (non-tunicate blub)



Loose scales attached only at the base

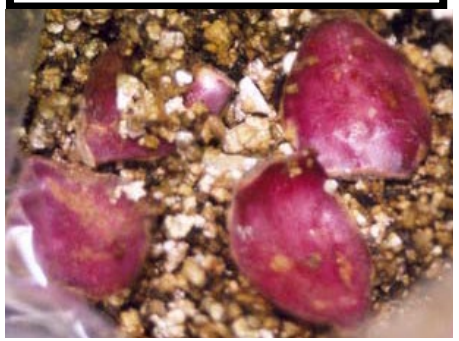
Scaling

Individual bulb scales are removed from the mother bulb, placed in appropriate conditions and adventitious bulblets (3-5) from at the base of each scale

Done in fall: Outer two layers of scales removed and mother bulb replanted or remove all outer scales

Put scales in a bag of 10:1 vermiculite to water

KEEP THEM MOIST!



Close bag and maintain for 6-8 weeks at 70°F

Bulblets will develop on scale

Transplant to flats

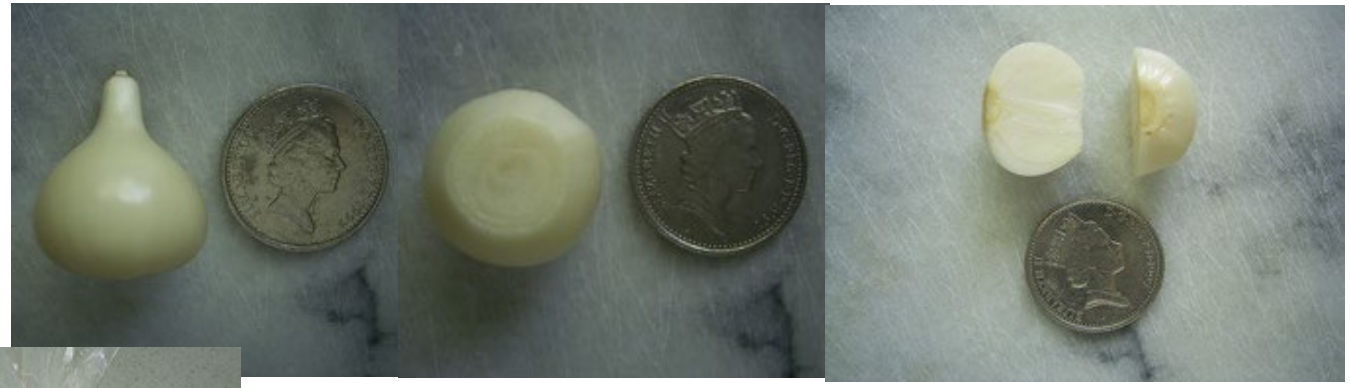
Bulb Chipping

A mature bulb is cut into a series of 8-10 vertical sections

Each section has part of the basal plate

Each fraction contains a piece of basal plate and segments of 3 or 4 scales

Cut off the top part of the bulb



Cut the bulb vertically into equal sections, each with a pieces of the basal plate

Place in bag with 10:1 vermiculite to water

12 weeks in dark at 68°F

Newly formed bulblet!

Newly formed shoot!


Questions?
muehlbauer@njaes.rutgers.edu