

COMPREHENSIVE RESEARCH ON RICE
ANNUAL REPORT
January 1, 1976 - December 31, 1976

- I. PROJECT NUMBER ACCORDING TO PROGRAM AREA:
RD-1 Rice Drying and Storage
- II. PROJECT LEADER AND PRINCIPAL UC INVESTIGATORS:
R. Paul Singh, Assistant Professor of Food Engineering, Department of Agricultural Engineering, University of California, Davis.
- III. LEVEL OF 1976 FUNDING: \$21,000 + \$8,500 = \$29,500
- IV. OBJECTIVES ACCORDING TO 1976 PROPOSALS AND EXPERIMENTS BY LOCATION CONDUCTED TO ACCOMPLISH THESE OBJECTIVES:
- Objective I. To increase the energy efficiency of rice dryers by: a) partial re-use of exit air, and b) the use of other dryer configurations such as concurrent flow, counter-current flow, etc.
1. Equipment design and construction - UC Davis.
- Objective II. 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.
1. Experiments conducted in Escalon, Stockton.
 2. Equipment construction - UC Davis.
- Objective III. To develop computer-aided simulations of rice dryers for evaluating the dryer performance in terms of energy efficiency, rice quality, and increased capacity.
1. Preliminary simulations conducted at UC Davis.
 2. Equipment construction and experiments on thin layer drying models of rice - UC Davis.
- V. SUMMARY OF CURRENT YEAR'S WORK (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:
- Objective I. A major accomplishment during 1976 was the design, construction and installation of an experimental rice dryer in the Food Engineering Laboratory, 1308 Bainer Hall, UC Davis. The dryer, as shown in Figure 1, is built with the type of flexibility needed to study various air-grain flow configurations such as, cross-flow, concurrent flow and counter-current flow. The dryer consists of three modules each 4' high. The column width within the modules can be easily adjusted to 5", 8" and 11" width. Each module contains 15 probes with platinum-resistance thermometers to allow precise temperature measurements at desired depths in the column. The grain flow can be easily adjusted to a pre-determined rate. The modules also provide the unique capability of using exit air from one module as inlet air to other modules. This feature will aid in evaluating the

re-use of exit air in improving energy efficiencies. At the time of this writing the exhaust systems are being connected to the main vent in the laboratory. The dryer will be then fully insulated to allow accurate energy analysis measurements. It is anticipated that preliminary experimental trials with high moisture rice (stored at low-temperatures in sealed bags) will be conducted in late December and early January 1977. Extensive trials are anticipated during the rice harvest season 1977.

It may be noted that the temperature and humidity data from 45 different locations in the dryer will be monitored, analyzed and plotted by an Advanced Data Acquisition System (Hewlett-Packard 3050B system). This mini-computer will assist in rapid data analysis, thus saving precious time during the rice harvest season.

Objective II. This objective will be fully accomplished during the next two years of the project. As an additional project, detailed energy analyses were conducted on a counter-current semi-continuous rice dryer (Shivver's Dryer). This project was separately funded by the dryer manufacturer. Extensive field tests were conducted to obtain necessary information. The data are currently being analyzed. A preliminary report will be available by February 1977. This study should assist the California rice growers in getting an evaluation of energy and quality aspects of the Shivver's Dryer.

Objective III. One of the major requirements in computer modelling is reliable thin layer drying equations for rough rice. Such equations are currently unavailable. The RRB funded additional monies to help purchase an environmental simulation equipment. On acquiring this equipment appropriate chambers to allow triplicate samples exposed to same conditions were designed and constructed. The rice samples in single layers are being exposed to different air conditions. The weight changes are determined with load cells allowing accurate weight measurements. These tests are currently being conducted and thin-layer drying equation for California grown rice varieties will be determined during 1977.

Rice Storage Research

During 1976, a private manufacturer was approached to investigate potential for modified atmosphere storage of rice. This type of storage, if successful, could have far reaching impact on rice drying and storage technology in California and then rice growing areas around the world. Food Storage Systems, Inc., has loaned \$15,000 worth of equipment to the Food Engineering Laboratory to store rice in chambers under modified atmospheres. Rice with high infestations of Sitophilus oryzae and Rhyzopertha dominica is stored under different storage conditions. Periodic measurements are being conducted, currently, to obtain preliminary information on the prospects of modified atmosphere storage of rice.

VI. PUBLICATIONS OR REPORTS: None

VII. CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

An experimental pilot-scale rice dryer was designed, constructed and installed in the Food Engineering Laboratory, University of California,

Davis. The dryer will be used to study methods to reduce energy use and improve head quality of rice dried in columnar dryers. Comprehensive studies are planned during the second and third years of the project (1977 and 1978).

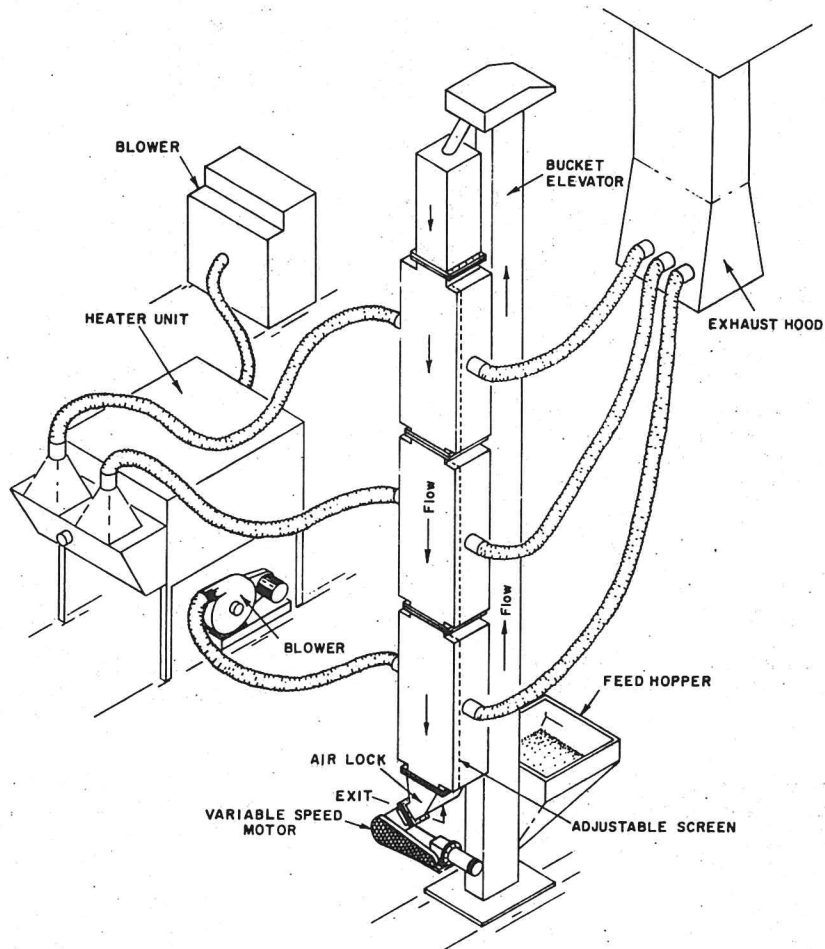


Figure 1. An experimental rice dryer installed in Food Engineering Laboratory, UC Davis.