



Orchard-specific factors contribute to the apparition of CA-related disorders in FRED[®]/CH201 pears

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FRED[®] is a **new pear cultivar** issued from the Agroscope breeding program

240 ha are currently planted in Europe (CH, BE, FR, IT)
+ 135 ha until 2025



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▪ **Characteristics**

- **Rapid entry** into production
- **High yield**
- Red blush → **bicolor**
- **Firm and crunchy flesh**
- **Long term storage** potential
- **Good resistance** to postharvest handling
- **Susceptibility to CA-related disorders, in particular cavities**





Postharvest factors influencing CA-related disorders that have been identified so far

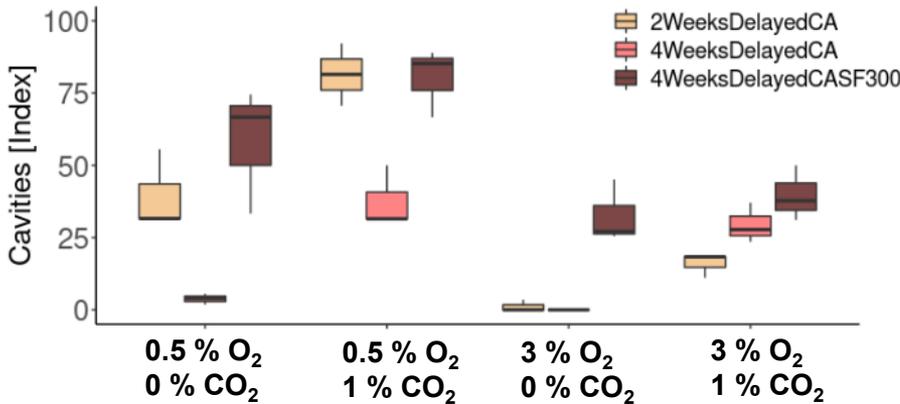
CO₂-level

O₂-level

CA-delay

1-MCP treatment

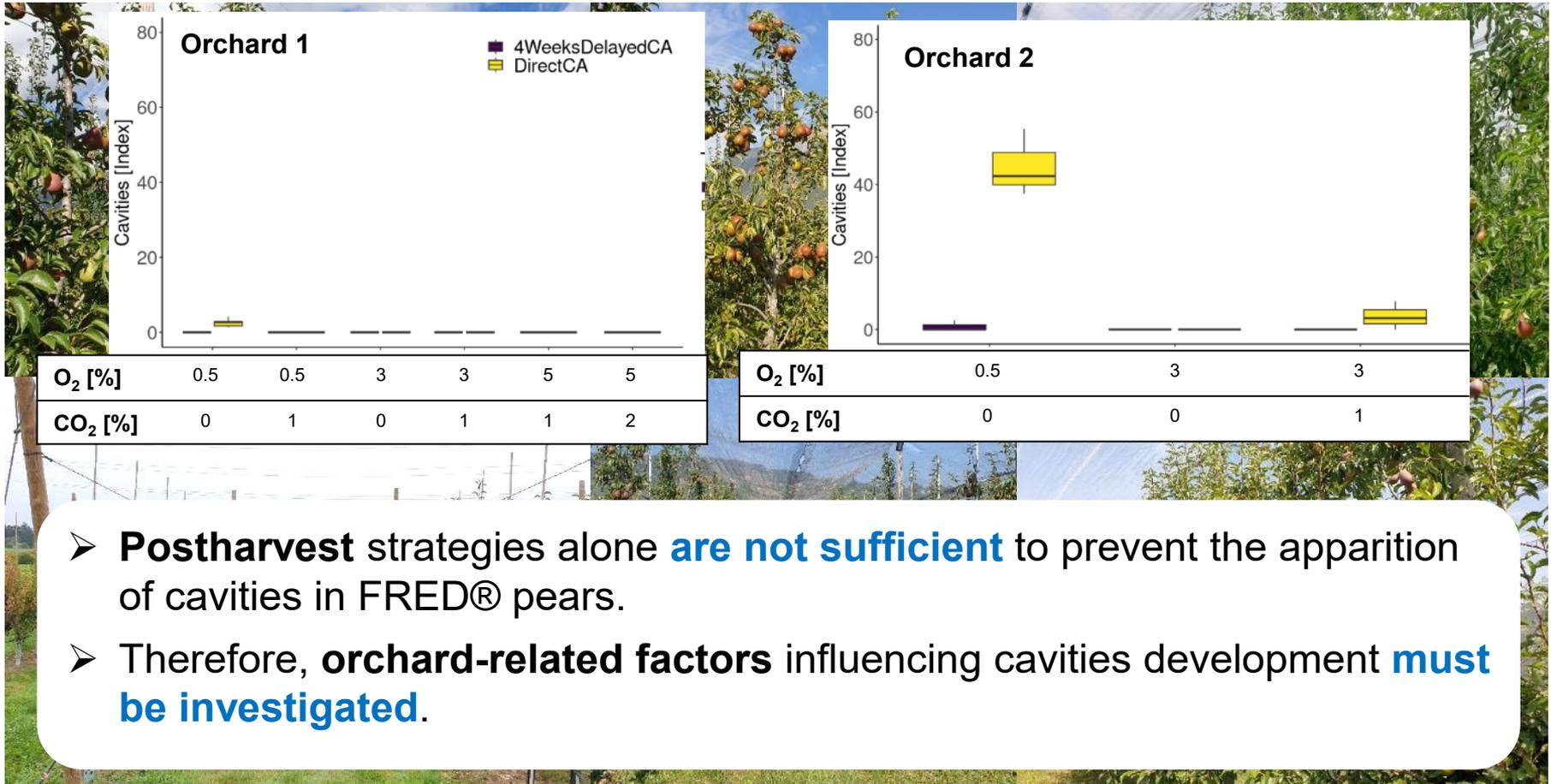
- **CO₂** is the **major postharvest factor** triggering CA-related disorders in FRED[®] pears.
- **Low O₂** (< 3 %), **short CA-delay** (< 4 weeks) and **1-MCP treatment** increase the susceptibility.



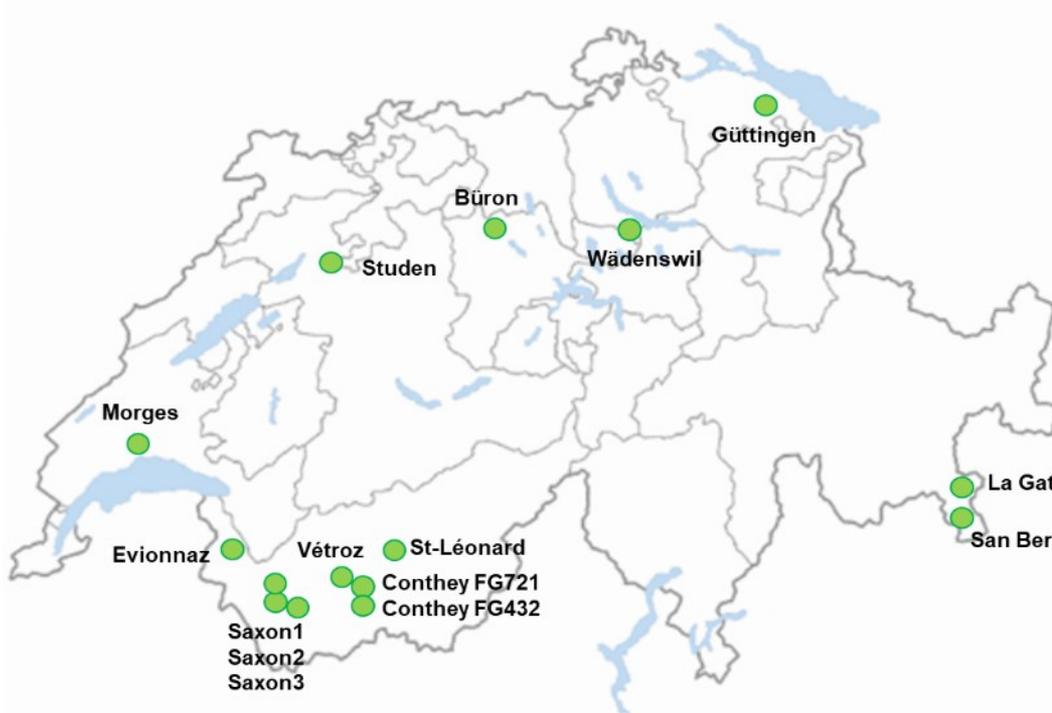
5 months 0.5 °C + 7 d 20 °C (2022-23)



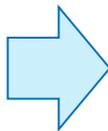
The influence of these factors on CA-related disorders **varies according to the orchard**



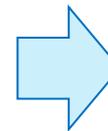
Studies with pears harvested in **different orchards** and stored in the **same CA-room** have been set up



Harvest at commercial maturity stage



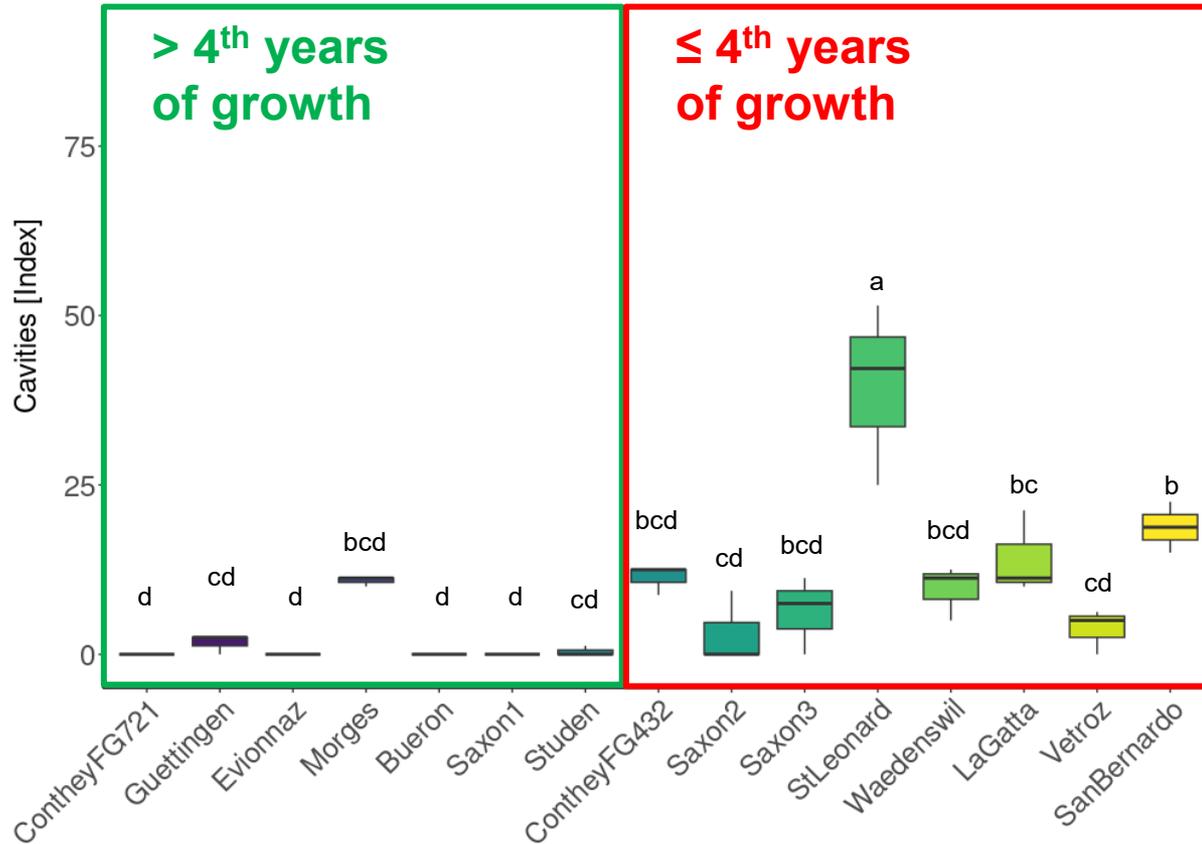
Storage in CA conditions:
O₂: 5/3 % and CO₂: 1 %
4 weeks CA-delay



Evaluation of quality and CA-related disorders after 5 and 8 months of storage



Trees $\leq 4^{\text{th}}$ year of growth are more prone to develop cavities



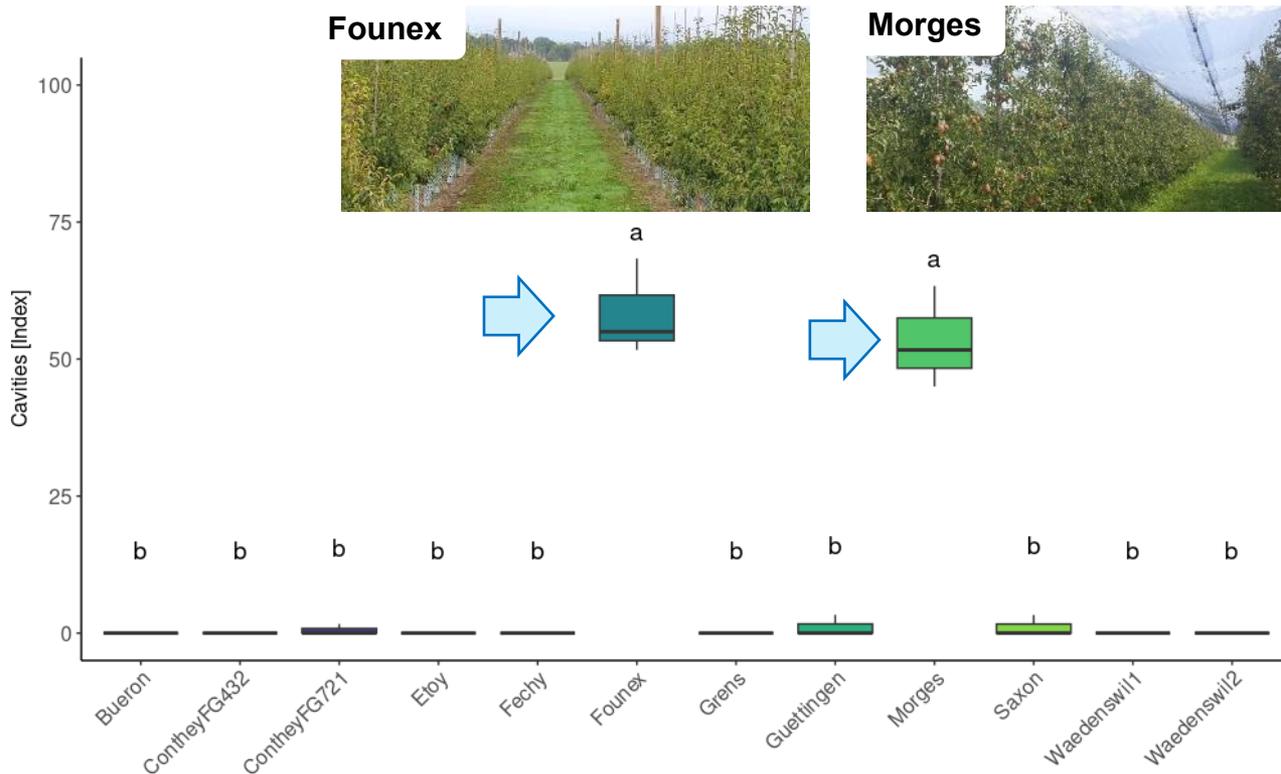
Ascorbic acid and calcium levels were tendentially **higher** in healthy pears

5 months 0.5 °C, 5 % O₂, 1 % CO₂ + 7 d 20 °C (2020-21)



'Unbalanced trees' seem to be more prone to develop cavities

- Low crop load and high vigor (high leaf area)



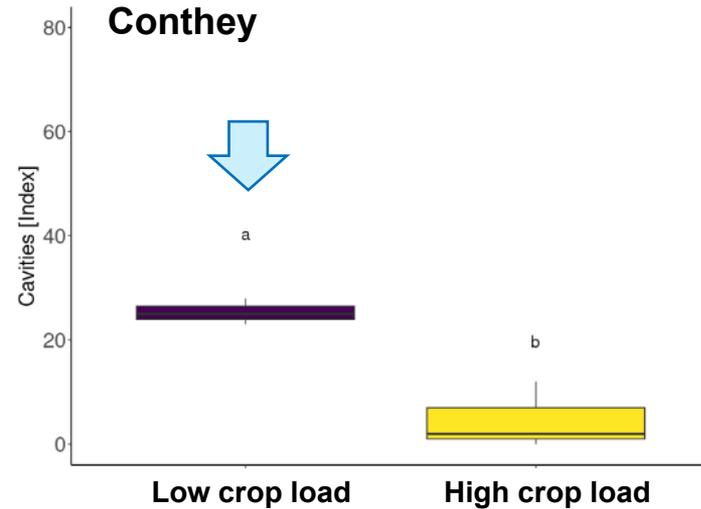
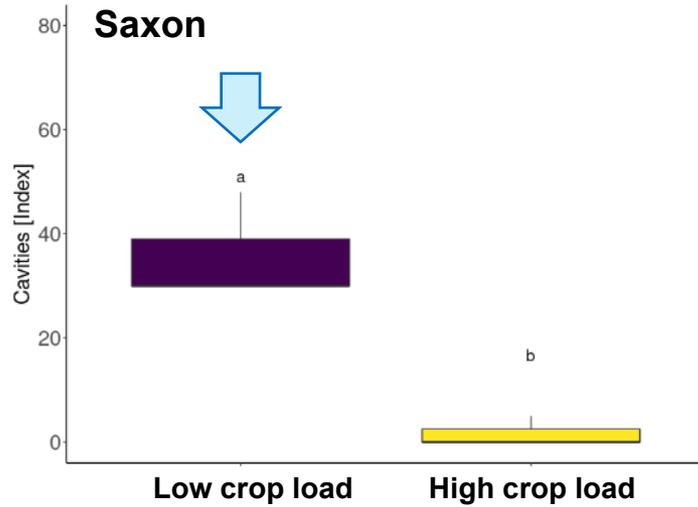
Sugar level at harvest was higher in unbalanced orchards.

Fruit weight was similar to healthy orchards.

5 months 0.5 °C, 3 % O₂, 1 % CO₂ + 7 d 20 °C (2021-22)



Pears issued from trees with **low crop load** are more prone to develop cavities...

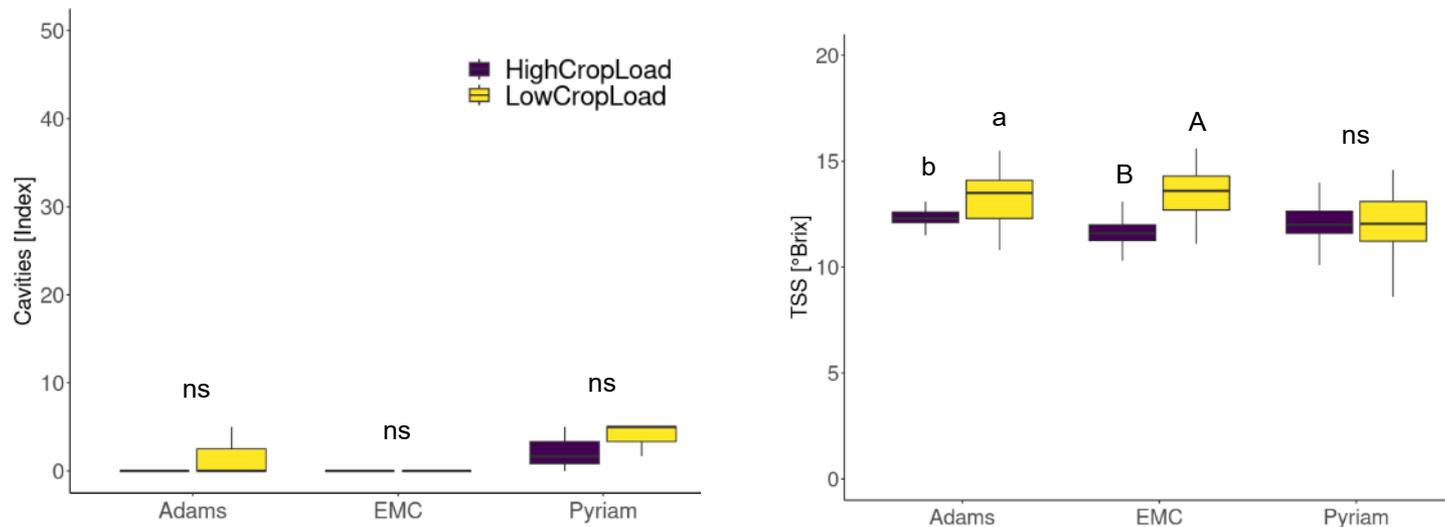


Quality at harvest	Saxon Low	Saxon High	Conthey Low	Conthey High
Weight [g]	236 ^a	223 ^a	269 ^A	219 ^B ←
Firmness [kg/0.5 cm ²]	6.2 ^b	6.8 ^a ←	6.7 ^A	6.6 ^A
TSS [°Brix]	12.1 ^a	12.4 ^a	13.7 ^A	13.5 ^A
Starch [1-10]	3.9 ^a	3.3 ^a	1.8 ^A	1.8 ^A

5 months 0.5 °C, 3 % O₂, 1 % CO₂ + 7 d 20 °C (2021-22 and 2022-23)

... while **low crop load resulting from hand thinning of pears in June** did not increase the susceptibility to **CA-related disorders**

- But it increased the sugar level (and acidity) on two rootstocks without influencing fruit weight and firmness.



These results suggest that **physiological processes happening between flowering and the end of cell division** are linked to the CA-related disorders.

5 months 0.5 °C, 3 % O₂, 1 % CO₂ + 7 d 20 °C (2021-22)

A flower thinning and pruning study suggests that **leaf area** contributes to the susceptibility to CA-related disorders



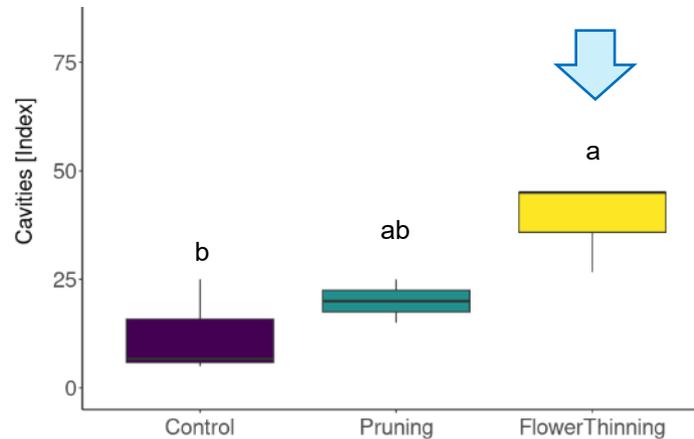
1. **Control**
2. **Pruning** (1/2 to 2/3 of branches were cut at flowering)
3. **Flower thinning** (2/3 of buds were removed)



	Crop load [%]	Vigor* [m]	Leaf area [m²]
Control	100	3.6 ^b	5.1 ^b
Pruning	68.3	11.3 ^a	4.9 ^b
Flower thinning	67.9	9.5 ^a	7.1 ^a ←

* Cumulative growth [m]

Flower thinning increased the susceptibility of the pears to CA-related disorders



Sugar level and fruit weight at harvest were also **higher** in the flower thinning treatment compared to pruning and control.

At harvest	Weight [g]	Firmness [kg/0.5 cm ²]	TSS [°Brix]	Starch [1-10]	Color [h]
Control	233.3 ^b	6.7 ^a	11.7 ^b	2.3 ^a	99.7 ^a
Pruning	252.8 ^b	6.7 ^a	12.1 ^b	2.6 ^a	100 ^a
Flower thinning	283.4 ^a ←	6.7 ^a	12.8 ^a ←	2.3 ^a	99.4 ^a

5 months 0.5 °C, 3 % O₂, 1 % CO₂ + 7 d 20 °C (2022-23)



Conclusions

- Our studies showed that **CO₂ is the major postharvest factor** triggering **CA-related disorders in FRED® pears** and that **low O₂, short CA-delay and 1-MCP treatment** increase the susceptibility.
- **Orchards with ≤ 4th year of growth** and/or **low crop load** are particularly susceptible to CA-related disorders, especially when the **vigor is high**.
- The susceptibility to CA-related disorders **is not always correlated** with high sugar level or fruit weight.
- Methods are currently developed **to identify at harvest susceptible pears**.
- Further data will be gathered, including the impact of **yearly climate parameters**.



Thank you for your attention

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