Foliar applications of Zinc and Potassium to increase yield by reducing fruit drop in Hamlin oranges

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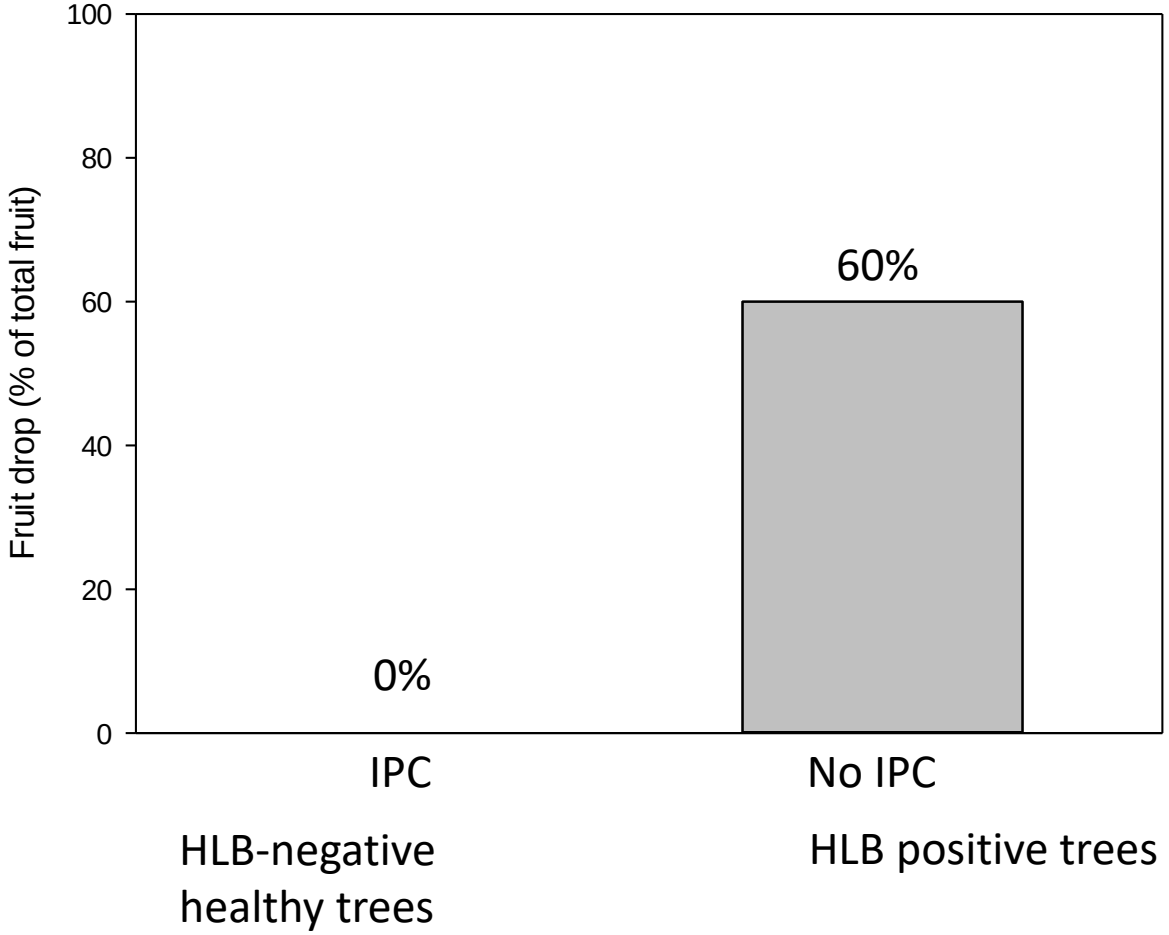
Fruit drop is a natural developmental process that may be influenced by other causes

FRUIT MATURATION

Increased **abscission** capacity

FRUIT DROP

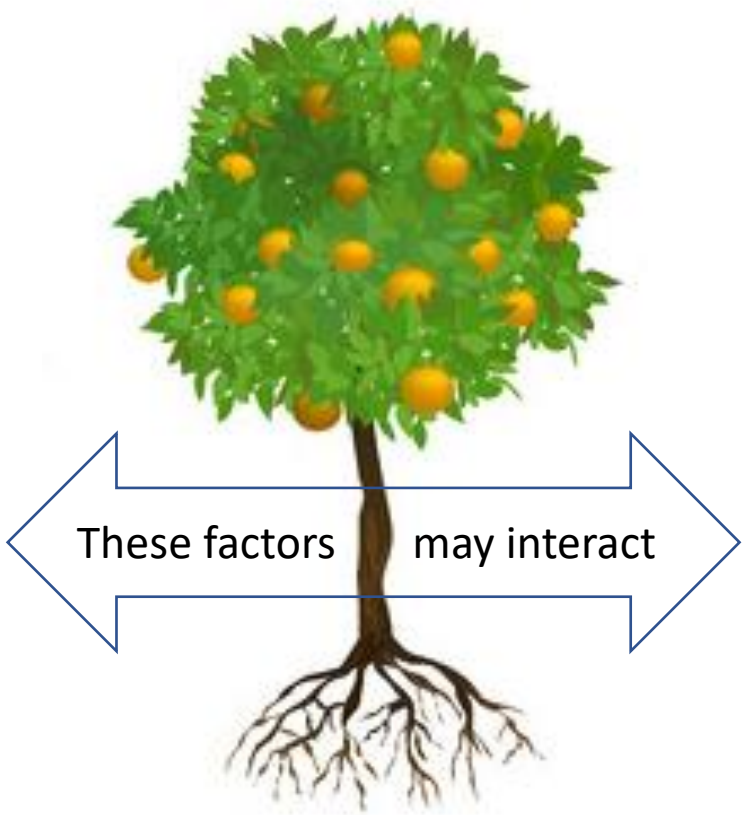
HLB is a major cause of increased preharvest fruit drop



Other possible causes?

Endogenous

- Loss of root density
- Altered hormonal balance
- Off blooms



Exogenous

- Other diseases
- Warmer and drier than normal weather

All related to HLB

March

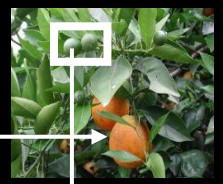
Late season
harvest
Dec-Jan

HAMLIN

Previous year's crop | Next year's crop

March

April-May



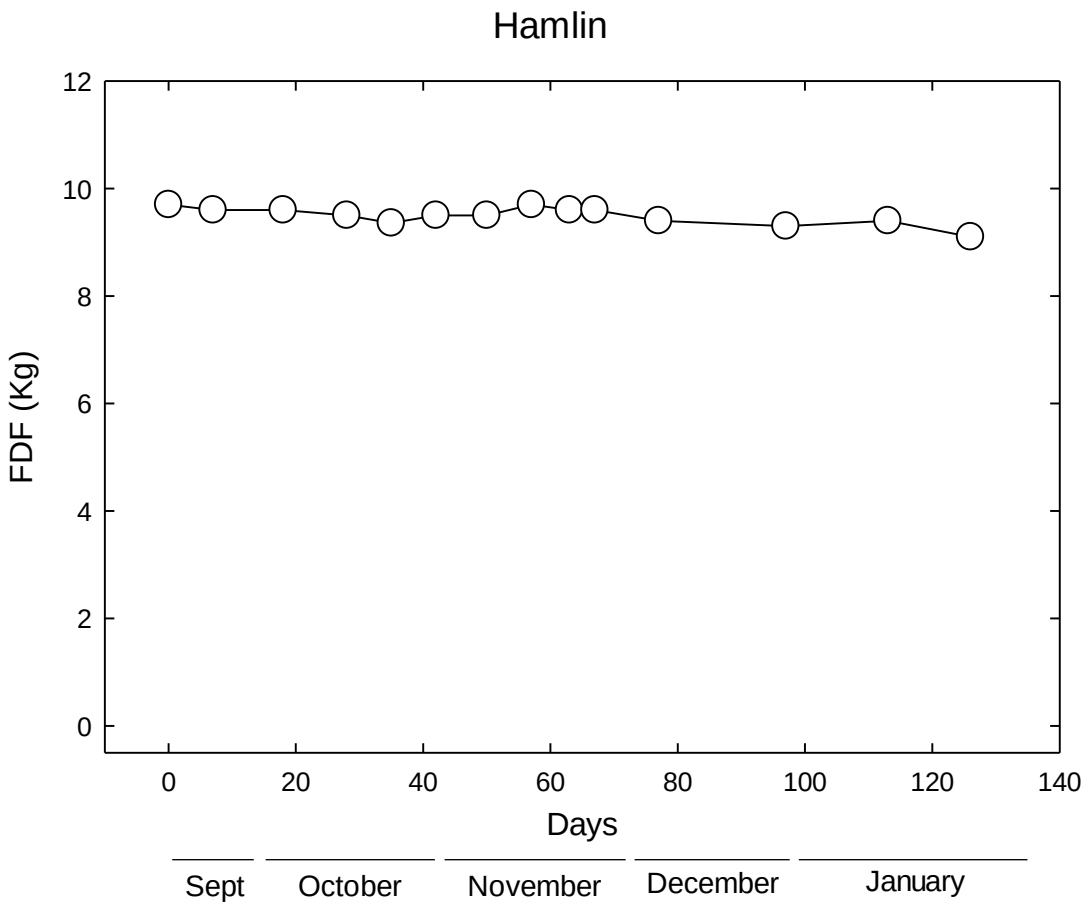
1 year for fruit development

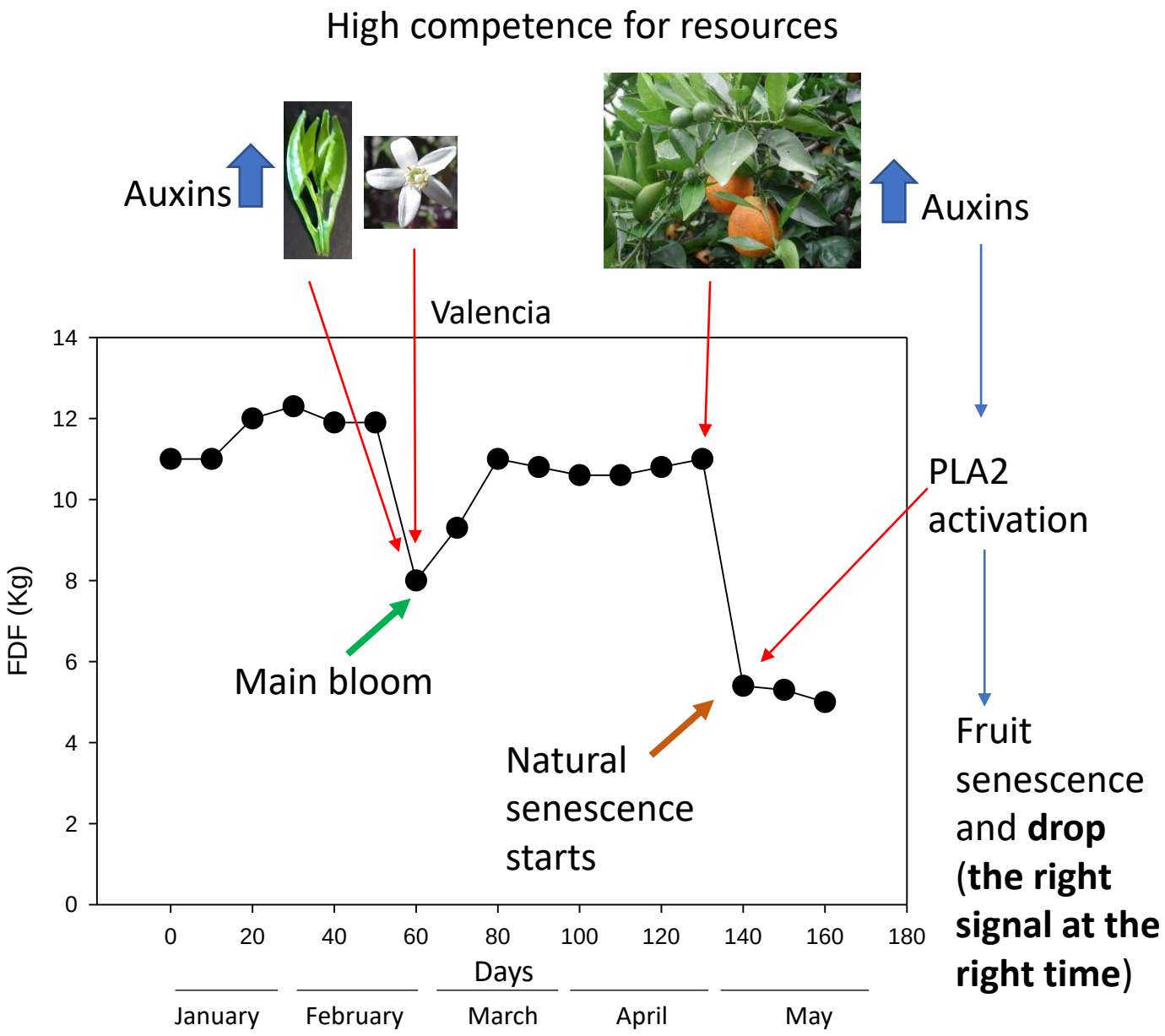
VALENCIA

Previous year's crop

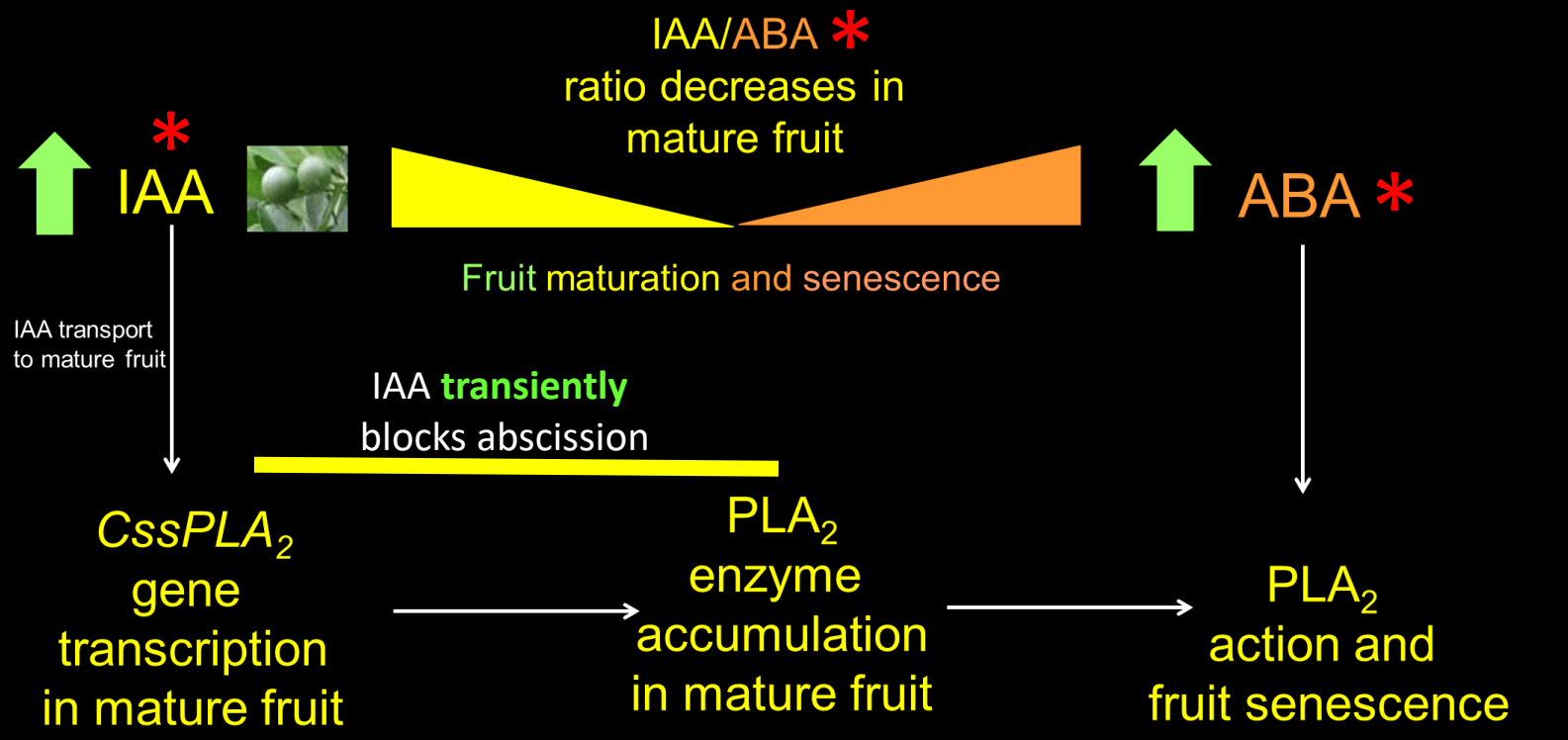
Next year's crop

Fruit retention in healthy Hamlin and Valencia trees





The situation in healthy Valencia

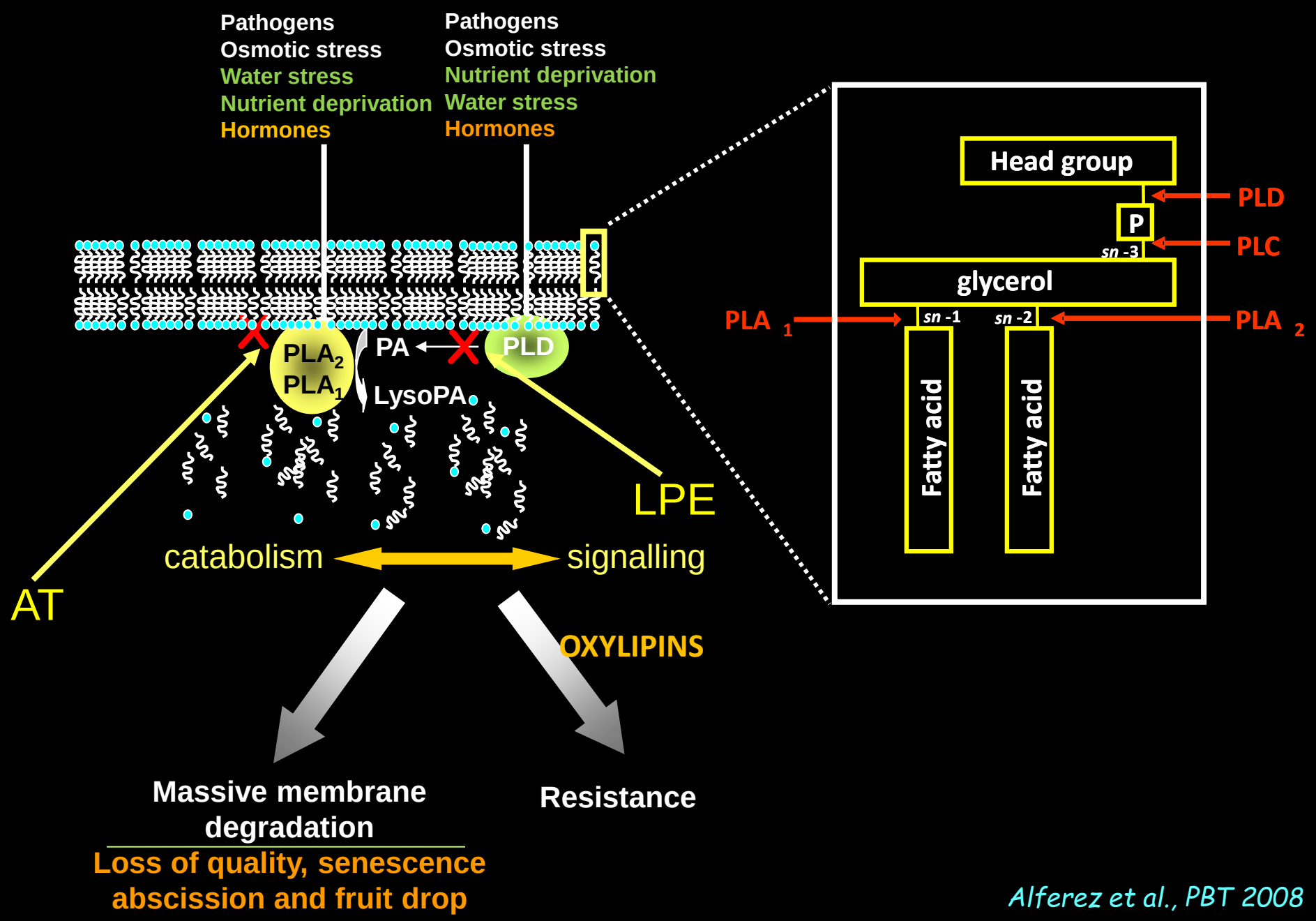


*possible signals

Abscission and fruit drop

Alferez and Burns, 2012

A hormonal switch triggers lipid signaling and abscission *via* phospholipid degradation.



Alferez et al., PBT 2008

The situation under HLB

Environmental stress

Spring flush

Summer flush

Off blooms

Fall flush

Fall-Winter harvest

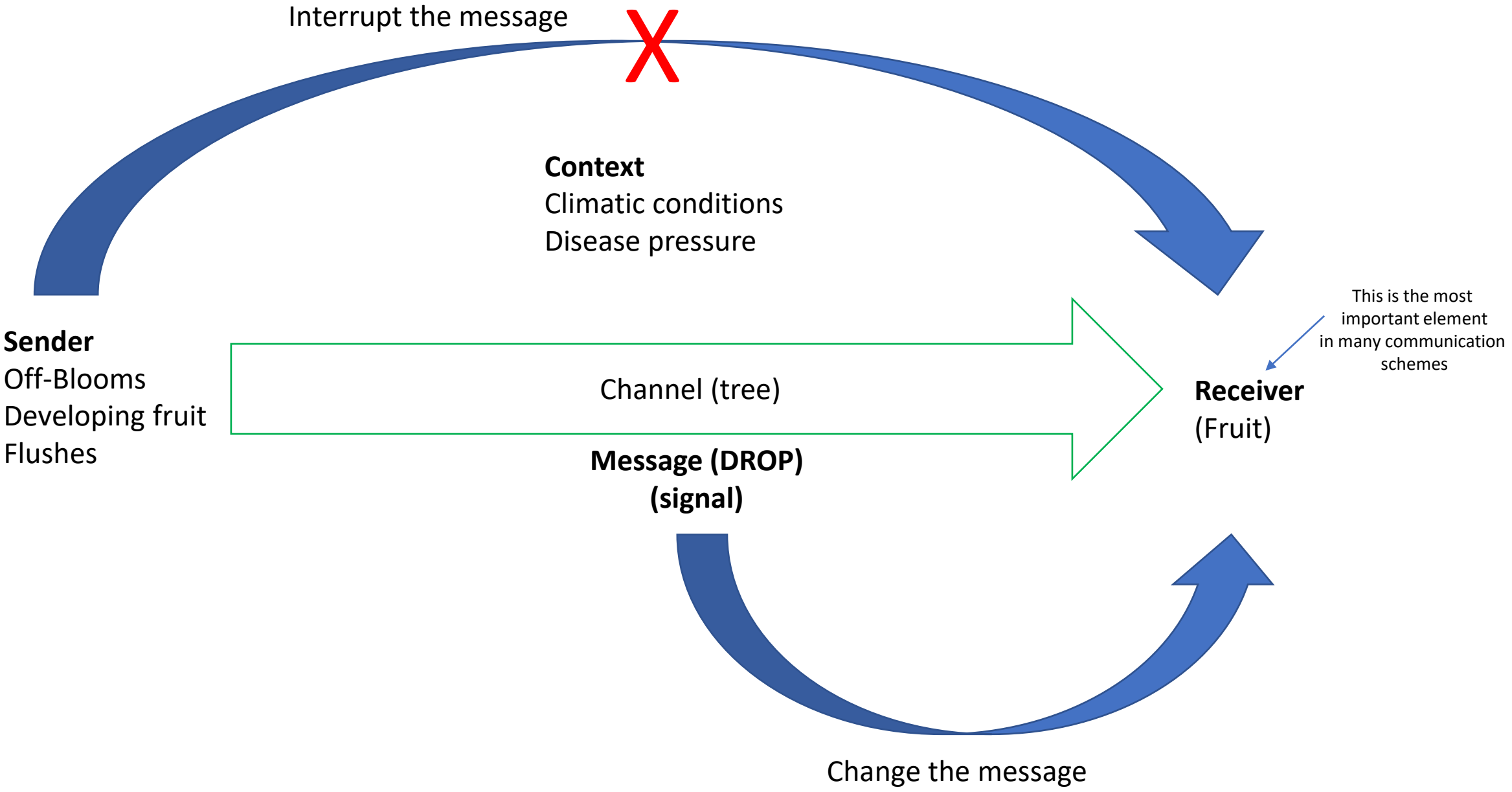
The wrong signal
at the wrong time

Massive preharvest fruit drop

HLB-infected Hamlin

Diversity of developmental stages affects hormonal interactions within the tree.

The wrong signal at the wrong time


Interrupt the message
Context
Climatic conditions
Disease pressure
Sender
Off-Blooms
Developing fruit
Flushes
Channel (tree)
Message (DROP)
(signal)
Receiver
(Fruit)
This is the most important element in many communication schemes
Change the message

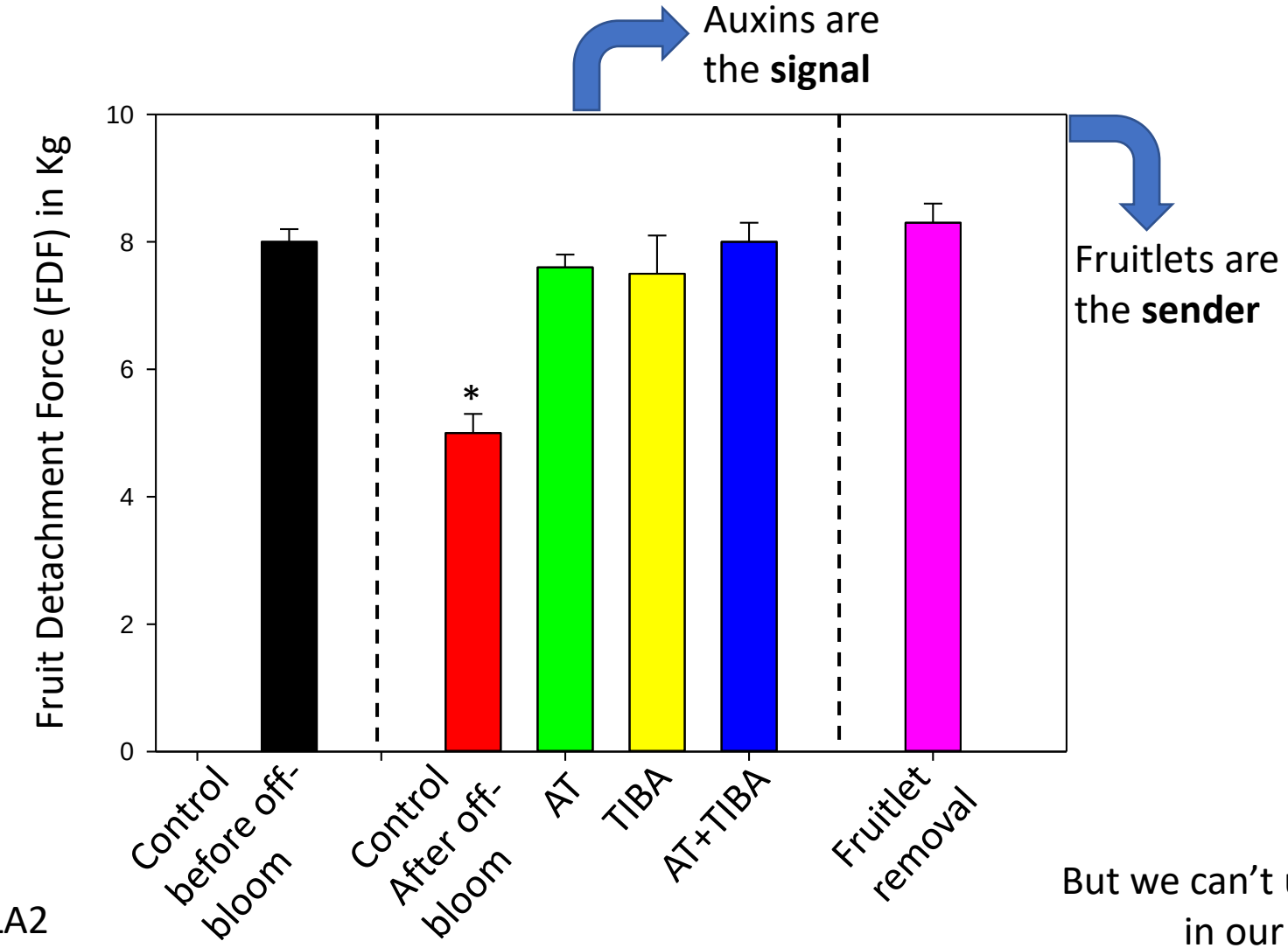
Interfering the message

Off bloom Fruitlets

Auxin

PLA2 induction

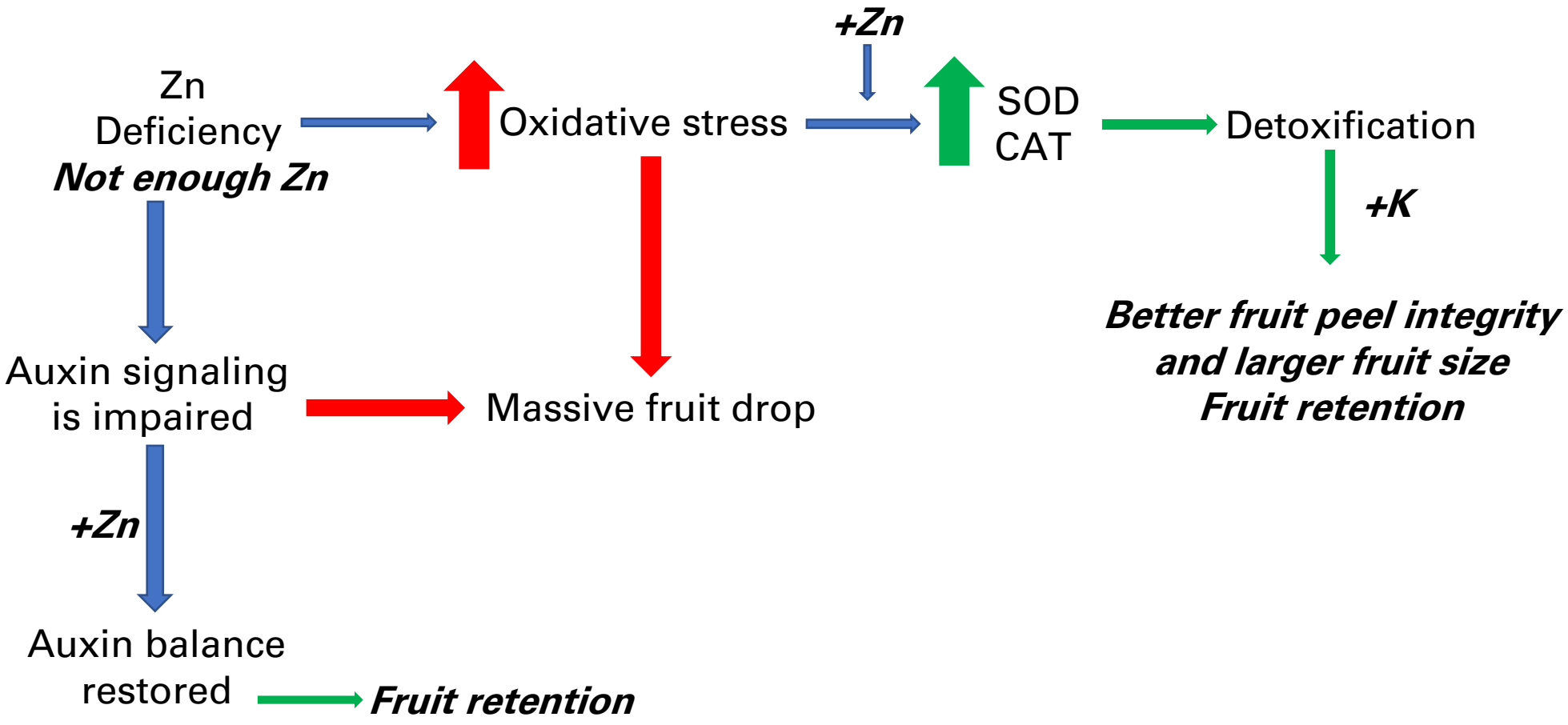
Mature fruit abscission



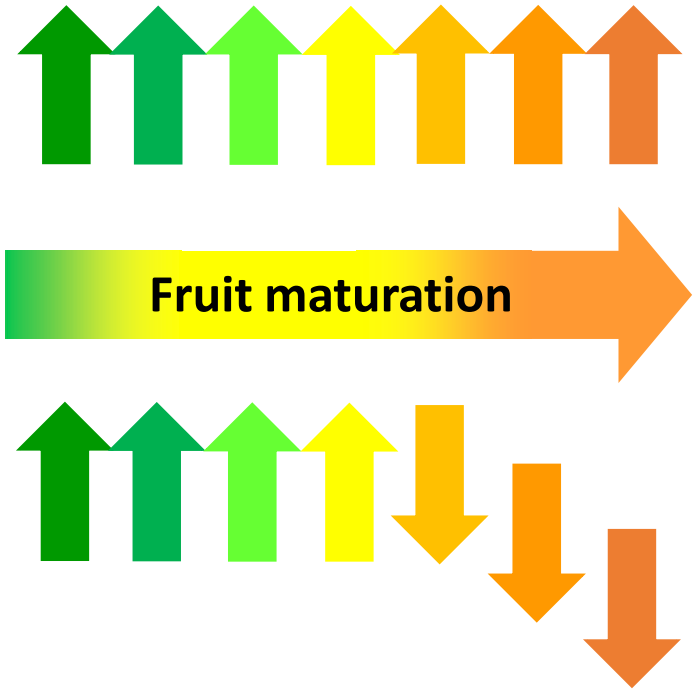
AT, competitive inhibitor of PLA2
TIBA, Auxin transport inhibitor

But we can't use AT or TIBA in our groves
What can we do?

Zn may modulate fruit physiology and retention.
K increases fruit quality



Our hypothesis: Auxin levels must be **maintained** high to avoid fruit abscission triggering and drop



Auxin levels **maintained** → No abscission/no fruit drop

Auxin levels transiently increase to **decrease** thereafter → Abscission/fruit drop

Zn and K treatment in Hamlin on US942

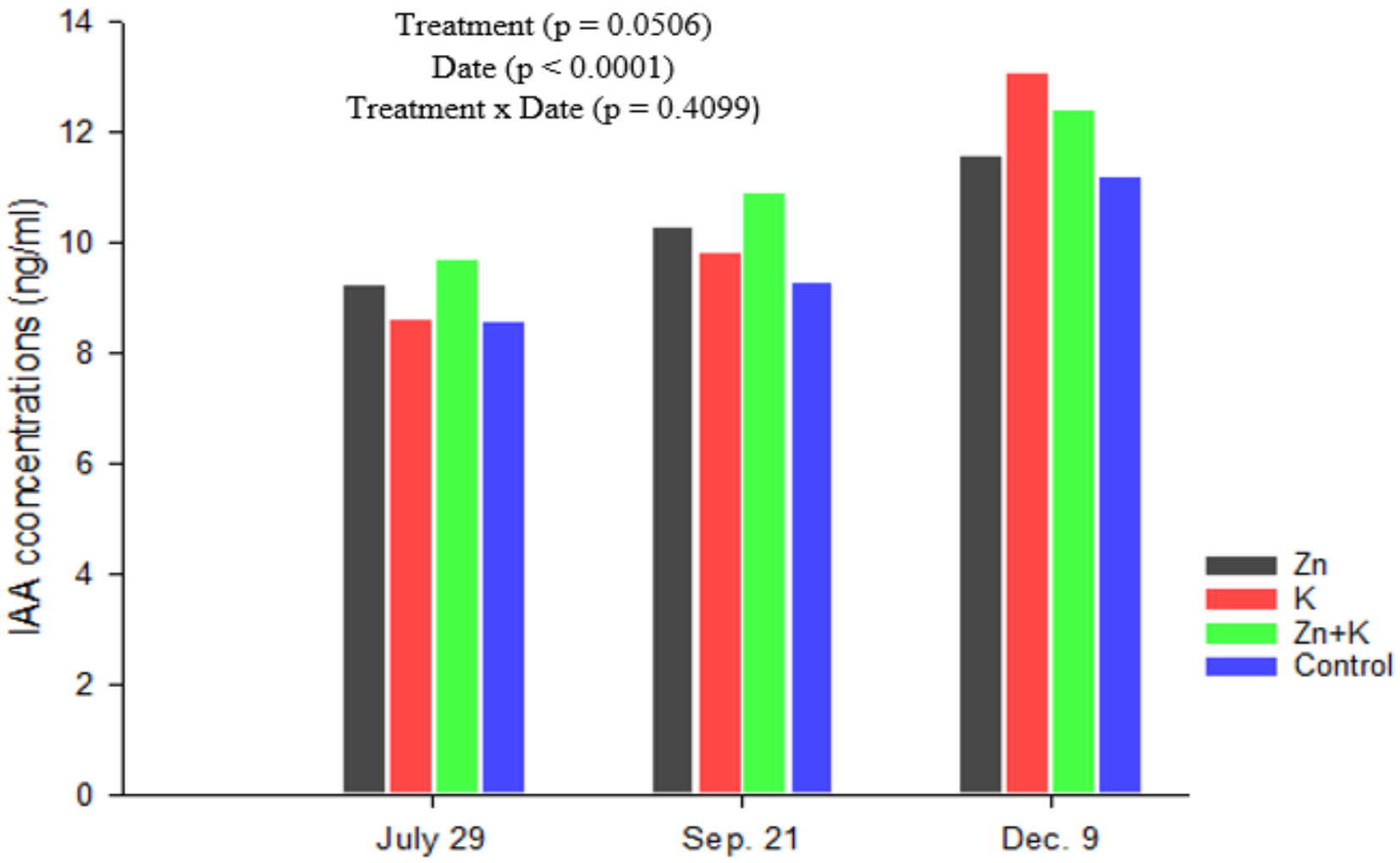
- $ZnSO_4$ (50 grams per tree, foliar spray)
- K_2SO_4 (60 grams per tree, foliar spray)
- ZN+K combined treatment

50 grams (0,11 pounds) / 1 gallon of water
218 trees/acre planted at 25x8 ft
24 pounds per acre

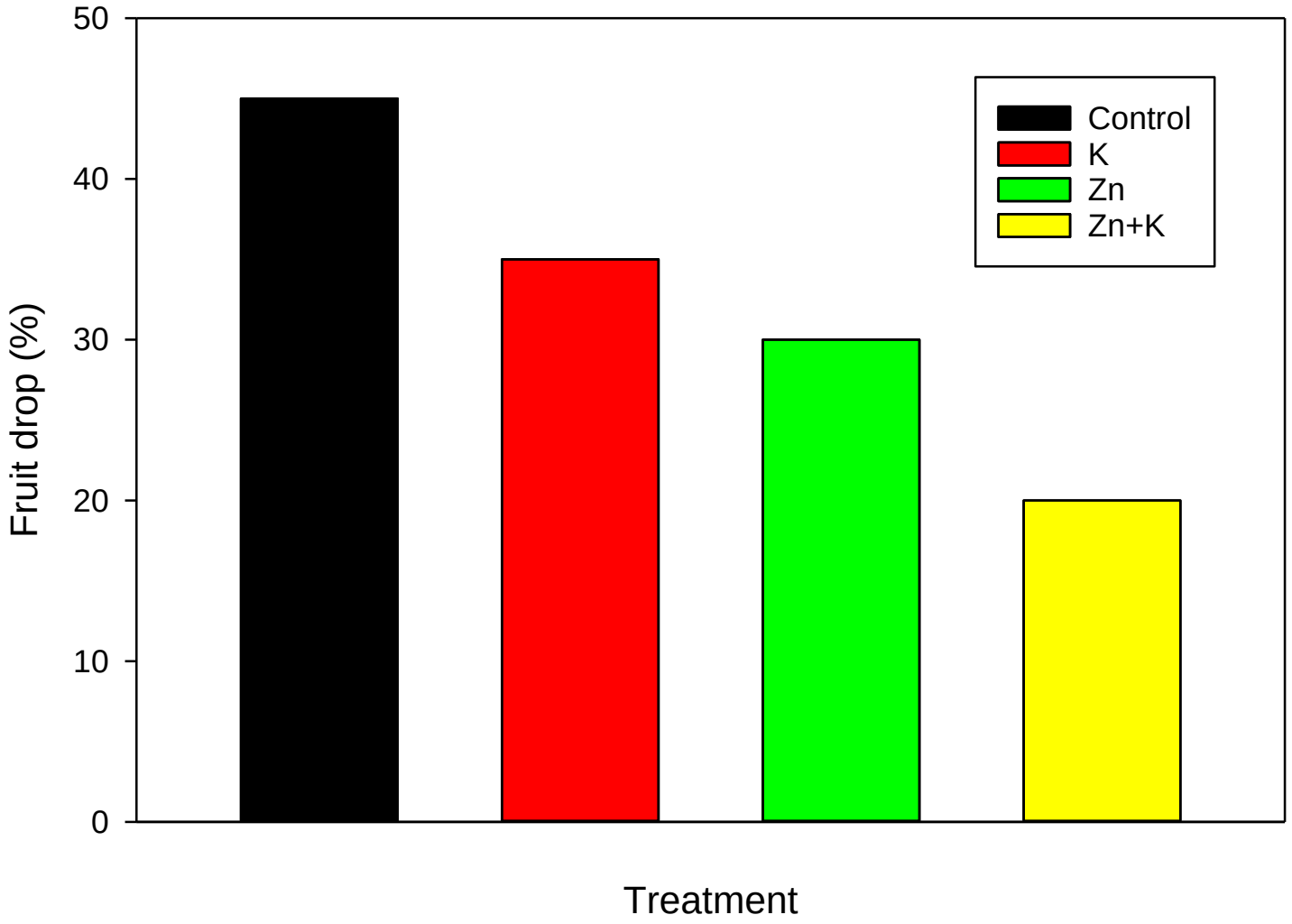
3 applications:

- After fruit set and physiological drop (early June)
- Fruit enlargement phase (July)
- Fruit color break (September)

Auxin levels are increased and maintained with treatments



Fruit drop reduction after 2 years of treatments

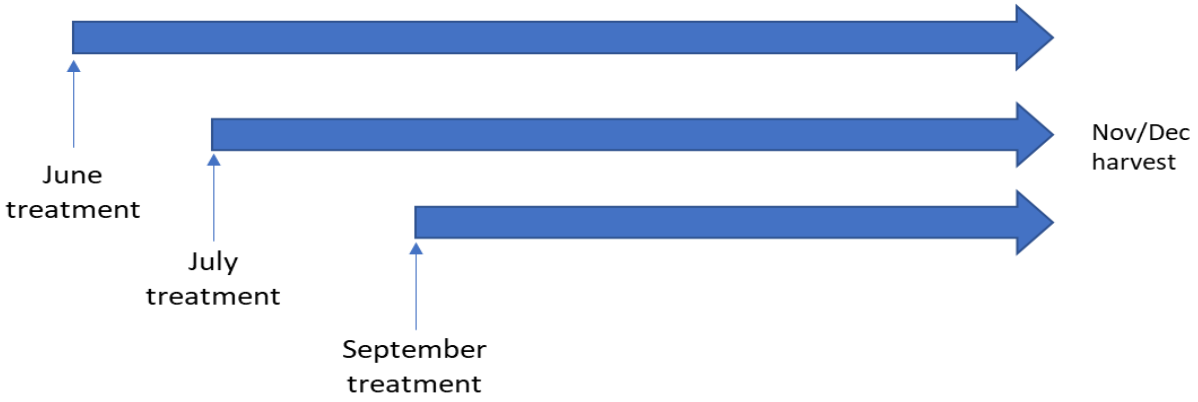


Yield

Boxes/acre				
	2020	% increase	2021	% increase
Control	197		200	
Zn	216	10%	**236**	**18%**
Zn+K	240	22%	**263**	**31%**

Conclusions and future work

- Zn and K combined increase yield in Hamlin by reducing fruit drop.
- These effects depend on the time of application.
- Independent treatments and harvests will help us to identify the best treatment dates and will likely increase yield beyond 31%



New Project #21-007