

Rice Grain Quality

USDA-ARS-Rice Research Unit Rice Quality Program

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Kernel Form

Rough (Paddy) Rice

Rice that has been harvested from the plant with its hull (husk) intact is known as rough or paddy rice. The hull is not eaten by humans but is sometimes burned for use as an energy source.

Brown (unmilled) Rice

When the hull is removed from rough rice it is called brown rice. However, not all dehulled rice is brown in color. The outer bran layer of the grain and embryo (germ) is what gives rice its color and can vary from light yellow to red to dark purplish black. Rice bran and germ contains greater amounts of dietary fiber, vitamins, minerals and other health-related components than the white center portion of the kernel (endosperm). But those outer portions of the kernel also contain more lipid (fats) material, making brown rice more susceptible to becoming rancid (spoilage). Brown rice, therefore, has a shorter shelf life compared to milled white rice. Storage under cool conditions will lengthen its shelf life. Cooked brown rice has higher fiber content and is chewier in texture than its white rice counterpart and is described as having a slightly nutty flavor.

White (milled) Rice

Rice that has had its bran and hull layers removed by milling is called white, table, polished, or milled rice. White rice cooks faster than brown rice and has a longer shelf life. In the U.S., most white rice is coated with iron, niacin, thiamin and folic acid to enhance its nutritional quality.

Milling Yield

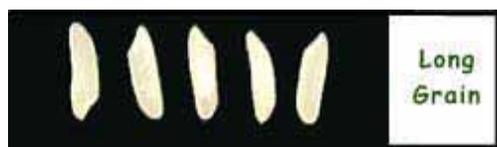
One of the most important aspects of rice grain quality is its milling yield. During the process of milling, the hull is removed from rough rice using a huller to yield brown rice. After the hull is removed, the embryo and the bran layer is removed from the brown rice through an abrasive mill to produce total rice (broken and whole kernels). The final step is separation of the whole (intact) kernels from the broken kernels using screens sized for use on long, medium or short grain varieties to produce whole grain rice. Head rice milling yield is the percentage of whole kernels recovered after milling and removal of the broken kernels. Producers are paid less for broken kernels than for whole.

Milling of rice increases its shelf life and provides consumers with a physical property they have come to desire, whiteness. Therefore the goal of milling is to remove as much of the colored bran and germ as possible. The quantity of bran remaining on the surface of the grain after milling is defined as milling degree. A high milling degree means that the milled rice is very white with relatively light milling. Degree of milling is influenced by to grain hardness, size and

shape, depth of surface ridges, bran thickness and mill efficiency. Consumers also have a preference for rice that is transparent and not chalky. Chalky areas of the grain are a result of air spaces in between the starch granules that make up the endosperm. Variation in kernel whiteness and transparency can be due to differences in rice varieties, cultural management methods, weather conditions during the crop year, and storage conditions of the harvested rice. Milling rice results in a loss of vitamins, minerals and dietary fiber. In less developed countries, where rice is a major component of the people's diet, such nutritional losses may significantly impact human health. As a result, in some areas, the government has encouraged the production of undermilled rice to improve nutritional well being in its population.

Grain Shape

Rice is primarily classified according to its grain shape. However, within grain shape categories there are differences in cooking qualities that are determined by the chemical make up of the grain and affect cooked grain texture. The various grain shape and specialty rice categories are described below.



Long Grain The category known as long grain contains milled rice that is approximately three times longer than it is wide. A conventional U.S. long grain rice has 19 to 23% grain amylose content. After cooking, it is firm and fluffy (not sticky). Consumers in areas of the world

such as North and South America, Southern China, Europe, and the Middle East often prefer this type of rice.



Medium Grain The medium grain rice category describes milled rice that is from 2.1 to 2.9 times longer than it is wide. Medium grain rice is generally has an amylose content of 16-18% and after cooking is soft, moist and sticky in texture. This type of rice is in

general preferred by people from Japan, Northern China and North and South Korea.



Short Grain Rice that is less than two times longer than it is wide is classified as short grain. In general short grain rice has cooking quality and amylose content similar to that of rice in the medium grain category. Because this type of rice is used for making sushi some call it sushi rice.

Specialty Rice

Rice that has cooking or processing quality different from the standard market classes described above is known as specialty rice. These are used for special styles of cooking and in specific products. Acreage of these types of rice in the U.S. is much lower than rice that fits into the standard long, medium and short grain market classes.

Arborio

This rice type originated in Italy where it has traditionally been used for making risotto. Arborio rice is classified as a medium grain, but it has fairly firm internal texture and a unique creamy exterior. It often has a very large white chalky center that is thought to be responsible for its ability to take up the flavor of the stock or sauce it is cooked in.

Basmati-Type

Rice of this type has the kernel dimensions of a long grain rice. It has a moderately firm cooked texture, is dry and not sticky after cooking and has an aroma often described as being popcorn like. This category is unique in that its grains become very long and thin (extreme elongation) after cooking. Basmati rice originated in India and Pakistan. Today, however, rice that has these same unique quality traits are also grown in the U.S.

Aromatics

This type of rice is a long grain aromatic rice whose aroma is said to be popcorn like. Although the aroma is similar to Jasmine- and Basmati-style rice its texture mimics that of conventional U.S. long grain firm cooking rice.

Japanese Premium Quality

Japanese Premium Quality rice is similar to conventional U.S. medium grain rice in terms of grain length and amylose content. However, these rice differ from standard medium grain rice because of their glossiness, lack of flavor, sticky but smooth texture, and softness after cooling. These properties have been traditionally desired by some people of Japanese and Korean descent.

Jasmine-Type

This style of rice is originally from Thailand. Much of the jasmine-style rice sold in the U.S. is imported from Thailand. However, U.S. produced jasmine-style rice is also available. Jasmine-style rice has long grains that when cooked are soft and cling to each other. It is considered aromatic rice because it possesses a distinctive aroma often reported to be popcorn-like.

Superior Processing Quality

Some long-grain rice has been developed to remain intact, firm and fluffy after parboiling or canning and thus produces a better appearing rice for use in canned soups and frozen dinners. This type of rice also has less solids loss and kernel splitting after processing compared to conventional U.S. long grain rice and has about 26% grain amylose content. Parboiled rice is produced by steeping and cooking the rice while the hull is still on the kernel. As a result, the color from the hull and the nutrients from the bran layer penetrate the grain during cooking. After parboiling the rice is dried and then milled, producing a slightly amber colored grain.

Toro-Type

This is long grain rice that after cooking is soft in texture and the kernels cling to each other. The apparent amylose content is similar to that of conventional U.S. medium grain rice. Toro-Type rice is primarily used in certain ethnic (i.e. Cajun) style cooking.

Waxy (glutinous, sweet or sticky)

This style of rice can be in the long, medium or short grain form, and is eaten both milled and unmilled. Milled waxy rice appears opaque (solid white), as opposed to nonwaxy rice, which is translucent. Waxy rice has very little amylose and cooked milled waxy rice is extremely soft and

sticky. When the bran is left on, waxy rice is slightly chewy and flavorful. Flour made from waxy rice is also used in products such as candy, salad dressings, baked crackers, and snack foods. It is a ceremonial rice used in areas of Asia.

Wild Rice

Wild rice is not rice nor is it wild. It is a grass, which is native to North America. It used to be just a natural grass found in shallow lakes and waterways, but it is now grown commercially in the U.S. Its nutty, chewy texture and dark brown to black color provide its appeal.

Processing

Parboiled

Rough rice that has been exposed to some combination of soaking in water and exposure to steam, dried, and then milled, is said to have been parboiled or converted. This process results in the natural vitamins and minerals being transferred from the rice bran layer into the starchy endosperm. Parboiling is thought to have originated in India and Pakistan more than 2,000 years ago. It came into use in the U.S. during World War II because it fit the military's need for nutritious food that had a long shelf life. Long grain is the type of rice that is generally parboiled for consumption as table rice. Medium grain rice is also parboiled and ground into flour for use as an ingredient in food products.

Quick cooking and Pre-cooked Rice

Quick cooking brown or white rice has been pre-cooked to reduce its cooking time; its starch may either be partially gelatinized (cooked) or not at all. The process sometimes entails cooking in water or steam and then drying.

Rice Flour

White rice that has been ground into a flour or meal is used in many different types of food products around the world. A few examples follow. The relatively bland flavor of rice makes it well suited for use in products with mild flavors. It has advantages over other grains in that it will not obscure what natural flavors are present and less added flavor is needed. Waxy rice is often used to make baked crackers, which are light and crispy. When a firmer less delicate baked cracker is desired medium grain rice is often used. Fried snack foods made using a blend of waxy rice flour and other grains will tend to be crisper and take up less fat than if made without the rice flour. Rice flour made into a cereal is ideal as an initial food for babies because it is hypoallergenic. Being hypoallergenic, plus having the ability to prevent and correct dehydration has resulted in beverage mixes being developed which are rice-based and used in the treatment of diarrheal diseases such as cholera and AIDS.