Postharvest treatments used to reduce external chilling injury in 'Pinkerton' avocados

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'Pinkerton' background…

- ✓ 'Hass' x 'Rincon' (California, 1961)

  (Guatamalan characteristics)

- ✓ Consistent heavy bearing green skin cultivar

  (8% to 12% of RSA exports)

- X Export threatened by physiological disorder

  – mesocarp discolouration (1999).

‘Pinkerton’ internal disorder…

Mesocarp discolouration	Solution (2000 – 2003)
	**Preharvest** **↓ Tree nitrogen (<1% Leaf N by March, RSA)**

‘Pinkerton’ internal disorder…

Mesocarp discolouration	Solution (2000 – 2003)
	**Postharvest** **↓ Storage temperature (5.5°C to 2°C)**

…However

Decrease in storage temperature…

Mesocarp discolouration	External chilling injury
	

Objectives…

Improve overall export quality of South African ‘Pinkerton’ avocados by:

- Finding techniques to reduce external chilling injury.

…How

Previous techniques…

- Heat treatments
- Intermittent heating
- Genetic modification
- Controlled atmosphere storage
- Treatments with calcium or other chemicals
- Applications of plant growth regulators
- Temperature preconditioning
- Waxing, film packaging

Why?

Temperature conditioning…

- Why?
  - Previous research (2000 – 2003)
    - Storage delay (3 d) = reduced external chilling
  - Positive results on ‘Hass’ in New Zealand
- How?
  - Keep fruit at temperatures slightly above critical chilling range prior to storage
  - Different to ‘step-down’ regime

Fruit coatings…

- Aim
  - Maintain high relative humidity around fruit
  - Modify gas exchange
- Question
  - What role does weight loss play in chilling injury development?

Materials & Methods …

- Fruit source close to University (±1 hr)
- Two harvest dates:

  03/08/2004 and 23/08/2004
- Treatments:

  Unwaxed, Waxed, Polypropylene bags

  (Polybags removed after storage)

Materials & Methods …

- Preconditioning treatment

  Period: 0, 1 or 2 days

  Temperature: 10^{o}C, 15^{o}C or 20^{o}C

- Storage temperature (30 days)

  2^{o}C or 5.5^{o}C

Materials & Methods …

- Measurements:
  - moisture content (maturity), firmness, weight loss, days to ripening
- Ratings:
  - chilling injury (external)
  - mesocarp discolouration
  - pathogenic infections

Results…

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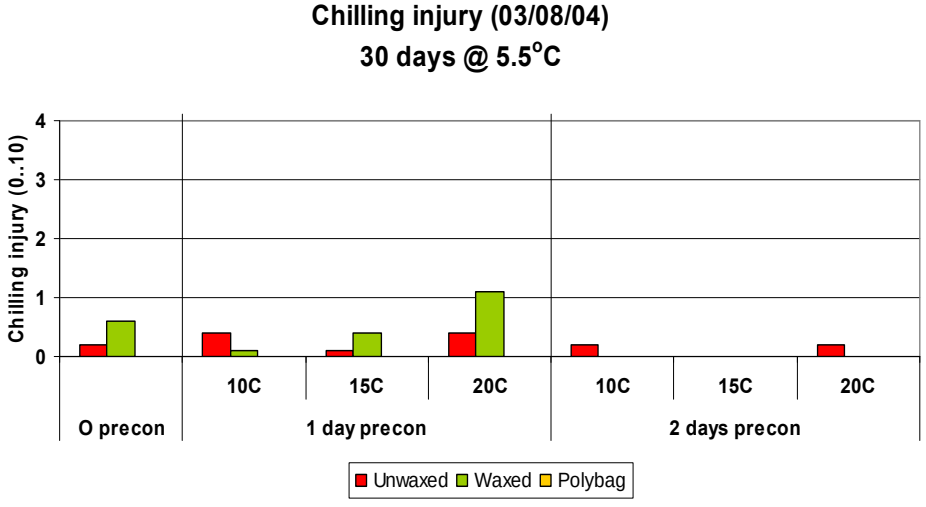
76.8% Moisture



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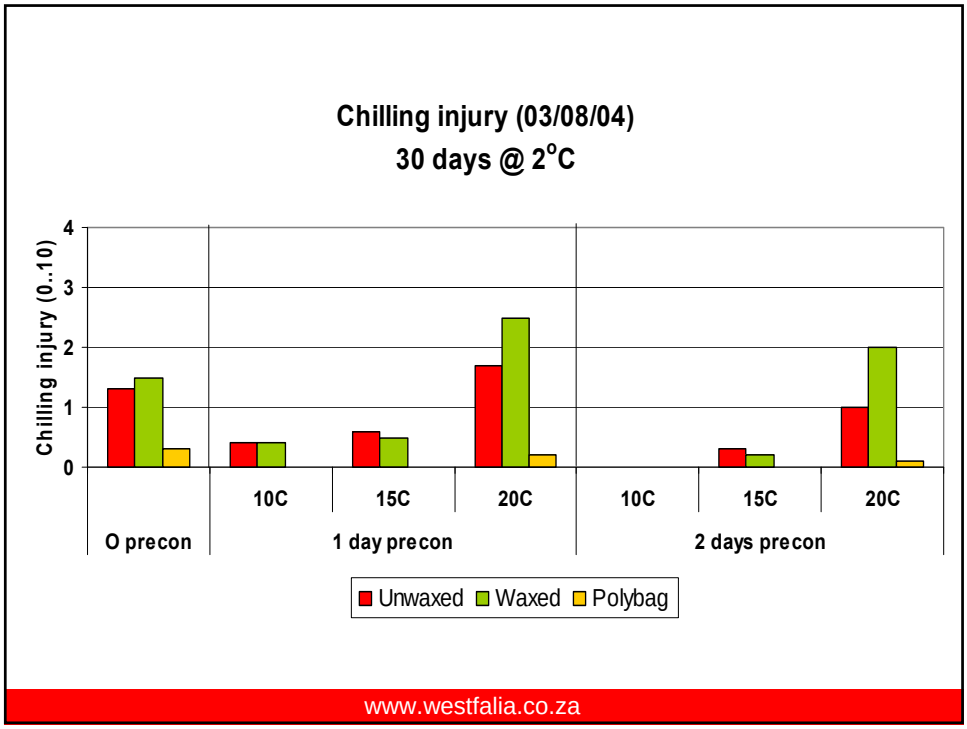
Chilling injury (03/08/04)
30 days @ 2°C
Chilling injury (0..10)
4
3
2
1
0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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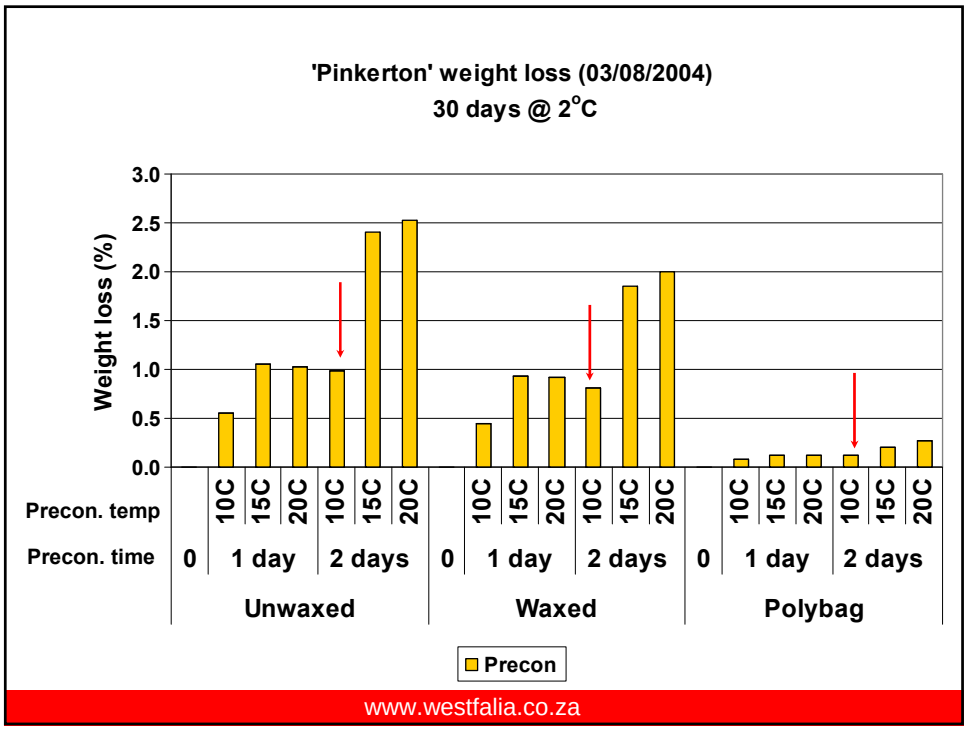
'Pinkerton' weight loss (03/08/2004)
30 days @ 2°C
Weight loss (%)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Precon. temp
Precon. time
10C
15C
20C
0
1 day
2 days
Unwaxed
Waxed
Polybag
Precon
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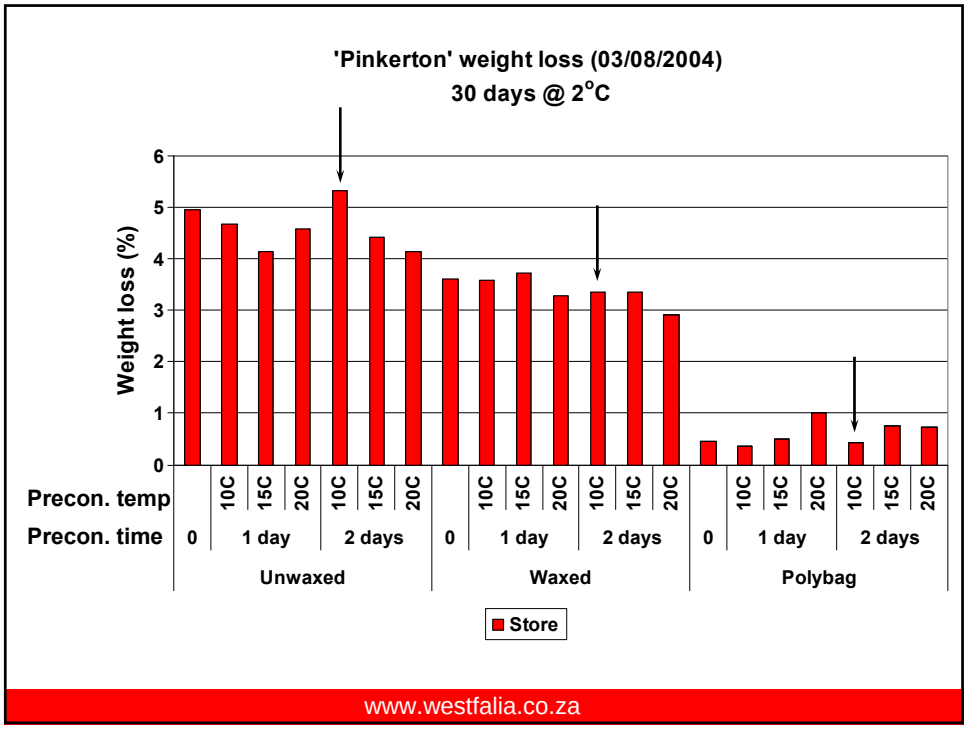
'Pinkerton' weight loss (03/08/2004)
30 days @ 2°C
Weight loss (%)
0
1
2
3
4
5
6
Precon. temp
10C
15C
20C
Precon. time
0
1 day
2 days
Unwaxed
Waxed
Polybag
Store
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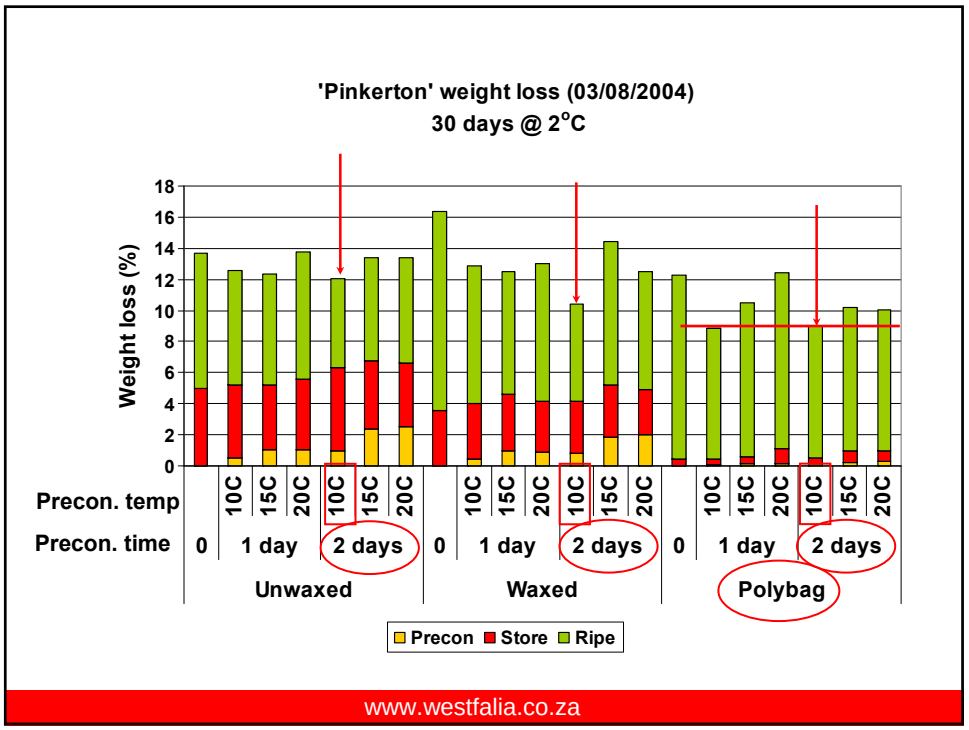
'Pinkerton' weight loss (03/08/2004)
30 days @ 2°C
Weight loss (%)
0
2
4
6
8
10
12
14
16
18
Precon. temp
10C
15C
20C
Precon. time
0
1 day
2 days
Unwaxed
Waxed
Polybag
Precon
Store
Ripe
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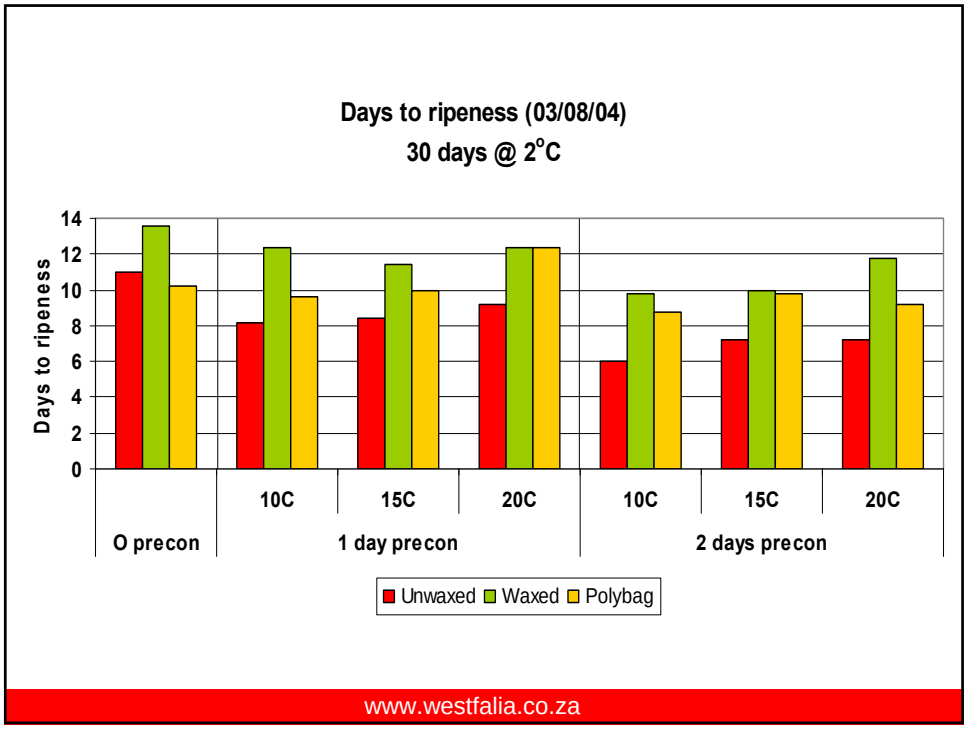
Days to ripeness (03/08/04)
30 days @ 2°C
Days to ripeness
14
12
10
8
6
4
2
0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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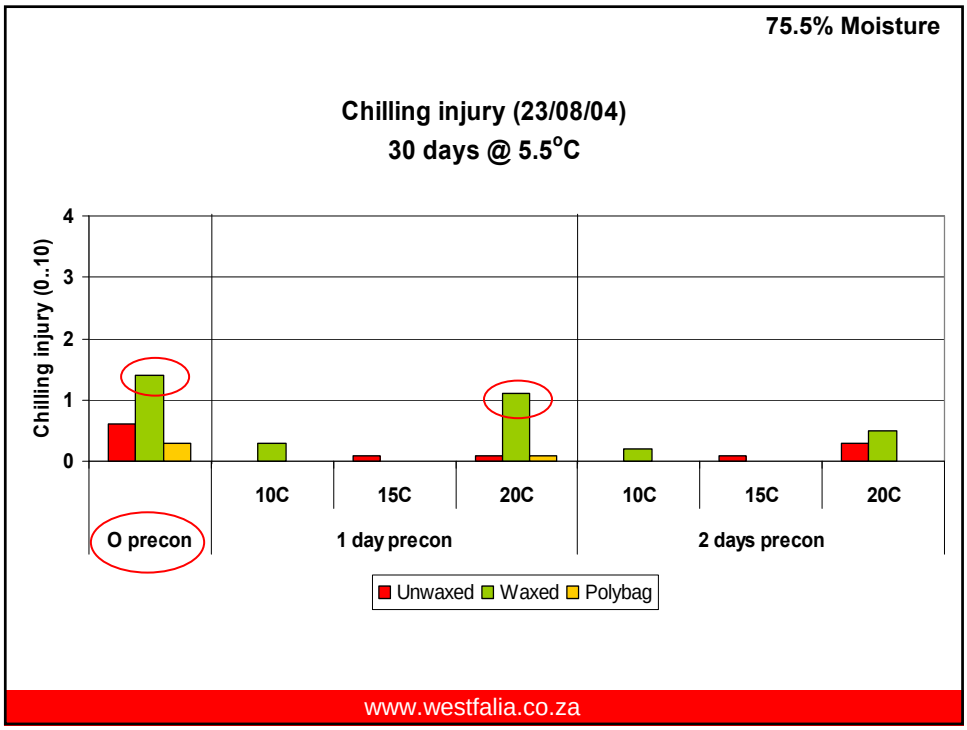
75.5% Moisture
Chilling injury (23/08/04)
30 days @ 5.5°C
Chilling injury (0..10)
4
3
2
1
0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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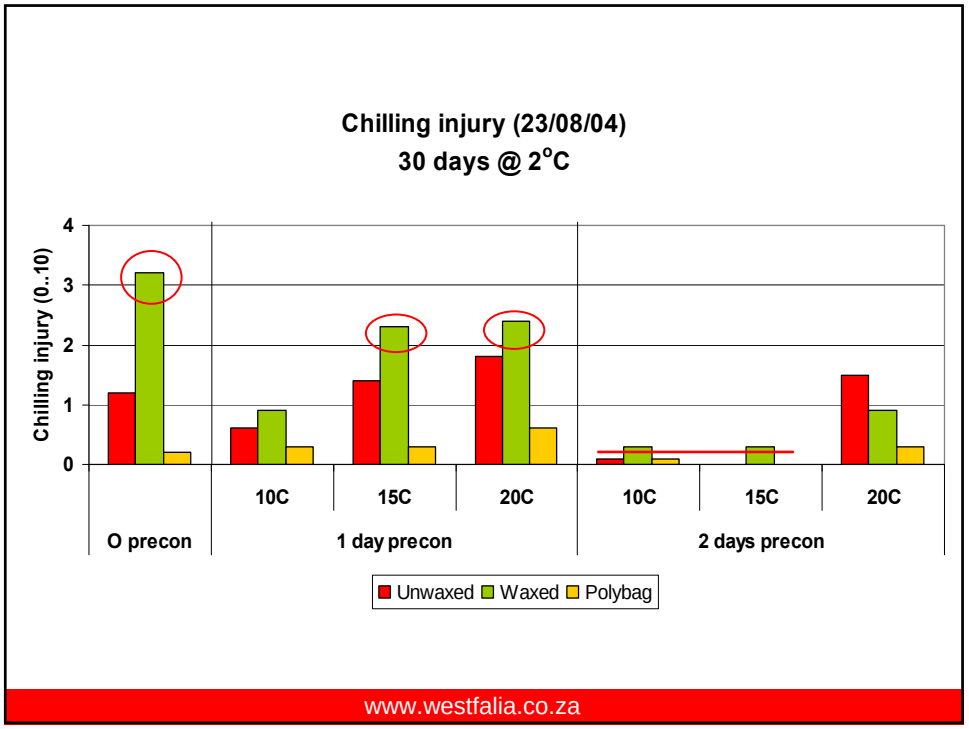
Chilling injury (23/08/04)
30 days @ 2°C
Chilling injury (0..10)
4
3
2
1
0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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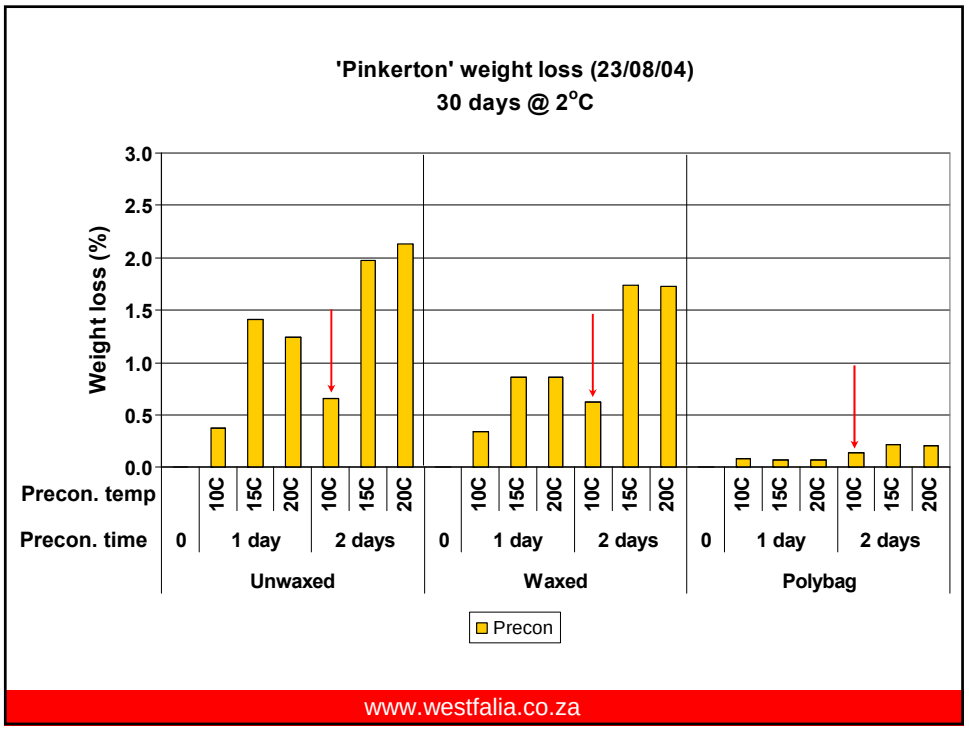
'Pinkerton' weight loss (23/08/04)
30 days @ 2°C
Weight loss (%)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Precon. temp
Precon. time
0
1 day
2 days
10C
15C
20C
Unwaxed
Waxed
Polybag
Precon
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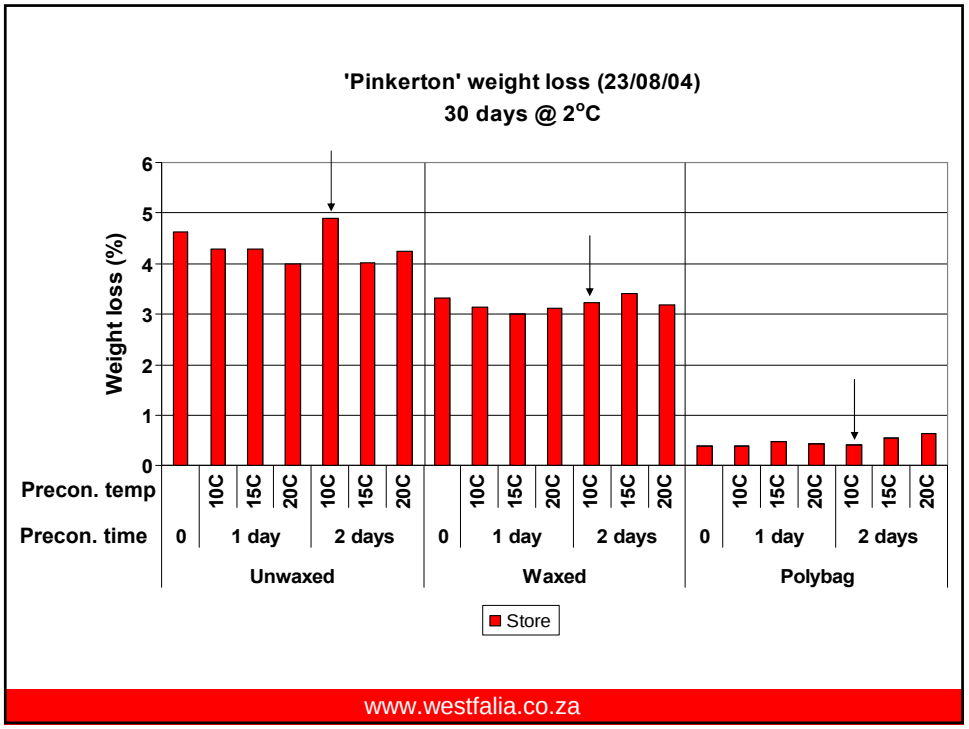
'Pinkerton' weight loss (23/08/04)
30 days @ 2°C
Weight loss (%)
0
1
2
3
4
5
6
Precon. temp
10C
15C
20C
Precon. time
0
1 day
2 days
Unwaxed
Waxed
Polybag
Store
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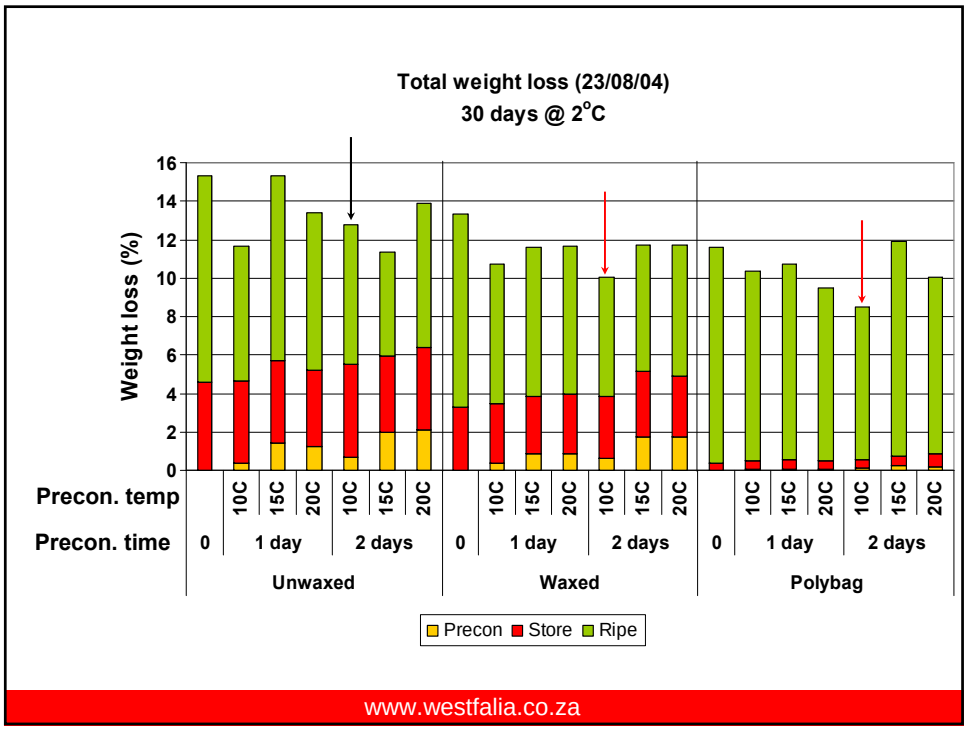
Total weight loss (23/08/04)
30 days @ 2°C
Weight loss (%)
0
2
4
6
8
10
12
14
16
Precon. temp
10C
15C
20C
Precon. time
0
1 day
2 days
Unwaxed
Waxed
Polybag
Precon
Store
Ripe
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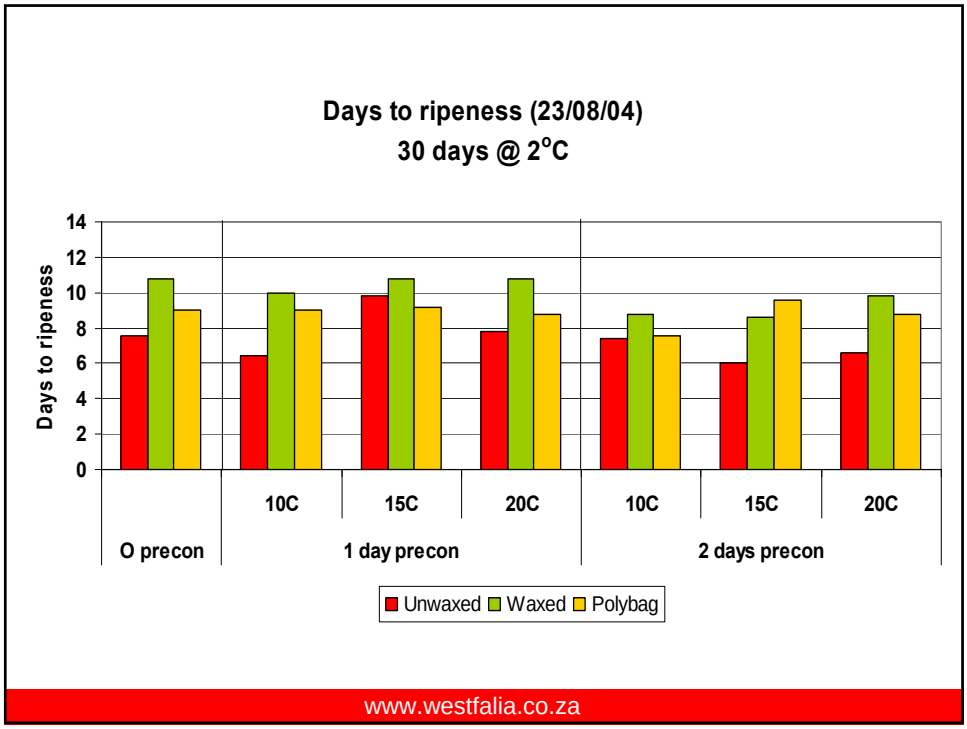
Days to ripeness (23/08/04)
30 days @ 2°C
Days to ripeness
14
12
10
8
6
4
2
0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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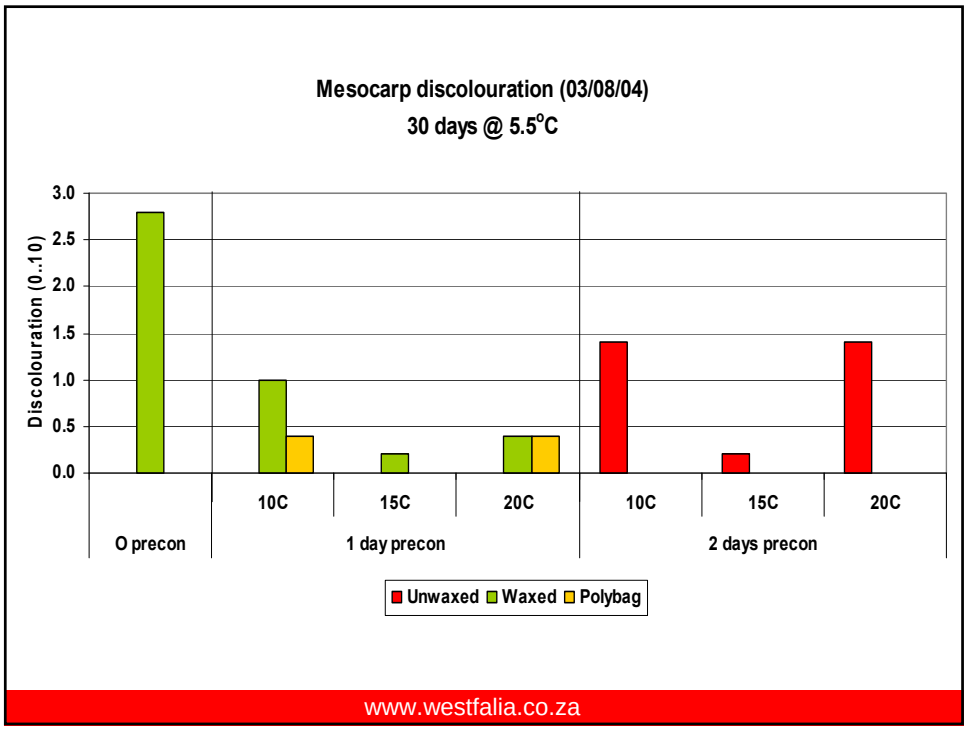
Mesocarp discolouration (03/08/04)
30 days @ 5.5°C
Discolouration (0..10)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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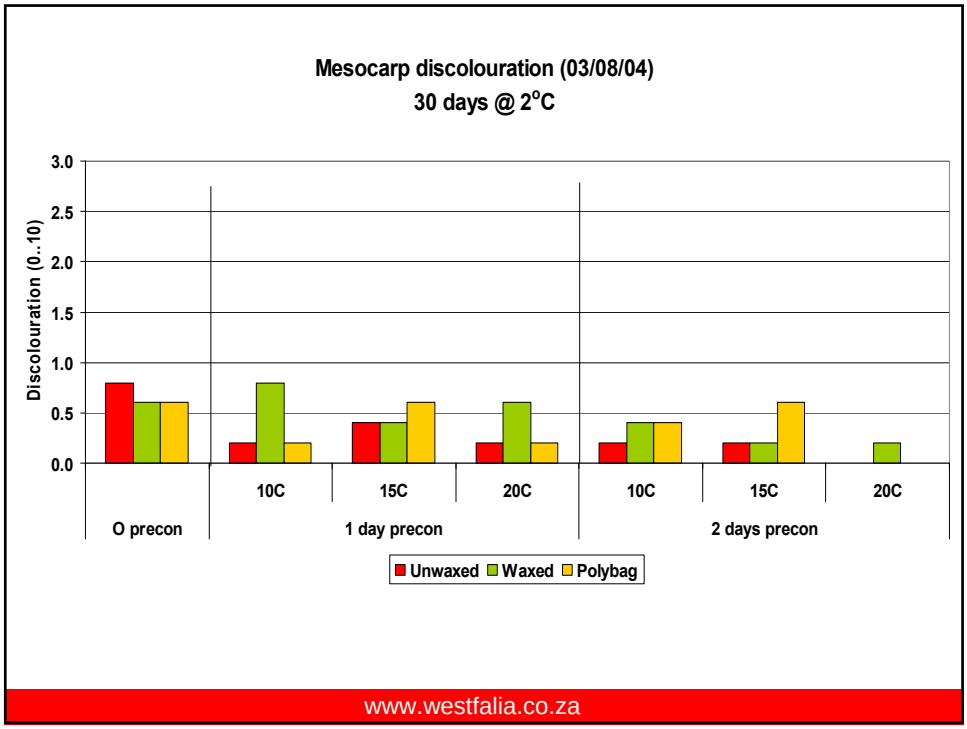
Mesocarp discolouration (03/08/04)
30 days @ 2°C
Discolouration (0..10)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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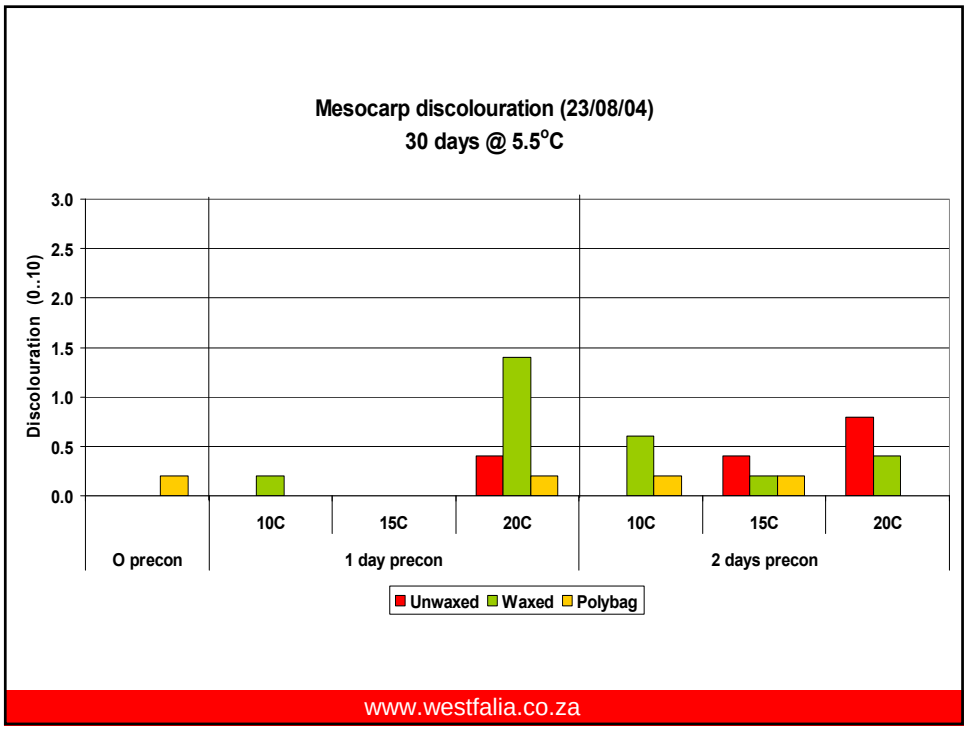
Mesocarp discolouration (23/08/04)
30 days @ 5.5°C
Discolouration (0..10)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10C
15C
20C
10C
15C
20C
O precon
1 day precon
2 days precon
Unwaxed
Waxed
Polybag
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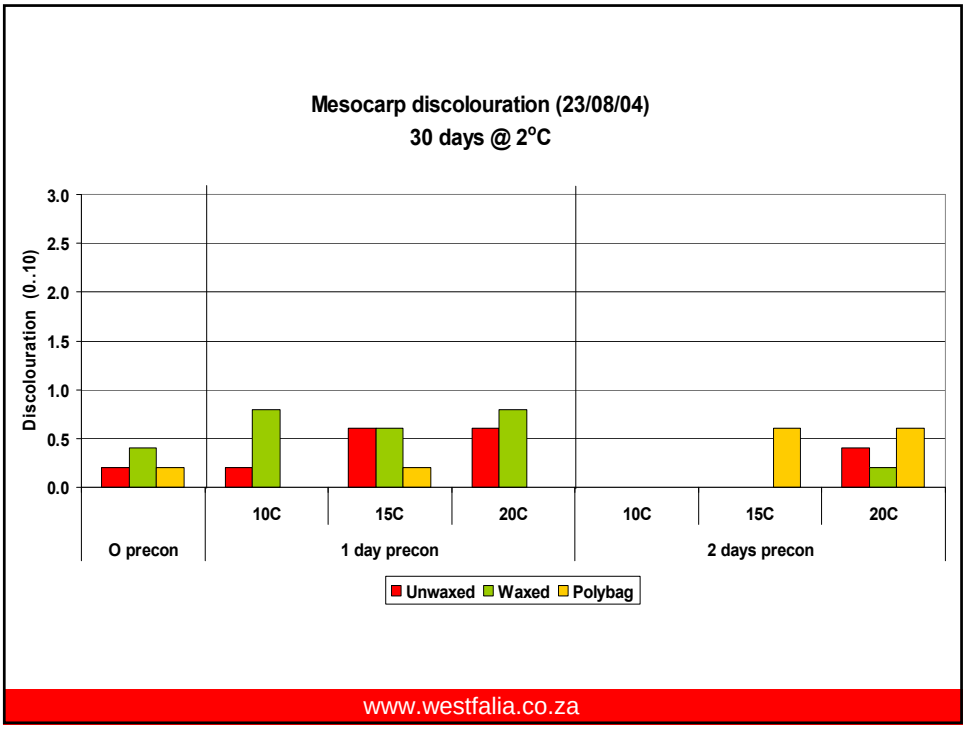

Conclusions…

- Preconditioning shows potential
  - 2 days @ 10°C most effective at reducing chilling injury (2°C or 5.5°C)
- Fruit coating plays a role
  - Waxed fruit most severe chilling injury
  - Polybag fruit showed least chilling injury (weight loss?)

Future work…

- Optimize length and temperature of preconditioning treatment

  (Best overall internal and external quality)
- Repeat trial on larger scale
- Investigate different wax types