

Agronomy Specialist Fact Cards

Dr. Chris R. Patty

Rice, known to scientists by its Latin name *Oryza sativa*, was first domesticated in Asia approximately 10,000 years ago. Archaeologists have found rice remains that are 10,000 years old in Thailand and rice farming tools that date back 8,000 years in China. Today, rice is grown on every continent but Antarctica. Due to continued selection by farmers and further work by plant breeders, the rice plants grown today are more productive, disease resistant, and widely adapted to a variety of growing conditions than the earliest domesticated varieties.



Rice grows best in tropical regions, requiring warm temperatures and consistently moist soil. Temperatures below 70°F will stunt the growth of most rice varieties. Rice is often grown in flooded fields to reduce competition from weeds. Paddies are rice fields designed so that the farmer can control the water level, which is kept shallow (2–5 inches) throughout the growing season and then drained for harvest. Irrigation is used to maintain a consistent water level during dry periods. Not all rice is grown in irrigated paddies. Some farmers plant on the edges of rivers or lakes or construct their fields to capture rainwater. Following heavy rains, the water can get as deep as 40 inches for up to 10 days without harming the rice plants. Rice can also be grown without flooding or irrigation in upland areas that receive sufficient rain. Drought is a serious threat to rainfed rice, which won't produce a crop without regular rain.

Rice is perhaps the most important grain for human consumption. Relatively little rice is used for animal feed or exported; most is consumed by people in the same country where it is grown. China and India alone produce approximately half of the rice grown in the world. The United States produces less than 2% of the world's rice. Most US rice is produced on expansive, highly productive, mechanized farms in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas. While a 500-acre rice farm is considered small in Arkansas, a 5-acre rice farm is just under average in Thailand where most of the work of rice farming is done by hand.

Most of the rice consumed, whether it be in Thailand, Utah, or Brazil, is white rice that has been processed at a mill to remove the hull and bran. The hull is the tough, protective seed coat, and the bran is the brown layer just beneath the hull that contains most of the vitamins and minerals. Brown rice still has its bran layer. White rice cooks faster and stores better than brown. Often, white rice is enriched after milling to restore its vitamin and mineral content.

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Dr. Kim D. Goosefoot

Quinoa (keen wah) was a staple crop of the ancient Inca civilization in the Andes Mountains of South America. The Inca called quinoa *chisaya mama*, which means mother of all grains. Quinoa was cultivated throughout the Andes from the time it was first domesticated until the Spanish arrived in the region in the early 1500s. After the fall of the Inca Empire, quinoa nearly disappeared, remaining only on small, traditional farms high in the Andes. In the 1970s, quinoa was rediscovered by the rest of the world, and its popularity has soared due to its highly nutritious seeds and ability to grow in adverse conditions.



Quinoa is not technically a grain but is more accurately called a *pseudocereal*. True cereal grains come from domesticated grasses, while pseudocereals are cooked and eaten like grains but come from different types of plants. Quinoa, known to botanists and agronomists by its Latin name *Chenopodium quinoa*, belongs to the Goosefoot subfamily, which is named for the shape of its plants' leaves. Many plants that belong to this group are weeds, and quinoa itself might be said to grow like a weed, tolerating drought and poor soils better than most crops.

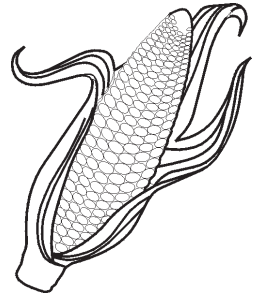
Native to high altitudes, quinoa grows well in cool, dry climates. Temperatures above 95°F will cause the pollen to become sterile, reducing yields. Over a period of 160 to 180 days, quinoa plants grow three to nine feet tall and produce large seed heads in a variety of colors, including red, purple, pink, and yellow. The most common commercial types are those that produce white, red, or black seeds. Seeds must be kept dry once they have matured and throughout harvest or else they will sprout. The outer layer of the quinoa seed contains a bitter compound that must be removed by washing or, in the case of commercial production, processing at a mill. Milled quinoa is highly nutritious; it is higher in protein than other grains and is one of few plant foods that provides a complete protein, which includes all of the amino acids in balance. In the United States most quinoa is sold as whole grains that can be cooked and served in a manner similar to rice. Quinoa can also be made into pasta, granola bars, bread, and breakfast cereal.

Today, most quinoa is produced in Bolivia, Peru, and Ecuador. In the United States, Colorado farmers have begun to produce quinoa, and high altitude, low precipitation regions in New Mexico, California, and Washington are potential areas for future quinoa production. Around the world, trials are being conducted to extend cultivation of this uniquely adapted crop.

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Dr. Cornelius E. Kernel

Corn was domesticated in central Mexico more than 7000 years ago and was a crop of central importance to the Aztec and Mayan civilizations. From this center of origin, corn spread throughout the Americas, playing a role of sacred importance to many tribes. When Columbus arrived in the Americas, he was introduced to corn by the Taino people who called it *mahiz*. This is the origin of the word *maize*, a common name for corn around the world. Scientists know corn by its Latin name *Zea mays*.



By 1492, Native Americans had already developed hundreds of varieties of corn by selecting and saving seed (each kernel on a mature corn cob is a fertilized seed) from plants with the most desirable characteristics. Today, processes like hybridization and genetic modification give plant breeders greater control to develop new varieties with traits like disease and pest resistance or sweeter kernels for fresh eating. All varieties and types of corn grow best with full sun, fertile soil, and regular rain or irrigation throughout the growing season. Corn seeds require warm soil temperatures of 60–95°F to germinate. Weed control and fertilization are important because corn needs lots of nutrients to grow. Modern American farmers grow a number of different types of corn, including sweet corn for eating fresh, popcorn for popping, and dent corn (commonly called field corn), which is used to make a variety of food and nonfood products.

Corn is grown around the world, but the United States produces more corn than any other country. The warm, rainy summers and deep, fertile soils of the Midwest make this part of the country particularly well-suited to growing corn. Iowa and Illinois are the top corn-producing states, growing just over one-third of the country's corn. The surrounding states are also important corn producers, and this region is known as the Corn Belt.

Most of the corn grown on US farms is dent corn. After harvest, dent corn is typically sent to a mill where the kernels are separated into their starch, oil, protein, and fiber components to be used in making products ranging from snack foods to plastics. Over 4000 food products include corn as an ingredient, often as a corn-derived product such as high fructose corn syrup or maltodextrin. Ethanol fuel and animal feed are other important corn products. In 2014 approximately 40% of US corn was used for animal feed and 30% for ethanol.

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Dr. Will G. Wheaton

Wheat has been an important human food for thousands of years. Hunters and gatherers in the Fertile Crescent of the Middle East recognized the nutritional value of grass seeds, which they began to cultivate around 10,000 years ago. By cultivating wild grasses and selecting and saving seed from those with the most desirable traits, early farmers developed new species of domesticated grains. One of those was bread wheat, or the species *Triticum aestivum*, which became an important crop for the ancient Egyptians. From its center of origin in the Middle East, wheat spread throughout Europe and Asia, and finally arrived in the Americas following the early voyages of Columbus.



Wheat is a cool season crop that can be planted in the early spring or in the fall for harvest the following summer. Wheat planted in the fall is called *winter wheat*. Winter wheat is planted 8–12 weeks before the soil freezes, so plants will be 5–6 inches tall when winter arrives. The plants go dormant for the winter and resume growing as soon as spring rains arrive. Spring wheat is planted as soon as the soil is dry enough to work, the earlier the better. Once the wheat has grown and formed seedheads, the crop finishes best in a warm, dry summer. Rain on wheat that is ready to harvest can cause the grain to sprout, ruining it for storage.

After wheat is harvested, it is sent to a mill. The mill will analyze, grind, sift, and blend the wheat to produce different kinds of flour. Whole wheat flour contains all the components of the original seed. The outer layers of the seed, which have a slightly bitter taste and contain most of the vitamins and minerals, are removed from white flour, leaving mostly carbohydrates and protein. Uniquely, most of the protein in wheat is gluten. The properties of gluten cause dough made from wheat flour to stretch and rise, capturing the gases released by yeast during fermentation. This gives bread, rolls, pizza crust, bagels and other goods baked with wheat flour their characteristic airy texture. Hard wheat varieties are high in gluten and best for baking bread. Soft wheats are lower in gluten and best for making cakes and pastries.

Bread and pastries are eaten around the world, and wheat is grown around the world. China, the European Union, India, and the United States are major wheat producers. In the United States only corn and soybeans are planted on more acres than wheat. Kansas and North Dakota are the top wheat-producing states in the country.