Effects of wheat residues and tillage on the water balance of a red earth soil

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This work measured the effects of crop residues on infiltration and evaporation over summer on a sandy-loam soil of southern NSW. The growth and water use of weeds over summer and autumn, in the presence and absence of residues, was also measured in a programme aimed at developing a package of cultural practices suited to the mixed farms of the region.

Methods

Wheat was grown in 1984, harvested, then grazed for several weeks to produce the required residue. Weeds were controlled with herbicides according to treatment.' In Experiment 1 there were 30 rates of residues from zero to 14 t/ha created by the removal or addition of residues. In Experiment 2, stubble was either retained (3 t/ha) or removed with a forage harvester and these treatments were combined factorially with weed control and tillage history (cultivated v direct drilled crop in 1984). In Experiments 1 and 2 a neutron probe was used to measure changes in soil water storage either fortnightly or after rain. In Experiment 3, 4 residue rates were established (0, 1.5, 3, 6 t/ha) and simulated rain of 34 mm was applied in March. Soil water was measured gravimetrically from 0-1, 1-3, 3-5, 5-10 and 10-15 cm on days 0, 1, 4, 8 and 16 after "rain". Rainfall from December-May was 140 mm and an additional 35 mm was simulated in February in Experiment 1.

Results and discussion

Soil evaporation.

High levels of residue (6 t/ha) in Experiment 3 reduced evaporation but large differences in surface soil water on day 1 after rain were reduced to nothing by day 16 (Fig. 1).

Infiltration.

Soil water storage increased over summer with increasing infiltration of rain which fell over 3 days in March.

Prior tillage and present weed control.

Rain in March also stimulated the growth of weeds in Experiment 2. Where residues were retained and the weeds were controlled (a "no-till" system) water storage at sowing was 45 mm more ($P < 0.01$) than when residue was removed and the weeds were allowed to grow (a "direct-drill" system). In return for the water, weed biomass was 1-2 t/ha. The benefits of residue retention and weed control accrued regardless of tillage history.

The results demonstrate the value of combining residue retention with opportunistic short fallowing in southern NSW. Analysis of long-term weather records using a water balance (G. Murray, unpublished) indicates that sufficient rain falls in 40% of years to be worth conserving in a short herbicide fallow.

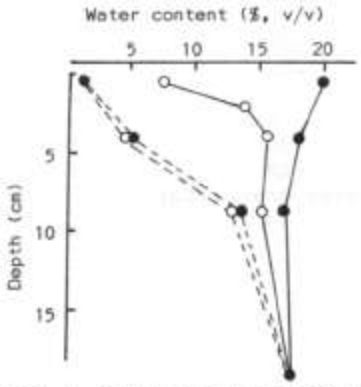

Fig. 1. Effect of residues on surface water content on day 1(—) and day 16(--) after rain.
● , present; ○ , absent (Expt. 3).

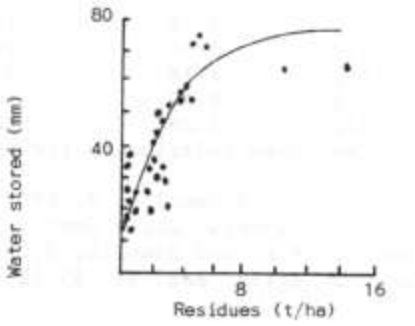

Fig. 2. Effect of increasing amounts of residue on water storage in a short fallow (Expt. 1).