

Relationships between water use, yield and grain size of barley I. yield

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It is commonly believed that low rainfall and post anthesis water stress reduce grain size and increase protein in barley, thus reducing the possibility of reaching malting quality. Hence malting barley has traditionally been grown in higher rainfall areas and with low-input agronomic management designed to conserve water for grain filling. The exact relationship between water use and grain size has not been quantified, and the gain in quality due to low-input agronomy has not been assessed in terms of the grain yield foregone. These issues were considered by us because of increased sowings of barley in drier areas, and because declining grain prices demand maximum yields for economic production. The first paper in this series quantifies the relationship between water use and yield. This relationship allows scientists or farmers to calculate potential, water-limited yields against which the success of any crop management programme can be judged.

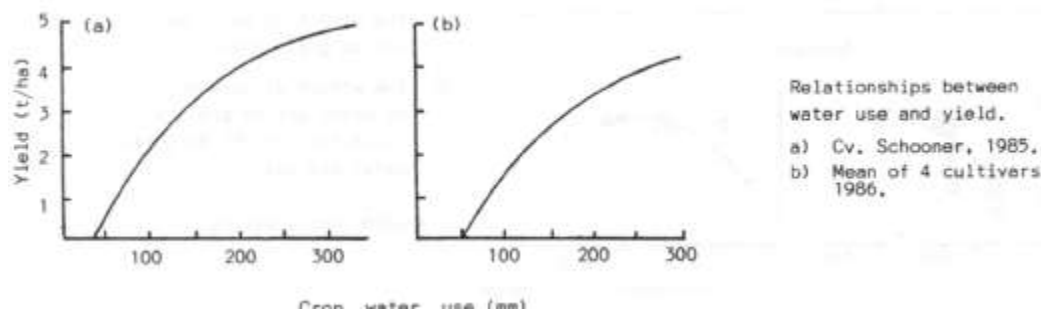
Methods

Schooner barley in 1985 and Schooner, Lara, O'Connor and Stirling barley in 1986 were grown in the field and covered by a mobile shelter during rain. Water was applied in different amounts and with varying seasonal patterns to simulate a wide range of rainfall regimes. Soil water, crop growth and grain yield were measured.

Results and discussion

In both years there was a good relationship between water use and yield. The four cultivars did not differ greatly in 1986. The response to water use was not linear, apparently because the potential yield in the wettest treatments was too low. That is, dry matter at anthesis was too low. Yield per unit of water use (transpiration plus soil evaporation) was lower in 1986 than in 1985. In both years, however, it was much higher than for wheat. For example, yield per unit of water use averaged over all crops in 1986 was 16.2 kg/ha/mm. By contrast, amongst 70 experimental and commercial wheat crops measured in South Australia, the most efficient crop was 12.7 kg/ha/mm and the best eight averaged 10.1 kg/ha/mm (1). Experimental crops of wheat at Wagga Wagga have given results of 9.2-13.9 kg/ha/mm (2).

Because barley has higher water use efficiency (WUE) than wheat it should give higher yields in a water-limited situation. District experience reveals that this is not so. Changes in management should be made to take advantage of the higher WUE. We propose that earlier sowing and greater agronomic inputs would increase pre anthesis growth and hence increase grain yield in wetter areas. But winter-types with lodging resistance would be needed. In drier areas, the practice of delaying sowing until after wheat should be avoided, and agronomic research to take advantage of the higher WUE would be justified.



1. French, R.J. and Schultz, J.E. (1984). Aust. J. Agr. Res. 35, 743-64.

2. Cornish, P.S. (1985). Proc. 13th Riverina Outlook Conf. RCAE, Wagga.