

Program Area: Comprehensive Research on Rice

Project Title and Number: RM-7 Rice Residue Management by Soil Incorporation

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Objectives:

1. To evaluate several methods of residue management under field conditions.
2. To determine environmental factors which affect rice residue decomposition by microorganisms and to measure decomposition rates under variable conditions of moisture, temperature, and nutrient status.
3. To measure effects of various residue management practices on soil properties and crop yields.

Work in Progress:

None. The project has been completed with the analysis of 1974 crop harvest data.

Experiments Completed:

Six different residue management practices have been compared in field plots at two locations. These compared the effects of grain yield of rice with straw incorporation with different tillage implements as compared to the traditional practice of burning. Four nitrogen fertilizer levels are superimposed on the tillage treatments. Also compared at the UCD Rice Research Center were the effects of chopping the straw versus spreading unchopped straw. Yield data from three years of cropping have been obtained at the UCD site and from 4 years of cropping at Landing Farms in Yolo County.

Field and laboratory experiments on the influence of moisture, temperature, drying and rewetting, addition of nitrogen, phosphorus and sulfur on decomposition of rice straw have been concluded.

Work Planned:

None.

Major Accomplishments:

Different residue management practices have been compared at the Davis Rice Center for three years and at Landing Farms for four years. In terms of grain yield none of the tillage treatments differed significantly from the burned plots at the UCD site in any of the three years of cropping. At Landing Farms statistical differences due to tillage treatments were found in only one of the four years of cropping. In that year, 1972, only fall plowing produced lower yields than burning and the highest yield was obtained with the least tillage, which was a light discing to insure soil contact with the straw. The overall picture for the four year period showed no statistical differences due to tillage treatment. These results are summarized in Table I.

TABLE I

Effect of Tillage Practices on Rice Yields at Two Locations

| Tillage Treatment  | UCD site<br>3 years<br>tons grain/acre | Landing Farms<br>4 years |
|--------------------|--|--------------------------|
| Burn and fall disc | 7.59                                   | 11.08                    |
| Fall disc          | 7.70                                   | 10.86                    |
| Fall rotovate      | 7.26                                   | 11.06                    |
| Fall plow          | 7.47                                   | 11.19                    |
| Soil contact       | 7.64                                   | 11.07                    |
| Spring disc        | --                                     | 10.76                    |

As in previous years, an increase in grain yield was produced by adding nitrogen fertilizer at Landing Farms but no increase in yield was observed beyond 40 lbs. nitrogen per acre.

Experiments on straw placement have demonstrated that incorporated straw decomposed more rapidly than straw left on the surface and that chopping or shredding did not increase rate of decomposition in the soil. The rate and extent of straw decomposition were found to increase and the lag period for initiation of decomposition to decrease with increasing relative humidity and temperature. The threshold moisture content for rice straw was found to be in the neighborhood of 7.5%.

Immediately Applicable Research Results:

It has been demonstrated conclusively that in an area where stem rot disease is not a major consideration, the degree of incorporation has little effect on yield of rice grain. Accordingly, several alternatives to burning of rice straw are available including very little fall tillage. The important consideration is to get the straw in contact with the soil. In view of the fact that very little tillage is sufficient to permit decomposition to proceed, the cost of these alternatives to the traditional practice of burning should not be a major consideration. In fact, if one takes into account the nitrogen lost when straw is burned, the cost of burning may actually exceed that of minimum tillage.

Evaluation of Project:

All three of the project objectives have been accomplished. The field data in particular have been remarkably consistent over a four year period and on this account the conclusions derived from them would appear to be strongly supported.

Publications or Reports:

Crop Residue Management by Soil Incorporation. ARB Project 2-908-1.

P. Sain. The effects of various environmental factors on rice straw decomposition in soils. Ph.D. Thesis, 1974.