QUALITY CHARACTERIZATION OF CALIFORNIA PUBLIC RICE VARIETIES

PHYSICOCHEMICAL TESTS

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. With support from the California Rice Commission, the Rice Experiment Station (RES), Rice End-Use Quality Research Laboratory at the USDA-ARS-Rice Research Unit (REQL) in Beaumont, Texas, and Department of Food Science at UC Davis performed a battery of physicochemical tests on public California rice varieties grown at RES. Results for the 2000, 2001, 2002 samples have been compiled in rice quality characterization sheets. The laboratory tests are summarized below.

APPARENT AMYLOSE CONTENT was determined at the REQL using a colorimetric method which is based on the ability of amylose to bind to iodine. To solubilize a sample, rice flour is first wet with ethanol then digested with sodium hydroxide. An auto-analyzer is then used to adjust the sample's pH by adding acetic acid. Next, iodine is added and the color change measured. A sample's apparent amylose content is calculated by comparing its color to that of several standards analyzed using the same method. The amylose content predicts the firmness of the cooked rice.

ALKALI SPREADING VALUE measures the gel type of the rice, which allows an estimate of the gelatinization temperature. Six milled kernels of each variety are soaked overnight in 10 ml of potassium hydroxide at concentrations of 1.5% and 1.7%. The next day, the kernels are evaluated visually and given scores ranging from 2 to 7, two being no reaction (high gel temperature) and seven being mostly dissolved (low gel temperature). The six kernels are averaged to give the final score. Long grains, with an intermediate to high gel type, tend to have a firm texture when cooked. Short and medium grain rice have a low gel type resulting in a softer, stickier cooked rice. This test was conducted at the REQL.

GRAIN DIMENSIONS were measured at RES using a flat bed scanner and Winseedle software developed by Regent Instruments Incorporated. Grain dimensions are used to separate the rice into the U.S. market classes of short, medium, or long grains. Specific grain dimensions are required to meet the U.S. market classes (short, medium, or long grains). These market classes are associated by selection and breeding to specific quality characteristics. Measurements are in millimeters.

PROTEIN CONTENT was measured at the REQL with a Leco FP-2000, which uses the combustion method. A dry flour sample is incinerated, producing various gases. A thermal conductivity cell detects the amount of gaseous nitrogen in the mixture. Then, a computer calculates the protein content using the nitrogen concentration measurement. Protein content is thought by some to impact rice texture such as tenderness, cohesion and flavor. Low protein rice is preferred in the Japanese market.

COOKING TIME was determined at the REQL by sampling boiling rice at various time intervals until 90% of the kernels are completely cooked. Ten grams of rice are added to 300 ml boiling distilled water. After 12 minutes, 10 grains are scooped out onto black plate glass. The kernels are squashed under a plate of safety glass and scored according to opacity. This procedure is repeated every minute until nine of the ten grains are transparent. The point at which this occurs is the cooking time. Measurement units are in minutes.

RAPID VISCO ANALYZER (RVA) uses a cycle of precise temperature and stirring velocity cycles to measure rice flour pasting viscosities. This information is used to estimate the cooking and processing characteristics of the rice. A computer regulates the cycles of the RVA and collects the data. Data is measured in RVU units developed specifically for the RVA machine. Because the RVA uses a smaller sample size (3g) and a shorter cycle (13 min.), it has replaced the Brabender Visco-Amylograph as an industry standard for measuring pasting properties. The RVA AACC method 61–02 was performed in duplicate at RES and REQL. Results were averaged between the four readings. The Japanese method was performed in duplicate at RES.

CONTROLLED STRESS RHEOMETER is similar to the RVA in that it produces a pasting curve to measure the viscous properties of rice starch. A small sample size (1.25 ml) and a precisely angled rotating plate allow the rheometer to evenly apply force and temperature throughout the sample. Although this test requires a greater precision and greater sample preparation time than the RVA, it produces a more precise measurement of pasting properties, particularly pasting temperature. Measurements are in Pascal seconds. This test was performed at UC Davis Food Science Laboratory.

DIFFERENTIAL SCANNING CALORIMETRY (DSC) is used to evaluate the gelatinization and retrogradation of starches. For a given sample, these transitions occur over a temperature range, however, a single temperature (°C) point determined midway through the process is often reported. In this study, the DSC was used to measure the gelatinization temperature, which relates to the cooking properties. In the U.S., rice in the long grain market class has an intermediate gelatinization temperature while medium grains have a low gelatinization temperature. This test was conducted at the REQL.

DISCLAIMER *— Each data value was determined by one sample of rice grown at RES. Thus, it does not represent absolute values for any of these measurements nor the range of variation. Environmental factors including variation in temperature and weather conditions, different locations, and pre- and post-harvest management will affect rice characterization quality characteristics. The summary sheets do provide a general profile of the rice varieties that indicate their cooking and processing attributes.*