Olericulture – Hort 320
Lesson 4, Classif, Growth & Development

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THE ARGYLE SWEATER **BY SCOTT HILBURN**

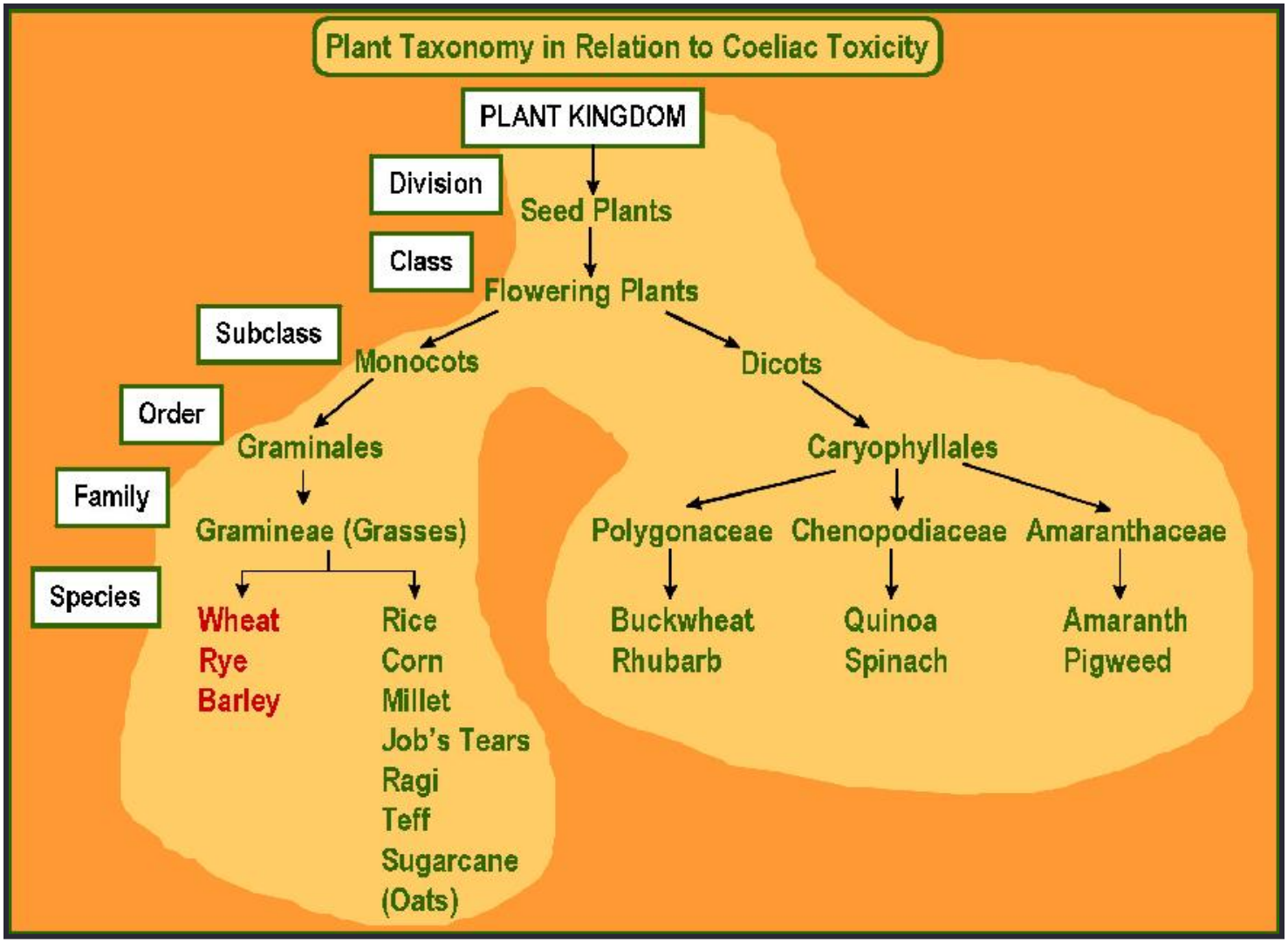
Classification

<table>
<tr><th>Linnaeus
1735</th><th>Haeckel
1866</th><th>Chatton
1925</th><th>Copeland
1938</th><th>Whittaker
1969</th><th>Woese
1990</th><th>Cavalier-Smith
1998</th></tr>
<tr><td>2 kingdoms</td><td>3 kingdoms</td><td>2 empires</td><td>4 kingdoms</td><td>5 kingdoms</td><td>3 domains</td><td>6 kingdoms</td></tr>
<tr><td rowspan="2">(not treated)</td><td rowspan="2">Protista</td><td>Prokaryota</td><td>Monera</td><td>Monera</td><td>Bacteria
Archaea</td><td>Bacteria</td></tr>
<tr><td rowspan="4">Eukaryota</td><td rowspan="2">Protoctista</td><td rowspan="2">Protista</td><td rowspan="4">Eucarya</td><td>Protozoa</td></tr>
<tr><td>Chromista</td></tr>
<tr><td>Vegetabilia</td><td>Plantae</td><td rowspan="2">Plantae</td><td>Plantae</td><td>Plantae</td></tr>
<tr><td>Fungi</td><td>Fungi</td></tr>
<tr><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td></tr>
</table>

Botanical Classification

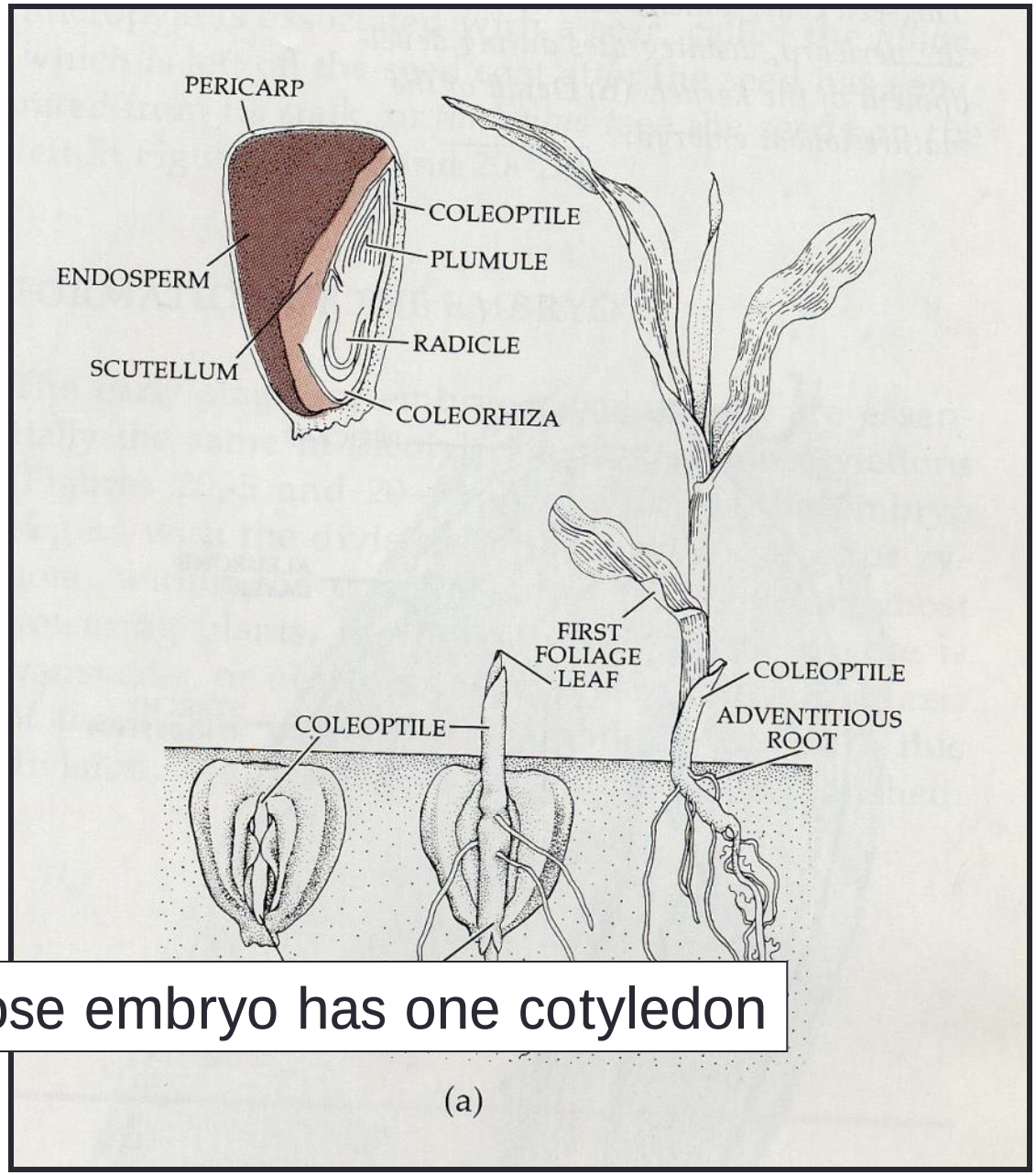
Kingdom:	Plantae
Sub-Kingdom:	Land Plants (Embryophyta)
Division:	Seed Plants (Magnoliophyta)
Class:	Cone Bearing (Gymnospermae) Flowering (Angiospermae)
Subclass:	Monocotyledon (Liliopsida) Dicotyledon (Magnoliopsida)

Plant Taxonomy



Monocots

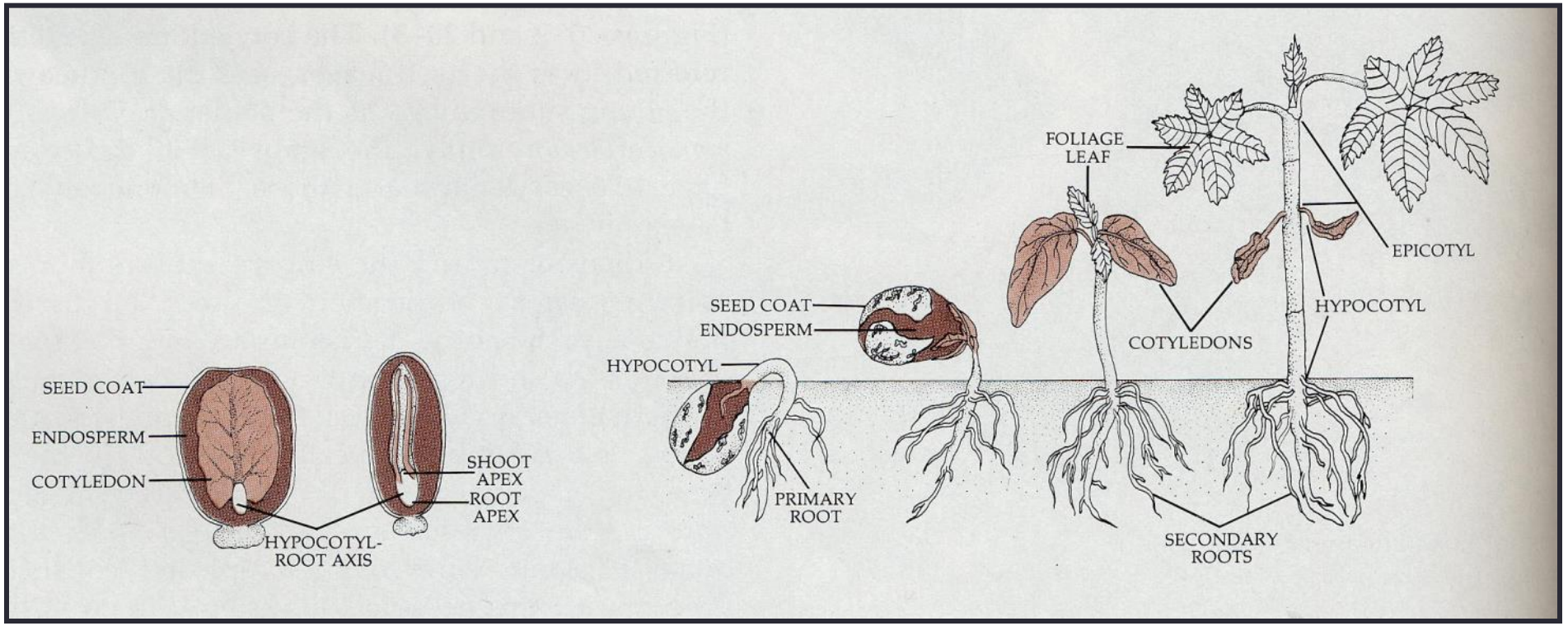
Corn - 1 seed leaf



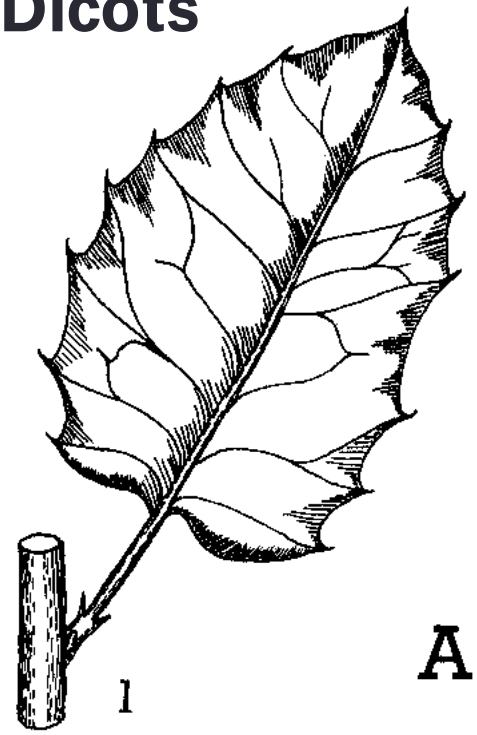
Monocot – a plant whose embryo has one cotyledon

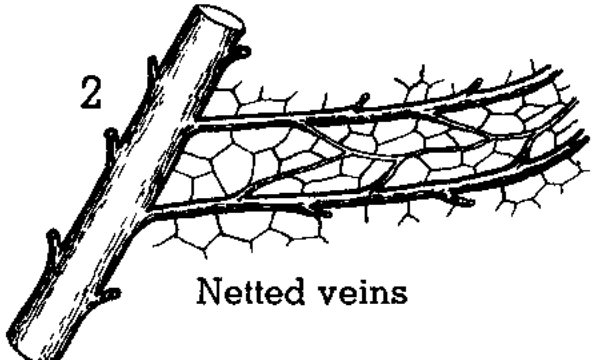
Dicots

Castor Bean
2 seed leaves

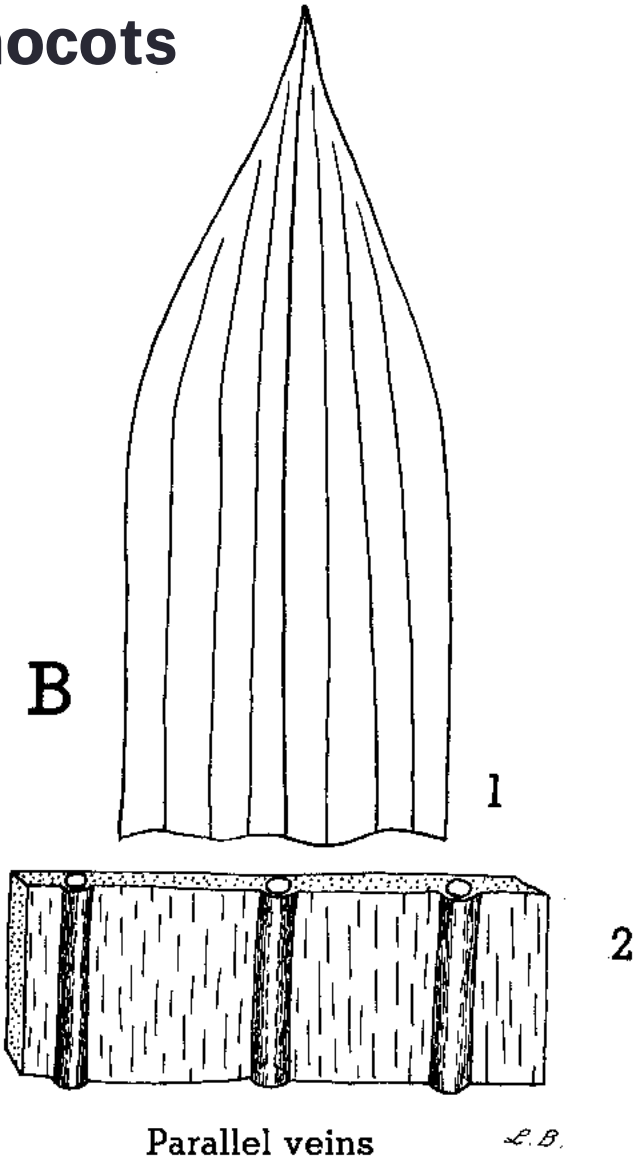


Dicots





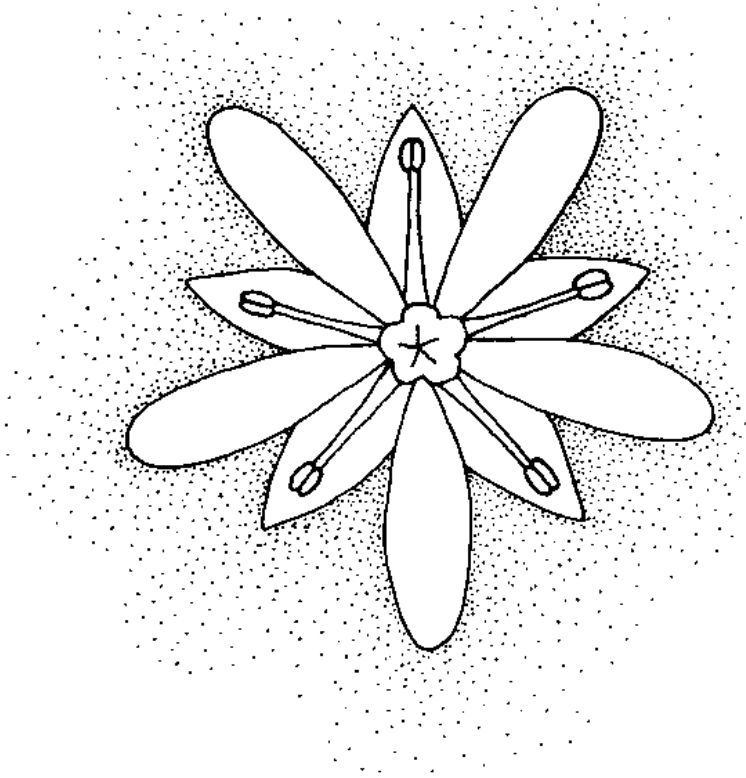
Monocots

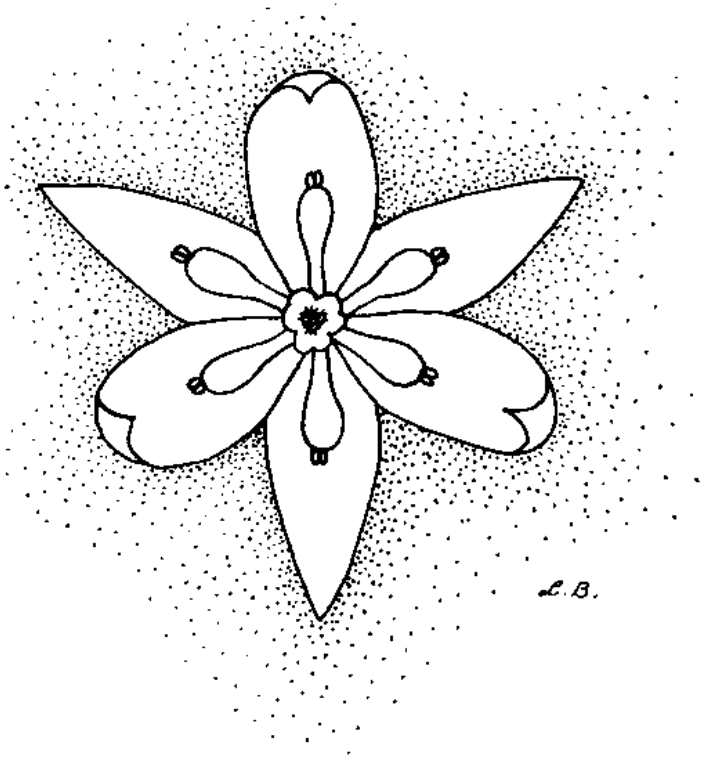


Dicots

Monocots

A



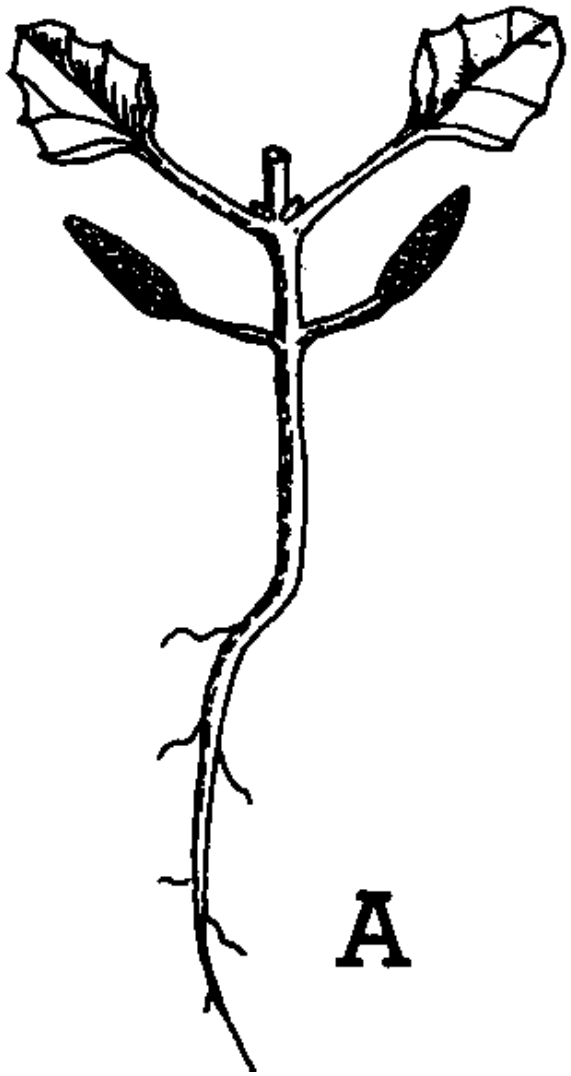


B

Flower parts
In 4’s or 5’s

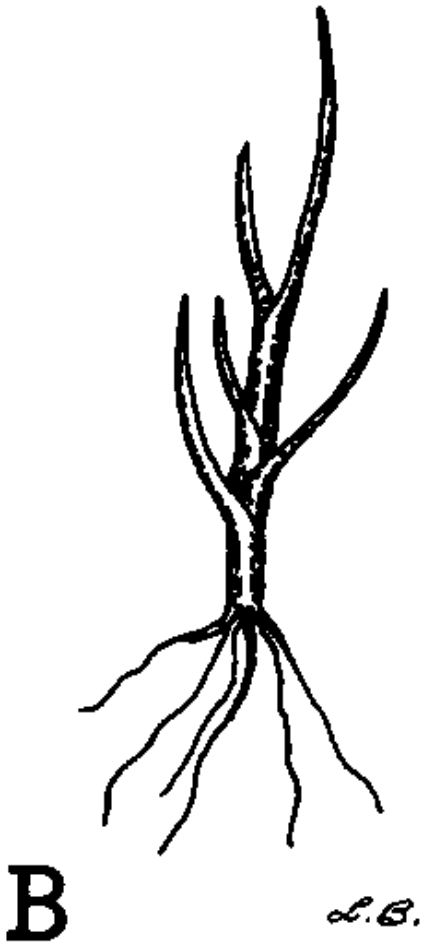
Flower parts
In 3’s

Dicots



Tap root

Monocots



Fibrous root

Dicots

Monocots

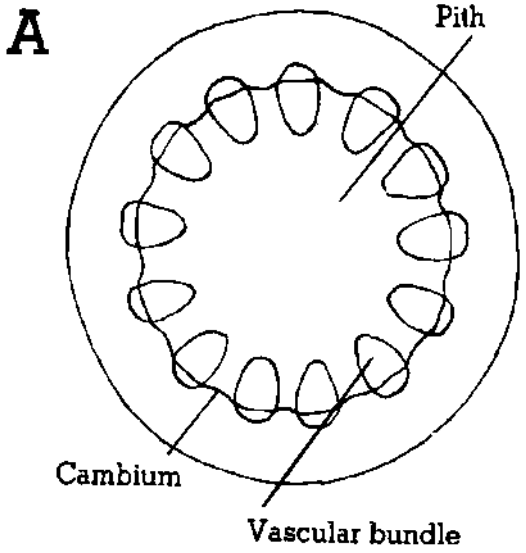
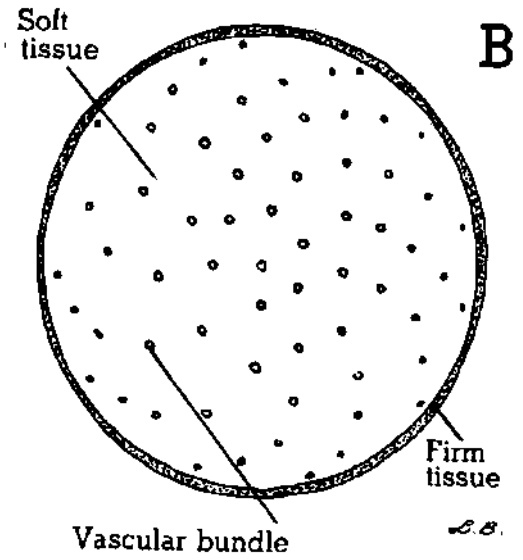


Fig. IX-4. Arrangement of vascular tissues in stems, cross sections: **A** typical annual dicotyledon (diagram); **B** typical monocotyledon (garden asparagus, *Asparagus officinalis* var. *altilis*). Note the cambium in **A** but not in **B**.



Vegetable Classification

Monocot vegetables:

Araceae – arum family

vegetables: taro, dasheen

related: calamus, jack-in-the-pulpit

Vegetable Classification

Monocot vegetables:

Dioscoreaceae – yam family

vegetables: yam

related: wild yams

Vegetable Classification

Monocot vegetables:

Gramineae – grass family

vegetable: sweet corn

related: grasses, sedges

Vegetable Classification

Monocot vegetables:

Lilieaceae – lily family

vegetables: onion, leek, garlic, shallot, chive, asparagus

related: lily, camas, solomon's seal

Vegetable Classification

Dicot vegetables:

Polygonaceae – buckwheat family

vegetables: rhubarb, sorrel

related: knotweed, smart weed, dock

Vegetable Classification

Dicot vegetables:

Amaranthaceae (Chenopodiaceae) – goosefoot family

vegetables: beet, swiss chard, spinach

related: lambsquarter, pigweed

Vegetable Classification

Dicot vegetables:

Brassicaceae (Cruciferae) – mustard family

vegetables: cabbage, rutabaga, turnip, radish

related: wild mustards

Vegetable Classification

Dicot vegetables:

Euphorbiaceae – spurge family

vegetables: cassava

related: poinsettia, castor bean, spurge

Vegetable Classification

Dicot vegetables:

Fabaceae (Leguminosae) – pea family

vegetables:	pea, bean, cowpea, soybean, peanut, others
related:	alfalfa, acacia, lupine, clover

Vegetable Classification

Dicot vegetables:

Malvaceae – mallow family

vegetables: okra

related: hibiscus, hollyhock

Vegetable Classification

Dicot vegetables:

Cucurbitaceae – gourd family

vegetables: watermelon, cantaloupe, squash, pumpkin, cucumber, others

related: luffa, wild cucumber

Vegetable Classification

Dicot vegetables:

Apiaceae (Umbelliferae) – parsley family

vegetables: carrot, parsnip, parsley, celery, others

related: hemlock, cow parsnip

Vegetable Classification

Dicot vegetables:

Convolvulaceae – morning glory family

vegetables: sweet potato

related: flowering morning glory, bindweed, dodder

Vegetable Classification

Dicot vegetables:

Solanaceae – nightshade family

vegetables: potato, tomato, pepper, eggplant, others

related: nightshade, jimson-weed, physalis

Vegetable Classification

Dicot vegetables:

Asteraceae (Compositae) – composite (aster) family

vegetables:	lettuce, chicory, endive, salsify, artichoke, others
related:	dandelion, thistle, daisy, ragweed, sunflower

Botanical Classification

Additional Taxonomy (most useful) -

Family

Genus

Species

Cultivar

Botanical Classification

Family:

An assemblage of genera that closely or uniformly resemble one another in general appearance and technical characters

Botanical Classification

Genus:

Identifies a more or less closely related and definable group of plants that may include one or more species.

The species within a genus are usually structurally or phylogenetically related.

Botanical Classification

Species:

A group of similar organisms capable of interbreeding and are distinctly different in morphological or other characteristics from other species in the same genus.

Botanical Classification

Variety:

A subdivision of a species consisting of a population with morphological characteristics distinct from other species forms.

(considered a naturally occurring taxonomic division)

Botanical Classification

Cultivar (**culti**vated **var**iety):

Denotes certain cultivated plants that are alike in most important aspects of growth but are clearly distinguishable from others by one or more definite characteristics.

Botanical Classification

Clone:

Identifies material derived from a single individual and maintained by vegetative propagation. (genetically identical)

Line:

A uniform sexually reproduced population, usually self-pollinated, that is seed propagated and maintained to the desired standard of uniformity by selection. (genetically similar)

Botanical Classification

Strain:

A term used to identify plants of a given cultivar that possess similar characteristics but differ in some minor feature or quality

Botanical Classification

Additional Taxonomy -

Family

Genus

Species

Cultivar

Complete Latin Binomial includes the name of the individual who first described the species.

Botanical Classification

Family:	Brassicaceae (Cruciferae)
Genus:	*Brassica*
Species:	*oleracea*
Group/Variety:	capitata
Cultivar:	‘Golden Acre’
Strain:	‘Golden Acre YR’

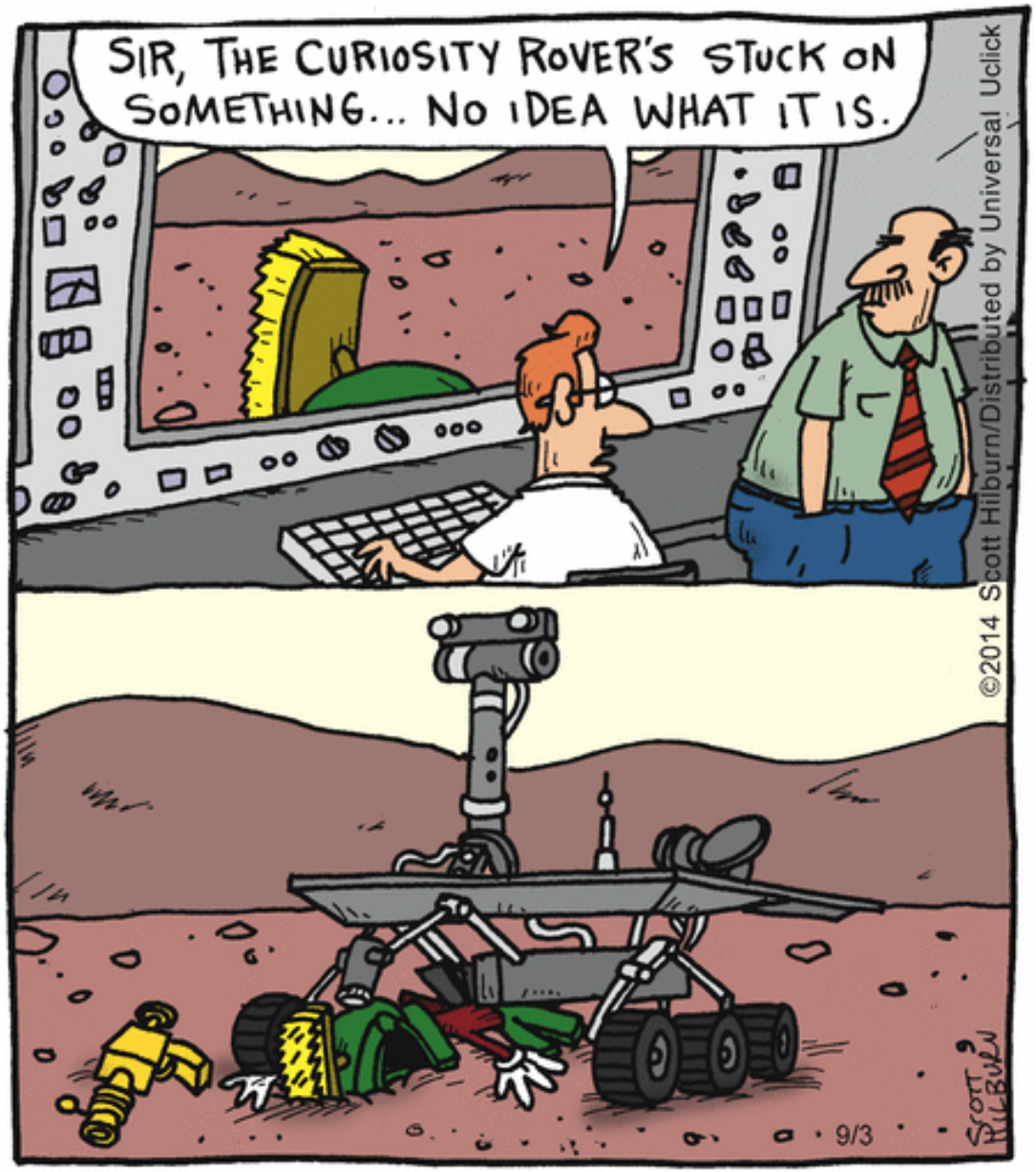
Complete Latin Binomial - cabbage

Brassica oleracea L. var. *capitata* L. cv. Golden Acre YR

Commercially:

Brassica oleracea cv. Golden Acre YR

Botanical Classification


SIR, THE CURIOSITY ROVER'S STUCK ON SOMETHING... NO IDEA WHAT IT IS.
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9/3
SCOTT HILBURN

Growth and Development

Growth stages:

Germination

Establishment

Vegetative growth

Reproductive growth

Ripening and senescence

Growth and Development

Growth stages:

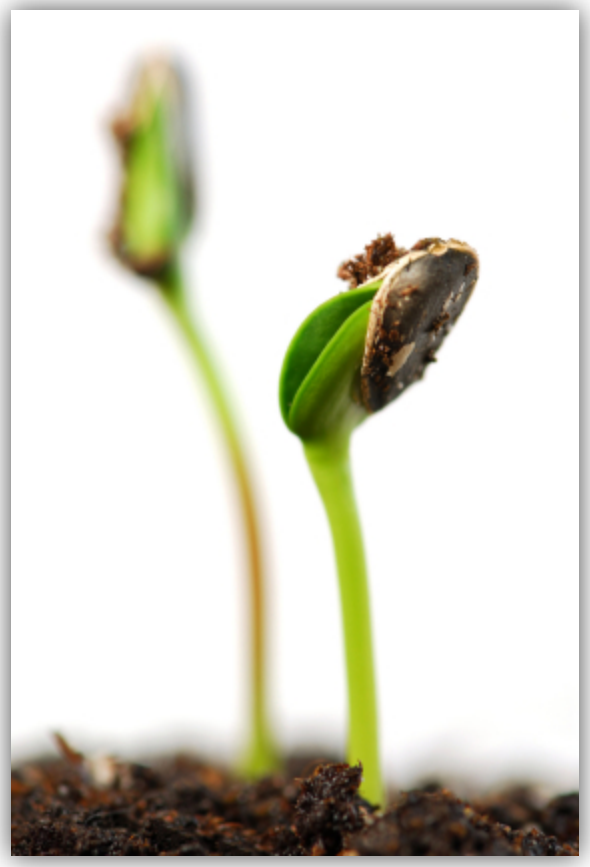
Germination - the beginning or resumption of growth by a spore, seed, bud, or other structure

Growth Stages

Germination

Process:

- Water inbibition
- Seed coat softening
- Expansion of hypocotyl and root
- Emergence



Growth Stages

Germination

Characteristics:

- Critical for plant productivity
- Disease susceptibility
- Requires near-ideal conditions

Growth Stages

Establishment

Process:

- Early shoot growth
- Root elongation

Growth Stages

Establishment

Characteristics:

- Environmental sensitivity
- Determines future growth rate and potential

Growth Stages

Vegetative Growth

Process:

- Increase root mass and rooting depth
- Rapid leaf area increase
- Increase in stem and leaf mass
- Large leaves and succulent growth produced

Factors Affecting Growth

Energy Production and Storage

Photosynthesis – $CO_2 + H_2O \rightarrow$ light $\rightarrow$ sugars ($C_6H_{12}O_6$)

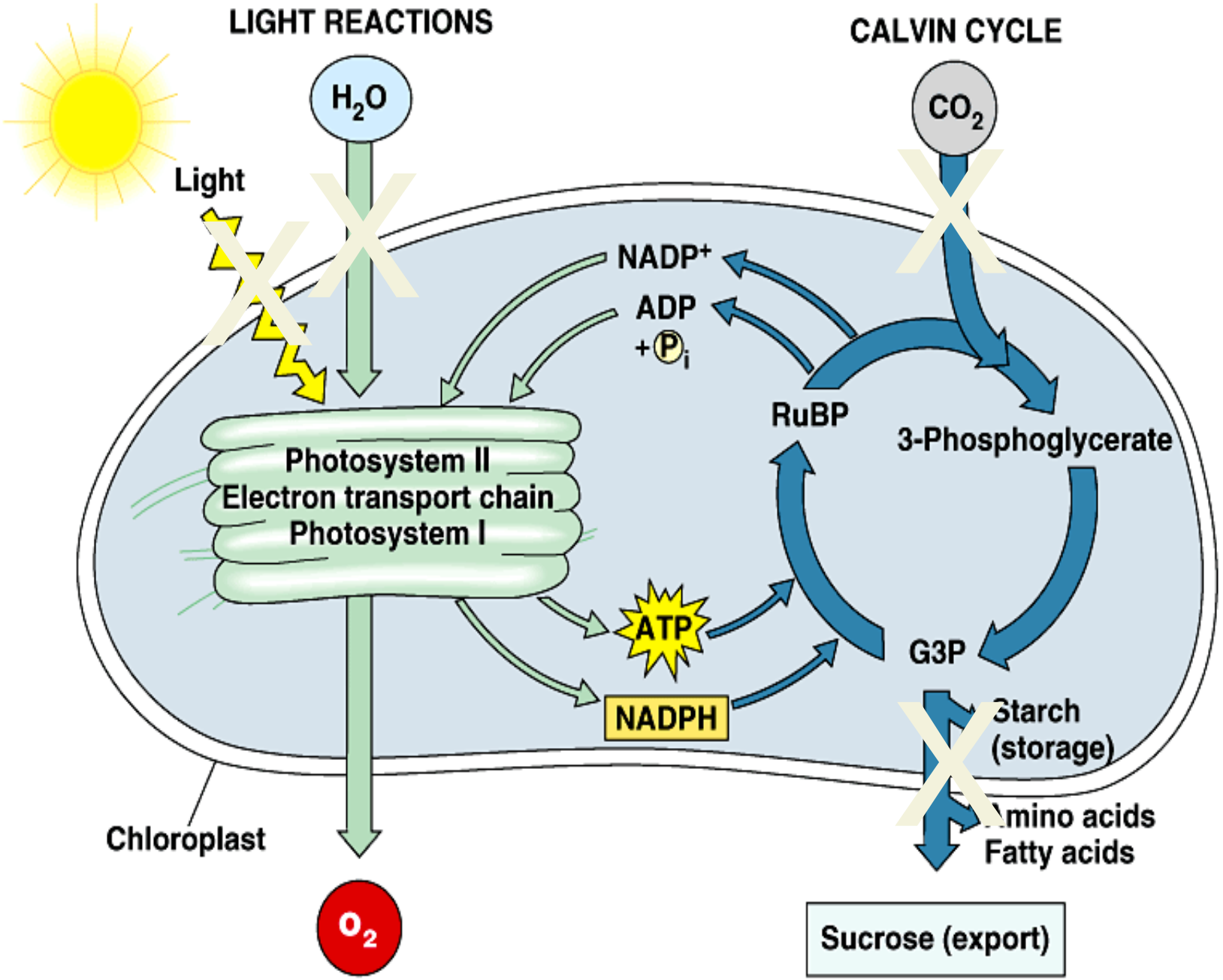
↓

Transport

↓

Respiration (energy use), structural and chemical synthesis

Net photosynthesis = photosynthesis - respiration



Growth Stages

Vegetative Growth

Characteristics:

- Period of rapid cell growth and expansion
- High rate of photosynthesis
- Determines reproductive potential
- Heavy use of water and nutrients

Growth Stages

Reproductive Growth

The transition from vegetative to reproductive growth is usually marked by flowering.

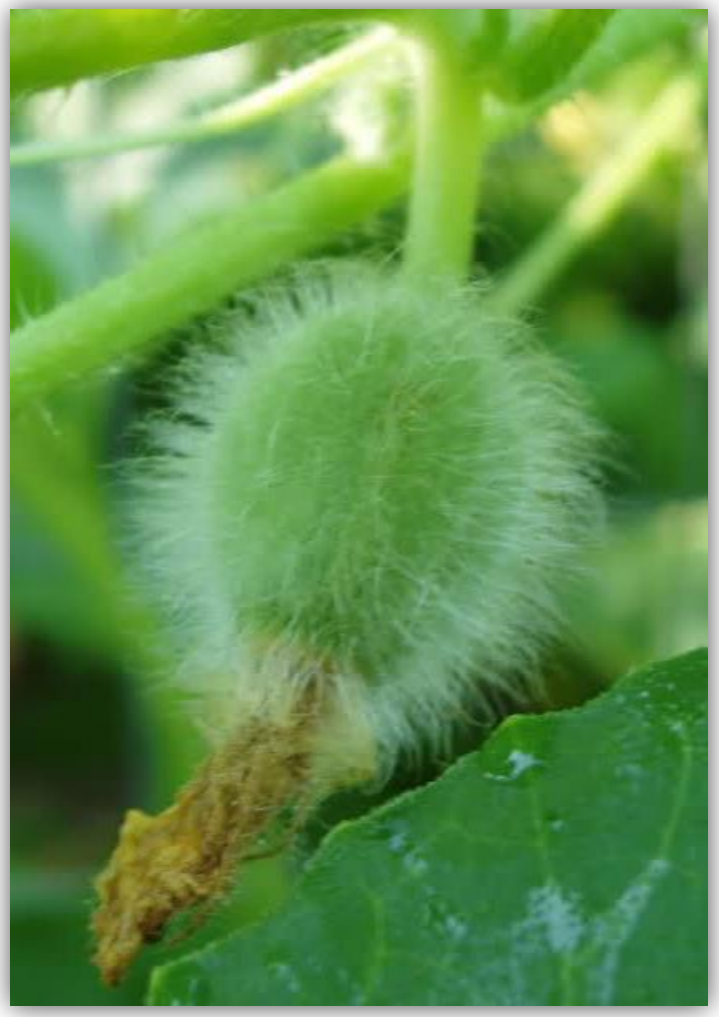
Leaves receive environmental stimulus for the proper timing of flowering.

Growth Stages

Reproductive Growth

Process:

- Organ differentiation
- Slowing or cessation of leaf expansion
- Flower production
- Fertilization and embryo growth
- Fruit growth
- Parallel storage organ growth in some species



Growth Stages

Reproductive Growth

Characteristics:

- Period of heavy fiber production
- Sensitivity for yield and quality
- Can be influenced by many factors including temperature, daylength, etc

Growth Stages

Senescence

The latter part of plant development which leads from maturity to the ultimate complete loss of organization and function.

Growth Stages

Senescence

Process:

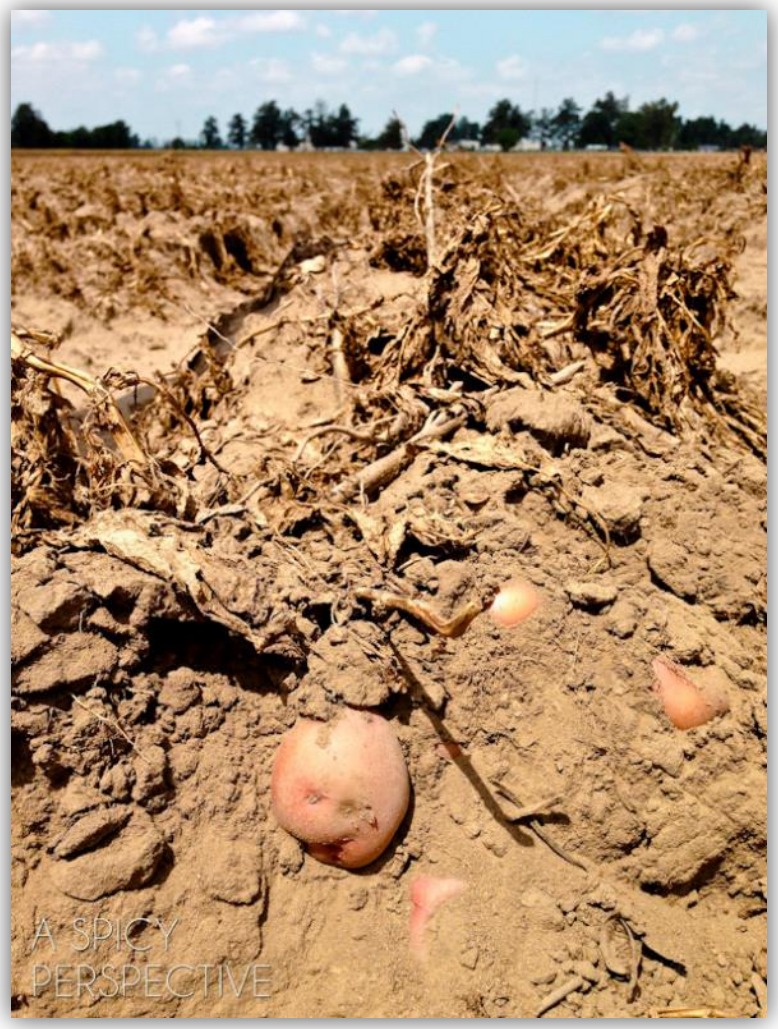
- Cessation of new growth
- Loss of leaf area
- Increased susceptibility to opportunists
- Ripening of fruit and seed
- Plant death

Growth Stages

Senescence

Characteristics:

- Yield not influenced by external factors
- Usually not reversible
- Management inputs have little impact
- Critical period for fruit and seed quality



Factors Affecting Growth

Light Factors

Intensity – most vegetable require full sun equivalent

Duration – requirements vary by species, fruiting vegetables need more

Wavelength – wavelengths 400-450, 650-700 best for photosynthesis

Factors Affecting Growth

Temperature

Optimum is the range for a crop that allows for maximum photosynthesis and normal respiration

Optimum differs by species

Optimum may change during growth period

Diurnal fluctuations as important as average

Factors Affecting Growth

Temperature

Temperatures above optimum slow growth and reduce quality (pungency, fibrousness)

- rapid respiration, stomate closure, reduced photosynthesis

Temperatures below optimum slow growth and affect quality by reducing sugar production and storage

- reduce photosynthesis, transport, and respiration

Factors Affecting Growth

Heat Units (Growing Degree Days, GDD)

Degree days above a crop baseline

Average of daily high and low - baseline
(onions 35, tomatoes 50, eggplants 60)

Used for determining suitable environments and predicting harvest dates

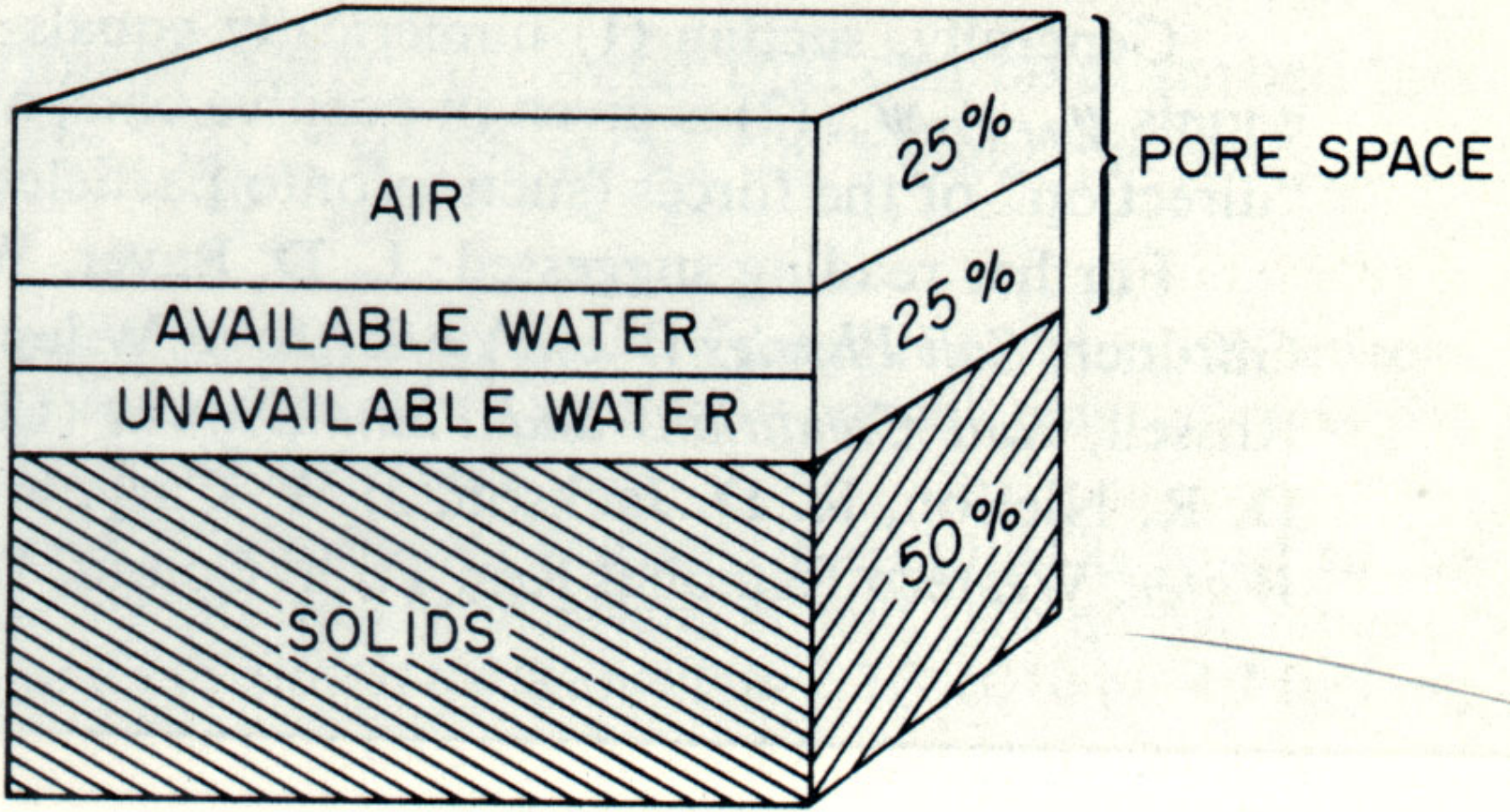
Doesn’t account for early soil temps, based on daily average not actual temps, doesn’t account for higher than optimum max temps

Factors Affecting Growth

Water availability

Need constant water supply
- periodic stress reduces growth and quality
- stomate closure, reduction in cell division

Soil moisture principles
- Water holding capacity
- Field capacity
- Optimum minimal soil moisture
- Permanent wilting point


AIR
AVAILABLE WATER
UNAVAILABLE WATER
SOLIDS
25%
25%
50%
PORE SPACE

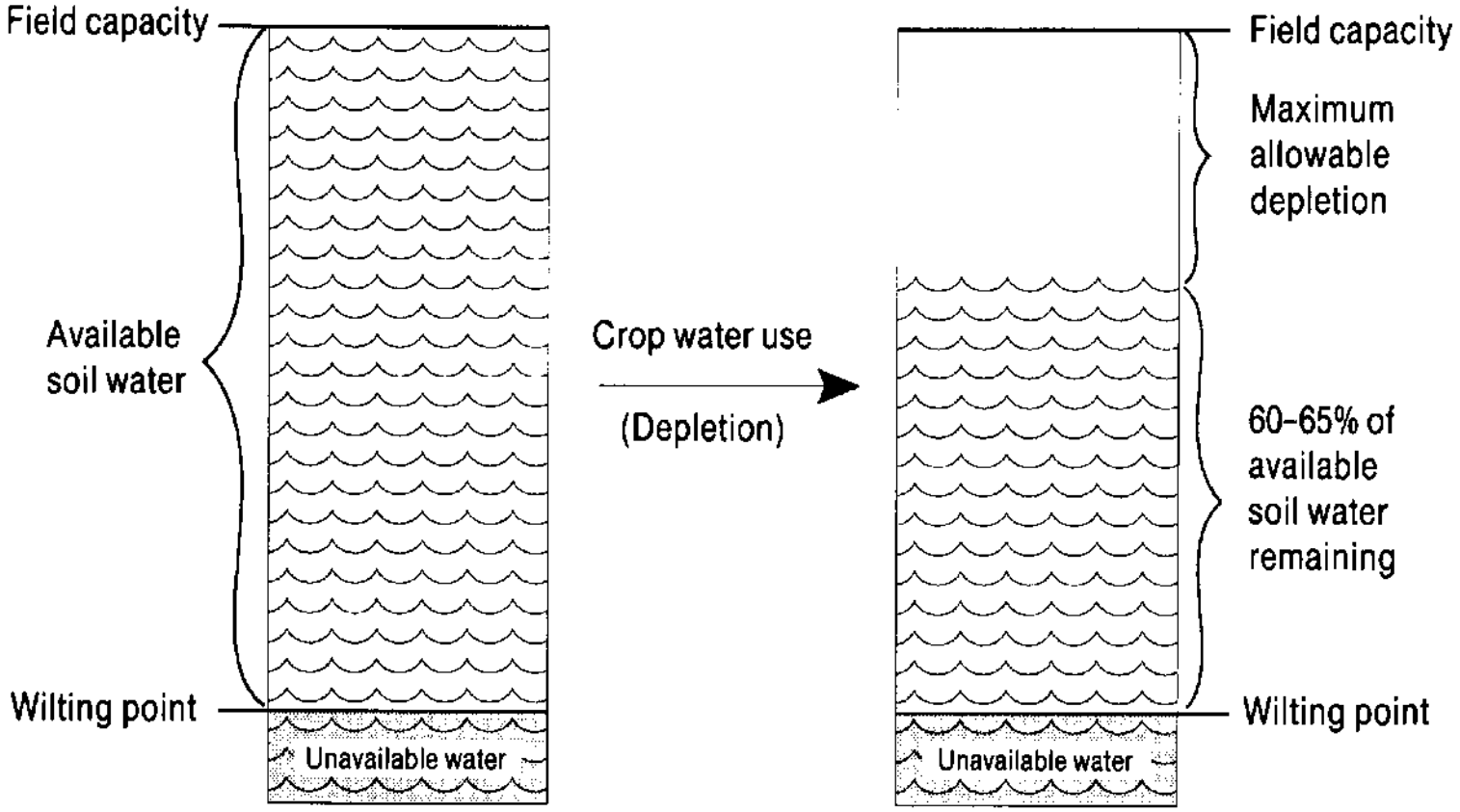


Fig. 8.2. Available soil water is the difference between the field capacity of a soil (the amount of water retained in the total soil pore space after saturated soil has drained) and the permanent wilting point (the point at which plants can no longer obtain water from the soil and thus wilt and die). Allowable depletion is the point to which available soil water can be depleted without inducing plant stress. For potatoes, the soil must always be maintained above 60–65% of available soil water.

Factors Affecting Growth

Fertility

Require nutrients at or near optimum

- sub or supra-optimum impacts yield and may severely impact quality

Seedlings need high levels of fertilizers

Seasonal applications beneficial to long-season crops

Can impact life expectancy, disease resistance, etc

Factors Affecting Growth

Genetics and Physiology

Growth habit (determinate vs indeterminate)

Vernalization requirement (or problem)

Photoperiodism

most crops are day neutral

Tolerance to environmental stresses

Factors Affecting Growth

Crop Management

Many growth factors can be managed

Many stress and disease related problems can be ameliorated with proper management