

Annual Report
Comprehensive Research on Rice
January 1, 1992 - December 31, 1992

Project title: Development of procedures for evaluating the effectiveness of rice straw incorporation methods in achieving residue incorporation and decomposition

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Level of Funding: \$19,000

Objectives:

1. to develop a sampling and test procedure by which the effectiveness of various rice straw incorporation methods can be determined and compared.
2. to develop physical methods to quantify the extent of straw decomposition achieved with various straw incorporation procedures.

Experimental Procedures:

Visits were made to several sites in Butte, Colusa and Sutter counties, with the assistance of Dr. Pettygrove, and Farm Advisors Steve Scardacci, Carl Wick, and Jack Williams. A range of straw incorporation methods were observed. Two plots in Sutter county were chosen as sites for data collection. The plots were on adjacent farms along Pleasant Grove road. A frame, made by welding together four pieces of 1 inch by 1 inch steel angle iron, provided a nominal 4 ft. by 4 ft. square section that was used to define the sample areas. The angle iron frame was carried the length of the basin and dropped at random locations, 10 sample locations per traverse. At each location, straw residue from within the frame boundary was collected into polyethylene bags. Then, the stubble was cut at soil level with shears and collected into another bag. After incorporation, surface residue samples were collected, using a shear to remove straw and stubble which was either lying loose on the surface or projecting from the soil surface. All residue samples were returned to the Department and spread in loose piles inside the building to dry. Moisture percentage was determined by oven drying of subsamples, the dried samples were weighed, and the residue weight was adjusted to a common reporting level of 12% for all samples.

The above procedures were followed for both plots. In plot 1, the straw was chopped on the combine and spread as it exited the chopper. The residue was stubble disked once or twice, with residue samples collected from both treatments. In plot 2, the straw was spread by the combine without chopping. A field disk in tandem with a set of smooth steel cylindrical rollers provided some initial mixing and soil packing. Then, the plot was moldboard plowed at a depth 8 - 13 inches. Finally, the plot was field disked, with a spike toothed harrow pulled behind.

Initial observations of rice harvesting operations suggested that the straw discharged from a combine mounted straw chopper might not be uniformly distributed. A piece of irrigation pipe 19

ft long was used as a core to roll up a canvas sheet, 18 ft by 19 ft. This sheet could be easily unwound behind the combine to collect straw residue. The sheet width was marked off into four sections, each approximately 4.5 ft in width. Straw residue in each of the four sections was removed, bagged, dried and weighed, to obtain a measure of straw distribution uniformity across the swath width of the combine.

A method of measuring straw tensile strength is being developed, as a means of characterizing the extent of straw decomposition over time. The straw stalks are very difficult to grip in the tension testing machine without being damaged. One method which appears to have some merit is the use of epoxy to bond the ends of the stalk specimens to wood blocks, after lightly abrading the stalk ends with a fine grit emery cloth.

Results:

The project was intended to be carried out over a period of 6-8 months, spanning the period from harvest through the following winter. It will be completed in late winter / early spring 1993. Thus this report is preliminary and covers those activities conducted through November.

The residue data from the experiment have not been fully analyzed. However, mean computed residue (straw plus stubble) weights per acre have been calculated for the various treatments and are presented in Table 1 and Table 2, for plots 1 and 2 respectively. Some general trends are apparent. In the stubble disked plot (1), it was obvious that the straw distribution behind the combine was not uniform across the combine width, but was concentrated with a narrow but distinct "windrow" evident. These "windrows" were still apparent after stubble disking. Residue samples were collected from light sections and from heavy sections. The amount of unincorporated residue was much higher for the heavy sections (3061 lbs / acre) as compared to the light sections (1498 lbs / acre). The samples collected after a single stubble disking produced an average surface residue of 2587 lbs / acre. The second stubble disking did not produce a substantial improvement over that obtained with one stubble disking. Overall, incorporation by stubble disking was about 75% effective. Comparison of the results from stubble disking with those from moldboard plowing show that the residue left after plowing was very low, and approximately 90% of the residue was incorporated.

The results of measuring straw distribution behind a combine (with attached straw chopper) are shown in Table 3. The right section (adjacent to the standing grain crop) was loaded with substantially greater amount of straw than any of the other three sections, and those three sections were rather uniformly loaded. The distribution of the straw is a function of how the discharge vanes of the chopper are adjusted, and is therefore under the control of the combine operator. In this case, the high loading rate for one side of the machine resulted in a definite "windrow" effect that was still evident after straw incorporation by stubble disking twice.

Summary of current year's results:

A surface residue sampling method was tested for two straw incorporation methods, stubble disking and moldboard plowing. The sampling method showed substantial surface residue differences between the two incorporation methods, with plowing resulting in very high incorporation.

Table 1. Computed residue weights, lbs / acre, for plot 1 treatments.

Before incorporation			After incorporation		
stubble	straw	total	disked once	disked twice light	heavy
5410	2850	8260	2587	1498	3061

Table 2. Computed residue weights, lbs / acre, for plot 2 treatments.

Before incorporation			After incorporation	
Stubble	Straw	Total	plowing	plowing and disking
4259	2581	6840	370	478

Table 3. Straw distribution behind combine with integral straw chopper, lbs / acre.

Section	
left	5185
mid left	6076
mid right	5240
right	9058