

COMPREHENSIVE RESEARCH ON RICE

PROGRAM AREA Rice Production, Processing and Marketing

PROJECT NUMBER & TITLE Systems Analysis and Optimization #69-16* & 69-18

PROJECT LEADER W. J. Chancellor

PERSONNEL Dr. Don Seaman (Biggs), Mr. V. Cervinka

OBJECTIVES

The objectives are to cooperate with all other rice research workers in devising improved rice management systems which will reduce production costs, attain maximum yields and will consist of practices designed to fit together with a minimum of scheduling conflicts.

Specific objectives are:

- 1) To construct models of rice production systems so that pre-research analyses may be made of these systems to test the value and workability of various specialized research objectives;

- 2) To undertake agronomic research aimed at development of advanced field production systems - starting with programs coordinating all factors in crop establishment and weed and pest control;

- 3) To construct models of basic systems of management alternatives facing rice growers, and to present the results in such a way that an individual grower may be able to use these models in selecting optimum management alternatives for rice production subsystems on his land.

WORK IN PROGRESS

Questionnaires were sent to rice growers to obtain basic input information on land holdings crop distribution, labor available, equipment inventories, crop production scheduling dates, and equipment performance. Responses to these questionnaires are presently being evaluated.

A computerized system for modeling the scheduling of equipment operations for crop production has been developed and survey information is being adapted to this modeling system. The system is also being tested for physical compliance with and representativeness of actual grower operations.

* This report represents only the portion of this project carried on by the Agricultural Engineering Department. That done by the Department of Agronomy and Range Science will be reported separately.

EXPERIMENTS COMPLETED

The three surveys completed are:

- 1) Land holding, crop distribution, labor force and equipment inventory;
- 2) Crop production operation scheduling experience for Rice, Safflower and Sorghum;
- 3) Daily records of combine performance.

Mailed questionnaire surveys were supplemented by interviews with rice growers, cooperative managers, extension personnel, research personnel and equipment dealers.

Weather information was collected and a table of most probable levels of available daytime tractor field hours per week for each week of the year was formulated for conditions at Davis and those at Chico.

The application of PERT or CPM to farming operations of rice producers was attempted. It was found that the advantages of these systems analysis techniques could not be fully realized in this case because apportioning decisions based on biological conditions could not be appropriately modeled.

A system of nomographs was developed which would allow rice growers to quickly ascertain appropriate equipment size and performance - factors required in machinery selection decisions.

A computerized flow chart method was developed for modeling equipment management alternatives.

A prototype equipment performance monitoring system was developed. Such a system would permit equipment operators with only basic skills, to optimize the performance of the very expensive tractor or combine units now in use in rice production.

WORK PLANNED

Cost data is to be collected to accompany the physical parameters now used in the computerized flow chart for rice production scheduling.

The computerized model is to be exploited in a search for potential changes in management procedures which would result in reduced costs.

The computerized model is to be further exploited to evaluate research ideas in terms of physical feasibility and of economic advantages.

Further information from the field is to be sought on:

- 1) Rotary tillers in soil preparation;
- 2) Ground applications of fertilizer, seed and chemicals - possibly in combination;

3) Specific details of air, water and soil temperature limitations on dates for rice planting;

4) Relationships between date of planting, date of maturity and yield.

Attempts will be made to formulate a computerized weather simulation generator.

MAJOR ACCOMPLISHMENTS

- 1) The initiation of a data bank for rice production systems information
- 2) The formulation of the nomograph system for equipment selection and scheduling
- 3) The formulation of the computerized flow chart model of rice grower operations
- 4) The development of a prototype equipment performance optimization monitoring system
- 5) The finding that rice production requires a much greater equipment power inventory per acre than do other companion crops - indicating that equipment costs are a major factor in high production costs for rice.

EVALUATION OF PROJECT

Although the project has just gotten underway, there are already indications of several specific areas in which research information might most quickly help rice growers in reducing production costs. The initial phases of the project have been concerned mostly with development of the tools necessary for the main job of modeled investigations of research ideas and cost saving procedures. It is planned that the efforts will tend to shift toward emphasis on the job rather than on the tools as time progresses.

PUBLICATIONS OR REPORTS

Manuscript entitled "Monitoring System for Equipment Performance" by V. Cervinka and W. J. Chancellor submitted to Agricultural Engineering.

Progress report on "Agricultural Engineering Activities in Rice Production Systems Analysis" by V. Cervinka and W. J. Chancellor - in preparation, Agricultural Engineering Department, University of California, Davis.