Pear Tree Survival under Extreme Water Deficits

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Background

The Goulburn Valley region has a temperate semi-arid climate and is the major producer of fresh and canned fruit in Australia. Growing season rainfall is well below crop evapotranspiration (ET_c) and water availability for irrigation of orchards has become severely limited. As a results, irrigation allocations have been less than 100 %. For example, in 2007/08 the final irrigation allocation was 57 %. Irrigation allocation for 2008/09 is currently at 0 %. Additional water to meet irrigation requirements in orchards can be purchased from other users, however, prices have escalated to over $ 1000 per ML. One option for growers is to "moth ball" orchards. In other words apply the absolute minimum amount of irrigation to keep trees alive with as little impact on the following season's crop. The aim of this study was to investigate the impact of extreme irrigation deficits and de-fruiting on pear tree water stress, bud number and bud dry weight.

Material and Methods

The experiment was carried out on a commercial pear (Packham) orchard in Ardmona, Victoria, (36.44°S, 145.27°E; elevation 114 m) during the 2007/08 growing season. The trees were spaced at 5.5 × 5.5 m between trees and rows, respectively, with open vase training. Plots were arranged in a randomized split-plot design, with irrigation level as the main plot, and fruited and de-fruited as the sub-plot. Treatments were irrigated to replace crop evapotranspiration (ET_c): (i) 30% ET_o; (ii) 15% ET_o; (iii) 7% ET_o; (iv) 4% ET_o and (vi) 0% ET_o. Each treatment was replicated four times and there were 7 rows of 4 trees in each plot. Subplots consisted of 2 rows of 2 trees. Each plot was irrigated with 7 fixed sprinklers and irrigation amount was monitored with a flow meter. Stem water potential (ψ_{stem}) was measured once per week and leaf conductance (g_{leaf}) was measured on suitable clear sky days. Fruit and vegetative buds were counted and their dry weight determined from wood samples collected in June 2008.

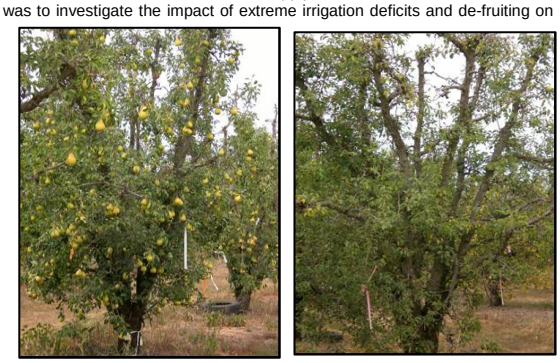

Fig 1. Fruited and de-fruited 'Packham' pear trees

Results

Preliminary results indicate that fruited trees were more stressed with higher leaf conductance (Fig.3) and lower stem water potential (Fig.4) than de-fruited trees. There were a rapid recovery of stem water potential after rainfall across fruited and de-fruited treatments. Measurements taken post harvest suggest that flower and vegetative bud dry weight were higher in de-fruited trees (Table 1).

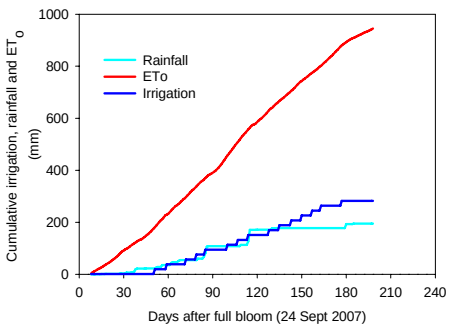

Fig 2. Cumulative irrigation, rainfall and ET_o during the growing season.

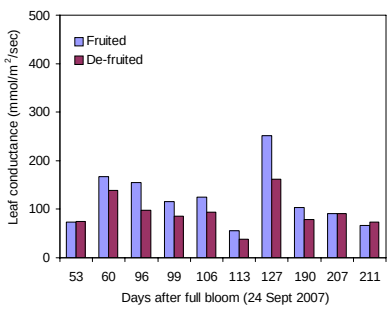

Fig 4. Effect of de-fruiting 'Packham' pear trees on leaf conductance.

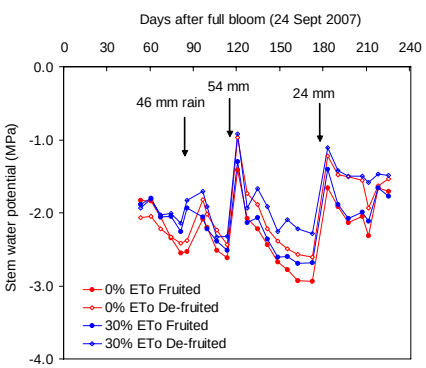

Fig 3. Effect of withholding irrigation and de-fruiting 'Packham' pear trees on midday stem water potential.

Table 1. Effect of irrigation deficits and de-fruiting 'Packham' pear trees on bud dry weight.

Treatment	Flower bud dry weight (mg)		Vegetative bud dry weight (mg)	
	De-fruited	Fruited	De-fruited	Fruited
0% ET_o	34.6	25.2	6.3	5.9
4% ET_o	38.1	32.1	8.3	5.9
7% ET_o	39.3	31.3	11.3	5.8
15% ET_o	44.4	30.0	7.8	6.0
30% ET_o	38.9	30.8	6.3	5.5

Conclusions

- De-fruiting improved tree water status.
- Flower bud dry weight was higher in the de-fruited trees.
- The implications of these treatments on subsequent yield and fruit quality will be evaluated in 2008/09 irrigation.

Acknowledgements

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