

Ripening of Colombian avocado's

Webinar

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Outline

- Quick Scan Colombian Avocado Supply Chain
 - Actual situation in NL and COL
- Pilot experiments
 - Hypotheses and set up
 - Results
- Recommendations to improve Quality
 - Colombian sector
 - Research

Current Colombian Avocado Supply Chain

SUMMARY

- In general:
 - Cold chain in most cases optimal
 - Postharvest treatments are optimal
 - Quality monitoring is optimal
 - Production and harvest with quality differences (main focus)
 - Heterogeneity and internal defects at destination
 - Controlled production may lead to further postharvest optimization

Current Colombian Avocado Supply Chain

Production and harvest

- Big difference in production farms (2 - >100 ha)
- Geographical variation in orchards (gradient)
 - Difference in soil type within orchard
 - Temperature and humidity (air and soil)
- Two blooming periods > 2 harvest moments/qualities
 - Mayor and minor (traviesa) harvest
 - Water management and nutrition?
 - Maturity selection
 - Impact on internal defects



Current Colombian Avocado Supply Chain

Production and harvest

■ Maturity at harvest

- Dry Matter content as indicator
- Same as in Peru, Chile, Mexico, South Africa
- Sampling method may differ
 - Note: deviation within the sample can be very high. Depending on size.

■ Big question all over the world:

- Is DM content the right indicator and how to measure?
- Need to have better insight in maturity stage

Current Colombian Avocado Supply Chain

- From harvest to packing house
- Temperature management in orchard and transport
 - Pulp temperature from 11 – 23gC
 - Shading
 - Short delivery at pack house
 - Protocol is good (within 24h in cooling)
- Chilling injury and protruding lenticels
 - Also seen in other countries (Peru)
 - Related to handling and pre-cooling speed
 - No solution yet, nor protocol

Lenticel discoloration



Current Colombian Avocado Supply Chain

Sorting packing cooling, transport

- Clear postharvest protocol (registration, disinfection, monitoring, sampling, sorting, packing, pre-cooling, stacking, pre-cooled reefers, CA-transport etc.)
- Not always, points of improvement:
 - Long waiting time from delivery to sorting/pre-cooling
 - Conditioning of the reception and sorting area.
 - Technical issues:



Most of the time resulting in:

- higher energy consumption
- longer cooling times = dehydration of product!



Current Colombian Avocado Supply Chain

Quality at destination (EU, The Netherlands)

- Main quality issues:
 - Heterogeneity in dry matter
 - External discoloration
 - Internal browning
 - Stem-end rot and anthracnosis
- Standardization is needed ((post-)harvest)
- Difference in growing conditions and behaviour of Colombian Hass has to be recognized.

Pilot experiments

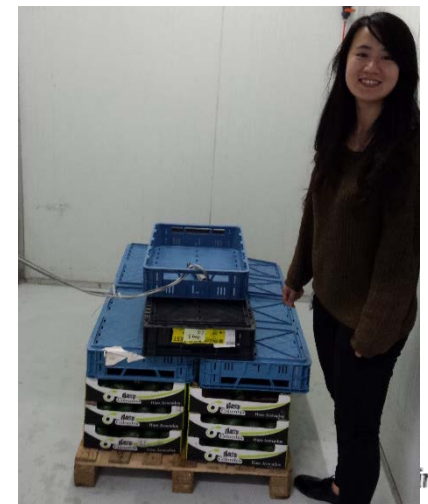
- Close collaboration with Agrosavia (Corpoica)
- Hypothesis
 1. Firmness at harvest as indicator for ripening behaviour (bench marking of maturity)
 2. Fast cooling will result in less internal problems (according to literature and experience)

Set-up of pilots Colombian avocados

- 2 pilots: Hass avocado's from two harvest seasons
 1. "Traviesa": July 31st –August 1st 2017
 2. "Principal": January 29th & 30th 2018
- Avocado's from two growers (A & B) in the east of Antioquia
- Each pilot 2 treatments, different pre-cooling strategies:
 - "fast" cooling
 - "delayed" cooling: 24-hours later

Set up of pilots: Process

- Harvest and transport to Corpoica laboratory for start measurements
- Pre-cooling at Corpoica
- Transport and packaging at Hass Colombia
- Transport in reefer container to the Netherlands (6-7°C)
- “Arrival” measurements at Wageningen laboratory
- Ripening/shelflife at 20°C: following ripening behaviour
- End measurements: Destructive quality measurements



Measurement methods

- Different measurement methods for firmness:
 - manual (destructive)
 - limited compression (semi-destructive)
 - acoustic firmness (aweta) (non-destructive)



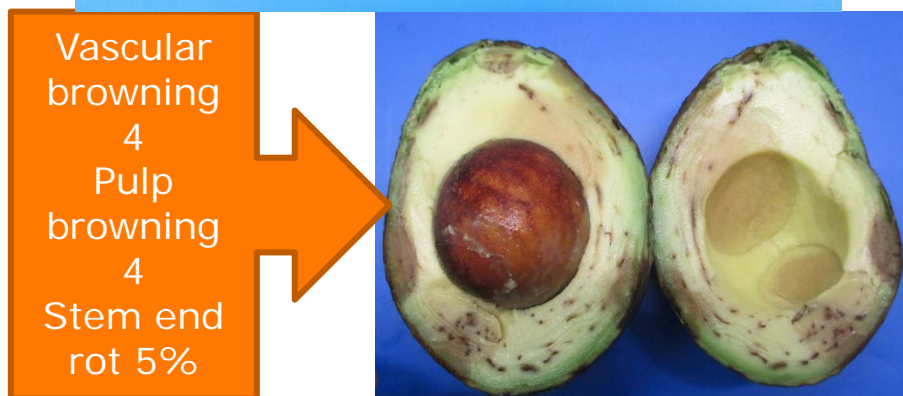
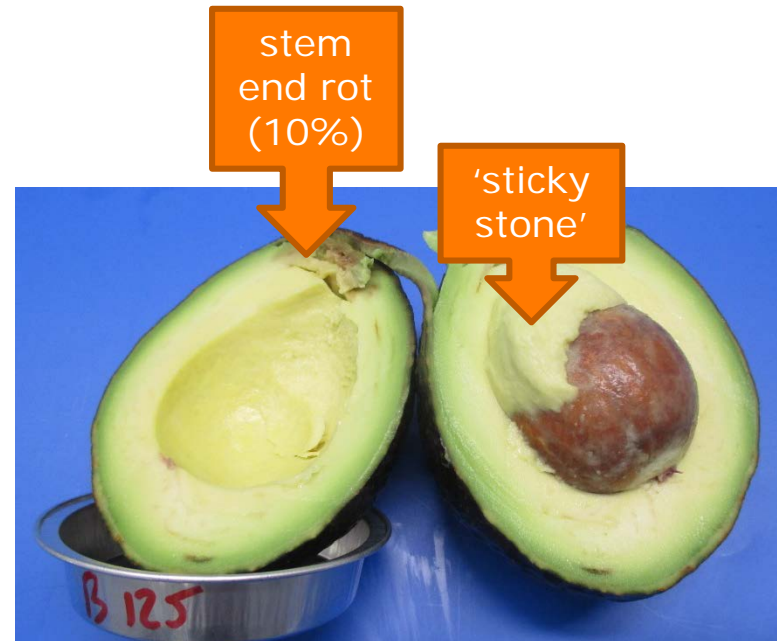
Measurement methods

- Colour
- Fresh weight, dry weight



Measurement methods

- Examples scoring of external – and internal decay



Conclusions (based on 2 pilots!)

- Hypothesis 1: firmness measurements at harvest is no suitable maturity indicator
 - Difficult to measure differences at differences
- Hypothesis 2: in this pilot delay of pre-cooling did not have an effect on internal quality
 - Heterogeneity due to harvest season and orchards, chain conditions probably have bigger influence
 - If production and chain conditions are optimal pre-cooling may have impact on internal quality.

Results and observations

- Pre-Harvest factors / results
- Effects of conditions directly after harvest (cooling)
- Relations between measurements at harvest and after transport

Variation and heterogeneity at harvest

Dry matter % at harvest:

Pilot 1 Traviesa Grower A: 30.1 ± **3.4**

 Grower B: 26.3 ± **4.0**

Pilot 2 Principal Grower A: 26.0 ± **2.6**

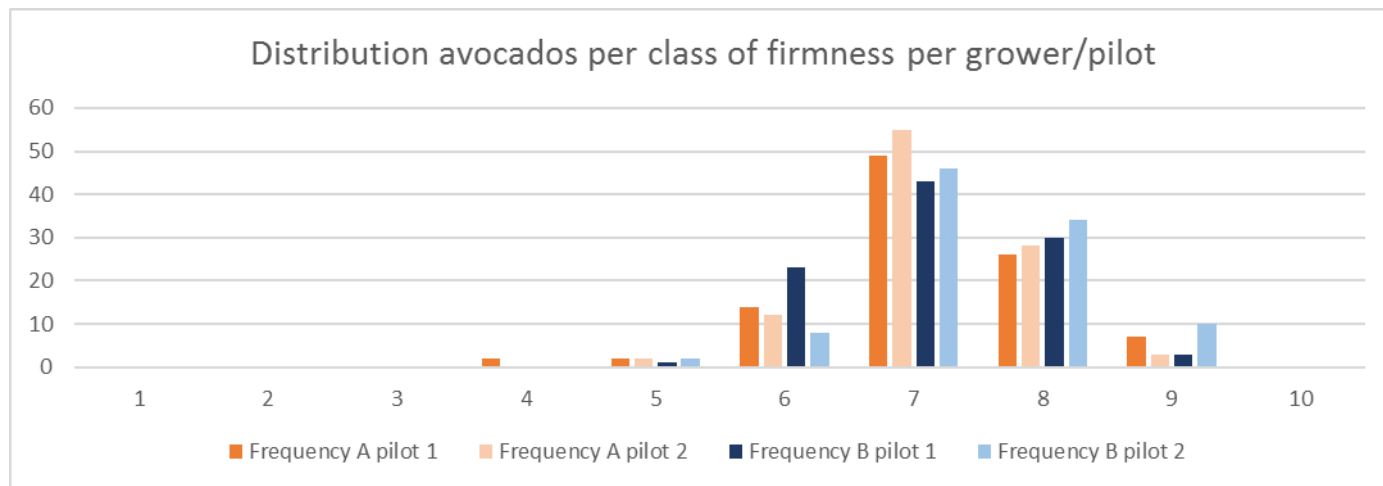
 Grower B: 24.6 ± **3.1**

- Large variation within batches, between growers, and between pilots!
- Biggest influencing factor: Orchard, season, harvest period, harvest window, sampling (sd<1)?

Heterogeneity: firmness at harvest

- **Within batches** large differences
- **Between growers** limited differences
 - Average values no or very little difference
 - Heterogeneity in batch: grower A in pilot 1 more heterogeneous
- **Between pilots:** limited differences

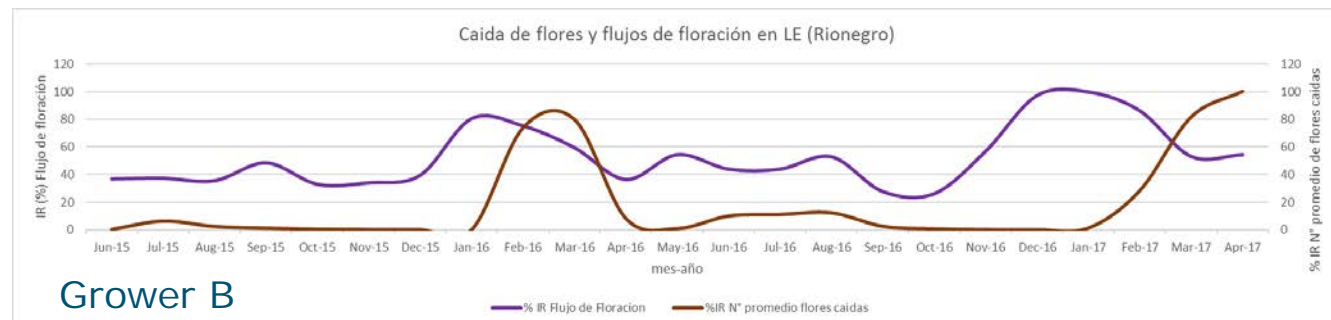
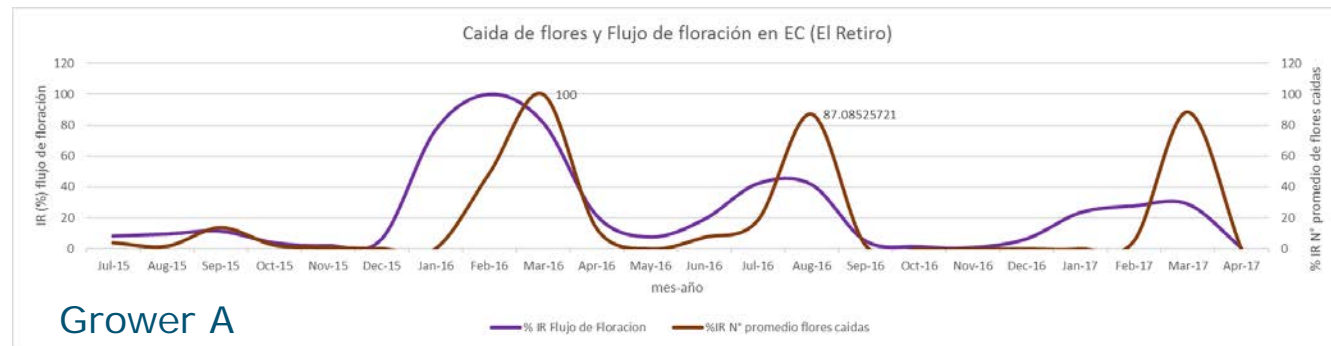
→ (Possible) Effects of orchard, season, harvest window not clearly visible via firmness measurements of avocados



Where heterogeneity starts?

- Grower A & B: different dynamics in flowering periods: clear peaks versus almost continuous flowering.

(Corpoica project)



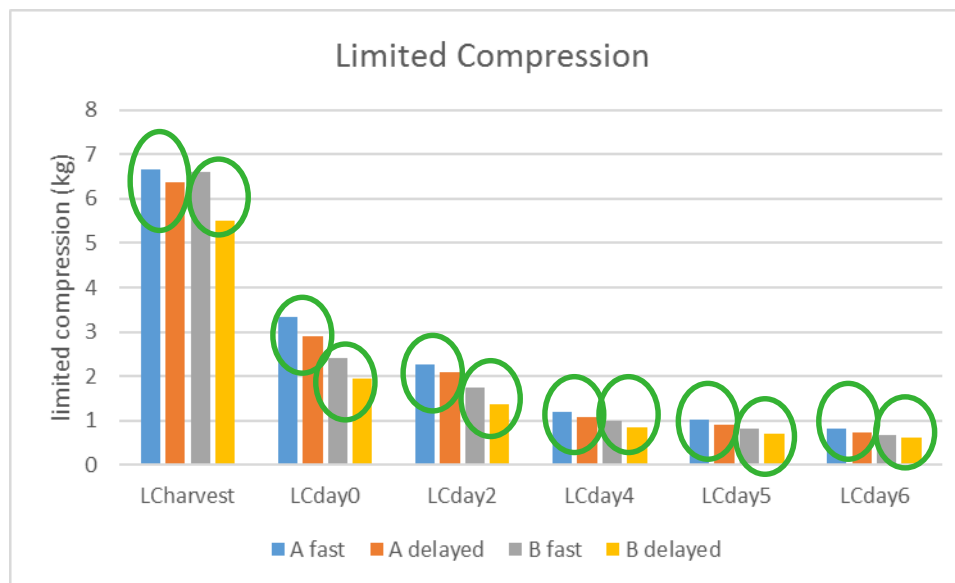
Ripening starts after picking

- Measuring 1 day later without cooling, already decrease in firmness is measured for both growers in both pilots



How important is immediate cooling?

- Small effect of pre-cooling remains during the whole supply chain (in pilot 1), but is of no significance on the end result of ripening. In second pilot no difference measurable at end of ripening.
- No impact on other factors, like ripening speed, RTE stages; other (production) factors may have bigger impact?

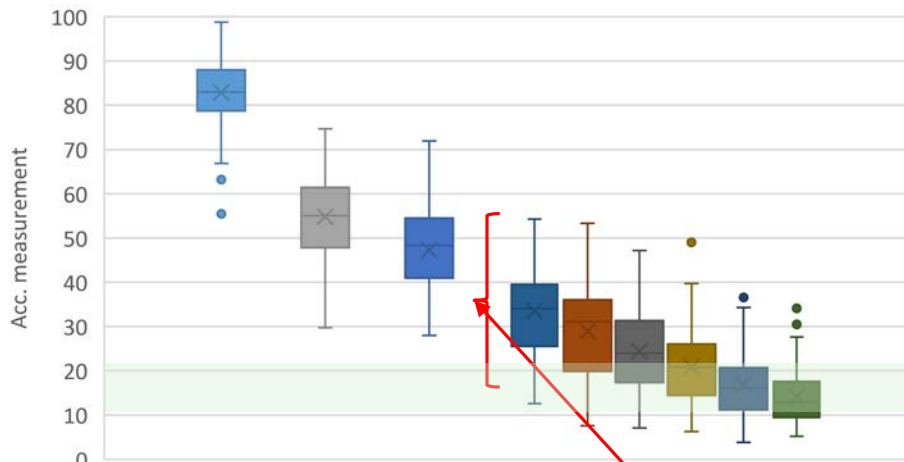


Pilot 1
Traviesa

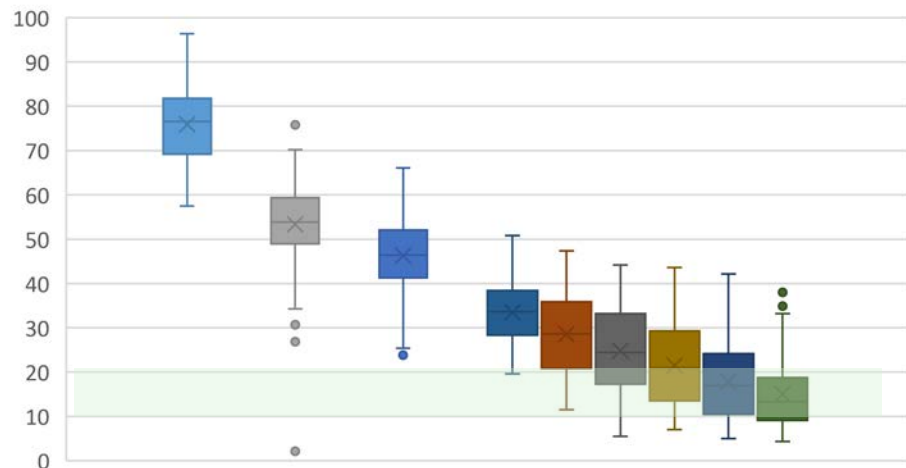
Effects of time, grower, cooling in pilots on heterogeneity

Pilot 2 Principal

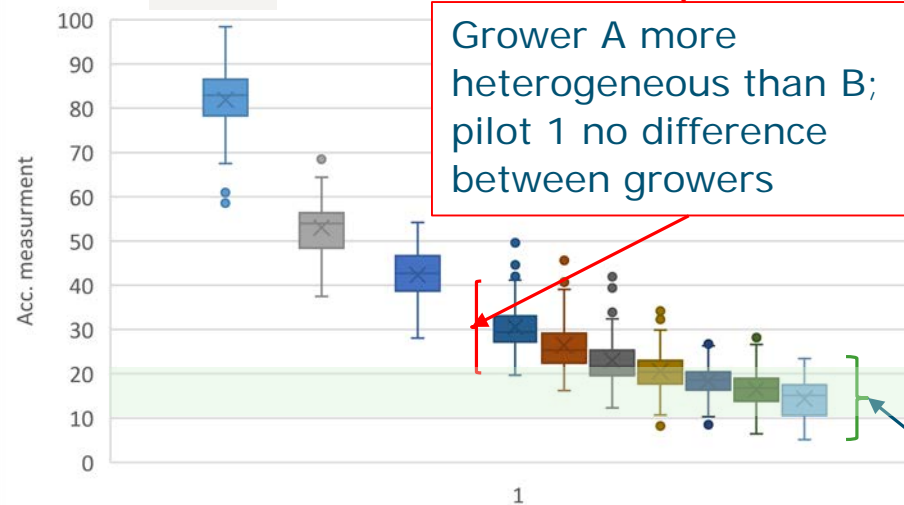
Grower A - fast



Grower A - delayed

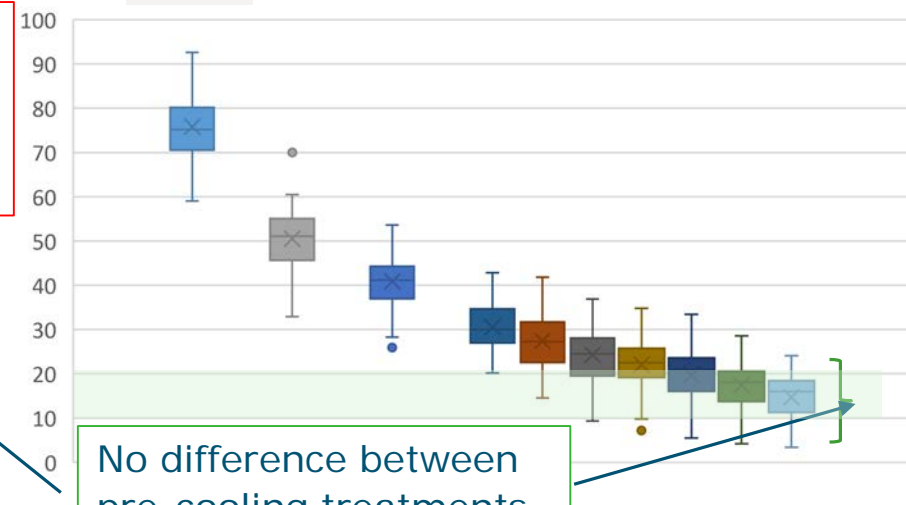


Grower B - fast



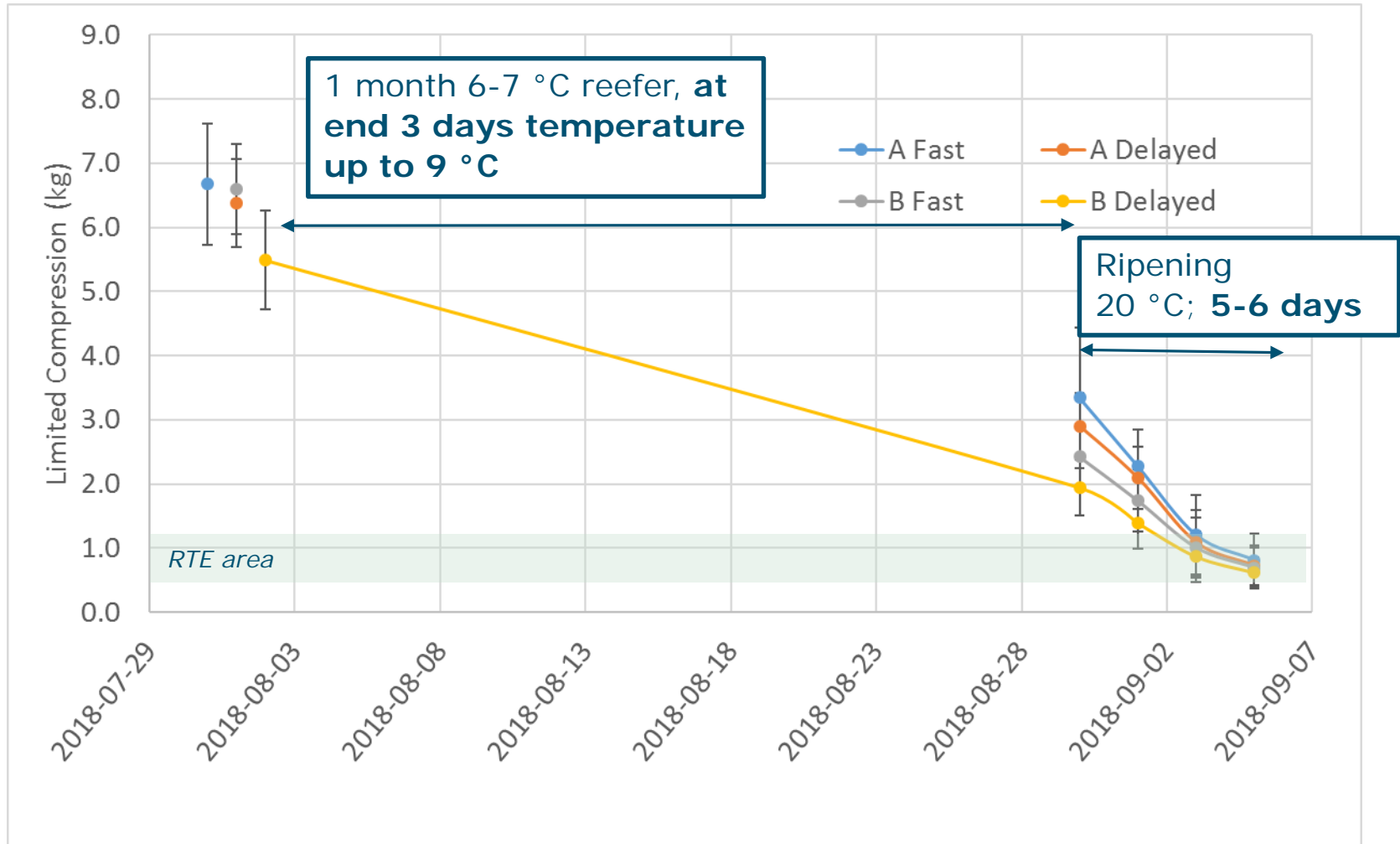
Grower A more heterogeneous than B; pilot 1 no difference between growers

Grower B - delayed

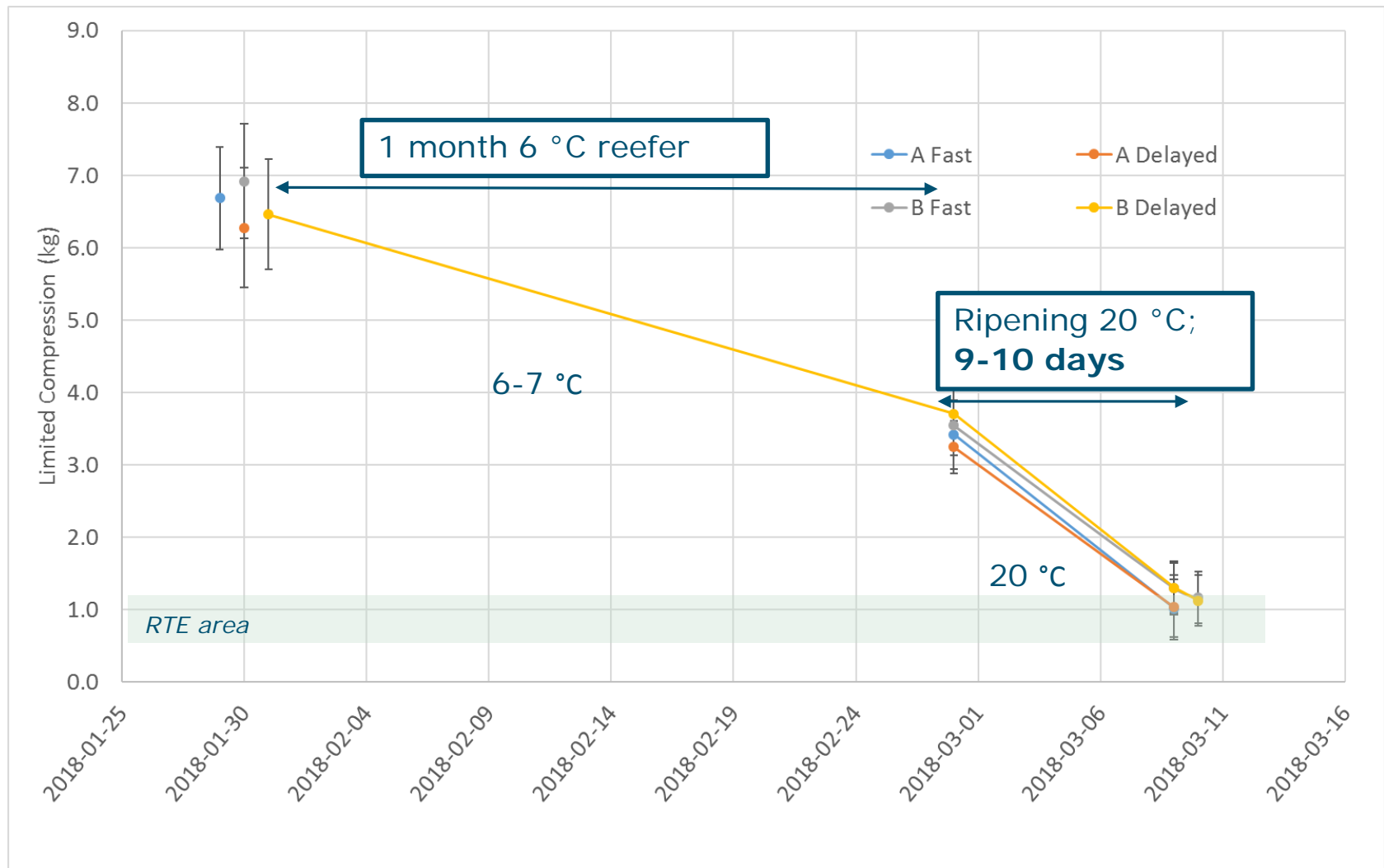


No difference between pre-cooling treatments

Effect of transport temperature?: Traviesa

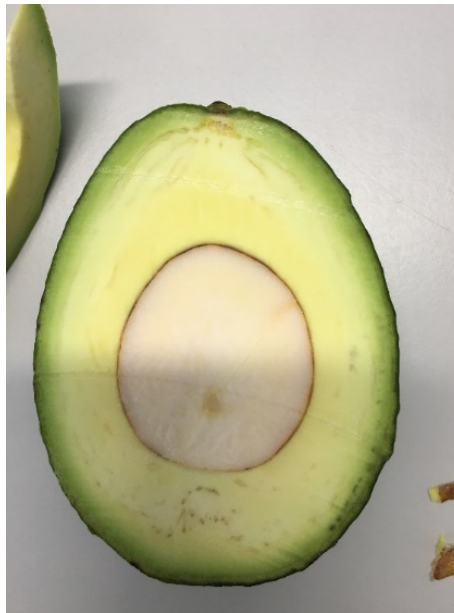


Effect of transport temperature?: Principal



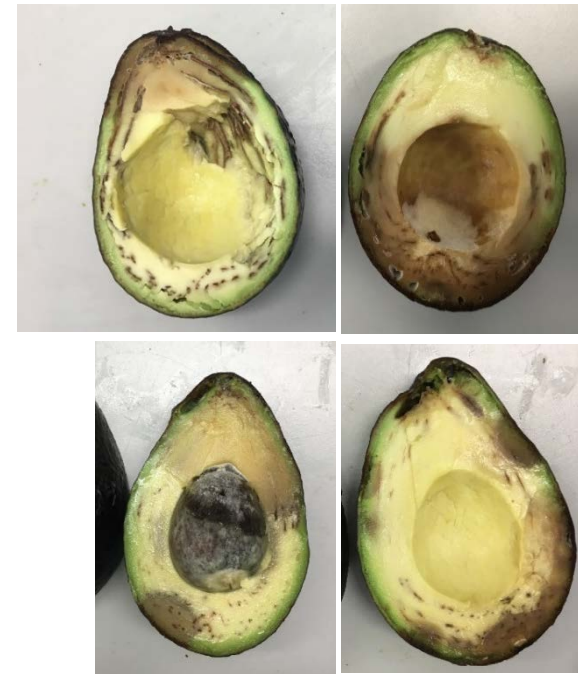
Problems with internal quality in pilots

- At arrival limited internal problems visible
- No browning, stem rot and fungi observed
- Few avocado showed vascular discoloration (stadium 2) but no significant difference between the treatments



Problems with internal quality in pilots

- After ripening high percentages of vascular browning and pulp browning and stem end rot in both pilots
- Pilot 2 more problems: influenced by harvest period and/or longer time to ripen?
- The softer the more disorders!
- Precooling no effect in our pilots
- Grower influence varied per pilot



| | RTE 1 | RTE 2 | RTE 3 | RTE 4 | RTE 5 |
|----------|--------|----------|----------|-----------|---------|
| Grower A | 2.0% a | 14.4% bc | 28.5% d | 56.9% e | 67.5% e |
| Grower B | 1.3% a | 10.0% ab | 23.0% cd | 20.8% bcd | 61.0% e |

Recommendations to improve quality: Colombian sector

- Postharvest protocol is OK!
 - Disinfection and Cold chain conditions are crucial
- Heterogeneity is a fact (mainly growing conditions)
- Optimization of production and harvest:
 - Influence of flowering (traviesa/principal)
 - Irrigation and nutrition
 - More control on maturity stage at harvest
 - DM sampling on size?
- How: monitoring give insight and possibility to analyze

Recommendations to improve quality: research

- More insight in dynamics of maturity, ripening and heterogeneity:
 - Monitoring heterogeneity within and between orchards and harvest seasons/window
 - Adapting PH-protocols & ripening strategies to different orchard, traviesa/principal (growing conditional)
 - Standardization of relevant measurements in the whole supply chain.

Recommendations to improve quality: research

- More insight in disorder development:
 - Prevention in production (disinfection, orchard management)
 - Control disorder development
 - Cold chain management (hypothesis!)
 - Ripening strategy
 - Green postharvest treatments
- How: monitoring, collaboration COL/NL

"Queen of Avocados"

Shawn Harris: founder of Nature's Pride



Picture: Roger Cremers

Quote NRC Dutch news paper :

"Avocado's are the most difficult fruit in the world, it still is complex."

Thank you!

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