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Agroscope

From pollination to postharvest conditions: understanding the development of CA-related disorders in CH201/FRED[®] pears



S. Gabioud Rebeaud *et al.*

21 May 2025, CAMA2025

www.agroscope.ch | good food, healthy environment



From breeding to market, it's a challenging 15-20 years journey for a new pear cultivar

Breeding and selection



- ✓ Resistance
- ✓ Adaptability
- ✓ Visual appeal and flavor
- ✓ Postharvest performance
- ✓ ...

Production



- ✓ Early, regular yields
- ✓ Uniform shape
- ✓ Ease of cultivation
- ✓ ...

Storage



- ✓ Firmness retention
- ✓ Physiological stability
- ✓ ...

Market



- ✓ Color and shape
- ✓ Flavor & juiciness
- ✓ Shelf appeal
- ✓ Attractive
- ✓ ...



CH201/FRED® pear: bred in 2000, launched in 2017

- Already produced in **several European countries**
- **Red blush** and **crunchy** texture
- **Long-term** storage
- **Good resistance** to postharvest handling
- Shelf life of **7 to 10 days** at 20 °C
- **Susceptible** to CA-related disorders



Cavities



Core browning



Cavities + Core browning





We understand the factors influencing the CA-related disorders, specifically the cavities

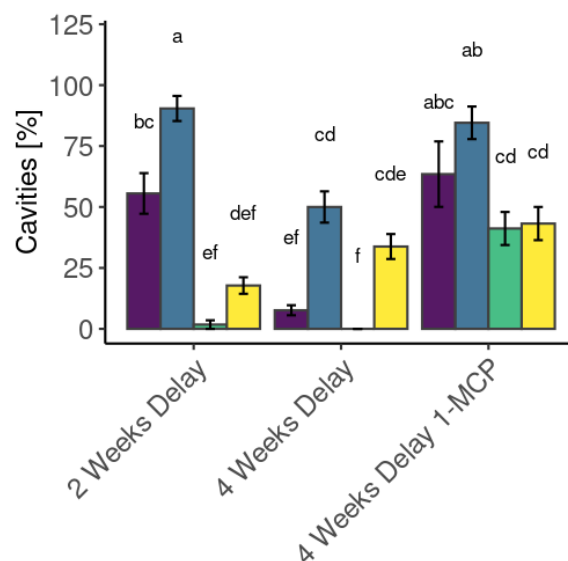
CO₂

Low
O₂-level

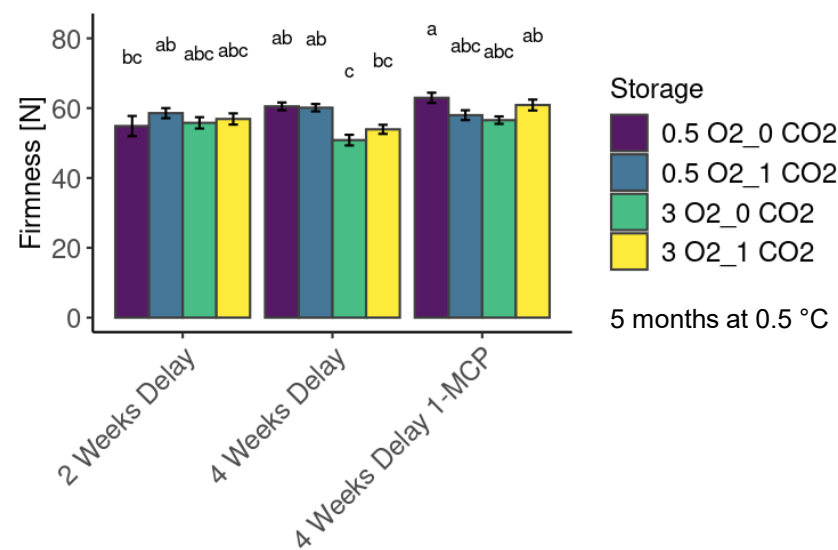
Short
CA-delay

1-MCP
treatment

Cavities



Firmness



→ Recommended storage conditions for FRED® in Switzerland:
0.5 °C, 4 weeks CA-delay, 3 % O₂ + complete adsorption of CO₂



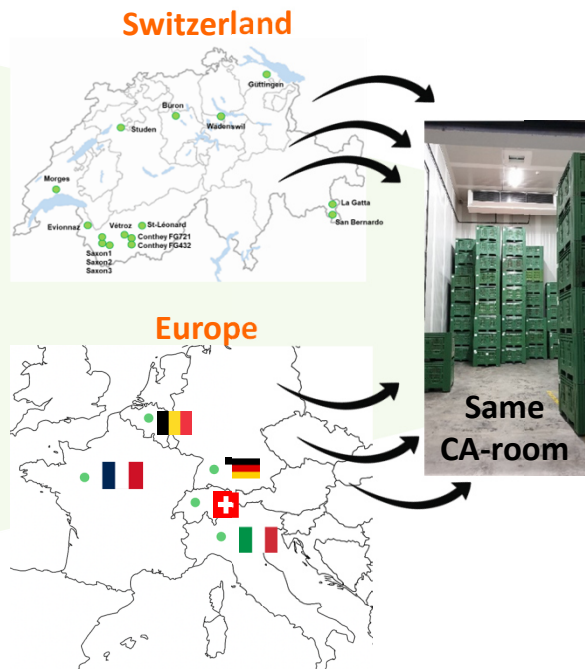
The origin of pears influences their susceptibility to CA-related disorders → studies have been conducted to identify influential pre-harvest factors

Factors

- Rootstock
- Tree age
- Crop load
- Tree vigor
- Pollination
- Growth regulators
- Irrigation
- Nutrient management
- Pruning
- Soil type
- Harvest timing
- Weather conditions
- ...



Network studies



Targeted experiences

Identification
of
key factors
+
Parameters
linked to
CA-related
disorders

Studies in
experimental
orchards
to **validate** the
influence of
identified
factors



CA-related disorders are mainly present in imbalanced orchards

High
vegetative
vigor

Low crop
load

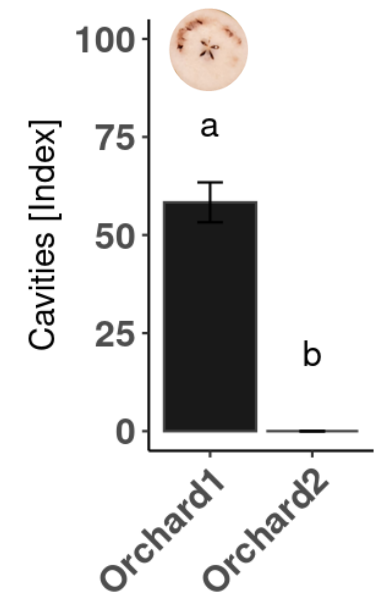
Young trees

Vigorous
rootstocks

Orchard 1: imbalanced



Orchard 2: balanced



Both orchards were planted in the **same year** on identical rootstock, with comparable soil and climate conditions, and **stored in the same CA-room.**



An experimental trial confirmed that low crop load combined with a high leaf area promotes the development of cavities

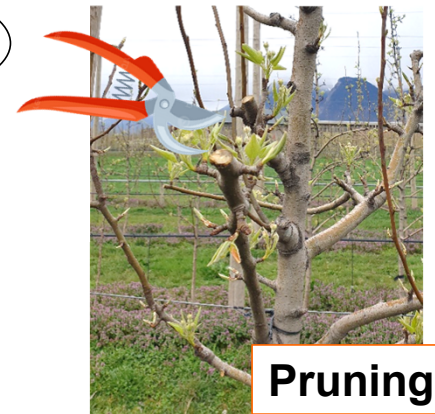
- At bud stage:

- Control**
- Pruning** (branches were shortened by 2/3)
- Flower thinning** (2/3 of floral bouquets were removed)

- Objectives:**

- Reducing crop load
- Promoting vegetative growth

5th leaf trees
Quince Adams



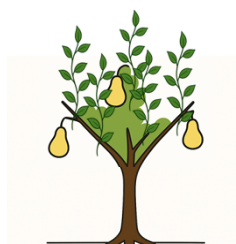
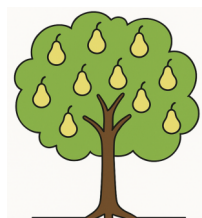
agronomy
2025

Pruning and Flower Thinning Influence the Storability of CH201/FRED® Pears

by Séverine Gabioud Rebeaud 1,* ✉, Pierre-Yves Cotter 1 ✉, Marlyse Raemy 2 ✉, Sébastien Dubois 2 ✉, Felix Büchele 3 ✉, Daniel Neuwald 3,4 ✉ and Philippe Monney 1 ✉



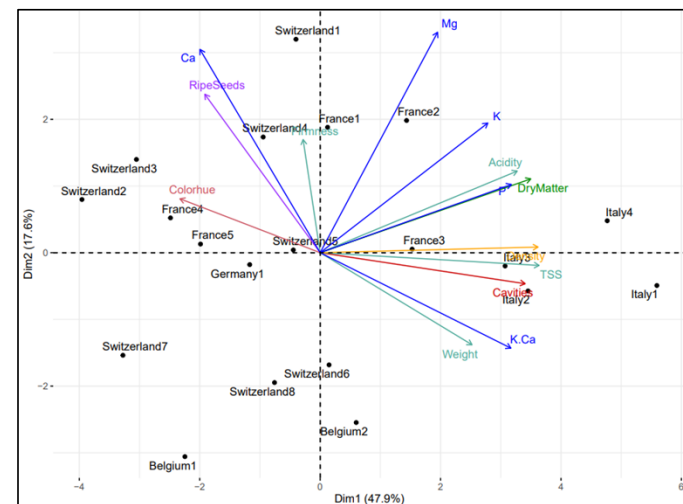
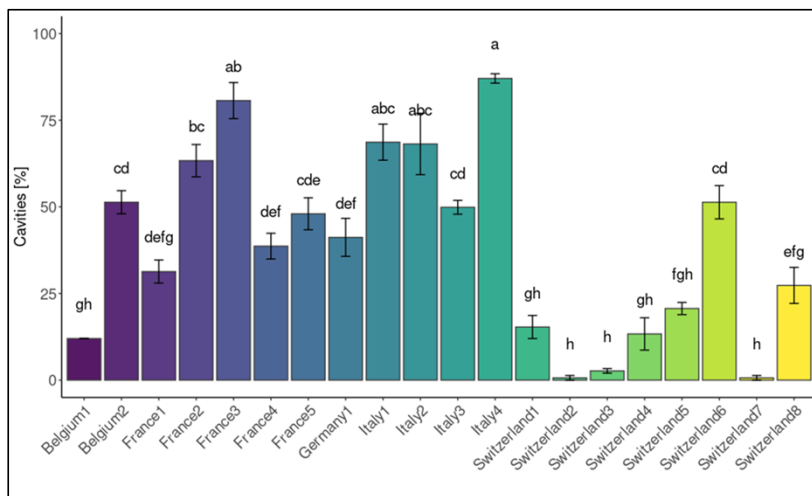
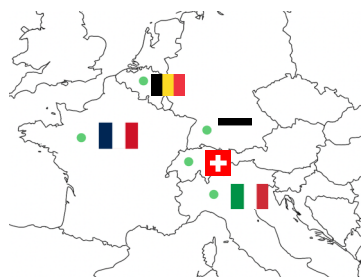
Flower thinning increased the leaf-to-fruit ratio, resulting in fruit with greater weight, higher TSS, more cavities, and elevated K/Ca ratio



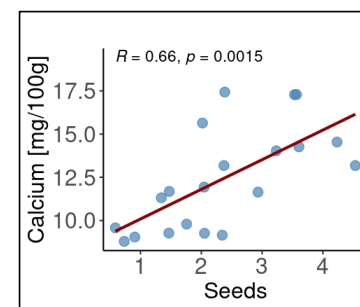
	Control	Pruning	Flower thinning
Crop load [no fruit/m ²]	22.3 a	15.8 b	12.6 b
Vegetative vigor [m/tree]	3.6 b	11.3 a	9.5 ab
Leaf area [m ² /tree]	5.1 b	4.9 b	7.1 a
Fruit weight [g]	240.1 b	253.3 b	285.0 a
TSS [°Brix]	11.7 b	12.1 b	12.8 a
Cavities [%]	16.0 b	43.7 ab	67.3 a
K/Ca	7.6 b	9.6 ab	10.06 a



Similar trends were observed in the EU-wide network study



- Orchards with a high incidence of cavities tended to have fruit with **higher K/Ca ratios, higher TSS, greater weight, and increased density.**
- Calcium and number of seeds** also showed a positive correlation.





The number of seeds influences the calcium uptake via auxin-related hormonal pathways (Bangerth, 2000)

Volz et al.
1994
Braeburn

Buccheri &
Di Vaio, 2005
Golden D.

Bramlage et al.,
1990
Golden D.

Brookfield et al.,
1995
Braeburn

- A relationship between seed number and fruit calcium has been observed in **various studies on apples**.
- The relationship remains poorly documented in the scientific literature **for pears**.

Current trial at Agroscope

Investigating the relationship between seed number, calcium and cavities in CH201/FRED® pears

- ✓ Natural pollination
- ✓ Manual pollination with compatible pollen
- ✓ Manual pollination with incompatible pollen
- ✓ Bagged

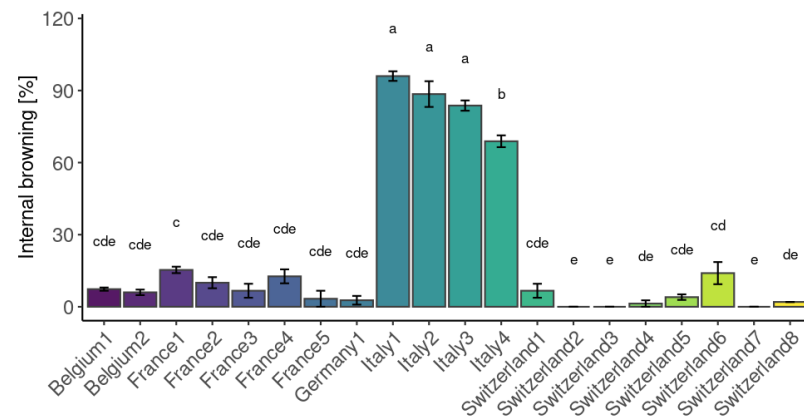


Harrow Sweet





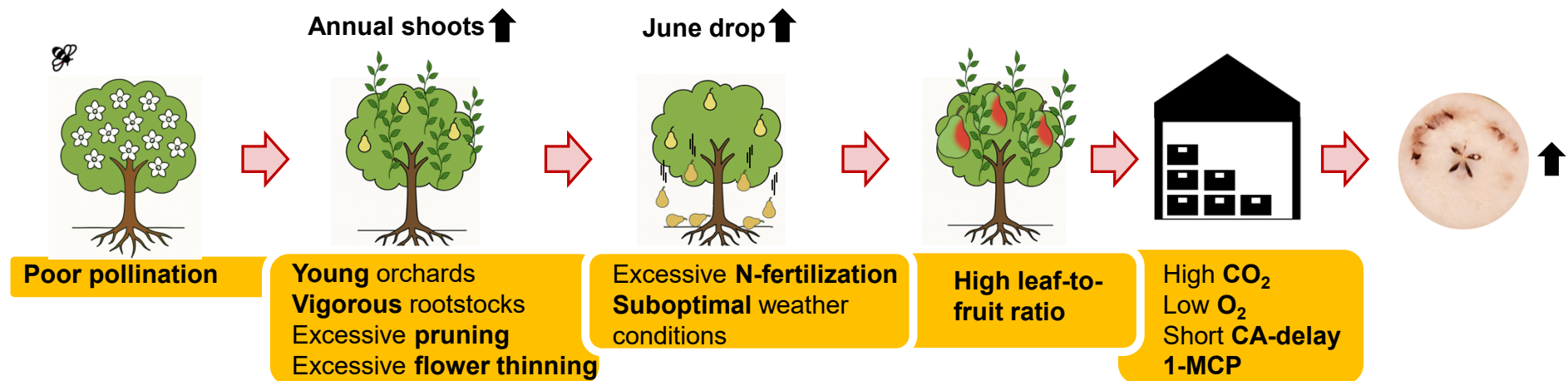
While cavities have been the most commonly observed disorder in our studies, symptoms of core browning and watercore have also been detected in some orchards



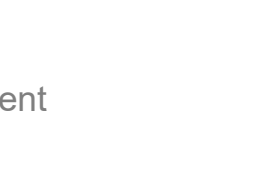
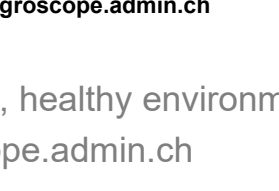
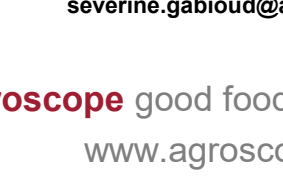
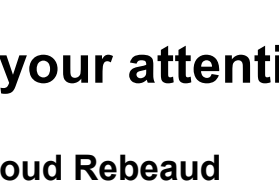
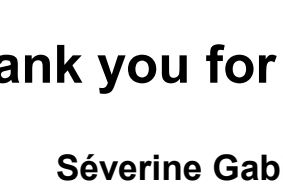
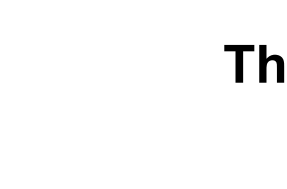
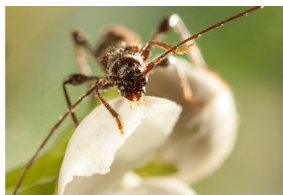
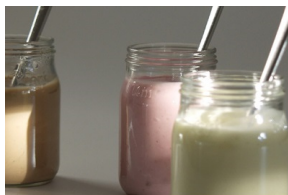
- In extreme cases where **the leaf-to-fruit ratio is high and temperatures are warm before harvest**, these disorders are more likely to appear.
- More leaves → Higher carbohydrate supply → Accumulation of a sorbitol-rich liquid → Watercore → Hypoxia → browning (Lu et al., 2022).



Conclusions: large in-field + postharvest studies brought practical solutions to mitigate CA-related disorders – backed by pear physiology



- The **impact of certain practices** still need to be evaluated (Gibberellin, Foliar Ca treatments,...)
- **Internal browning and watercore**—associated with high preharvest temperatures and an elevated leaf-to-fruit ratio—should be monitored, especially in the context of **global warming**.



Thank you for your attention

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