Nitrogen availability and wheat performance following rice crops

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In southern N.S.W. rice has traditionally been grown in a rotation of 1 year rice then 3 to 4 years pasture. In recent years there have been large increases in rice acreage and this has resulted in rotations of rice-rice and rice-wheat becoming more widespread. A wheat crop may be sown within a month of the rice harvest and this leads to stubble management problems. The effects of stubble quantity, management technique and nitrogen level on the growth of a wheat crop following rice were studied at Yanco. N.S.W. Experimental outline is given below.

Cultural treatment		Rice N kg/ha	->	Stubble t/ha		Wheat N (kg N/ha as NH_4NO_3)
Burn (April), Sod Sow (July)		0	->	11.7		0
Early Rotovate (April), Sod Sow (July)	X	83	->	15.2	X	70
Rotovate then Sod Sow (July)		167	->	18.3		140
Sod Sow into stubble (July)						210

High levels of stubble and wheat nitrogen reduced plant establishment. On standing stubble plots stubble 8-10 cm thick affected seed burial and seedling establishment. Plant growth on these plots was vigorous and could be correlated with high levels of soil nitrate nitrogen. The large quantity of stubble on the late rotovated plots affected plant establishment by immobilizing mineral nitrogen and probably by increasing microbial production of phytotoxic substances frequently associated with stubble breakdown. The higher wheat nitrogen would also stimulate stubble breakdown and increase production of the phytotoxins.

The early rotovated plots had good wheat growth because much of the stubble had broken down in the three months between incorporation and wheat sowing.

Plant growth on the burnt plots was very poor. This was reflected in a low tiller number per established plant of 1.34, compared with a mean of 2.59 for the other stubble treatments. Plant nitrogen content at tillering was also relatively low (1.3 compared with 1.6% on standing stubble plots). Both these factors suggest there is considerable loss of fertilizer nitrogen from these plots. This loss may be due to contact with the stubble ash leading to ammonia volatilisation or absorption.

There was a significant interaction between plant yield and the amount of stubble. Yield component analysis showed this was due to reduced tiller number at high levels of stubble on late rotovated plots in contrast to the increased tillering with high levels of stubble on standing stubble plots.

The experimental results suggest that sod sowing into standing stubble is satisfactory provided there is adequate seed burial. Burning stubble resulted in poor plants deficient in nitrogen while stubble incorporation at sowing apparently resulted in nitrogen immobilisation and accumulation of phytotoxic substances. Current research is aimed at identifying and quantifying the mechanisms suggested above.