

Seed Basics

Botany and Biology

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Hawai'i Public Seed Initiative
Seed Saving and Production Basics



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Monocots and Dicots

- Major division in plant biology
 - Angiosperm
- Difference in plant growth pattern
- Difference in seed germination



Monocots

- one cotyledon in seed
- include all grasses
- parallel veins
- bundled vascular strands scattered
- flower petals number 1, 3 and 6
- secondary growth absent



Monocots

MONOCOTS

Cotyledons



One cotyledon

Veins in leaves



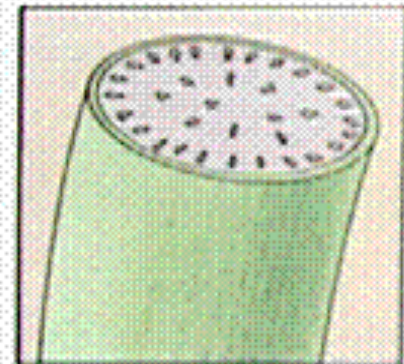
Usually Parallel

Flower parts



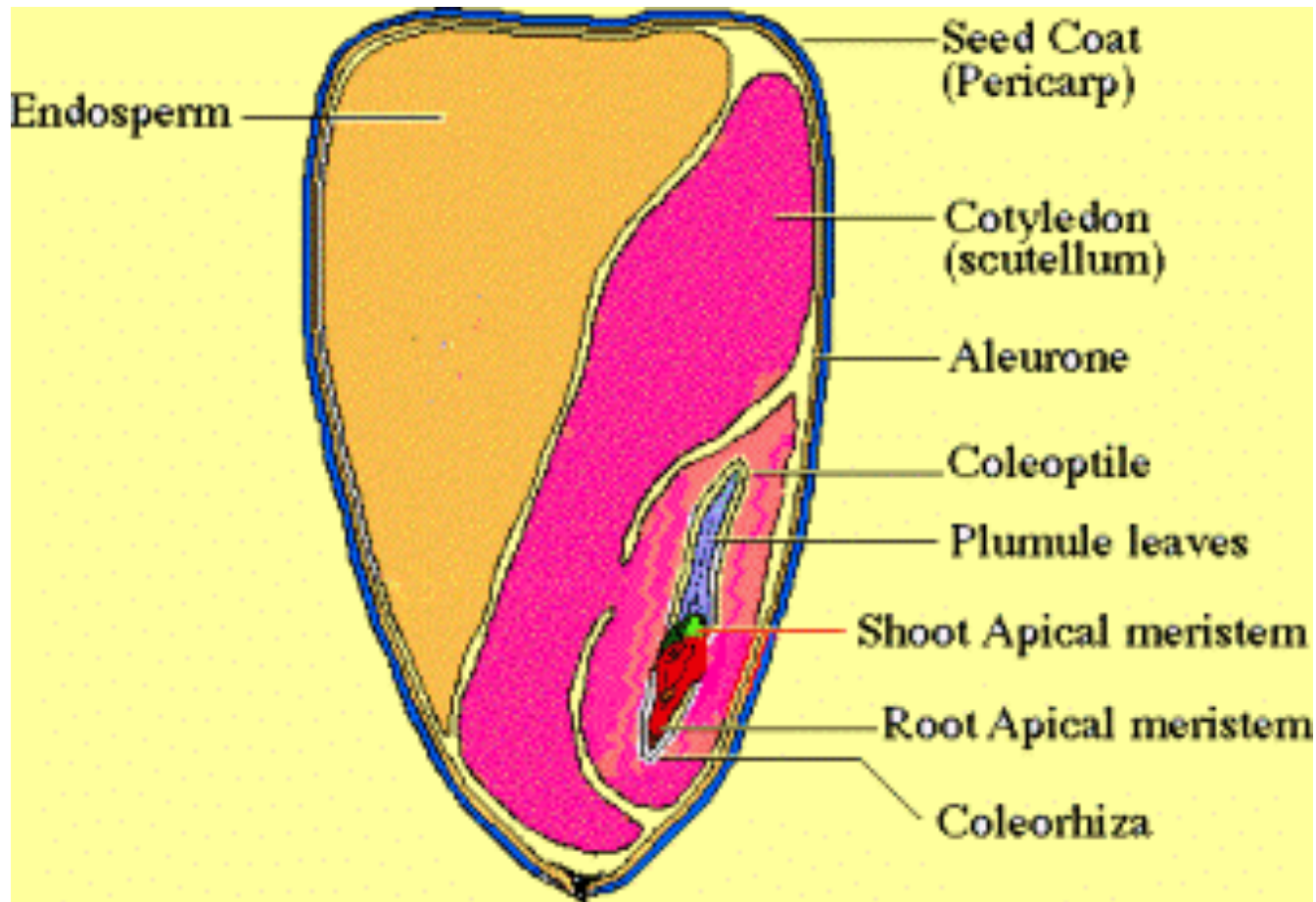
Usually in multiples of three

Arrangement of primary vascular bundles in stem



Scattered

Monocot Seed



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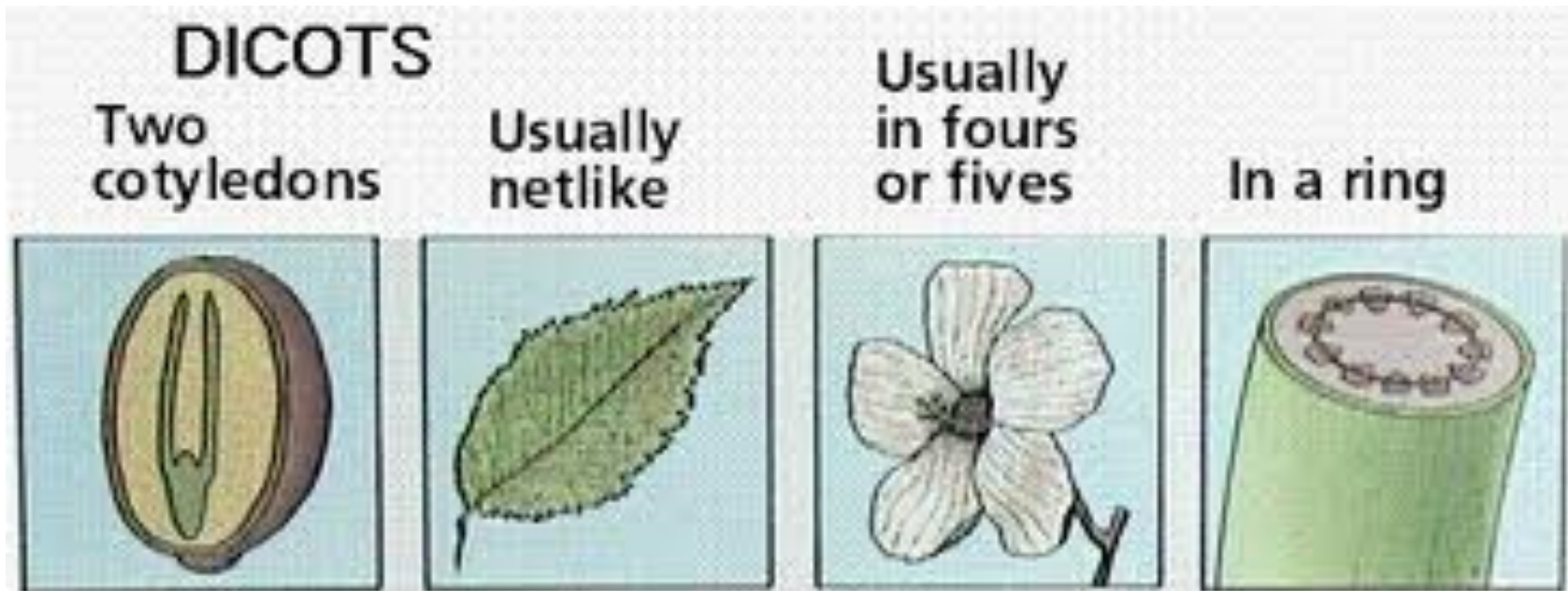
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Dicots

- two cotyledons in seed
- major veins netted
- flower petals number 4, 5 and many
- secondary stem growth
- vascular bundle in ring

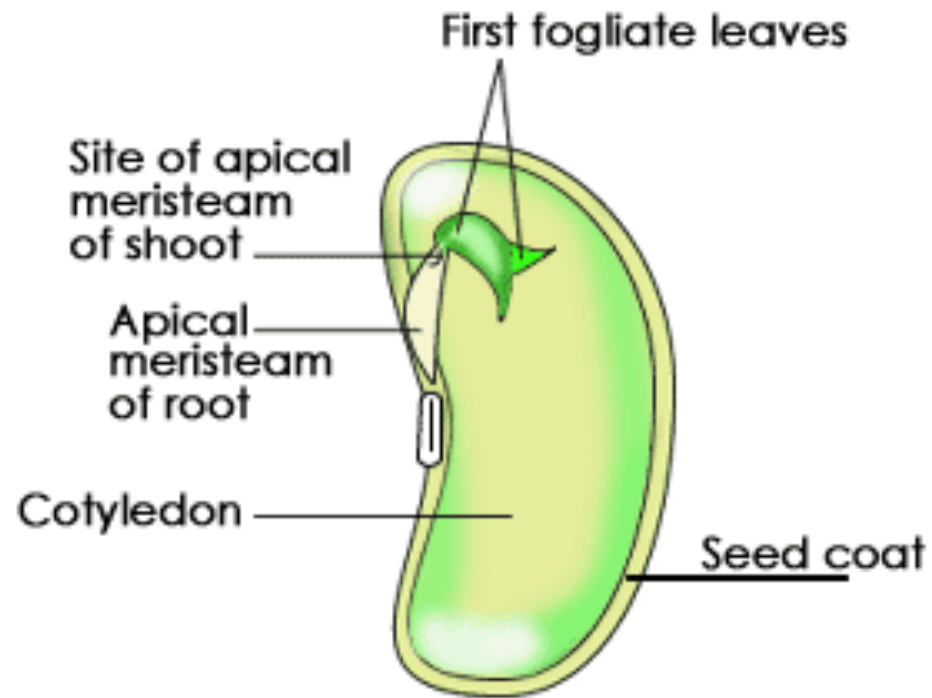


Dicot Characteristics

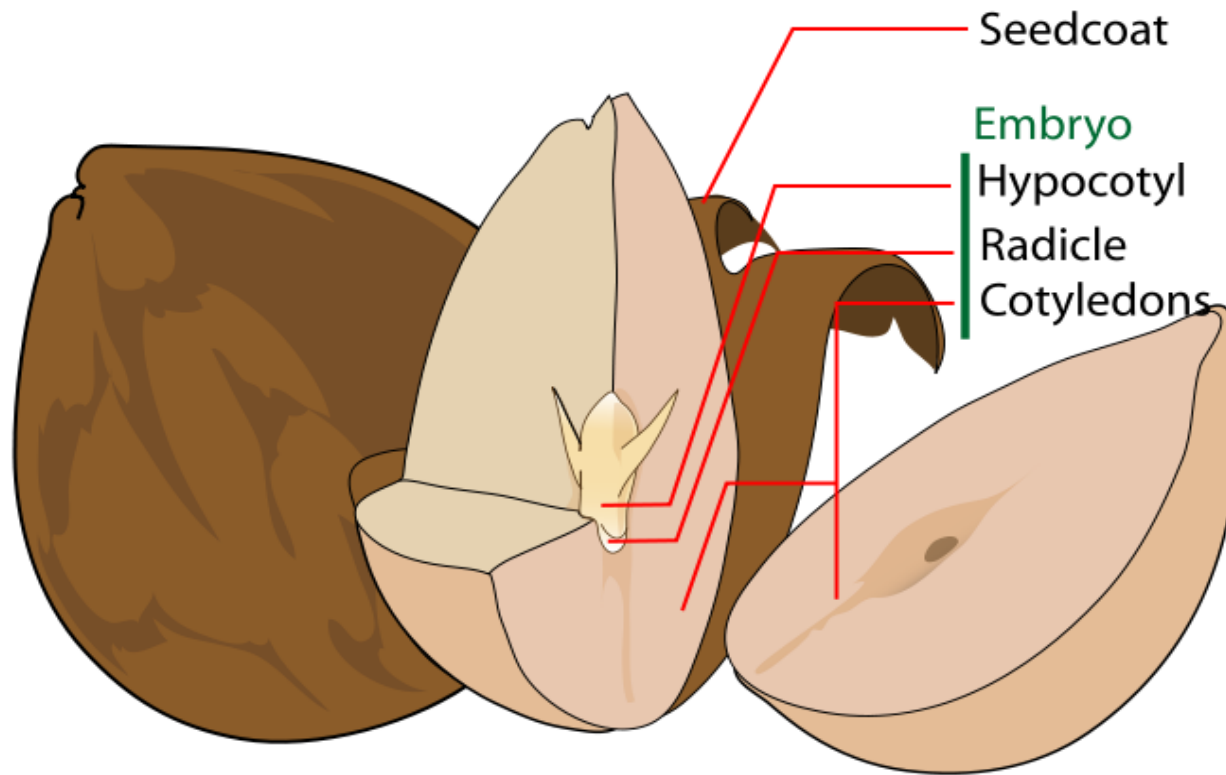


Dicot Seed

Dicot Seed



Dicot Seed



Comparison

- One cotyledon
- Petals multiple of 3
- No secondary stem growth
- Parallel major veins
- Vascular bundle scattered
- Two cotyledon
- 4 or 5 petals
- Secondary stem growth
- Net like major veins
- Vascular bundle in ring



Seed Types

- **OP or Open Pollinated Variety**
- **Hybrid Variety**
- **Heirloom Variety**



Open Pollinated Variety

- allowed to “randomly mate”
- variation in plant types are normal
- good for self saving seeds
- genetic drift constant issue
- seeds generally low cost
- includes most heirloom varieties



Heirloom Variety

- normally 2 to 3 generations or 60 years of planting history
- began in an person's garden or small farm
- has local or regional adaption
- has one or more outstanding characteristics
- possible to self save seeds



Hybrid Variety

- created by control crossing of two plants
- anthers emasculated by hand or physiologically, or by incompatibility
- plant vigor often associated with hybrids
- difficult to create hybrid seeds in home garden
- usually most expensive seeds
- cannot self save seed



Mating Preferences

- Self Pollinators
- Out Crossers



Self Pollinators

- **Self Compatible**
- **Floral Morphology**
 - **enclose reproductive structures**
 - **tubes**
 - **pollination prior to flower opening**
 - **flower positioned to favor self pollination**
- **Tomato, Snap Beans, Lettuce**



Out Crossers

- **Wind Pollinated**
 - **light, loose pollen**
 - **dependent on wind direction**



Out Crossers

- **Wind Pollinated**
- **Insect Pollinated**
 - **availability of pollinators**
 - **pollinator preference**
 - **greenhouse production conditional**



Out Crossers

- Wind Pollinated
- Insect Pollinated
- Vertebrate Pollinated
 - birds, mammals



Out Crossers

- **Wind Pollinated**
- **Insect Pollinated**
- **Vertebrate Pollinated**
- **Self Incompatibility**
 - **Chemical Recognition**
 - **Pollen and seed compatibility**
 - **Eg. Cabbage, Onions, Radish**



Out Crossers

- Wind Pollinated
- Insect Pollinated
- Vertebrate Pollinated
- Self Incompatibility
- Floral Biology



Floral Biology

- **Monoecious**
 - one plant with male and female flowers
- **Dioecious**
 - separate male and female flower plants
- **Receptivity**
 - pollen shed and stigma receptivity not synchronized



Out Crossers

- Wind Pollinated
- Insect Pollinated
- Vertebrate Pollinated
- Self Incompatibility
- Floral Structure Dependent
- Hybrid Vigor



Out Crossers

- Wind Pollinated
- Insect Pollinated
- Vertebrate Pollinated
- Self Incompatibility
- Floral Structure Dependent
- Hybrid Vigor
- Inbreeding Depression Possible
 - **reduced plant vigor**



Pollen Transfer

- **Wind**
 - **direction important in small plots**
 - **loose pollen grains**



Pollen Transfer

- **Wind**
- **Insects and Animals**
 - **Sticky Pollen Grains**
 - **Packaged Pollen Grains**
 - **Bees and Wasps**
 - **Beetles**
 - **Flies**
 - **Butterflies and Moths**



Pollen Transfer

- **Wind**
- **Insects and Animals**
- **Humans**
 - **Lack of Natural Pollinators**
 - **New Character Combinations**
 - **Variety Purity**



Reproductive Cycles

- **Annuals**
- **Biennial**
- **Perennial**



Annuals

- Seed to Seed in One Growing Season
- Herbaceous
- Bean, pea, corn, lettuce, cucurbits



Biennials

- **Require Two Growing Seasons**
 - **seed to seed**
- **Need Dormancy or Photoperiod**
- **cabbage, beets, carrots, collards, kale**



Perennials

- **Grow Many Years**
- **Many Seed Cycles**
- **Many Are Woody Plants**
- **coconut, avocado, etc.**



Strategies on Saving Seeds

- What is the best source
- Genetic diversity
- Seed purity and rouging
- Selection criteria
- Isolation distances



What to Save From?

- Heirlooms
- Self Pollinated Crops
- Annuals
- Open Pollinated Varieties
- No Hybrids Unless...



Maintaining Genetic Diversity

- **How Many Plants to Keep**
 - **Mating Biology**
 - **Genetic Drift**
 - **Available Space**
 - **More Plants or More Seeds**
 - **Seed Yield Ratio**
 - **Seed Quantity Needed**



Maintaining Genetic Diversity

- **How Many Plants to Keep**
- **Plant Selection**
 - **Reason For Selection**
 - **Eliminated Undesirables**
 - **Move in New Direction**
 - **New Possibility**



Maintaining Genetic Diversity

- How Many Plants to Keep
- Plant Selection
- Population Makeup
 - Population Uniformity
 - Narrow Genetic Base
 - Open Pollinated



Maintaining Genetic Diversity

- How Many Plants to Keep
- Plant Selection
- Population Makeup
- Pollination Biology
 - mating behavior
 - pollen transfer



Seed Purity

- **Dependent on Starting Material**
 - **What are your objectives?**



Seed Purity

- **Dependent on Starting Material**
- **Selection and Rouging Procedures**



Seed Purity

- **Dependent on Starting Material**
- **Selection and Rouging Procedures**
- **Cleanliness**



Seed Purity

- **Dependent on Starting Material**
- **Selection and Rouging Procedures**
- **Cleanliness**
- **Proper Labeling – Seed to Seed**
 - **Variety Name**
 - **Common or Scientific Name**
 - **Date**



Seed Purity

- **Dependent on Starting Material**
- **Selection and Rouging Procedures**
- **Cleanliness**
- **Proper Labeling – Seed to Seed**
- **Seed Saving Goals and Objectives**



Seed Purity

- Dependent on Starting Material
- Selection and Rouging Procedures
- Cleanliness
- Proper Labeling – Seed to Seed
- Seed Saving Goals and Objectives
- Pollen Flow Control
- **Start to Finish**



Isolation Distances

- **Crop Specific**
 - **Pollination Biology**
 - **Self Pollination**
 - **Cleistogamy**
 - **Wind Pollinated**
 - **Insect Pollinated**
 - **Animal Pollinated**



Isolation Distances

- **Crop Specific**
- **Location Specific**
 - **In Geographic Space**
 - **In Time**
 - **Exclusion of Pollinators**



