PROJECT NO. RU-2

COMPREHENSIVE RESEARCH ON RICE

REPORT COVERING PERIOD 1977-1984

(No funding was requested from the Rice Research Board for 1984)

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

RICE RESEARCH HIGHLIGHTS AT WRRC 1977-84

1. Rice-Soy-Milk (RSM). Blended food for young children

This material, comprised of pregelatinized rice, full-fat or defatted soyflour and non-fat dried milk was prepared as a potential PL480 product. The technology of preparation, specifications, and domestic appraisals were completed. USDA Blended Foods Committee and Food for Peace, State Department, approved the concept and products. Status: The material never did enter the PL480 program even after help from one California Congressman. Purportedly, this was due to uneasiness about future availability of rice, but realistically also involved politics, since RSM would likely displace corn-soy-milk in the PL480 program. During 1984 it was confirmed by WRRC that ground parboiled rice, or ground quick-cooking rice could be substituted for the original extruded rice in the RSM formulation. It was also shown that non-fat dried milk could be omitted, and that a rice-soy beverage was adequate for the perceived market. The RSM story has been picked up by FAO and will be discussed in a position paper at the next International Rice Commission Meeting in 1985.

Publication: Shepherd, A. D., Betschart, A. A., Saunders, R. M., Rokey, G., and Huber, G. Brokens Spark Interest in Rice-Soya Infant Milk. Rice J. May, 16-21 (1981).

2. Stabilized Rice Bran and Edible Oil

Complete operational parameters have been established for stabilizing rice bran, on a commercial scale. A stabilizing unit is presently installed at the PIRMI rice mill in Woodland, and is used for demonstration purposes. Conditions have been established for edible oil recovery and refining. Stabilized bran shows a 20% improvement in feed efficiency compared to raw bran in chick feeding, and shows no difference to raw bran in pig feeding. Status: The U.S. company manufacturing the stabilizing unit (Brady Extruder Corporation, Torrance, CA), has already sold units to Haiti, Surinam, Malaysia, India, Indonesia and New Zealand. In the U.S., one California company is poised to sell stabilized bran as a food ingredient; Riviana in Houston, TX, is already selling bran stabilized by this process as a food ingredient.

Publications:

Enochian, R. V., Saunders, R. M., Schultz, W. G., Beagle, E. C., and Crowley, P. R. Stabilization of Rice Bran with Extrusion Cookers and Recovery of Edible Oil: A Preliminary Analysis of Operational and Financial Feasibility. Marketing Research Report 1120. United States Department of Agriculture (1980).

Randall, J. M., Sayre, R. N., Schultz, W. G., Fong, R. Y., Mossman, A. P., Tribelhorn, R. E., and Saunders, R. M. Rice Bran Stabilization by Extrusion Cooking for Extraction of Edible Oil. J. Food Sci. (1985) In Press.

Saunders, R. M. and Heltved, F. Fluorometric Assay of Lipase in Rice Bran, and its Application to Determination of Conditions for Rice Bran Stabilization. J. Cereal Sci. (1985) In Press.

Saunders, R. M., Sayre, R. N., Kratzer, H., and Calvert, C. Stabilized Rice Bran: Nutritional Qualities. Proc. 19th Rice Technical Working Group Meeting, Arkansas (1982).

Saunders, R. M., and Sayre, R. N. Preparation, Composition and Utilization of Rice Bran Oil and its Potential Exploitation from Stabilized Rice Bran. Proc. Amer. Oil Chemists Soc. Meet. (1984). Awarded Outstanding Paper Presentation.

Sayre, R. N., Saunders, R. M., Enochian, R. V., Schultz, W. G., and Beagle, E. C. Review of Rice Bran Stabilization Systems with Emphasis on Extrusion Cooking. Cereal Foods World 27: 317 (1982).

Sayre, R. N., Schultz, W. G., Fong, R. Y., Randall, J. M., Mossman, A. P., Tribelhorn, R. E., and Saunders, R. M. Rice Bran Stabilization by Extrusion Cooking. Proc. 19th Rice Technical Working Group Meeting, (1982).

3. Rice Germ

Rice germ was thoroughly evaluated for stability, nutritional and functional properties, including consumer appraisal tests of breads, cakes and breakfast cereals containing germ as an ingredient. The study culminated in an award of a M.S. degree by U.C. Berkeley to the principal investigator. Status: Rice germ is superior to wheat bran in composition, and was well received in consumer food tests. Riviana, Houston, TX, is researching how to recover germ from modern rice milling operations. One California company expects to shortly market rice germ products.

Publications:

Fong, R. Y. Rice Germ: Its Potential as a Food. M.S. Thesis, University of California, Berkeley, California, USA (1980).

4. Rice Flour

Numerous studies have been completed on the use of rice flour in baked goods, and in specific applications where rice flour excels, e.g. freeze-thaw situations. The effect of different milling techniques upon rice flour performance is profound and is now documented. Comparisons have been made among California waxy varieties. Status: Several companies now market rice flour mixes for breads and cakes, or market breads and cakes, using WRRC formulations. Large new markets have been established for rice flour by at least one California company.

Publications:

Bean, M. M., Elliston-Hoops, E. A., and Nishita, K. D. Rice Flour Treatments for Cake-Baking Applications. Cereal Chem. 60: 445 (1983).

Bean, M. M., Esser, C. A., and Nishita, K. D. Some Physicochemical and Food Application Characteristics of California Waxy Rice Varieties. Cereal Chem. (1984) In Press.

Bean, M. M., and Nishita, K. D. Rice Flour for Baking Applications for Wheat-Sensitive Diets. Proc. Sixth Intern. Congr. Food Sci. and Technol. (1983).

Nishita, K. D., and Bean, M. M. Physicochemical Properties of Rice in Relation to Rice Bread. Cereal Chem. 56: 185 (1979).

Nishita, K. D., and Bean, M. M. Grinding Methods: Their Impacts on Rice Flour Properties. Cereal Chem. 59:46 (1982).

Nishita, K. D., Roberts, R. L., Bean, M. M., and Kennedy, B. M. Development of a Yeast-Leavened Rice Bread Formula. Cereal Chem. 53: 626 (1976).

5. Reduction of Stickiness in California Rices

Several processes have been developed to reduce stickiness in short- and medium grain rices. However, all processes cause minor changes in other rice qualities such as color and texture. Status: Not adopted by industry, although indirectly, parched rice produced by one California rice company has inherently reduced stickiness.

Publications:

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).

Fellers, D. A., Mossman, A. P., and Suzuki, H. Rice Stickiness. II. Application of an Instron Method to Make Varietal Comparisons and to Study Modification of Milled Rice by Hot-Air Treatment. Cereal Chem. 60: 292 (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).

6. High-Protein Rice Flour

Laboratory and pilot-plant scale experiments have been conducted to convert rice (or brokens or flour) to a high-protein (25%) rice flour and sugar sirup. This is achieved through partial conversion of the starch to maltose using enzymatic means. The high-protein rice flour is envisioned as having immediate use as an infant food, both domestically and internationally, while the sugar sirup can be used as a sweetener, or as a substrate for yeast cultivation. Work on these uses of the sugar sirup have been completed. Status: Mead-Johnson continue to show active interest in this process, but to our knowledge have not yet adopted it.

Publications:

Hansen, L. P. The Potential of High-Protein Rice Flour and its Byproducts to Increase the Nutritional Well-Being of Young Children in Rice-Eating Countries. Proc. Sixth Intern. Congr. Food Sci. and Technol. Vol. 3. Human Nutrition (1983).

Hansen, L. P., and You, G. A Biological Evaluation of High-Protein Rice Flour for Infants and Young Children. Nutrition Reports International 26:1087 (1982).

Hansen, L. P., Hosek, R., Callan, M., and Jones, F. T. The Development of High-Protein Rice Flour for Early Childhood Feeding. Food Technol. (November, 1981) pp 38-42.

7. Other WRRC rice work (Summary)

Dietary fiber content of a range of rice materials has been determined. The high level in bran is helping to promote food sales of the stabilized bran. Some of the specific dietary effects of rice components have been investigated.

The preparation and potential use of rice bran protein concentrates in foods has been described, including preparation of whey-rice bran protein mixes.

Utilization and properties of rice in the tropics has been described.

Rice postharvest losses and how to combat them in developing countries have been described.

Publications:

Mod, R. R., Ory, R. L., Morris, N. M., Normand, F. L., Saunders, R. M., and Gumbmann, M. R. Effect of rice hemicellulose and α-cellulose on selected minerals in blood and feces of rats. J. Cereal Sci. (1984) In Press.

Mossman, A. P. Rice in the Tropics. In Handbook of Tropical Foods (ed. Chan) M. Dekker, New York (1983).

Normand, F. L., Ory, R. L., Mod, R. R., Saunders, R. M., and Gumbmann, M. R. Influences of rice hemicellulose and α-cellulose on lipids and water content of rat feces and on blood lipids. J. Cereal Sci. 2: 37 (1984).

Saunders, R. M. Cereal Byproducts: Wheat and Rice. In Handbook of Nutritional Supplements Vol. I. Human Use (ed. Recheigl, Jr.) CRC Press, Boca Raton, FL. (1983) pp 253-262.

Saunders, R. M., and Betschart, A. A. Rice and Rice Foods: Chemistry and Nutrition. In Tropical Foods: Chemistry and Nutrition Vol. I. (ed. Inglett and Charalambous). Academic Press, New York (1979) pp 191-216.

Saunders, R. M., Hautala, E., and Elliston, E. A. The measurement of dietary fiber and its components. Proc. IFT Meeting, (1980).

Saunders, R. M., and Kohler, G. O. Preparation of Protein Concentrates from Whey and Seed Proteins. U.S. Patents 4,204,008 and 4,225,629 (1980).

Saunders, R. M., Mossman, A. P., Wasserman, T., and Beagle, E. C. Rice Postharvest Losses in Developing Countries. U.S. Department of Agriculture. Agric. Reviews and Manuals, ARM-W-12 (1980). 224 pp.