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COMPREHENSIVE RESEARCH ON RICE

Program Area: Rice Crop Management.

Project Number and Title: 70-15 Rice Residue Management by Soil Incorporation and Its Effects on Rice Production Practices.

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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, including those of low temperature and excess moisture.
3. To determine the effects of various residue management practices on soil properties and subsequent crop yields.

Work in Progress:

1. Six different residue management practices are being compared in field plots at two locations. These compare the effects on grain yield of straw incorporation with different tillage implements versus burning with 4 nitrogen levels superimposed on the tillage treatments. Also compared at the UCD Rice Research Center are the effects of chopping straw versus spreading unchopped straw. Effects of straw treatments on levels of organic carbon and

nitrogen in the soil are being measured. Yield data from the first year's crop have been obtained and are now being analyzed.

A hygrothermograph installed at ground level at the UCD center is providing a record of atmospheric conditions which allow moisture absorption by rice straw on the surface and by standing stubble to the level required for initiation of microbial decomposition.

2. Laboratory and greenhouse incubation experiments are being conducted to measure rice straw decomposition rates in different soils under a variety of environmental conditions including combinations of low temperature and flooding such as are encountered in the field during the winter season. Effects of additional nitrogen are also being measured.

Experiments Completed:

1. An experiment conducted to measure effects on soil carbon of two levels of straw, straw incorporation vs. surface application and N vs. no N during a three month period of decomposition showed highly significant differences due to straw level, N-level and placement after one month. After two months the effect of nitrogen application was no longer significant and after three months differences due to placement had been eliminated.

2. A greenhouse experiment involving incubation of rice straw 0, 4, and 8 weeks under flooded conditions prior to planting of rice showed that with no pre-incubation, nitrogen uptake by the rice crop was severely depressed, even when additional nitrogen equivalent to 1% of the weight of straw was applied. N-uptake was not greatly increased by 8 weeks pre-incubation of straw as compared to 4 weeks. As would be expected, total organic nitrogen in the soil after harvest of the rice crop was highest with no pre-incubation.

3. A series of experiments involving incubation of soils receiving rice straw additions for two months under a variety of conditions including some unfavorable to straw decomposition followed by two months at 77°F and optimum moisture showed that even very adverse conditions during the first two month period had little effect on the total carbon lost over the entire four month period.

Work Planned:

In addition to the experiments currently in progress, experiments will be conducted in a controlled environment chamber to determine critical moisture and temperature values required for initiation of decomposition of rice straw.

Major Accomplishments:

Although it is too early to draw firm conclusions, it seems already established that little or no benefit is derived from addition of nitrogen to accelerate the rate of straw decomposition, provided the straw is in contact with soil. It has also been shown that microbial decomposition of rice straw at levels likely to be added in field practice results in losses of 60-80% of the added straw within a four month period. The time required for loss of 80% of the added straw ranged from 219 days in flooded Sacramento clay at 46°F to 53 days in aerobic soil at 77°F.

Analysis of the first year's field data at the UCD site indicates that in terms of rice grain yield there was no advantage in chopping straw over spreading it uniformly. None of the tillage treatments differed significantly from the burned plots.

4.

Immediately Applicable Research Results:

Although the best straw management practice has yet to be defined, any practice which brings the straw into contact with the soil will greatly increase decomposition rates. Slow decomposition during a cold, wet winter can be largely overcome by a few weeks of favorable temperatures during the spring. Addition of nitrogen fertilizers on straw residues has little value.

Evaluation of Project:

In general satisfactory progress toward the stated objectives is being made, although it is too early to give a good evaluation of the field trials. Lack of good control over field operations has caused some problems in the first year of operation on a commercial rice grower's property.

Publications or Reports:

None.