Interactive Effects of Fungal Root Diseases and Drought On Water Use Efficiency of Wheat

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Introduction

Wheat is normally subjected to multiple simultaneous stresses such as drought and fungal root diseases.
The objective was to investigate the effects of drought at tillering or anthesis and fungal root diseases (*Rhizoctonia solani* and *Pythium sp.*) on water relations of wheat.

Methods

Spring wheat cultivars Mulgara (with an osmoregulation gene) and Janz were used. Millet seed inoculum was placed 2-3 cm beneath each of 3 wheat seeds per pot (20 x 20cm).
Droughts were imposed by withholding watering for 7 days at tillering (GS 22; D1) or anthesis (GS 65; D2) on separate sets of plants, and compared with well-watered (WW) plants.

Results

Water-use efficiency

Anthesis drought reduced total transpiration (Fig. 1).
There was a disease effect at D1 on transpiration in Janz where controls transpired 2 litres more water than diseased plants. There was no difference between WUE of D1 and WW plants (Fig. 2). WUE was decreased significantly in D2 for both cultivars. There was no difference between WUE of diseased plants (d) and controls (c).

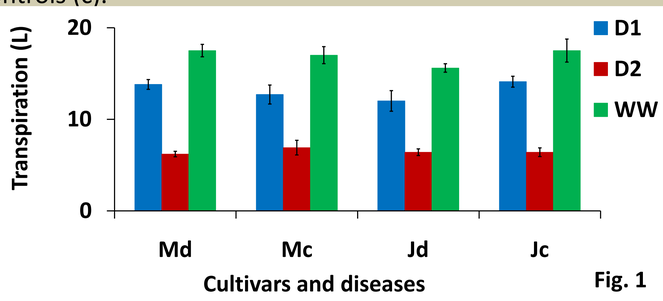

Fig. 1

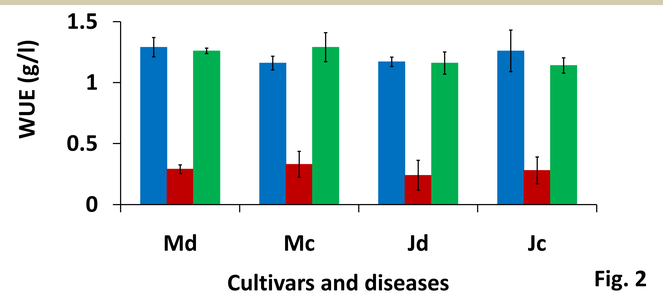

Fig. 2

Water Relations

Water stress was more severe in D2 than in D1 (Fig. 3 and 4). The total leaf water potential (Ψ) and osmotic potential (π) were lower in droughted diseased plants of Janz than in controls in D1 (Fig. 3A and 4A). Mulgara had lower π in controls than diseased ones at D2 (Fig. 4B).

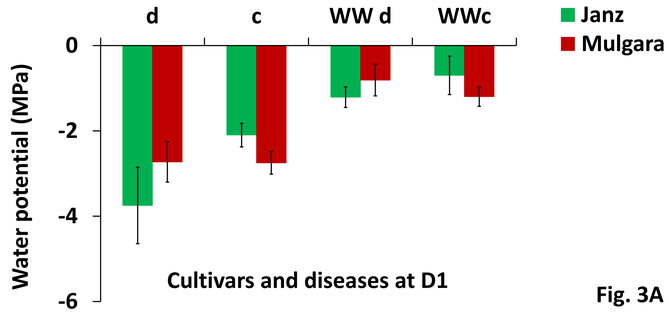

Fig. 3A

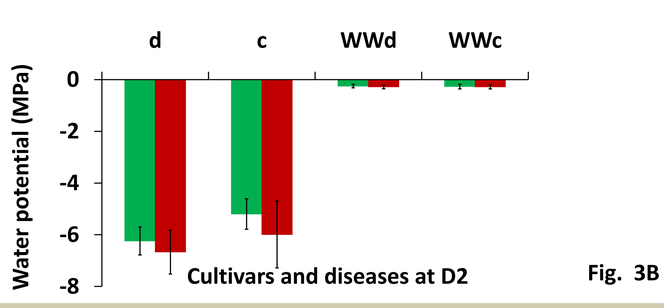

Fig. 3B

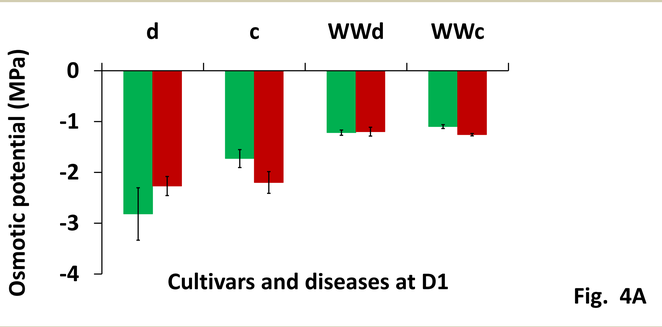

Fig. 4A

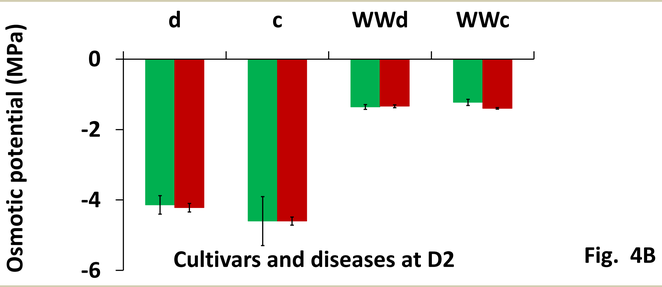

Fig. 4B

Lesion percentage

The variety × fungus interaction had a significant effect on root lesion percentage (Fig. 5). *Rhizoctonia* resulted in more lesions on Mulgara than on Janz. Drought treatments had no significant effect on percentage of root lesioned.

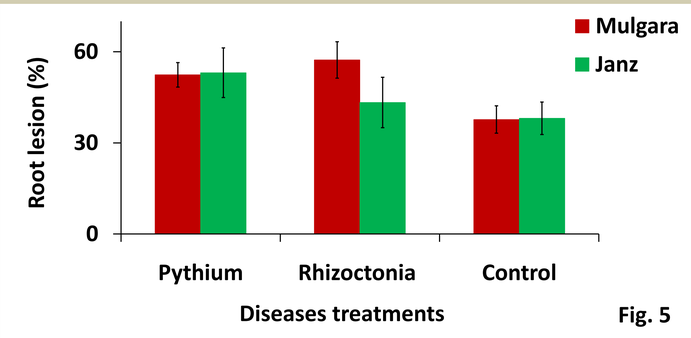

Fig. 5

Conclusion

Mulgara tolerated drought better than Janz.
The diseases had minor effects on above-ground physiological parameters but had major effects at the underground level. The pathogens affect transpiration at tillering but not at anthesis when the roots had developed further below the inoculation point.
There was no significant drought × fungus interaction in this study.

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