

Why cultivate?

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Cultivation before sowing has been traditional practice in Australian agriculture. Over the past four years studies at the Agricultural Research Centre, Yanco, with wheat and rice have highlighted some of the advantages and disadvantages of direct drilling with a triple disc into rice stubble.

Cultivation is frequently carried out to remove trash from previous crops; yet in 3 out of 4 seasons stubble removal has not significantly increased yield of wheat following rice crops (Table 1).

Table 1. Effect of land preparation techniques on wheat performance (t ha) Good yields have been obtained without stubble removal for several reasons.

Preparation Technique	1978	1979	1980	1981
Burn only	0.73	3.76	2.45	2.77
Burn and cultivate	-	-	1.76	1.55
Incorporate 2-3 months before sowing	1.76	3.53	0.89	1.54
Incorporate at sowing	1.40	3.58	1.12	1.11
Standing stubble	2.63	2.98	2.37	2.54

First, burning can result in a hard, impermeable soil surface covered with an alkaline ash. Water penetration is poor while the ash can result in large losses of fertilizer nitrogen to the atmosphere. This loss is greatest when the urea is applied to a moist soil surface soon after burning. Volatilization losses of 5-7.5% of applied N per day were recorded from moist burnt plots on an acid (pH 5.5 in 0.01M CaCl₂) clay loam.

Second, stubble incorporation can result in nitrogen immobilization. Plots in which heavy stubble (18.3 t ha⁻¹) was incorporated 3 months before wheat sowing and fertilization (210 kg N ha⁻¹) had 22 ug g⁻¹ NO₃-N in the top 10 cm of soil at tillering, while plots on which stubble was incorporated immediately before wheat sowing had 17 ug g⁻¹ NO₃-N at tillering. The corresponding nitrate concentration on plots where wheat was sown directly into standing stubble was 32 ug g⁻¹. The difference in nitrate concentration was reflected in final yield: the three treatments yielded 1.9, 1.2 and 2.9 t ha⁻¹ respectively.

Third, cultivation increases microbial activity, probably through a combination of improved aeration and exposure of decomposable organic material. The increased microbial activity can result in temporarily increased nitrogen mineralization rates. Unfortunately, plant nitrogen requirements soon after sowing are normally low and are frequently satisfied with a basal fertilizer, so soil nitrogen N mineralized in this period can be lost by leaching, denitrification and immobilization. Recently cultivated soil at Yanco has 2-3 times the mineralization rate of uncultivated soil and losses of up to 20 kg N ha⁻¹ NO₃-N have been measured.

Soil temperature and moisture studies show that soil temperature on standing stubble plots is up to 10°C lower than on bare soil surfaces, while the soil water content is higher under standing stubble. Better root penetration, higher nutrient uptake and longer maturation period are obtained under standing stubble. Earlier wheat sowing can occur under standing stubble plots, and the sowing is unaffected by recent rain.

Optimal conditions for this sowing technique include a moist seed bed and a dry stubble capable of being cut by the triple disc's coulter, thus permitting seed placement below the soil surface. Rain soon after sowing will improve crop establishment.