

COMPREHENSIVE RESEARCH ON RICE
ANNUAL REPORT

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PROJECT TITLE: Rice Utilization and Product Development RU-2

PROJECT LEADER: R. M. Saunders
Research Leader
Cereals Research Unit
Western Regional Research Center
USDA
Albany, California 94710
Telephone: (415) 486-3296

WRRRC INVESTIGATORS: M. M. Bean
C. A. Esser
R. Y. Fong
L. U. Hansen
A. P. Mossman
K. Nishita
R. N. Sayre
A. D. Shephard

LEVEL OF 1983 FUNDING: \$20,000

PROPOSAL OBJECTIVE: To carry out research work on California rices that ultimately will lead to new products for domestic and foreign markets.

RESEARCH OBJECTIVES: 1. Rice Flour
2. High Protein Rice Flour and Liquid Sugars
3. Rice Test Mill
4. Rice Bran Oil and Stabilized Rice Bran
5. Rice:Soy:Milk
6. Other Activities

SUMMARY OF 1983 RESEARCH

1. Rice Flour

Rice flour treatment with water just prior to use enhanced its functionality in baked products. Hydration with intense mixing and/or holding time improved eating quality, volume, and appearance of layer cake made from 100% rice flour. Flours from short and medium grain rices gave superior cake textural characteristics compared to long grain rice.

A manuscript "Rice Flour Treatment for Cake Baking Applications" has been published, and a patent application has been filed. A review of all rice flour work concerning baking applications was presented (at USDA expense) at the Sixth International Congress of Food Science and Technology, Ireland.

Three California waxy rice varieties grown in 1982 were evaluated by several physicochemical methods to compare and contrast their properties. They were Mochigome, Cal Mochi 202 and Ampec.

The Cal Mochi 202 replaced last year's 201 variety which showed many differences from the other two varieties. The new Cal Mochi has properties more like those of the 1982 crops of Mochigome and Ampec. Very few differences were found in tests of the three varieties. None would appear significant. Only slightly softer gel consistency and slightly lower amylograph viscosities were obtained with the Mochigome variety. Ampec and Cal Mochi 202 were similar.

Eating quality differences were found in the traditional mochi cakes made from the three varieties but reasons for these differences continue to elude us. Limited studies using waxy rice in pizza doughs did not show sufficient improvement in freeze-thaw stability of the frozen dough to continue the experiments.

2. High Protein Rice Flour and Liquid Sugars

A pilot plant model setup was designed to produce high-protein rice flour (25% protein) from rice brokens and/or second-heads based on a scaleup of the laboratory procedure reported previously. Essentially the protein concentration of rice flour is increased enzymatically by digesting some of the insoluble starch to soluble sugars, a byproduct of the process. Our pilot plant studies confirmed that the process would work on 25 lb batches of rice flour using commercial manufacturing equipment available in our pilot plant (retorts, pumps, plate-heat-exchanger, industrial separator, spray-dryers, and drum dryers). In selecting conditions to use in the pilot plant consideration was given to the properties of the solids, liquid, and slurry of the rice flour in exploring parameters of the process. Most of the time was devoted to determining feed rates of rice flour slurry into the industrial separator to obtain the maximum amount of high-protein rice flour. Drum-drying of the high-protein rice flour involved determining adequate feeding rates of slurry, steam pressures, drum clearance and rotational speeds. The by-product, the liquid sugar, was used as a substrate to grow yeast, with the addition of inexpensive salts (magnesium sulfate and phosphates). The pilot plant study was preliminary in nature and more extensive studies are needed to make the process more efficient with optimal conditions for commercial use. Sufficient high-protein rice flour and yeast was obtained to conduct further animal nutrition studies.

This work was presented (at USDA expense) at the Sixth International International Congress of Food Science and Technology, in the Session "Nutrition in Developing Countries".

3. Rice Test Mill

The WRRC decorticating test mill has been successfully modified such that samples of paddy rice may be dehulled and debranned in a single milling, which is accomplished in about one minute and requires only 10 grams of paddy. The operation would seem to meet the needs of plant breeders for routine screening. Tests are underway to optimize the milling parameters, impeller diameter and speed, for short and medium grain paddy, i.e. to predict test milling yields, and correlate with present official methods.

4. Rice Bran Oil and Stabilized Rice Bran

Interest in stabilizing rice bran for production of edible oil continues to increase, particularly in developing countries. A poster display of the stabilization process, oil preparation, and nutritional qualities of the stabilized bran was presented at the 1983 Institute of Food Technologists Annual Meeting in New Orleans, LA.

Commercial negotiations have continued throughout the year exploring the possibilities of stabilizing and exporting rice bran from California to Japan and/or Korea for oil extraction. The demand for food grade rice bran oil, particularly in Japan, appears to be high. A California based company which manufactures the extrusion equipment used in our studies has been active in promoting this new market possibility. WRRC involvement has been frequent demonstration of the process to interested parties and technical consultation.

More experiments have been conducted in correlation with U.C. Davis personnel on feeding rice bran and stabilized rice bran to chicks and pigs. The stabilization process improved the feed quality of rice bran for chicks.

5. Rice: Soy: Milk

This rice based infant food which was developed earlier by WRRC for potential inclusion in PL-480 purchases continues to be of fluctuating interest in the State Department. They have recently invited a commercial rice company to submit samples and arguments. WRRC has contracted the Wenger Company, Sabetha, Kansas, to supply the pregelatinized rice ingredient, to be prepared from California short or medium grain rice. WRRC will also provide the rationale and background information to the rice company.

6. Other WRRRC Activities Pertinent to the Rice Research Board

- A. A chapter, Rice in the Tropics, was written by a WRRRC staff member, and published in the book, Handbook of Tropical Foods. A concise summary of the entire rice production sequence is now available. The same author is preparing a review of rice drying, which will be made available to the Board.
- B. Papers were published on an objective measurement of rice stickiness, and on the effect of steam treatment of rice paddy on milling properties and rice stickiness. This work was supported by the Board, and reflects attempts to reduce the inherent stickiness of California rices for market development.
- C. The WRRRC Project Leader spent five months on sabbatical leave during 1983. Two months of this time were spent at Carlsberg Research Center, Copenhagen, where he devised techniques to measure lipase activity in rice and processed rice materials. The results were very positive; one can now monitor lipase activity in single rice kernels in minutes, compared to current practices necessitating amounts of materials and days for assays. In addition, he studied deposition of β -glucans in Californian rice types, and their correlation with cooking quality.
- D. The WRRRC Project Leader organized and chaired the Rice Workshop held at the 1983 Annual Meeting of the American Association of Cereal Chemists, Kansas City, MO. The subjects discussed were exactly tailored to the Rice Research Board's needs including topics: Current Industrial Uses of Rice and Rice Milling Byproducts, and Where Industry Needs Help; Recent Advances in U.S. Rice Research Relevant to Expanding Markets for Rice; Status, Advances, and Needs in Rice Quality Assessment; and How Can Rice Researchers More Effectively Use Basic and Applied Approaches to Respond to Industry's Needs? Between 60 and 80 people attended this 3-hour session.

PUBLICATIONS

Bean, M. M., Elliston-Hoops, E. A., and Nishita, K. D. Rice flour modifications for baking applications. *Cereal Chem.* 60:445 (1983).

Bean, M. M., and Nishita, D. K. Rice flour for baking applications for wheat-sensitive diets. Sixth International Congress of Food Science and Technology, Dublin, Ireland (1983).

Fellers, D. A., and Deissinger, A. E. Preliminary study on the effect of steam treatment of rice paddy on milling properties and rice stickiness. *J. Cereal Sci.* 1:147 (1983).

Hansen, L. P. The potential of high-protein rice flour and its by-products to increase the nutritional well-being of young children in rice-eating countries. Sixth International Congress of Food Science and Technology, Dublin, Ireland (1983).

Mossman, A. P., Fellers, D. A., and Suzuki, H. Rice stickiness. I. Determination of rice stickiness with an Instron Tester. *Cereal Chem.* 60:286 (1983).

Mossman, A. P. Rice in the tropics. In *Handbook of Tropical Foods*. (ed. H. T. Chan, Jr.) Marcel Dekker, Inc. New York. pp 489-534 (1983).

Sayre, R. N., Fong, R. Y., Randall, J. M., Schultz, W. G., Mossman, A. P., Nayyar, D. K., Tribelhorn, R. E., and Saunders, R. M. Rice bran stabilization for edible oil extraction and for addition to food and feed. Institute of Food Technologists Meeting, New Orleans, LA (1983).

CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS

1. Short and medium rice flours are superior to long grain rice flour in baking applications. Different functional properties were found in three 1982 Californian waxy rice varieties.
2. Production of rice flour containing 25% protein was carried out on a pilot-plant scale to provide material for further animal feeding tests.
3. A mill has been constructed which predicts test milling yield directly from paddy, and on a 10-gram scale suitable for breeders.
4. Commercial equipment for stabilizing rice bran is now available from Californian manufacturers. Stabilized bran is superior to raw bran for chick feeds.
5. Lipase analysis in rice and rice products can now be conducted in minutes, on samples as small as a single kernel.
6. A Rice Workshop involving government, academia and industry specifically highlighted the needs and problems of the rice industry.