

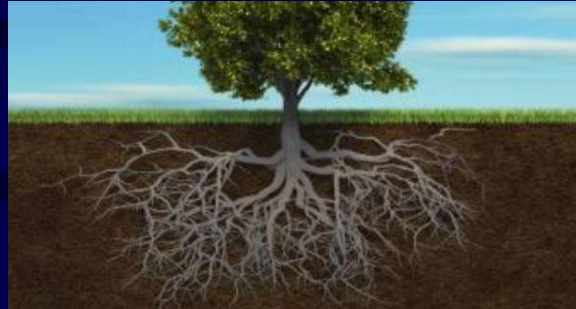


Physiology of Fruit Trees

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Growth and Development of the Fruit Tree root system

Introduction:



History:

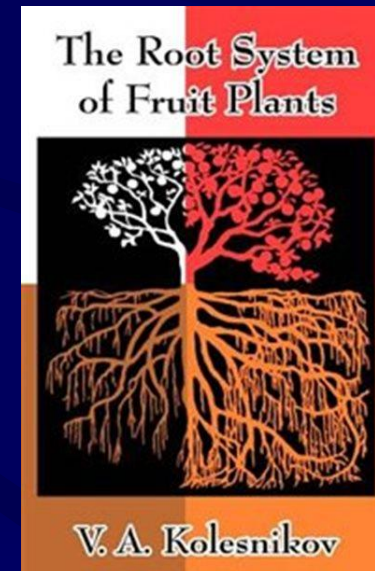
Hales (1727); Du Hamel du Monceau (1758)

Bobrinsky (1852); Sachs (1865)

Bailey (1895); Goff (1897); Shitt (1913)

V. A. Kolesnikov (1920-1960)

D. Atkinson



Root Functions:

- Absorption and transportation of water and minerals (Assimilate 0.7-1.5, Minerals 2-4, water 14 m h⁻¹)
- The production of amides, amino acids, proteins, hormones,
- Excretion into the soil of various substances (Phenolic compounds, Organic acid,....)
- Accumulation and storage of nutrients
- Anchoring the plant in the soil
- Propagation of fruit trees (Quince, Pomegranate,
- Control of fruit tree size

Root Structure

Meristematic zone

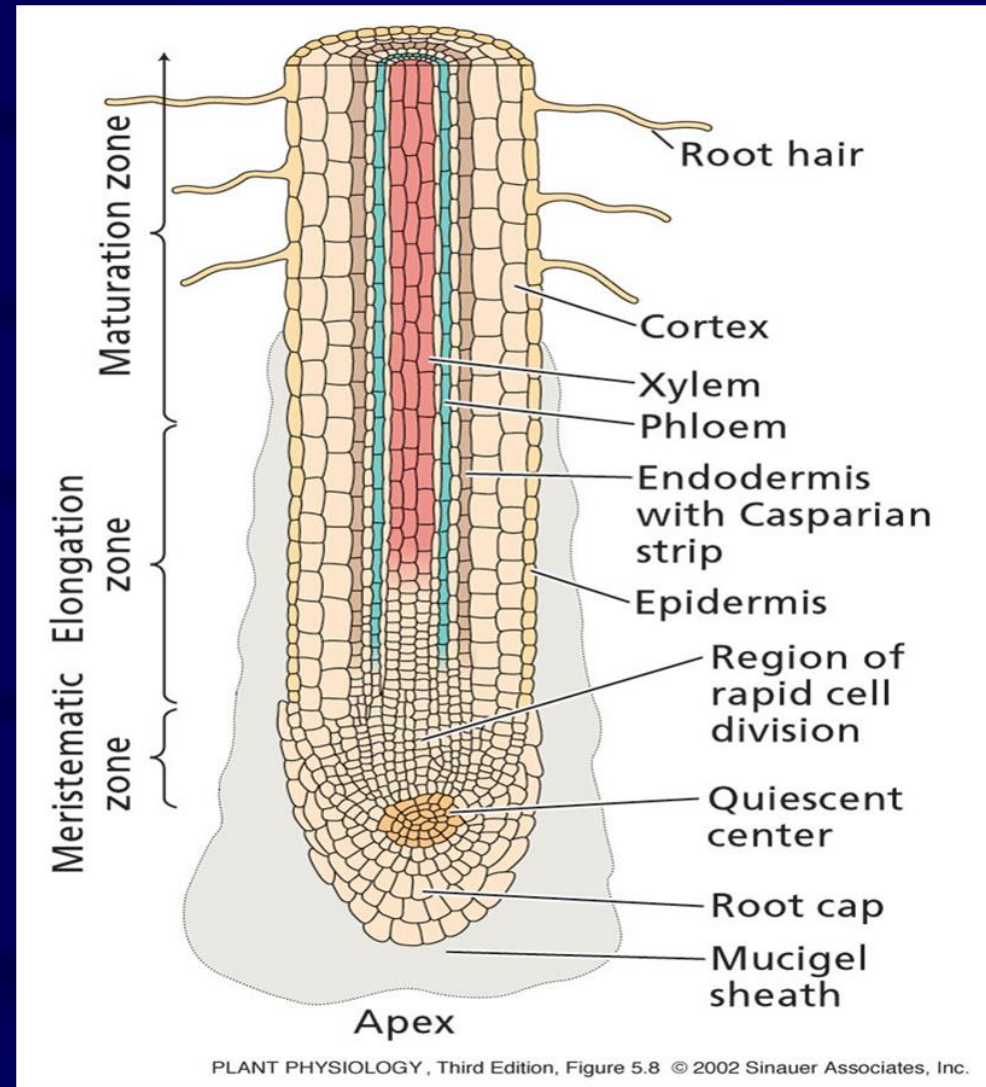
→ Cells divide both in direction of root base to form cells that will become the **functional root** and in the direction of the **root apex** to form the **root cap**

Elongation zone

→ Cells elongate rapidly, undergo final round of divisions to form the **endodermis**. Some cells thicken to form **casparian strip**

Maturation zone

→ Fully formed root with **xylem** and **phloem** – **root hairs** first appear here



The development of individual roots

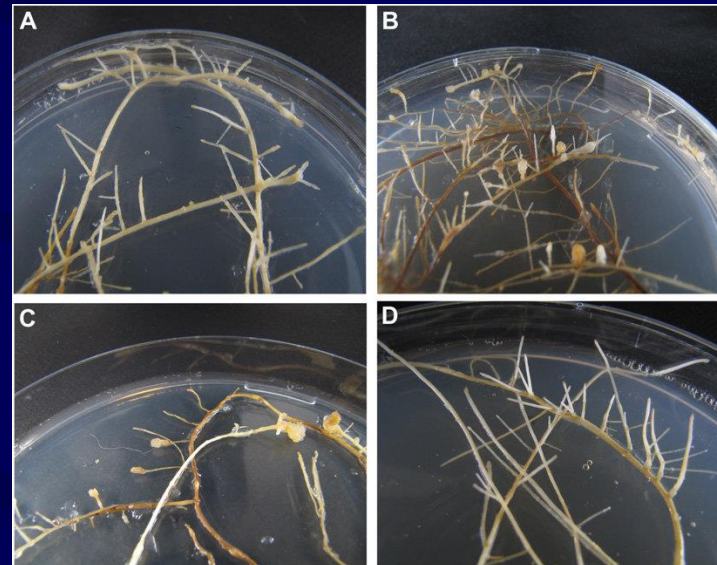
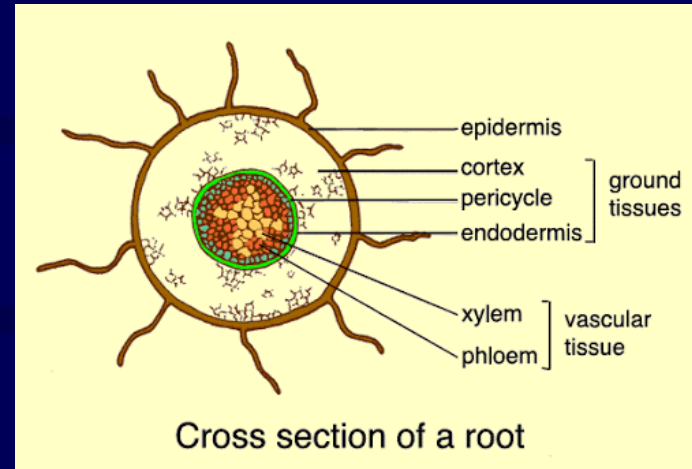
A. Growth and changes with age:

Apple 0.3-2 mm

Apple 1 cm/day

Root hairs:

Apple 0.025-0.05 mm



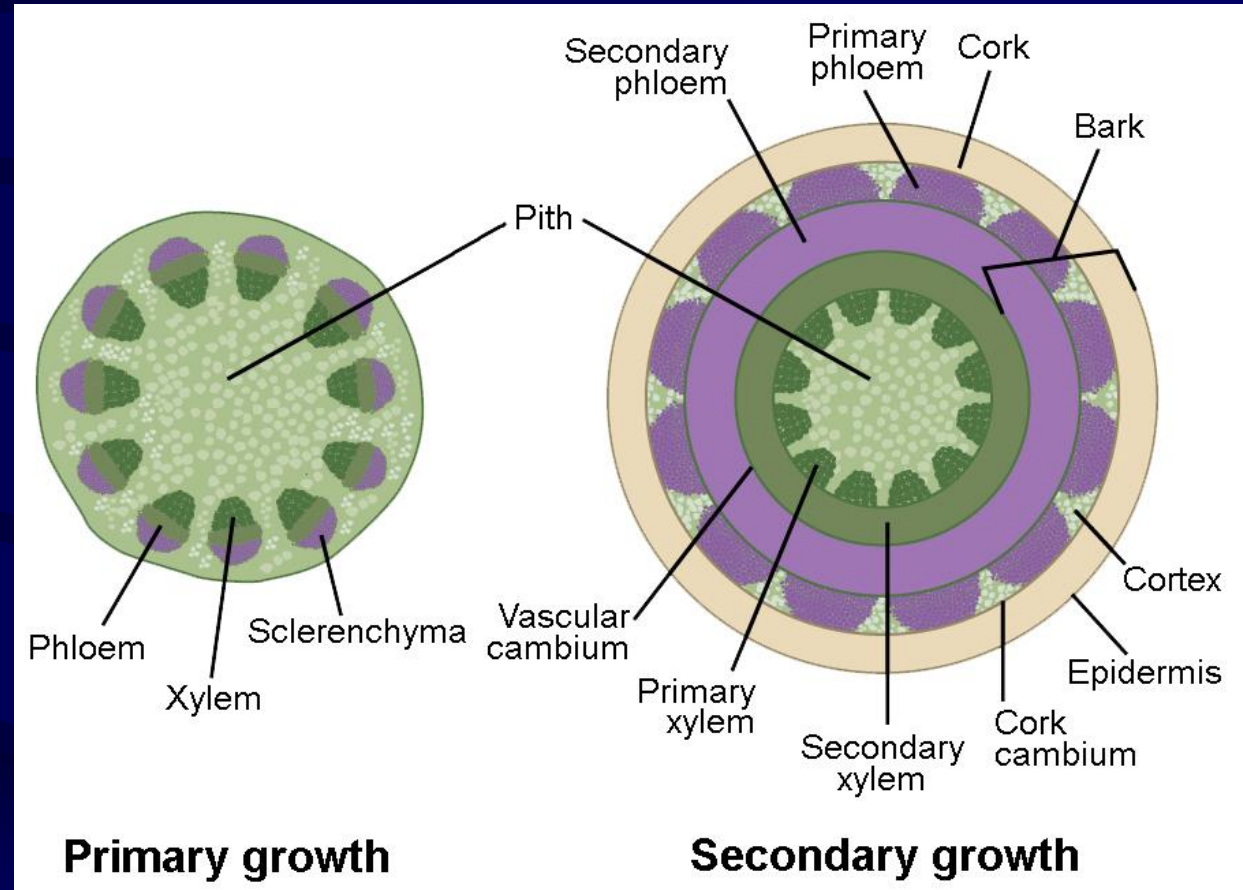
B. Secondary Thickening

C. Root-Soil Contact

-Ca, Zn

-Soil fauna (Nonparasitic Nematodes)

-Water stress



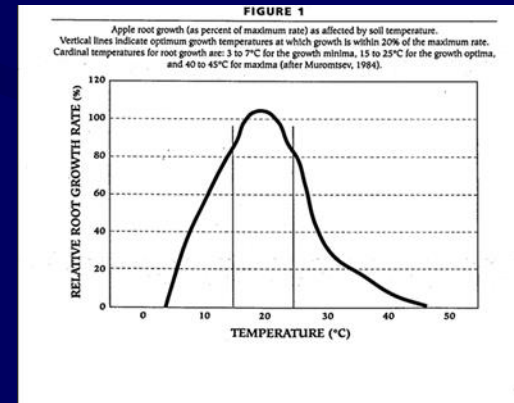
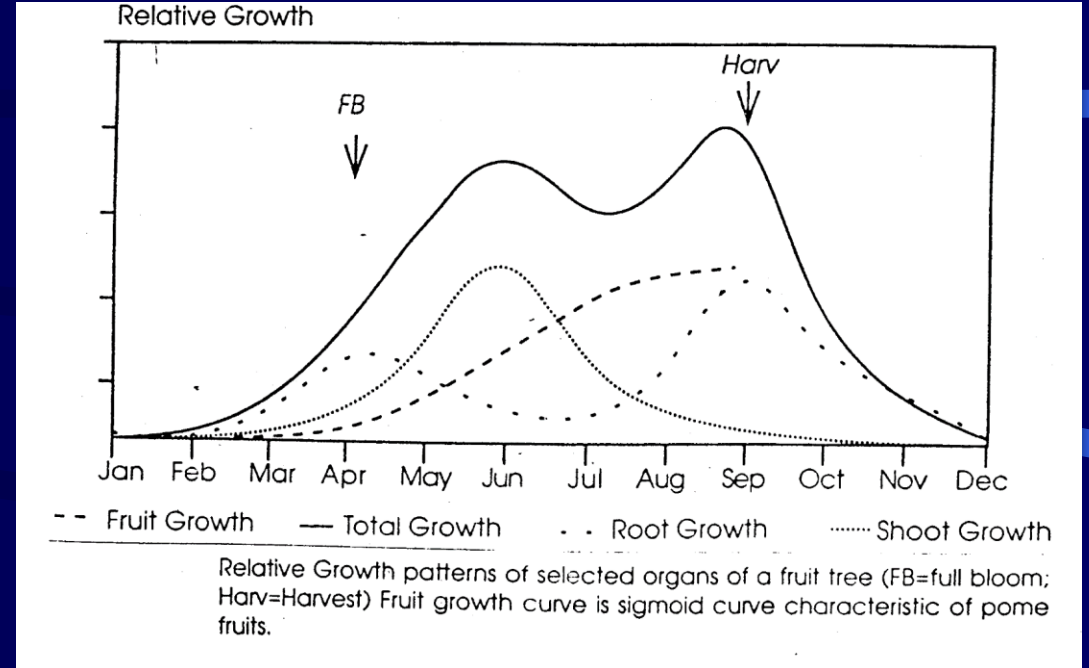
Seasonal Pattern of Root Growth

Root growth in the spring begins before bud break

- Soil Temperature
- Water availability

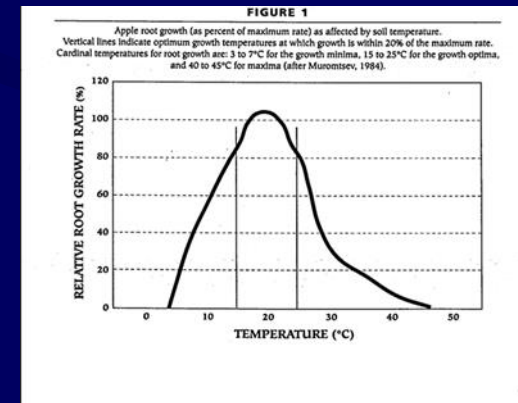
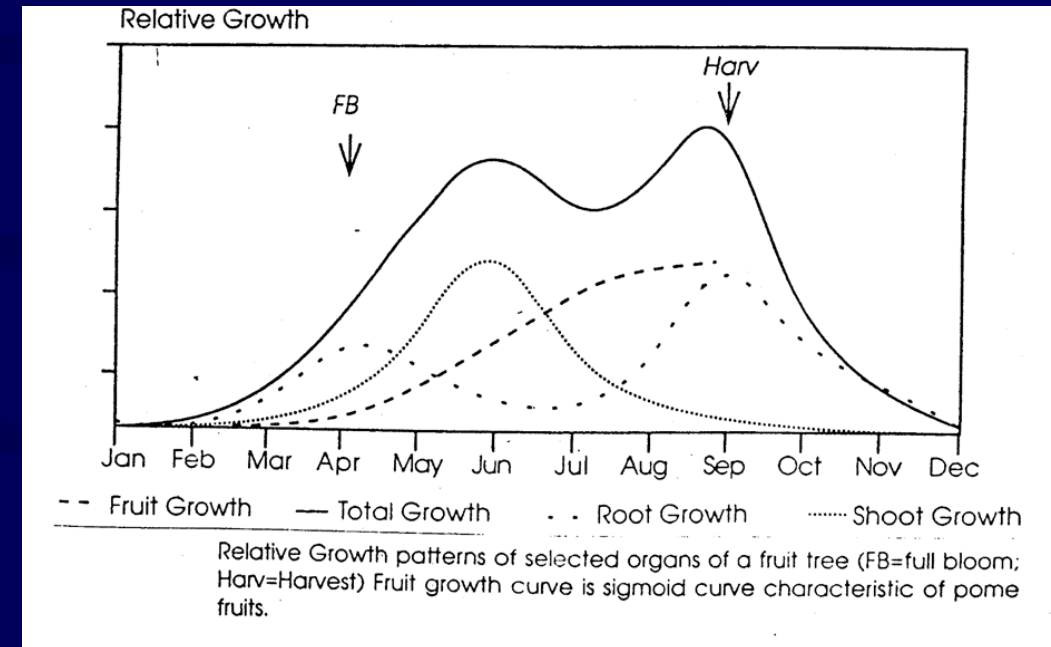
Cardinal temperature for root growth

- 3-7 °C for the growth minima
- 15-25 °C for the growth optima
- 40-45 °C for the growth maxima



Factors affected seasonal root growth:

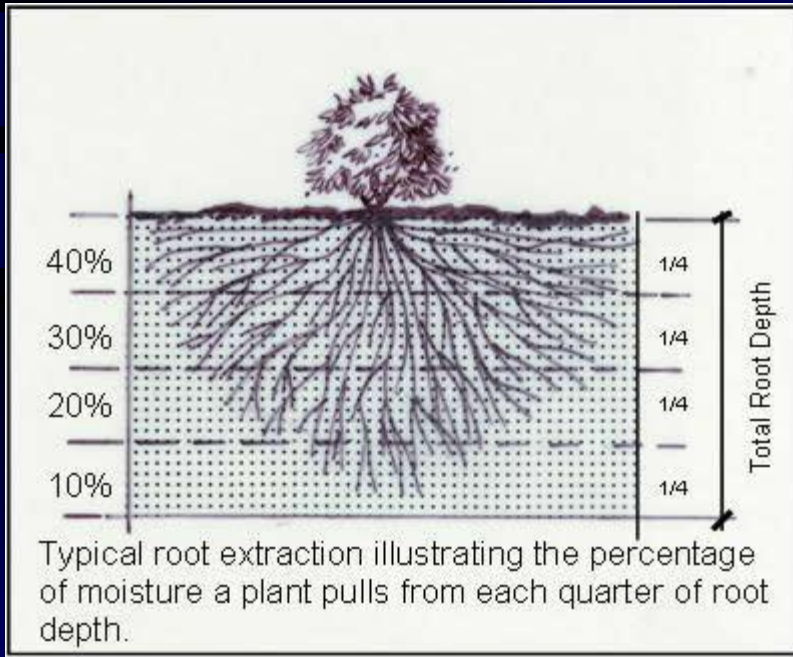
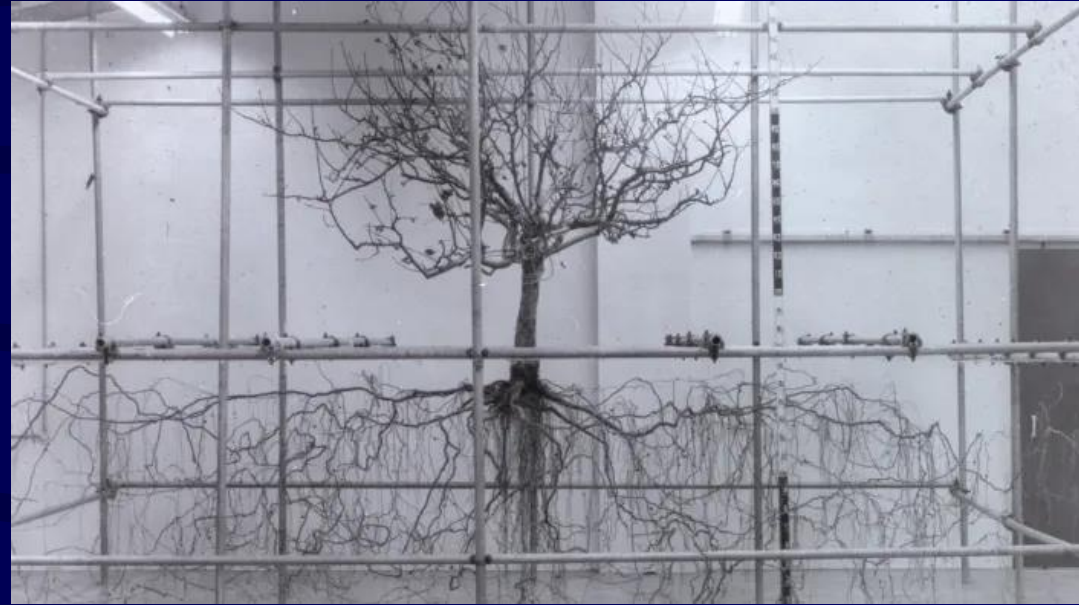
- Variation among species
- Effect of pruning
- Vigor of shoot growth (Paclobutrazol)
- Cropping
- Others factors (Defoliation- Nitrogen)



Distribution of the roots of tree crops

Pome fruits

Stone fruits



Effect of environmental and management factors on root distribution

- Hormones (Auxin, IAA; Cytokinin, Ethylen)

- Soil factors

Fertilizers

Aeration

Solvent organic compounds with low molecular weight

(Fulvic acid, Para-Hydroxybenzoic, Acetic acid, Ethylene)

- Irrigation
- Temperature
- Root pruning

