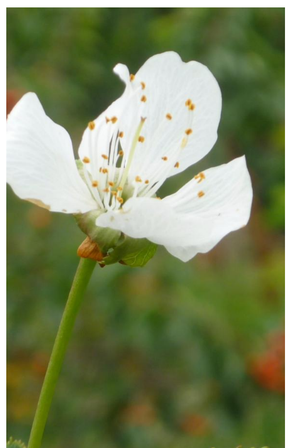
# Can crop load be used to minimise rain-induced cracking in sweet cherry?

P. F. MEASHAM, S. A. BOUND, A. J. GRACIE & S. J. WILSON

Tasmanian Institute of Agricultural Research, School of Agricultural Science, University of Tasmania, Private Bag 54, Hobart, Tasmania 7001, Australia.



The aim of this study was to investigate the relationship between fruit load and cracking. Given that cracking can be induced by internal vascular flow, it was hypothesised that higher crop loads will reduce the incidence of cracking through increased competition between fruit for internal water and assimilate supply. Crop load was measured as the number of fruit per cross-sectional trunk area. Fruit property values were additionally used to assess the relationship with the incidence of cracking *in situ* for each variety. All trials received rainfall in the three weeks prior to harvest.

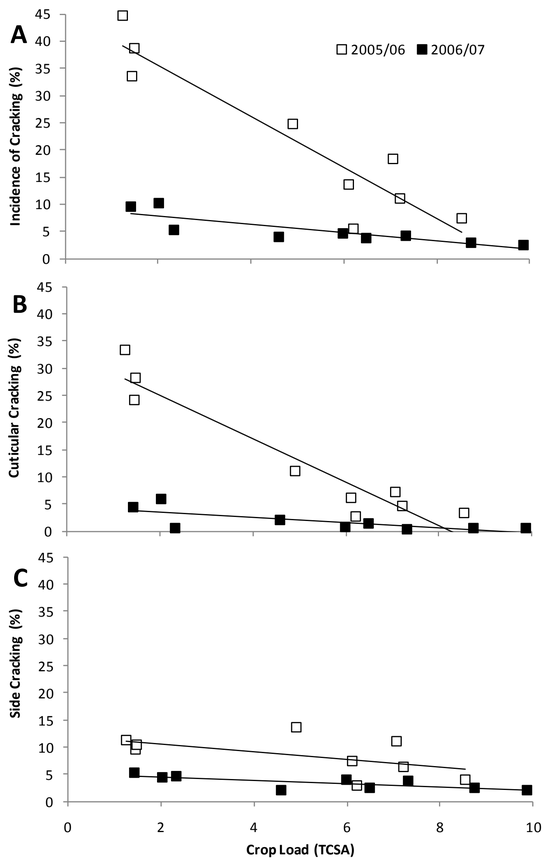



**Figure 1** In Simone, as crop load increased a reduction occurred in;
(A) total cracking in 2005/06 ($R^2$ = 0.903, P<0.001) and 2006/07 ($R^2$ = 0.511, P = 0.03),
(B) cuticular cracking 2005/06 ($R^2$ = 0.907, P<0.001) and 2006/07 ($R^2$ = 0.540, P = 0.02) and
(C) side cracking in 2006/07 ($R^2$ = 0.575, P = 0.02).

Manipulated crop load trials included treatments achieving low, medium and high loads.

- 'Simone' in 2005/06 and 2006/07: treatments applied post bloom, 4 weeks after full bloom (4WAFB).
- 'Sweetheart' and 'Regina' in 2010/11: treatments applied at dormant bud stage, full bloom and post bloom (4WAFB). Actual crop load achieved at harvest was recorded.

Natural crop load was recorded at harvest over three seasons (2005/06, 2006/07, 2007/08) for

- 'Kordia', 'Lapin', 'Regina', 'Simone', 'Sweetheart', 'Sylvia' and 'Van'.

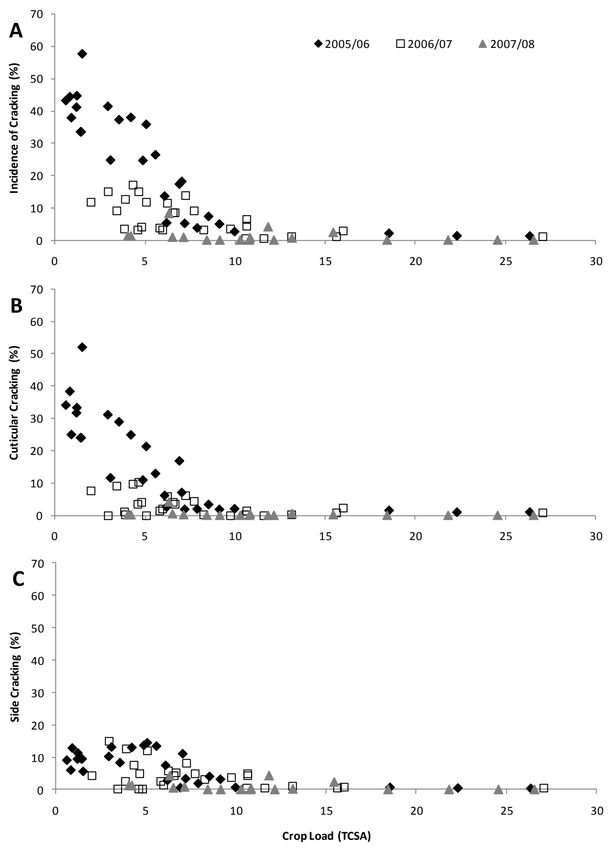



**Figure 2** The percentage of total cracked fruit (A), cuticular-cracked fruit (B) and side-cracked fruit (C) with natural crop load (TCSA)

A negative linear relationship between actual crop load and total cracking incidence was recorded in all trial years. This relationship was evident in variety 'Simone' over both 2005/06 and 2006/07 (**Figure 1**). In 2011 a significant main effect of crop load on both total and side cracks was found in 'Regina'. (**Figure 2**). A significant interaction (P = 0.045) between level and timing of crop load on total cracking in variety 'Sweetheart' was found. Within treatment times, a significant effect of crop load on total and side cracks was found with post bloom thinning. Lower natural crop loads recorded higher levels of cracking incidence (**Figure 3**).

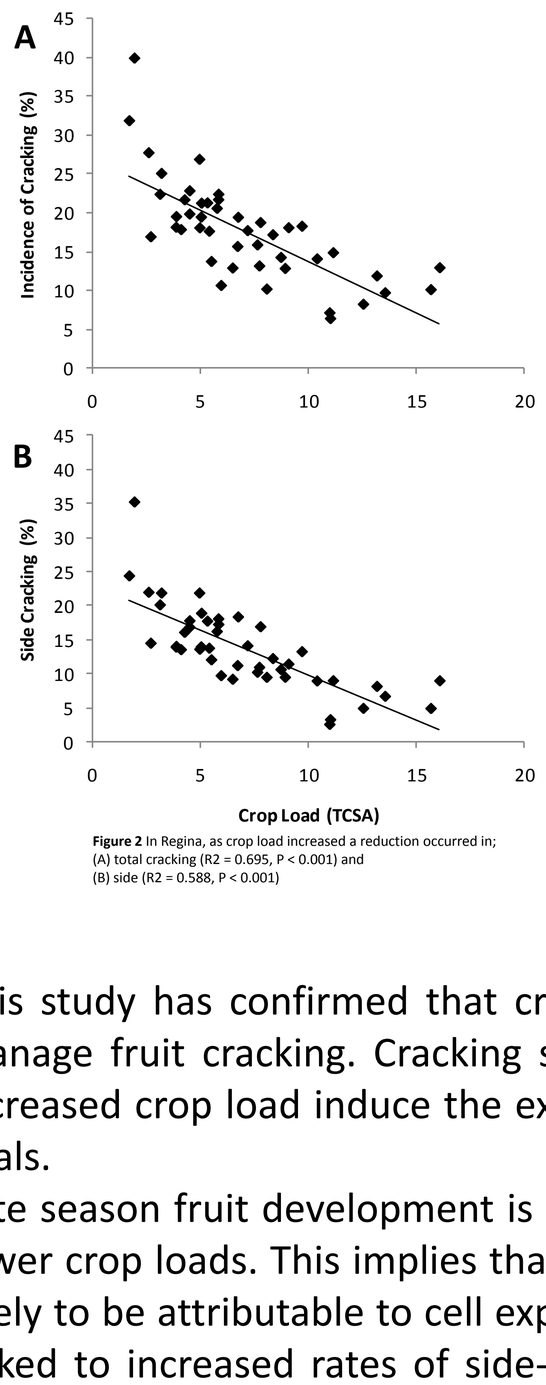



**Figure 2** In Regina, as crop load increased a reduction occurred in;
(A) total cracking (R2 = 0.695, P < 0.001) and
(B) side (R2 = 0.588, P < 0.001)

No significant relationship was found between any fruit properties and total cracking incidence or individual crack type in any of the trials, except one. In one manipulated load trial fruit size was positively correlated (P = 0.01) with cuticular cracks. A decrease in size and weight, but not total soluble solids, only occurred with a dramatic increase (beyond 20 fruit per TCSA) in crop load in 2007/08.

**Table 1 and 2** The range of yields, t/ha, required to avoid cracking under low crop loads and loss of size under high crop load for two different tree sizes (av. 12g fruit)

35cm Trunk Circumference

| Increased Cracking | 10 fruit/TCSA | 15 fruit/TCSA | 20 fruit/TCSA | Decreased Size |
|---|---|---|---|---|
| 900 trees/ha | **10.3** | **15.7** | **21** | |
| 1000 trees/ha | **11.6** | **17.5** | **23.4** | |
| 1100 trees/ha | **12.8** | **19.3** | **25.7** | |
| 1200 trees/ha | **14** | **21.1** | **28.1** | |

40cm Trunk Circumference

| Increased Cracking | 10 fruit/TCSA | 15 fruit/TCSA | 20 fruit/TCSA | Decreased Size |
|---|---|---|---|---|
| 900 trees/ha | **13.7** | **20.6** | **27.5** | |
| 1000 trees/ha | **15.2** | **22.9** | **30.5** | |
| 1100 trees/ha | **16.8** | **25.2** | **33.6** | |
| 1200 trees/ha | **18.3** | **27.5** | **36.6** | |

This study has confirmed that crop load should be a major consideration in orchard practices in developing strategies to manage fruit cracking. Cracking susceptibility in this study did not seem to be related to fruit quality properties, nor did increased crop load induce the expected drop in size and sugars or increase in firmness in any of the manipulated crop load trials.

Late season fruit development is important in crack susceptibility as all post bloom thinning showed increased cracking with lower crop loads. This implies that the effect of crop load on final cracking levels are determined post cell division, and more likely to be attributable to cell expansion during the later stages of growth; a function of internal water entry which has been linked to increased rates of side-cracked fruit. This supports the hypothesis presented that cracking due to internal water supply is influenced by number of fruit and therefore individual competition.

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Penelope.Measham@utas.edu.au