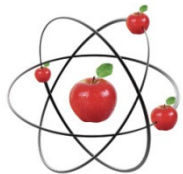


# Respiration and softening rates of 'Maluma' and 'Ryan' avocados and the effect that cold chain breaks have on the ripening and quality of these cultivars

D. Lemmer & F.J. Kruger



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# Why research needed?

- Most important **problems are soft landings** (fruit softening while in transit) as well as physiological and pathological disorders
- Currently there is **no data available** regarding the physiological changes (particularly **respiration rate increase and firmness loss**) that occur during the storage period
- **Urgent need** for this information



# Background

- **Four year project: Post-Harvest Innovation Programme**
- **Year one:** Baseline – ‘Hass’ at different **maturities and temperature regimes** stored @ **RA** - Firmness and Respiration rate
- **Year two:** Breaks simulated at different stages in the cold chain, ‘Hass’ stored @ RA, CA and SmartFresh - Firmness, Respiration rate, Ripening & Quality
- **Year three:** most important trials repeated with ‘Fuerte’ and ‘Pinkerton’
- **Year four (current):** most important trials repeated with ‘Maluma’ and ‘Ryan’



# Material and methods:

- Export 'Maluma' and 'Ryan' fruit count 18:
  - 70% MC
  - Mayo & Pienaar Pakkers
- Stored for 30 days @ 4,6 and 8°C
- Respiration rate (mg CO<sub>2</sub>/kg/h):
  - 2 ten box replicates
  - measured, 4 day intervals
- Firmness: Sinclair firmness meter (iQ)
  - measured, 4 day intervals
  - 4 boxes / temperature setting
- Quality: DTR, CI, GP, PS, SER, ANT, VB



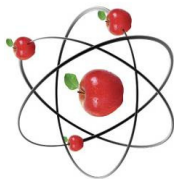
# Treatments

'Maluma'  
and  
'Ryan'

Treat no	Moist (%)	Storage Temp	Storage condition	Break (day)	Break Period (hours)
1	70	4	RA	no break	
2	70	4	SF	no break	
3	70	4	CA	no break	
4	70	6	RA	no break	
5	70	6	SF	no break	
6	70	6	CA	no break	
7	70	6	RA	5	5
8	70	6	RA	5	10
9	70	6	RA	5	20
10	70	6	RA	20	5
11	70	6	RA	20	10
12	70	6	RA	20	20
13	70	6	SF	5	5
14	70	6	SF	5	10
15	70	6	SF	5	20
16	70	6	SF	20	5
17	70	6	SF	20	10
18	70	6	SF	20	20
19	70	8	RA	no break	
20	70	8	SF	no break	
21	70	8	CA	no break	

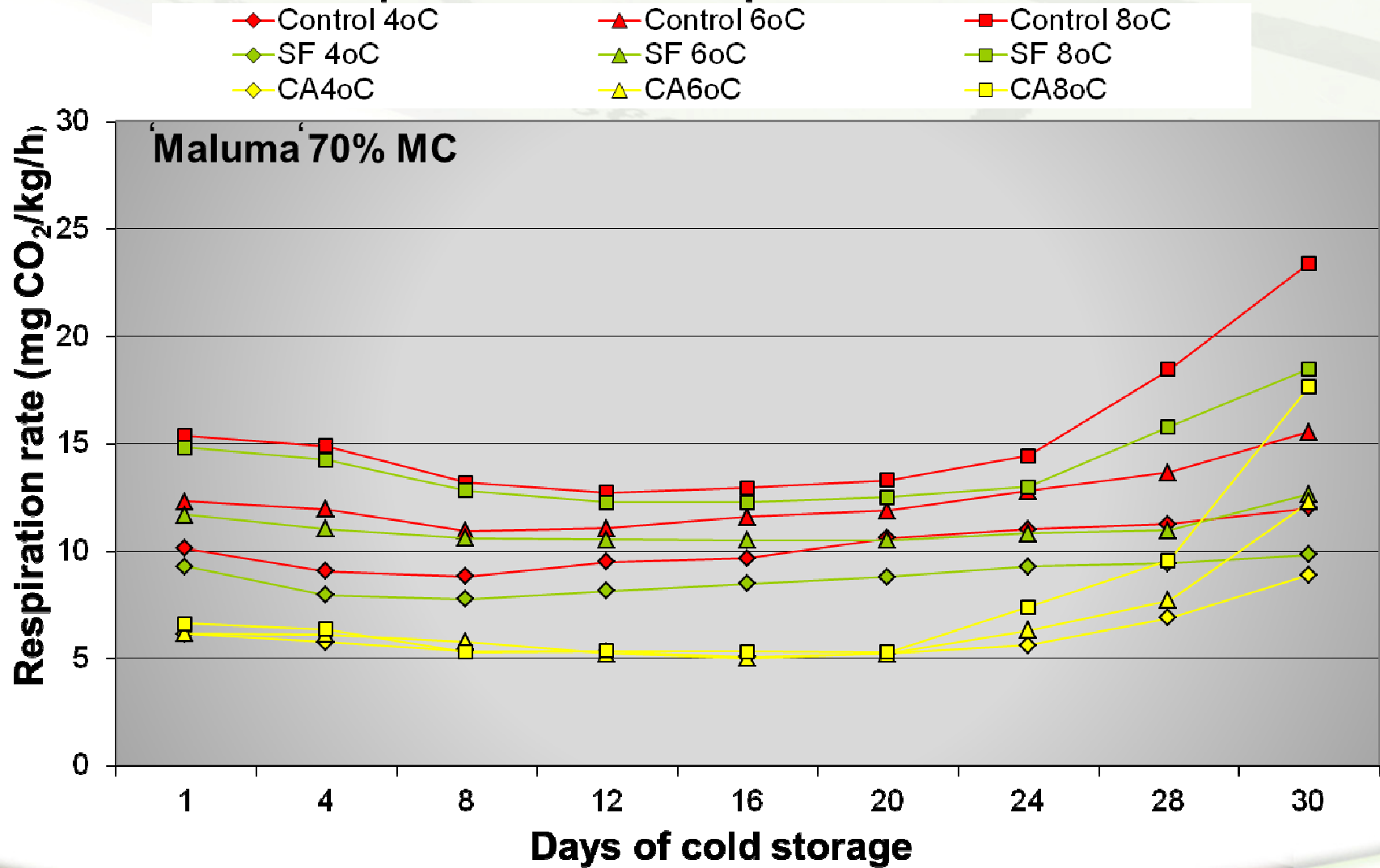
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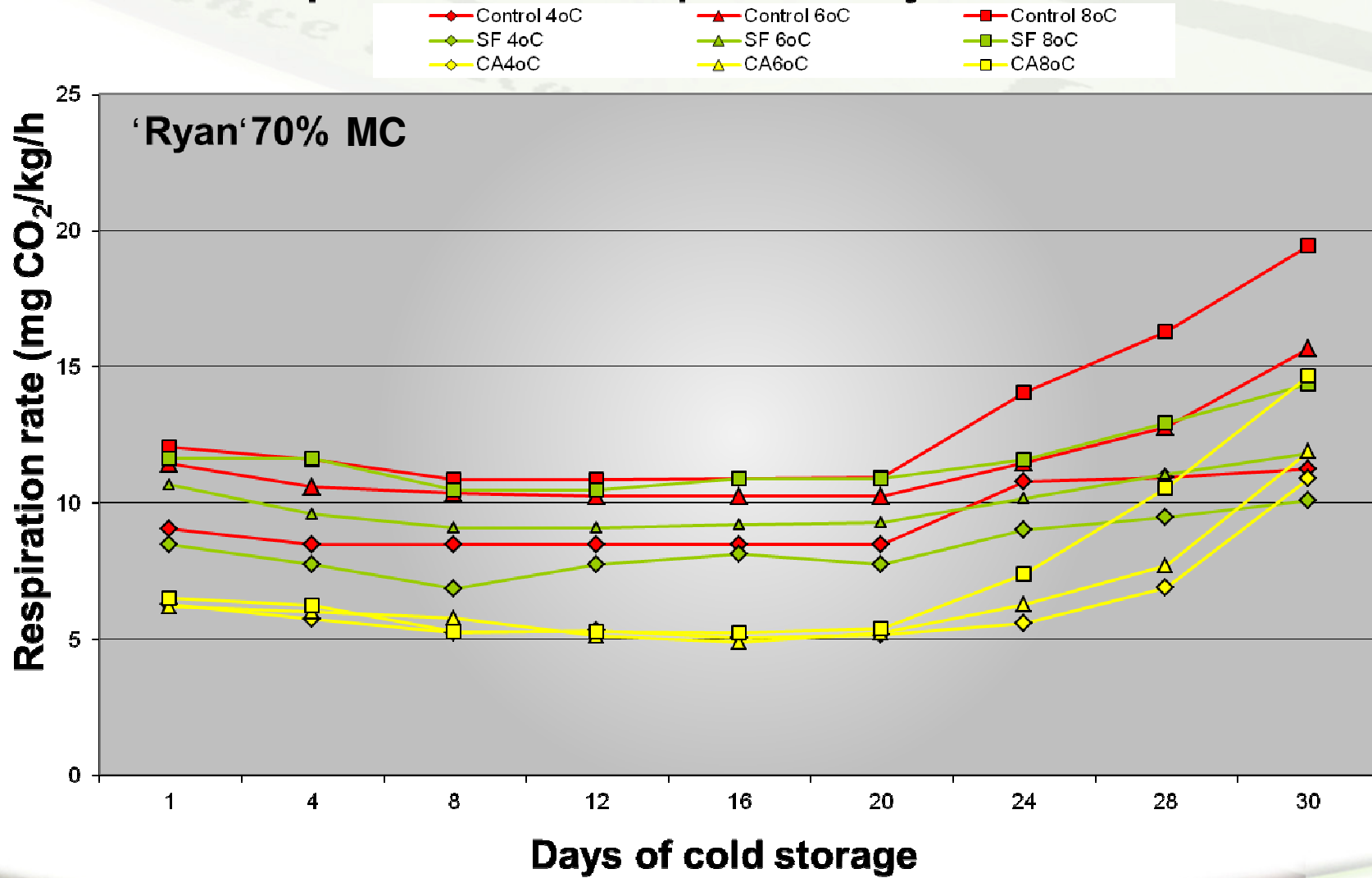
# Results

## Respiration rate All temperatures 'Malumá 70% MC



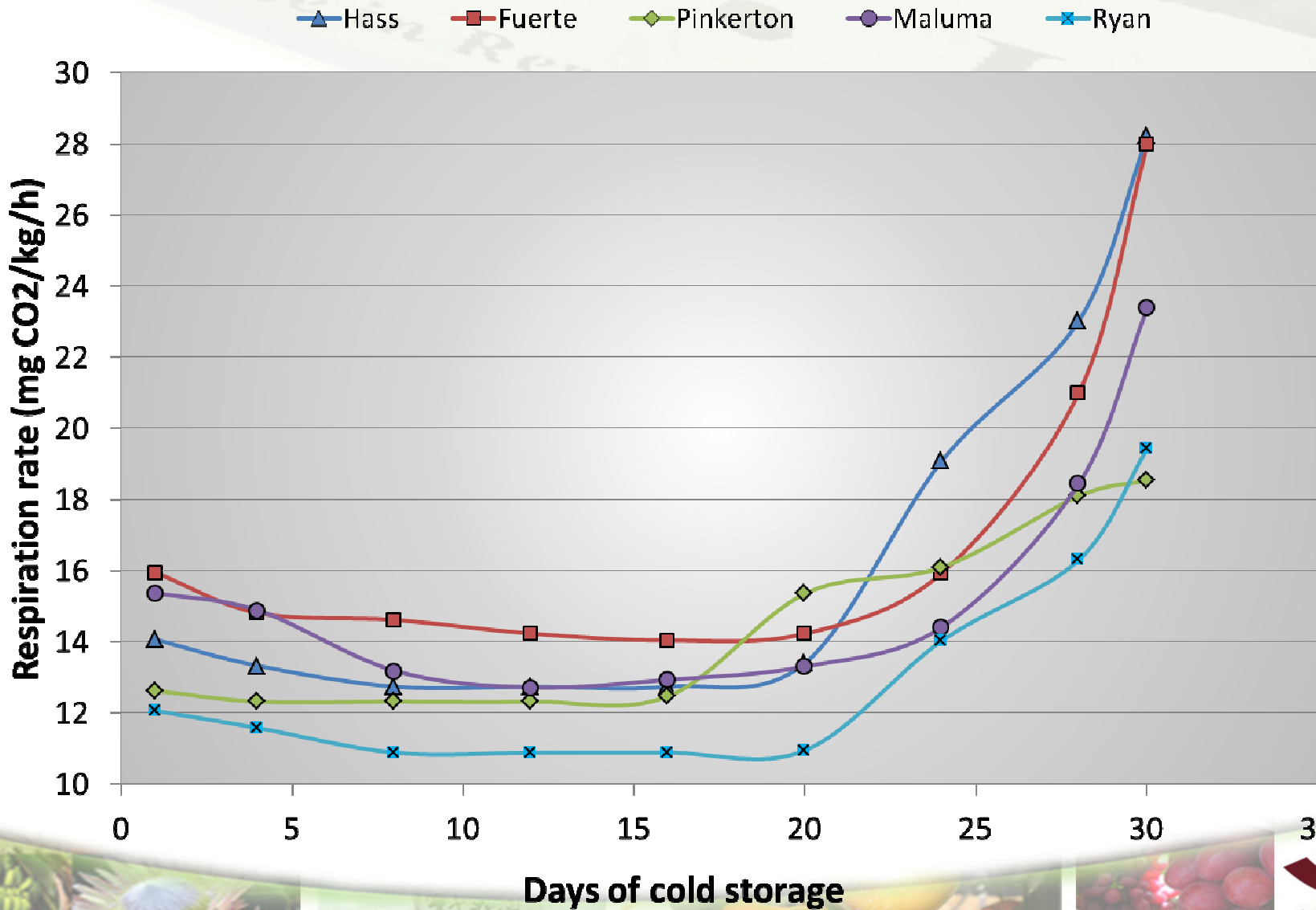
# Results

## Respiration rate All temperatures 'Ryan' 70% MC



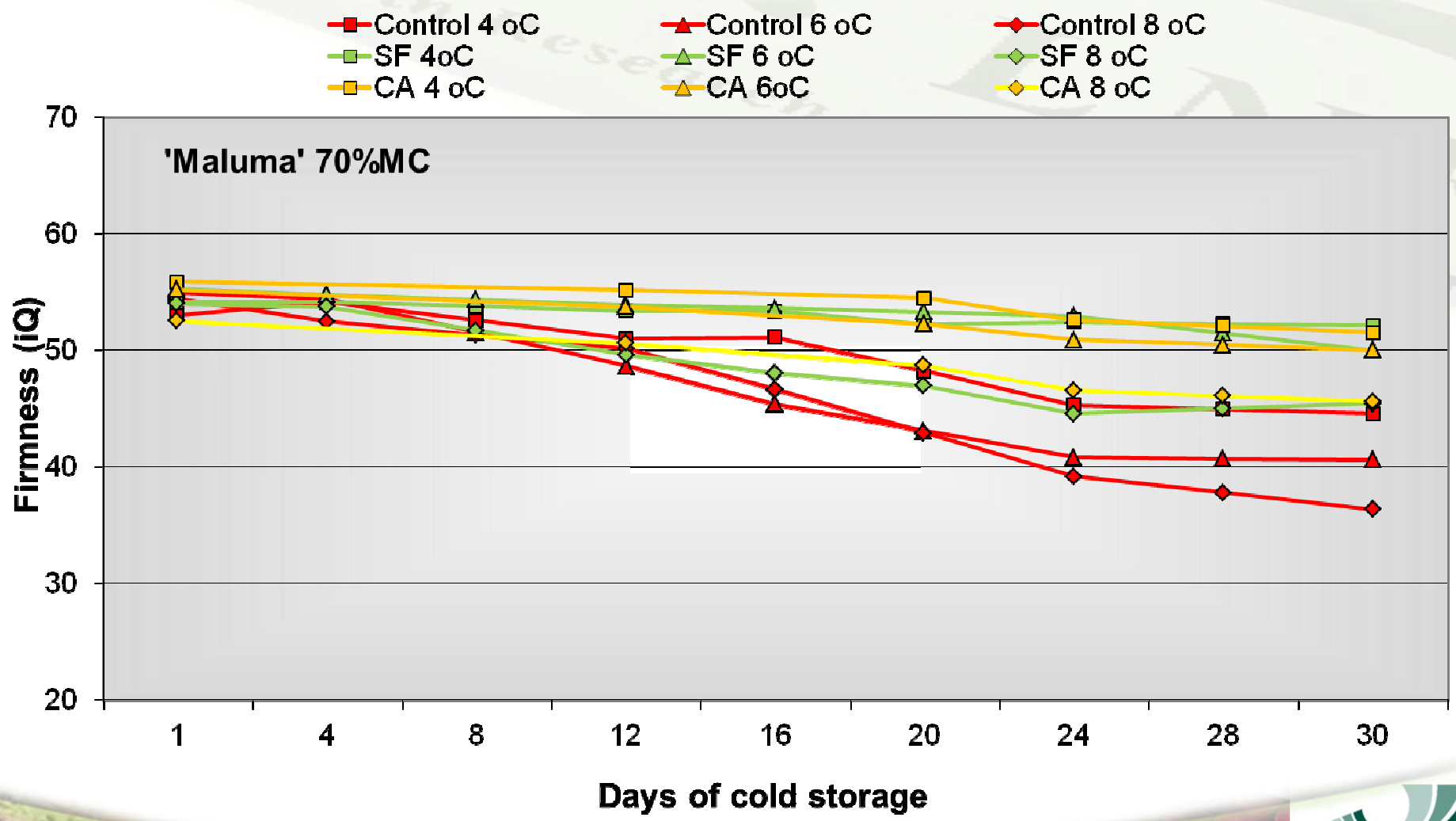
# Results

Respiration rate all cultivars at 8°C



# Results:

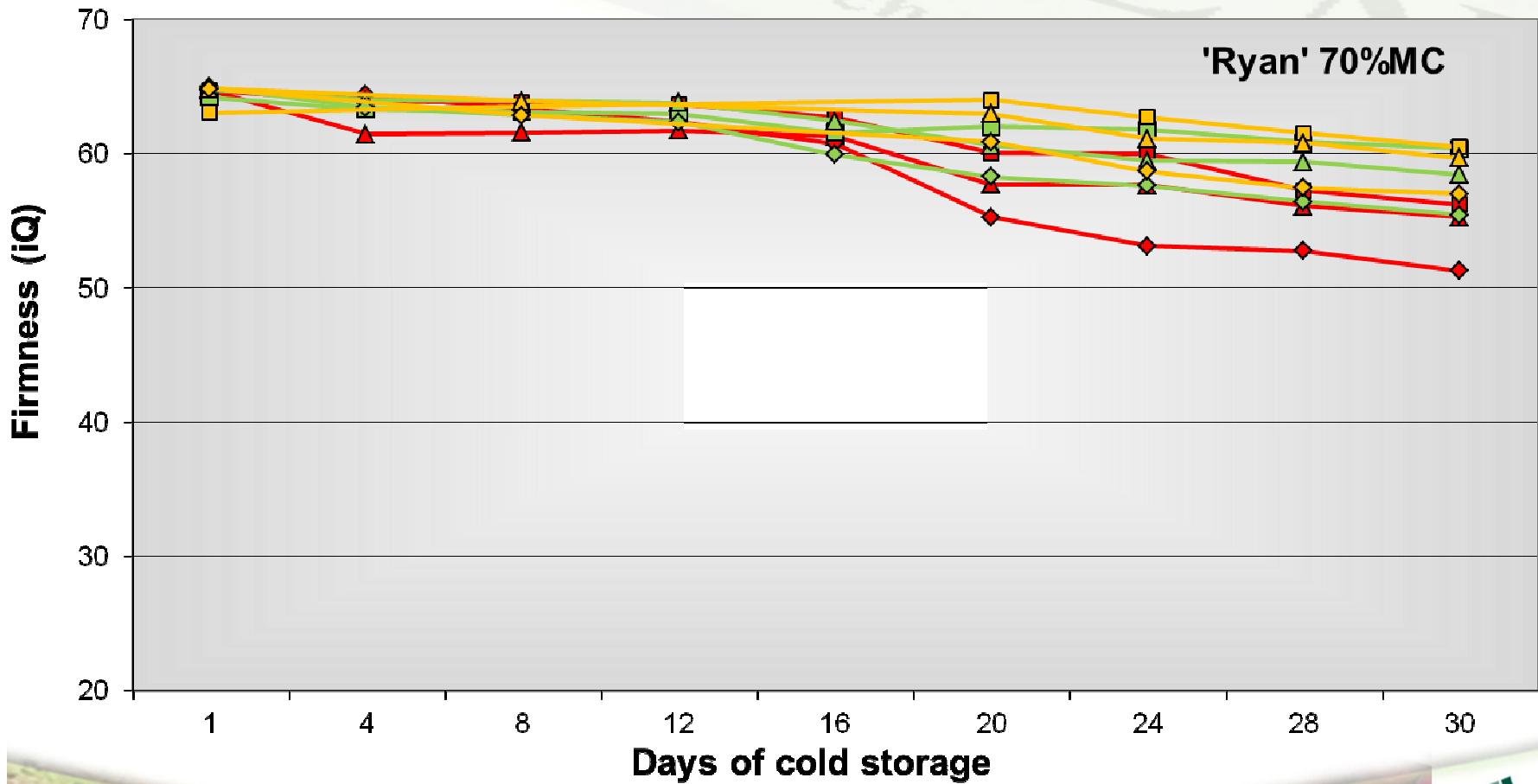
## Firmness reduction 'Maluma'



# Results:

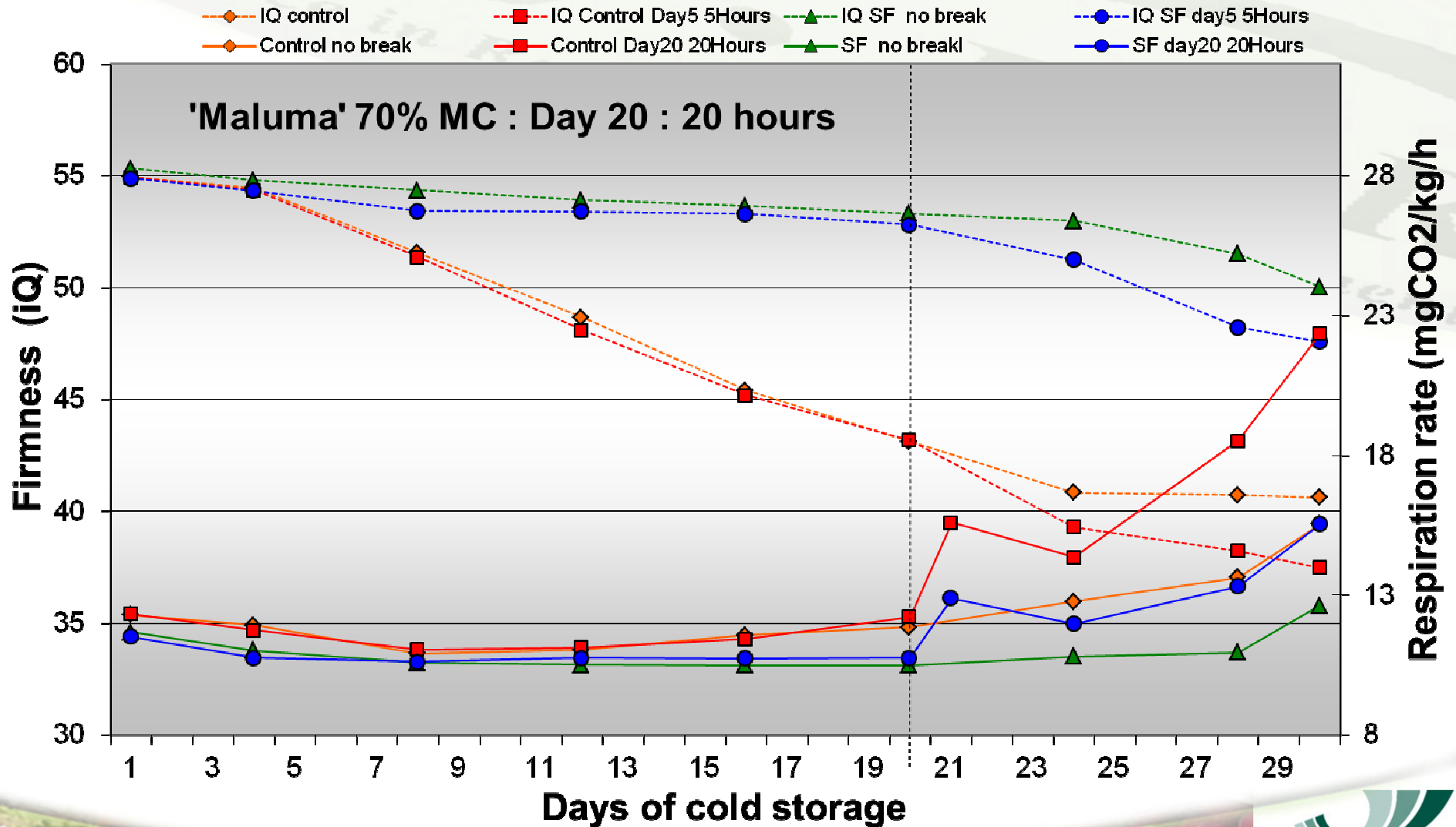
## Firmness reduction 'Ryan' 70% MC

- Control 4 C
- Control 6 C
- Control 8 C
- SF 4 C
- SF 6 C
- SF 8 C
- CA 4 C
- CA 6 C
- CA 8 C



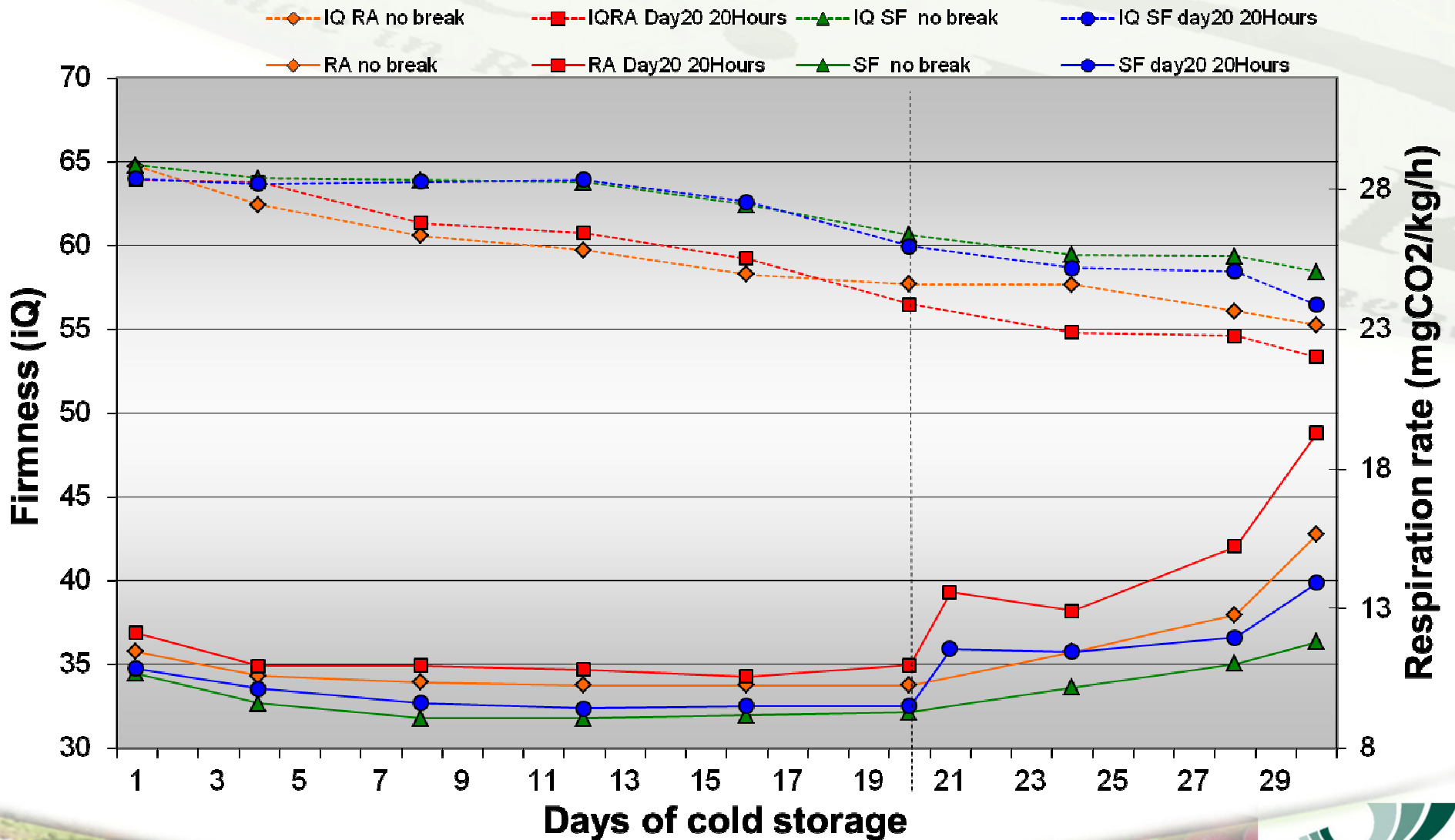
# Results

## Cold chain break 'Maluma' Day20 : 20 Hours



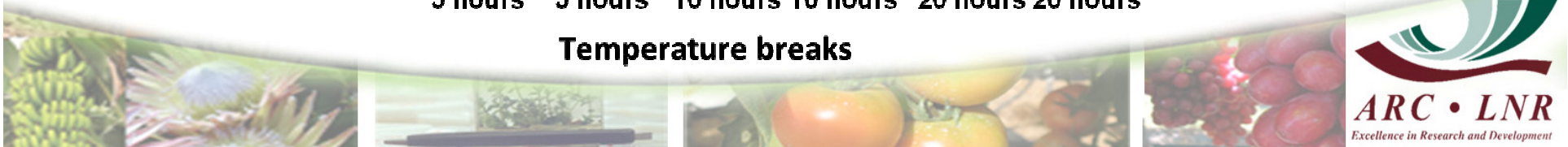
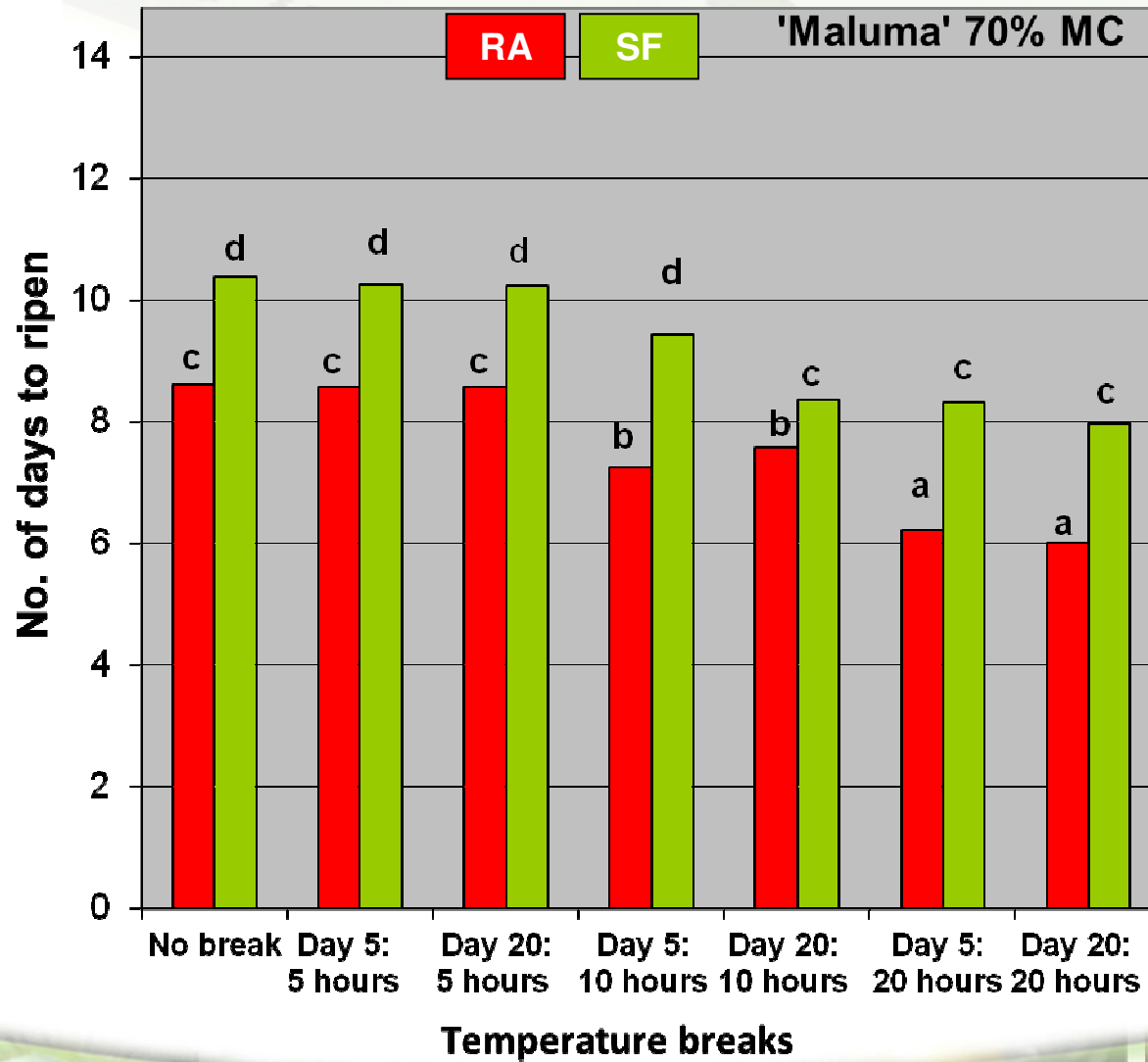
# Results

## Cold chain break: 'Ryan' 70% MC : Day 20 : 20



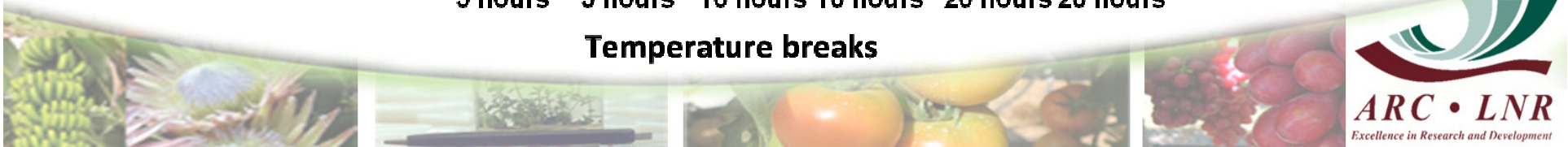
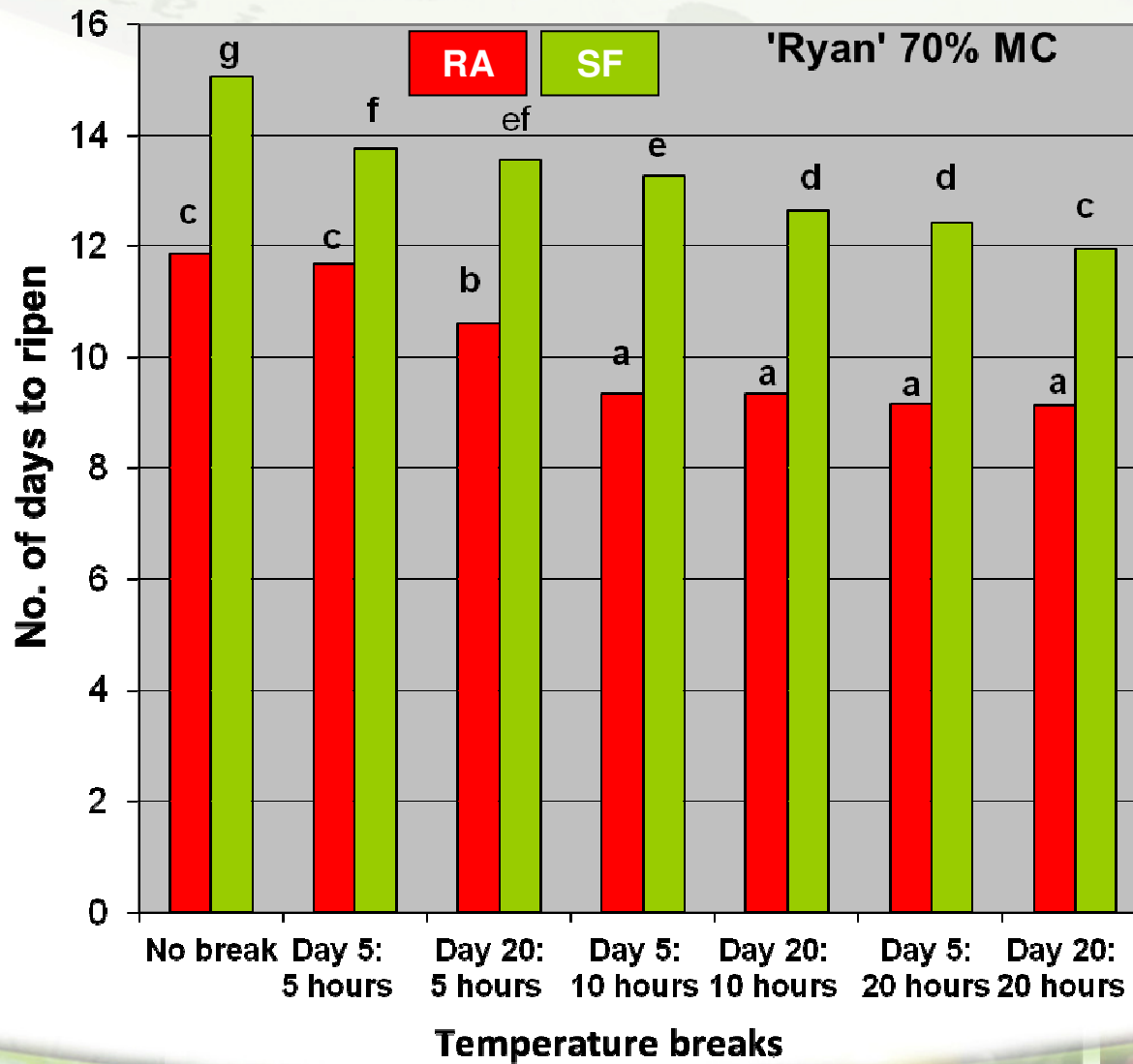
# Results

Cold chain brakes: No of days to ripen 'Maluma'



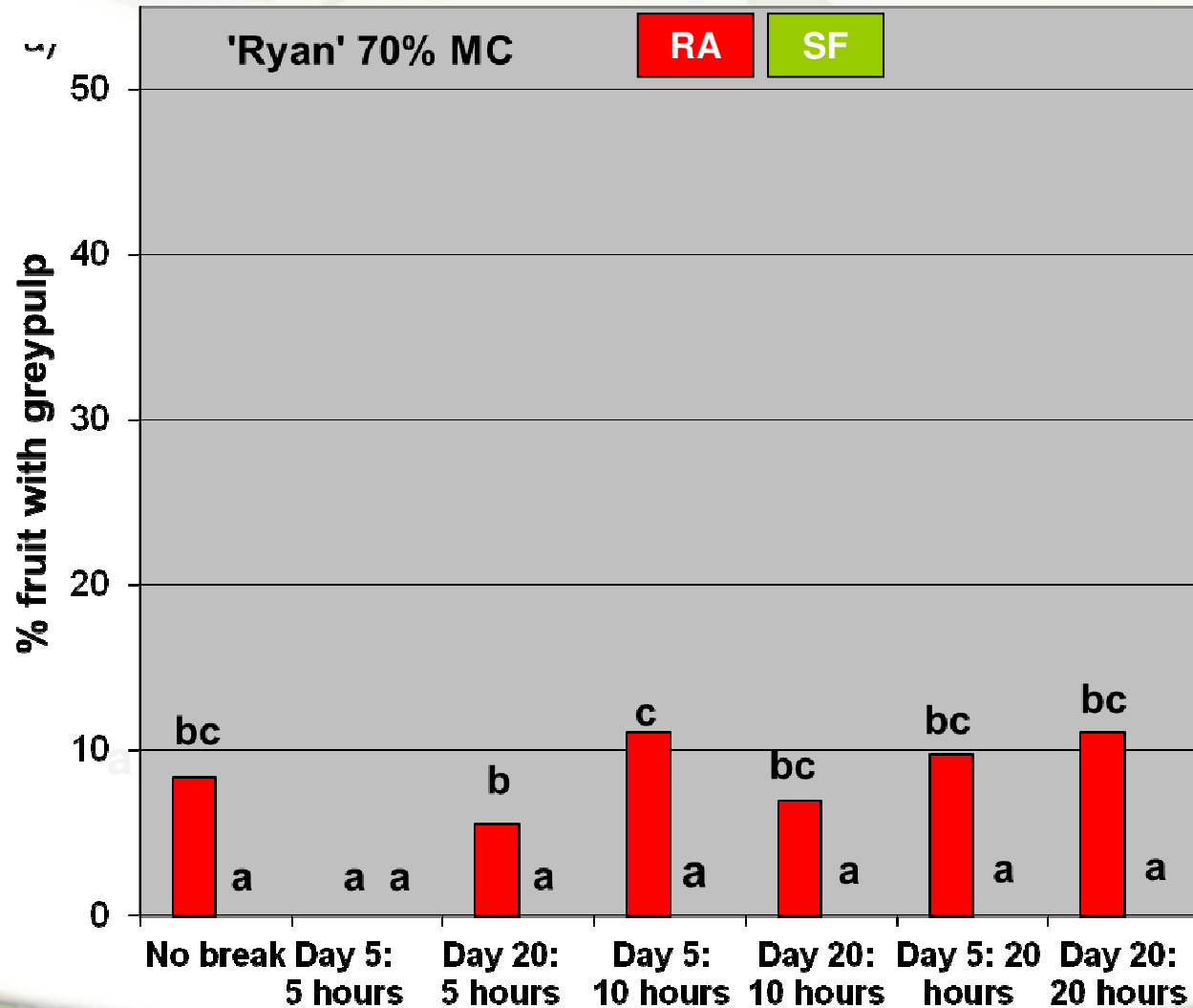
# Results

Cold chain brakes: No of days to ripen 'Ryan'



# Results

Cold chain breaks: greypulp 'Ryan'

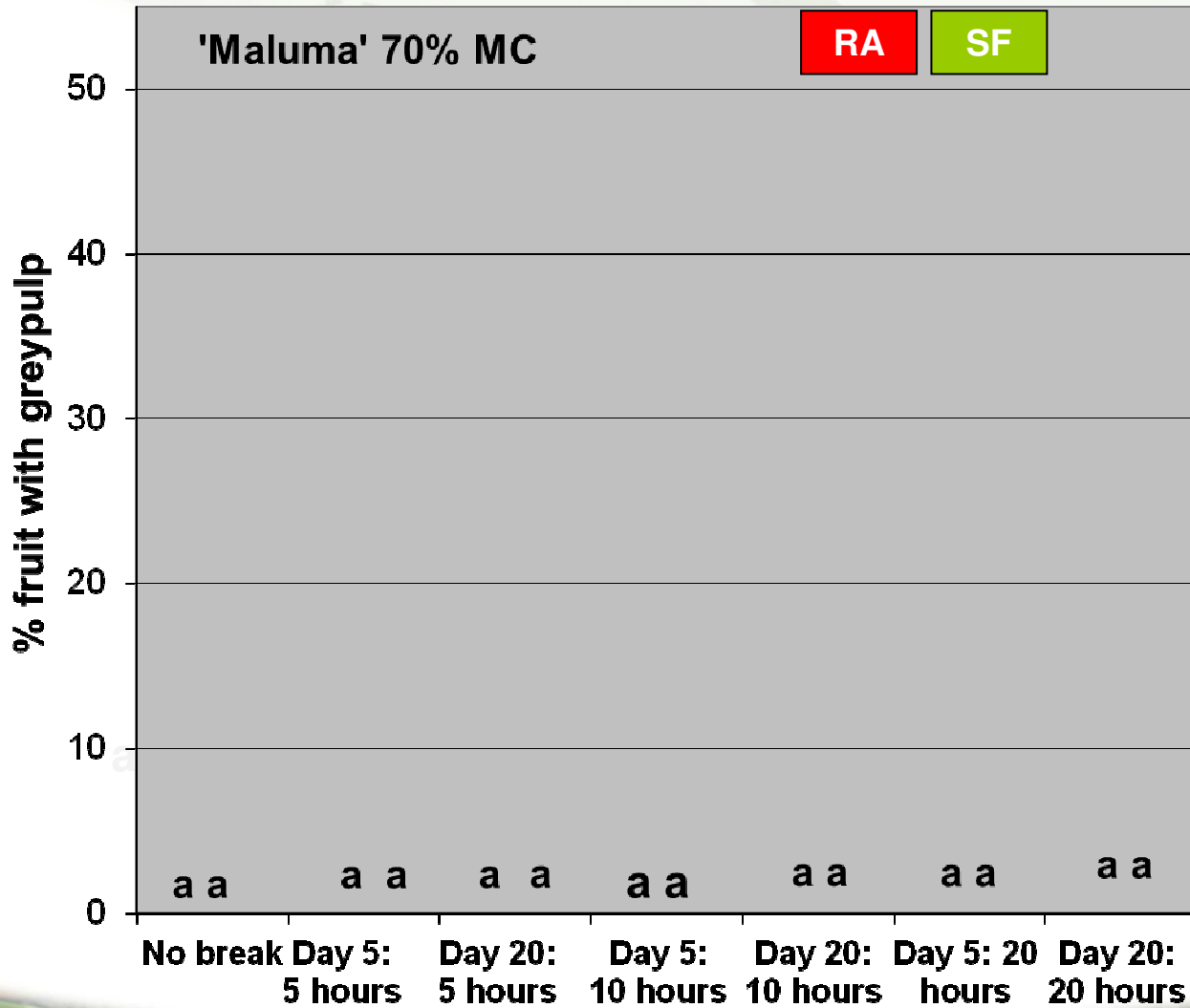


Temperature breaks

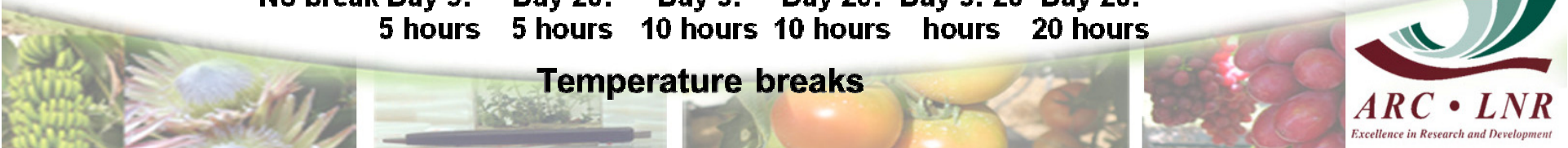


# Results

## Cold chain breaks: greypulp 'Maluma'

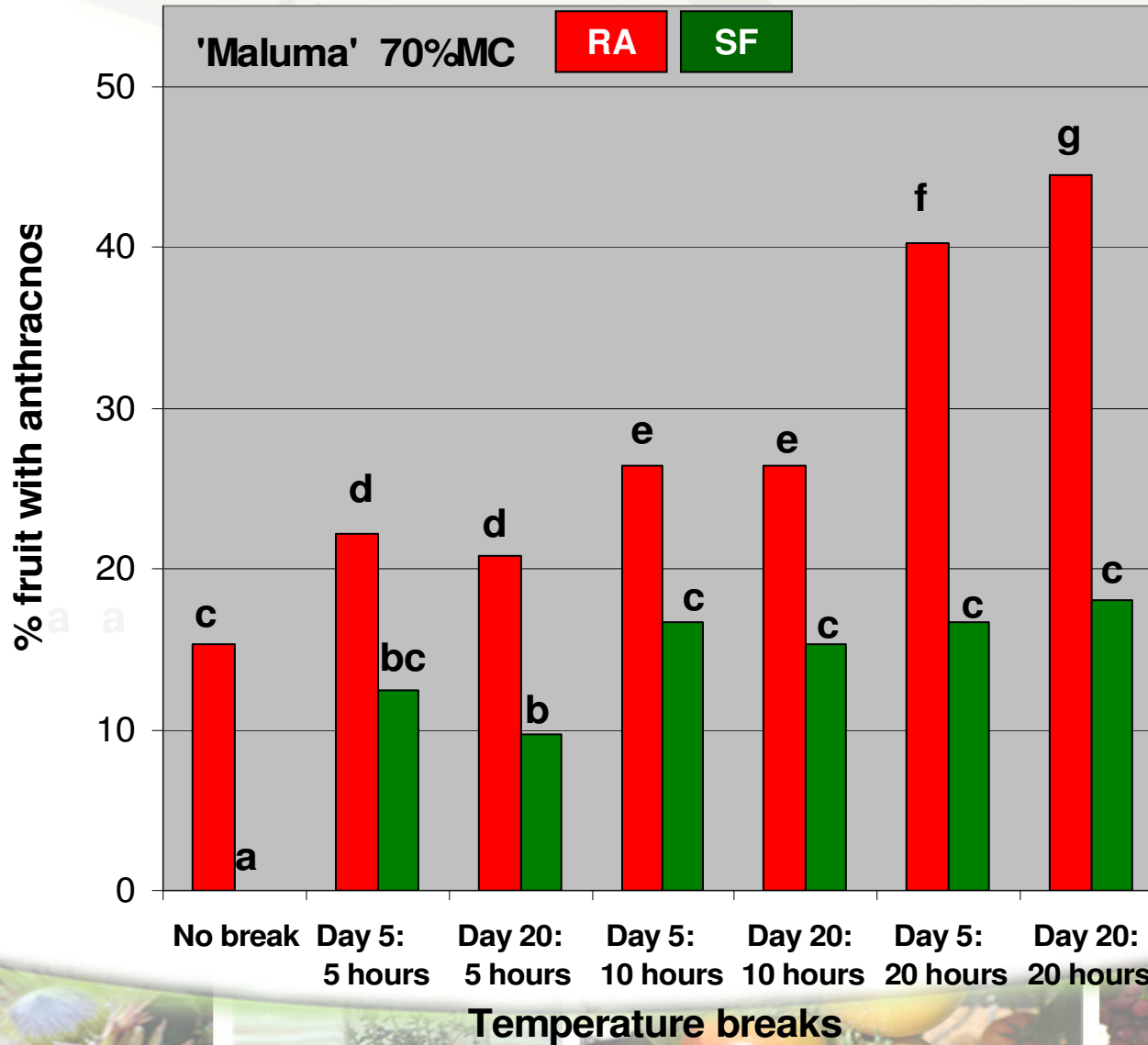


Temperature breaks



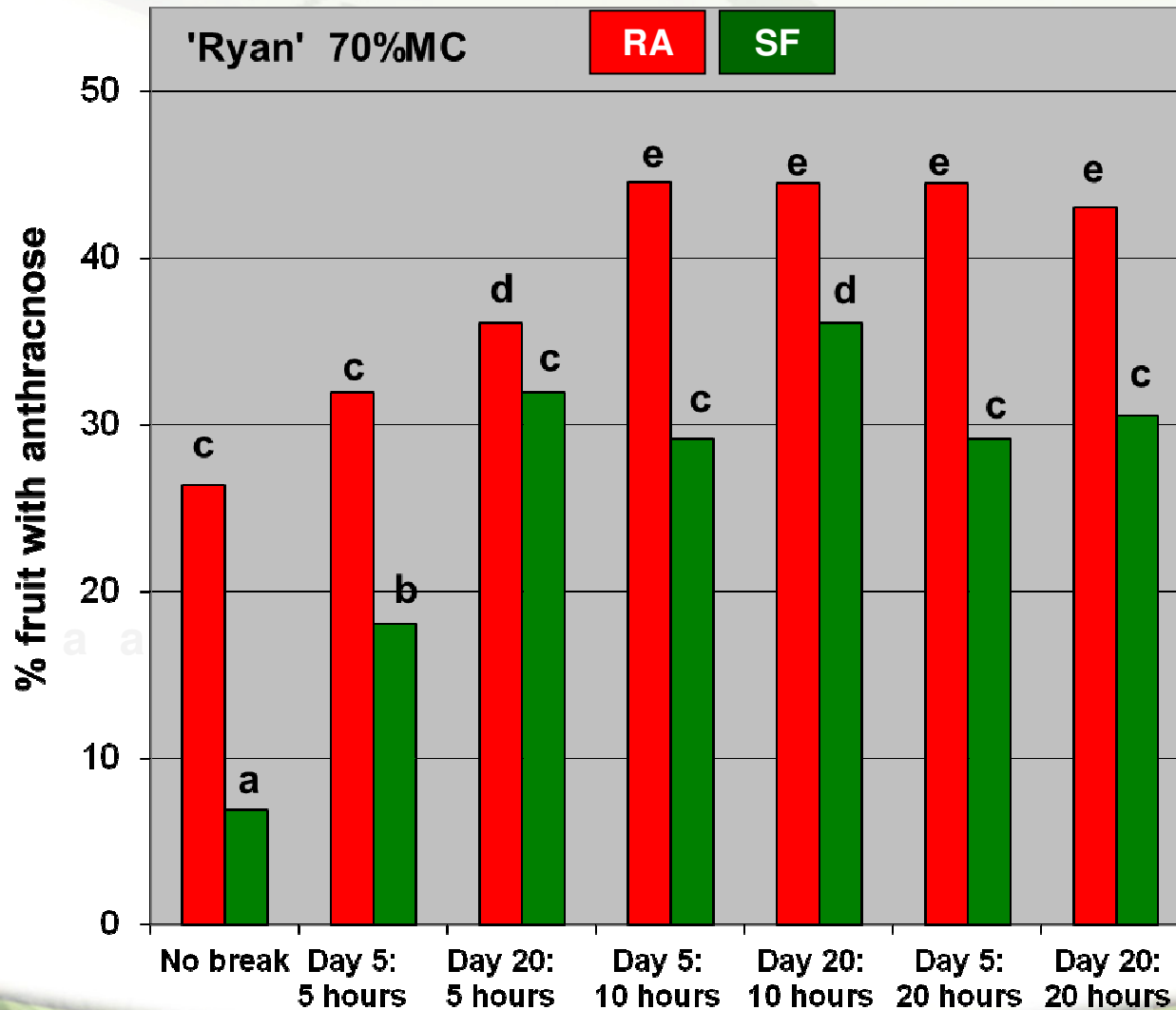
# Results

## Cold chain breaks: 'Maluma' Anthracnose



# Results

## Cold chain breaks: 'Ryan' Anthracnose

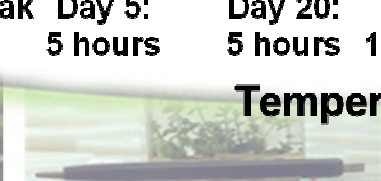
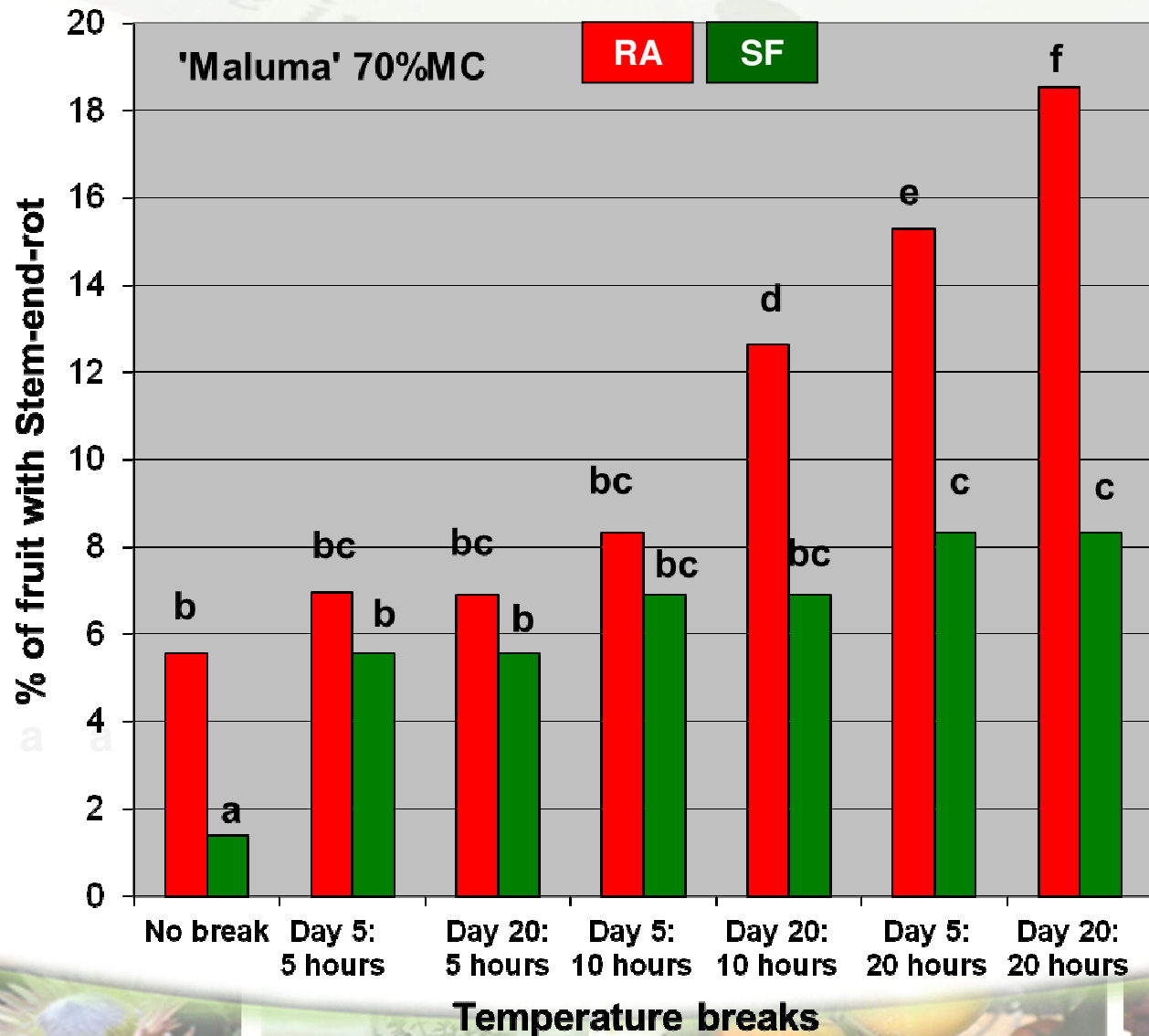


Temperature breaks



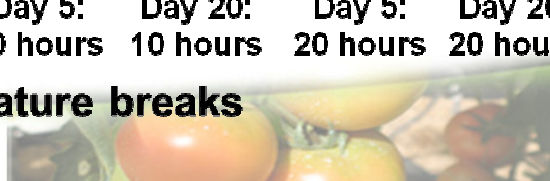
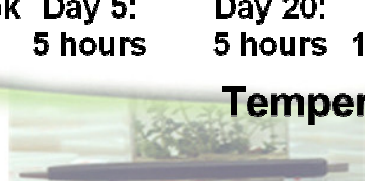
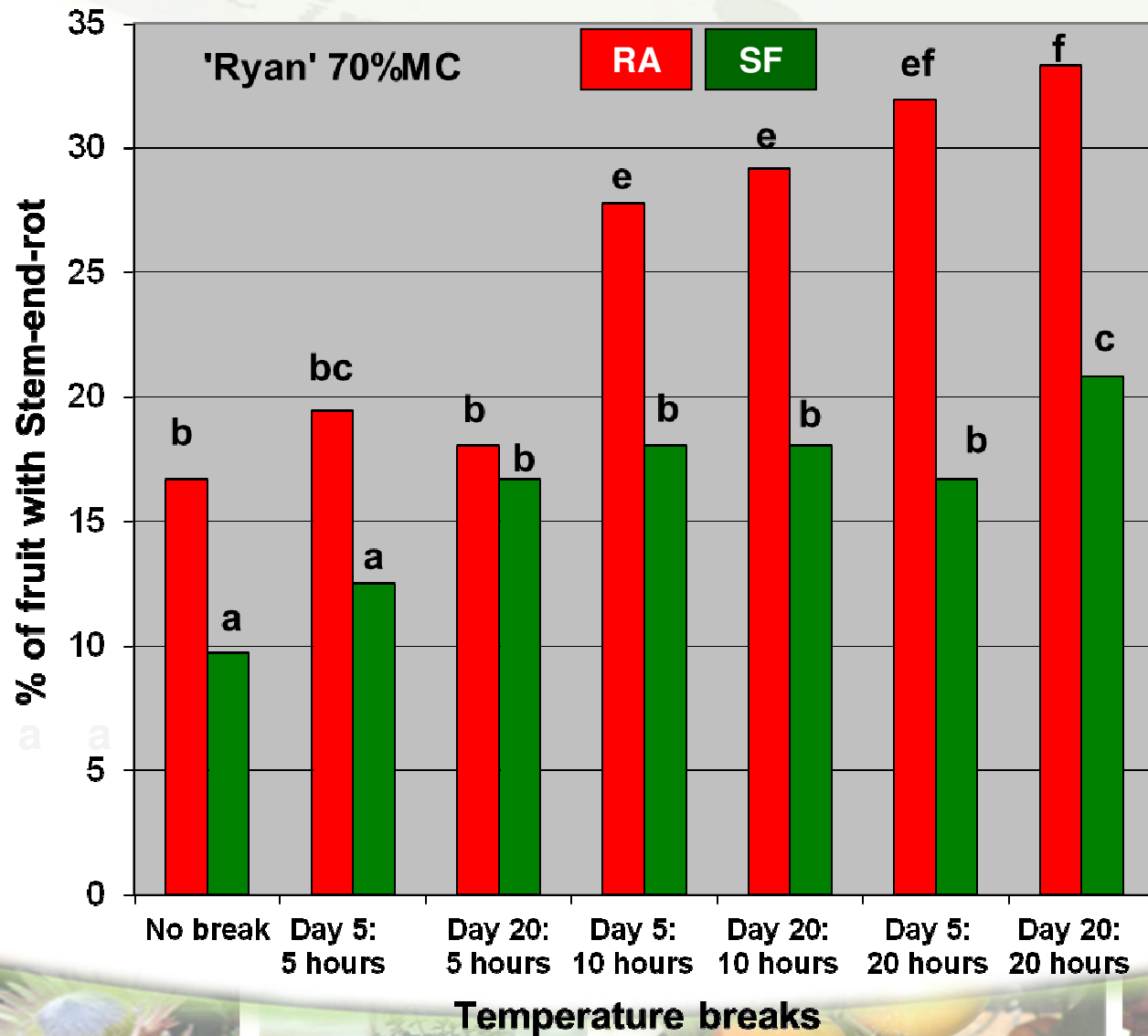
# Results:

## Cold chain breaks: 'Maluma' Stem-end-rot



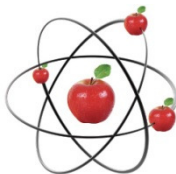
# Results:

## Cold chain breaks: 'Ryan' Stem-end-rot



# Conclusions

- Respiration rate of **‘Maluma’** comparable to that of **‘Hass’** with the following exceptions:
  - **‘Maluma’** respiration rate higher than **‘Hass’** at the start of the export simulation period
  - **‘Hass’** higher than **‘Maluma’** after **day 20** when the respiration rates start to increase
- **‘Ryan’s’** respiration rate, like **‘Pinkerton’**, **more stable** than other cultivars at higher storage temperatures, with the following additional observations:
  - **‘Ryan’s’** respiration rate starts to increase later than that of **‘Pinkerton’**
  - Two cultivars’ ultimate respiration rate (day 30) similar
  - Two cultivars’ mean DTR significantly higher than other cultivars – **‘Ryan’s’** DTR higher than **‘Pinkerton’s’**



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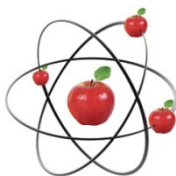
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# Conclusions

- **Firmness starts to drop before respiration rate increases**
  - Firmness of **'Maluma'**, **'Hass'** and **'Fuerte'** decreased at the **fastest** rate
  - **'Ryan'** and **'Pinkerton'** had the **lowest** rates of firmness loss
- **Inverse relationship between respiration rate increase after days 16-20 and the mean DTR.**



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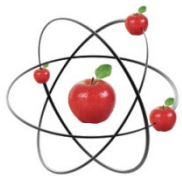
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# Conclusions

- At all storage temperatures during the last week of storage:
  - Respiration rate highest / firmness & DTR lowest in **RA** treatments
  - **SF** and **CA** reduced the post-day-20 respiration rate gradient

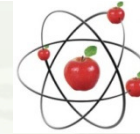


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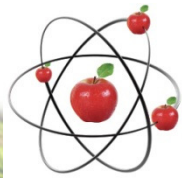
# Conclusions

- **Breaks in cold chain caused an increase in respiration rate and a reduction in firmness & DTR - correlates with the length of the break.**
- **In certain cases a break on day 20 slightly more harmful than a break on day 5**
- **SmartFresh successfully reduced respiration rate increase, as well as firmness & DTR loss during breaks. Very effective in 'Maluma'**
- **Firmness loss caused by breaks in cold chain:**
  - **'Fuerte' more sensitive and other cultivars comparable**



# Conclusions

- Breaks in cold chain (on day 5 and day 20) caused a **dramatic increase in pathology**.
- The longer the break, the **worse** the pathology.
- **Smartfresh** alleviated the pathology to **some extent** (anthracnose more than SER)
  - presumably because of **slower firmness loss** after the break



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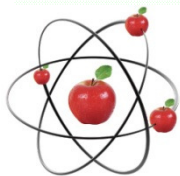
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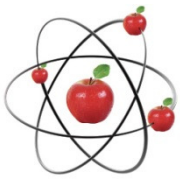


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