



Buying Better Broccoli

Freshness and quality at retail

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Background

- Broccoli has a strong aura of health and can add variety and texture to many meals
- Barriers to purchase (VG12045, Colmar-Brunton) include;
 - High prices (!)
 - Long stems (!)
 - Poor and inconsistent quality
 - Short storage life

But is this perception true????



Is retail quality poor and inconsistent?

VG13086 – Identify process improvements for preserving peak freshness of broccoli

PART 1 – Is there a problem??

- ‘Audits’ of randomly selected retailers in Sydney, Melbourne, Brisbane and Perth
 - Assess display type, consumer appeal and temperature
 - Evaluate quality of broccoli on offer
- Storage life assessments of purchased samples
- Temperature monitoring of different supply chains

Grading scale

Broccoli colour



1

Fully green

2

5-10% yellow

3

10-20% yellow

4

30-50% yellow

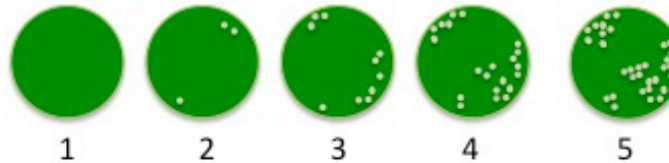
5

Very yellow and/or rotten



Blistering

1. Even, well formed, no blisters
2. 1-2 blisters, very minor
3. Immature blistering over 5-10% surface
4. Blistered florets over >10% surface
5. Enlarged & open florets affecting >10% surface area



1

2

3

4

5

Breakages

1. None or <1cm² crushed area
2. Minor crushing of a few florets 1-3cm²
3. Broken stemlet or 3-5cm² crush injury
4. 2-3 broken stemlets or 6-10cm² crush injury
5. Major physical damage



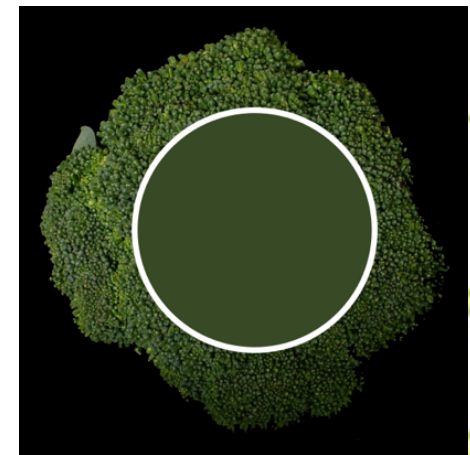
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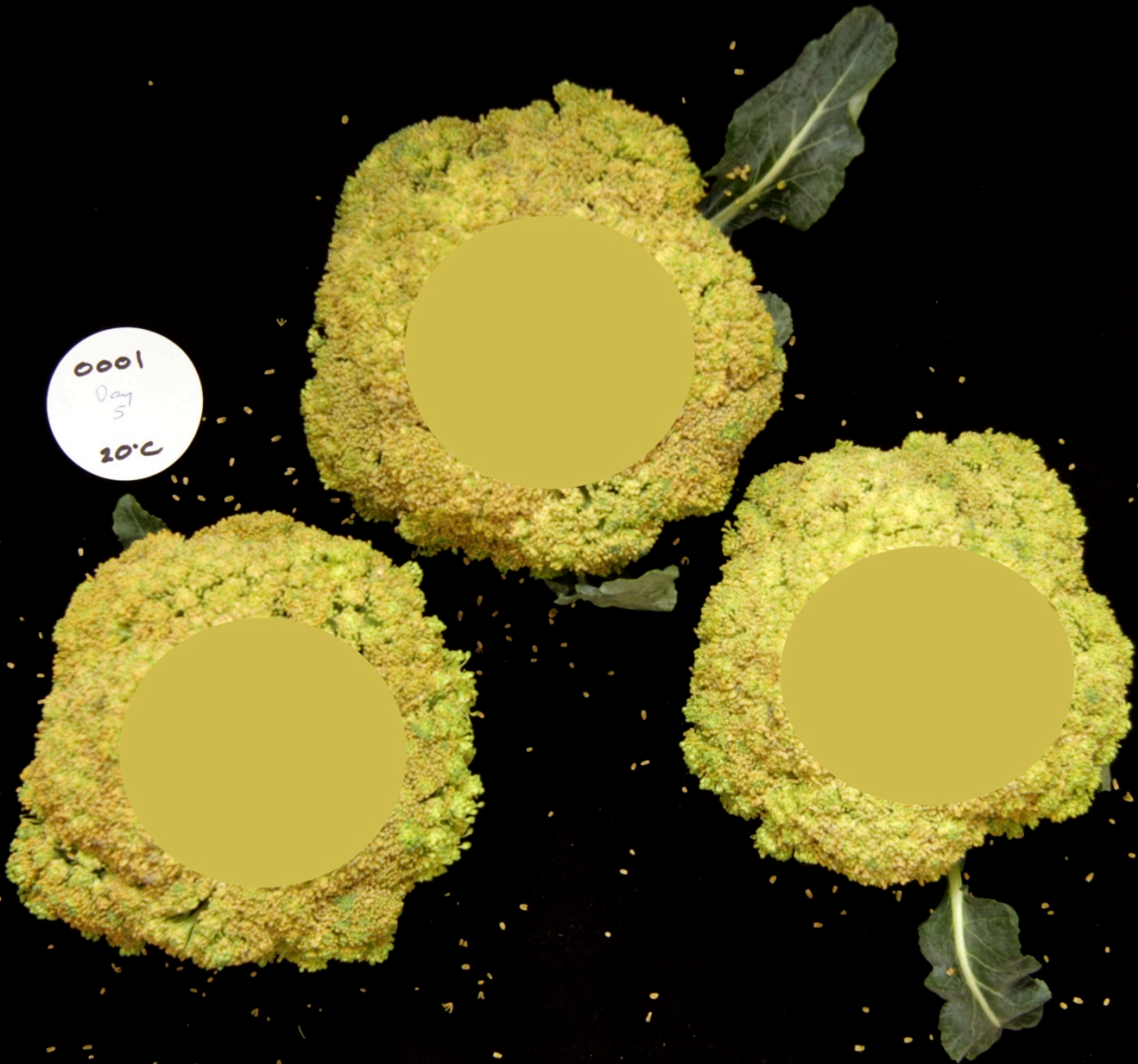
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4

5



0001
Day
5
20°C



Grading scale

Firmness

1. Solid head, very firm
2. Very slight 'give' but less than 1cm flex across head
3. Slightly softened, still firm, approx 1-2cm flex
4. Moderately soft, approx 3-4cm flex
5. Soft, floppy, rubbery, >4cm flex

Odour

1. No off odours, fresh broccoli smell
2. Very slight odour, inoffensive
3. Slight off odour, noticeable only when held to nose
4. Moderate off odour, offensive
5. Extremely stinky

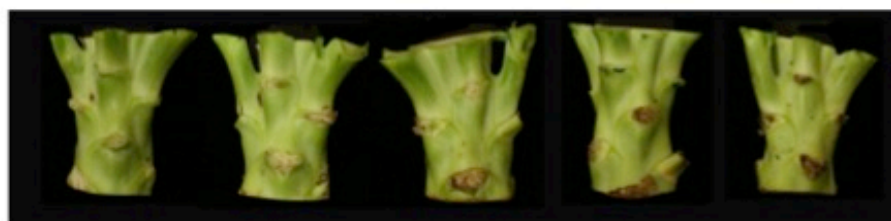
Floret Rots

1. No rots in florets
2. Very slight, a few dark florets
3. Slight, <5% florets with rots
4. Moderate, 5-10% florets rotten
5. Severe, >10% florets rotten, obvious slimy lesions



Stem scars

1. Freshly cut
2. Slightly discoloured
3. 50% brown or grey
4. Brown or grey
5. Dark brown to black



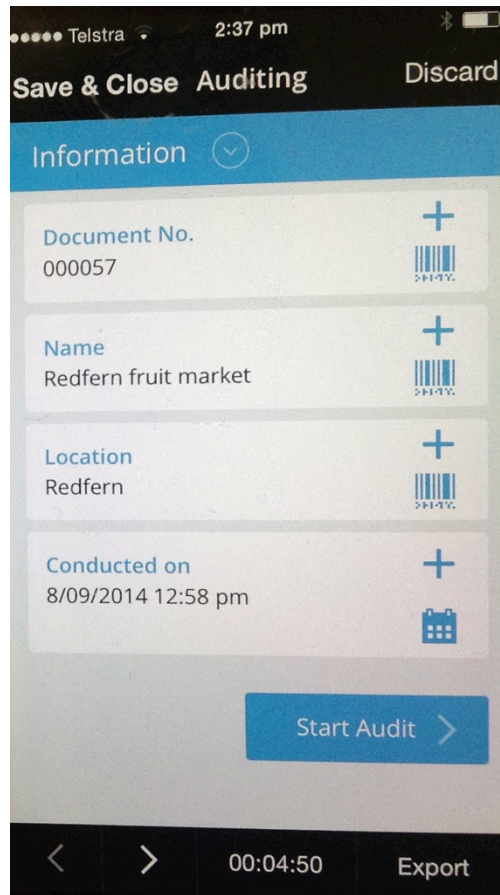
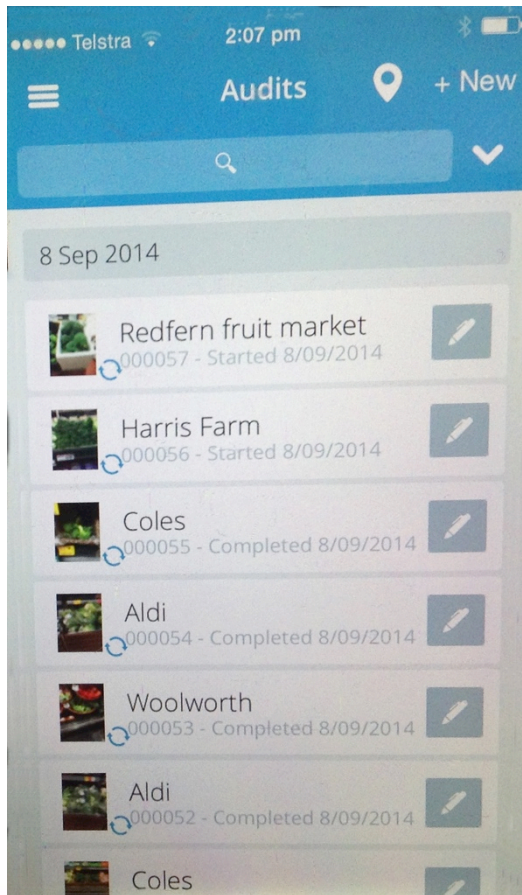
1 2 3 4 5

Overall appeal

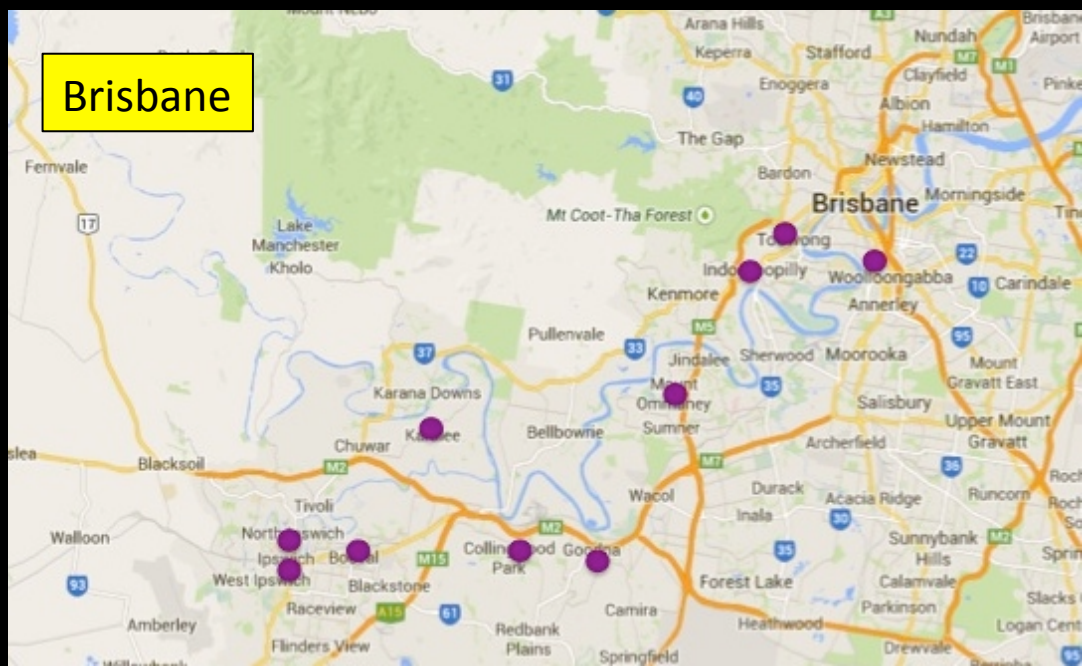
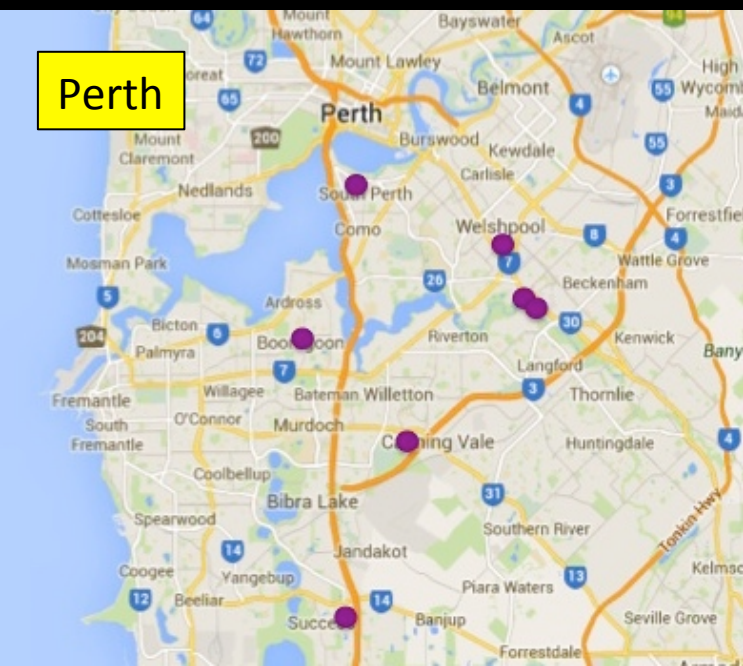
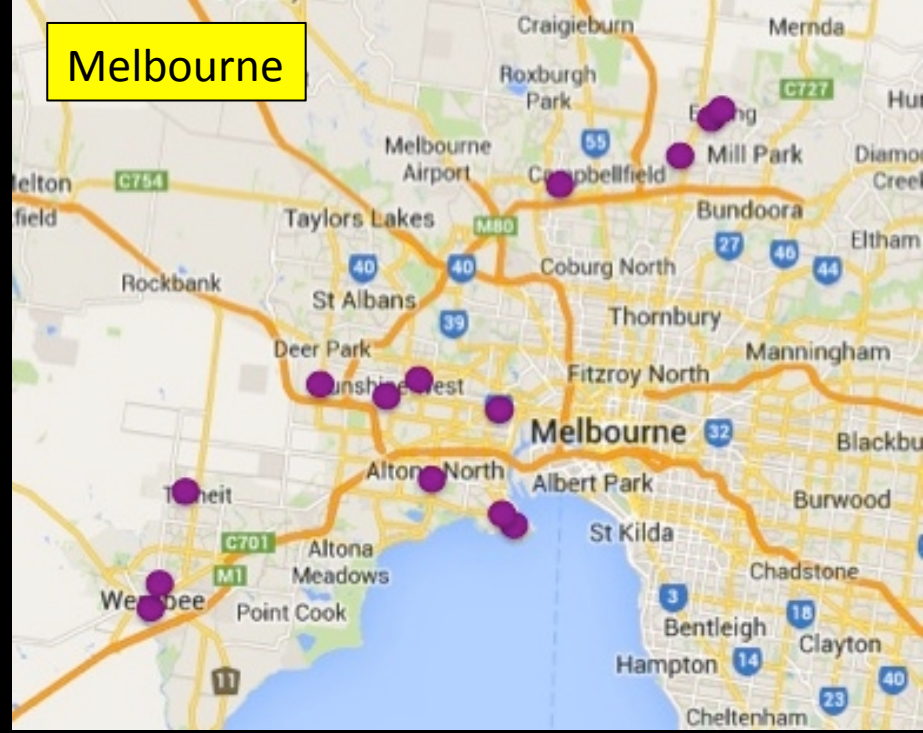
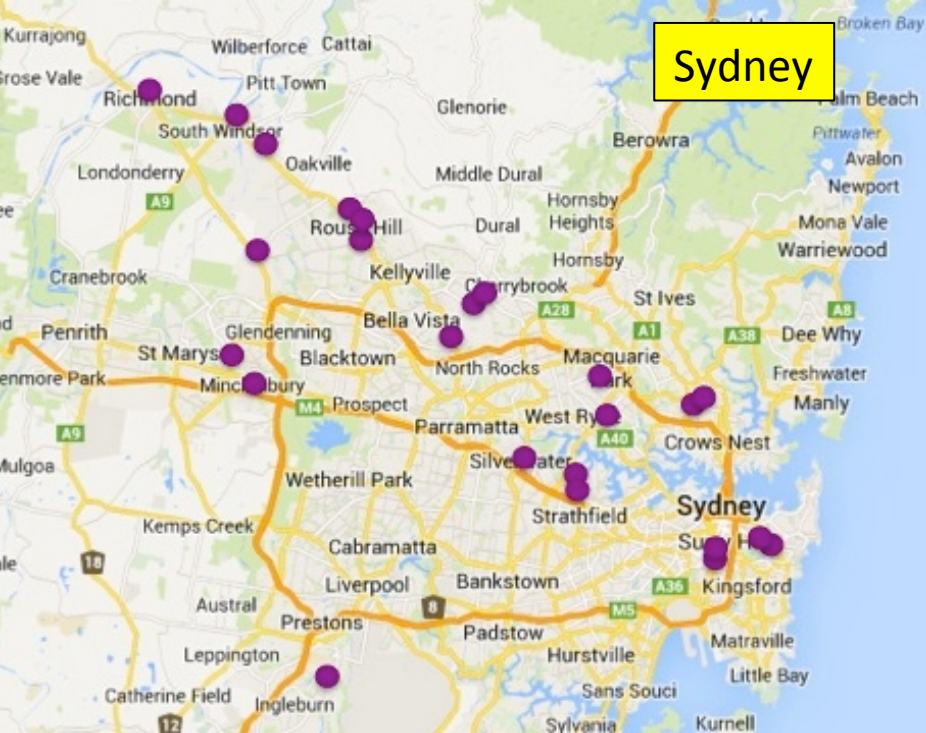
1. Excellent, fresh, looks like just harvested
2. Very good, would definitely buy
3. Good, would probably buy
4. Poor, wouldn't buy but would still eat
5. Very poor, compost quality



Retail assessments



X 3 points



Retailers

Location	Retailer	No.	Price (\$/kg)		
			Average	Max	Min
Sydney	Greengrocer	23	\$4.42	\$15.98	\$1.20
	Supermarket	29	\$4.54	\$7.98	\$1.19
	Minimart	4	\$7.99	\$8.99	\$6.99
Melbourne	Greengrocer	1	\$3.99	\$2.99	\$1.15
	Supermarket	1	\$3.99	\$3.99	\$1.15
	Minimart	1	\$3.59	\$3.59	\$3.59
Perth / WA	Greengrocer	1	\$3.70	\$3.70	\$1.49
	Supermarket	1	\$3.99	\$3.99	\$1.15
	Minimart	1	\$7.79	\$7.99	\$1.99
Brisbane	Greengrocer	1	\$4.27	\$5.99	\$2.99
	Supermarket	15	\$3.81	\$3.98	\$2.69

Average =
\$4.18
Range =
\$15.98 - \$1.15

Greengrocer displays

The Good



Greengrocer displays

The not-so-good



Supermarket displays



Supermarket displays



Supermarket displays



Minimart displays

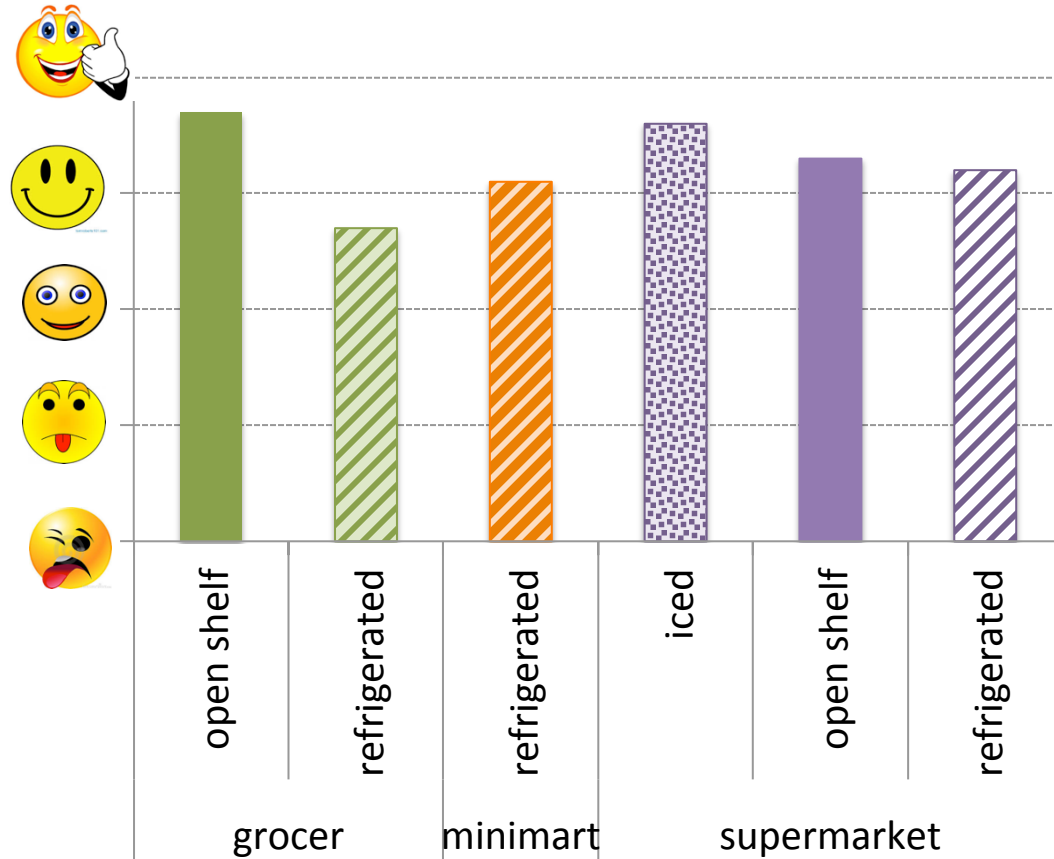


Supermarket display quality

- Highly variable

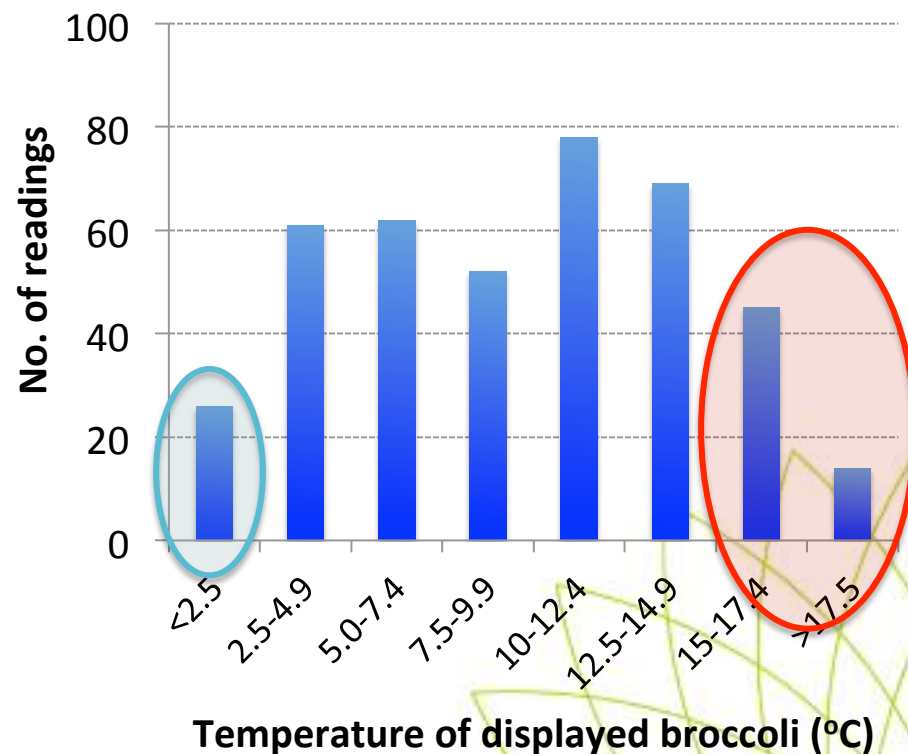
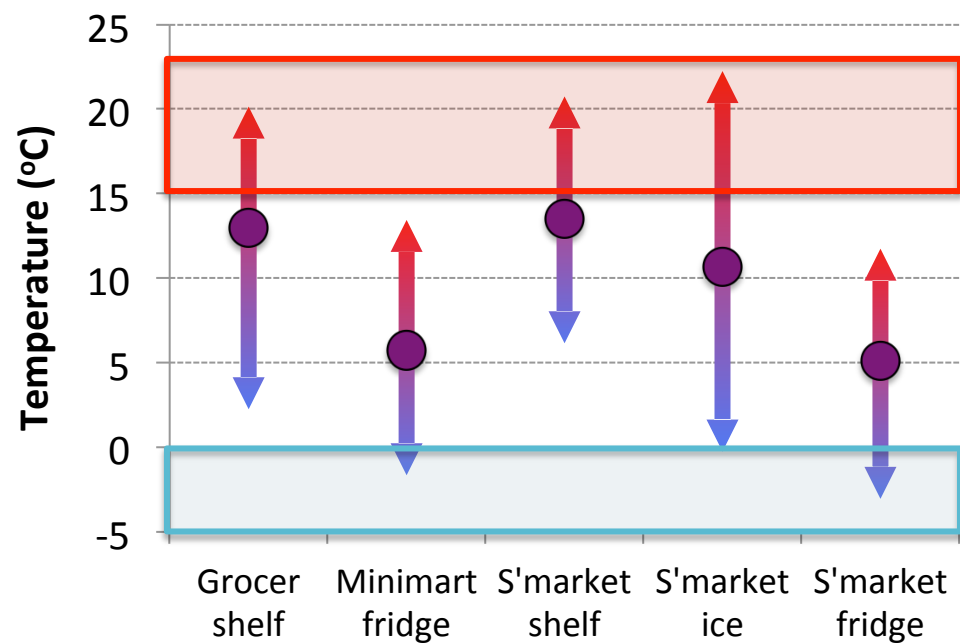
- Most greengrocers un-refrigerated (except Brisbane)
- Minimarts always refrigerated
- Supermarkets 50:50

- Best displays often NOT refrigerated



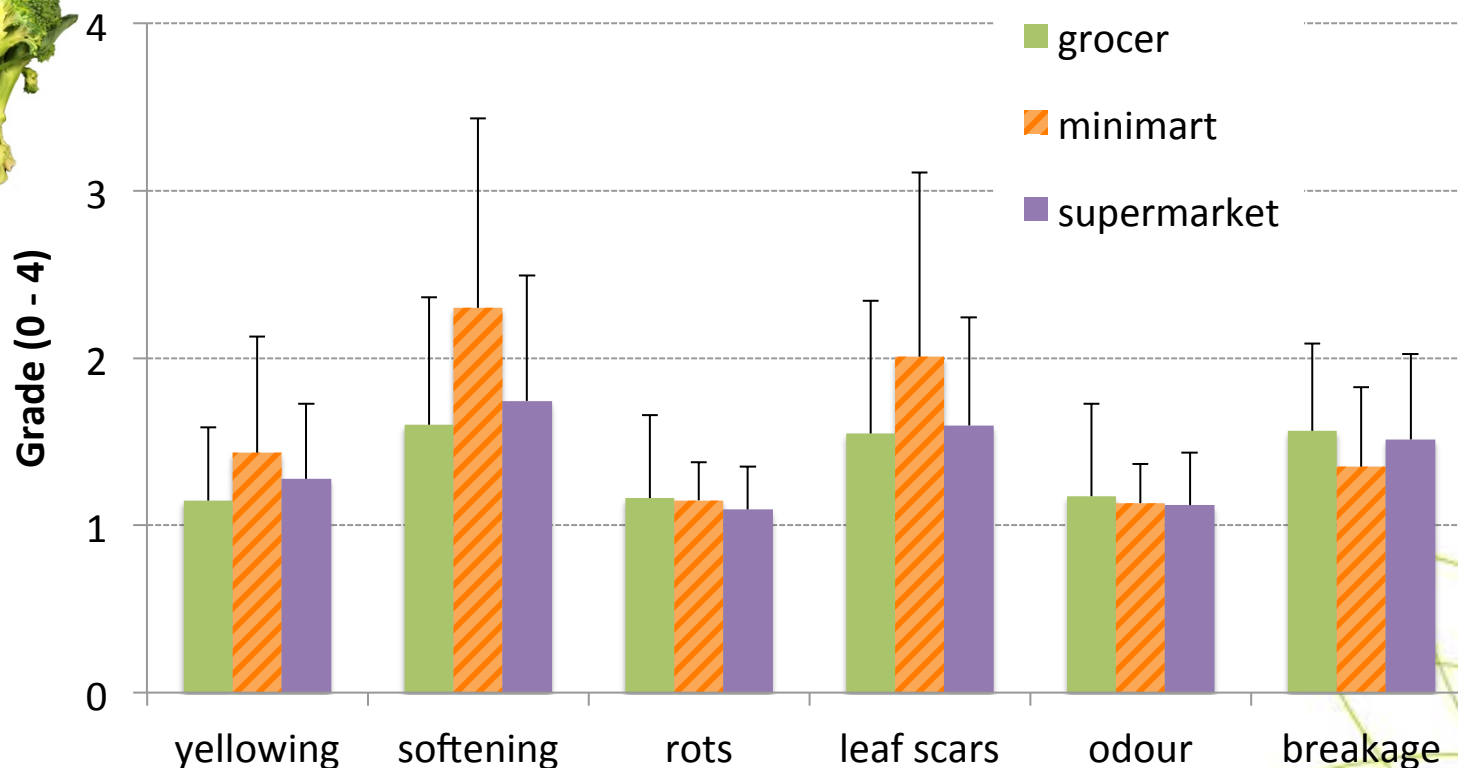
Display temperatures

- Even more variable!








Product quality

- A total of 530 heads of broccoli were purchased and evaluated



Product quality

- Overall quality was similar at greengrocers and supermarkets

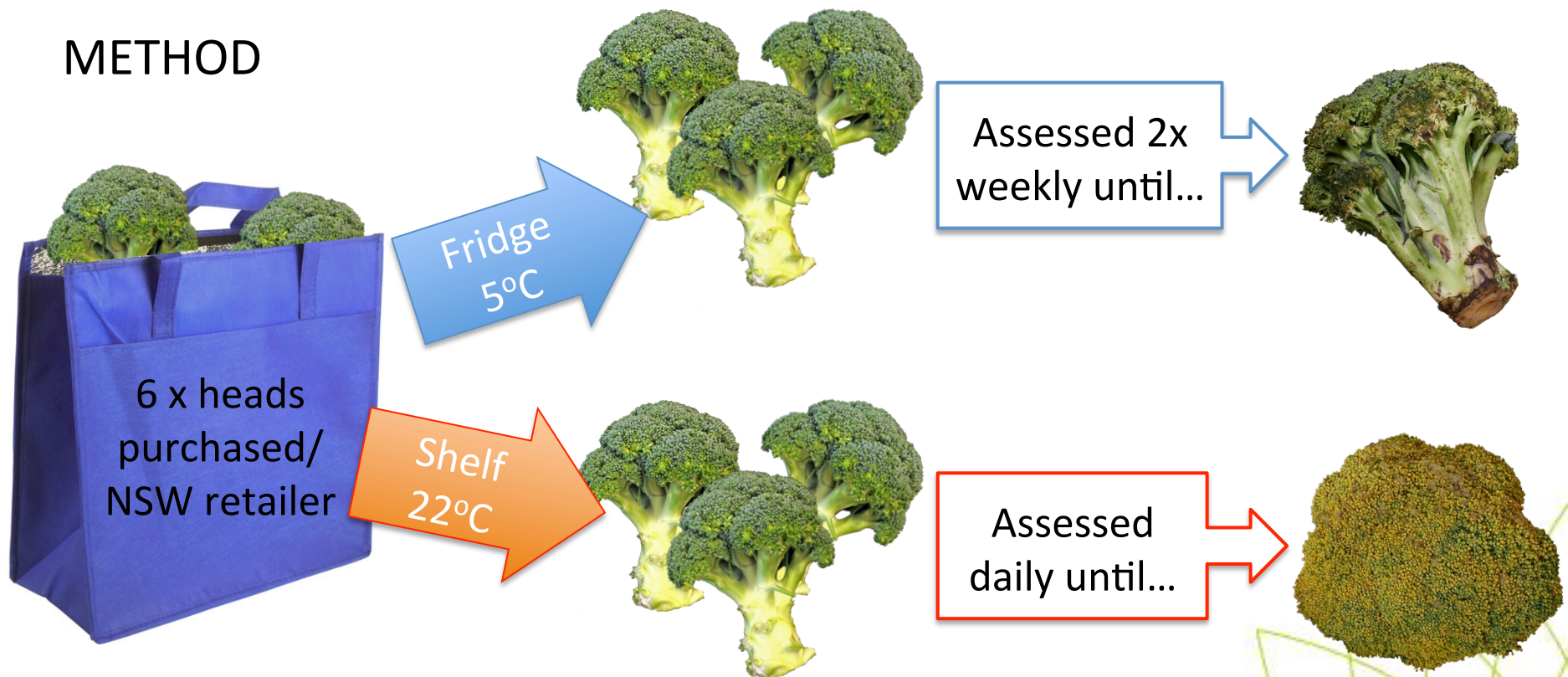
	Proportion of samples (%)
 Excellent, fresh	57.4
 Good to very good	19.8
 OK, saleable	13.4
 Poor, not saleable	8.1
 Disgusting	1.3

This suggests that consumers will be **disappointed** in the quality available at least **one trip in five**



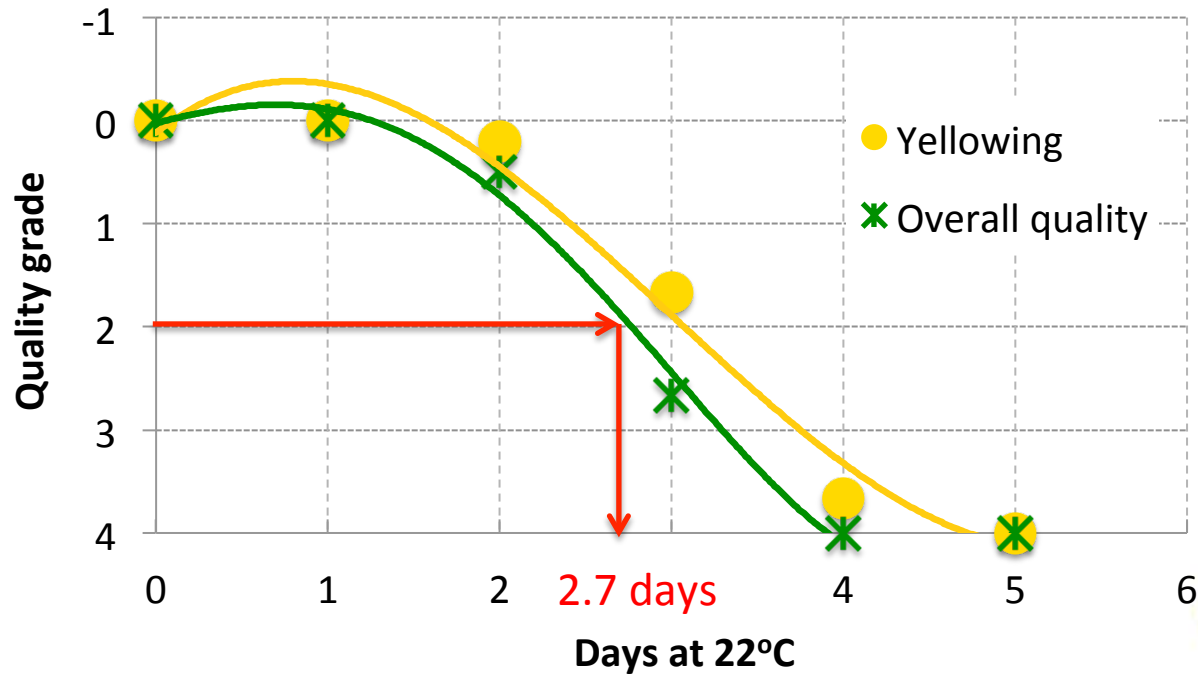
Storage and shelf life

METHOD



Storage and shelf life

- Number of days until the end of life estimated by fitting polynomial trendlines to quality attributes



Storage and shelf life

- According to Colmar Brunton research, consumers expect broccoli to stay fresh in the fridge for at least 7 days
 - 56 separate samples were purchased.
 - 13 remained acceptable for less than 7 days at 5°C
 - 9 remained acceptable for less than a day at 22°C

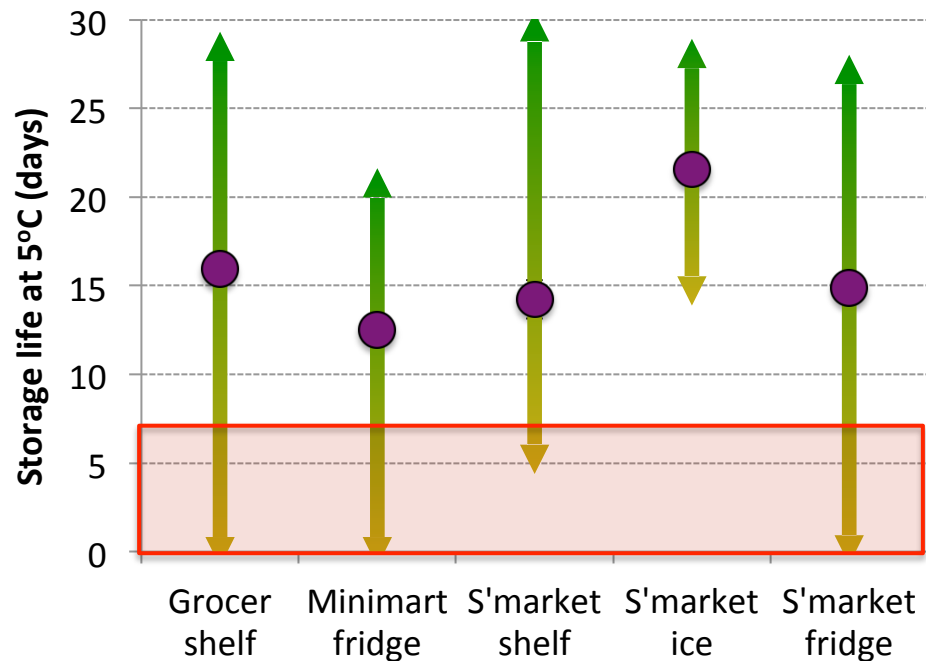
23% of purchased samples **failed** to meet consumer storage life expectations



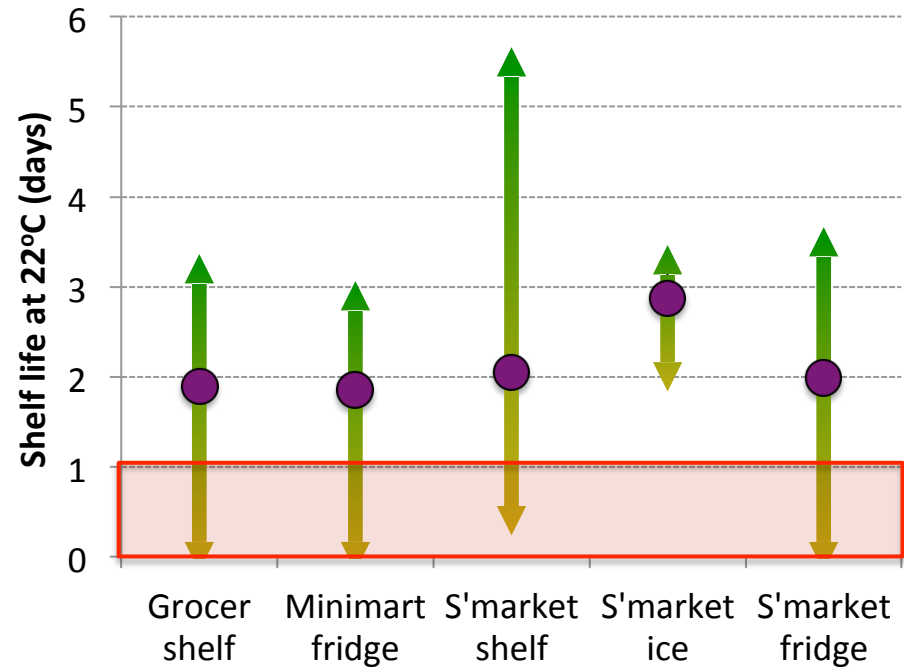
Effects of display type

- While some were bad, others were good – variability is king!

FRIDGE

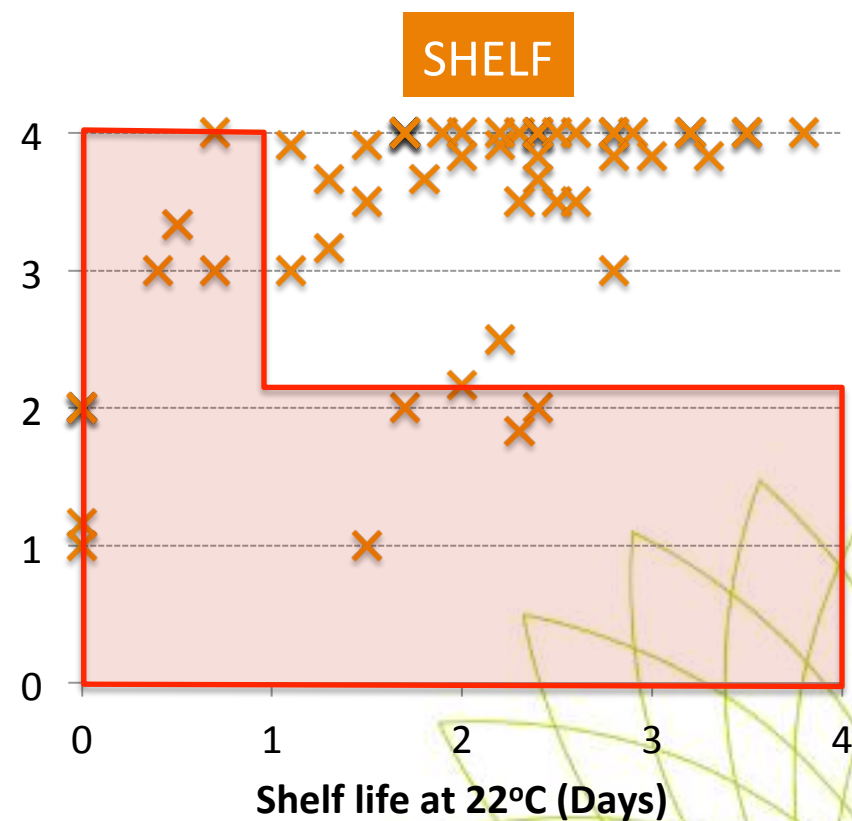
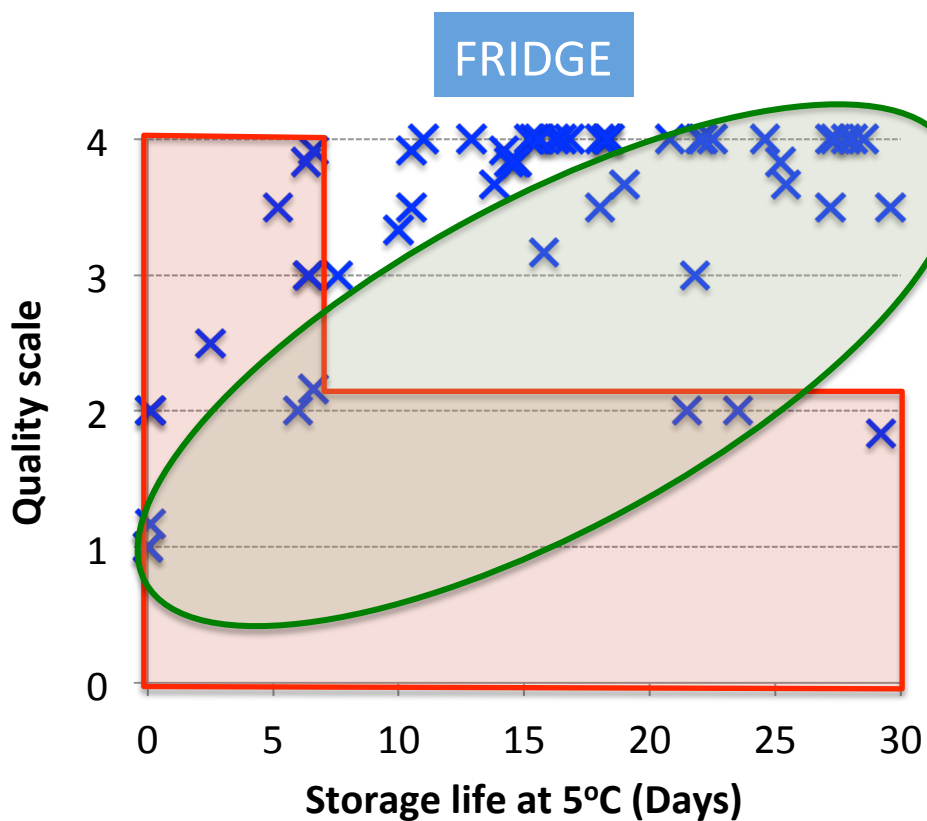


SHELF



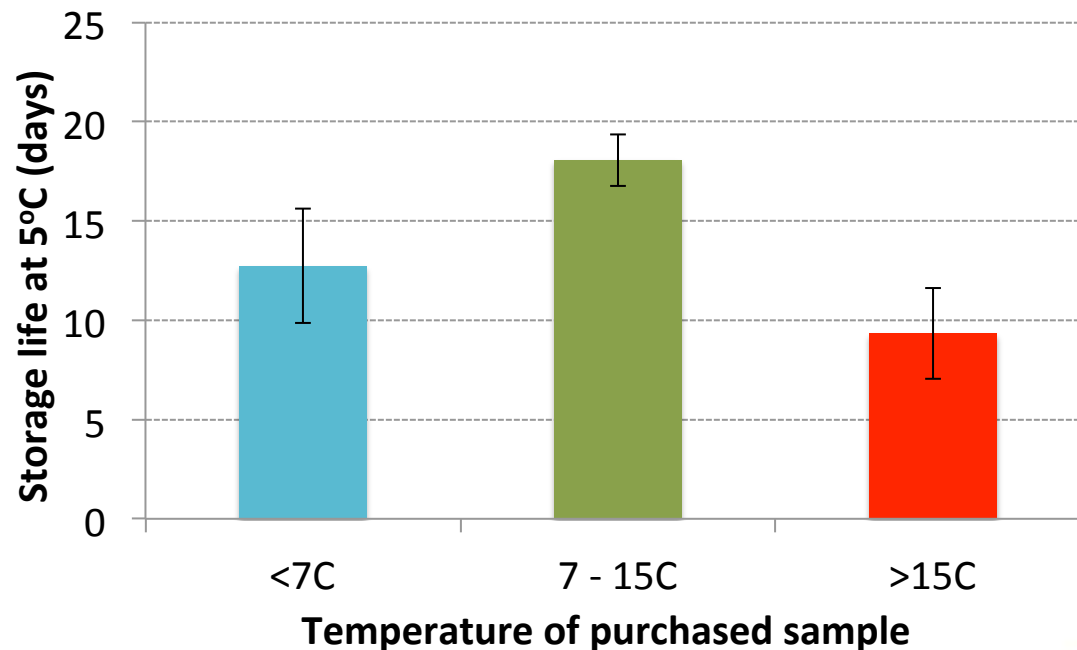
Effect of initial quality

- Little relationship between initial quality and shelf life



Effect of display temperature

- Broccoli that was displayed warm had shorter shelf life than that kept cooler
- BUT why were the coldest heads worse? (dry air??)



Storage and shelf life

- There was no relationship between price and either quality or storage life
- 16 of 56 samples, or around 28% of samples, were either barely acceptable at purchase or lacked expected storage and shelf life



YES, it's TRUE, retail quality of broccoli **IS** inconsistent and lacking in freshness



But why?

- Supply chain monitoring in Werribee, Manjimup and Gatton
- Data loggers and probes inserted into broccoli at harvest, tracked through to wholesale / stores
 - Iced and non-iced broccoli in styrofoam containers
 - Styrofoam vs plasticised cardboard both top-iced
 - Non-iced, packaged in RPCs

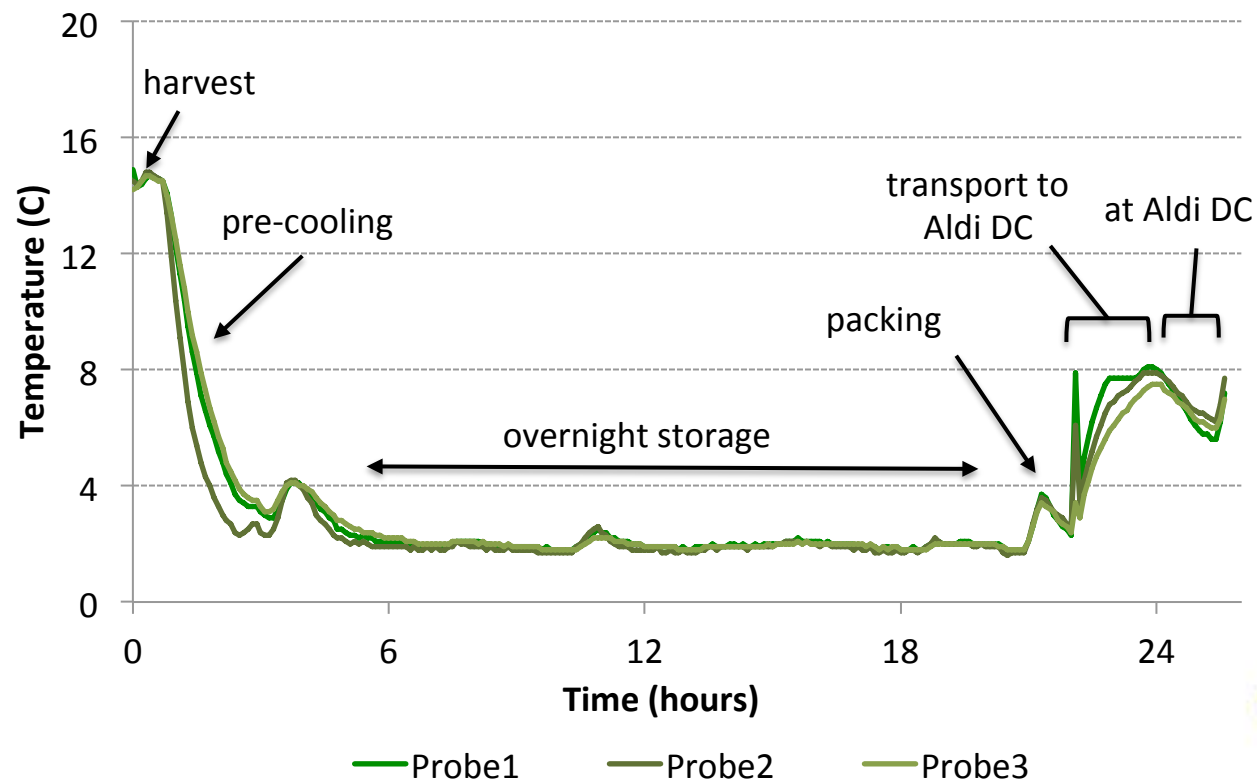


Werribee → local Aldi stores



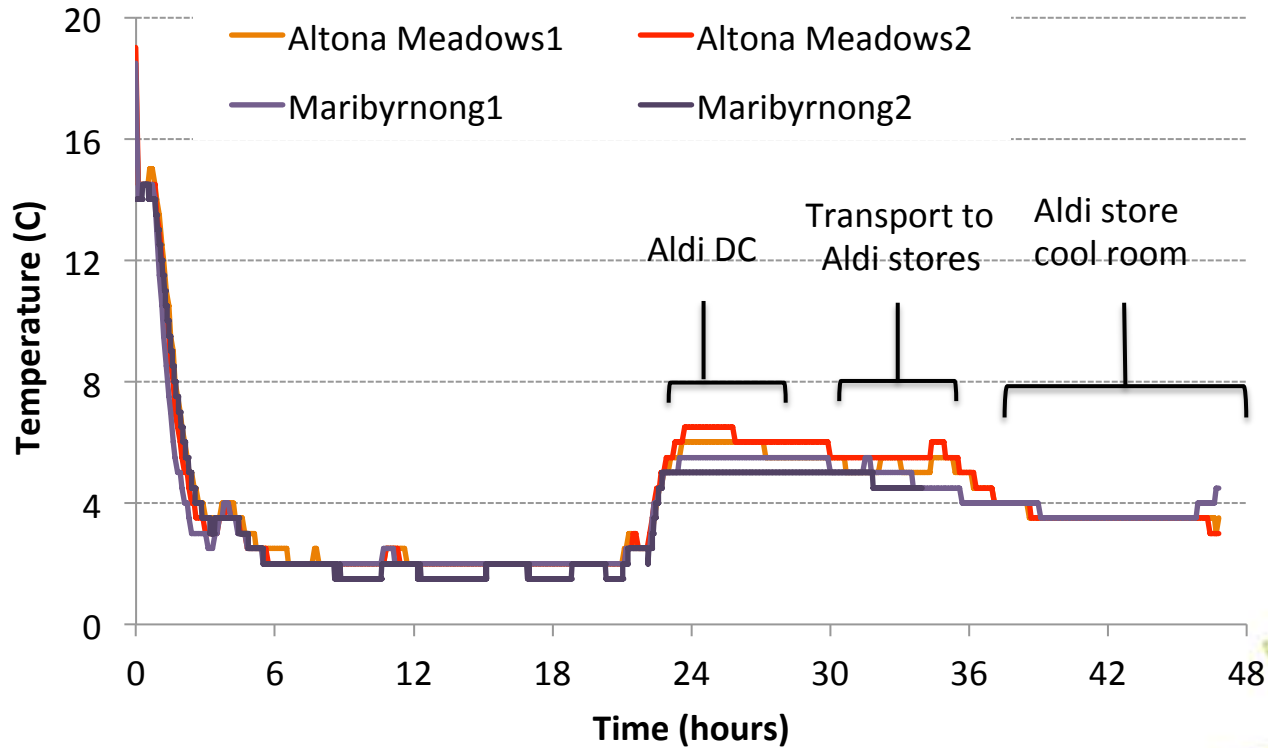
Cooling time in Werribee

- 7/8 cooled 2–2.5 hours after harvest



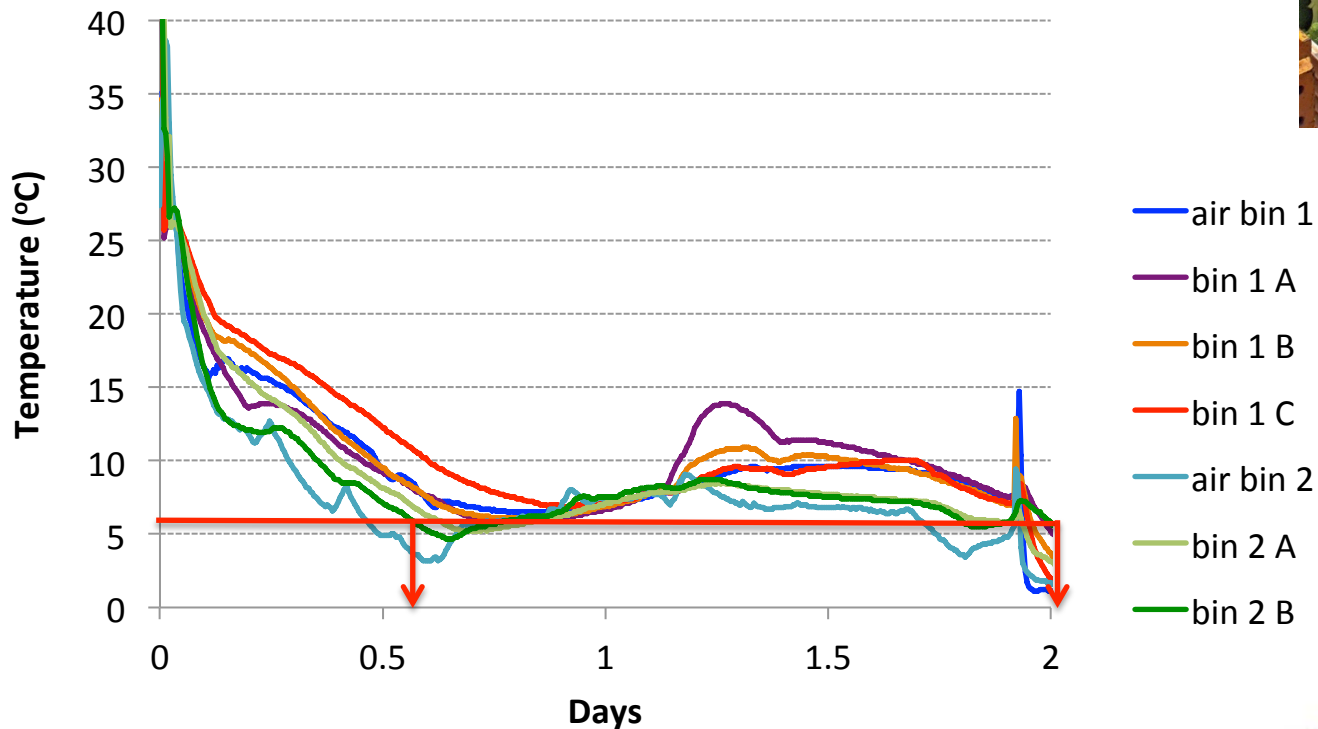
Transport to stores

- Delivered overnight, sold the next day!



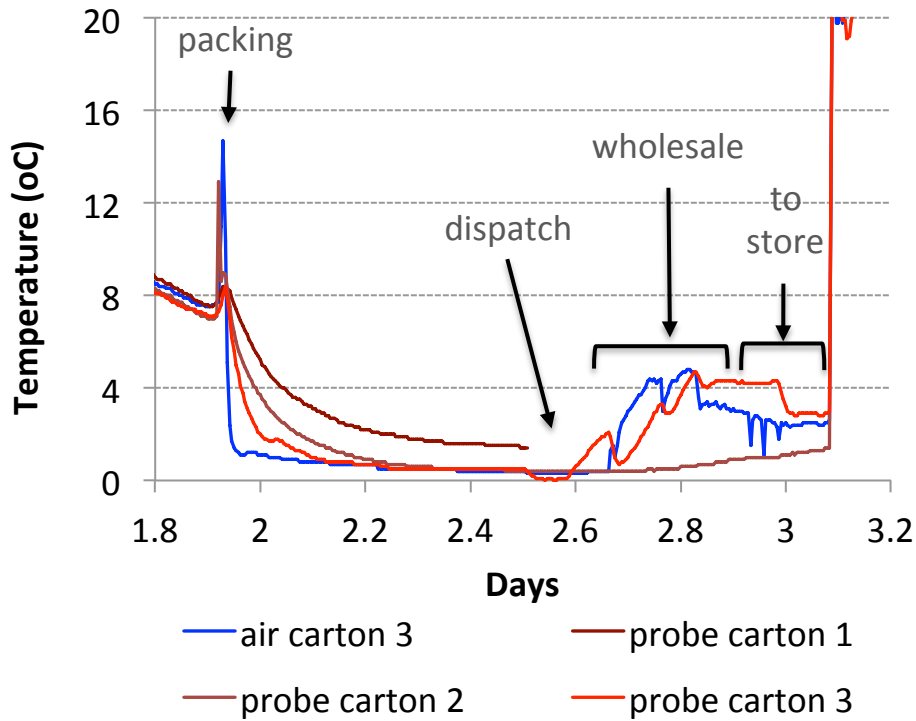
Cooling time in Gatton

- Harvesting in a heatwave ~ 40°C
- 7/8 cooling 14 hours to 2 days...

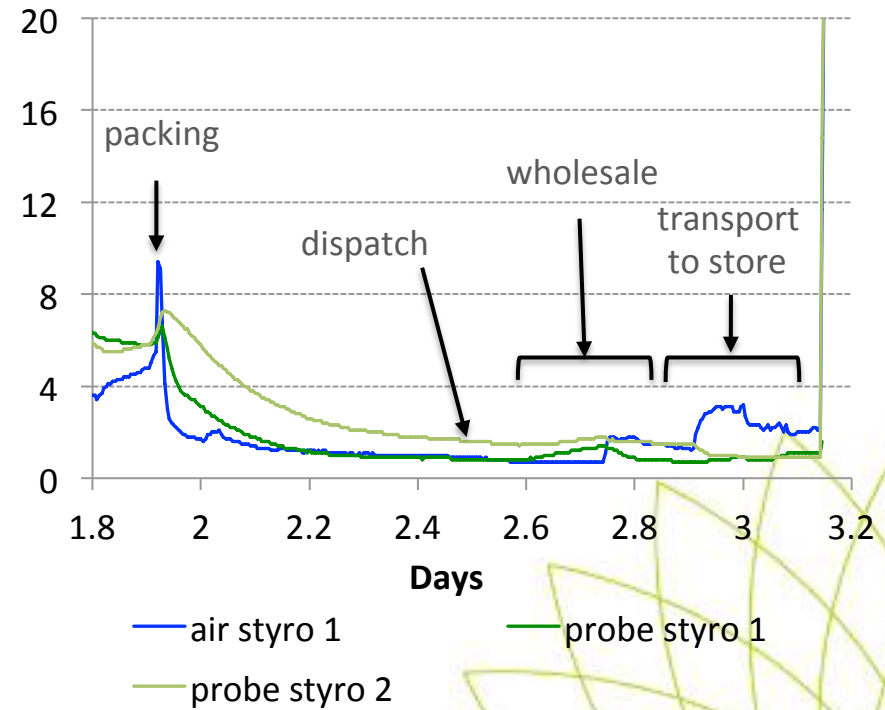


Transport to stores

MURWILLUMBAH



MT TAMBOURINE



Transport to stores

MURWILLUMBAH



MT TAMBOURINE



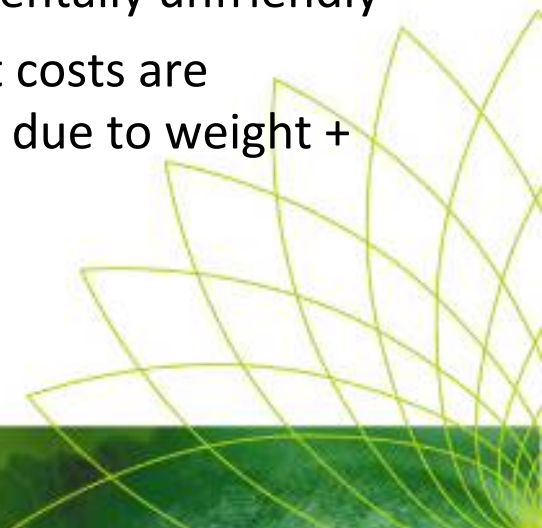
Top icing

ICE is good


- Protects against temperature fluctuations – cheap insurance
- Looks good in the box
- Keeps broccoli hydrated
- Styrofoam boxes are strong

ICE is bad

- Only cools when it melts. Broccoli sitting in water rots, splits, discolours
- Producing ice uses a lot of energy, potable water
- Styrofoam boxes are environmentally unfriendly
- Transport costs are increased due to weight + volume



Next steps...

- Evaluate the cost and effectiveness of different cooling practices used on farm –
 - Hydro-vacuum coolers, hydrocooling, forced air, bin cooling
 - Include study of subsequent storage life
 - Develop training materials for retailers to improve temperature management and handling
 - Monitor temperature and outturn quality in other supply chains, particularly iced vs non-iced systems
 - Test the effectiveness of new technologies eg Smartfresh In-box system during normal transport and marketing process
- 



Control

SmartFresh



A photograph of a large field of green leafy vegetables, possibly chard or spinach, growing in rows. The plants are vibrant green with prominent veins. In the background, there is a line of tall, dark green trees under a grey, overcast sky. A single white marker is visible in the field. The word "Thankyou" is written in a purple, rounded font with a white outline, centered over the middle of the image.

Thankyou