

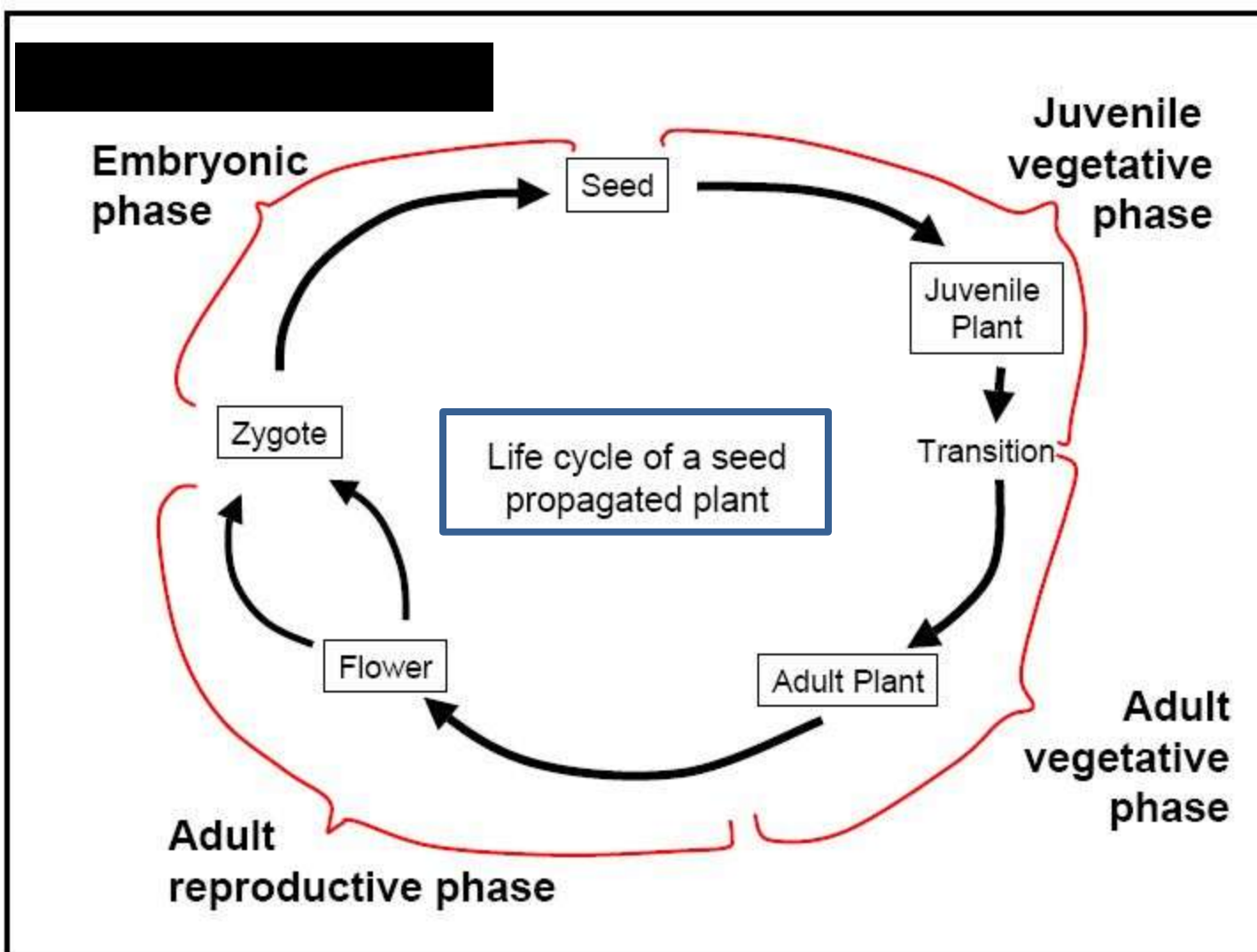


Vegetative Growth

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PHASE CHANGE: JUVENILITY, MATURATION, SENESCENCE

- Phasic development
 - embryonic growth
 - juvenility
 - transition stage
 - maturity
 - senescence
 - death



Clonally propagated plants pass through veg. adult phase, a transition stage, maturity, senescence & death.

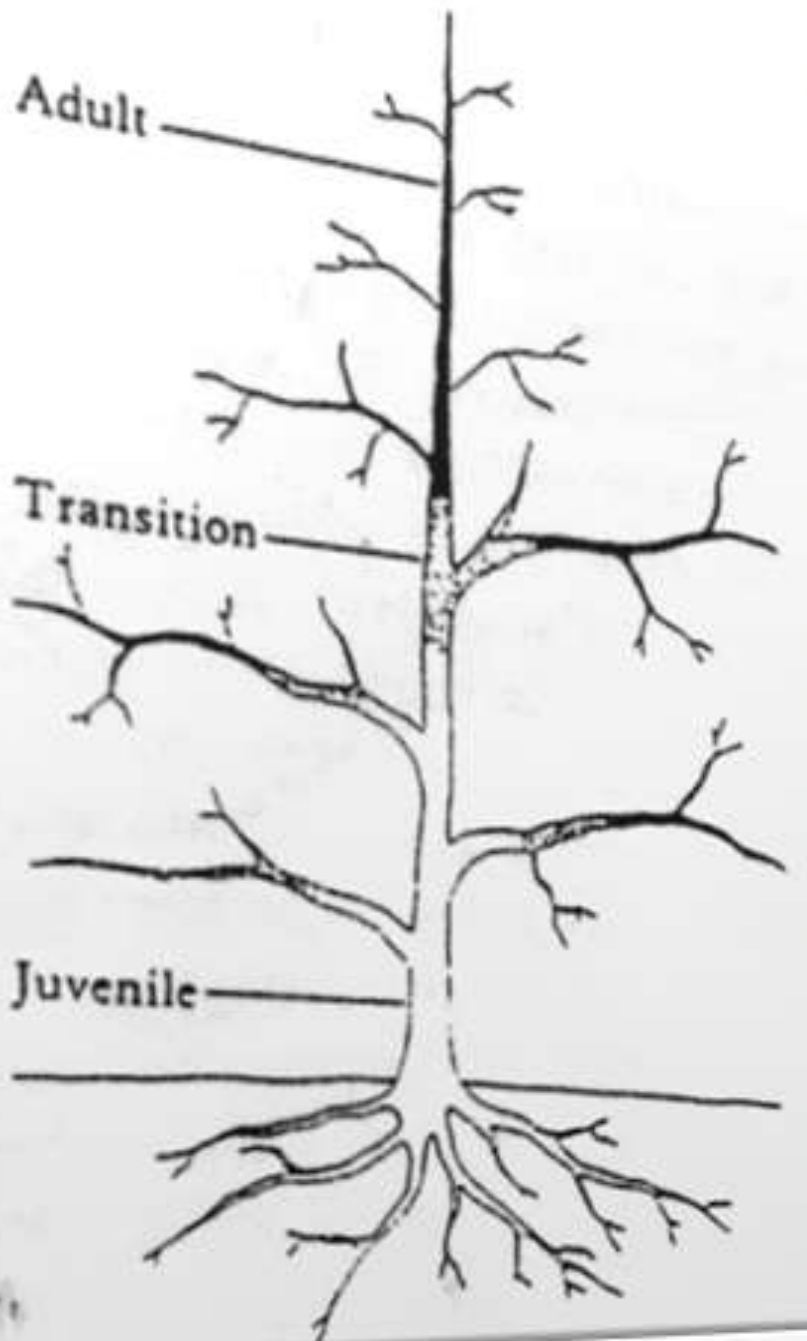
Juvenility

- Physiological state of a seedling plant during which it :
 - Lack of ability to flower, vegetative growth only
 - Ability to form adv. Organs (shoots, roots)
- **Physiologically related**
 - lower part of plant may be oldest chronologically, yet be youngest physiologically.
 - top part of plant may be youngest in days, yet develop into the part that matures and bears flowers and fruit

Duration of juvenile phase

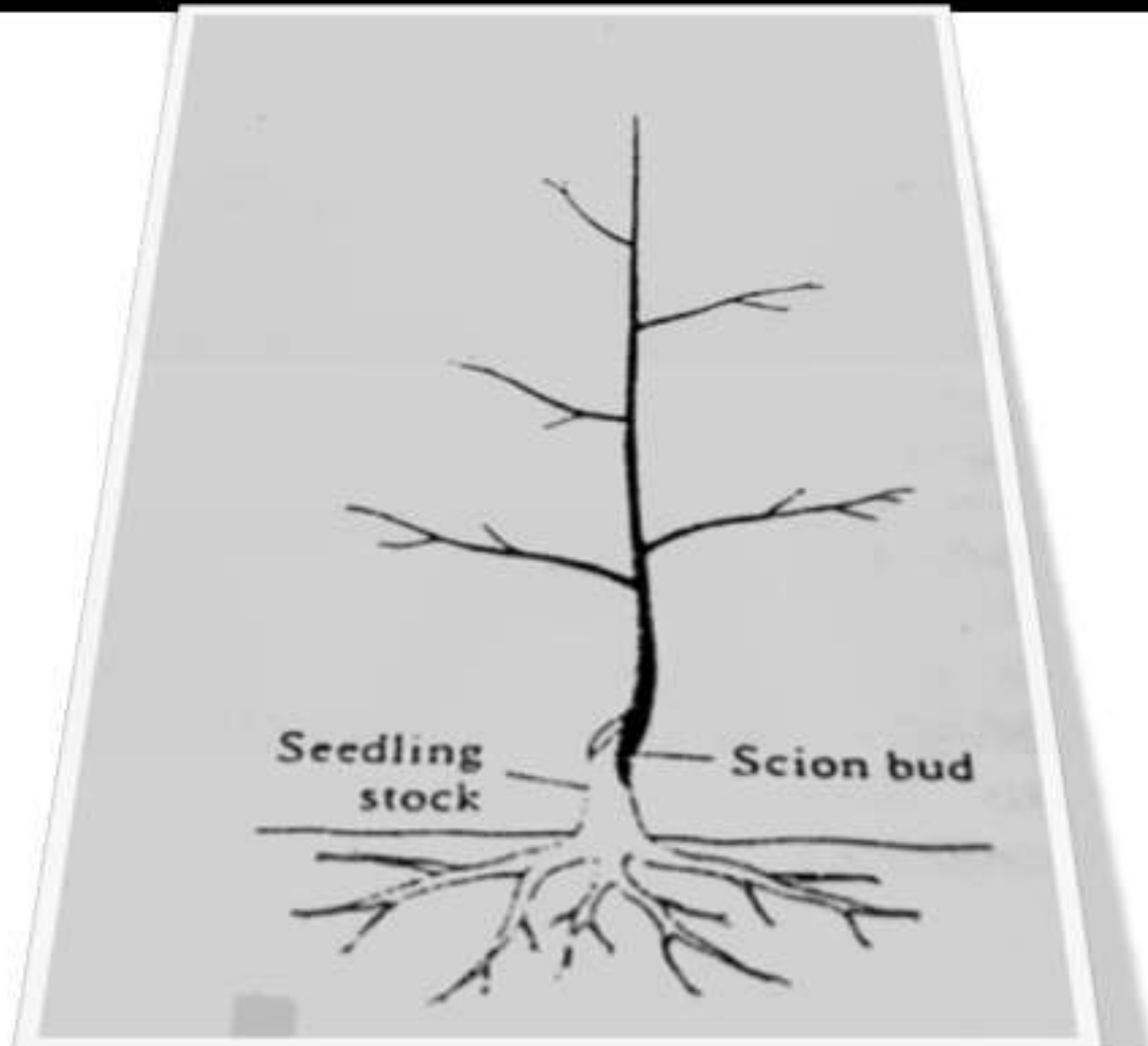
Species (Common Name)	Duration of Juvenile Phase
<i>Malus pumila</i> (apple)	6–8 years
<i>Citrus sinensis</i> (orange)	6–7 years
<i>Citrus paradisi</i> (grapefruit)	6–8 years
<i>Pyrus communis</i> (pear)	8–12 years

➤ Juvenile phase may be very short or very long depending upon both environment & genetic factors (species) & growth rate.



- Juvenile bud develops to juvenile shoot
- Adult bud develops to adult shoot
- The young seedling is juvenile in all its tissues until it grows into the transition phase
- The adult phase does not alter the juvenile tissue, they remain *in situ* at the base of the tree for its entire life

In contrast to the seedling plant, varieties budded to seedling stocks are entirely adult above the bud union



Marks of juvenility

- Inability to flower
- Glabrous, lobed leaves, Creeping stem
- Thorniness: Citrus
- Semi-evergreen habit in deciduous species
- Ability to form adventitious organs: shoot, root
- Ease of rooting: juvenile tissue contain a number of cofactors that are absent or low in adult tissue

Transition Phase

- Loss of juvenile characteristics.
- May be accompanied by morphological changes.
- Phase change includes the acquisition of the ability to flower.

Maturity

- loss or reduction in ability of cuttings to form adventitious roots.
- Plants can flower & reproduce sexually.

Vegetative adult phase / reproductive adult phase

a. Adult Vegetative Phase

- It is the non flowering phase of clonally propagated varieties , could be short or quite long.

- Grafted trees do not go through a juvenile stage because the buds were taken from mature bud



b. Adult reproductive phase

plants are able to flower

How to control?

Delays reproductive phase:

- Vigorous rootstock
- Excess N
- Gibberellin applications
- Severe pruning

Hastens reproductive phase:

- Dwarfing rootstock
- Bending branch toward horizontal
- Gibberellins inhibitors or ethylene
- Growth retardant (Damenozide,)

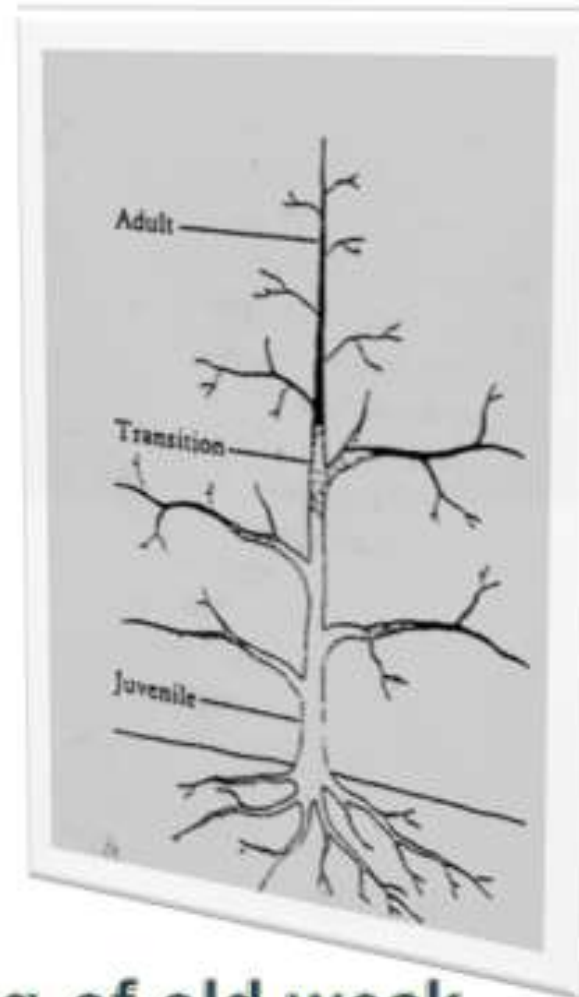
AGING AND SENESCENCE

- Life spans among plants differ greatly
 - range from few months to thousands of years
 - clones should be able to exist indefinitely
- Senescence
 - a physiological aging process in which tissues in an organism deteriorate and finally die
 - considered to be terminal, irreversible
 - can be postponed by removing flowers before seeds start to form

Rejuvenation:

The adult portion of woody plant reverts to the juvenile (do not happen normally)

- Thus an old seedling tree, cut off at the lower trunk, would produce juvenile sprouts from latent buds of the juvenile portion of the tree.



Rejuvenation pruning: Heavy pruning of old weak orchard

Vegetative growth & development

- The fruit trees are perennials
- In juvenile & veg. adult phase, all buds are veg. & develop to shoot
- In adult phase, veg. & floral buds are born on shoots

Shoot growth pattern:

- The buds grow in flushes (1-3 flushes depending on sp.)
- Spring flush (the main) result from accumulated food stored in the tree previous year.
- Other flushes could appear in summer & autumn

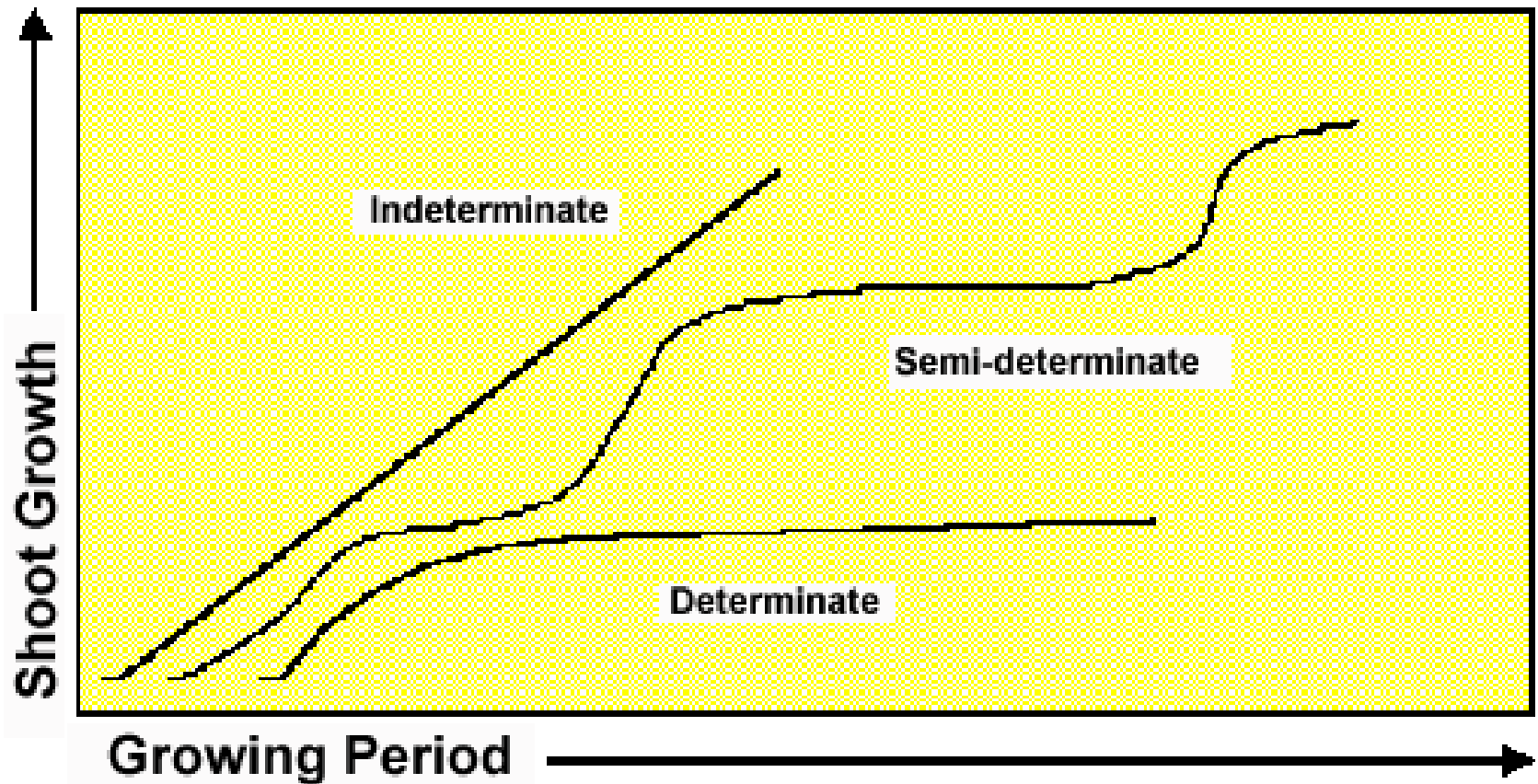
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Type of shoot growth

- **Determinate** : flower bud formed at the shoot terminal, stop shoot elongation (apple, pear, loquat,..)
- **Indeterminate** : flower bud form laterally in the axil of the leaves (apricot, peach, fig, olive,..)

Shoot Growth Patterns





Peach Shoots



Loquat Shoot

Root growth pattern :

- Spring flush result from accumulated food stored in the tree previous year.
- Late summer or early fall flushes result from accumulated food stored in the tree the same year.