Six Plant Families of Economic Importance
Six Top Agricultural Crop Families

• **Grass family** (Poaceae)—rice, wheat, corn, etc.
• **Bean family** (Fabaceae)—soybeans, peas, beans
• **Tomato family** (Solanaceae)—tomatos, potatoes, peppers, eggplants
• **Mustard family** (Brassicaceae)—cabbage, mustard, turnips, broccoli
• **Squash family** (Cucurbitaceae)—watermelon, honeydews, squash, zucchini
• **Carrot family** (Apiaceae)—carrots, celery, parsnips, cilantro
Poaceae

(=Gramineae)
Poaceae—Grass family

• Named for genus *Poa*
• Crops called *cereal* crops (Greek god of agriculture was Ceres)
• Monocots
• Old family name: *Graminae* (=grains)
• Of the total food produced by the World's top 30 crops (based on dry matter), about 23.4% comes from wheat, followed by maize (21.5%) and rice (16.5%) (Harlan, 1995).
Poaceae

• ~70% of all farmland dedicated to this group
• 9,000 species worldwide
• 35 species domesticated, 5 important today
• Only 1 from New World—which one?
Grass vegetative structure

- Fibrous roots
- Leaves wrap around stem
- Produces clones (tillers) from runners (stolons) or from rhizomes
Grass reproductive structures

- Highly modified flower—no sepals, no petals
- Protective leaves (glumes) around flower stem base
- 2 more protective leaves: lemmas, paleas around flower
- 1 carpel, 2 stigma lobes, 3 stamens
Grass seeds:

- As seed matures, fuses completely to ovary wall = **caryopsis** (kernel)
- Ovary wall + seed coat = **bran**
- Interior to seed coat is oil-rich layer called **aleurone layer**
- Lots of endosperm
- 1-cotyledon = monocot
Wheat
Rice
Corn
Sorghum, Millet
Sugar Cane
Oats, Rye
Fabaceae
(= Leguminosae)
Bean family - Fabaceae

- 2\textsuperscript{nd} to grasses in economic importance
- Major crops: soybeans, peanuts, beans, peas, alfalfa, clover, chickpeas, lentils
- Old family name = \textbf{Leguminosae} because fruit type is \textbf{legume}
- 1-carpel flowers with many seeds; dehiscent at maturity
Fabaceae – Papilionoid Flowers, wings like butterfly

Wings (2 petals)  Banner (1 petal)

(Front View)

Free Stamen  9 fused filaments

Banner  Wings  Keel

Flowers of the Fabaceae (legumes)
Legumes
Soybeans consists of more than 36% protein, 30% carbohydrates, and excellent amounts of dietary fiber, vitamins, and minerals. It also consists of 20% oil, which makes it the most important crop for producing edible oil.
Soybean Products
Peanuts – *Arachis hypogea*

indehiscent legumes, develop underground
Garden Beans – *Phaseolus vulgaris*

Nineteen varieties of beans: Northern, pinto, large lima, blackeye, garbanzo, baby lima, green split pea, kidney, cranberry bean, small white, pink bean, small red, yellow split pea, lentil, navy, white kidney, black bean, pearl barley and scarlet runner.
Carat is derived from the word "carob," in reference to the carob seed. One carat is precisely 200 milligrams. The diamond in the engagement ring shown above is 1.09 carats or 218 milligrams.
Fabaceae

- *Rhizobium* bacteria form symbiotic relationships with roots
- Produce nodules. Nitrogen in atmosphere “fixed” by bacteria
Solanaceae
Tomato Family - Solanaceae

- Flowers radially symmetrical with
- 5 united sepals and
- 5 petals united at base
- Stamens are usually 5
- Superior ovary
- Leaves are alternate, simple or lobed.
- Fruit is a berry or 2-chambered capsule
Tomato Family - Solanaceae

Edible Genera:

*Capsicum*
- bell pepper
- chilies, all kinds
- paprika

*Physalis*
- tomatillo
- strawberry tomato

*Solanum*
- tomato, roma, cherry, heirloom
- eggplant
- potato
Tomatos

- *Solanum lycopersicum*
- Domesticated in Central America
- Nahuatl tribes called them ‘tomatl’
- First record in Europe is 1544 in Italy
- Not eaten for centuries in Europe because it looked like local toxic cousins
- Ketchup popularized in early 1900s, salsa in the 1980s
Potatoes

- *Solanum tuberosum*
- Domesticated in mountains of Argentina
- Good crop for cool, moist, country,
- **Tuber** = modified *stem*, produced underground
- Biennial crops
- ‘eyes’ = axillary buds
- Native name → ‘batatas’
- Scrape away any sprouts or green spots, since they might contain a mildly toxic compound called solanine
Potatoes & history

- **Irish potato famine**—1840s—killed 1-6 million people—caused by potato fungus *Phytophthora*
- Russians used potatoes as fermentation source → **vodka**
Eggplant

- *Solanum melongena*
- Native to India
- Domesticated about 3,000 yrs ago
- Original plants produced egg-like fruit
- Modern varieties have thicker, purple skin
Peppers

3 main species, each with many varieties:

*Capsicum annuum*

*Capsicum frutescens*

*Capsicum chinense*

The name “Capsicum” could arise from the Latin *capsa* (box) or the Greek *kapto* (to bite).
Alkaloids of Solanaceae plants:

Atropine from belladonna

Hyosciamine from Henbane
Tobacco - Nicotine

• 2 main species:
  *Nicotiana rusticum*
  & *N. tabacum*
Brassicaceae

(= Cruciferarceae)
Mustard Family - Brassicaceae

- Leaves are **alternate** and **simple**.
- Flowers in **raceme**
- **sepals** 4
- **petals** 4, separate
- **Stamens** 6, inner 4 long, outer 2 short (tetradynamous)
- Ovary divided by a **replum** or false partition.
- Fruit a narrow **silique** or a short **silicle**
Mustard Family - Brassicaceae

- **siliques**
- **4 petals**
- **4 sepals**
- **4 tall stamens**
- **2 short stamens**
- **pistil**
- **raceme**
- Various silicles
Mustard Family - Brassicaceae

- Crops: cabbage, broccoli, cauliflower, turnips, kale, collards, mustard, brussel sprouts, rutabagas
Mustard Family - Brassicaceae

Edible Genera:

*Brassica*

- kohlrabi
- mustard
- canola oil (rape seed oil)
- cabbage, head of leaves
- kale, without a head
- cauliflower, flower buds
- brussels sprouts, axillary buds
- broccoli, flower buds
- rutabaga
- turnip
- chinese cabbage
- bok choy
**Brassica oleracea** – Wild Species
Cultivars all selected from different parts

<table>
<thead>
<tr>
<th>Strain</th>
<th>Kohlrabi</th>
<th>Kale</th>
<th>Broccoli</th>
<th>Brussels sprouts</th>
<th>Cabbage</th>
<th>Cauliflower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified trait</td>
<td>Stem</td>
<td>Leaves</td>
<td>Flower buds and stem</td>
<td>Lateral leaf buds</td>
<td>Terminal leaf bud</td>
<td>Flower buds</td>
</tr>
</tbody>
</table>
Mustard Family - Brassicaceae

Other Edible Genera:

*Armoracia rusticana*

**horseradish**, root used to flavor foods

*Eruca stiva*

**arugula**

*Nasturtium officinale*

**watercress**

*Raphanus sativus*

**radish**

**daikon**
Cucurbitaceae
Squash Family - *Cucurbitaceae*

- Leaves **palmately veined** or lobed.
- **Monoecious** - separate male and female flowers (imperfect)
- Inferior ovary
- Ovary 3 carpels, single **locule** with **parietal placentation**.
- Fruit is a **pepo**, a berry with a hard rind.
Squash Family - *Cucurbitaceae*
Cucumbers, melons, squashes, zucchinis, gourds, pumpkins, loofahs

Fruit type - **pepo**
3 carpels
Parietal placentaion
Squash Family - *Cucurbitaceae*

**Edible Genera:**

*Citrullus lanatus*
- watermelon

*Cucumis*
- cantaloupe
- honey-dew
- cucumber

*Cucurbita*
- pumpkin
- squashes
Squash, Pumpkins, and Gourds – *Cucurbita*
Apiaceae = Umbelliferae
Carrot Family - Apiaceae

- Carrots, parsnips, celery
- Herbs: chervil, angelica, dill, caraway, coriander, cumin, fennel, parsley, aniseed, cilantro, rhubarb
- Old name: Umbelliferae
Carrot Family - Apiaceae

- **Compound leaves, petioles sheathing**
- Flowers borne in dense, flat-topped **umbel**.
- **Sepals, petals** and **stamens** of an individual flower are each five.
- **Ovary inferior** made up of 2 **carpels**, 1 **ovule** in each.
- Fruit develops into a **schizocarp**, splits in 2
- Aromatic oils in leaves and fruit
compound umbels

schizocarp

Fennel fruit

Fennel fruit x-section

Mericarp

Cumin

Mericarp

Schizocarp
Carrot Family - Apiaceae

Edible Genera:

*Anethum graveolens*  
**dill**

*Apium graveolens*  
**celery** (petiole, root)

*Carum carvi*  
**caraway**, herb and spice with edible leaves a roots. Can be used medicinally as an antispasmodic

*Coriandrum sativum*  
**cilantro**  
**coriander**

*Cuminum cyminum*  
**cumin**
Edible Genera:

*Daucus carota*

*carrot*, cultivar of the wild variety, grows a tap root during its first growing season and then produces flowers and seeds during the next.

*Foeniculum vulgare*

*fennel*, with edible petioles

*Pastinaca sativa*

*parsnip*

*Petroselinum crispum*

*parsley*

*Pimpinella anisum*

*anise*
Other Notable Genera:

*Cicuta maculata*

*water hemlock*, the deadliest plant in North America affecting the central nervous system and causes paralysis of the lungs. A tiny piece is enough to kill a human, contains large amounts of *cicutoxin*

*Conium maculatum*

*hemlock*, also extremely deadly and is said to be the plant that killed Socrates

*Heracleum mantegazzianum*

*giant hogweed*, causes painful blisters on contact with human skin
Carrot Family - Apiaceae
End