RICE STRAW . . .

BURNING vs. INCORP

EFFECT OF STRAW TREATMENT AND FERTILIZER NITROGEN ON GRAIN AND STRAW YIELD AND NITROGEN ECONOMY OF COLUSA RICE—AVERAGES FOR 8 CROP YEARS

Straw treatment	Fertilizer nitrogen (lbs/acre annually)				
	0 N	40 N	80 N	120 N	Mean
			Grain yield cwt/acre (14% moist)		
Incorporated	23	36	49	55	41
Burned	23	38	50	56	42
			Straw yield cwt/acre (dry)		
Incorporated	25	41	56	64	47
Burned	26	43	57	66	48
			Grain N%		
Incorporated	.99	.99	1.05	1.13	1.04
Burned	.99	.99	1.05	1.14	1.04
			Straw N%		
Incorporated	.41	.42	.47	.53	.46
Burned	.41	.41	.47	.54	.46
			Straw N lbs/acre		
Incorporated	10	17	26	34	22
Burned	11	17	26	35	22
			Grain + straw N lbs/acre		
Incorporated	30	48	70	87	59
Burned*	31	50	71	89	60

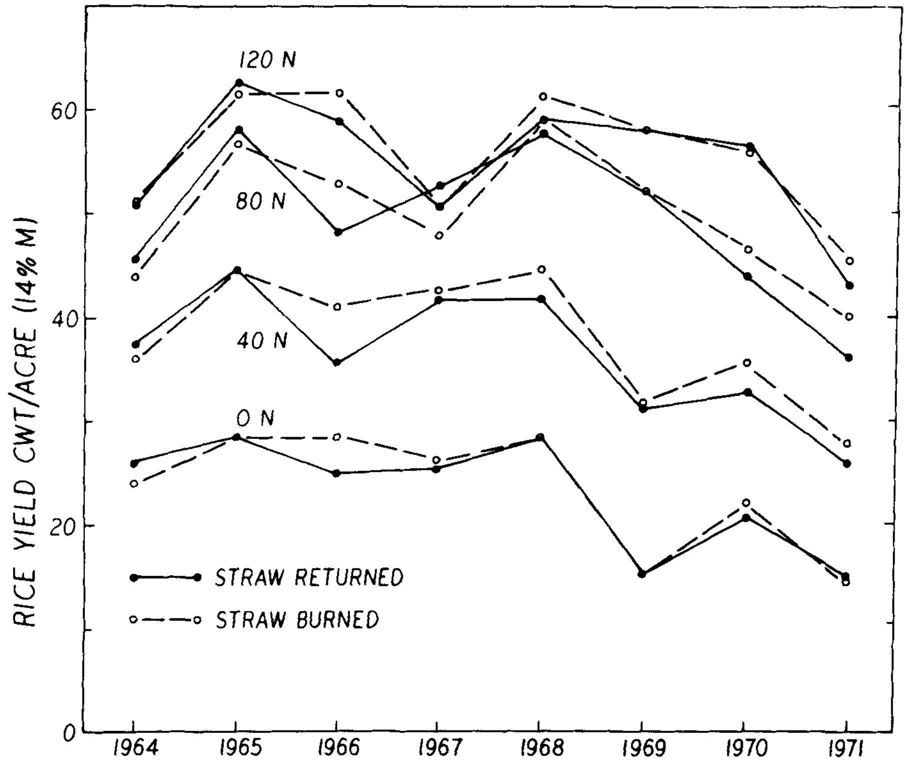
* Nitrogen in burned straw is lost through volatilization.

THE DISPOSAL OF rice crop residues has received increasing attention over a number of years from those both inside and outside the field of agriculture. The residues present a growing and costly management problem as grain yields, increased by improved technology, are accompanied by increasing straw yields. The traditional method of economical disposal—burning—faces growing public opposition and legal regulation, as air pollutant levels from many sources increase and state and local controls are established.

The experiment described here compared incorporation and burning of rice straw at various fertility levels in a field where rice was grown every year. Straw management treatments were begun in the fall of 1963 in a field planted annually to Colusa rice at the Rice Experiment Station, Biggs, on Stockton clay. The straw and stubble were either incorporated by disking and plowing, or were burned. During the first 5 years an added variable was purple vetch planted in the fall, at rice draining time, in combination with the straw treatments.

The rice crop was fertilized annually by drilling in ammonium sulfate at rates of 0, 40, 80, and 120 lbs per acre of nitrogen before flooding. All treatments were repeated on the same plot sites annually with six replications. Because of a heavy watergrass infestation in two replications in the first year, data were used from only the four relatively clean replications. In succeeding years, watergrass was controlled chemically and data from all replications were used. Grain yields were corrected to 14% moisture. Other data are on a dry weight basis.

EFFECT OF STRAW TREATMENT AND FERTILIZER NITROGEN ON YIELD OF RICE GRAIN OVER AN 8-YEAR PERIOD



ORATION

W. A. WILLIAMS · M. D. MORSE

J. E. RUCKMAN · F. P. GUERRERO

Both burning and incorporating rice straw resulted in similar grain production and nitrogen economy for 8 years in a field planted annually to Colusa rice. There was no observable increase in disease or insect populations in any of the treatments.

The yield of grain averaged over 8 crop years showed no statistically significant difference between the burning treatment and incorporation of all the residues at any of the fertilizer nitrogen levels (see table). Nitrogen applications had a highly significant effect up to the maximum of 120 lbs per acre. The yearly variation in grain yield is shown in the graph. Although burning in 1966 gave a yield advantage, neither burning nor incorporation was preferable in the other 7 years, and no cumulative trend.

Straw production followed the pattern of grain yields closely, except that relatively more straw was produced at the highest fertility levels (see table). The overall average of the straw-grain ratio was 1.34 (pounds of straw per pound of rice, dry basis).

The overall average nitrogen concentration in the grain was 1.04%, and 0.46% in the straw; concentrations in both increased with increasing nitrogen fertility. The method of handling the straw made no difference in the nitrogen concentration of either grain or straw.

The amount of nitrogen contained in the straw residue varied from 10 to 35 lbs per acre, depending on the fertility level. This nitrogen was probably volatilized during the burning. This loss was not reflected in a decreased uptake of nitrogen by rice grown on the burned plots, even by the eighth year of the experiment; this may be attributed to lack of release of straw nitrogen because of the lower-than-critical nitrogen concentrations (0.54% N) in the unburned straw. Uptake of nitrogen by grain and straw ranged from 30 to 89 lbs per acre depending on nitrogen fertility level. The use of fertilizer nitrogen averaged close to 50% at all levels of application.

The vetch green-manure treatments did not affect the results of the straw management treatments, although there was a fertility response equivalent to about 40 lbs per acre of fertilizer nitrogen per year due to the vetch. The vetch treatments were discontinued after 5 years to focus research emphasis on straw management.

In some rice areas in the U. S. and in other parts of the world, such difficulties have been associated with rice residue incorporation as (1) increase in diseases like stem rot, *Sclerotia oryzae;* (2) increases in insect pests; and (3) algae or toxic gas formation with accompanying seedling mortality. In this experiment the Colusa variety (with low susceptibility to stem rot) was used, and the straw substrate was well incorporated—tending to decrease the stem rot inoculum level. Insect problems in California rice growing areas presently do not seem to be associated with method of residue management. Algae and gas were not problems in this experiment because of the care taken to completely cover the residues during incorporation. Moreover, the field where the experiment was conducted was well drained, and the field work was done when the soil was in good condition for cultivation.

The results of this long-term experiment show that the incorporation of the larger rice crop residues associated with the continuing advance in yield need not necessarily be troublesome from the aspect of nitrogen fertility. Thus, a rice grower who has well drained fields, with no serious disease or insect infestations has alternative rice crop residue management practices to consider for his particular situation.

William A. Williams is Professor in Agronomy and Range Science, University of California, Davis; Morton D. Morse is Superintendent of the Rice Experiment Station, Biggs; Joseph E. Ruckman is Associate Specialist and Frank P. Guerrero is Staff Research Associate, Department of Agronomy and Range Science, University of California, Davis.