

Breeding for improvement in weed competitive ability in bread wheat

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Summary Wheat is the most widely grown cereal crop in southern Australia where herbicide resistance in weeds is increasing at an alarming rate. Comparisons with other winter cereals show wheat to be among the poorest competitors with weeds. Wheat varieties showing greater competitive ability would assist to reduce weed growth and seed production and reduce the potential for crop yield loss.

Previous research on both the Cranbrook/Halberd and Vigour 18/Chuan-Mai 18 doubled haploid populations highlighted the importance of early crop vigour for weed suppression and tolerance to weeds (Coleman *et al.* 2001). Several plant traits associated with early crop vigour (early canopy cover, greater leaf width and tiller number) were positively correlated with competitive ability.

A unique recurrent selection breeding population was developed comprising of the 16 most vigorous wheats available. Lines were selected for greater vigour through four cycles of recurrent selection resulting in an average 6% gain in early leaf area per cycle. Elite high vigour selections were crossed to donors of gibberellic acid-sensitive dwarfing genes (Rht8, Rht12 and Rht13) before top-crossing to commercial wheat parents. This created a set of approximately 3000 F4 lines which were grown in the field at Roseworthy, South Australia during 2006 and 2007. Lines were assessed for a range of traits including early vigour. A large proportion of the population were significantly more vigorous than the commercial wheat checks while a number of progeny produced leaf areas consistent with that of the high vigour control, barley. Flag-leaf temperatures were recorded during anthesis and early grain-filling using an infra-red thermometer. This showed a very strong linear relationship with visual early vigour score ($r^2 = 0.81$ to 0.89 , $P < 0.01$) (Figure 1). It appears the lines having higher early vigour are capable of extracting more soil water which in turn enables them to maintain lower canopy temperatures.

This confirms leaf/canopy temperature during anthesis and grain-filling is a useful indicator of the

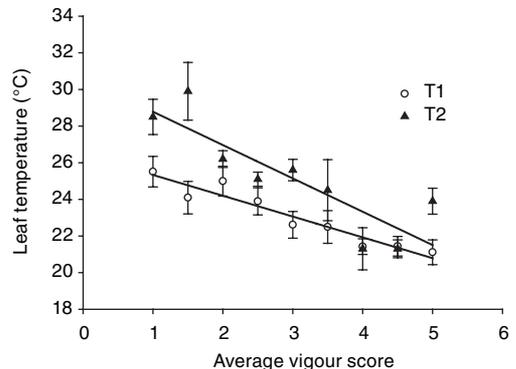


Figure 1. The relationship between visual early vigour scores and leaf temperatures measured at two times, anthesis (T1) and early grain-filling (T2). (1 = low vigour, 5 = max. high vigour).

capacity of plant roots to access available soil water. In future work, we aim to confirm the relationship between shoot vigour and leaf temperature, and evaluate selected high vigour lines with suitable agronomic characteristics for their ability to tolerate and suppress weeds.

Keywords Wheat, competition, high early vigour, weed tolerance, suppression.

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REFERENCE

Coleman, R.K., Gill, G.S. and Rebetzke, G.J. (2001). Identification of quantitative trait loci for traits conferring weed competitiveness in wheat (*Triticum aestivum* L.). *Australian Journal of Agricultural Research* 52, 1235-46.