

Unit 5) Specialty Crops in Kansas

That was Then and This is Now...

THEN

"Busy as a 'cranberry merchant' all day with about 40 people who were here either picking or buying cherries. Over 23 bushels went out of the orchard which is the biggest cherry day we have ever had.

The Stockton folks had a big picnic dinner in the grove and later many of them went fishing in the creek near by and caught several fine messes of fish. Taking it all and all was quite a gala day and one long to be remembered."¹

Elam Bartholomew, June 16, 1913

Now

"I took my daily walk through the patch this morning after the kids left for school. It is so fun to look for all the different varieties and see new pumpkins, squash and gourds that are growing under the large leaves and vines. I can't believe that it is almost time to open the patch for the season! It feels like we just planted the little seeds in the ground with our big tractor and planter, but it is already September and that was the end of May. We have worked hard on this patch all summer long. We have watered and weeded as we watched them grow to all shapes, sizes and colors. We have a rainbow of colors – orange, pink, red, yellow, green, and even blue!

So much work is being done to get the farm ready for the thousands of customers coming to the farm this year. We are working on the play area today, getting the slide ready for all the children that love to come every year and enjoy the 30-foot hayloft slide. There is so much to do to get ready this week, but we are so excited to open the farm once again. Children young and old will be coming to ride a hayrack ride, visit barnyard animals, swing on the tree swing, and of course pick the perfect pumpkin."

Danielle Geesling, Harvest Farm & Pumpkin Patch,
September 2010

Nearly 90 percent of the land in Kansas is devoted to agriculture. This includes land used for the cultivation of plants or agricultural produce (cropland), livestock production (pasture, rangeland, and grassland), and forestry or related products (forests, orchards, and Christmas tree farms).

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TEACHER'S RESOURCES

Even though Kansas is known as the "wheat state," Kansas agriculture produces a wide variety of plant-related products. The U.S. Department of Agriculture (USDA) defines many of these agricultural products as specialty crops, or plants that are intensively cultivated. Specialty crops include fruits, vegetables, tree nuts, dried fruits, horticulture and nursery crops, and floriculture.

HORTICULTURE WORDS

Horticulture – the science or art of cultivating fruits, vegetables, flowers, or ornamental plants.

Floriculture – the cultivation of flowering and ornamental plants.

Nursery crop – plants grown in a greenhouse or outdoor nursery until the plants are large enough to be planted in a more permanent location.

Specialty crops represent a growing segment of the agriculture industry both nationwide and in Kansas. At this time, however, the production and sales of many specialty crops grown in Kansas are not tracked in the same detailed way as the major grain and oilseed crops.

KANSAS HISTORY

American Indians produced the first agricultural crops in what is now Kansas. Early Spanish explorers observed the Quivira Indians cultivating the soil, and the Kansa Indians served corn and vegetables to other early explorers. By the time Congress passed legislation creating the Kansas Territory in 1854, farms were common on the lands reserved for the American Indians.

The Homestead Act of 1862 promoted the idea that anyone could become a farmer, leading to a population explosion after the Kansas Territory was opened for land ownership. However, prior to the end of the Civil War, settlers in the Kansas Territory barely raised enough food for their own consumption and some years, they did not even manage to do that. In the 1870s, the population of the state grew faster than the state's ability to feed its people. The hard work and natural disasters, among other factors, led many of the pioneering homesteaders to abandon their efforts to create new farms, homes, and communities. Others persevered and laid the foundation for the Kansas agriculture industry known today.



Farm on Delaware Indian Reservation in Kansas, 1867

Source: Library of Congress; Alexander Gardner, photographer



Wheat Market, Offerle, 1916

Source: Library of Congress; Jno. E. Cox, photographer

AGRICULTURAL COMMODITY PROMOTION

Agricultural producers work together to promote commodities and market development (domestically and internationally) through research, education, and information. These efforts may be voluntary, funded and managed entirely by producers, or mandated by state or federal laws.

There are 18 active national generic promotion programs for agricultural commodities that have been authorized by Congress. Those check-off programs support commodities including beef, blueberries, cotton, dairy products, eggs, fluid milk, Hass avocados, honey, lamb, mangos, mushrooms, peanuts, popcorn, pork, potatoes, sorghum, soybeans, and watermelons.

The "Got Milk?" (milk moustache) dairy campaign is an example of a generic advertising campaign funded by a mandated program. The internationally recognized and copied slogan was first funded by the California Milk Processor Board and later licensed to the National Milk Processor Board.

In Kansas, the "Harvest Salute" (wheat harvest) promotional campaign is a project of both the Kansas Association of Wheat Growers – the producer's voluntary membership organization – and the Kansas Wheat Commission, which is funded by a voluntary assessment on each bushel of wheat produced in Kansas.

Early pioneers soon realized that beyond the eastern border of Kansas, their survival depended on changing the traditional farming methods they had brought with them. Out of necessity, Kansans adopted an attitude of innovation and experimentation. Continuing that tradition, the Kansas State Agricultural College (KSAC) and the KSAC Agricultural Experiment Station have assisted agricultural producers in meeting crop production challenges since 1863. Both entities, now Kansas State University and the Kansas State University Agricultural Experiment Station and Cooperative Extension Service (K-State Research and Extension), continue those efforts today. Research conducted at research centers and experiment fields across the state provide test results for a variety of agricultural crops, including many specialty crops.

SPECIALTY CROPS

Specialty crops grown in Kansas include edible food crops and non-edible crops. Some of these crops hold special places in Kansas history, while others are relatively new to Kansas agriculture. All contribute to the health of the agriculture-based economy of the state.

EDIBLE FOOD CROPS

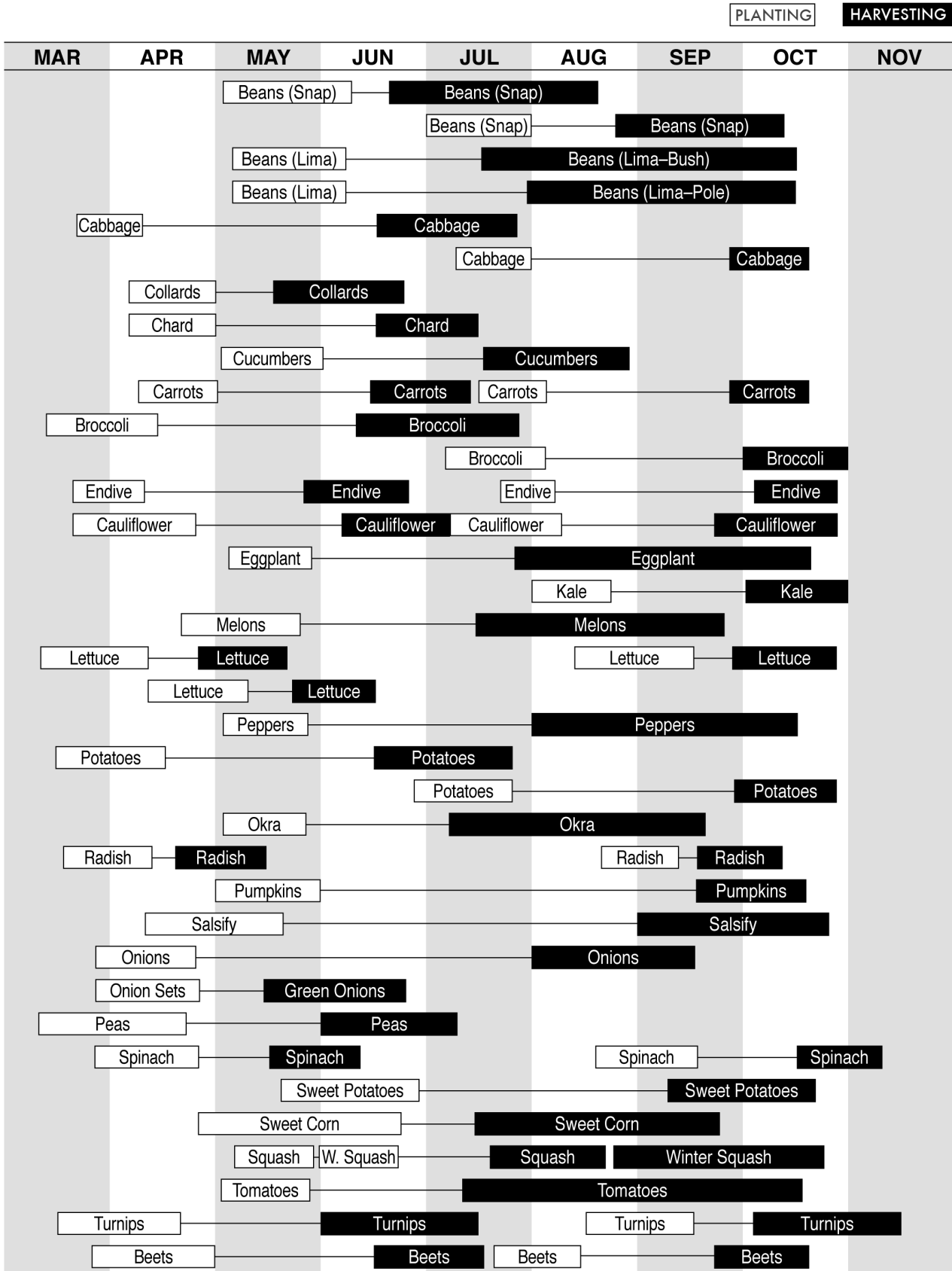
Edible specialty crops grown in Kansas include fruits, vegetables, nuts, and specific varieties of traditional crops, such as corn and sunflowers. Only specific parts of each plant are harvested for food consumption, such as the seeds, fruits, flowers, leaves, stems, or roots.



Specialty Food Crops

Credit: Julia Debes

TIMELINE FOR PLANTING AND HARVESTING SPECIALTY FOOD CROPS



Source: K-State Research and Extension

Specialty Crops in Kansas

SEEDS

Of all the parts of a plant, seeds are the most important source of human food. Seed food crops include cereal grains grown for their hard dry seeds, like wheat, corn, and rice. Kansas produces several specialty crops specifically for their seeds, including pinto beans, popcorn, sweet corn, and non-oil (confection) sunflowers. Other seed crops include peas, chickpeas, and lentils.



Wheat Foods

Credit: Keith Weller, USDA ARS

Pinto Beans

In Kansas, nearly all the acreage planted to dry edible beans (dry beans) is planted to pinto beans. Most of the pinto beans grown in Kansas are grown in Wallace, Sherman, and Cheyenne counties on the western border of the state. In 2009, pinto bean production in Kansas nearly doubled from 2008, according to the Kansas Agricultural Statistics Service.



Marinated Bean Salad

Credit: U.S. Dry Bean Council

Pinto beans are high in protein, iron, potassium, magnesium, and fiber. The beans are soft medium-sized beans that are beige with reddish-brown splashes of color. When cooked, however, the beans turn pink. Products made from pinto beans include refried beans used in chili, refried bean paste, and Mexican foods.

Pinto bean plants are legumes, so they are able to utilize nitrogen from the atmosphere. Despite this advantage, pinto beans are not as efficient at converting nitrogen for their own use as other legumes, such as soybeans or alfalfa. In fact, pinto beans still require additional nitrogen in order to complete the seed production cycle.

In Kansas, pinto bean seeds are planted in the spring, after the soil temperature reaches 55 to 60 degrees Fahrenheit. The seeds are planted one to three inches deep in rows 20 to 30 inches apart. The narrow rows force the plants to grow upright, allowing them to feed correctly through a combine at harvest. The new plants emerge within eight to 10 days of planting and begin to flower and form bean pods 32 to 40 days after planting. If the temperature is over 93 degrees during the two-week period of blooming, the blossoms will not stay on the plant, which negatively affects both the quality and quantity of the seeds (beans) in the pods.



Pinto Beans

Credit: Scott Bauer, USDA ARS

DRY BEAN FACTS

Dry edible beans are also called "dry beans."

Dry beans are not harvested until the seeds (beans) have matured and ripened. In contrast, green beans are harvested while the seeds are still immature.

There are many different types of dry edible beans: navy, Great Northern, pinto, light red kidney, dark red kidney, large lima, baby lima, small white, blackeye (cowpeas), pink, small red, cranberry, garbanzo (chickpeas), black (black turtle), yellow eye, fava (horse or broad beans), mung, adzuki, marrow, appaloosa, Christmas lima, and blackgum (Lucier) beans.

Dry edible bean production in Kansas is dominated by pinto and Great Northern beans.

Sources: Kansas State University and Agricultural Marketing Resource Center, Iowa State University.

Bean pods begin to fill with seeds 60 to 70 days after planting. In the fall, the bean plants and bean pods stop growing and turn golden brown as they dry out. When the pods are dry enough to split open and reveal the beans, the crop is ready to harvest. Under optimal conditions, pinto beans will be harvested about 14 weeks after planting. Processors prefer beans that are free of cracks, so pinto beans are carefully harvested and handled to minimize cracking or splitting.

Pinto Bean History

Many dry beans originated with a common plant ancestor in Peru, including pinto beans, kidney beans, navy beans, black beans, and green beans (snap beans). As the bean plants spread throughout South America and Central America, bean seeds developed individualized characteristics. For example, the word "pinto" means "painted" in Spanish, identifying pinto beans by the splashes of color that appear on the neutral background color.

In the 15th century, Spanish explorers returning from the New World introduced pinto beans to Europe. Spanish and Portuguese traders then spread pinto beans to Africa and Asia. These beans gained wide acceptance as an inexpensive source of protein in many countries.



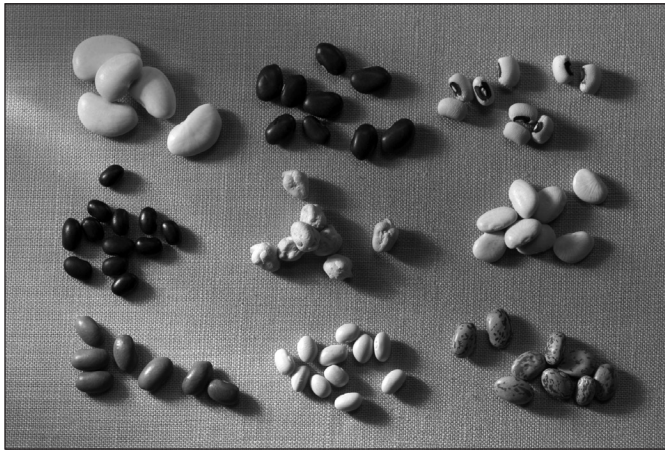
Lima Beans

Credit: National Garden Bureau



Snap Beans

Credit: National Garden Bureau



Dry Beans

Credit: U.S. Dry Bean Council

Today, pinto beans account for the highest consumption of dry edible beans in the United States. According to the USDA Economic Research Service, U.S. consumption of pinto beans was predicted to be nearly 3 pounds per person in 2010.²

Sweet Corn

Sweet corn results from a natural genetic mutation in field corn, which causes the endosperm of the seed (kernel) to accumulate about twice as much sugar as the endosperm in a kernel of regular field corn. This produces sweet-tasting corn kernels suitable for human consumption, either as a fresh or processed product.

Sweetness is determined by the genetic background of the corn variety. There are three distinct types of sweet corn: normal sugary (SU), sugary enhanced (SE), and supersweet (Sh2). Each type contains a distinct gene that is responsible for the sweetness and texture of the kernels. Those genes slow down the conversion of sugar to starch, lengthening the time the kernels retain their sweetness.

Sweet corn comes in three colors: yellow, white, and bicolor (yellow and white kernels on the same cob). There is no relationship between color and sweetness.

American Indians grew the first sweet corn varieties. In fact, the first sweet corn variety, Papoon, was acquired by European settlers from the Iroquois Indians in 1779.³

Today, the United States dominates worldwide production, and sweet corn is grown in all 50 states. In 2009, per person consumption of sweet corn in the United States averaged 25.5 pounds.⁴ Americans consumed slightly higher amounts of fresh sweet corn than frozen sweet corn, both of which outpaced canned sweet corn consumption. This includes sweet corn packaged and consumed in other food dishes.



Sweet Corn

Credit: Julia Debes



Ear of Sweet Corn

Credit: Alissa Krafft

SWEET CORN FACTS

There are three types of sweet corn: normal sugary, sugary enhanced, and supersweet.

The three types of sweet corn are further divided into at least 200 different named varieties, including "Sugar Buns," "Kandy Korn," "Cotton Candy," "Bodacious," and "Ambrosia."⁵

Sweet corn comes in three colors: yellow, white, and bicolor (yellow and white).

In 2009, Americans consumed 25.5 pounds of sweet corn per person on average, including fresh, frozen, and canned sweet corn.⁶



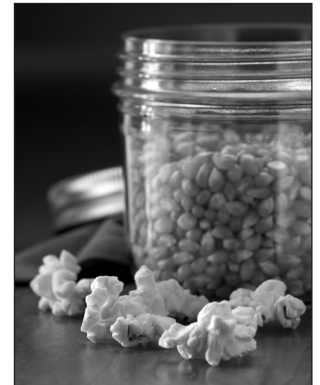
Fresh Sweet Corn

Credit: Julia Debes

Popcorn

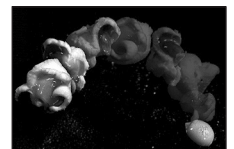
Popcorn results from another genetic mutation of the corn plant that occurred at least 4,000 years ago, according to the Popcorn Board. The hull (outer covering) of a popcorn kernel is thinner than that of other corn kernels, allowing the kernel to explode when it is heated. The starchy endosperm inside a popcorn kernel surrounds a small drop of water, which turns into steam when heated and changes the starch into a thickened liquid. Additional heating builds enough pressure inside the kernel to burst the hull. As it explodes, the steam is released, the starch cools, and the kernel forms its "popped" shape.

According to the Popcorn Board, Americans consume 17 billion quarts of popcorn each year. Nearly all of that popcorn is grown in the United States, which is the main supplier for the rest of the world's popcorn.



Popcorn Kernels

Credit: Popcorn Board



Kernel Popping

Credit: Popcorn Board



Popcorn

Credit: Popcorn Board



Sunflower Seeds

Credit: National Sunflower Association

Sunflower Seeds and Kernels

Credit: National Sunflower Association



Sunflower Bread

Credit: National Sunflower Association



Non-oil (Confection) Sunflowers

Non-oil (confection) sunflower varieties produce black-colored seeds with white stripes that are approximately five-eighths of an inch long. In contrast, oilseed sunflowers, which consist of about 80 percent of the sunflowers produced in the United States, are characterized by small, shiny black seeds.

Non-oil sunflowers produce seeds used for baking or for sunflower seeds, an original American snack! According to the National Sunflower Association, sunflower seeds are naturally low in carbohydrates and naturally high in vitamin E and other antioxidants.

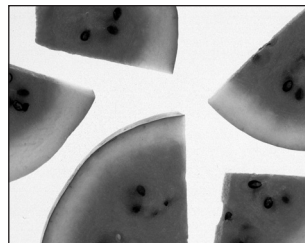
Confection sunflower seeds are sorted according to size, and then the largest seeds are sold intact. The hulls are usually removed from medium-sized seeds, which are sold as sunflower kernels and used in food products like snacks and breads. The smallest seeds are sold for birdseed and pet food.

The American Indians first domesticated the wild sunflowers native to North America and used sunflowers as food. Later, in the early 1800s, Russian researchers identified the two types of sun-flowers and implemented sunflower breeding programs to improve yields and other characteristics, particularly in oilseed sunflowers. These improved sunflower seeds were the foundation for commercial sunflower production in Canada and the United States.



Canary Melon

Credit: National Garden Bureau



Watermelon Seeds

Credit: Scott Bauer, USDA ARS



Tomato Seeds

Credit: Scott Bauer, USDA ARS

FRUITS VS. VEGETABLES

While scientists define what is a fruit in a very precise way, the common categorization of plants as "fruits" or "vegetables" is based on cultural or culinary definitions. In some cases, the cultural and scientific definitions are contradictory.

The U.S. government's recommended nutritional dietary guidelines divide plant-based foods into fruits or vegetables based on cultural – rather than scientific – definitions.

FRUIT

Scientifically speaking, a fruit is the ovary of a seed-bearing plant, the part that nourishes and protects developing seeds that have been fertilized as a result of pollination and will be capable of generating new plants. The fruit develops at the same time as the seeds, with the number and size of the fertilized seeds determining how large the fruit will grow. For example, watermelons and pumpkins contain many large seeds, while cherries and grapes have fewer small seeds.

Edible fruit crops include fruit grown on trees (like apples and peaches), fruit produced by cultivated plants (like strawberries, peppers, and tomatoes), and fruits produced on vines (like pumpkins, melons, berries, and grapes). Although some botanists disagree about certain nut species, tree nuts are also commonly considered "fruits."

A wide selection of fruit grows well in Kansas, both in home gardens and larger commercial orchards and farms. Apples, pumpkins, and pecans represent three examples of the fruit crops grown in Kansas.



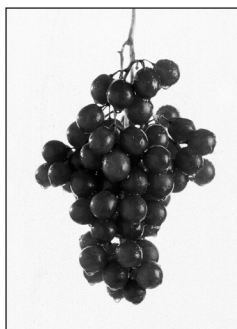
Peaches

Credit: Keith Weller, USDA ARS



Walnut

Credit: USDA ARS



Grapes

Credit: Scott Bauer, USDA ARS



Chile Peppers

Credit: National Garden Bureau

STRAWBERRY PLANTS

Strawberries do not grow on vines. Instead, strawberry plants grow low to the ground and produce stolons, commonly called "runners." Stolons are horizontal stems running above the ground that may root and form new plants at various intervals.



Strawberries

Credit: Brian Prechtel, USDA ARS

Apples

Apples are one example of a fruit crop that grows on a tree. As the weather warms up in the spring, the leaf buds unfold on the branches of the apple tree, and the flower buds begin to open. Honeybees, attracted by the scent of the pale pink or white flower blossoms, pollinate the blossoms while gathering nectar. The blossoms on an apple tree cannot be pollinated by pollen from the same tree or trees of the same variety, so a different variety of apple tree must be nearby in order for any apple tree to produce fruit.

After an apple blossom is pollinated, the outer wall of the flower's ovary develops into the white fleshy inside of the apple and the inner wall of the flower's ovary forms the core that surrounds the seeds. The core contains five seed pockets, but the number of seeds in each pocket depends on the variety and the health of the apple tree.

The fleshy white inner part of an apple contains starch. As the apple begins to ripen, the starch begins to turn into sugar, starting near the core in the center of the apple and working outwards towards the skin of the apple (the peel). Apples are completely ripe when most of the starch has turned to sugar. In commercial orchards, some of the apples are thinned from the trees after the blossoms have started producing fruit. This prevents the weight of the fully developed apples from overloading or breaking the branches of the tree.



Apples

Credit: Scott Bauer, USDA ARS



Apple Blossom

Credit: Wm. E. Carnahan, USDA ARS



Apple Varieties

Credit: Scott Bauer, USDA ARS

APPLE PHOTOSYNTHESIS FACT

Producing a single apple requires the energy of 50 leaves.⁷



Apple Core

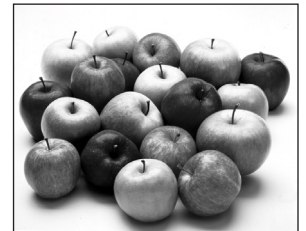
Credit: U.S. Apple Association

APPLE RESPIRATION

During the process of turning starch into sugar, an apple takes in oxygen and gives off carbon dioxide. This process, known as respiration, is part of the carbon cycle.

Growing apples from seed is very difficult, sometimes taking 15 years before the new tree produces fruit. Every apple seed has a unique set of genetic materials, even those in the same seed pocket at the core of a single apple. Years of work nurturing and tending a tree grown from a seed might not produce a desirable apple. Rather than starting from seeds, most apple trees are grown using grafting or budding methods. These methods join plant parts from two or more sources so that they will grow as one new plant. Using either of these methods, it takes four to five years for an apple tree to produce fruit.

The crabapple is the only apple tree native to North America. Early colonists brought apple seeds into the United States, but the apples trees that survived did not produce fruit because there were no honeybees to pollinate the blossoms. In the 1620s and 1630s, honeybees were shipped to the colonies from England, and apple trees began to produce fruit. Today, there are 2,500 varieties of apples grown in the United States. Apples are grown in all 50 states, and the most widely grown variety is the Red Delicious. In Kansas, most fruit orchards are apple orchards; however, the acreage planted to apple trees has been rapidly declining in recent years.



Apple Varieties

Credit: U.S. Apple Association

PRODUCING NEW PLANTS

Budding – taking flower buds off one tree or plant, slipping them under the bark of the rootstock, and fixing them in place with glue or tape.

Cutting – growing a new plant from a piece of an existing stem, leaf, or root.

Grafting – attaching branches from one or more trees or plants onto rootstock.

Propagate – to produce new plants.

Rootstock – a bit of a tree trunk or stem of a plant with some roots still attached.



Red Delicious Apple

Credit: U.S. Apple Association



Apple Snack

Credit: Stephen Ausmus, USDA ARS

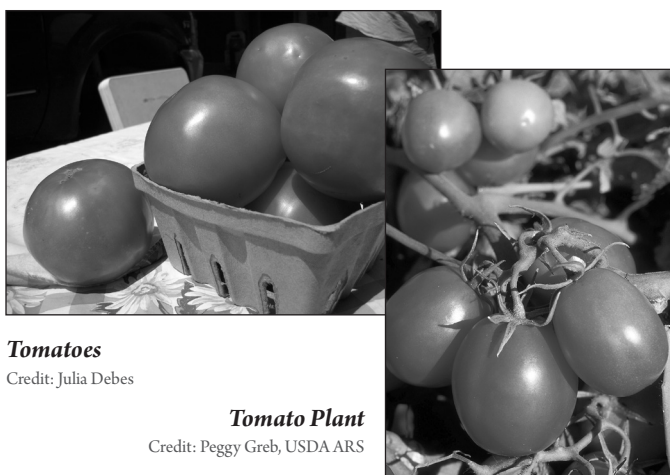
According to the USDA Economic Research Service, more than two-thirds of the apples produced in the United States are consumed as fresh fruit. A medium apple, unpeeled, is a nutritious snack, containing about 80 calories, five grams of fiber, but no fat or sodium.

Tomatoes

Tomatoes are the fourth most popular fresh vegetable and the largest commercially produced vegetable crop in the United States.⁸ In fact, the USDA Economic Research Service forecast that U.S. consumption of tomatoes in 2010 would be almost 91 pounds per person, more than 80 percent of which would be from commercially canned or processed products.⁹

K-State Research and Extension reports that tomatoes are also the most popular vegetable grown in home gardens. Tomato plants are easy to grow, partly because they produce well under a variety of growing conditions. Although tomato plants can be grown from seeds, most gardeners prefer to purchase small plants and transplant them into their own gardens.

Since tomato plants are easily damaged or killed by frost, transplants allow fruit production to occur before summertime temperatures get too high. In fact, the optimum daytime growing temperature for tomato plants is 70 to 75 degrees Fahrenheit. When temperatures are above 90 degrees and the humidity is low, tomato blossoms wither and drop off the plants or are poorly pollinated, resulting in lowered fruit production. If allowed to ripen on the vine, tomatoes will not turn red in color when daytime temperatures reach 95 degrees or higher. However, tomato plants often begin producing again once temperatures are lower in the fall.



Tomatoes

Credit: Julia Debes

Tomato Plant

Credit: Peggy Greb, USDA ARS

POLLINATING TOMATO PLANTS

Tomato plants are self-pollinating. Each flower contains both male and female parts, and the wind transfers the pollen between the two.

If the temperature is too high, the pollen sticks to the male flower part. Then, when the female part does not get pollinated, the entire flower drops off the plant.

TYPES OF TOMATO PLANTS

There are two main types of tomato plants – determinate and indeterminate.

Determinate tomato plants follow a genetically pre-determined pattern of growth and fruit production. These tomato plants stop growing when the tomatoes begin to fill, and the leaves begin to die as the tomatoes ripen. This type of tomato plant is appealing to commercial growers since all the fruit ripens at the same time and the plants can be mechanically harvested.

Indeterminate tomato plants continue to grow and produce fruit as long as the plants are alive.

A tomato plant grows upright, with one main stem. During the first month of growth, a tomato plant's energy is directed at producing leaves. The plant grows very rapidly and may double in size every 12 to 15 days. As the plant continues to grow, branches form in the spaces between the leaves and where the leaves are attached to the main stem. If left alone, these new stems will grow and produce flowers and fruit just like the main stem.



Tomato Plant with Stakes

Credit: Julia Debes

To maximize photosynthesis, tomato plants need to be supported so that they will continue to grow in an upright position, rather than being forced to the ground by the weight of the fruit and additional branches. Stakes or cages are used to support the plants, which also improves yields and the overall quality of the fruit produced by the plants.

From smallest to largest, the five major tomato types are cherry, plum, pear, standard, and beefsteak. There are many different tomato varieties, producing fruit that range in size from cherry tomatoes weighing one-fourth to one ounce to larger tomatoes weighing more than two pounds.



Testing Skin Strength

Credit: Keith Weller, USDA ARS

TOMATO RECOGNITION

The tomato is the state vegetable of New Jersey and Arkansas.

The tomato is also the state fruit of Arkansas!

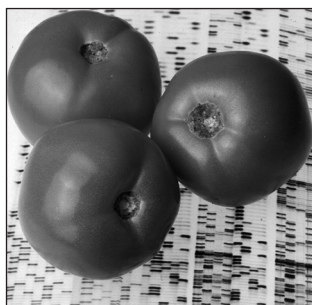
Tomato juice is the official state beverage of Ohio.

In the United States, the fresh market industry and the processing industry do not use the same varieties. Fresh market tomatoes are generally hand-picked, because the preferred varieties have a higher water content, thinner skin, and bruise more easily while being handled or transported. Tomatoes intended for processing have a higher percentage of solid material in the fruit and a thicker skin that is sturdy enough to be mechanically picked and handled by processing machinery.

In terms of vitamins and minerals, the tomato is an important vegetable in the diet of most Americans. One medium-sized tomato provides 40 percent of the recommended daily allowance of vitamin C and 20 percent of the recommended daily allowance of vitamin A. That same medium-sized tomato contains only 25 calories.

The tomato is believed to have originated in the Andes Mountains of western Peru. From there, the plant migrated into Central America. When the Spanish conquistadors arrived in what is now Mexico, tomatoes were already being cultivated as a food crop. The Spanish introduced the tomato in Europe, where it became a popular in Spain, Italy, and France. However, the tomato plant was mainly grown as an ornamental plant in northern Europe, due in part to the plant's resemblance to the poisonous nightshade plant. In fact, the tomato plant does belong to the nightshade family, as does the potato plant.

Although British colonists brought the ornamental tomato plant to the United States, the fruit was viewed with such suspicion that it was not widely accepted for food uses until the 1830s. In the United States, commercial production of tomatoes began in the mid-1800s, and the first hybrid tomatoes were introduced in 1880. However, it was the development of new efficient and



Tomatoes

Credit: Jack Dykinga, USDA ARS

CLASSIFYING FRUITS AND VEGETABLES

Common Name	Common Name of Plant Family
Asparagus	Lily
Broccoli	Mustard
Cabbage	Mustard
Carrot	Parsley
Cauliflower	Mustard
Lettuce	Sunflower
Onion	Onion
Potato	Nightshade
Pumpkin	Gourd
Sweet Potato	Morning Glory

TOMATO FACTS

Early names for tomatoes included "love apples" and "wolf peaches."

In an effort to convince the people in Alabama of the merits of growing and eating tomatoes, George Washington Carver authored a bulletin in 1918 titled, "How to Grow the Tomato and 115 Ways to Prepare it for the Table."

Cherry tomatoes are also marketed as "grape tomatoes" because these plants produce fruit in clusters like grapes.

Typically, it takes two large or three medium-sized fruit to equal one pound of tomatoes.

low-cost commercial canning techniques in the 1920s that caused tomato production in the United States to soar.

Today, California and Florida lead the states in the commercial production of tomatoes for both the fresh market and processing industries. Worldwide, China is the top tomato-producing country, followed by the United States.

Pumpkins

Pumpkins are cucurbits, members of the *Cucurbita* family of plants that produce large, fleshy tough-skinned or hard-skinned fruits. Cucurbits include watermelon, cucumbers, zucchini, gourds, muskmelon (cantaloupe), and several varieties of squash. With plant vines that can grow as much as six inches per day and sprawl up to 30 feet in length, these plants are also called vine crops.



Pumpkin

Credit: Julia Debes

Pumpkins come in many colors, shapes, and sizes. All pumpkins are edible, but there is great variation in the sweetness, texture, and quantity of edible pulp between different varieties. Genetics determine the size, roundness, and color of each pumpkin. There are orange, white, tan, blue, red, and blue-green pumpkins, ranging in size from just a few ounces to more than 1,000 pounds. Crop yields vary with the size of the pumpkins. Smaller varieties yield up to 4,000

PUMPKINS VS. SQUASH

Pumpkins, squash, and gourds all belong to the same genetic family – *Cucurbita*.

Within the cucurbits, four botanical species produce squash and pumpkin on trailing vines. Generally speaking, those plants that produce round, orange fruit are called pumpkins, while those with edible fruit of other shapes and colors are called squash.

Gourds are used for ornamental purposes rather than food uses. A dried gourd shell has a wooden appearance and many are sturdy enough to be carved or used as containers.

Source: K-State Research and Extension



Pumpkins
Credit: Julia Debes

Pumpkin Vines

Credit: Gary Wilson, USDA NRCS



Pumpkin Vines

Credit: Tedi Lacey



Pumpkin Flowers

Credit: Tedi Lacey

WORLD RECORD PUMPKIN

Christy Harp, a teacher from Ohio, set a new world weight record for pumpkins in 2009 – 1,725 pounds!

Source: Pumpkin Nook

pumpkins per acre, while larger varieties, such as those typically sold in the fall for carving and ornamental displays, may yield 1,000 to 2,000 pumpkins per acre.

Pumpkins are planted when the soil warms up in the spring because the seeds do not germinate in cool soils and pumpkin plants are easily injured by late spring frosts. The seeds are planted one inch deep in "hills," or rounded mounds of soil. Several seeds are planted in each hill. The spacing between the hills and the rows of hills depends on the type of pumpkin being grown.

Every pumpkin plant has a main vine and a secondary vine, which usually grows in the opposite direction of the main vine. Smaller vines, which can be clipped off without damaging the plant, develop as side shoots from the two main vines. Leaves and flowers then develop on the vines.

Pumpkins produce both male and female flowers on each plant. The first flowers that appear are the male flowers, which only bloom for one day before dropping off the vine. However, the plant continues to produce male flowers throughout the growing season, which provides pollen to fertilize the plant's female flowers. Once pollinated, the female flowers produce the fruit (pumpkins).

There are four pumpkin species, with many different plants in each

Giant Pumpkin

Credit: Julia Debes



JACK O-LANTERNS

European immigrants brought the custom of carving jack o-lanterns to the United States. They discovered that the pumpkins they found growing in North America were perfect for carving scary faces, which could be lit by candles placed inside the shell of the pumpkins.

The jack o-lantern tradition began in Ireland, where people carved faces in turnips or potatoes. Potatoes were also used in Scotland. Today, beets are still used in England to celebrate this Halloween tradition.¹⁰

CLASSIFYING PLANTS

Taxonomy is the method by which living things are classified and organized to understand the relationships between them.

Plant taxonomy is the science that describes, identifies, categorizes, and names plants. One system that categorizes plants is a hierarchy, with the Plantae (Plant) kingdom at the top, divided into 10 phyla (divisions), then classes, orders, families, genera, and species. Plants become more closely related as they move further down the hierarchy.

All plants are named in Latin according to an international code, which means that the same scientific name is used for each plant anywhere in the world. When a new plant is identified, it is given a two-part name. The genus name becomes the first name, followed by the species name.

A genus is the name for a group of plants that have similar characteristics and are more closely related to each other than plants in any other genus. For example, pumpkins belong to the *Cucurbita* genus of the gourd family of plants.

A species is an identifiable group of individual plants that do not share the exact same characteristics of any other identified group of individual plants. Often, the species name is descriptive, as in "*Cucurbita maxima*," the scientific name for giant pumpkins. Many times, different plants within the same species can successfully pollinate each other, but not reproduce with plants of any other species.

A variety is a specific group of individual plants within a species that are genetically different from other varieties of the same species. For example, the Atlantic Giant is a variety of giant pumpkins.

species. For example, acorn squash, zucchini, and some miniature pumpkins all belong to the same species, *Cucurbita Pepo*. The pollen from any plant is capable of pollinating the flowers of other plants belonging to that same species. Pumpkins are pollinated by bees. With bees capable of carrying pollen up to a mile, it is possible for a pumpkin flower to be pollinated with pollen from a zucchini plant. This cross-pollination does not affect the growth of the pumpkin plant or the color, shape, or taste of the fruit. However, a distinctively different type of pumpkin might be produced if the pumpkin seeds were saved and planted another year.

Pumpkin vines are technically defined as "stems." For vine crops, however, the "stem" refers to the smaller stem that grows from the blossom end of the flower and attaches the fruit to the vine. Thin, hair-like tendrils growing from the stem twist around objects to help anchor the vine and protect it from being blown around and damaged by wind. By anchoring the vine, the tendrils help the pumpkin plant

PUMPKIN FACT

Pumpkins consist of 90 percent water.

**Stem**

Credit: Mary Anne Stoskopf

**Tendrils**

Credit: National Garden Bureau

have good air circulation, which is necessary to prevent mold, mildew, and other diseases from attacking the large leaves.

As the fruit grows larger, the plant requires more water and other nutrients, especially nitrogen. The rigid thin protective outer layer – the skin or rind – forms a hard shell around the pulp. The pulp surrounds a cavity filled with stringy fibrous strands and seeds. Both the pulp and the seeds are edible. Pumpkin pulp is high in fiber and rich in vitamin A and potassium. Pumpkin seeds, a popular snack food, are rich in both oil and protein.

The top pumpkin-producing states are Illinois, Ohio, Pennsylvania, and California.¹¹ In these states, pumpkins are primarily grown for processing, rather than for the ornamental or fresh markets. The pumpkin varieties grown for commercially canned pumpkin usually produce tan-skinned pumpkins that are oblong in shape.

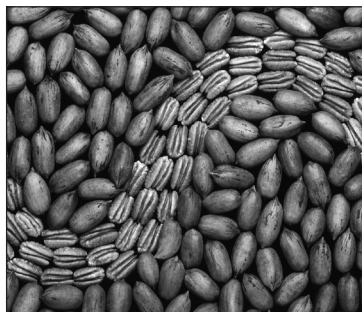
Pumpkins originated in Central America. The American Indians also ate pumpkins and even cut the rinds into strips, then wove those strips into mats. Early colonists began growing pumpkins for their own use, and pumpkin seeds were eventually carried back to Europe. Today, pumpkins are grown on every continent except Antarctica.

Pecans

Pecans are an important commercial nut crop in Kansas with production valued at nearly \$2 million each year. Pecan trees grow between 80 and 90 feet tall and have a taproot root system. Pecan trees have compound leaves. The fruit of the pecan tree is a hard-shelled nut between one and one-half and three inches

**Pumpkin Rind**

Credit: Peggy Greb, USDA ARS

**Pecans**

Credit: Scott Bauer, USDA ARS

**Pecan Leaf**

Credit: Amy Langvardt

**Pecan Tree**

Credit: Peggy Greb, USDA ARS

PECAN NUTS

The seed kernel of a tree nut is also referred to as the "meat" or "nutmeat."

The two halves of the seed kernel of a pecan nut are the two cotyledons, which are the parts of the embryo that emerge from the soil and produce food for a new tree through photosynthesis. Once the first leaves take over the photosynthesis process, the cotyledons dry up and stop producing food for the new tree.

CULTIVAR VS. VARIETY

Cultivar – shortened term for "cultivated variety," a variety that is grown by using grafting, budding, cuttings, or other techniques rather than being grown from seed.

Variety – a named cultivated plant with distinct characteristics; most varieties will produce a seed that can be used to grow a plant identical to the parent plant.

long, growing in clusters of two to five nuts. In Kansas, the nuts ripen from October to November.

Pecan trees are grown in nurseries, which start with stratified seeds – seeds that must be held at cold temperatures for 90 days before they will germinate. Grafting methods are used to improve the seedlings. Pecan growers select pecan cultivars based on characteristics such as winter hardiness and nut size. However, a pecan tree may not produce nuts until it has been established for five to 10 years. Pecan trees are not pruned regularly because pruning can affect nut production for up to three years. However, in a commercial pecan orchard, some pecan trees may be eliminated before they reach maturity to provide ample space for the trees that are left.

Pecan trees produce separate male and female flowers. The male flowers, called catkins, are fluffy finger-like projections that produce and shed pollen while the female flowers, or racemes, resemble small stars. The female flowers are pollinated by the wind.

Once pollinated, the fruit (nut) develops an outer shell, called a husk or "shuck." The husk envelops a woody inner shell called the pericarp. The pericarp surrounds the seed. The husk supplies the developing nut with the sugars produced through the process of photosynthesis. As the nut begins to ripen, the liquid inside solidifies into a solid kernel. When the nut is fully mature, the green

TREE WORDS

Grove – a naturally occurring stand of trees that may be managed to increase the output of fruit or nuts.

Orchard – an area planted to trees, which are planted in rows and spaced to allow the development of a large canopy of branches.

Plantation – an area planted to trees for timber (lumber) production where the trees are planted in rows, but spaced closely together to force the trees to grow tall straight trunks, minimizing the canopy.



Native Pecan Grove

Credit: Dr. William Reid

husk begins splitting into four sections, a process known as "shuck split." As the husk withers and dries up, the nut is exposed, helping it to dry.

Once it is fully dry, the nut falls off the tree. Pecans must be picked up and moved into cool storage shortly after they fall to the ground or the kernels may become rancid. Pecans may be harvested mechanically, using a tree-shaker to remove the pecans from the tree. Then a nut harvester picks up (sweeps) the pecans off the ground and moves the nuts into a holding trailer, which eventually dumps the nuts into a trailer used to transport the nuts to a processing facility.

The availability of water is a significant factor in nut production. Young trees may require only 10 gallons of water a day, but mature trees might require more than 200 gallons of water a day. As a result, even mild drought conditions can affect both the size and quantity of nuts produced. In fact, severe drought conditions can cause a tree to terminate the current year's nut crop and may even affect the next year's production. Zinc is a critical nutrient for nut production but pecan trees usually do not require additional phosphorus or potassium. However, pecan trees are sensitive to soil pH.

Pecans are native to North America, including southeastern Kansas, and were an important food source and trade item for American Indians. The first recorded shipment of pecans to England occurred in 1761.¹² Pecan seedlings were grown from nuts until the mid-1800s when grafting techniques were adopted to produce new cultivars. Today, there are more than 500 pecan cultivars.

In Kansas, the pecan industry is located in the southeastern and east-central areas of the state. Kansas State University maintains a pecan experiment field east of Chetopa, Kansas, where scientists conduct research to develop pecan cultivars most suitable for the growing conditions in Kansas.

TREE NUTS

Under a strict botanical classification, the seeds of a tree nut are released when the fruit wall decays or the nut is digested by an animal.

Nuts such as walnuts and pecans that retain an inner shell covering the seed are closely related to plants known as "stone fruits," such as peaches, apricots, and olives.

The U.S. Department of Agriculture defines a tree nut as a hard-shelled dried fruit or seed that grows on a tree and has a separate rind or shell and an edible kernel. Using this definition, pecans, walnuts, cashews, pistachios, and almonds are considered tree nuts, even though they would not be classified as such nuts under a strict botanical classification system.



Pecan Clusters

Credit: Peggy Greb, USDA ARS



Harvesting Pecans

Credit: Dr. William Reid

PECAN FACTS

More than 70 percent of a pecan kernel is unsaturated fat.

As fats or oils begin to decompose, they turn rancid, which means they develop a strong disagreeable smell or taste.

SQUIRREL FACT

One squirrel can consume 50 pounds of nuts per year, greatly affecting a pecan orchard's profitability.¹³

FLOWERS

Flowers are generally the attractive part of a plant, specifically designed to catch the attention of pollinators and ensure reproduction takes place. Not all flowers are edible, although cooking with flower blossoms goes back to the Romans and is popular in many cultures.



Squash Flower

Credit: Jim Cane, USDAARS

However, some plants, such as cauliflower and broccoli, produce edible flower buds, which are short stems with embryonic flower parts.

Other popular crops, like cabbage, produce unusually large flower buds, harvested for the leaves that surround the dormant buds. Some types of lettuce, a member of the sunflower or daisy family of plants, also produce large buds that are harvested for the leaves.

bright yellow flowers emerge. Picking the central head stimulates smaller stems to grow and develop from where lower leaves connect to the main stalk. These side shoots produce heads, allowing the same broccoli plant to be harvested multiple times, assuming temperatures stay cool.

The fleshy stalk of the broccoli plant is also edible. However, if the stalk is left on the broccoli plant too long, the sugars develop into a strong fiber known as lignin, and the stalk becomes too tough to eat.

Like other members of the cabbage family, broccoli's origins trace back to the wild cabbage plant first domesticated along the coast of the Mediterranean Sea. From there, the broccoli plant made its way to Italy, where it became a favorite food of the Romans. It is likely that the Romans spread broccoli to Europe, and early colonists then introduced broccoli into North America.



Broccoli Heads

Credit: Scott Bauer, USDAARS

COLE CROPS

The word "cole" means "stem."

Cole crops belong to the cabbage group of plants in the mustard family.

All cole crops are cool season vegetables that trace their origin back to the wild cabbage plant. While they share a common ancestor; however, the edible plant parts vary widely among the various cole crops.

Cole crops include cabbage, cauliflower, broccoli, turnips, Brussels sprouts, collards, kale, and kohlrabi.

Cauliflower

Cauliflower is a nutritious vegetable that is low in fat and high in vitamin C, folic acid, and dietary fiber. It is more difficult to grow than other members of the cabbage family of plants because it is more sensitive to the sun. In addition, any interruption in growth, including extreme temperatures, drought, insect damage, or disease, can cause a cabbage plant to bolt – produce an elongated flower stalk rather than develop flower buds. The cauliflower plant also has a shallow fibrous root system that can be easily damaged by hoeing or cultivating the soil around the plant.



Cauliflower

Credit: Brassica Growers Association



Brussels Sprouts

Credit: Brassica Growers Association



Cauliflower Heads

Credit: Doug Wilson, USDAARS

Broccoli

Broccoli is a nutrient-dense vegetable rich in vitamin C, calcium, folic acid, and fiber. Broccoli plants grow one main stem, or stalk, from which branches develop. Each branch supports leaves and a compact cluster of green flower buds known as the head. These individual clusters develop and enlarge and then must be harvested before the head begins to loosen, open up, and



Broccoli

Credit: Brassica Growers Association

CAULIFLOWER FACTS

A cauliflower "curd" is the tight cluster of flower buds that form the cauliflower plant's head.

To remain white, the curd must be blanched (protected from the sun), either by leaves that naturally curl around the head as it develops or by tying the leaves around the head.

If the curd is exposed to the sun, the flower buds will turn cream or brown in color and develop a disagreeable taste.

Specialty Crops in Kansas

Cauliflower plants have one main stem topped by a head and a tight cluster of flower buds known as the curd. As the curd begins to form, the flower buds must be protected from the sun (blanched) in order to retain their white coloring. Some cauliflower varieties have leaves that curl around the head to prevent sunlight from reaching the developing flower buds. Other varieties must be protected by tying leaves around the head. The protected flower buds lack chlorophyll, so if they are exposed to the sun, they will turn cream or brown in color and develop a disagreeable taste.

Like broccoli, cauliflower is a plant variety developed from the wild cabbage plant in the Mediterranean. As early as 600 B.C., cauliflower was grown in Turkey and Italy although it was not introduced in Europe until the 1500s. After cauliflower became popular in France, it was cultivated in other European countries and the British Isles. Cauliflower was first grown in North America in the 1600s.

LEAVES

More than 1,000 plants produce edible leaves.¹⁴ Typically, these edible leaves are low in calories, low in fat, and high in fiber. Since leaves contain large quantities of water, plants grown for their leaves require an ample supply of water throughout the growing season. Without water, a plant will pull water from its leaves, causing them to wilt. While tender leaves are usually selected for food uses, the darkest leaves are generally the most nutritious. Plants harvested for their leaves include cabbage, lettuce, spinach, collard greens, and some herbs.



Edible Leaves

Credit: Peggy Greb, USDA ARS

CELERY STALKS

Celery plants grow many celery stalks from one main stem. The stalks, known as petioles, are actually part of the leaf system, but they carry out many of the functions of a stem.



Cabbage

Credit: Mary Anne Stoskopf

Cabbage

Cabbage is an annual plant that is one of the earliest cool season crops. Cabbage leaves are high in vitamin C and fiber. The outer leaves of a cabbage head contain more vitamin E and calcium than the inner leaves. Cabbage leaves are green or red in color.

Cabbage plants grow best in full sunlight. When directly seeded in a garden or field, seeds are only planted one-fourth to one-half inch deep. As the cabbage plant begins to develop, the short stem grows upright, then expands in diameter. The first leaves unfold and become part of the structure that will support the cabbage head as it continues to develop. Eventually, these outer leaves may spread up to three feet in diameter.



Cut Stem – Red Cabbage

Credit: Mary Anne Stoskopf



Cabbage Heads

Credit: Dave Kirsten

CABBAGE FACTS

Cabbage contains chemicals that break down into sulfur compounds during cooking, producing an odor that becomes especially strong when the cabbage is cooked in an aluminum pan. The longer the cabbage is cooked, the stronger the odor becomes. This odor can be avoided by cooking cabbage in stainless steel pots and pans and just long enough for it to become tender.

The indigestible carbohydrates in cabbage degrade in the human intestinal tract, producing gas.

The top portion of a cabbage head is more tender and shreds easier than the bottom.

**Cabbage Crop**

Credit: Dave Kirsten

The next leaves only partially unfold, forming the cabbage head and enclosing the innermost leaves, which then cannot fully expand. The result is a compact head of leaves that becomes denser as the plants grow. When the cabbage head is firm to the touch, the plant is ready to harvest.

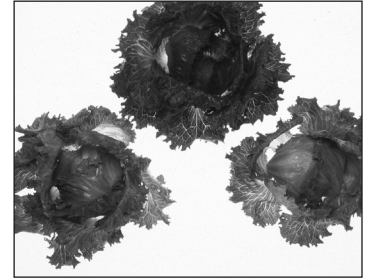
A cabbage plant only produces one head, and the rest of the plant is discarded once the head is harvested. Early maturing varieties of cabbage will produce heads weighing between one to three pounds, while later maturing varieties can produce heads weighing up to eight pounds.

Fluctuations in moisture and temperature can easily damage a cabbage crop. For example, an excessive amount of water taken up by the plant after the head has become dense, like that available after a sudden heavy rainstorm, can cause the head to split. If the cabbage head cracks or splits open, the internal leaves are exposed and become unusable. Additionally, if cabbage plants are exposed to low temperatures for extended periods, the plants bolt and produce premature seed stalks rather than form heads.

A wild cabbage plant native to the Mediterranean region is the ancestor of all plants belonging to the cabbage family. The development of the cabbage plant from a common ancestor is an example of the way humans have influenced genetic changes in plants for thousands of years. By collecting seeds from plants with desirable characteristics and growing new plants from those seeds, humans developed new food crops that added variety to their diets. Today, these food crops provide specific nutritional benefits and people are able to choose from a wide selection of edible plants.

**Lettuce**

Credit: Peggy Greb, USDA ARS

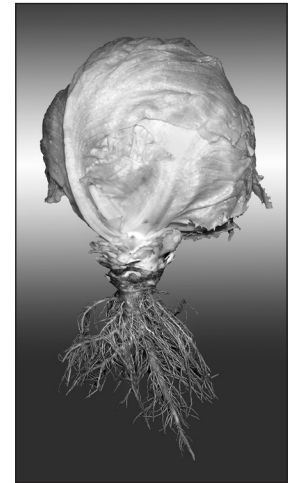
**Lettuce Heads**

Credit: Scott Bauer, USDA ARS

Lettuce

Lettuce belongs to the sunflower or daisy family. It is a cool season vegetable grown from seed, and it is sensitive to day length and high temperatures. The leaves of the lettuce plant are harvested as a food crop.

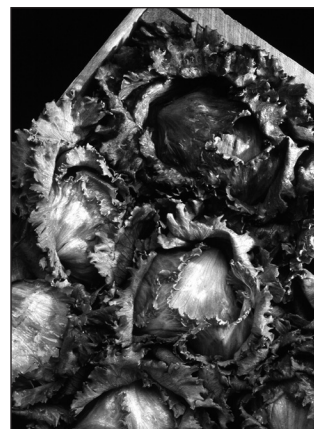
Lettuce is a self-pollinating plant. When a lettuce plant begins producing seeds, a seed stalk sprouts from the center of the plant, growing from the main stem. Careful watering is necessary throughout the growing season because lettuce plants do not have an extensive root system. However, excessive watering will cause a lettuce head to split open, letting the seed stalk emerge through the opening and ruining the head.

**Lettuce Roots**

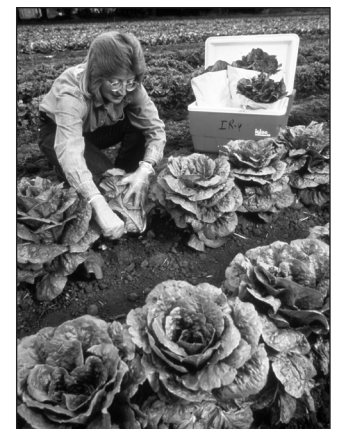
Credit: Beiquan Mou, USDA ARS

There are four main types of lettuce: crisphead, butterhead, Romaine (cos), and leaf. Crisphead lettuce is similar in appearance to cabbage with large, heavy, tightly folded heads of leaves. The inner leaves are whitish-yellow and the veins are highly visible in the mild-flavored crispy leaves. Iceberg lettuce is a common variety of head lettuce.

Butterhead lettuce forms an open, loose head with mild-tasting green leaves that have a buttery texture. Romaine lettuce, known as cos lettuce in European countries, forms a large loaf-like head with elongated, dark leaves. Romaine lettuce has a strong taste and a crispy texture.

**Iceberg Lettuce**

Credit: Scott Bauer, USDA ARS

**Romaine Lettuce**

Credit: Scott Bauer, USDA ARS

Specialty Crops in Kansas

In contrast to the other three types of lettuce, leaf lettuce, also known as loose-leaf lettuce, does not form a head. Instead, the leaves are joined at the stem. The outer leaves are harvested first, and the inner leaves continue to grow and are available for a later harvest. Leaf lettuce varies in color from red to dark green.

Cultivated lettuce is closely related to wild lettuce, which originated in modern day Turkey and Iran. In fact, paintings of lettuce appear in Egyptian tombs and are recorded in Greek and Roman history. In 1493, Christopher Columbus planted lettuce seeds in the West Indies, the first lettuce planted in North America. Today, lettuce is the leading vegetable crop in the United States in terms of monetary value.¹⁵ Globally, the United States is the world's second largest producer of lettuce behind China and the world's second largest exporter of lettuce behind Spain according to the Agricultural Marketing Resource Center at Iowa State University.

STEMS

All stems serve basically the same function – supplying water and nutrients to the leaves and carrying the sugar manufactured in the leaves to storage. All stems have nodes, or points where leaves join the stem. Each leaf has a bud at its base that can be used to create a new plant. Many plants are harvested for their edible stems, including potatoes, asparagus, onions, and garlic.



Bell Pepper Stem

Credit: Julia Debes

STEMS VS. ROOTS

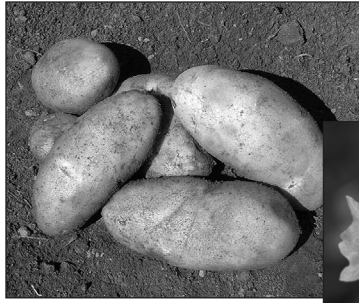
Stems have nodes, but roots do not.

A node holds a bud that grows into leaf, flower, stem, or root.



Garlic

Credit: Bruce Fritz, USDA ARS



Potatoes

Credit: Peggy Bain, USDA ARS



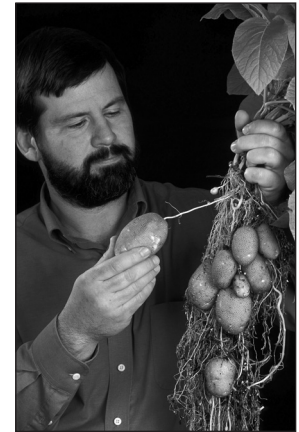
Potato Flowers

Credit: Keith Weller, USDA ARS

Potatoes

Potatoes are the world's fourth most important food crop according to the Food and Agriculture Organization of the United Nations (FAO).¹⁶ The potato is an annual plant belonging to the nightshade family. It produces purple flowers and small green berries, each containing 100 to 400 seeds.

Potatoes are a tuber crop. A tuber is a swollen underground plant part that stores food. There are two types of tubers: stem tubers and root tubers. Potatoes are an example of stem tubers. A stem tuber has the typical cell structure of any stem and forms from either a thickened rhizome (horizontal underground stem) or stolon (a long stem that droops



Stem Tubers (Potatoes)

Credit: Peggy Greb, USDA ARS

TUBERS

Tuber – a swollen underground part of a plant that stores food.

Root tuber – an enlarged root that does not have nodes and stores food for the plant; small stems and roots may grow from the tuber, but it remains attached to the parent plant and continues to increase in size as long as it is left in the soil. Example: sweet potato.

Stem tuber – a tuber that has the typical cell structure of any stem; a stem has nodes that hold a bud that grows into a leaf, flower, stem, or root; typically forms an oblong rounded shape that grows vertically with vegetative buds on the top and fibrous roots on the underside. Example: potato.

CROP WORDS

Food crop – a crop that is grown for human consumption.

Feed crop – a crop that is grown for animal consumption.

Nonfood crop – a crop that is grown for uses other than human or animal consumption.

to the ground and forms a new plant where it touches the soil). Typically, a stem tuber forms an oblong rounded shape that grows vertically with vegetative buds on the top and fibrous roots on the underside.

New potatoes are grown using pieces of harvested potatoes. An average size potato typically yields four seed potatoes. "Seed" potatoes are small whole potatoes or potato pieces cut from a harvested potato. Each piece contains one to three "eyes," which are actually the nodes of new stems that can develop into new plants. One eye grows into a plant that can produce between two to 20 new tubers. Seed potatoes are planted either two inches deep in the spring or four to five inches deep in the fall.

The main upright stem of the potato plant supports compound leaves and smaller stems that branch out from the main stem. As the potato plant grows, tubers form at the tips of the underground stems. As the potatoes themselves develop, mounds of soil are pushed up around the stem of the potato plant to prevent the sun from scalding the newly formed potatoes. Regular watering throughout the growing season helps prevent the tubers from cracking, developing hollow cavities, or developing knobs (second growths). When the potato plants begin to die, the potatoes are dug up from the soil, either by hand or mechanically. Mechanized potato harvesters slide under the surface of the ground and lift the potatoes out of the soil. These machines use conveyor belts to elevate the potatoes and then unload them into trucks.

Potatoes can be cooked or served fresh, frozen, or dried. They also can be processed into flour or alcohol and can even be used as



Seed Potato

Credit: Peggy Greb, USDA ARS



Potato Plant

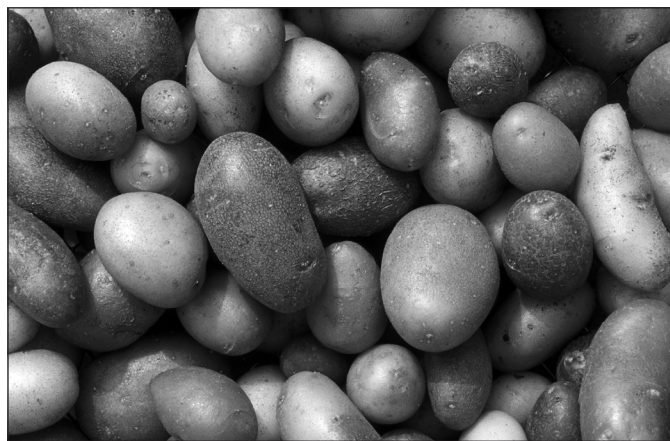
Credit: Scott Bauer, USDA ARS



livestock feed, which is common in Europe. Potatoes are rich in vitamin C, potassium, and protein. Additionally, they are an energy-rich source of carbohydrates, converting starch into sugar – and back into starch – depending on storage temperatures.

Digging Potatoes

Credit: Peggy Greb, USDA ARS



Potato Varieties

Credit: Scott Bauer, USDA ARS

Nearly 8,000 years ago, the potato was cultivated from a wild plant native to the Andes Mountains in modern day Peru. Spanish con-quistadors carried potatoes back to Spain in the 1500s, but, in Europe, the potato was not embraced as a food crop until the late 1700s.¹⁷ European colonists brought potatoes with them as they traveled to the United States. Until the early 1990s, potato production centered in Europe, North America, and the countries of the former Soviet Union. Since then, potato production has increased in countries in Asia, Africa, and Latin America. According to the Food and Agriculture Organization of the United Nations, China is now the world's leading potato-producing country. In fact, almost one-third of the world's harvested potatoes are produced in China and India.¹⁸ Today, potatoes grow in many colors, shapes, and sizes. The International Potato Center in Peru has identified nearly 4,300 different potato varieties growing in the Andes Mountains.¹⁹

GENETIC DIVERSITY

Because of the potato plant, the importance of maintaining genetic diversity in agricultural crops was recognized by plant breeders and scientists in the mid-1800s. By 1815, the potato had become a principal ingredient in the diet of people across northern Europe. In Ireland, for example, the potato was providing 80 percent of the caloric intake for the country's population before what is commonly known as the potato famine.²⁰

From 1844 to 1845, a disease struck the potato fields in continental Europe, wiping out the potato crops. In Ireland, the disease destroyed three potato crops from 1845 to 1848, leading to the deaths of one million people. At the time, there were only a few genetically similar potato varieties grown in Europe and North America. These varieties had no resistance against the disease, late blight, which killed the leaves of the plants and caused the potatoes to rot in the ground as they were developing.

Scientists and plant breeders immediately began searching for additional sources of genetics and then developed potato varieties that were resistant to the disease that had ravaged European potato fields. Today, researchers and plant breeders can access genetic material from more than 1,400 seed banks in the world and use biotechnology to respond much more quickly to anticipated crop threats.

Specialty Crops in Kansas

Asparagus

Asparagus, one of the earliest harvested spring crops in Kansas, is a perennial vegetable crop. In fact, when well tended, established asparagus beds will produce for 15 to 20 years or more. Once established, asparagus plants are very drought-tolerant and prefer full sunlight. However, the plants do not tolerate competition from other plants well. The harvested stalks (stems known as "spears") are rich in B-vitamins, vitamin C, calcium, and iron. Additionally, asparagus is low in sodium. In Kansas, asparagus has been grown commercially in both the Kansas and Arkansas River valleys.



Asparagus

Credit: California Asparagus Commission



Baked Asparagus

Credit: California Asparagus Commission

An asparagus crown is a compressed stem that forms just beneath the surface of the soil and has an attached root system. One-year-old asparagus crowns, usually raised from hybrid seed, are planted six inches deep and one and one-half feet apart. All asparagus plants are either male or female. New hybrid crowns on the market usually produce all-male plants, because those yield more edible plant material as they do not expend energy trying to produce seeds. Female plants are easily identified by small red berries, which appear late in the growing season. Any female plants are usually removed from the asparagus bed to prevent their berries from dropping seed to the ground and producing competitive seedlings.

Asparagus spears are produced one at a time from buds on the crown. Soil temperature determines when the first spears emerge in the spring. As temperatures rise, spears grow more rapidly. Spears are then harvested when they reach about six inches in height, by either snapping off the spear near ground level or cutting the spear just

below ground level. The next spear develops from a different bud on the crown, providing multiple asparagus harvests during a single growing season. Once the plant starts producing pencil-sized or smaller spears, the spears are left on the plant and not harvested.

Asparagus is not harvested the first year that it is planted and only lightly harvested during the second growing season. When asparagus spears are left on the plant and not harvested, the tips of the spears loosen and fiber forms at the base of each spear. This enables the spears to support the fern-like foliage that develops as the tips



Asparagus Spears

Credit: California Asparagus Commission

open. Through photosynthesis, the green foliage produces carbohydrates, which are stored in the plant's crown to support the next year's production. The foliage is left on the plants until after the first killing freeze, when it may be removed without affecting the next year's crop.

Asparagus is a member of the lily family and is closely related to the onion. The plant is native to the Mediterranean region. In fact, the ancient Greeks harvested wild asparagus for food, and the Romans were the first to cultivate asparagus. In the 1500s, asparagus became popular in France and England. Early colonists from those countries then brought the plant to America. Today, there are green, white, and purple varieties of asparagus.



Asparagus Foliage

Credit: Mary Anne Stoskopf

Onions

All onions are classified as bulbs, or flattened underground stems. Each bulb has a center bud that is surrounded by scale-like leaf bases. These leaf bases store the plant's food. The onion bulb functions in the same way as other stems. However, the size of the bulb is determined by the size and number of green leaves, known as a top, growing above the ground. For each leaf, there is one ring of onion in the bulb – the larger the leaf, the larger the ring of onion. The onion plant forms a top first and only begins to form a bulb when the length of the day corresponds with the needs of the particular onion variety planted. Onions are harvested when their tops begin to fall over. If left in the ground, a central flower stalk may develop from the bud in the center of the bulb, causing decay while the onion is stored.



(above) Onion Bulbs

Credit: Jeff Vanuga, USDA NRCS

(left) Onions

Credit: National Onion Association

ONION FACTS

An onion bulb is a flattened underground stem.

The size of an onion bulb is determined by the size and number of green leaves growing above the ground. For each leaf, there is one ring of onion in the bulb.

The green leaves growing above the ground are called the onion's "top."

Onions come in three colors: yellow, red, or white.



Dry Onions

Credit: National Onion Association

Sets, small onion plants, and seeds are typically used to grow onions. Sets are small onion bulbs. Dry onions are produced by planting onion sets that are less than one inch in diameter so that there is plenty of room between the plants to allow the bulbs to grow larger. Onion plants have shallow inefficient root systems, so they require regular watering and fertilizing. Dry onions are harvested once the green tops fall over, turn brown, and start to wither. Once harvested, the onions are allowed to cure until the outer skin dries to a crisp. Then the tops are cut short, one to two inches long, and the onions are stored or marketed. Generally, onions with higher water content are sweeter but do not store as well as onions with lower water content.



Dry Onion

Credit: Mary Anne Stoskopf



Onion Plants

Credit: Jeff Vanuga, USDA NRCS



Onion Plants

Credit: Peggy Greb, USDA ARS

ONION WORDS

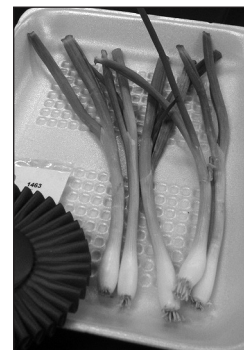
Dry onion – a mature onion bulb with multiple layers of thick, papery skin, a higher percentage of solids, and a more intense flavor; also called "storage onions" or "dry bulb onions."

Green onion – an immature onion bulb (one to two inches in diameter) with green tops that may be edible; typically have a higher water content and are sweeter and milder than storage onions; also called "fresh onions" or "fresh market onions."

Scallion – an onion harvested before it has developed into a bulb.

Larger onion sets are often planted in the spring to harvest as small green onions since they tend to bolt or produce a seed stalk. These sets are planted close together to limit the growth of the bulbs, causing the plants to put more energy into producing the leaves (tops). These plants are harvested after the tops grow at least six inches tall.

Small onion plants are transplanted early in the spring to produce a mature dry onion. Since seeds produce onions late in the growing season, transplanting small onion plants often yields more harvestable mature onion bulbs.



Green Onions

Credit: Mary Anne Stoskopf

Onions are a member of the onion family and come in three colors: yellow, red, or white. Although primarily used to add flavor to cooked foods, onions are a good source of vitamin C, dietary fiber, vitamin B₆, folic acid, and potassium. Green onions also provide vitamin A.

Wild onions grow in many regions of the world, so it is possible that the plants were domesticated in several places at nearly the same time. However, many believe that onions originated in central Asia. During the Middle Ages, onions were one of the three main vegetables produced for food in Europe, along with cabbages and beans. The Pilgrims brought onions with them on the Mayflower, introducing European varieties to North America. However, they discovered onions already growing wild and realized that the American Indians were already harvesting those onions for food and other uses. Today, onions are grown in more than 175 countries and commercially produced in more than 20 states in the United States, according to the National Onion Association.²¹



Onion Collection

Credit: National Onion Association

ROOTS

The term "root crop" describes a wide range of plants that have underground storage organs. This plant category includes the carrot, radish, beet, parsnip, turnip, and sweet potato plants. The two main root crops consumed in the United States are carrots and radishes.



Sweet Potatoes

Credit: Louisiana Sweet Potato Commission



Sweet Potato Plant

Credit: Lawrence Stoskopf

Sweet Potatoes

From 1885 to 1917, Wamego, Kansas, claimed to be the "Sweet Potato Capital of Kansas." Sweet potatoes are grown in all 50 states. In Kansas, sweet potatoes are grown in the sandier soils of the Arkansas and Kansas river valleys; however, North Carolina, California, Louisiana, and Mississippi produce most of the sweet potatoes grown in the United States.

The sweet potato plant is a member of the morning glory family. Sweet potatoes are a warm season vegetable crop that thrives in tropical climates with lots of sunshine and warm nights. The sweet potato plant produces long trailing vines, which grow along the ground. Although sweet potato plants produce both male and female flowers, the plants generally do not flower where there is more than 11 hours of daylight. The sweet potato plant's energy is stored, rather than used to produce flowers.

A sweet potato is an example of a root tuber, an enlarged root that stores food for the plant. Small stems and roots will grow from the tuber, but the sweet potato remains attached to the parent plant and continues to increase in size as long as it is left in the soil. Sweet potato plants develop a fibrous root system, with each plant producing from four to 10 sweet potatoes, or about two pounds per plant.



Sweet Potatoes

Credit: Louisiana Sweet Potato Commission

GROWING SWEET POTATOES

Sweet potatoes do not have "eyes," so they cannot be propagated by planting pieces of the root in the ground. Instead, sweet potato plants are grown from "slips," or new plants grown from starter roots. The starter roots are saved from the previous year's harvest. Slips are gently separated from the starter root and are transplanted once they sprout and develop their own root systems.

A sweet potato may also develop leaves and roots if partially submerged in water.

SWEET POTATOES VS. YAMS

Sweet potatoes and yams are distinctly different vegetables. In fact, they are not even distantly related to each other.

Sweet potatoes, yellow or orange tubers with ends that taper to points, belong to the morning glory family of plants. There are two main types of sweet potatoes: those with a thin, light yellow skin, pale yellow flesh, and a texture similar to a baked potato and those with a thicker, dark-colored skin (dark orange or reddish), bright orange flesh, sweet taste, and moist texture.

A yam is the tuber of a flowering tropical vine belonging to the yam family of plants, closely related to lilies and grasses. Yams are generally sweeter and larger than sweet potatoes, growing more than seven feet in length and ranging in size from less than one pound to over 100 pounds. The skin of a yam resembles the bark of a tree and is brown or black in color. Depending on the variety, the flesh of a yam is off-white, purple, or red.

When commercial production of the orange-fleshed sweet potato began in the United States, those sweet potatoes were often called "yams" to distinguish them from the lighter-colored sweet potatoes that were already in production. Today, the U.S. Department of Agriculture requires that any label with the term "yam" must include the words "sweet potato."

Source: Library of Congress

Because they require a long growing season, sweet potatoes are grown from "slips," (cut pieces of stem that develop roots) or root cuttings grown from other roots. These are planted three to four inches deep in loose soil in wide raised rows, with the soil piled eight to 10 inches high and 12 to 16 inches wide. Sweet potatoes can withstand dry spells, but utilize water when it is available.

Sweet potatoes are harvested when the leaves begin to turn yellow in color. Generally, the leaves and vines above the ground are cut off or mowed before the sweet potatoes are harvested. Harvesting machines slide under the soil and lift the sweet potatoes out of the ground, carrying them onto a conveyor where the dirt is shaken off. The sweet potatoes continue moving on the conveyor belt to a platform, where they are sorted by hand and placed in bins.

The skin of a sweet potato is very tender and the flesh is easily bruised, so sweet potatoes are handled very carefully. Freshly dug sweet potatoes can even sunburn if exposed to direct sunlight for more than an hour. Sweet potatoes are allowed to cure for four to six days, which means they are temporarily stored in a warm moist environment to increase the sugar content and intensify the color of the skins. Sweet potatoes are not refrigerated because they develop a hard core and an undesirable taste when stored at temperatures below 55 degrees Fahrenheit.

Sweet potato skins vary in color from orange or copper to white, red, or purple. The inside flesh can be orange, white, yellow, or purple in



Sweet Potato Cultivars

Credit: Scott Bauer, USDA ARS

color. Kansas State University plant breeder Ted Carey is even developing a purple sweet potato.²² Sweet potatoes are low calorie, low in sodium, and rich in vitamin A, vitamin C, and fiber.

Sweet potatoes are native to Central and South America. When Columbus explored the Caribbean, he dined on sweet potatoes and took them back to Europe. Sweet potatoes were spread around the globe by Spanish and Portuguese explorers in the 1500s. Today, China is the world's largest producer of sweet potatoes, although about one-half of China's crop is used as livestock feed.

Carrots

The carrot plant is a member of the parsley family. As a biennial plant, the carrot plant completes its life cycle in two years. The first year, the plant stores the food needed to produce seeds in a taproot – a single root with no branches. Generally, that root is harvested for food uses during the first year of its life cycle and does not reach maturity or actually produce seeds.

Carrots vary in shape, size, and color. Some varieties produce carrots that are short and round with rounded tips, while others grow different lengths of elongated carrots with pointed tips. The long thin varieties do not grow well in Kansas, so growers and gardeners choose varieties that produce moderate length, miniature, or short round carrots. Carrots also come in several colors – orange, yellow, white, red, and purple.

Carrots are cool season vegetables grown from seeds. In Kansas, this means carrots can be grown in both the spring and fall seasons. Carrot seeds are extremely small black seeds, so tiny that 1,000 or more would fit in a single teaspoon.



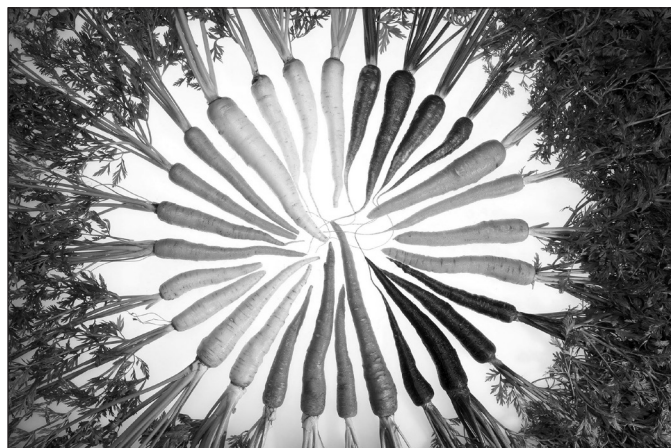
Carrots

Credit: USDA ARS



Carrot Shapes

Credit: Mary Anne Stoskopf



Carrot Colors

Credit: Stephen Ausmus, USDA ARS

CARROT FACTS

The carrot plant is a biennial plant, but its taproot, which stores the plant's food, is usually harvested during the first year of the plant's life cycle.

The carrot plant is designed to produce seeds in the second year of the plant's life cycle. Carrot seeds are so tiny that 1,000 or more would fit in a single teaspoon.

Carrots come in many colors, including orange, yellow, white, red, and purple.

An orange carrot contains more beta-carotene than any other fruit or vegetable.

About 87 percent of a carrot is water.

The seeds are planted in rows between one-fourth and one-half inch deep. The seeds take two to three weeks to germinate, and the soil must be kept moist during that time. The seeds eventually produce a plant with clusters of feathery compound leaves originating from a very short stem at the top of the root. As the leaves develop and produce sugar through photosynthesis, the sugar is transported to the root of the plant (the carrot), which enlarges as the sugar accumulates.

The tiny carrot seeds are scattered along the row, producing many weak and spindly young carrot plants. As a result, the plants are thinned out so some of the roots have enough space to enlarge. Carrot plants grow well in full sun, but continue to require water throughout the growing season. When the taproots (carrots) are exposed to the sun, they turn green and taste bitter, so the roots need to stay completely covered by the soil while growing.

Carrots are harvested by digging or pulling the carrots out of the soil. If the plant is left in the soil, it will send up a tall flowering stalk during the second year of growth. The flowers produced are pollinated by insects and will eventually produce seeds. Commercially grown carrots are harvested using self-propelled harvesters.

These machines undercut the roots, using belts to dig and lift the carrots out of the soil. The tops are cut off before the machine deposits the carrots into a truck or trailer for transportation. From the field, the carrots go to a facility where they are washed, sized, and packed before being stored or transported to a market or food processing facility.

Beta-carotene, which the human body converts into vitamin A, gives orange carrots their color. In fact, no other vegetable or fruit contains as much beta-carotene as an orange carrot. However, the first cultivated carrots were purple carrots grown in central or western Asia, probably near modern day Afghanistan. Yellow carrots appeared later in the Mediterranean region.

Instead of being grown for food, early carrots were grown for medical uses. In the 16th and 17th centuries, the Dutch improved upon early orange-colored varieties, producing juicier and sweeter carrots for food uses. Early colonists and settlers introduced

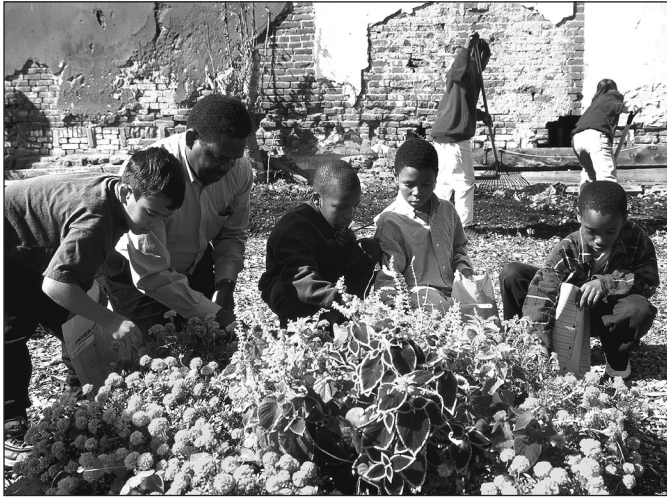


Harvested Carrots

Credit: Joe Larson, USDA NRCS

Specialty Crops in Kansas

cultivated carrots in North America. Today, carrot production in the United States is concentrated in California, which grows 87 percent of the country's fresh market production.²³ Globally, China leads the world in carrot production, followed by Russia and the United States.



Harvesting Marigold Seeds

Credit: Bob Nichols, USDA NRCS

NON-EDIBLE SPECIALTY CROPS

Kansas farmers have always experimented with a variety of agricultural crops. In the 1860s, flax, hops, rye, tobacco, and Indian corn were included in the state's annual agricultural reports. Other crops like hemp, castor beans, sugar beets, cowpeas, and broomcorn have been prominent agricultural crops in Kansas at one time or another. Today, the fertile and productive soils of Kansas support a variety of crops that provide not only food but also other benefits.

TREES

Historically, periodic prairie fires kept much of the state of Kansas treeless, especially the western half. The majority of the forestland in Kansas was – and still is – found in the eastern third of the state, mostly adjacent to streams and rivers.

The Homestead Act of 1862 opened the Kansas Territory for settlement and land ownership, and established the beginning of tree farming in Kansas. Settlers planted trees and orchards to recreate the familiar landscapes they had left behind as well as provide food and income. Additionally, the Timber Culture Act of 1873 provided free land to settlers if 40 acres of the homestead claim was planted to trees and kept in growing condition for 10 years. Later, the requirement was actually



Planting a Tree

Credit: Keith Weller, USDA NRCS



Mission Creek– Wabaunsee County

Credit: John Charlton, KGS

THE SILK INDUSTRY IN KANSAS

Silkworms feed on the leaves of mulberry trees; then spin cocoons of silken thread. At one time, silk production was an active industry in Kansas.

In the 1870s, the French settlement of Silkville in Franklin County was the center of silk production in Kansas. In fact, Ernest de Boissiere, a Frenchman, founded Silkville in 1869 specifically for manufacturing silk. In addition to planting 40 acres of mulberry trees in 1870, de Boissiere imported silkworms from France and Japan. He also brought families from France to Kansas, including experts from the French silk industry.

Ten thousand mulberry trees provided the leaves to feed the silkworms, which spun cocoons of silken thread that were collected and used in the silk factory at Silkville. Looms in the factory turned out 250-300 finished yards of silk fabric a day. However, it proved difficult to compete with the Italian and Japanese silk industries, and by 1886, Silkville had stopped producing silk.

Silk production also took place in the south-central area of Kansas. When Russian Mennonites immigrated to south-central Kansas in the 1870s and 1880s, many brought silk production skills to the region. At one point, silk production was reported in more than 40 counties in Kansas. In 1887, the State Board of Agriculture organized a special silk commission and established a silk station at Peabody. The silk station included ten acres of land planted to mulberry trees. The primary work of the silk station was to raise silkworm eggs for free distribution to Kansas residents, who hatched the eggs, raised the silkworms, and sold the cocoons back to the silk station. The station also included a building where the silk thread was reeled and sold.

Many Kansas families participated in the silk venture, but in 1897, the legislature ended state funding and the Kansas silk industry was abandoned.

PLANTING TREES IN KANSAS

The Timber Culture Act of 1873 provided free land to homesteaders if 40 acres of the homestead claim was planted to trees, and those trees were kept in growing condition for 10 years. An amendment to the act in 1878 reduced the requirement to 10 acres.

In Kansas, land patents from timber claims were issued for more than two million acres.²⁴ In fact, more timber claims were filed in Kansas than any other state.

Orchard

Credit: Scott Bauer, USDA ARS



Windbreak

Credit: Lynn Betts, USDA NRCS





State Champion Tree– Water Oak

Credit: Kansas Forest Service

reduced to 10 acres. As a result, Kansas had more timber claims filed than any other state under the provisions of the Homestead and Timber Culture legislation.

Today, trees in Kansas serve many purposes, including producing fruit and nuts, reducing the speed and impact of the wind, stabilizing streambanks and protecting water quality, providing shade, reducing energy consumption, and enhancing recreational opportunities, in addition to supplying wood, paper, and other products.

Christmas Trees

Christmas trees are considered an agricultural crop, even though it may take 12 to 15 years of growth before the trees are ready to harvest. According to the Kansas Christmas Tree Growers Association, there are about one million acres in the United States producing Christmas trees. The National Christmas Tree Association estimates Christmas tree growers planted about 42 million new seedlings in 2009.²⁵

Christmas trees are grown from two- to four-year old seedlings grown in nurseries and then transplanted and planted in rows on Christmas tree farms in the spring. The Christmas trees are tended year-round to control weeds and prevent damage from disease, insects, or wildlife in addition to being irrigated when necessary. Depending on the species, Christmas trees are sheared or pruned starting in the second or third year of growth. Shearing controls the growth and development of the branches and allows the tree to develop in the commonly desired cone shape. A Christmas tree receives its final shearing the summer before it will be

Transplanting Trees

Credit: Lynn Betts, USDA NRCS



White House Christmas Tree

Credit: National Christmas Tree Association



Christmas Tree Farm

Credit: USDA NRCS



Shearing Christmas Tree

Credit: National Christmas Tree Association



Baling Cut Tree

Credit: National Christmas Tree Association

harvested. Some trees never develop a good shape for a Christmas tree, and the branches are used for wreaths and other greenery. Tree growers also spray a green coloration on the trees to give the trees the deep green color that customers desire.

Christmas trees are harvested by cutting or as live trees. Live trees are dug up with an attached root ball in soil that is wrapped, usually in burlap. These trees can be harvested in early September, but must be watered periodically to stay alive until they can be planted in the spring. In Kansas, Christmas trees can be cut as early as late October or early November. Trees that are harvested this early are baled (tied or wrapped) to protect the branches during shipping as they are distributed to garden centers and other markets.

Evergreen trees, trees that have leaves year-round, have long been associated with winter celebrations. In fact, the first decorated Christmas trees appeared in Europe in the 1500s. The first commercial sales of Christmas trees in the United States began about 1850. Those early Christmas trees were cut from forests, but growers began producing Christmas trees on tree farms and tree plantations in the mid-1900s. Today, about 98 percent of all cut Christmas trees in the United States are grown on farms.²⁶

In Kansas, the Christmas tree industry got its start in 1959. While visiting the state of Michigan, Cecil Delp had the idea to grow Christmas trees in the sandy soil near St. John. One of the first Christmas tree farms in Kansas, the Delp Christmas Tree Farm is still in business today.



Evergreen

Credit: USDA NRCS

Timber

Timberlands are areas capable of producing wood for commercial and industrial uses. Planted timberlands are usually species such as black walnut that are highly valued for the lumber. Although Kansas is not typically thought of as a forested state, most of the timberlands along the eastern border of Kansas are of natural origin. Kansas timberlands actually grow enough wood each year to build one thousand homes.²⁷ Management practices may involve planting, pruning, and thinning trees; removing undesirable trees; applying



Log

Credit: Julia Debes

Specialty Crops in Kansas



Natural Timber – Cherokee County

Credit: John Charlton, KGS



Flagging Tree for Removal

Credit: Jonas N. Jordan, USACE

chemicals to thwart attacks by insects or disease; and preventing and managing fires.

Trees from Kansas timberlands are harvested as logs, which are processed by sawmills. According to the Kansas Forest Service, Kansas has more than 70 active sawmills and timber buyers in the state. The sawmills process logs into lumber, mainly for use in the furniture and pallet industries. In fact, lumber from the official Kansas state tree, the cottonwood, is used extensively in the pallet and crate industries. It is lightweight and readily available, especially since the cottonwood is the most abundant tree species in the state. As a result, more cottonwood is harvested and processed in Kansas than any other tree. Higher-quality "vener logs" harvested in Kansas are shipped to other states or countries to be sliced into very thin sheets of veneer, wood that is overlaid on less expensive wood to provide an expensive-looking product at a more affordable price. Veneers are used in both paneling and the furniture industry. In Kansas, the forest products industry contributes \$1.3 billion to the state's economy each year.²⁸



Cutting Tree

Credit: USACE



Kansas Sawmill

Credit: Kansas Forest Service

WOOD WORDS

Lumber – harvested wood processed into boards at a sawmill; woods of specific lengths and thickness used as construction materials.

Sawlogs – sections of trees large enough to be processed at a sawmill and cut into lumber.

Timber – uncut trees or logs suitable for producing wood for commercial industrial uses.

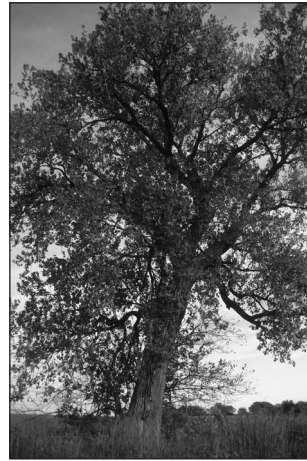
Veneer – thin slices of wood, usually less than one-eighth inch thick, typically glued onto core panels of less expensive wood.

Veneer logs – high-value logs harvested from hardwoods such as cherry, red oak, white oak, walnut, birch, and sugar maple; the value of the logs is based on the color of the wood, the grain pattern, and the lack of defects, such as knots, decay, seams, bulges, bumps, scars, worm holes, and bird pecks.

COTTONWOOD – KANSAS STATE TREE

The cottonwood is the most abundant tree species in the state, which is why it was designated as the Kansas state tree in 1937. Before Kansas was settled, mature cottonwood trees growing along streams and rivers survived the prairie fires due to their thick protective bark. Cottonwoods were also widely planted by settlers in the late 1800s. In the 1930s and 1940s, even more cottonwoods were planted as fast-growing tall trees in new windbreaks across Kansas.

Cottonwoods can reach a height of more than 100 feet and can have trunk circumferences greater than 12 feet. The wood of the cottonwood tree is light in color, easy to work with, and lightweight. In the manufacture of furniture, it is used as the core material. Then other high-grade furniture veneers are overlaid on it. Cottonwood is also used in the construction of pallets, boxes, and crates for transporting merchandise. Overall, more cottonwood is harvested and processed than any other tree in Kansas.



Cottonwood Tree

Credit: Bob Gress, Great Plains Nature Center

TURFGRASS SOD

According to the Turf Resource Center, turfgrass sod is a mature grass cover produced in a managed agricultural operation, removed intact with a minimum amount of soil, and transplanted in another location. Since the early 1900s, there have been turfgrass sod farms in Kansas. In 2006, there were 6,500 acres of sod being grown in Kansas, accounting for sales of more than \$13 million, according to the 2006 Kansas Horticultural Survey.²⁹

Sod production fields are planted to specific grass varieties that are best suited for the climate. The grass is planted by using seed or inserting small shoots of grass with attached roots, called sprigs or plugs, into the soil. Weed control is critical to the production of a marketable product as well as supplying the water and nutrients that the plants need to grow strong root systems. Typically, turfgrass is six to 18 months old when the sod is harvested.

Right before the sod is harvested, the turfgrass is mown and swept. The sod is harvested with a sod cutter, a machine that slips under the



Turfgrass Sod

Credit: Kathleen R. Pine, Pine Family Landscape Center

TURFGRASS WORDS

Sod (turfgrass sod) – squares or strips (rolls) of turfgrass cut from a production field with a thin layer of soil still attached; used for installing a turfgrass area by transplanting living plants.

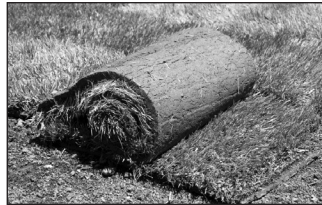
Turf – a soil covering of mowed vegetation, usually a turfgrass.

Turfgrass – a species or cultivar of grass that is maintained at a desired height through regular mowing.

Source: University of Minnesota



Harvesting Sod



Small Roll



Small Rolls

Credits: Kathleen R. Pine, Pine Family Landscape Center



Large Rolls

surface of the soil, cuts the roots of the grass plants, and removes a thin layer of roots. Generally, sod is cut at a depth of one-fourth to one-half inch and contains surprisingly little soil. Sod is harvested in slabs or rolls. A small roll, measuring 18 inches wide by six feet long, contains nine square feet of sod, or one square yard. A large roll, measuring 42 inches wide by 116 feet long, contains 45 square yards of sod.

Rectangular slabs of sod are stacked on pallets. A typical pallet holds 500 square feet of sod and weighs about 1,800 pounds. Both rolls and pallets have to be moved using forklifts. Sod should be laid, or transplanted, at its destination within 24 hours after it is harvested. The sod is a mass of living plants, so it requires good contact with the soil and frequent watering to survive.

Pallet



Yard Installation

Credits: Easton Sod Farm



Sports Field Installation

When sod is harvested, most of the grass root system is left in the soil at the production field. For some varieties, the next harvestable crop will grow from ribbons (narrow strips) of turfgrass left in the field after harvest. With other varieties, the roots and plants that remain in the field after harvesting will decompose and add organic matter to the soil. Those fields will be re-seeded after the harvest is completed.

The greatest demand for sod comes from the housing industry. "Instant" lawns provide visual appeal, prevent soil erosion, and conserve water. Golf courses, commercial business developments, parks, and athletic fields also use sod to establish useable grassed areas quickly.



Golf Course

Credit: Peggy Greb, USDA ARS

LEARNING ABOUT TURF

The College of Agriculture at Kansas State University offers three degree programs that focus on turf management. Students can specialize in sports turf operations management, golf course management, or landscape management. All three degree programs are areas of specialization in the Horticulture, Forestry, and Recreation Resources Department of the KSU College of Agriculture.

Source: Horticulture, Forestry, and Recreation Resources Department, KSU College of Agriculture

FLORICULTURE

Flowers add color and fragrance in our homes and places of work. They are used to celebrate special occasions and for decorative purposes. Floriculture – the cultivation of flowering and ornamental plants – is an emerging industry in Kansas. This industry includes specialty fresh or dried cut flowers and other cultivated plant materials in addition to bedding plants and potted flowering or foliage plants. Commercial floriculture activities include production in fields and greenhouses, retail sales, and landscape installations.



Celosia and Marigolds

Credit: National Garden Bureau

Scientists at Kansas State University conduct field trials of annual and perennial flowering plants at four research sites in Olathe, Haysville, Colby, and Hays. In addition to the development of new plant varieties, the researchers release recommendations each year for plant varieties best suited for growing conditions in Kansas. For example, the Prairie Star collection focuses on annual flowers that will bloom throughout the entire summer growing season, while the Prairie Bloom collection highlights perennial flowers that bloom for



Bedding Plants

Credit: Lynn Betts, USDA NRCS

FLORICULTURE WORDS

Bedding plant – a fast-growing plant grown within a container in a greenhouse or similar structure and transplanted once it reaches maturity; most bedding plants are annuals, planted in groups to create a display of colorful flowers or foliage.

Floriculture – the cultivation of flowering and ornamental plants.

Foliage plant – a plant grown primarily for its decorative leaves rather than its flowers or fruit.

Ornamental plant – a plant grown for its decorative value; in addition to flowers, common ornamental features include leaves, fruit, stems, and bark, as well as the shape, color, or scent.

Potted plant – a plant grown in a flowerpot or container; the plant grows and remains healthy even though the container restricts its roots.



Dianthus

Credit: National Garden Bureau

ADDING DIVERSITY

Specialty crops add diversity to the mix of agricultural crops grown in the state of Kansas. Commercial production of these plants boosts the state's economy and provides additional jobs in the production and retail segments. These crops also increase the variety of healthy foods we eat and enhance our family celebrations and traditions by providing quality products for our use and enjoyment. ■

shorter periods (10 days to two weeks) and annual flowers that bloom with less intensity.

Statistics for the floriculture industry in Kansas are not widely available, although the Society of American Florists reports that sales of floriculture items at all U.S. retail outlets topped \$35.6 billion in 2008. The top five states in floricultural production are California, Florida, Michigan, Texas, and North Carolina. Despite increasing production, however, the United States is still a net importer of floricultural products.



Ornamental Pepper Plant

Credit: Robert Griesbach, USDA ARS

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Ornamental Foliage – Poinsettia

Credit: Scott Bauer, USDA ARS



Celosia Bouquet

Credit: National Garden Bureau



Sweet Pea

Credit: National Garden Bureau



Geraniums Growing in Greenhouse

Credit: Peggy Greb, USDA ARS

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NOTES:

TEACHER'S RESOURCES

The Kansas Foundation for Agriculture in the Classroom (KFAC) offers lesson plans and other educational resources on the KFAC website: www.ksagclassroom.org.

