

8060 Lincmar  
# 6477 Oregon burner

1970-71 Report  
COMPREHENSIVE RESEARCH ON RICE  
December 30, 1971

PROGRAM AREA Engineering

PROJECT NUMBER & TITLE 70-20 Combustive Disposal of Rice Straw and Stubble

PROJECT LEADERS George E. Miller, Extension Engineer, UCD

John F. Williams, Farm Advisor, Sutter County

John R. Goss, Department of Agricultural Engineering, UCD

PERSONNEL Jim Thompson, Staff Member, Department of Agricultural Engineering

<u>Al Arkush,</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>
<u>Gerry Weigt,</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>
<u>Paul Christensen,</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>
<u>Reed Borgwardt,</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>
<u>Jim Schubert,</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>
<u>Lowell Jahn,</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>

Note: Work done under RM-8 in the Fall of 1971 is also included in this report.

OBJECTIVES

1. Continue studies of the effects of management of straw and fire, and micro-meteorology on particulate emissions from the combustive disposal of field residues.
2. Initiate studies on the mechanical and economic feasibility of mobile incineration of rice field residues.

WORK IN PROGRESS

Open Field Burning

Data has been collected on 36 open field burns during the Summer and Fall of 1971. Six of these were in wheat field residues and 30 were in rice field residues. The wheat field burns were made to obtain preliminary data on comparisons of front and backfire burns, and to test new instrumentation for monitoring rice field burns. Analysis of the wheat field burns is essentially complete and results indicate a trend toward reduced particulate production on backfire burns, under the conditions tested. The rice field data is still being reduced. When data reduction is completed it will be analyzed together with the 1970 field trial data. Because

of the large number of variables in environmental and field conditions, many tests must be conducted to obtain sufficient data for statistical analysis. As additional data is accumulated computer analysis becomes more appropriate and practical in this study.

Preliminary analysis and observations indicate that meteorological conditions generally have relatively little effect on particulate production, except possibly as they affect other factors such as straw moisture content. Meteorological conditions and straw moisture contents varied little in the 1970 trials. Because of the overall precision of the monitoring system, small differences in individual factors did not produce an effect large enough to show significant changes in particulate production. Some of the 1971 trials were designed to produce sufficient differences in moisture content of the straw to ascertain the effect of moisture content on particulate production. This data is being reduced for analysis.

#### Mobile Incinerator Trials

The Oregon State mobile field sanitizer was brought to California and tested on the Roy Osterli Ranch. The first tests were conducted as it had been set up for grass seed straw combustion in the Willamette Valley. Front wheel surfaces were increased and modifications on the screen grate were made after preliminary trials pointed up some special problems inherent in the disposal of rice straw that had not been as much of a factor in the grass seed straw. Further tests were run and emission data was collected to ascertain the reduction in emissions that could be expected through the use of the field sanitizer. This data is being reduced for analysis.

At the close of testing late in November 1971, the field speed of the unit was about 3/4 of a mile per hour, with some short-term speeds up to about 1 mile per hour on a straw row from a 17-foot swath. This does not appear to be a practical speed. The unit will remain in California until after the Spring 1972 open field burn period. Modifications are being considered to increase the speed. Spring 1972 trials are planned for further testing, weather and soil conditions permitting.

Another unit developed by Ben Thompson of Yuba City, California, was given a brief field trial and is currently being modified. This unit utilizes the return stack principle similar to approved orchard heaters and some wigwam sawdust burner modifications.

Both units had problems with after-fires and required substantial fire fighting equipment and crews to keep up with the problem. It is apparent at this point that more work will be required before an adequate production unit will be available for rice straw disposal. Preliminary indications show a substantial reduction in particulate production under the controlled combustion conditions. Cost, manpower requirements, mobility under varying field conditions, and durability are still not known at this time.

### WORK PLANNED

Further testing is planned of open field burning and the mobile field burner-sanitizers during the Spring of 1972. Substantial work is still required before recommendations can be made. It does not now appear that one solution can be developed to satisfy all needs.

### MAJOR ACCOMPLISHMENTS

Data collections of particulates have been made from open field burns under three different straw management practices and two different fire management systems. Analysis of this data and that from the previous year is expected to provide direction for further testing and even more important to give direction for larger scale trials for 1972.

Field flaming trials, simulating the field sanitizer operation, have indicated a substantial reduction in the quantity of viable seed (watergrass, etc.) on the soil surface after flaming as compared with before flaming. Obtaining the cooperative help of the Oregon State University team and use of their field sanitizing unit resulted in a very low cost approach for investigating the value of this method of disposal. The cooperative assistance received has been highly beneficial.

### IMMEDIATELY APPLICABLE RESEARCH RESULTS

Preliminary trends based on averages of the limited number of 1970 burns monitored indicate:

1. Spread straw produces less particulate matter per ton of fuel burned than front fire burned straw rows.
2. When front firing, raked straw rows produce less particulate matter than did unraked straw rows or spread straw per ton of fuel burned.

Preliminary trends based on three front fire and three backfire burns on spread dry wheat straw and stubble in 1971 indicate reduced particulate matter produced in backfire burns per ton of fuel. While these results were not conclusive, they provided guidance for the 1971 trials and future trials. The economic aspects and practical application of these procedures, if the trends prove valid as trials continue, will be a further consideration. It does appear, however, that based on time and manpower required, backfiring or raking straw would be substantially less than incorporation or mobile incineration. At this point a first step seems to favor spreading the straw with the standard attachment available for all harvesters. Two potential advantages are: 1) it would reduce particulate production, and 2) the possibility of a more thorough effect on the control of stem rot. However,

backfire burns in low quantity, medium moisture content (15-20%) rice straw resulted in a fire that did not maintain itself. Thus, there are likely to be conditions when backfiring would not be at all practical. Maintaining a backfire was not a problem in straw rows or raked straw rows, nor did it present any problems in the spread wheat straw. The reduction of particulates from backfiring straw rows may be similar to the reductions in front firing of spread straw over that of front firing straw rows. Further analysis of the 1971 data is needed before firm conclusions can be drawn.

#### EVALUATION OF THE PROJECT

As of this date the project is on schedule, and results while not conclusive are encouraging. Two of the original objectives have been put aside temporarily. These are the study of collection and burning of straw in stacks, and the smoke particle precipitation. The cost studies for moving the straw out of the field for burning in stacks indicated that this method would be in a cost range comparable with baling and roadsiding. Adding the cost of burning and air supply equipment and burning site places a low priority on this study at this time. With a budget reduction in project funds this item was delayed for the present. The smoke particle precipitation study was delayed because the equipment industry proponent of this technique has not made equipment available for trials and the reduced project funding.

#### PUBLICATIONS OR REPORTS

Insufficient data has been collected and analyzed to prepare written publications. Oral progress reports have been made at the Farm Machinery Conference and Rice Research Review held in January, 1971, at one rice growers research progress report meeting, and the 1971 summer meeting of the American Society of Agricultural Engineers. One silent film has been produced on the management and measurement techniques for open field burning and a number of slides and additional movie footage have been taken of these operations and that of the mobile field sanitizer in operation.