

WESTERN REGIONAL RESEARCH CENTER

COMPREHENSIVE RESEARCH ON RICE

ANNUAL REPORT

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PROJECT TITLE: Rice Utilization and Product Development RU-2

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PROPOSAL OBJECTIVE: To carry our research work on California short, medium and long grain rices that ultimately will lead to new products for domestic and foreign markets.

RESEARCH OBJECTIVES

1. Rice Foods
2. Rice Flour
3. Rice Milling
4. Rice Germ

SUMMARY OF CURRENT YEAR'S WORK

1. Rice Foods. Rice can be utilized as a basic ingredient of high quality foods for preschool children and lactating females. The potential of finely ground gelatinized white rice in protein-enriched food blends has been examined in rice-soy-milk blend (RSM). Blends of cooker-extruded rice (prepared from secondheads or broken), defatted soy flour, non-fat dry milk, oil, vitamins,

and minerals, have been prepared as shown in the table below. Each one of these blends meets U.S. Government quality requirements for nutrient content and dispersing properties in water. Tentative specifications for RSM have been prepared by WRRC and submitted to FGIS, USDA, AID, etc., as well as commercial operators such as ADM. Cost estimates have also been prepared. At the present time, 300 pounds of RSM in 1 lb. packages are being held in the Food for Peace office, U.S. State Department, Washington. It is anticipated that this material will undergo initial consumer acceptance test in 300 foreign locations.

RICE-SOY-MILK BLEND FORMULATIONS

Ingredient

Rice	63.0	61.1	59.2	57.3
Soy	23.7	20.6	17.5	14.4
NFDM	5.0	10.0	15.0	20.0
Oil	5.5	5.5	5.5	5.5
Vitamins	2.7	2.7	2.7	2.7
Minerals	0.1	0.1	0.1	0.1

2. Rice Flour. It has been clearly established that the type of mill used to convert rice into rice flour has a profound effect upon particle size distribution, water absorption, behavior of slurries during retorting/cooling, and rice baking properties. Flour from short and medium grain rices outperforms long grain flour in rice breads where rice is the major ingredient.
3. Rice Milling. The current energy problem and the desire for high yields of total and head rice are important economic factors in the production of milled white rice for direct food use. Work at WRRC has demonstrated that the use of additives, notably water, during milling showed reductions in milling time and energy requirements, and increases in total and head rice yields. With the cooperation of a California mill(s) WRRC will confirm these observations on commercial equipment. Commercial size rice mills have been ordered (federal funds) from India, Japan, and Great Britain as part of this work.

A laboratory test mill has been developed with the capability to decorticate short, medium and long grain rice. It was found that when other conditions were fixed, sample size affected the degree

of decortication, which varied from about 24% at 5 g to about 11% at 30 g. When the degree of decortication was fixed at about 10% (by altering time only), use of a coarser abrasive surface reduced grain breakage by one-half (from about 4% to 2%). The influence of the number of impeller blades and the speed of rotation are currently being studied in similar fashion.

The mill has been found useful for providing a sequence of grain samples of increasing degrees of decortication. Samples could be stained with a mixture of methylene blue and eosin. Colored photomicrographs (prints about 8x magnification) of stained and unstained grain allowed one to follow the mechanism of decortication. The mill has been used in attempts toward a standardized milling test for breeders samples. Future cooperation with two California rice milling organizations is expected to bring the laboratory decorticating mill into greater use on rice. The extent of worldwide interest in this equipment continues to be ascertained.

4. Rice Germ. During milling to produce white rice, the germ is removed from the kernel, either intact or in fragments, along with the bran, and like the bran, is destined for the feed lot. Rice germ, by virtue of its favorable content of essential lipids, good quality protein, vitamins and carbohydrate, holds promise as a useful food. Subjective preliminary examination of the material suggested in addition an auspicious degree of storage stability, at least in the temperate U.S. The effects of storage of rice germ at refrigerated and ambient temperatures (2°C. and 20-25°C., -29°C. control) and under high temperature, high moisture conditions (37°C., 15-17% H₂O) on odor development and nutritional quality (peroxide value, titratable acidity, fatty acid profile, protein digestibility, reactive lysine, starch, total and reducing sugars, and thiamin) were tested. Additional measurements included proximate composition, amino acid pattern, riboflavin, niacin, minerals and trypsin inhibitors. Data accumulated thus far indicate no changes in odor, lipids, starch, or sugars after three months of storage at ambient or refrigerated temperatures. High temperature, high moisture storage, in contrast, provoked increases in titratable acidity and reducing sugars, development of sour odor, and finally visible microbial triumph. Germ added to cookie and muffin recipes has been met informally with approval.

PUBLICATIONS

- Laboratory decortivating mill for small grains. A.D. Shepherd.
Accepted for publication in Cereal Chem. (1979).
- Physico-chemical properties of rice in relation to rice bread.
K.D. Nishita and M.M. Bean. Cereal Chem. 56/3, 185-189. (1979).
- Rice and rice foods: chemistry and nutrition. R.M. Saunders and
A.A. Betschart. In Tropical Foods: Chemistry and Nutrition,
Vol. 1. G.E. Inglett and G. Charalambous, ed. Academic Press,
New York. pp. 191-216. (1979).
- Long, medium and short grain rices: enzyme activities and physical
properties. K. Lorenz, R.Y. Fong, A.P. Mossman, and R.M. Saunders.
Cereal Chem. 55/6, 830-841. (1978)
- Nutritional evaluation of rice bran and rice bran fractions using rat
and chick bioassays. A.A. Betschart, R.M. Saunders,
M.R. Gumbmann, and F.H. Kratzer. Presented at the Joint Meeting
of the American Oil Chemists Society and the Japan Oil Chemists
Society, San Francisco, California, U.S.A. April 29-May 3.
J. Am. Oil Chem. Soc. 56, 194A-195A. (Abstract) (1979).

CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

1. A rice-soy-milk blended food targeted for preschoolers and lactating women in developing countries is now in the hands of Food For Peace, USAID, State Department for initial consumer testing.
2. Different milling techniques produce rice flours of markedly different properties in food applications. Efforts to capitalize upon this phenomenon are underway.
3. Rice mills which include innovative design modifications have been ordered from India and Japan. A test-mill capable of milling as few as 16 rice grains has been developed.
4. Storage stability, nutritive value and preliminary food applications have been carried out favorably on rice germ.
5. Other work at WRRRC includes: parboiling with lower energy input; quick-cooking rices from short and medium white and brown rices; rice bran stabilization and recovery of edible oil; correlation of enzyme content of white rice and cooking quality.