PHYSICOCHEMICAL TESTS

MARKET TYPE
US Rice is classified in the market as Medium Grain, Long Grain, or Short Grain based on shape and grain dimensions.

QUALITY TYPE
Within the different grain types there are quality types recognized by the marketers, millers, processors, and end-users.

GRAIN DIMENSIONS
Grain dimensions are used to separate the rice into medium, short, or long grain market types. Specific grain dimensions are required to meet the US market types. Grain dimensions are provided for paddy, brown, and milled rice. Sample measurements of length, width and length/width ratio are now collected with image analysis software rather than by hand measurement.

California is fortunate to produce and market a very broad range of types of high quality rice. These varieties include all the major US market types as well as many special purpose types with distinct cooking and processing characteristics. The Rice Experiment Station (RES), as part of its varietal development process, performs a battery of physicochemical tests in the breeding process to assure that new varieties perform within the parameters of the market type. Comparisons are made to standard reference varieties to ensure it falls within the limits of the of the market type as a requirement for commercial release. These values are determined using samples from the RES breeding nursery, and thus are not absolute values for any of these measurements, nor cover the range of variation. Environmental factors, including variation in temperature and weather conditions, different locations, different years, and pre- and post-harvest management, will affect rice quality characteristics. The summary sheets do provide a comparative profile of the rice varieties that indicates their relative cooking and processing characteristics. The special purpose varieties are typically "identity preserved" and not comingled with other varieties for drying, storage, and processing. In contrast, because of their similar properties and close genetic relationship, Calrose types are comingled after they are harvested.

Cereal Chemists have developed a number of laboratory tests that are used to characterize the cooking and processing characteristic of rice. These, along with the grain dimensions, are used by rice breeders to select for the desired market and quality type. US rice varieties through the breeding process have been selected to have specific starch properties, identified by physicochemical tests, for different grain types: long grains cooking dry and flaky and medium and short grains moist and cohesive.

Apparent Amylose Content: The percentage of the starch component amylose in the kernel is the major determinate of the cooking characteristics of rice. A colorimetric method is used based on the ability of amylose to bind to iodine. A solubilized sample of rice flour is chemically processed, treated with iodine, the color change measured and compared to a set of standards, and the apparent amylose content calculated. As seen in the table the dry-cooking long grain have over 20% apparent amylose whereas medium and short grain varieties have values below that level. The exception for long grains would be the Jasmine long grain type, with a lower amylose content and it cooks more moist and cohesive unlike the conventional long grains. Glutinous rice, all amylopectin and with no apparent amylose, cook very sticky.

Gelatinization Temperature Type: The gelatinization temperature of rice starch has traditionally been defined in rice quality research as the temperature at which nearly all the starch granules in a sample lose their "birefringence" or have gelatinized. This value ranges roughly from 55 degrees to 79 degrees C in rice. The temperature that rice starch granules gelatinize is another indicator of cooking and processing characteristic of a rice variety. It is associated with the cooking time and texture of cooked rice and after it has cooled. A visual scoring of the physical digestion of a milled rice kernel in a dilute alkali solution is a simple method used to classify gelatinization temperature as low, intermediate, or high.

Percent Protein: Protein content is reported for brown and milled rice. Milling off the bran from brown rice lowers the protein, but dramatically increases storage stability and changes the cooking and culinary properties. Long grains show higher protein content and the premium medium and short grains trend toward lower protein contents. Nitrogen fertilization and milling degree can influence the protein content of rice.

Rapid Visco Analysis: The Rapid Visco Analyser (RVA) is a rotational viscometer that continuously records the viscosity of a sample of flour mixed with water under controlled temperature and shear over time. The Peak, Hot Paste, and Cool Paste are temperature points collected during the treatment cycle. The Setback and Breakdown are calculated differences in those points that are related to texture (retrogradation) and stickiness, respectively.

California Rice
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