PROJECT NO. RD-1

COMPREHENSIVE RESEARCH ON RICE
ANNUAL REPORT
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PROJECT TITLE:

New Approaches and Energy Savings in Drying of California Smooth and Rough Hulled Rice Varieties

PROJECT LEADER AND PRINCIPAL UC INVESTIGATORS

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OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH OBJECTIVES:

1) To increase the energy efficiency of rice dryers by: a) partial reuse of exit air, and b) the use of other dryer configurations such as concurrent flow, countercurrent flow, etc.
2) To determine the optimum time in terms of moisture content of rice when it is most economical to transfer rice from a column dryer to a deep-bed dryer. The study will include energy costs and head quality.
3) To develop computer-aided simulations of rice drying for evaluating the dryer performance in terms of energy efficiency, rice quality, and increased capacity.

All research was conducted at the Department of Agricultural Engineering, UC, Davis.

SUMMARY OF 1979 RESEARCH BY OBJECTIVES:

Since the project was not funded at the requested level, the objectives presented in the proposal were only partially accomplished. Research emphasis was placed on examining moisture movement inside rice grain. This basic study was designed to provide information on drying rates of California grown rice and examine tempering process. This research allowed determination of moisture diffusivity in the rice hull, bran layer and starchy endosperm. It was found that the rice hull provides the maximum resistance to moisture movement. Results indicate that temperature and drying time (or degree of moisture removal during drying) have the greatest effect on tempering time. Initial grain moisture content and the relative humidity of the drying air have a minimal effect in comparison to the above variables. In the multi-pass drying of rough rice, the degree of tempering between passes will affect the final moisture content of the grain. Tempering times currently used in commercial rough rice drying may be much longer than necessary. In simulation studies, for temperatures ranging from 35 to 55°C and other typical drying conditions, tempering was 95 percent complete in less than two hours and fully complete in less than five hours.

A new drying system, namely spouted-bed drying, was examined for drying rough rice. This research was made possible by a private manufacturer who has loaned the unit for experimental trials. The preliminary results indicate a major-fold improvement in reducing the drying time when compared to conventional cross-flow dryers. In addition, this drying system allows uniform drying time, thus significantly reducing milling quality loss during the drying operations.

PUBLICATIONS:

Zuritz, C., R. P. Singh, S. M. Moini, and S. M. Henderson. 1979. Desorption isotherms of rough rice from 10°C to 40°C. Trans. of the ASAE 22(2):433-436, 440.

Morita, T., and R. P. Singh. 1979. Physical and thermal properties of short-grain rough rice. Trans. of the ASAE 22(3):630-635.

Wang, C. Y., and R. P. Singh. 1978. Use of various equilibrium moisture content in modeling rice drying. Paper presented at the Amer. Soc. of Agric. Engrs. meeting at Chicago, IL. Paper No. 78-6505, 19 pages, including 6 figures and 1 table.

Steffe, J. F., and R. P. Singh. 1979. Diffusivity of starchy endosperm and bran of fresh and rewetted rice. Paper presented at the 39th Annual Meeting of the Inst. of Food Technologiests, St. Louis, MO. 24 pages, including 4 tables and 3 figures.

Wang, C. Y., T. R. Rumsey, and R. P. Singh. 1979. Convective heat transfer coefficient in a packed bed of rice. Paper presented at Amer. Soc. of Agric. Engrs. meeting, Winnipeg, Canada. Paper No. 79-3040, 14 pages, including 5 figures.

Steffe, J. F., and R. P. Singh. 1979. Liquid diffusivity of rough rice components. Paper presented at Amer. Soc. of Agric. Engrs., Winnipeg, Canada. Paper No. 79-6005, 29 pages, including 3 figures and 3 tables.

CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

Research has revealed basic information on moisture movement inside rice grain. This information is useful in determining optimum tempering period. A new drying system is being investigated to allow uniform drying of rice at high rates of moisture removal.