Olericulture – Hort 320
Lesson 5, Environment, Propagation

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Yo, SAL, THIS LADY THINKS WE'RE A SALON. HA, HA. SAYS SHE NEEDS HER HAIR HIGHLIGHTED.
ACS
SAL'S
LANDSCAPI
NO, I SAID MY ROOTS ARE SHOWING.
9/9
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Environmental Factors Influencing Growth

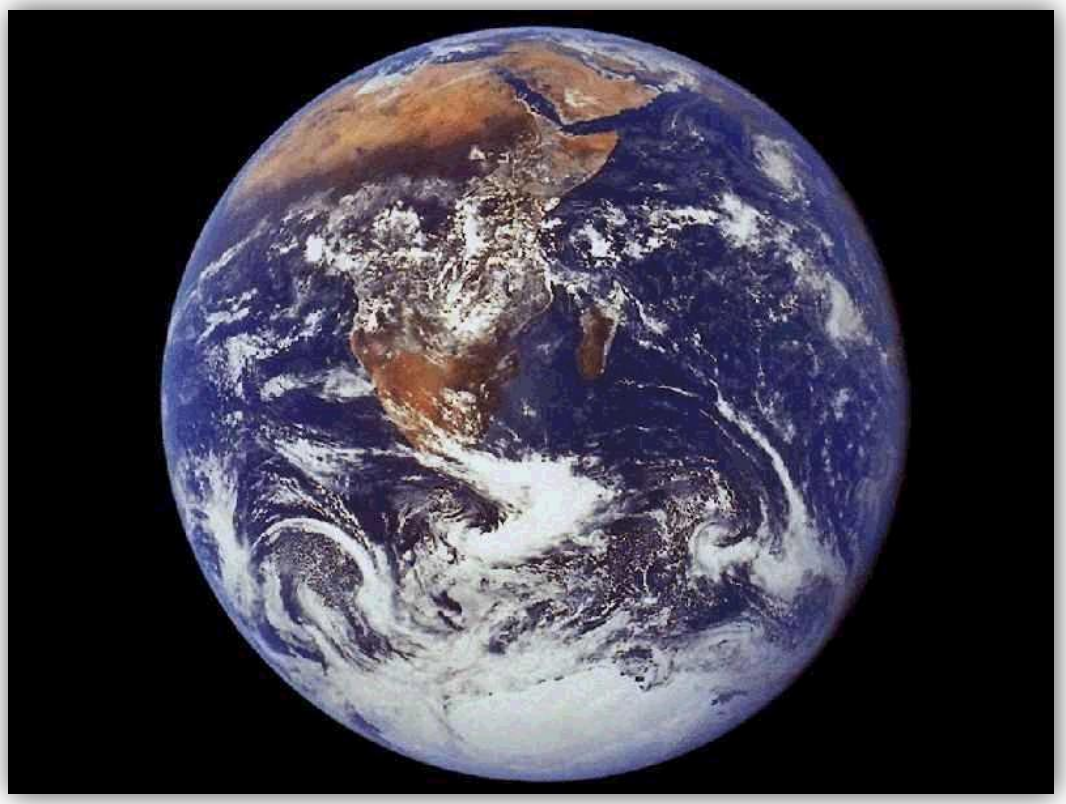
Climate

Temperature

Moisture

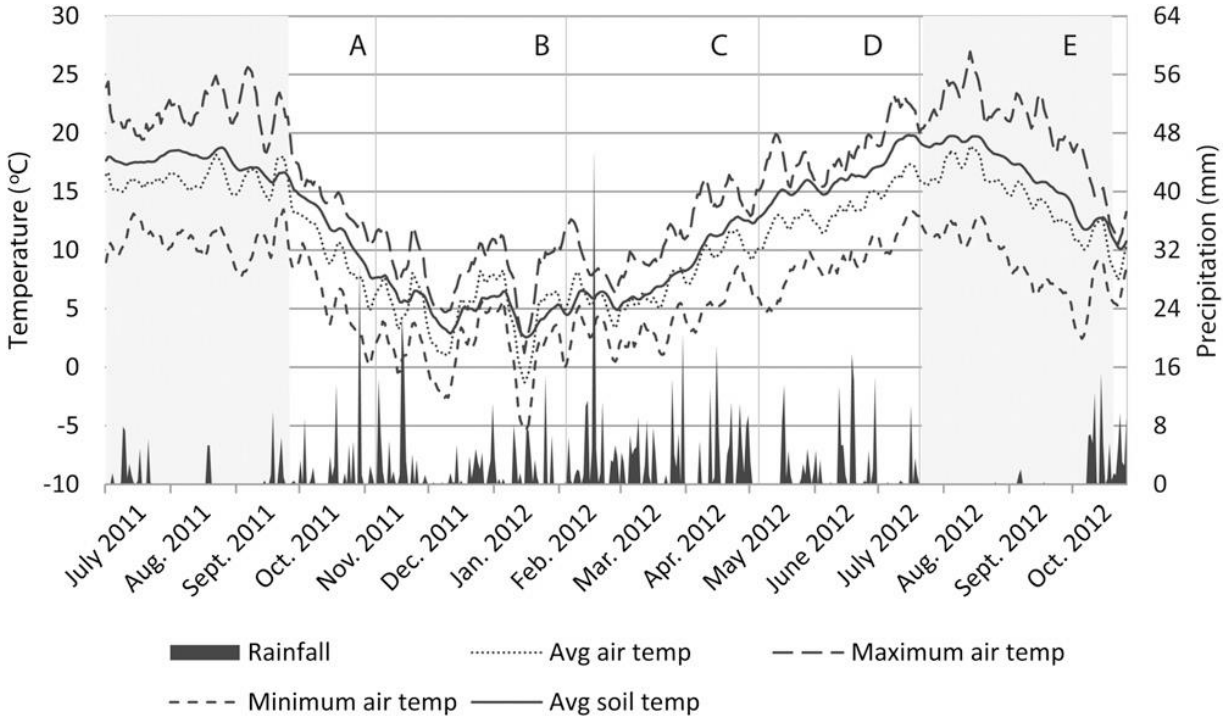
Light

Wind



Environmental Factors Influencing Growth

Climate - the average course of weather at a specific location over a period of many years and is the integrated effect of the weather

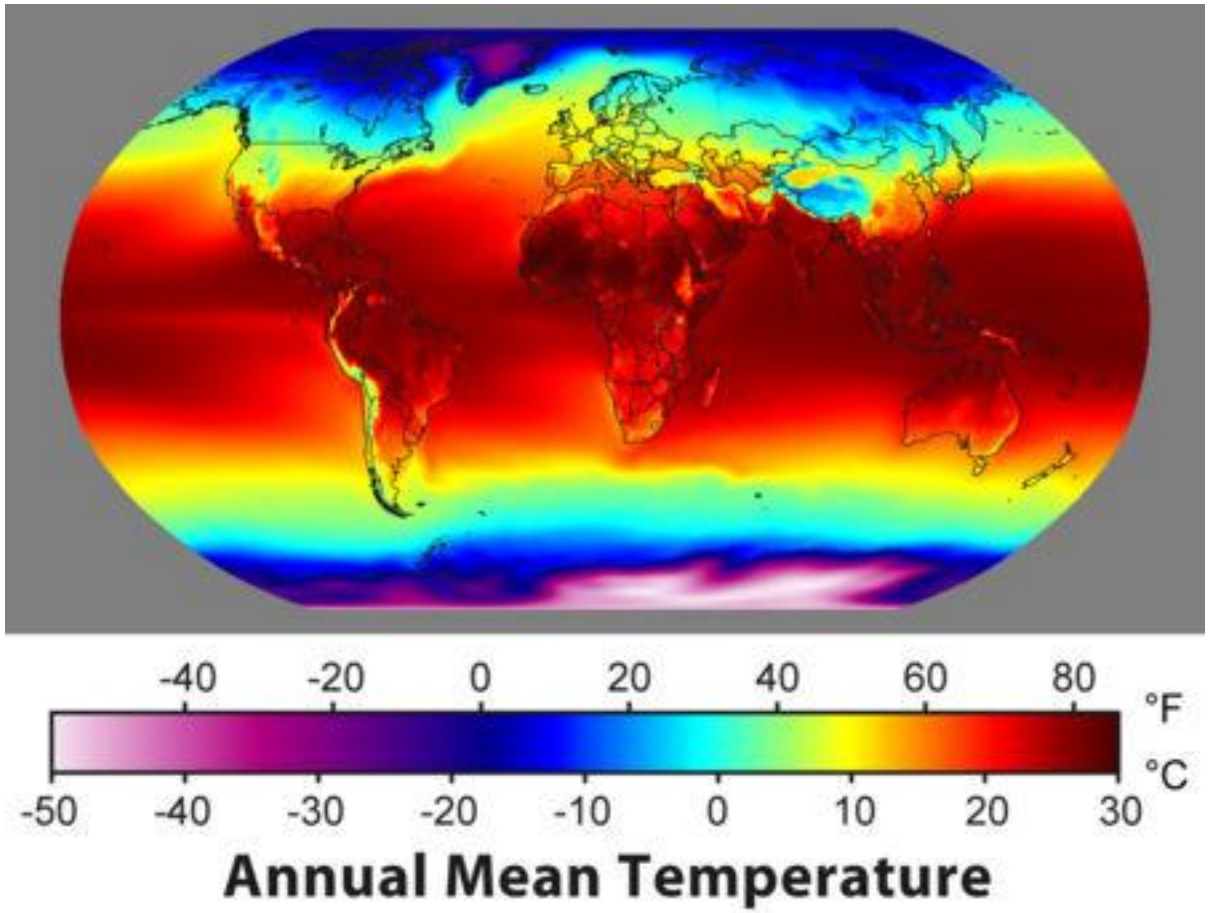


Environmental Factors Influencing Growth

Weather - the state of the atmosphere with respect to temperature, moisture, solar radiation, air movement, and other meteorological phenomenon over a short period of time

Environmental Factors - Temperature

Global temperature zones



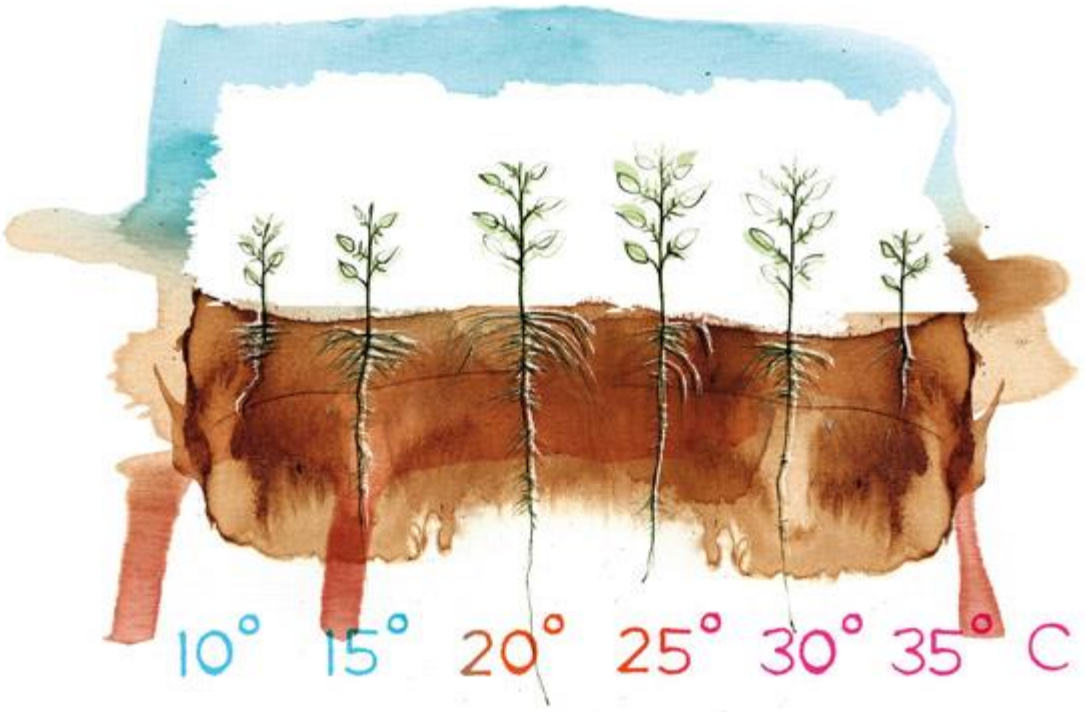
Temperature Effects on Plants

Cardinal temperatures

Minimum

Maximum

Optimum



Temperature Effects on Plants

Cardinal temperatures

Maximum – Growth ceases

Optimum – Growth proceeds w/o limitation

Minimum – Growth ceases

Temperature Effects on Plants

Van Hoff's Law (Q_{10} factor)

For every 10°C rise in temperature, the rate of dry matter production or growth doubles (usually true between 5-35°C)

Temperature Effects on Plants

High temperature Injury

Plants cease to grow at specific temperatures, and at some point are damaged or killed.

Leaf temperatures can be as much as 8°C higher than the ambient air temperature.

Temperature Effects on Plants

Heat Units (Degree Days)

$$\left(\frac{\text{daily high temp} + \text{daily low temp}}{2} \right) - \text{baseline temp}$$

Accumulated daily throughout the season

Temperature Effects on Plants

Diurnal Changes = Thermoperiodicity

A large diurnal range is favorable to photosynthesis

High night temperatures increase respiratory rates.

Temperature Effects on Plants

Vernalization

The low temperature induction of floral initiation

With some species, imbibed seed can be vernalized.

Juvenile or non-responsive plants are insensitive to low-temp exposure at certain growth stages.

Temperature Effects on Plants

Dormancy

Seeds and organs that have the potential to germinate but do not because of unfavorable environmental conditions

The change from dormancy to active growth changes slowly, usually as a result of gradually diminishing concentrations of inhibitors or hormones.

Temperature Effects on Plants

Length of growing season

Frost-free days – average period between the last killing frost in the spring and the first in the fall

Temperature Effects on Plants

Freezing Injury

Some vegetables are injured by temperatures at or slightly below freezing.

Some vegetables show above-freezing cold injury

Many tropical / subtropical plants can be injured at nonfreezing temperatures below 10°C.

Varies with species, cultivar, growth stage…

Temperature Effects on Plants

Hardening

Adaptation of plants to withstand cooler (or warmer) temperatures by subjecting them to gradually decreasing (increasing) temperatures.

Hardening also occurs when plants are subjected to gradual water stress or nutrient deprivation.

Soil Temperature

Soil temperature

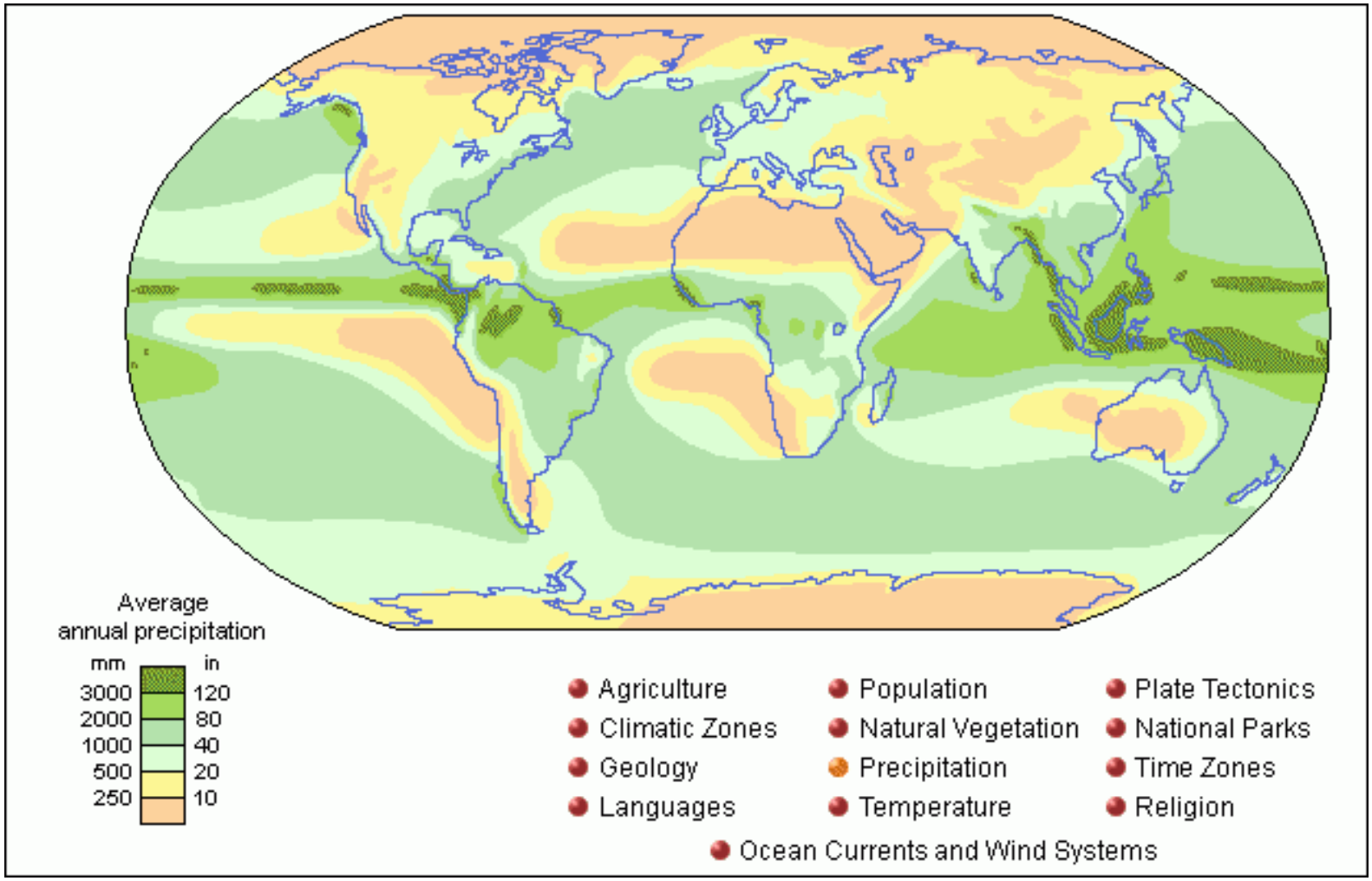
Soil temps are dependent on air temps

Dry soil may actually be hotter than air

Soil temps need to be monitored before planting:

- seed germination
- root growth
- tuber/bulb growth & development

Moisture Effects on Plants – Rainfall

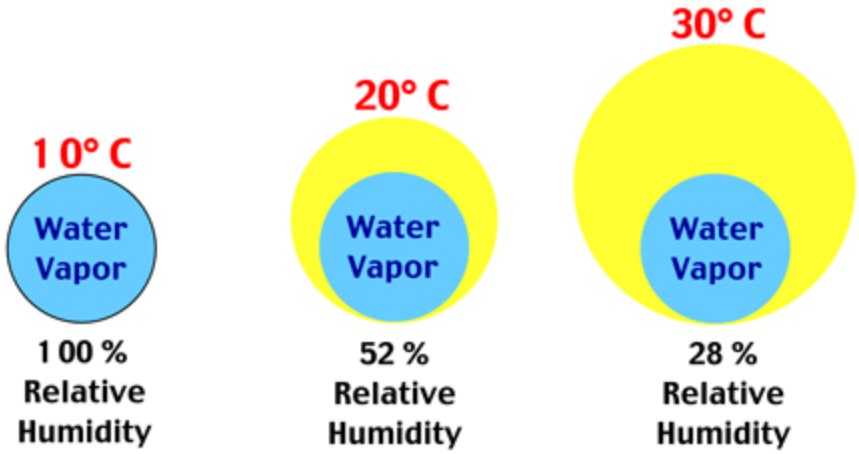


Moisture Effects on Plants

Absolute Humidity

vs.

Relative Humidity



AH = the amount of water in air as a proportion to the volume of air

RH = the amount of water in air as a percentage of what the air can hold – temperature dependent

Moisture Effects on Plants

Relative Humidity

Along coastal areas high RH and fog may condense to dew, which is an important water source in arid regions

Physiology of Water in Plants

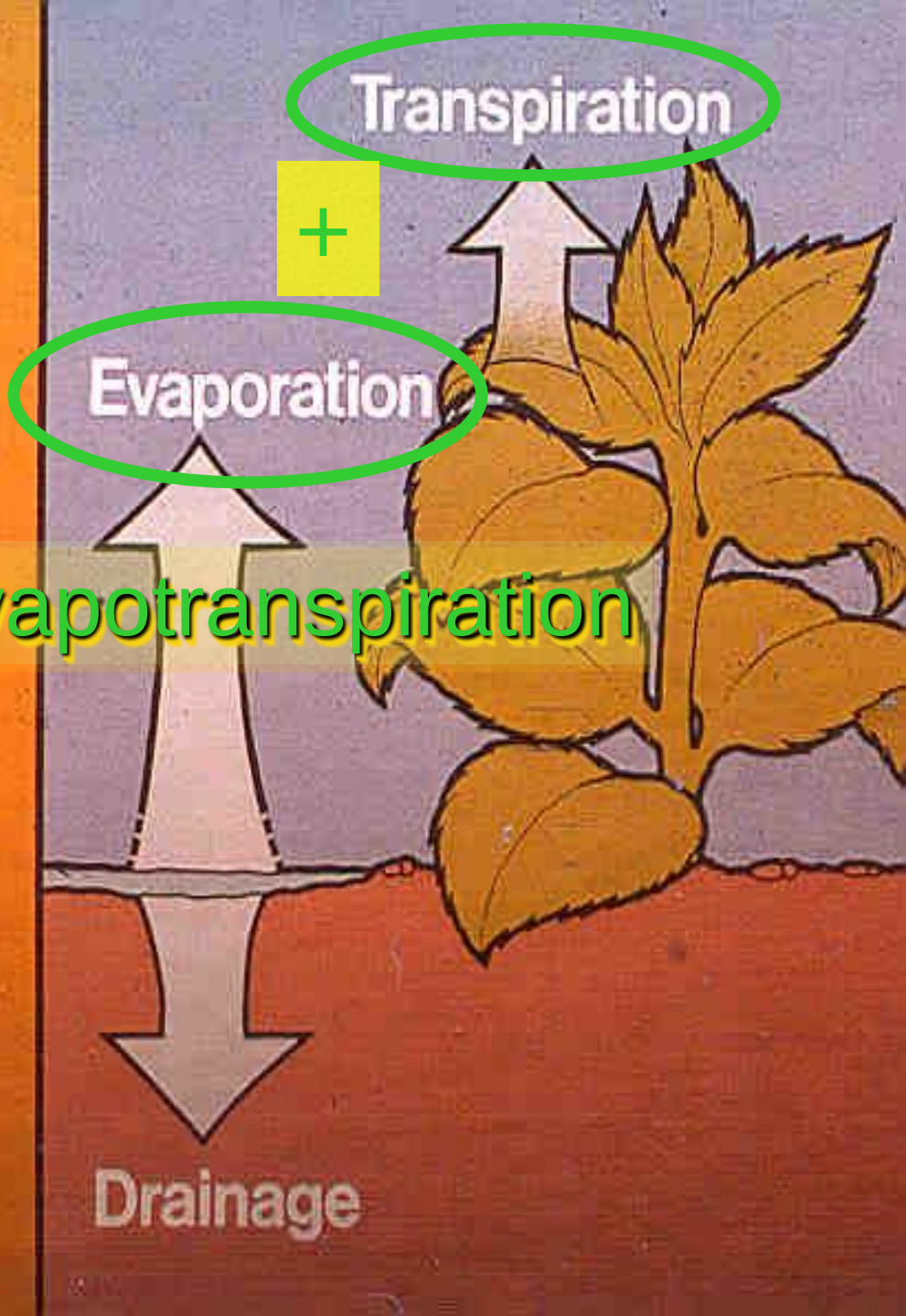
Plant water relations

Less than 1% of the water that passes through the plant is utilized in the photosynthetic process. Most is used in transpiration.

Evapotranspiration – the combined evaporation from the soil surface, transpiration, and cuticular loss of water from plants

Irrigation Replenishes Water Removed By:

- Evaporation
- Growing Plants
- Drainage



Physiology of Water in Plants

Plant water relations

Hydrophytes – water-loving aquatic plants that normally grow in water or swamps

Mesophytes – prefer to grow in well-drained soils, wilt if water stressed

Xerophytes – prefer dry climates and can survive long periods of drought without permanent damage

Light and Light Intensity

Day Length

Photoperiodism = sensitivity to length of dark period in triggering developmental responses such as flowering or growth of storage organs.

Light and Light Intensity

Light Intensity

Light compensation point = the light intensity at which photosynthesis equals respiration

Light and Light Intensity

Light Intensity

Light saturation point = the light intensity at which there is no additional increase in photosynthesis

Light and Light Intensity

Light Quality

Leaf area index – the total leaf area subtended per unit area of land

Light and Light Intensity

Plant physiological responses to light

Response	*Wavelength (nm)*
Stem elongation	720–1000
Germination inhibition of certain seed	
Stimulation of onion bulbing	
Suppression of onion bulbing	650–690
Red pigment (lycopene) synthesis in tomato	
Flower stimulation of long-day plants	
Flower inhibition of short-day plants	
Promotion of germination of certain seeds	
Promotion of anthocyanins	
Photosynthesis	440–655
Chlorophyll formation	445–660
Phototropism	350–500

Light and Light Intensity

Duration

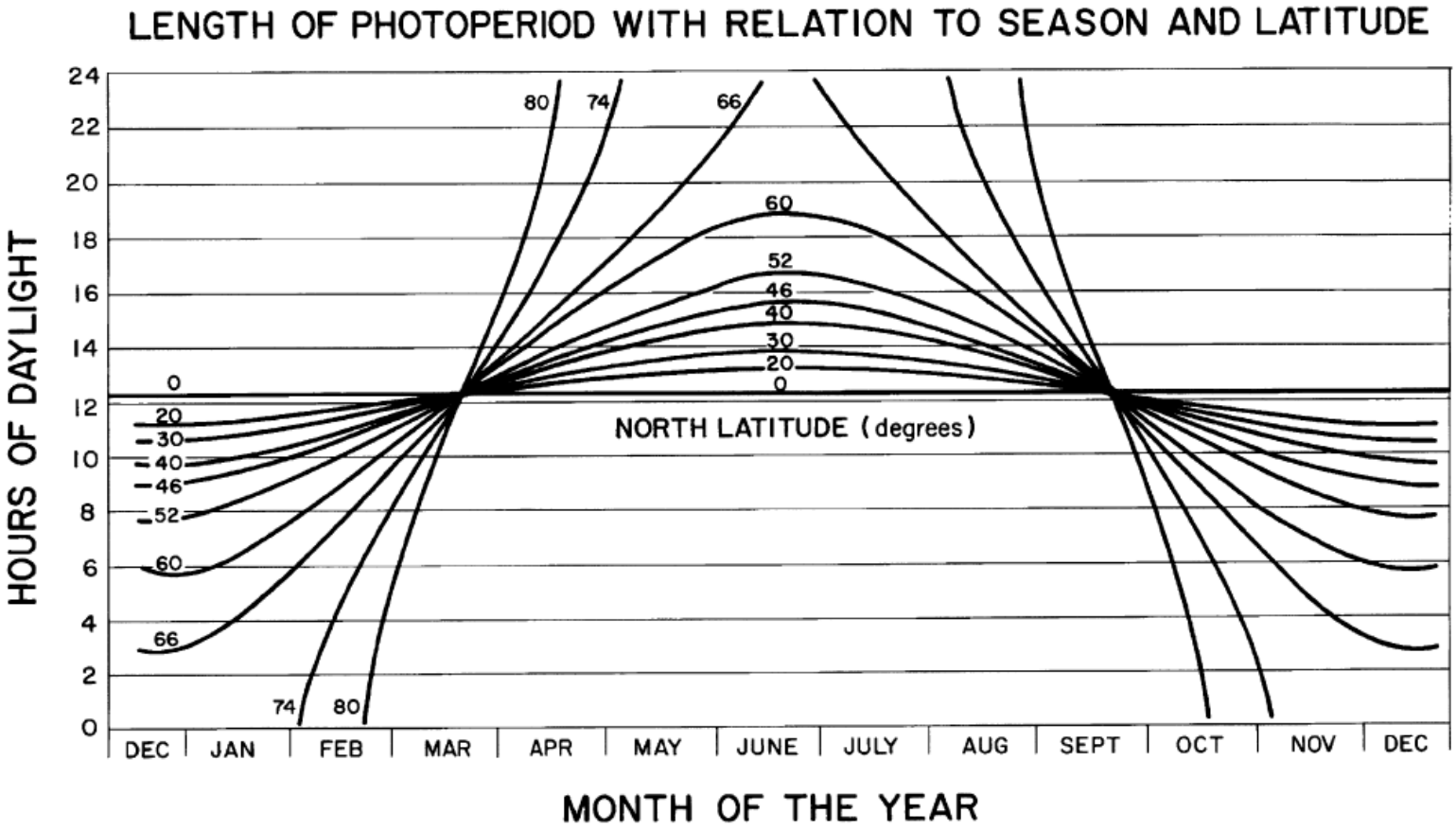


FIG. 6.2. Length of photoperiod relative to season and latitude.

Wind

Increase transpiration rate

Decrease leaf temperature

Replenish CO_2

Can damage plants


GO AHEAD... MAKE MY DAY.
9/8
SCOTT HILBURN
©2014 Scott Hilburn/Distributed by Universal Uclick
IN HIS EARLY YEARS, HE WAS KNOWN AS REALLY DIRTY HARRY.

Vegetable Propagation

Types of propagules:

Botanical seed

Transplants

Vegetative cuttings, tubers, bulbs, rhizomes, roots, etc.

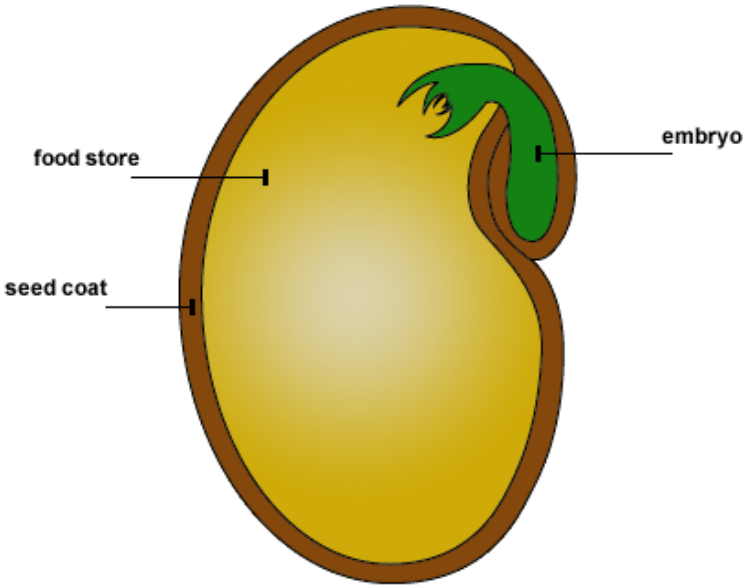
Tissue culture

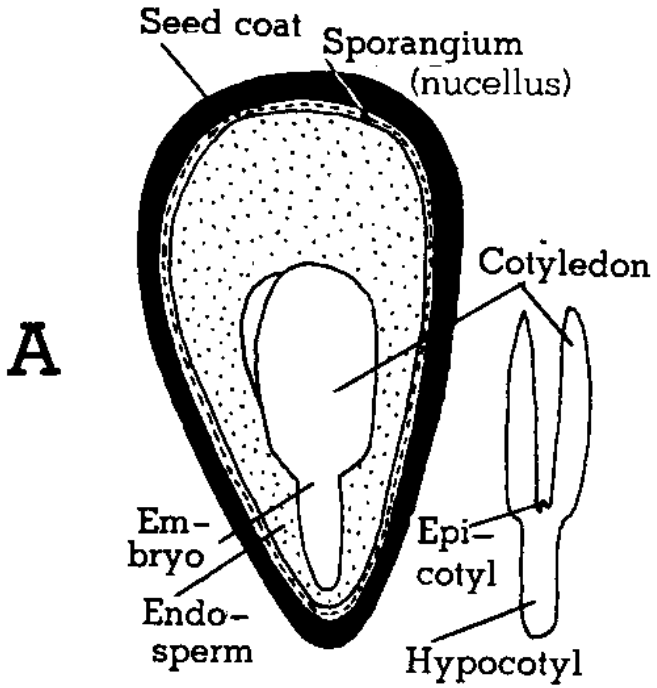
Seed

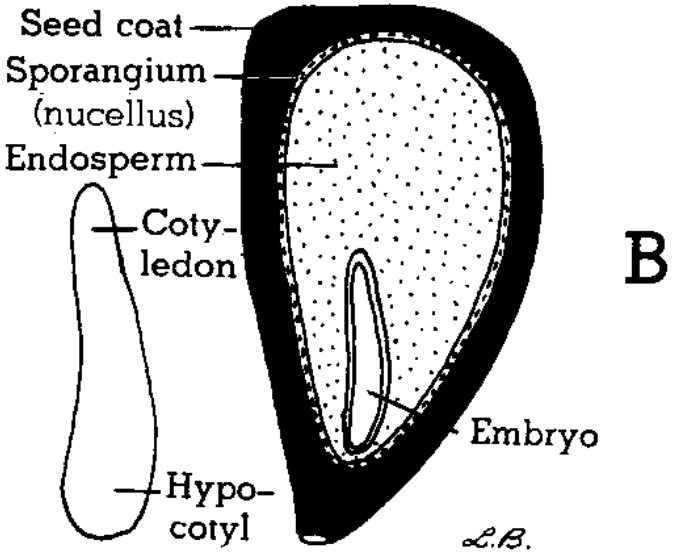
What is a seed?

Fertilized mature ovule including:

- Embryo (small undeveloped plant)
- Endosperm (food storage tissue)
- Seed coat (protective covering)




A
Seed coat
Sporangium
(nucellus)
Cotyledon
Em-
bryo
Endo-
sperm
Epi-
cotyl
Hypocotyl


Seed coat
Sporangium
(nucellus)
Endosperm
Coty-
ledon
Hypo-
cotyl
Embryo
L.B.
B

Seed

Characteristics of good seed:

Genetically pure

High germination

High vigor

No dormancy

Disease free

Free of weed seed and foreign matter

Seed

Maintaining genetic purity:

Production under isolation

- Cross-pollinated - 1/8 to 1/4 mile
- Self pollinated – 300 to 600 feet
- Insect pollinated – ½ to 1 mile

Prevention of mechanical mixing

Seed

Germination standards:

Federally mandated standards

Range from 40% (New Zealand spinach) to 80% (pea, lettuce, cucumber)

Labeled “Below Federal Standard”

State standards for certification
WAC 16-301-090

Certified Seed

Certification:

Tagging system that assures seed meets minimum standards

Standards established by Association of Official Seed Analysts (AOSA) and by state certification agencies

Certified Seed

Importance of the tag:

Basis of all certification procedures

Creates a paper trail in cases of poor performance

Identifies seed by searchable lot numbers

Certified Seed

Certification:

Certified seed labeled with:

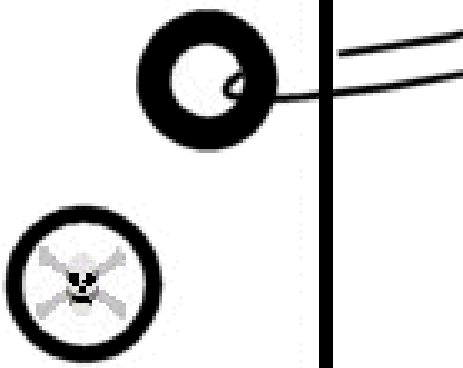
- Cultivar name
- Lot number
- Purity
- Germination percentage (date of test)
- Amount of inert or other material
- List of insect or disease control treatments

Certified Seed

Example of seed certification tag

1) RUSS HRS WHEAT
2) PURE SEED 99.00%
3) INERT MATTER 0.98%
4) OTHER CROP SEED 0.01%
5) WEED SEED 0.1%
6) GERMINATION 98%
7) HARD & DORMANT SEED 0%
8) TOTAL VIABLE 98%
(GERM + HARD + DORMANT)
9) NOXIOUS WEED SEEDS 0.00%
10) LOT No. 8613
11) JOE H. SEEDGROWER
ANY TOWN, SD 57000

15) UNAUTHORIZED PROPAGATION PROHIBITED – US PROTECTED VARIETY PVP-94
12) ORIGIN: SD
13) DATE TESTED 1-97
14) SEED TREATMENT – TREATED WITH VITAVAX 200. DO NOT USES FOR FOOD, FEED OR OIL PURPOSES. (POISON)
(USE SEPARATE LABEL IF SKULL & CROSSBONES NEEDED)



Certified Seed

Certification Process:

Application from seed producer

Farm background search and inspection

Crop inspections

Storage inspections (if required)

Shipping point inspections and tagging

Certified Seed

Certification:

Classes:

Breeder - derived from original stocks

Foundation (white tag) – 1st generation

Registered (purple tag) – 2nd generation

Certified (blue tag) – 3rd generation, usually sold for vegetable production

Seed Production Principles

Production:

Practices that maximize seed yield and quality

Practices that minimize disease exposure

Practices that maximize germination

Storage conditions that retain vigor

Seed Production Principles

Factors affecting vigor:

Mother plant health

Production conditions

Storage conditions

Seed age

Seed Production Principles

Improving seed quality

Seed treatment (fungicide, insecticide)

Seed sizing

Hybrid seed production

Seed coating

Osmoconditioning

Synthetic seed???

Stand Establishment – Direct Seeding

Methods for optimizing stand:

Bed preparation – shape, orientation

Anticrustants – vermiculite, phosphoric acid, thiosol, gypsum

Precision drilling

Plug mixes

Fluid drilling

Moisture control

Stand Establishment – Transplanting

Transplanting

Plants are started in various kinds of plant growth structures and transplanted outdoors when conditions become favorable.

Extends growing season.

Stand Establishment – Transplanting

Methods for successful transplanting

Use of plugs

Use of vigorous plants

Appropriate hardening (7-14 days)

High level of fertility (e.g. 10-50-10 starter solution)

Stand Establishment – Transplanting

Methods for successful transplanting

Frost protection

Moisture control

High level of fertility (e.g. 10-50-10 starter solution)

Row covers – hot caps, cloches, plastic tunnels

Stand Establishment – Transplanting

Benefits

Improve stand and production uniformity

Force earliness

Reduce seed costs

Improve weed control

Decrease season-long water use

Stand Establishment – Transplanting

Crops typically transplanted:

Tomato
Cauliflower
Celery
Broccoli
Eggplant
Cabbage
Brussels sprouts
Peppers
Lettuce
Melons
Beets
Onion (sets)
Broccoli

Vegetative Propagation

Methods:

Cuttings (sweet potatoes, taro, cassava)

Tubers or bulbs (potatoes, onions, garlic)

Root division (asparagus, rhubarb)

Vegetative Propagation

Unique features:

Chronic disease problems

Complex certification procedures

Quality dependent on previous crop

Perishable propagules