Long term effects of rotation, tillage and stubble management on wheat yields on a red earth soil in Southern N.S.W.

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Declining soil structure and nitrogen fertility throughout large areas of the wheat belt of eastern Australia has led to declining yields and grain protein. Clover ley farming will maintain yields and soil fertility but economic constraints have limited the ability of many farmers to maintain this system. Grain legumes (eg. lupin) can provide nitrogen for the following wheat crop but long term trials are required to measure the cumulative effects of rotation and cultural techniques on the soil and crop.

Methods

The experiment commenced in 1979 on a fertile red earth (total N 0-10cm; 0.13%). Treatment details and mean (1979 - 1988) yields are outlined in Table 1. Stubble was either slashed or burnt in late February. Tandem discs were used to incorporate stubble in appropriate treatments and a scarifier used for cultivations where stubble was burnt. Nitrogen fertilizer was added in a 3 way split at sowing, tillering and flowering, and herbicides applied post emergent.

Results and discussion

Table 1. Effects of rotation, tillage and stubble on grain yields and total dry matters of wheat.

Treatment	Mean Grain Yield (t/ha) 1979-88	Mean TDM (t/ha)
WL, R, DD	2.98	10.6
WL, R, CC	2.75	10.7
WL, B, DD	3.36	11.1
WL, R, CC	3.15	10.8
WWL, R, DD	3.1, 2.26	10.3, 6.9
WW, B, CC	2.31	8.13
WW+N, B, CC	2.64	9.90
WCG, R, CC	2.81	10.2
WC, R, DD	2.74	9.66
WC, R, CC	2.68	10.2

W = wheat, L = lupin, C = clover, CG = clover grazed, DD = direct drilled,
+N = 100 kg N/ha as urea,
CC = conventional cultivations, R = stubble retained, B = stubble burnt.

WL yields have been usually higher than WC and WW rotations. WW without added nitrogen has declined with time relative to WL and WC. The addition of N fertilizer to WW has increased yields since 1983 but were still less than WL in the majority of years. The differences were usually related to a higher incidence of diseases such as eyespot lodging in WW + N. The lower yields from WC (cf WL) have been associated with a greater incidence of take all particularly when grass weeds infested the previous clover phase. The second wheat crop in WWL rotations has consistently yielded lower than the first due to reduced nitrogen fertility but also due to greater disease and weed infestation. In the WL rotations wheat yields have been higher where stubble was burnt. These differences were usually associated with a lower grass (esp. Brome) weed infestations and diseases in the burnt treatments. Direct drilling generally resulted in higher grain yield than cultivated treatments. This was not always related to differences in total dry matter production but more to differences in harvest index.