



Preventing Postharvest Calcium Disorders in Pome Fruit

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[Symptoms/ terminology]



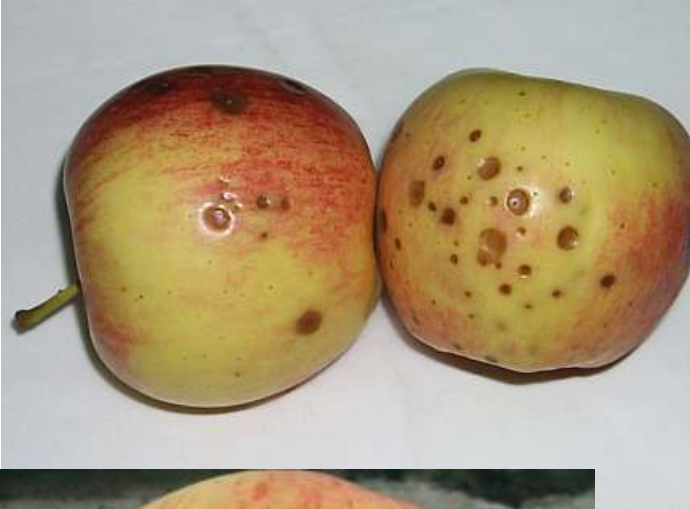
Lenticel Blotch pit

[Symptoms/ terminology]



Bitter pit

[Symptoms/ terminology]



Lenticel breakdown



[Lack of Boro]





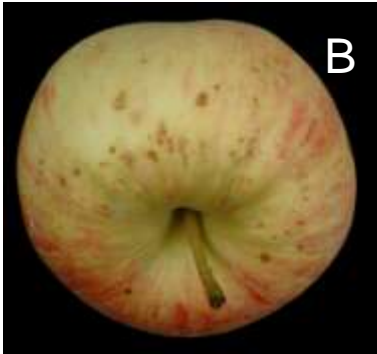
OTHER SYMPTOMS

Related with product Toxicity
on GALA



Detergent Toxicity

Detergent is used for apple clearing in the packing line



Sodium toxicity

Sodium accumulates from Sodium hypochlorite used for water sanitation

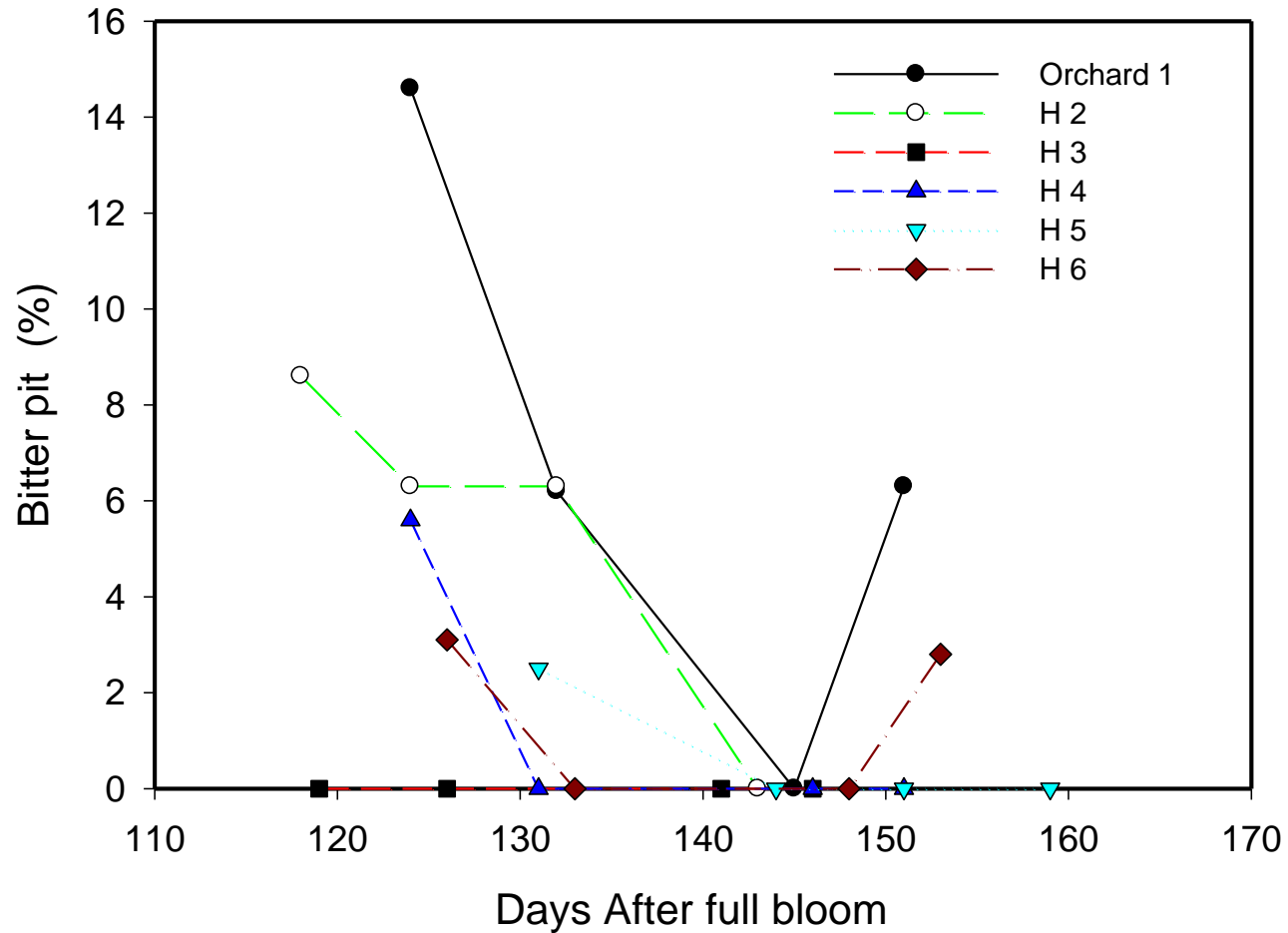




Chlorine Phytotoxicity

Calcium chlorine produces phytotoxicity on Gala and Golden Delicious varieties

[Orchard Variability]

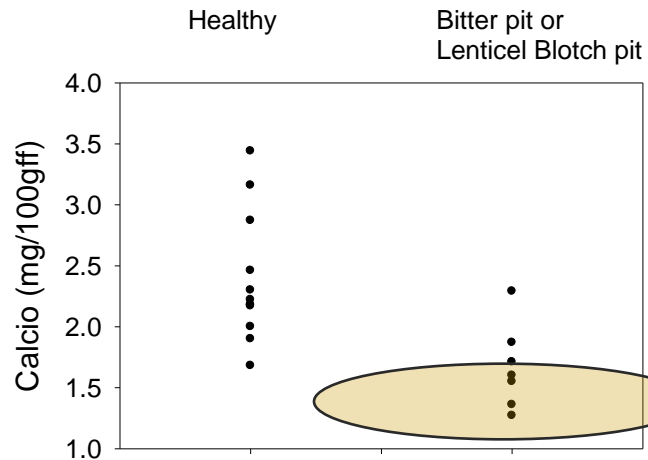
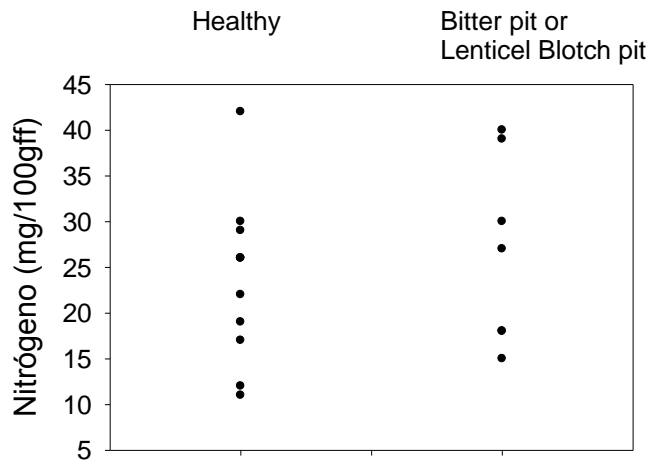


Mineral nutrients are related with corking physiological disorders.

- Calcium is the nutrient most commonly associated with corking postharvest disorder in apple (Bitter pit).
- Calcium
 - Improve membrane integrity.
 - Reduce senescent related process.
 - Activation of enzyme.
 - Signal transduction process.
 - Structure of cell wall.
- However calcium is not the primary factor involved in Bitter pit.

Mineral nutrients are related with corking physiological disorders.

- Increasing fruit calcium has been demonstrated to reduce corking physiological disorder.

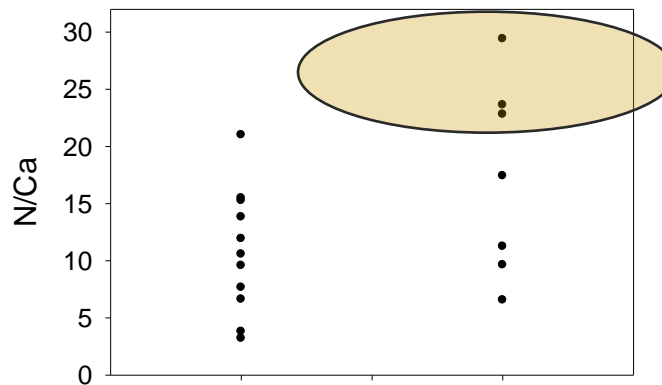
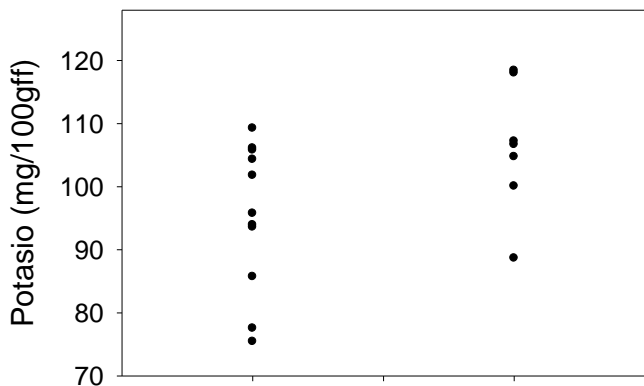


Others minerals

N < 25 mg / 100gff

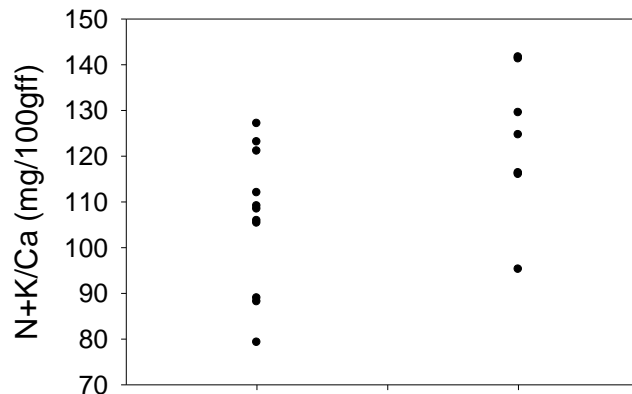
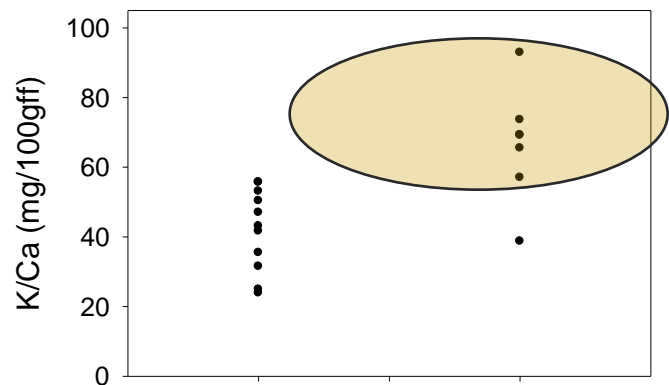
K < 65 mg / 100gff

Mg < 3.8 mg / 100gff



Poor yield, color

Therefore



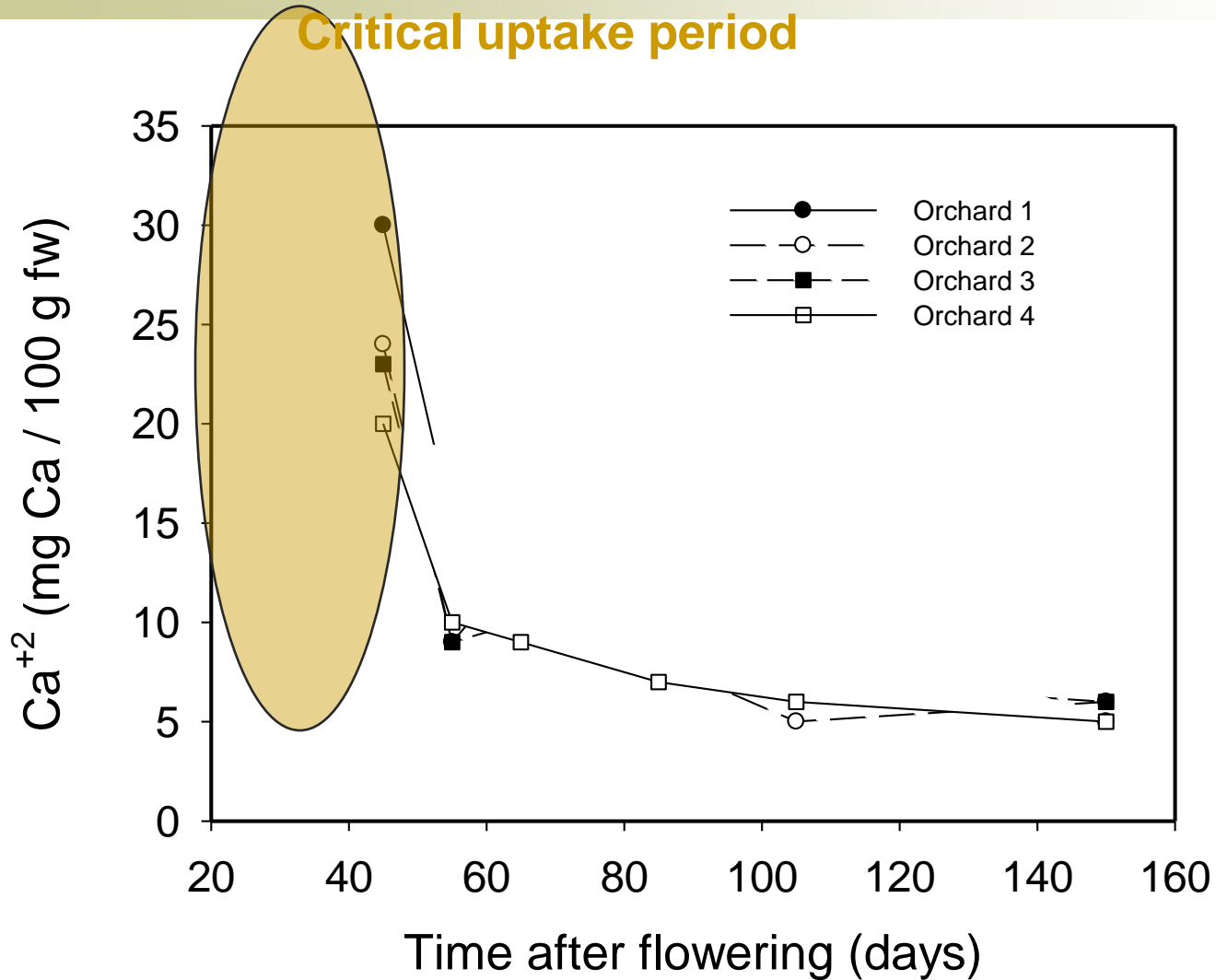
To increase them
with
Calcium > 5.4 mg/
100gff

[Calcium applications]

Ca ⁺² application		Bitter pit (%)			
Pre-harvest	Post-harvest	Orchard 1	Orchard 2	Orchard 3	Orchard 4
Control	Control	34.0 a	29.8 a	21.5 a	10.3 a
Control	Ca ⁺²	25.0 b	21.3 b	9.7 b	8.0 a
Ca ⁺²	Control	24.7 b	22.1 b	5.9 b	11.1 a
Ca ⁺²	Ca ⁺²	15.0 c	13.8 c	5.0 b	3.3 b

Seven 2% Ca⁺² sprays pre-harvest applications.
 0.2% Ca⁺² dipping post-harvest application.

Ca²⁺ concentration during time



Leaf surface transpiration area

Treatments	Calcium (%)		
	Fruit size (g)		
	2.2-11	30-60	60-120
Control	100	100	100
Without leaf	39 *	74 *	55 *
Bagged spur	59 *		
Bagged leaf	72 *		
Bagged fruit	94		

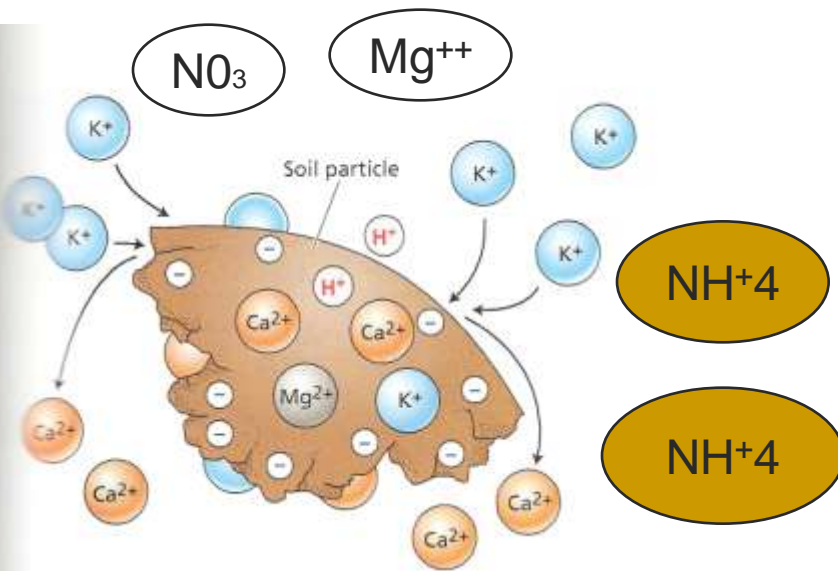
* Significant

Jones and Samuelson, 1983



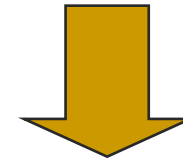
- Objective of AGRONOMIC practices
 - **IMPROVE THE ABILITY OF THE SPUR AND BOURSE LEAVE TO DRAW CALCIUM INTO THE FRUTING WOOD.**

FRUITING HABIT



Ca^{+2} availability, translocation, immobilization and fruit allocation.

- SPUR leaves:
 - HIGH transpiration rate early in the season.

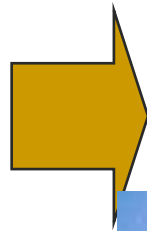


EXPANDING LEAVES
FROM YOUNG AND VIGOROUS
SPUR,
AVOID MULTIPLE OLD
TERMINAL FRUITING WOOD.

[FRUIT HABIT]



Small branch with a flower bud at the end



Strong branch with terminal flower bud, new shoot will remove the old branch and maintain the vigor.



Weak branch with terminal flower bud, shoot from the bource will extend the branch with weak tissue, developing multiple long and old branch. Gil, 1989

[FRUITING HABIT]







SPURS



Strong spur, from cutting back
On the old branch, large leaves.

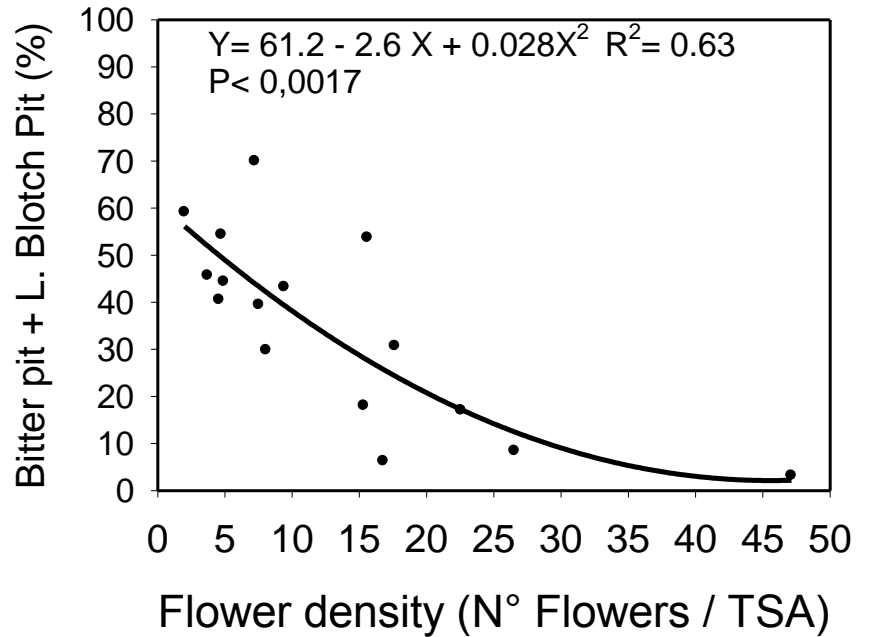
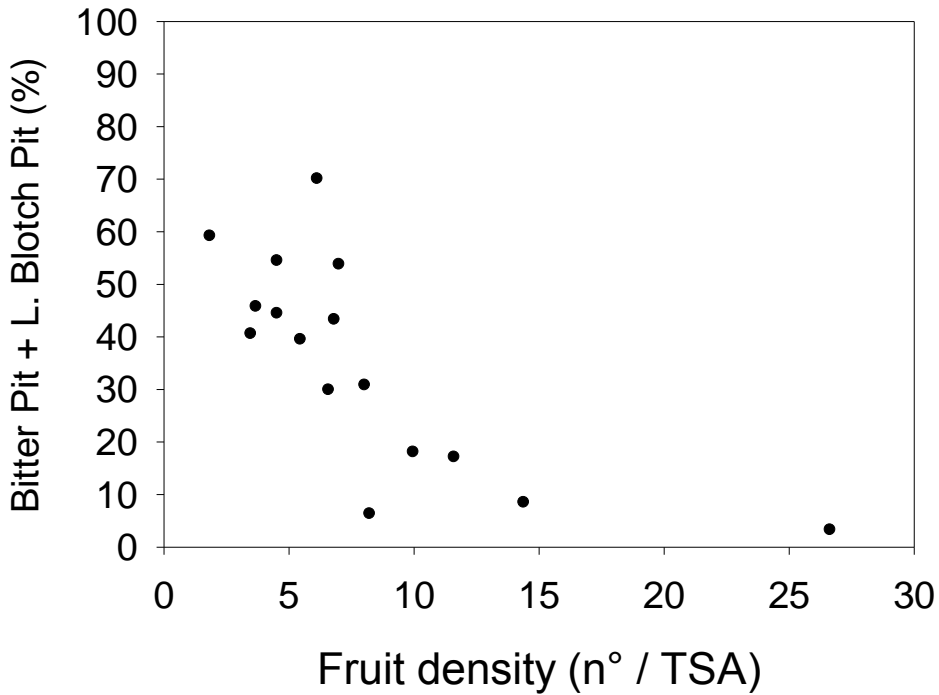


Old spur with small leaves,
multiple small growing, weak tissue.

Fruit Habit		Bitter pit (%)	
		Fruit size	
		Large	Small
Small branch with terminal fruit		6.5 a	0.0 a
		23.6 b	15.4 b
Spur		23.6 a	22.6 a
		19.5 a	3.2 b very small

Large fruit: 150-160 g; Small fruit: 120-140 g

[Braeburn]



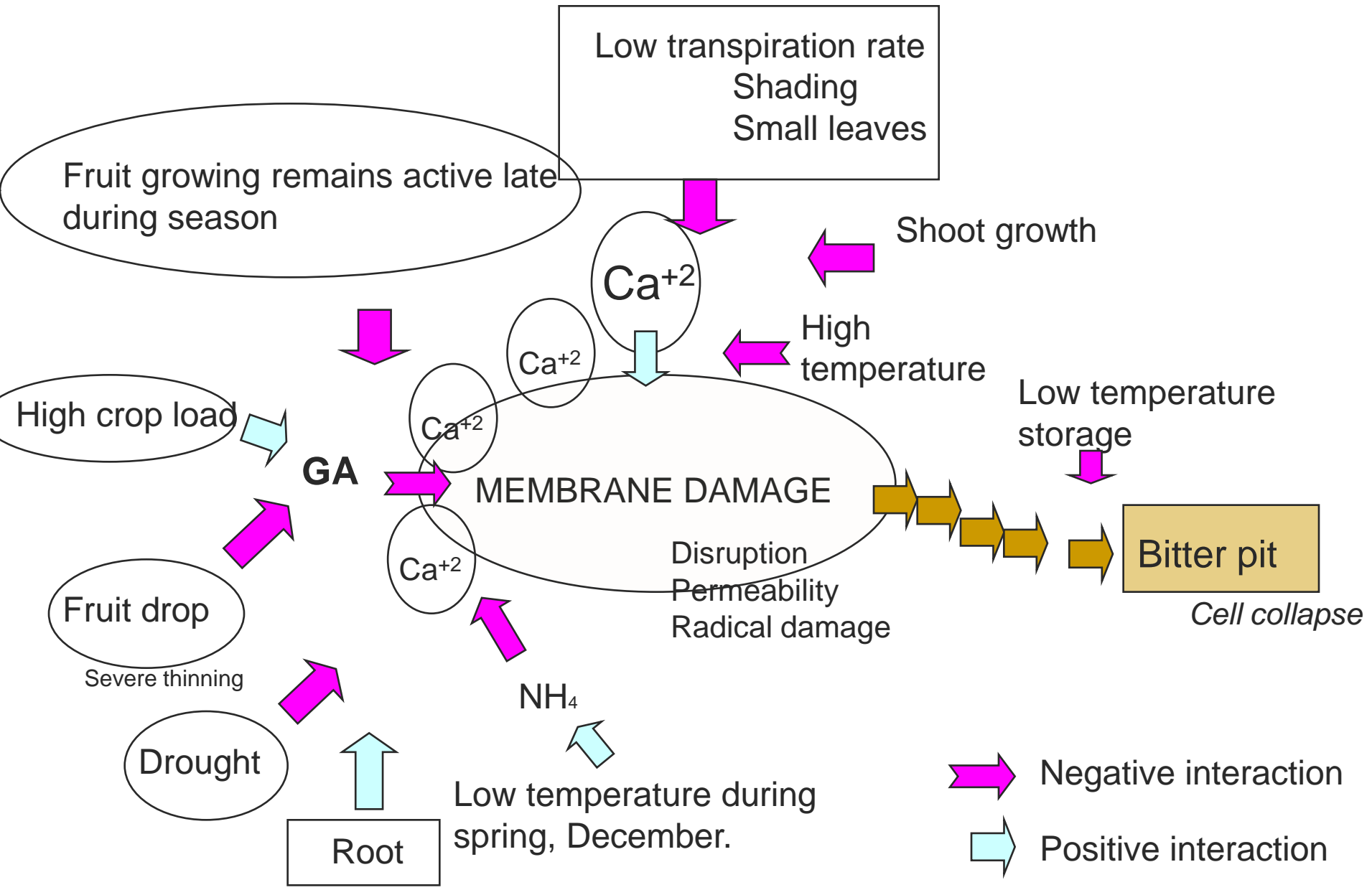
Bitter pit + Lenticel Blotch pit (%) after 3 months at 0°C.

Treatment	Flower Density			
	High		Low	
	Crop load			
	High	Low	High	Low
CONTROL	33.9 b	20.1 b	31.1 b	26.6 b
Calcium spray (every week)	6.7 a	7.7 a	14.5 b	27.1 b

Braeburn

	Thinning Intensity		
	1 fruit / uneven spur	1 fruit / spur	2 fruits / spur
Lenticel Blotch pit + Bitter pit	10.9 B	5.7 A	5.7 A
Weight / fruit (g)	204.9 A	187.6 B	178.9 C
Fruits / tree	214.5 A	414.6 B	603.4 C
Fruit / TSA (n / cm ²)	1.8 A	3.7 B	5.1 C

TSA: Transversal section area



[CONCLUSION]

- Incidence of Corking physiological disorders is variable among seasons and orchards.
- Integrated approach is recommend in order to increase calcium concentration in the fruit and counteract toxic compounds produced under adverse (stress) conditions.
 - Moderate pruning and focus to increase vigour in the productive zone, regulate fruit set, irrigation, nutrient sprays, harvest timing and segregate the fruit in term of disorder potential.

A photograph of a sunset over the ocean. The sun is a small, bright orange orb on the horizon, casting a long, thin, horizontal glow across the sky. The sky transitions from a pale blue at the top to a soft orange near the horizon. The ocean is a deep blue-grey, with white-capped waves breaking in the foreground. The beach is visible at the bottom of the frame, appearing as a dark, sandy strip.

Thank's you

**For the
Hospitality**