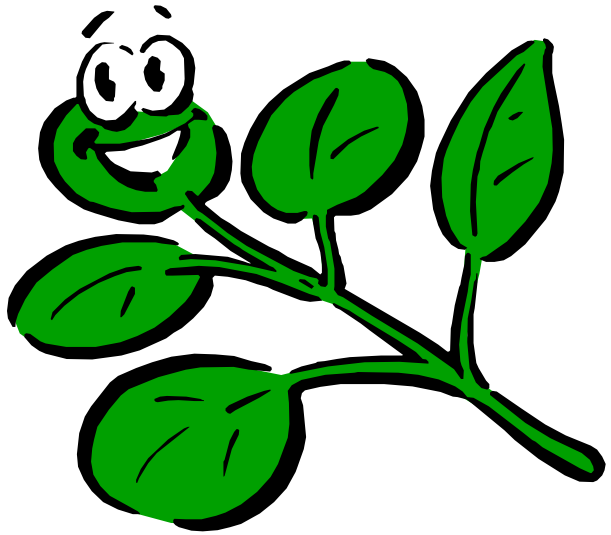
Plant Science

Agriscience Applications



The Uses of Plants

- Without plants, the web of life cannot exist.
- Basic Part of the Food Chain
- Most of our clothing comes from Plants
- Our homes are constructed primarily from plant materials.
- Many of our recreational activities revolve around plants.
- Plants are essential in cooling our planet, purifying our air and the production of oxygen.

Applied Plant Sciences

- Agronomy – the science of field crop
- Horticulture – the science of producing, processing and marketing fruits, vegetables and ornamental plants
  - Olericulture – the science of vegetable production
  - Pomology – the science of fruits and nuts
  - Ornamentals – the growing and using of plants for beauty and recreation.

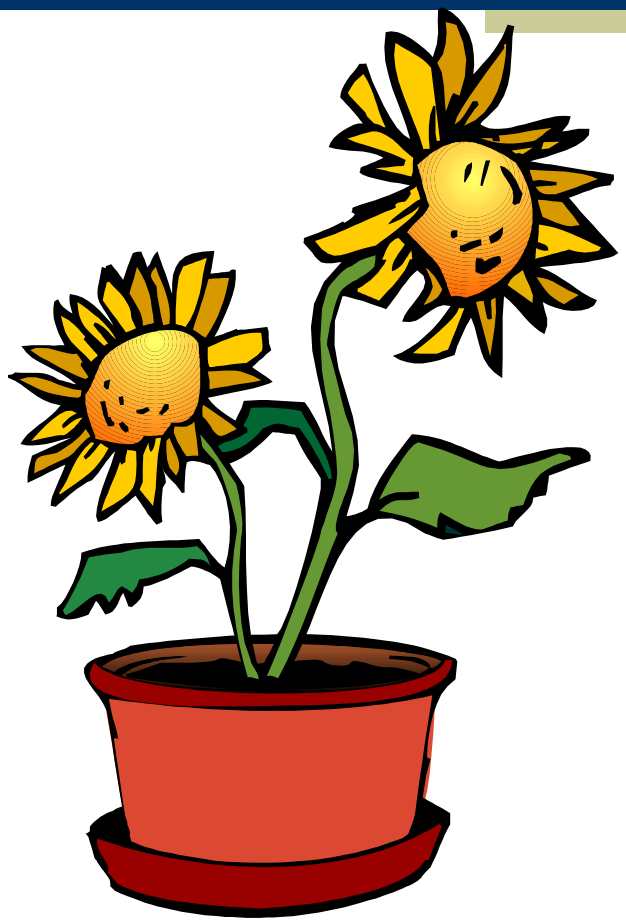
- Forestry – the science of growing trees and producing wood products.

Seven Categories of Plants

- Grain crops
- Sugar and oil crops
- Fiber crops
- Vegetable crops
- Fruit and nut crops
- Forage crops
- Turf and ornamentals

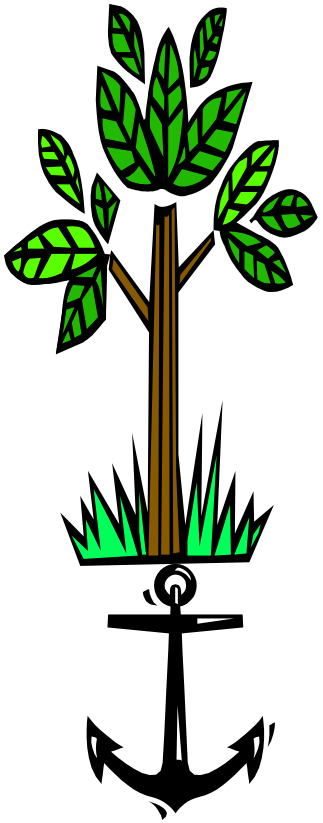
Understanding Plants

- Major Plant Parts
  - Roots
  - Steams
  - Leaves
  - Flowers



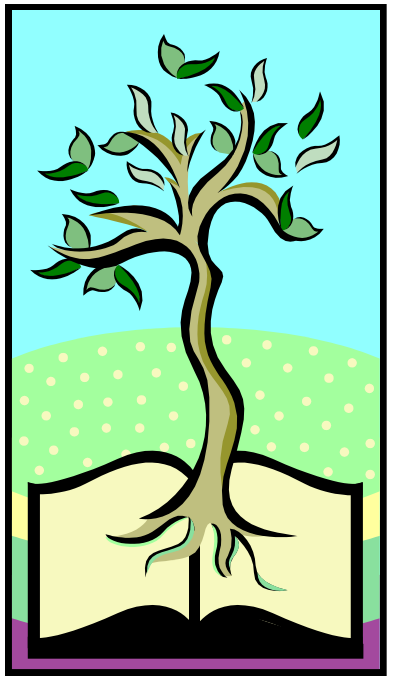
Functions of Roots

- Two Primary Purposes
  - Anchor the Plant
  - Absorb water and nutrients



Roots

- Often the largest part of the plant
  - Squash can have miles of roots
- Adventitious roots
  - Found in places unexpected
  - Poison ivy
  - Mistletoe



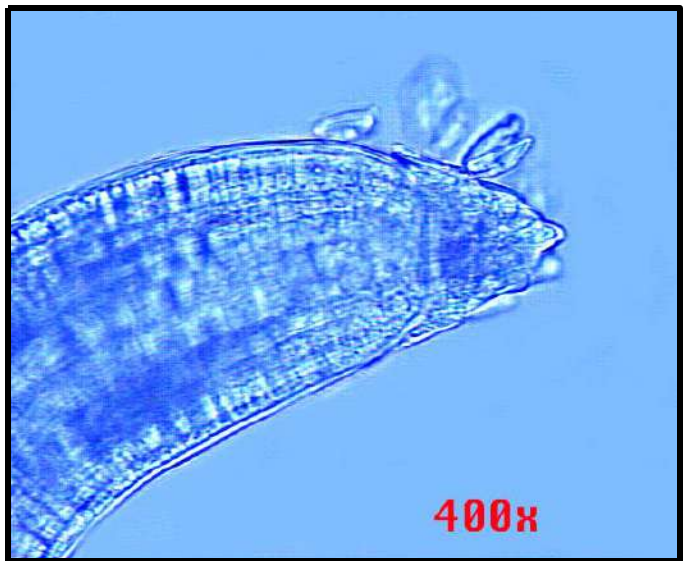
Root

Two types of systems

1. Taproot- main root that usually grows down
   - Carrots
2. Fibrous roots- thin, hair like, and numerous
   - Grass
   - Corn

Root Tissue

- Root hairs – Fine hair like roots
- Root cap- outermost part of a root hair
  - Tough cells that penetrate the soil
  - Pushes through soil partials



Stems

- Supports plants parts such as the leaves, flowers and fruits.
- There are two types of above ground stems
  - Woody – hard and usually has bark
  - Herbaceous – soft, full of water.

Leaves

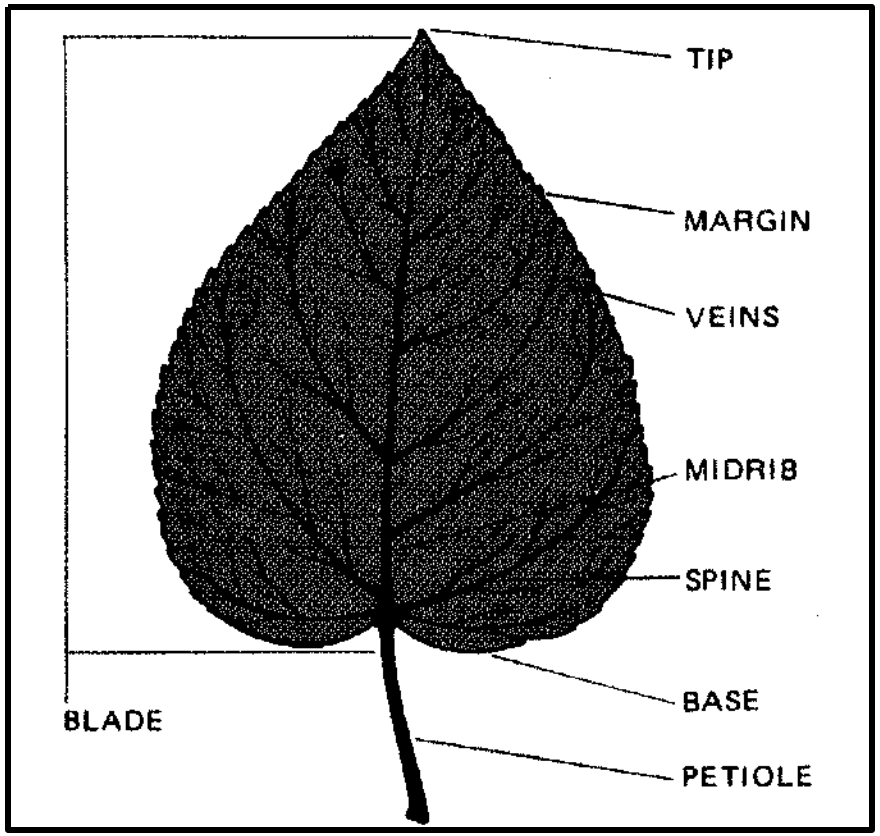
- Manufactures food for the plant
  - Makes food using light energy
  - Plant food is sugar
  - Called Photosynthesis

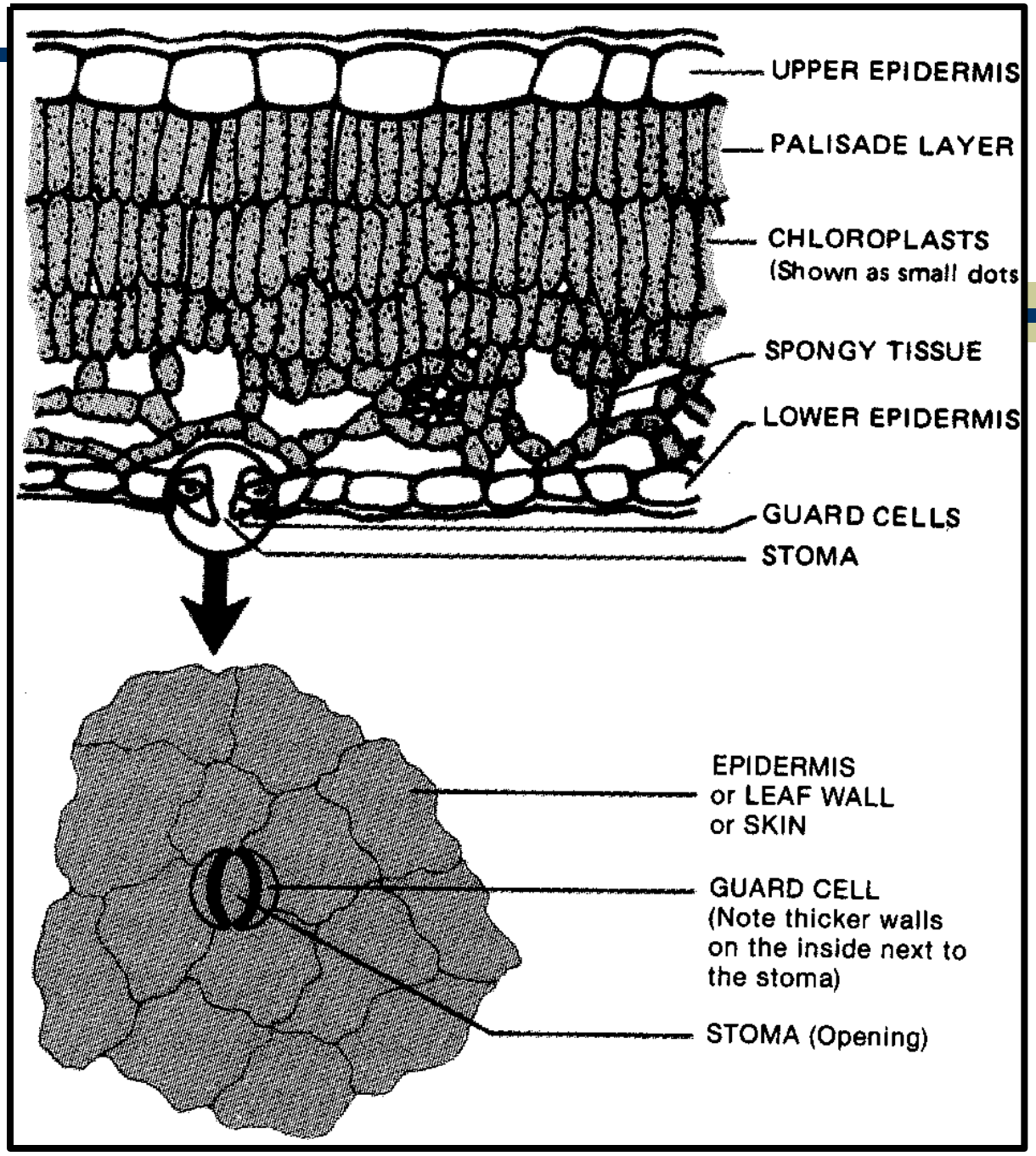
Light

Carbon dioxide + water = sugar + oxygen

Leaves

- Help in the identification of plants
  - Leaf margins
- Shape and size varies with each species
  - Simple leaves
  - Compound leaves




UPPER EPIDERMIS
PALISADE LAYER
CHLOROPLASTS
(Shown as small dots
SPONGY TISSUE
LOWER EPIDERMIS
GUARD CELLS
STOMA
EPIDERMIS
or LEAF WALL
or SKIN
GUARD CELL
(Note thicker walls
on the inside next to
the stoma)
STOMA (Opening)

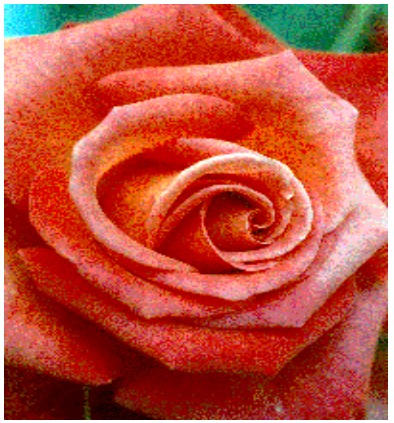
Flowers

- Functions to produce seeds
- Types of flowers
  - Basic attractive flower like a rose
  - Ugly inconspicuous flowers like on an pine tree

- Pollination
  - The union of male pollen with the female part of the flower

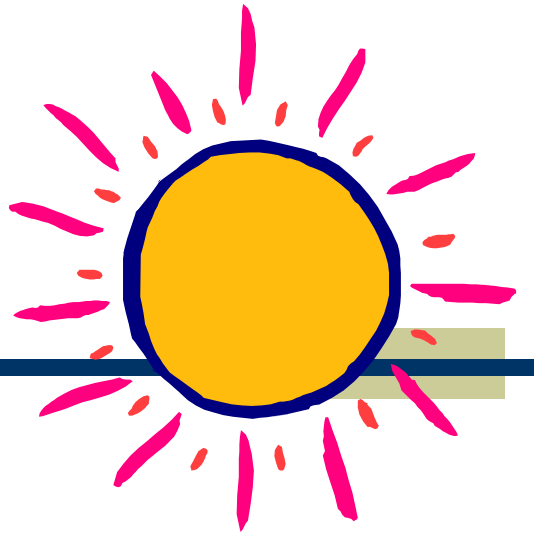
Fruit / Seeds

- Product of a Flower – Fruit / Seed
  - They develop in the female part of the flower
  - It enlarges to be come a fruit.
  - Not all fruits are pretty and not all seeds are edible.



The Plant Process

1. Photosynthesis



- A series of processes in which light energy is connected to chemical energy to form a simple sugar
  - Plant cells have chloroplast which contains chlorophyll
  - Simple sugars are produced (glucose)
  - Carbon dioxide is used
  - Oxygen is produced

Photosynthesis

Glucose

Oxygen

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

Carbon Dioxide

Water

Factors Affecting Photosynthesis

- Light intensity
- Temperature
- Amount of Carbon Dioxide in the Atmosphere

Slowing Photosynthesis

- Low Carbon dioxide lowers lowers photosynthesis
  - Greenhouses can have low carbon dioxide levels
  - Carbon dioxide generators are often used to increase levels.

Slowing Photosynthesis

- Low Light
  - Dark rooms
  - Light intensity matters
- Temperature
  - Best at 65-85 degrees Fahrenheit
  - Extreme temps, high or low, can stop photosynthesis
  - Ranges can vary from plant to plant.

2. Respiration

- Food is used
- Energy is released
- Oxygen is used
- Carbon dioxide is produced
- Occurs in both light and dark

Transpiration

- Release of water vapor from the stomata
- 90% of the water entering the roots
  - 10% is used in chemical processes
- Functions:
  - cooling
  - transportation
  - maintaining turgor pressure

Plant Reproduction

Plant Reproduction

- Two types of propagation:
  - Sexual
    - use of seed for reproducing plants
    - only way to obtain new varieties and hybrid vigor
    - often least expensive and quickest
  - Asexual
    - Vegetative – the use of parts of a plant to reproduce itself..
    - exact duplicate of the parent plant

Parts of the Flower

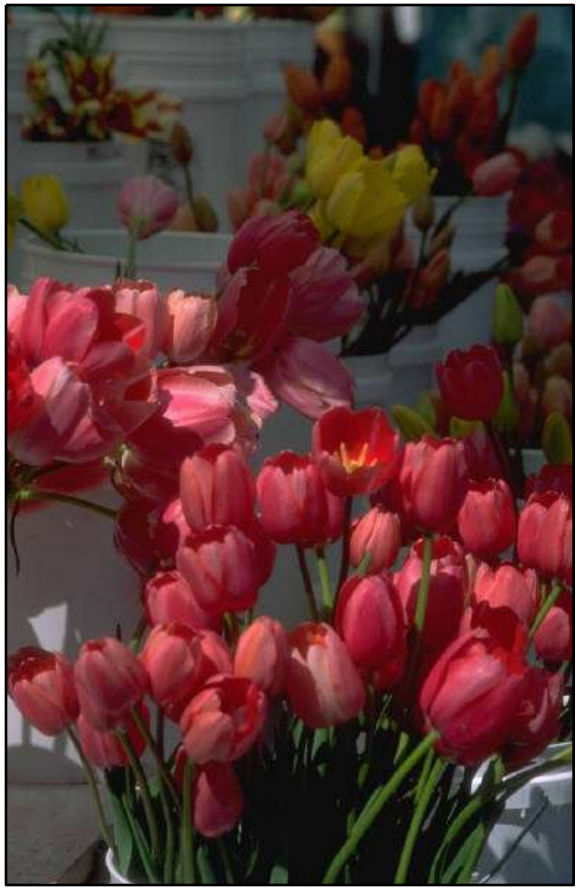
- Stamen (male part)
  - Filament
  - Anther- manufactures pollen
  - Pollen- male sexual reproductive cell

Parts of the Flower

- Pistil (female part)
  - Stigma- receives the pollen
  - Style- connection to the ovary
  - Ovary- contains the ovules or female reproductive cells

Parts of the Flower

- Petals (corolla)
  - Colored part of the flower
  - Attract insects or other natural pollinators



Parts of the Flower

Pollen

Stamen (Male)Anther

Filament

Stigma

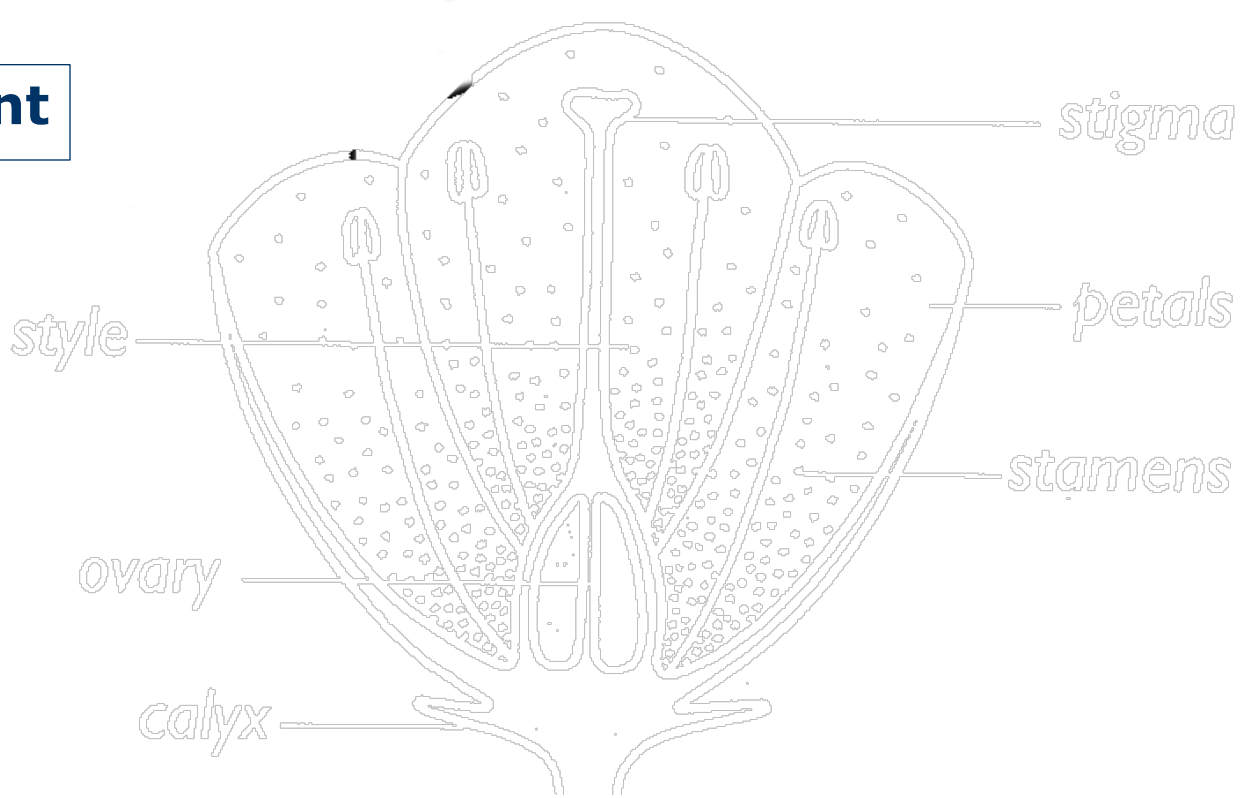
StylePistil (Female)

Ovary

Flower Parts

Anther

Filament



The Seed

Parts of the seed:

- Seed Coat offers protection
  - Sometimes it is very hard and must be scarified (damaged) to promote germination.
- Endosperm supplies food for seed
- Embryo is the young plant

Germination

- The process in which seeds start to sprout and grow
- Requires four environmental factors:
  1. Water
  2. Air
  3. Light
  4. Temperature

Asexual Propagation

- Cuttings are vegetative parts of the plant:
  - Parts of the plant used for cuttings
    - leaves
    - roots
    - stems

Other Asexual Propagation Methods

- Layering – Method of producing roots on the stems while it is still attached to the parent plant.
- Division – Method of dividing or separating the main part of the plant into smaller parts.
- Grafting – Method of joining two separate plants together as one.
- Tissue Culture or Micropropagation - Method of using very small part of a plant to produce unlimited numbers of new plants.
  - Cloning is accomplished by this process

Producing or Growing Plants

Plant Growing Media

- Soil is the top layer of the earth's surface and is the primary medium for cultivated plants.
- Other Types of Media
  - Sphagunm moss
  - Perlite - volcanic glass, great for starting new plants, and is uses in many media mixes

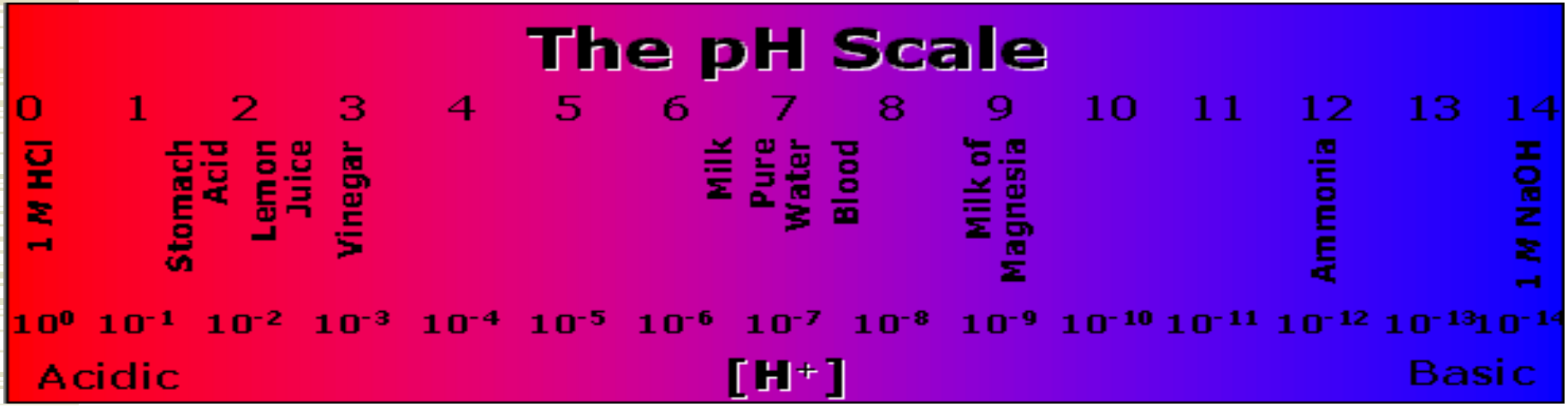
Soil and Plant Media

- Vermiculite - mineral mica-type material and is great for stating plant seeds, cuttings, and media mixes
- Peat Moss – used in media mixes for its water holding ability.

Factors Affecting Plant Growth

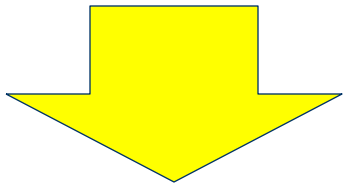
1. Soil pH

- The amount or percentage of Hydrogen in the Soil.
- Improper pH affects availability of nutrients
  - Ph Scale



Amending soil pH

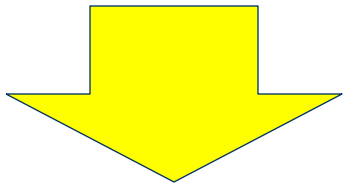
High Alkalinity



Change to acidic by adding sulfer or aluminum sulfate

Amending soil pH

High Acid



Change to more alkaline by adding lime

Amending soil pH

- Lime is usually applied as finely ground dolomitic limestone
  - calcium
  - magnesium

2. Fertilizers

A material added to the soil to supply plants with needed minerals.

Meeting the Needs of the Plant

- Macronutrients – Needed in large amounts
  - Carbon (C)
  - Hydrogen (H)
  - Oxygen (O)
  - Nitrogen (N)
  - Phosphorus (P)
  - Potassium (K)

- Calcium (Ca)
- Magnessium (Mg)
- Sulfur (S)

- Micronutrients – Needed in small amounts
  - Chlorine (Cl)
  - Manganese (Mg)
  - Iron (Fe)

- Zinc (Zn)
- Copper (Cu)
- Boron (B)

Fertilizers

N-P-K

Basic Fertilizers contain Nitrogen-Phosphorus-Potassium
Example: 10-10-10
(10%N, 10%P, and 10%K)

Fertilizers

- Fertilizers must become soluble (liquid form) before they can be used by plants

- Organic fertilizers
  - Manure
  - Bone meal (phosphorus)
  - Soybean meal

Fertilizers

- Organic fertilizers
  - slow acting
  - long lasting
  - lacking some primary nutrients
- Inorganic _ Commercial fertilizer
  - High level of nutrients

Fertilizer Application Methods

- Broadcasting – spreading evenly over the entire surface.
- Side-dressing – placing fertilizer in bands about 8 inches from growing plants
- Chemigation - mixing soluble fertilizers into the water supply system.
- Foliar Application - Spraying fertilizer directly onto the leaves of plants.

Careers in Plant Science

- Forest Careers – careers related to growing, managing and harvesting trees for wood and its by-products
- Forester
  - Helps with the science of growing trees
- Forest Ranger
  - Management of forest including fire prevention
- Logging Foreman
  - Supervise the harvesting of trees

Careers in Plant Science

- Horticulture Careers are as varied as the industry itself
  - Floriculture- flower production and use
    - Floral designer
    - Flower grower
    - Greenhouse manager
    - Retail florist
    - Wholesale florist
    - Interiorscaper

Careers in Plant Science

- Landscape and nursery- plants used around homes and businesses for aesthetic purposes Floriculture (Horticulture)
  - Landscaping and nursery (Horticulture)
    - Greenskeeper- cares for golf courses
    - Lawn Care and Maintenance
    - Landscaper- installs plants
    - Landscape architect
    - Nursery operator- grows trees and shrubs
    - Turf farmer- grows turf (grass) for sale

Careers in Plant Science

- Fruit, Vegetable and Nut Production – the production of edible horticulture crops
  - Plant Breeder
  - Processing Plant Worker
  - Marketing Specialist
  - Production Worker
  - Pest Management

Careers in Plant Science

- Field Crop Production – the production of field crops such as corn, peanuts, hay, etc.
  - Equipment Designers
  - Fertilizer Dealers
  - Farm Chemical Supply
  - Crop Scouts
  - Grain Brokers
  - Transportation Specialists

- Which is a horticulture related career?
  - ? Timber cruiser
  - ? Broiler producer
  - ? Wholesale florist
  - ? Forest ranger

- Which career is involved in the harvesting phase of forestry?
  - ? Forest ranger
  - ? Tree planter
  - ? Logging foreman
  - ? Forester

- Which career is in forestry?
  - ? Florist
  - ? Logging foreman
  - ? Greenhouse manager
  - ? Landscaper

- Landscape architects are a part of the horticulture industry because they:
  - ? Plant landscapes.
  - ? Shoe horses.
  - ? Design landscapes.
  - ? Treat animals for disease.

- Which career is involved with plants grown around the home for aesthetic purposes?
  - ? Forester
  - ? Landscaper
  - ? Wholesale florist
  - ? Floral designer

- Which career relates to plant science?
  - ? Veterninarian
  - ? Logging foreman
  - ? Farrier
  - ? Greenskeeper

- Which career supplies flowering plants to a florist?
  - ? Greenhouse manager
  - ? Forest ranger
  - ? Floral designer
  - ? Landscape architect

- The BEST tool to use when shaping shrubbery into a continuous row for screening is the:
  - ? Hedge shears.
  - ? Lopping shears.
  - ? Pruning shears.
  - ? Chainsaw.

- The best tool to use when pruning limbs in high places is the:
  - ? Pole pruner.
  - ? Chainsaw.
  - ? Pruning shears.
  - ? Lopping shears.

- What tool is BEST when cutting bushes and undergrowth?
  - ? Lopping shears
  - ? Bulb planter
  - ? Chainsaw
  - ? Bush axe

- The BEST tool to use when preparing a plant to be joined to another plant asexually is/are:
  - ? Pruning shears.
  - ? A tube cutter.
  - ? A grafting tool.
  - ? Lopping shears.

- What is the BEST tool used to set out tree seedlings?
  - ? Bulb planter
  - ? Shovel
  - ? Planting bar
  - ? Rake

- The BEST tool to use when cutting large trees and limbs is the:
  - ? Pruning saw.
  - ? Chain saw.
  - ? Auger.
  - ? Pole pruner.

- The BEST tool to use when sawing limbs from shrubbery and trees is the:
  - ? Pruning saw.
  - ? Half hatchet.
  - ? Lopping shears.
  - ? Hedge shears.

- What is the BEST tool to cut large branches when pruning shrubs that are hard to reach?
  - ? Bush axe
  - ? Hedge shears
  - ? Chainsaw
  - ? Lopping shears

- The BEST tool to use when pruning small limbs to shape shrubbery is the:
  - ? Pruning saw.
  - ? Pole pruner.
  - ? Pruning shears.
  - ? Floral scissors.

- Soil pH affects the availability of:
  - ? Microbes in the soil.
  - ? The structure of the soil.
  - ? The land class of the soil.
  - ? Nutrients in the soil.

- Sulfur is used to lower soil pH so that the soil will become more:
  - ? Eroded.
  - ? Acidic.
  - ? Alkaline.
  - ? Porous

- Lime raises the soil pH level so that the soil becomes more:
  - ? Acidic.
  - ? Alkaline.
  - ? Eroded.
  - ? Porous.

- Which plant growing media is a mineral mica-type material?
  - ? Perlite
  - ? Peat moss
  - ? Soil
  - ? Vermiculite

- What is applied to lower the pH value of soil?
  - ? Sulfur
  - ? Fertilizer
  - ? Sand
  - ? Lime

- Which plant growing media is a volcanic ash material?
  - ? Vermiculite
  - ? Perlite
  - ? Peat moss
  - ? Soil

- What type of fertilizer is animal manure?
  - ? Lime
  - ? Complete
  - ? Inorganic
  - ? Organic

- A procedure of fertilizer application used on row crops where the fertilizer is placed in bands about 8 inches from the row is known as:
  - ? Side-dressing.
  - ? Broadcasting.
  - ? Foliar application.
  - ? Top-dressing.

- The three primary nutrients supplied in a complete fertilizer are:
  - ? Nitrogen, phosphorus, and potassium
  - ? Carbon, nitrogen, and sulfur.
  - ? Carbon, hydrogen, and oxygen.
  - ? Calcium, magnesium, and sulfur.

- Organic fertilizers made from dried and pulverized manure are:
  - ? Caustic to plants and can cause injury.
  - ? Slow acting and long lasting.
  - ? In soluble form and quickly available to plants.
  - ? Balanced sources of plant nutrients.

- What form must most nutrients become before they can be absorbed by a plant?
  - ? Gas
  - ? Air
  - ? Liquid
  - ? Solid

- Foliar application of fertilizer is applied by:
  - ? Spraying the fertilizer on the leaves of the plant.
  - ? Sprinkling the fertilizer on the ground beside the plant.
  - ? Injecting the fertilizer in the soil below the plant.
  - ? Placing the fertilizer in a band on either side of the row.

- What is the primary function of flowers?
  - ? Radicles
  - ? Fruit
  - ? Seeds
  - ? Food

- The primary function of the stem is:
  - ? To support other plant structures.
  - ? To produce flowers.
  - ? To anchor the plant.
  - ? To produce fruit.

- The primary function of the leaf is:
  - ? To support other plant structures.
  - ? To produce fruit.
  - ? To produce flowers.
  - ? To manufacture food for the plant.

- The major types of root systems are:
  - ? Cell division and fibrous.
  - ? Fibrous and taproot.
  - ? Fibrous and root cap.
  - ? Cuttings and root hairs.

- The primary function of the root is to:
  - ? Ensure that the plant can be propagated.
  - ? Hold up the stem of the plant and provide propagation material.
  - ? Make sure that the plant will grow.
  - ? Anchor the plant and supply water and nutrients.

- The part of the plant that is responsible for development of seed is the:
  - ? Stem.
  - ? Petiole.
  - ? Flower.
  - ? Leaf.

- Photosynthesis can be enhanced in the greenhouse:
  - ? By keeping all ventilation equipment turned off.
  - ? By using a fertilizer injector.
  - ? With a carbon dioxide generator.
  - ? By using black plastic to cover plants at night.

- John discovers the house plant foliage is yellowing and stunted when compared to another house plant grown next to a window. What is the likely cause?
  - ? Low light intensity hindered food production and photosynthesis in the stunted plant
  - ? Water was not available for the stunted plant
  - ? The stunted plant was too cold since it did not get enough direct sunshine
  - ? The stunted plant was making too much food

- Photosynthesis may be affected in enclosed conditions such as a greenhouse because of:
  - ? Too much chlorophyll in the plant.
  - ? A shortage of food.
  - ? A shortage of carbon dioxide.
  - ? Extremely cold temperatures.

- Jan discovered that plants requiring high light intensity can not be grown well under greenhouse tables because:
  - ? Plants get too much water from dripping plants.
  - ? Low light intensity hinders food making process of photosynthesis.
  - ? High light levels damage foliage and cause leaf burn.
  - ? Plants root in the ground instead of in their pots.

- Antonio is concerned that the photosynthesis process is too slow in his plants because the heat in his greenhouse was cut down by accident. What temperature range will photosynthesis work best in?
  - ? 85 to 95 degrees Fahrenheit
  - ? 50 to 60 degrees Fahrenheit
  - ? 65 to 85 degrees Fahrenheit
  - ? 60 to 70 degrees Fahrenheit

- The rate at which photosynthesis is carried out depends on the amount of:
  - ? Respiration carried on during the daylight hours.
  - ? Light intensity, temperature, and carbon dioxide.
  - ? Oxygen in the atmosphere.
  - ? Nitrogen, phosphorus, and potassium in the water.

- The female part of a flower is called the:
  - ? Anther.
  - ? Pistil.
  - ? Petal.
  - ? Filament.

- Food for the seed is stored in the:
  - ? Embryo.
  - ? Seed coat.
  - ? Endosperm.
  - ? Radicle.

- Food for the seed is stored in the:
  - ? Embryo.
  - ? Seed coat.
  - ? Endosperm.
  - ? Radicle.

- Pollen is produced in the stamen by the:
  - ? Stigma.
  - ? Anther.
  - ? Filament.
  - ? Pistil.

- The purpose of petals in flowers is to:
  - ? Hide the plant from animals.
  - ? Attract insects for pollination.
  - ? Store food for young seeds.
  - ? Support the stamen.

- The three parts of a seed are:
  - ? Root, seed coat, and endosperm.
  - ? Seed coat, endosperm, and embryo.
  - ? Root, stem, and flower.
  - ? An embryo, cotyledon, and new plant.

- Sexual reproduction in plants is the propagation of plants by:
  - ? Roots.
  - ? Seeds.
  - ? Flowers.
  - ? Stems.

- When a seat coat is damaged to encourage germination, the process is called:
  - ? Scarfication.
  - ? Pollination.
  - ? Grafting.
  - ? Cloning.

- The purpose of a seed coat is to:
  - ? Store genetic material.
  - ? Protect the seed.
  - ? Store food.
  - ? Filter light.

- Tissue culture may be used for:
  - ? Sexual reproduction.
  - ? Cloning.
  - ? Disinfecting.
  - ? Sterilization.

- Propagation is defined as:
  - ? The only way to propagate some species and cultivars.
  - ? The process of increasing the number of a species.
  - ? The union of an egg and sperm.
  - ? A cheaper method of propagation than with seeds.

- Grafting is:
  - ? A method by which two plants are propagated.
  - ? A type of sexual propagation.
  - ? A method of joining two different plants.
  - ? A type of hybridization

- The propagation method where a plant is separated into smaller parts is:
  - ? Division.
  - ? Grafting.
  - ? Tip layering.
  - ? Air layering.