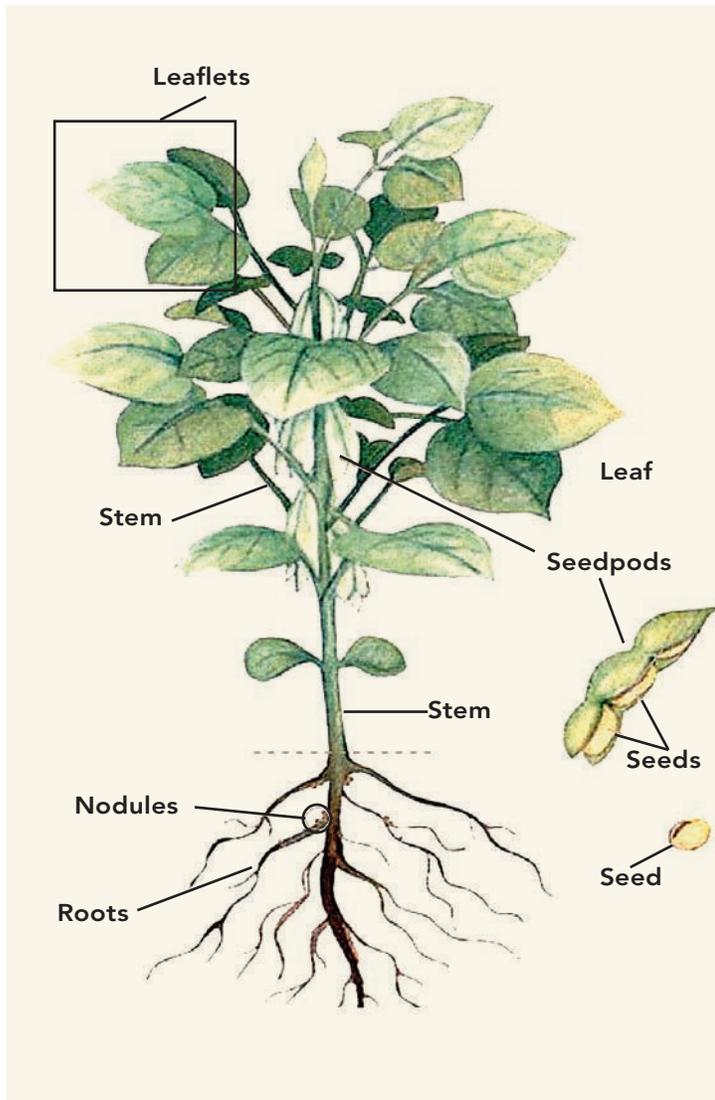


SOYBEANS

USES: candy, cakes, cheeses, peanut butter, animal feeds, candles, paint, body lotions, biodiesel, furniture

WHAT ARE SOYBEANS?

Soybeans are small round seeds, each with a tiny hilum (small brown spot). They are made up of three basic parts. Each soybean has a seed coat (outside cover that protects the seed), cotyledon (the first leaf or pair of leaves within the embryo that stores food), and the embryo (part of a seed that develops into a new plant, including the stem, leaves and roots). Soybeans, like most legumes, perform nitrogen fixation. Modern soybean cultivars generally reach a height of around 1 m (3.3 ft), and take 80–120 days from sowing to harvesting.



VOCABULARY

CULTIVAR: a variety of plant that has been created or selected intentionally and maintained through cultivation.

EMBRYO: part of a seed that develops into a new plant, including the stem, leaves and roots.

EXPORTS: products or items that the U.S. sells and sends to other countries. Exports include raw products like whole soybeans or processed products like soybean oil or soybean meal.

FERTILIZER: any substance used to fertilize the soil, especially a commercial or chemical manure.

HILUM: the scar on a seed marking the point of attachment to its seed vessel (the brown spot).

LEAFLETS: sub-part of leaf blade. All but the first node of soybean plants produce leaves with three leaflets.

LEGUME: plants that perform nitrogen fixation and whose fruit is a seed pod. Beans, peas, clover and alfalfa are all legumes.

NITROGEN FIXATION: the conversion of atmospheric nitrogen into a nitrogen compound by certain bacteria, such as rhizobium in the root nodules of legumes.

NODULES: place on stem where leaves, branches and flowers are attached. Plant height is related to the number of nodes and the length of the distance between each node (internode). Each node produces three buds.

RADICLE: the lower part of the axis of an embryo, the primary root.

SEED COAT: outside cover that protects the seed.

SEED PODS: a structure that holds seeds. Each pod typically holds 3-4 beans.

SOYBEAN OIL: a pale yellow oil derived from soybeans by expression or solvent extraction. Used as a food and in the manufacture of soap, candles, inks, paints, varnishes, etc.

TAPROOT: a main root descending downward from the radicle and giving off small lateral roots.

TRIFOLIATE: having three leaflets.

SOYBEANS

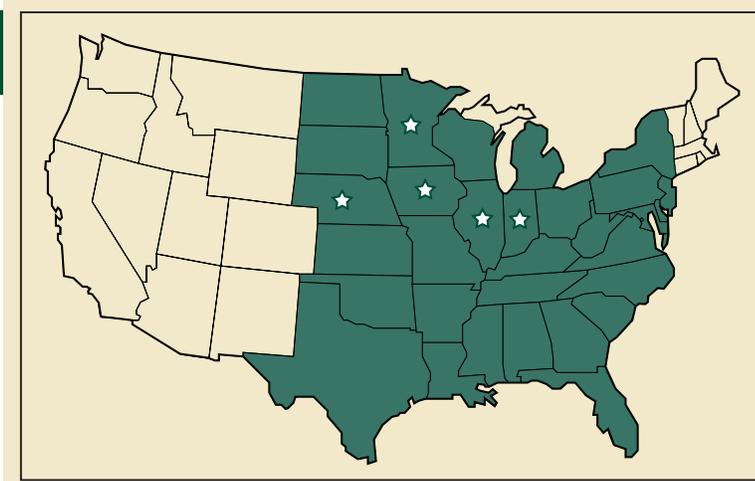
UNITED STATES SOYBEAN PRODUCTION

■ Soybean producing states

Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia and Wisconsin

☆ Top 5 soybean producing states

Iowa, Illinois, Minnesota, Nebraska and Indiana



SOYBEAN TIMELINE

Farmers in China began growing soybeans **MORE THAN 5,000 YEARS AGO**.

1765 — Soybeans, or “Chinese vetches” as they were known, were introduced to North America.

1804 — James Mease, a physician and amateur horticulturalist, reported that soybeans had adapted to Pennsylvania’s growing climate.

1861-1865 — Soybeans were used to brew a hot drink for soldiers during the Civil War.

1898 — The United States Department of Agriculture (USDA) introduced several varieties of soybeans from Asian countries and set up a system to keep track of the different kinds of seeds.

1904 — George Washington Carver began studying soybeans at the Tuskegee Institute in Alabama. Carver discovered a method of extracting soybean oil and also invented a process

for making paints and stains from soybeans. Farmers in the South were encouraged to plant soybeans to keep the soil fertile for their cotton crop.

1907 — William J. “Bill” Morse joined the USDA and devoted his life to studying soybeans. He was also the founder of the American Soybean Association and wrote more than 80 publications about soybeans.

1920s — Palemon Howard (P.H.) Dorsett and William Morse traveled to China and Korea collecting varieties of soybeans. Over 10,000 varieties were sent back to the United States from their excursions.

1940 — Henry Ford took an ax to a car trunk made with soybean plastic to demonstrate its durability. This increased the popularity of soybeans and the United States began to export soybeans and soybean products.

1950s — Soybean meal became available to use as a livestock feed ingredient. It was high in protein and low-cost. This prompted a large increase in livestock and poultry production in the United States.

1994s — Soybean-based crayons win the first Indiana Soybean Development Council/Purdue University Soybean Utilization Contest.

2002 — USDA’s Agricultural Research Service begins heating its buildings in Beltsville, Maryland, and fueling all its diesel vehicles, generators and equipment sterilizers with B20 made from soybeans.

TODAY — Farmers throughout the United States produce 3,329.3 million bushels of soybeans each year. Iowa alone produces 466 million bushels yearly making them 1st in soybean production.

One acre of soybeans can produce 82,368 crayons.

Soy ink is used in over 95 percent of America’s daily newspapers that circulate more than fifteen hundred copies per run.

Livestock are the largest consumers of soy meal.

A bushel of soybeans weighs about 60 pounds.

One and a half gallons of biodiesel and 48 pounds of soybean meal can be produced from one bushel of soybeans.

**DID YOU
KNOW?**

SOYBEANS

CAREERS: Nematologist, Fisheries Scientist, Biotechnologist, Soil Scientist, Farmer, Researcher, Entomologist

SPOTLIGHT ON CAREERS:

FISHERIES SCIENTIST — Fisheries scientists are dedicated to effective management, use and conservation of aquatic plants and animals. They use their expertise to protect and enhance recreational, commercial and aquacultural fisheries resources. Soy plays a significant role in feeding aquatic livestock.

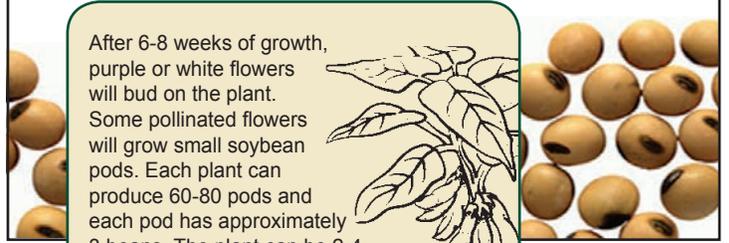
NEMATOLOGIST —

Soybean cyst nematodes are small plant roundworms that attack the roots of soybeans and can cause a decrease in yield. **Nematologists** study nematodes and their

SOYBEAN USE IN THE UNITED STATES

A soybean seed takes about 4-7 days to begin growing. The radicle, an apostrophe shaped bud, will emerge from the seed. The primary root will form from the radicle. Tap roots will branch out from the lateral root. Above the ground, the cotyledon emerges from the soil.

After 6-8 weeks of growth, purple or white flowers will bud on the plant. Some pollinated flowers will grow small soybean pods. Each plant can produce 60-80 pods and each pod has approximately 3 beans. The plant can be 2-4 feet tall and is covered with fuzzy, short hairs.



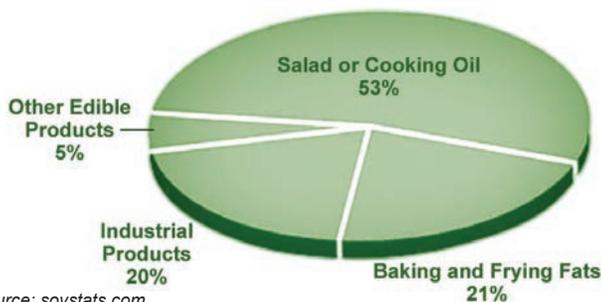
Sometime between late August and early October, the ripe bean pods change color and dry out. The farmer will harvest the plants with a combine. The combine will separate the beans from the rest of the plant and store the beans in the combine's tank.



After the soybeans are harvested, they are taken to a grain elevator where they are stored and prepared for wholesale. When the soybeans are ready, they are loaded onto semi-trucks, freight trains or barges and shipped all over the United States and around the world where it will be processed into soy oil and soy meal. The soybeans will be used for animal feed, biodiesel and many other consumer products.



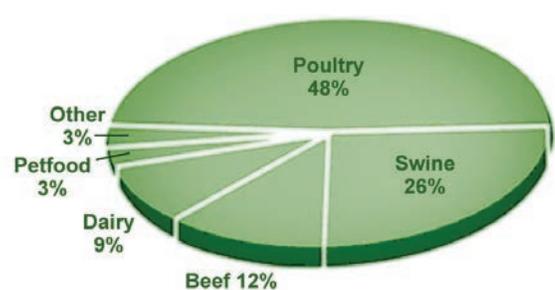
U.S. SOYBEAN OIL CONSUMPTION 2011



Source: soystats.com

| | Million Pounds | Million Metric Tons |
|------------------------|----------------|---------------------|
| Salad or Cooking Oil | 9,450 | 4.29 |
| Baking and Frying Fats | 3,750 | 1.70 |
| Industrial Products | 3,600 | 1.63 |
| Other Edible Products | 900 | 0.41 |
| Total | 17,700 | 8.03 |

U.S. SOYBEAN MEAL USE BY LIVESTOCK 2011



Source: soystats.com

| | Million Short Tons | Million Metric Tons |
|--------------|--------------------|---------------------|
| Poultry | 13.14 | 11.92 |
| Swine | 6.98 | 6.33 |
| Beef | 3.30 | 2.99 |
| Dairy | 2.33 | 2.12 |
| Petfood | 0.68 | 0.62 |
| Other Feed | 0.79 | 0.79 |
| Total | 27.30 | 24.77 |

SOYBEANS

SOYBEANS 2011 AT A GLANCE

2011 SOYBEAN STATISTICS

75.0 million acres planted
41.5 bushels/acre soybean yield
3,056 million bushels produced
\$11.70 average price per bushel
\$35,784 million soybean crop value

SCIENCE AT HOME

MIGHTY SEEDS

How strong are soybeans? This experiment shows how germinating soybean seeds can generate enough force to crack plaster of Paris.

What's the Word?

Observation, germinate, exothermic reaction

What You Need (per student or pair of students):

| | |
|-----------------------------------|--------------------------|
| Clear plastic cup | Plastic spoon for mixing |
| 5 tablespoons of plaster of Paris | Dropper |
| 2 or more tablespoons of water | 3 soybean seeds |

What to Do?

Put the plaster of Paris in the plastic cup, add 2 tablespoons of water and mix. Continue to add drops of water until the mixture has the consistency of a very thick milkshake. Push the soybeans into the plaster until they are covered and then smooth the surface. What do you think will happen to the soybeans? Make regular observations. What happens? Why? The next day, add a tablespoon of water to the cup and continue to make observations. What happens? Why?

What's Going On?

Seeds require moisture and warmth to germinate. In this case, the seed absorbs moisture from the plaster mixture. As the seed absorbs water it increases in size and applies pressure to the surrounding plaster. This force, combined with the strength of the germinating sprout, causes the plaster to crack and allows the shoot to grow up through the plaster. The strength and ability to grow in adverse conditions allow plants to survive in a wide range of environments. You may also notice that when water is mixed with plaster the cup becomes warm. A chemical reaction that gives off heat like this is known as an exothermic reaction.

Compliments of the Ohio Soybean Council

2011 LEADING U.S. SOYBEAN EXPORT CUSTOMERS

\$Million

Soybean Exports

| | |
|-------------|----------|
| China | \$10,453 |
| Mexico | \$1,651 |
| Japan | \$954 |
| Indonesia | \$859 |
| Taiwan | \$704 |
| Egypt | \$301 |
| Germany | \$286 |
| South Korea | \$267 |
| Spain | \$194 |
| Thailand | \$176 |
| All Others | \$1,720 |

Total \$17,564

Soybean Meal Exports

| | |
|--------------------|-------|
| Canada | \$375 |
| Mexico | \$369 |
| Venezuela | \$260 |
| Philippines | \$229 |
| Morocco | \$221 |
| Dominican Republic | \$145 |
| Japan | \$119 |
| Guatemala | \$110 |
| Ecuador | \$84 |
| South Korea | \$71 |
| All Others | \$720 |

Total \$2,702

Soybean Oil Exports

| | |
|--------------------|-------|
| Morocco | \$336 |
| Mexico | \$194 |
| China | \$129 |
| Colombia | \$77 |
| Algeria | \$72 |
| Dominican Republic | \$71 |
| Venezuela | \$57 |
| Guatemala | \$52 |
| Canada | \$47 |
| Peru | \$36 |
| All Others | \$196 |

Total \$1,268

Source: soystats.com

BIODIESEL

Biodiesel is a clean-burning, renewable fuel produced from domestic resources like soybeans and other vegetable oils and animal fats. Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create an alternative fuel for use in diesel engines with very few or no modifications.

Biodiesel helps reduce America's dependence on foreign oil while creating local job opportunities.



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