Adaptation of wheat to direct - drilling

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The crop environment in new tillage systems can be very different from that in a conventional crop. Thus wheats specifically adapted to these conditions may be desirable. Before deciding to make these selections, however, breeders need to know whether existing genotypes lack general adaptability to the range of tillage systems practiced, or if there is a specific problem which could be solved most easily by breeding.

After pilot studies in 1978/79, we began comprehensive studies in 1980 to determine if interactions occur between crop genotype and tillage method; and if so, why. We hoped to identify particular genotypes with superior adaptation to one or a range of tillage practices. Results from 1980 are reported here.

Methods

Two tillage systems (main treatments) were used: a "conventional" tillage of 4 cultivations during a short fallow period (Feb-Jun), and "direct-drilling" with no cultivation before sowing. Thirty-six winter cereal cultivars representing all mainland States were sown as sub-treatments in a split-plot lattice design. Emergence, crop growth and yield were determined, together with measurements of soil/crop water relations. The site was first crop after pasture, on a red-brown earth soil.

Results and Discussion

Tillage method had no effect on emergence, but direct-drilling reduced pre- anthesis growth by an average of 30%,with much greater reductions in some cultivars (e.g. Songlen, Jacup). Grain yield, averaged over varieties, was 9% greater in the direct-drilled treatment (1.5 v 1.4 t ha^{-1}), but there was a significant interaction between cultivar and tillage method. There was no simple relationship between the interactions found in pre-anthesis growth andyield, hence reductions in early growth were associated in different cultivars with yield increases (e.g. Banks), no change in yield (Condor) or yield reductions (Songlen). There was slightly more available soil water at flowering (8 mm) in the direct-drilling crops, leading to improved relative leaf water content.

Reduced early growth frequently occurs with direct-drilling. We are exploring the way in which this may influence the grain yield of different cultivars through its effect on the balance between pre- and post-anthesis water use. Increased yields may result from direct-drilling when, *under conventional cultivation,* the pre-anthesis growth and water use of any cultivar exceeds the optimum for that cultivar/season. This would leave insufficient post anthesis water for the crop to achieve its potential yield, which is set at anthesis. Conversely, direct-drilling may give lower yields when reduced early growth reduces yield potential to the point where the crop cannot take advantage of the water saved for grain filling.