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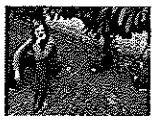
TASMANIAN INSTITUTE OF AGRICULTURAL RESEARCH

Splitting Headaches
New Research Outcomes in Cherry Cracking



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UTAS

TIAR is a joint venture of the Tasmanian Department of Primary Industries, Parks, Water and Environment and the University of Tasmania

Tasmania
Explore the possibilities

Facing the challenge.....

- 2004, Industry Project – identify risks
- 2005, Honours – quantify the problem
- 2006 -2010, Doctorate – Understanding mechanisms (HAL CY06001)
- 2010-2012, CI HAL CY09002 – Evaluating new and existing management strategies
- **The future?????**

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CY09002

Improving marketable yield of premium quality fruit

- Three seasons
  - Two down, one to go
- Three states
  - Tasmania, South Australia, Victoria*
- Five sites
- Four approaches
  - Spraying, Irrigation, Pruning, Crop Load
- Cracking Index

- Two mechanisms
  - Internal, external

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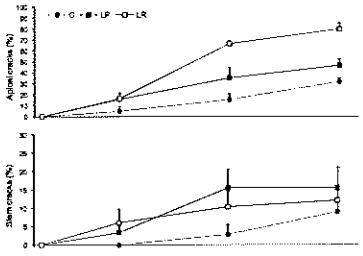
Back to CY06001

- Crack types induced by different modes of water uptake
  - Internal = side, external=cuticular
- Varietal propensity to crack type
- Drivers of internal flow within tree (climate)
- Shape of fruit and tangential stress on skin
- Fruit/Leaf relationships
- Crop Load

Cuticular

- Spray, prevent uptake of water through the skin
- Crop load, change in canopy cover and/or fruit surface area exposed



Strategies

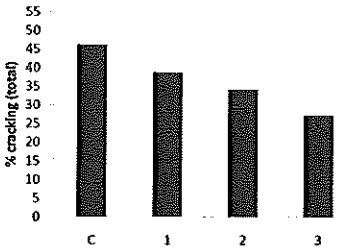
- Side
  - Irrigation, skin elasticity
  - Pruning, internally supplied water
  - Crop load, reduce competition between individual fruit

Sprays

- Three Sprays and a control
  - Sure Seal, RainGard, 24/7
- Sites
  - Huonville, on Sweetheart, 58.2 mm
  - Old Beach, on Sweetheart, 49.6mm
  - Lenswood, on Stella, 18.8 mm
  - Lenswood, on Sweetheart, 17.0 mm
  - Victoria on Sweetheart, 100+ mm*
- At least 40 trees per spray

Sprays

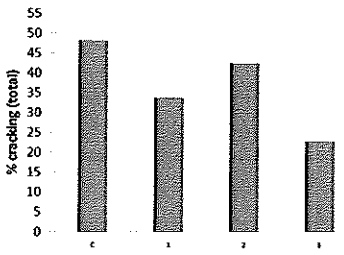
- Huon



A significant (P=0.024 effect of spray type on total cracking was found (lsd = 9.5)

Sprays

- Site B



A significant (P=0.001) effect of spray type on total cracking was found (lsd = 8.1)

Sprays

- Fruit properties

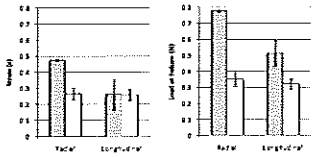
Huon	Size (mm)	Force (g/m)	TSS
Control	29.1[a]	414.0[a]	15.2[a]
24/7	29.2[a]	454.7[b]	18.3[c]
SS	27.4[b]	445.2[b]	14.6[a]
RG	30.2[c]	403.3[a]	17.0[b]
Old Beach			
Control	25.5[a]	412.7[a]	16.5[a]
24/7	27.1[b]	436.4[b]	18.9[b]
SS	27.1[b]	464.7[b]	16.4[a]
RG	27.6[b]	403.0[a]	19.5[b]

Sprays

- Sprays reduced total cracking in all sites
  - Up to 50% reduction
- Majority of reduction in stem and apical end cracks
- Influence on fruit properties
  - positive

Irrigation

- Sylvia
  - Predominantly exhibited side cracks
  - Influence of shape (Sawada 1934)



Mean fruit skin Strain (ε) and Load (N) at tissue failure in both the radial and longitudinal planes in Variety 'Van' (grey columns) and 'Sylvia' (white columns). A significant ($P<0.001$) difference was found between planes in variety 'Van'. Error bars represent SEM, n = 10.

Irrigation

- Old Beach, 4.2 mm RF only
- Three treatments
  - High, Medium and Low Volume
- Applied from end of Stage 1
- No significant difference in cracking
  (Less than 1% cracking)
- Fruit properties and Cracking Index determined

Irrigation

- Fruit properties

Site A	Size (mm)	Force (g/m)	TSS
High	**29.5**[a]	322.4[a]	18.0[a]
Med	27.9[b]	**343.0**[b]	18.4[a]
Low	27.0[c]	**347.1**[b]	19.3[b]

Irrigation

	2007 08	Christenson	Greco
Kendia	39	na	na
Regina	64	na	na
Simone	25	na	na
Summit	6	71	17
Sunburst	17	57	13
Sweetheart	6	na	na
Van	23	74	15

Cracking Index

Sig. relationship with side cracking

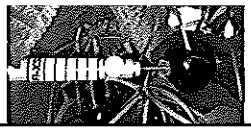
High 7

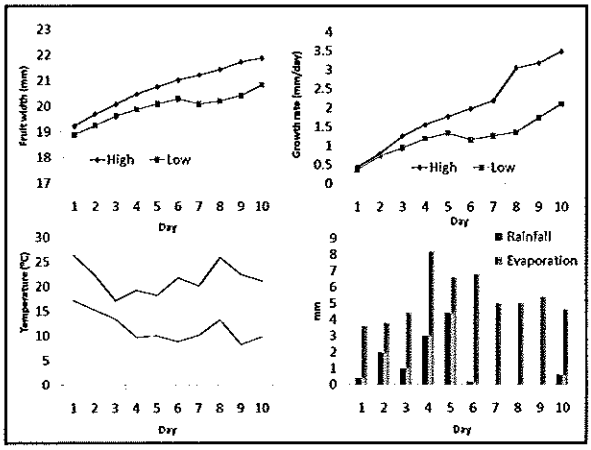
Medium 7

Low 16

Irrigation

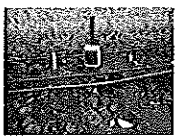
- Fruit under low Irrigation
  - more fluctuation in relation to total daily growth
- Reduce diurnal fluctuations in fruit shrinking and swelling
- Impact on Skin elasticity
- Fruit growth monitors





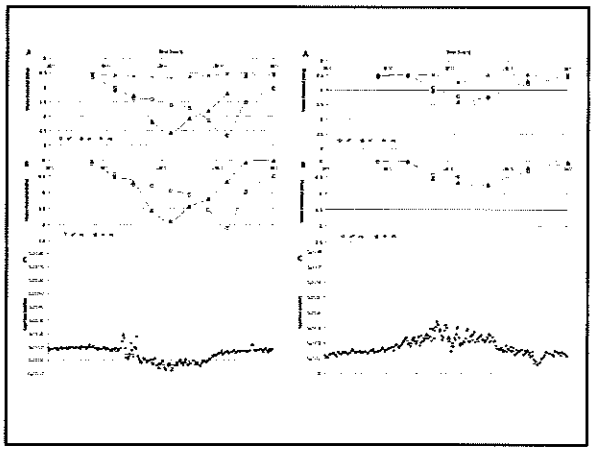
Irrigation

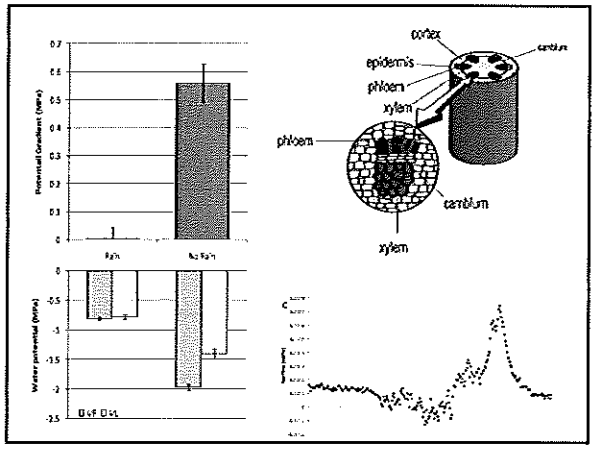
- Maintaining or increasing irrigation has the potential to reduce side cracking
- Increase in size (27 to 29.5 mm)
- small loss of sugars (19.3 to 18)



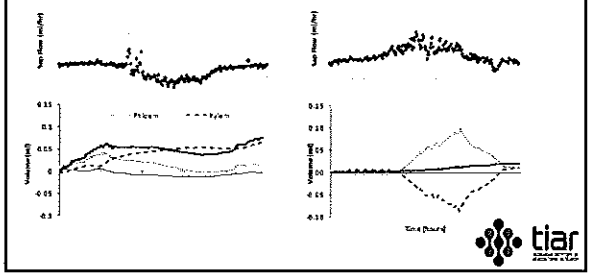
Pruning

- Huonville and Old Beach
- Simone
- Internal mechanism and side cracks
- Two internal pathways
- Xylem
- Phloem
- After rainfall?



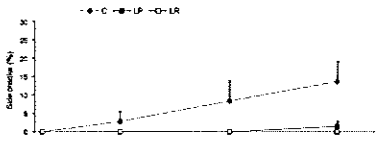


Phloem or Xylem?



Pruning

- Removing leaves
  - Limit rapid phloem influx during rainfall
- Impact on cracking
  - Side cracks significantly reduced with spur leaf removal

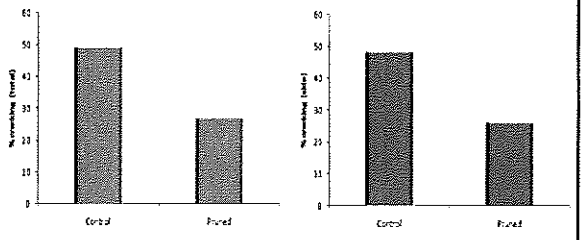


Pruning

- Impact on sugars?
  - Removing top growth during rainfall
    - Cracking and sugars
  - Ayala and Lang (2008)
    - Cherry fruit strong sinks
    - Stage III (cracking)
    - Alternative sources
      - Spur leaves, new leaves current season

Pruning

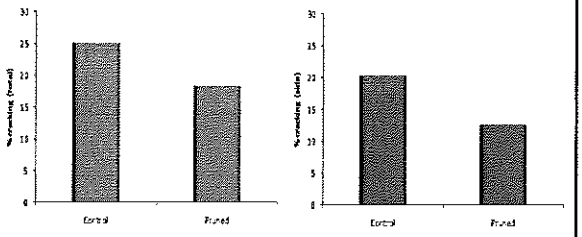
- Cracking reduction – Old Beach



Significant (P<0.05) effect of pruning on total and side cracking (lsd = 6.4, 6.2)

Pruning

- Cracking reduction – Huon



Significant (P<0.05) effect of pruning on total and side cracking (lsd = 1.84, 1.95)

Pruning

- Fruit properties

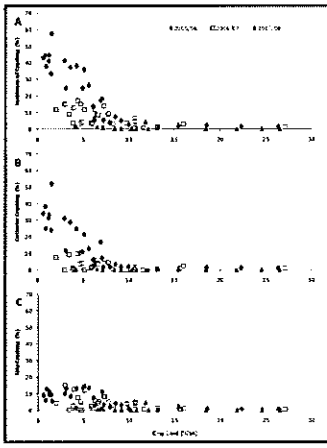
Old Beach	Weight (g)	Size (mm)	TSS
Control	10.31[a]	30.28[a]	16.04[a]
Pruned	10.34[a]	30.31[a]	**17.66[b]**
Huon	**Weight (g)**	**Size (mm)**	**TSS**
Control	10.23[a]	30.20[a]	17.05[a]
Pruned	10.69[a]	30.66[a]	**17.83[b]**

Pruning

- Pruning reduced total cracking in both trials
  - Up to 50%
- Majority of reduction in side cracks
- No loss of size
- Increase in sugars (17.1 to 17.8 and 16.0 to 17.7)
- Further research – timing of pruning, removal of competing sink or removal of water source

Crop Load

- Sites
  - Old Beach on Sweetheart, 49.2mm
  - Huonville on Sweetheart, 49.6mm
  - Huonville on Regina, 42.4mm
- Factorial
  - Three crop levels
    - Low, Medium, High
  - Three thinning times
    - Dormant, Full Bloom and 4WAFB

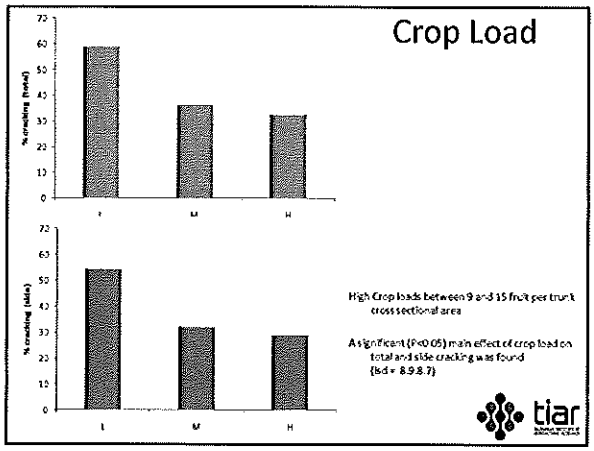


Crop Load

The percentage of;
- total cracked fruit (A),
- cuticular-cracked fruit (B)
- side-cracked fruit (C)

with natural crop load.

Girth (cm)	Fruit Number
25	500
30	750
35	1000
50	2000



Crop Load

- Cracking with timing of thinning

	Low	Medium	High
Dormant	47.53	44.31	32.72
Full Bloom	68.09	35.15	35.19
4WAFB	50.71	35.58	31.62

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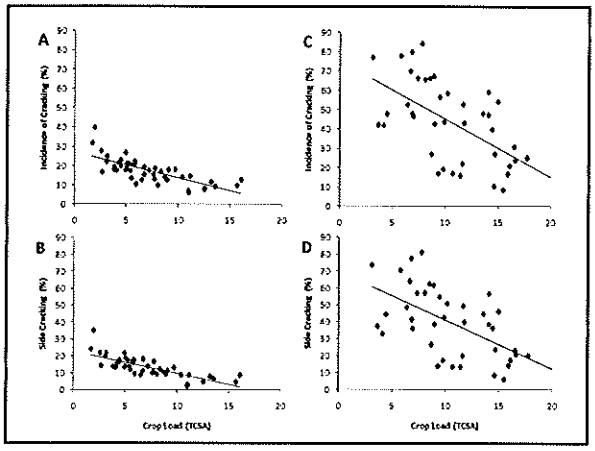

Crop Load

- Lower crop loads show higher % cracking
- Higher and medium levels of crop loads show lower % cracking
- Reduction up to 50%
- Higher crop loads not always showing loss of size or sugar content
- Thinning to low levels at Full Bloom induced most cracking

	10	15	20
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

The range of yields, t/ha, required to avoid cracking under low crop loads and loss of size under high crop load for tree with 30cm circumference (av. 12g fruit)

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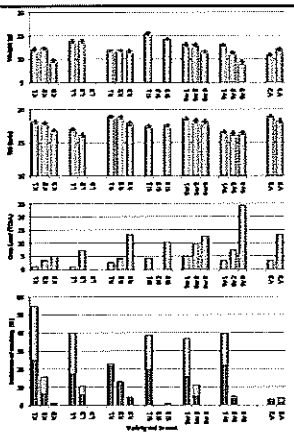

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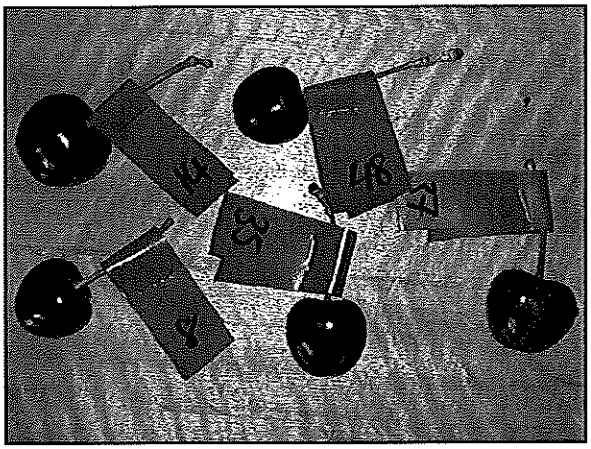

Finding the Solution?

- One more season
- Combine promising outcomes
- Explore interactions
- Explore seasonal climate

- Grower feedback – Thankyou!
- Coordinated research
- **The future????? – one more step – where?**

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Acknowledgements

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- fgt
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Questions?