

Effect of rate of straw incorporation into the soils on rice growth and yield

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Abstract

Straw incorporation is an alternative management in place of burning before land preparation. Experiments were conducted in both greenhouse and field at Pathum Thani Rice Research Center in 2006-2007. A randomized complete block (RCB) was used with 4 replications. It featured 7 treatments where rice straw was incorporated into the soil at the rates 0, 400, 800, 1,200, 1,600, 2,000 and 2,400 kg/rai (6.25 rai = 1 ha). Number of rice plants/area at 15 days after broadcasting, redox potential and yield were recorded. Results showed that straw incorporation at rates of 0-800 kg/rai did not affect numbers of plant/m² at 15 days after planting or yield. However, number of plants/m² at 15 days after planting decreased when straw was incorporated at rates of 1,200-1,600 kg/rai whereas both the number of plant/m² at 15 days after planting and yield decreased when straw was incorporated at rates of 2,000-2,400 kg/rai.

Key Words

Straw incorporation, rice growth, alternative management.

Introduction

Rice cultivation in irrigated areas in Thailand is continuous cultivation. Average yield is about 715 kg/rai. After harvesting there is typically straw remaining in the field at rate of 715-1,072 kg/rai (6.25 rai = 1 ha) calculated from rice harvest index. Rice typically has a harvest index of about 0.4-0.5 (Nittaya *et al.* 2007) Straw analysis of 'suphanburi 1' rice variety showed N, P and K concentrations of 5.4, 1.4 and 13.0 kg respectively. (Nittaya *et al.* 2007).IRRI, (1996) reports that there are 0.03, 0.8, 6.5, 2.0, 3.5, 0.3, 0.45, 0.003 and 0.01 kg of Zn, S, Si, Mg, Ca, Fe, Mn, Cu and B, respectively in one ton of straw. Straw incorporation is an alternative management in place of burning before land preparation. But straw incorporation into the soil contributes to reducing condition in the rice field and possible negative impacts on rice growth. Because straw incorporation into the soils reduces oxygen and increases toxic carbon compounds. Severe oxygen depletion in flooded soil is related to disease occurrence. In early-season rice causing yellow leaves, dark roots, and low root activity caused by nitrogen immobilization. The nitrogen in the soil and applied nitrogen temporary decrease that effect at early rice growth stage. (Broadbent 1979) Straw fermentation encourages reducing condition causing Fe⁺⁺ and Mn⁺⁺ to increase in the soil where they may replace available potassium in the soil. (Ponnaperuma 1984)

Method

A randomized complete block (RCB) was used with 4 replications. It featured 7 treatments where rice straw was incorporated into at rate of 0, 400, 800, 1,200, 1,600, 2,000 and 2,400 kg/rai (6.25 rai = 1 ha). Starting at drainage 10 days before harvesting followed by field drying for 15 days next water flooded the field; straw incorporated into the soils, land cultivated and germinated rice broadcast immediately. Number of rice plants/area at 15 days after broadcasting, redox potential and yield were recorded. The experiment was conducted both in the greenhouse and in the field at Pathumthani Rice Research Center in 2006-2007.

Results

Rice growth and yield

The experiment in the greenhouse showed that the different rates of straw incorporation into the soil affect early rice growth stage and yield (Table 1). The experiment in the field showed that the different rates of straw incorporation into the soil affected early rice growth stage and yield. Straw incorporation into the soil at the rate 0-1,600 kg/rai did not affect number of plant/square meter at 15 days after broadcasting but the rate 2,000 - 2,400 kg/rai had an effect. The yield was lower when the rate of straw incorporation into the soil was higher. (Table 1)

Eh of soil solution

The experiment in the greenhouse showed that Eh of soil solution in the pots for every rate of straw incorporation into the soil was over 300 mV for the first day of irrigation. After that Eh of soil solution

decreased dramatically being lowest at the 28th day after irrigation at every rate of straw incorporation into the soil. The Eh of soil solution increased by 35 days after irrigation for every rate of straw incorporation into the soil (Figure 1).

Table 1. Effects of rate of straw incorporation into the soils on rice growth and yield at Pathum Thani Rice research Center in wet season 2006 and 2007.

Rate of straw (kg/rai)	Pot experiment (wet season 2006)		Field experiment (wet season 2007)	
	Yield (g/pot)	Plants/pot 15 DAP	Yield (kg/rai)	Plant/sq.m. at 15 DAP
0	75.2 b	30 a	669 ab	402 a
400	78.3 b	30 a	630 ab	380 a
800	70.8 b	30 a	668 ab	396 a
1,200	85.9 a	27 a	667 ab	345 a
1,600	83.5 a	23 b	635 ab	343 a
2,000	65.0 c	24 b	674 a	296 b
2,400	66.4 c	15 c	619 b	250 b
Aver.	75.0	26	651	362
CV(%)	5.9	8.9	4.8	15.2

Mean in the same column followed by a common letter are not significantly different at 5% level by DMRT.

The experiment in the field showed that Eh of soil solution for every rate of straw incorporation into the soil was over 0 mV at the first day of irrigation. After that Eh of soil solution decreased dramatically. The lowest of Eh of soil solution was for no straw incorporation into the soil. Eh of soil solution in the plots with rates 2,000 and 2,400 kg/rai straw incorporation into the soil decreased rapidly and was lower than Eh of soil solution in the plots for rates 400, 800 1,200 and 1,600 kg/rai (Figure 2).

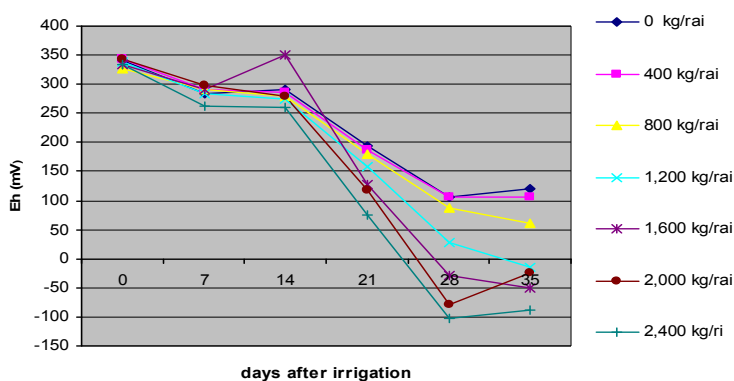


Figure 1. Soil Eh between 0-35 days after irrigation as effects of rate of straw incorporated into the soil on rice growth and yield at Pathum Thani Rice Research Center in wet season 2006 (pot experiment).

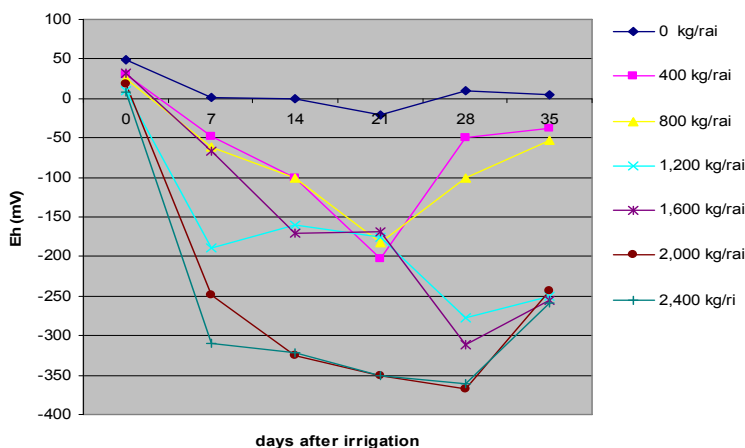


Figure 2. Soil Eh over 0-35 days after irrigation as affected by rate of straw incorporated into the soil (field experiment).

Conclusion

Straw incorporation into the soil at rates of 0-800 kg/rai did not affect early rice growth stage or rice yield. The number of plants /square meter at 15 days after broadcasting decreased for 1,200 and 1,600 kg./rai straw incorporation into the soil. 2,000 and 2,400 kg./rai straw incorporated into the soil affected both early rice growth stage and rice yield.

Reference

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