



# Physiological basis of summer fruitlet abscission in avocado

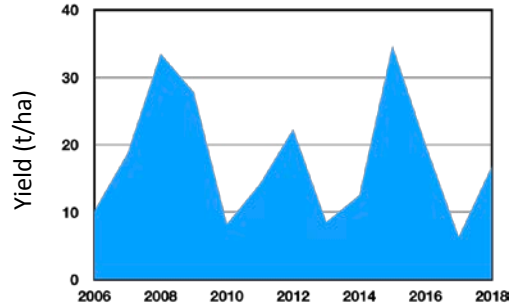
Harley Smith | Research Team Leader | Future Breeding | CSIRO Agriculture & Food

04 April 2023

**Hort  
Innovation**



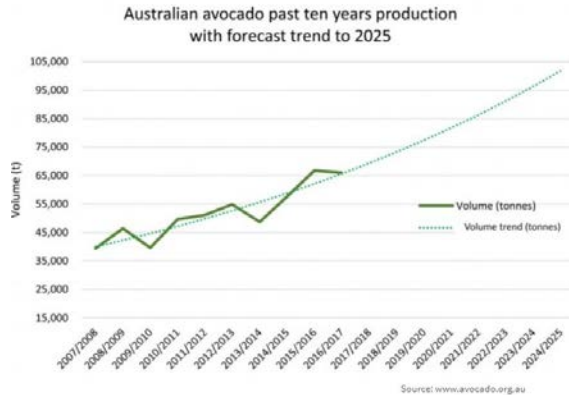
# Irregular Bearing is a significant challenge for avocado production in Australia



Flower Abscission (poor fruit set)

Fruitlet Abscission

Biennial Bearing



# What are the drivers of avocado flower and fruitlet abscission?

## Flower Abscission (poor fruit set)



## Fruitlet Abscission



### Summer Fruitlet Abscission

Up to 40% dry matter invested in fruits



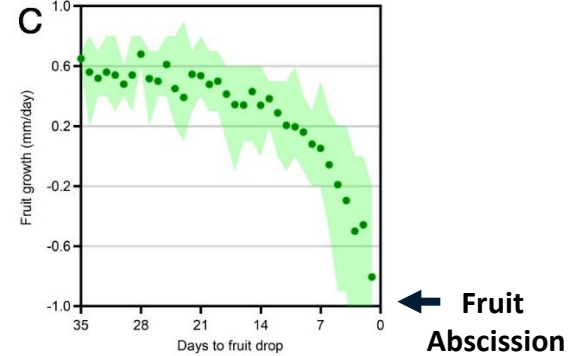
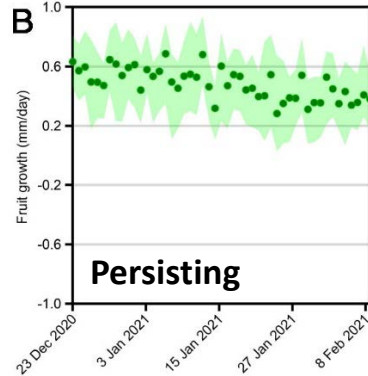
**Excessive flowering:** Depletes carbohydrate reserves in trees

**Vegetative bias:** Diverts carbohydrates away from flowers and fruitlets (dominance)

### Challenge Changing Climate:

High temperature & low humidity promote abscission

# Is there a change in growth associated with summer fruitlet abscission?



## Developmental Pathway of Summer Fruitlet Abscission

Fruitlet Growth Arrest → Seed Coat Senescence → Abscission

**Management: Target fruitlet growth arrest**



# How to manage summer fruitlet growth arrest?



Irrigation



Nutrition/Fertilization



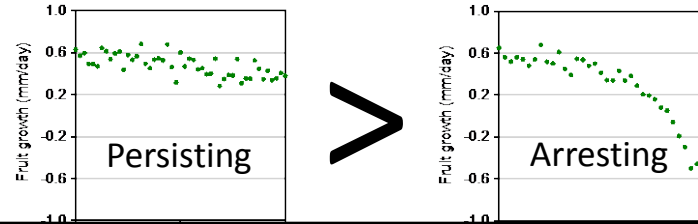
Plant Growth Regulators

# Is irrigation a viable method to manage summer fruitlet growth arrest?

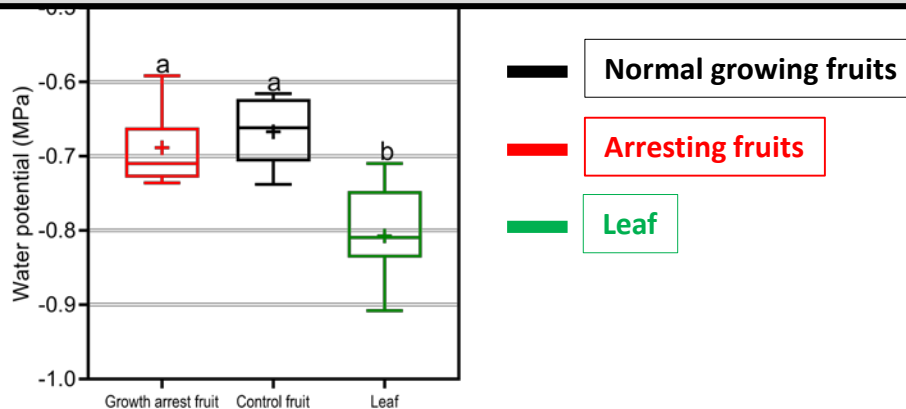
Irrigation



Hypothesis: Decrease in H<sub>2</sub>O Potential is a Driver of Growth Arrest



**Developing new irrigation systems may not be a viable pathway to mitigate summer fruitlet abscission**

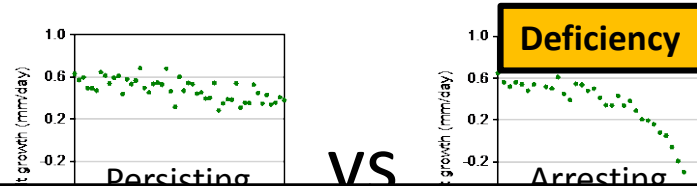


# Is nutrition/fertilization a viable method to manage fruitlet growth arrest?

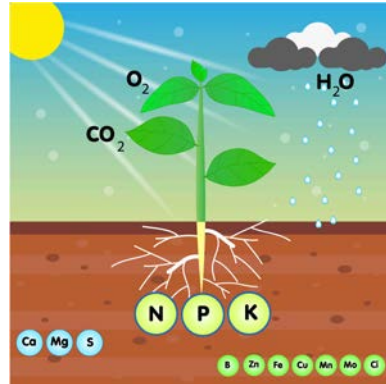
Nutrition/Fertilization



Hypothesis: Nutrient deficiency is a Driver of Growth Arrest



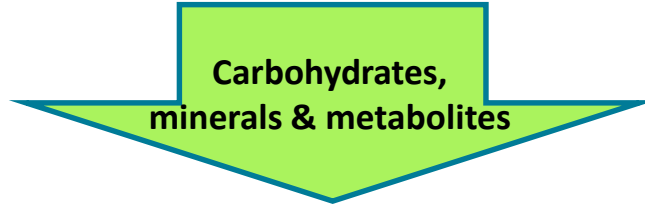
Developing new nutrition programs may not be a viable pathway to mitigate summer fruitlet abscission



Summer fruitlet abscission is not associated with a deficiency in a mineral element (s)

Is growth arrest associated with a change in carbon status of the fruit?

**Mother Plant**

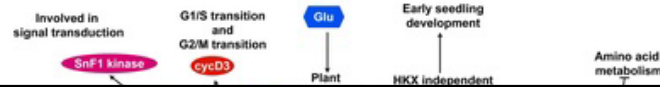


**Seed Coat**

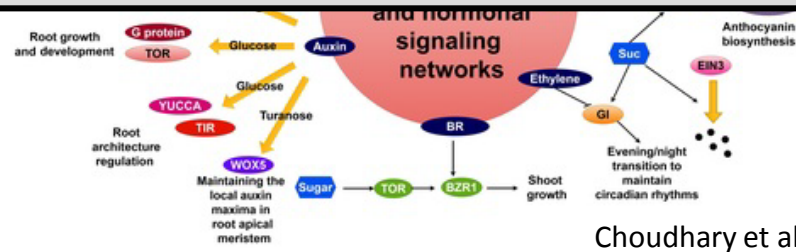
**Seed Coat**  
Depletion of soluble sugars and starch  
Activation of a carbohydrate starvation pathway



# Interaction between hormone and sugar signaling/metabolism regulates growth



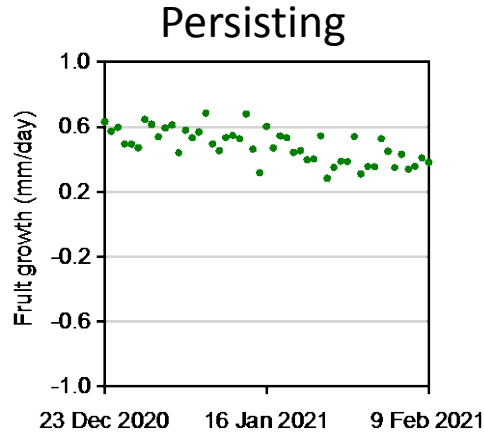
Understanding hormonal control of fruit growth arrest may be a viable pathway to develop a Plant Growth Regulator-based application to mitigate summer fruit drop



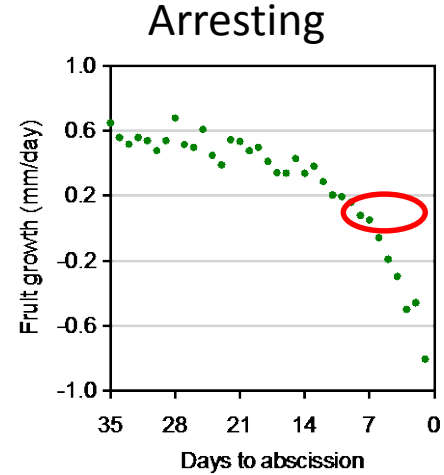
Choudhary et al., 2022

Investigated the hormonal control of fruitlet growth arrest

# Hormonal control of fruitlet growth arrest

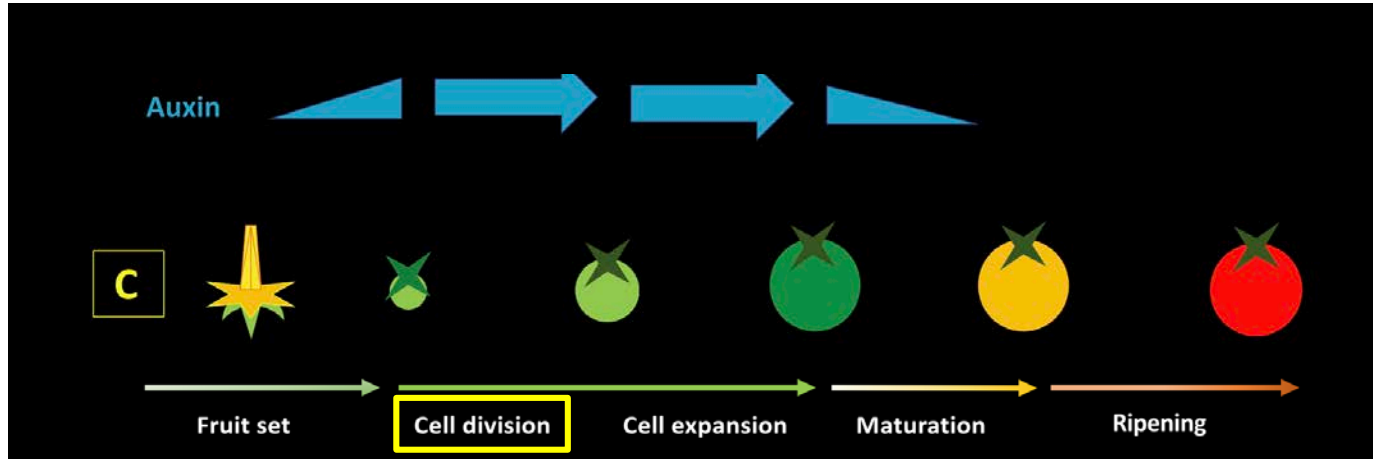


Auxin (IAA)  
Ethylene (ET)  
Abscisic Acid (ABA)  
Jasmonic Acid (JA)



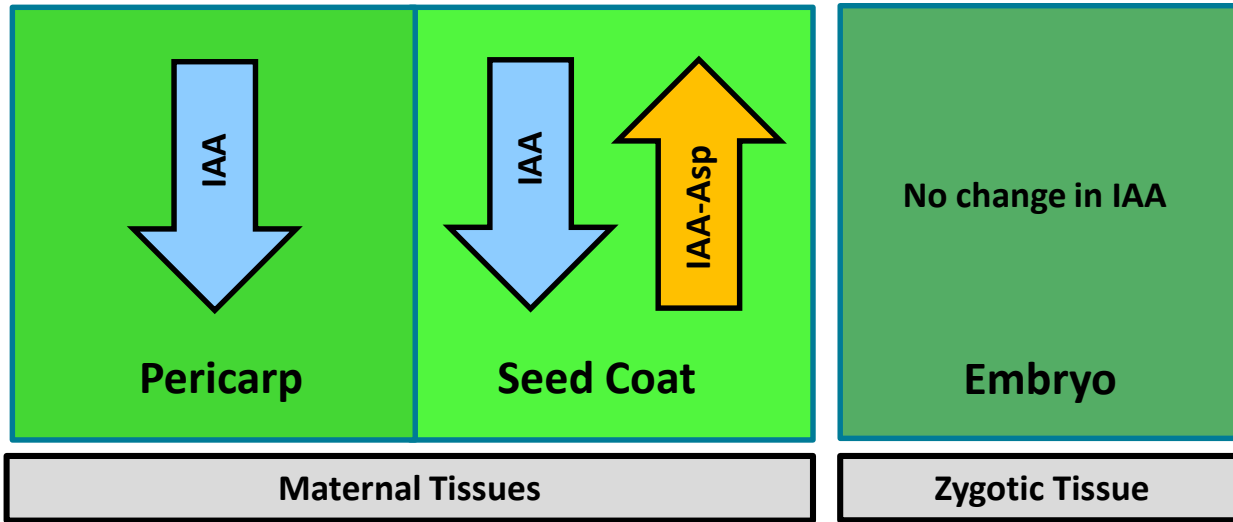
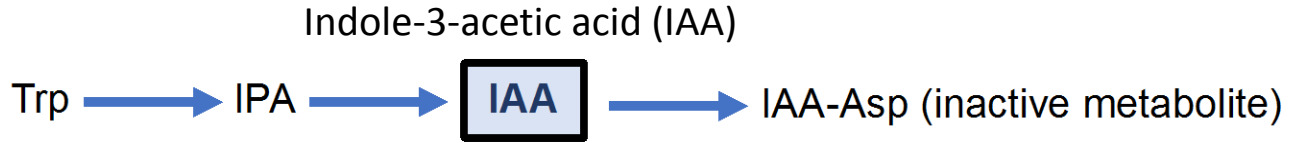
Compared hormone profile between persisting and arresting fruitlets  
(late stage of growth arrest)

# Auxin is a key hormone that regulates fruit growth and maturation



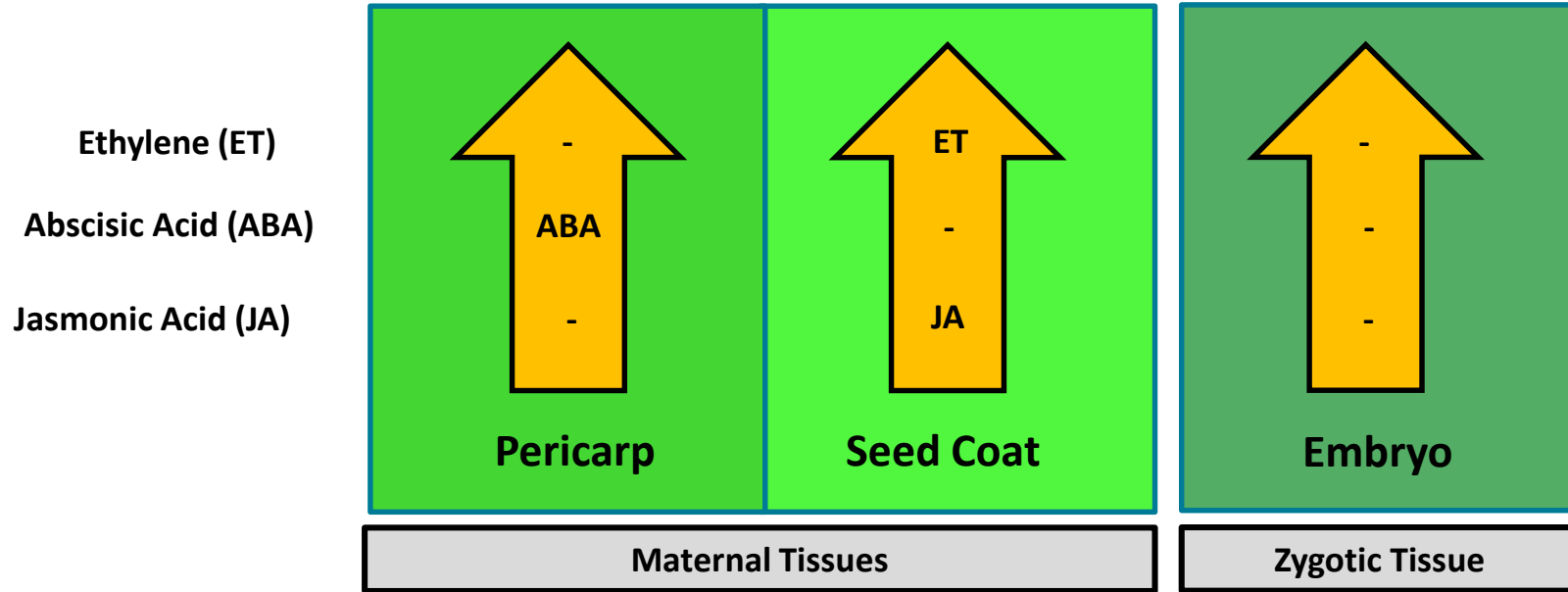
Fenn & Giovannoni, 2021

# A role for auxin in fruitlet growth arrest

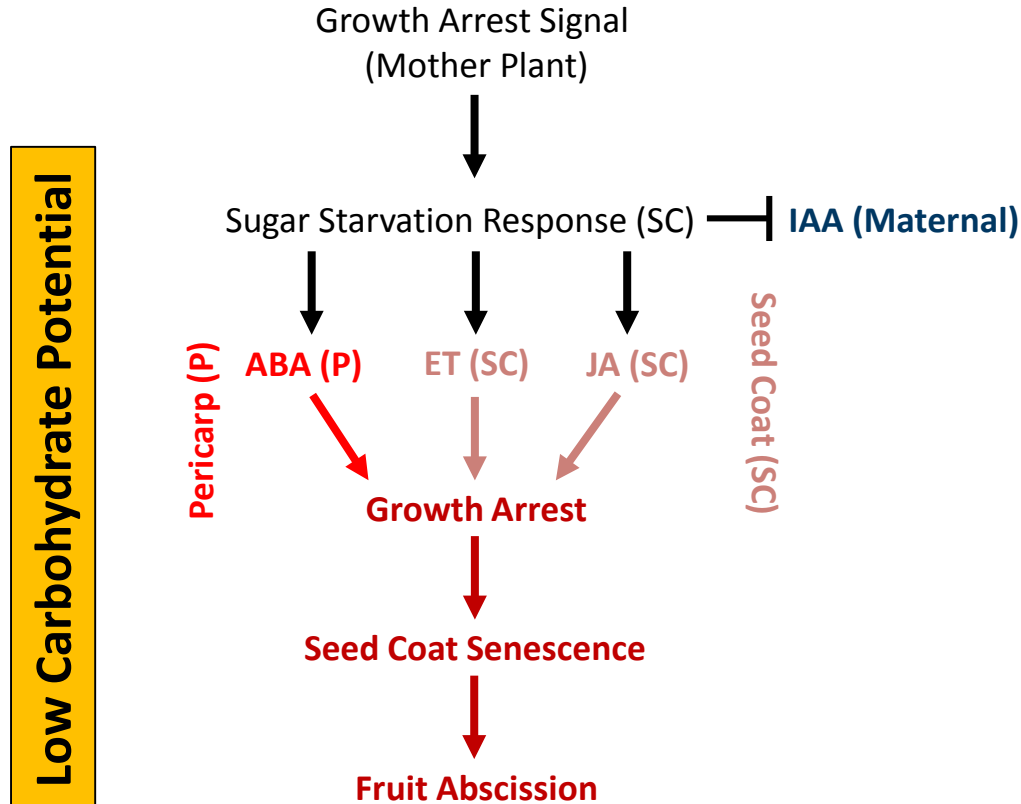


IAA production and conjugation in the maternal tissues is critical for fruit growth

# Evaluation of candidate hormones involved in the abscission of organs

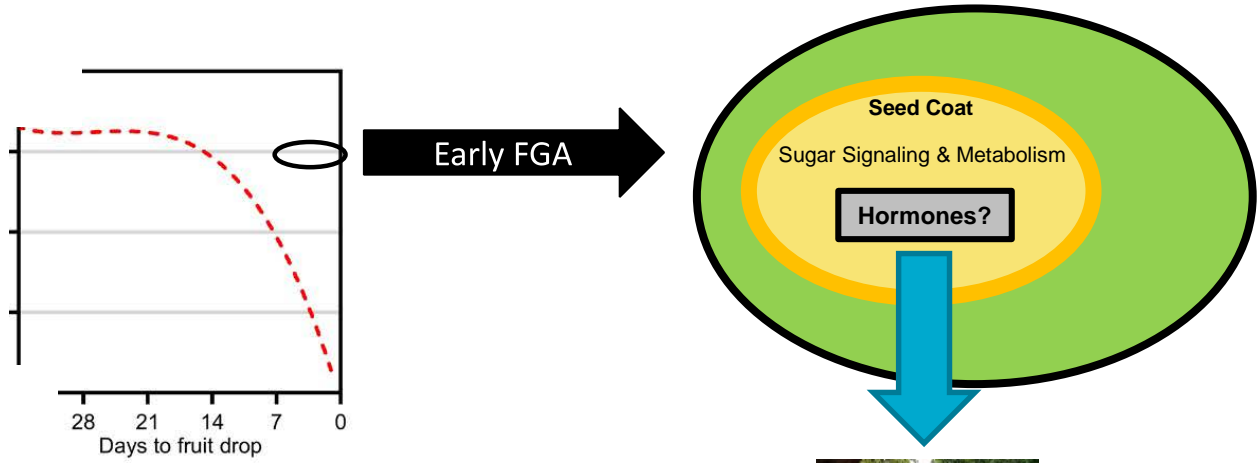


# Hormone signaling pathway for summer fruitlet abscission (late stage of growth arrest)

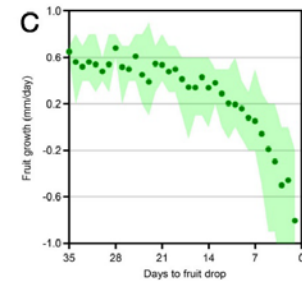
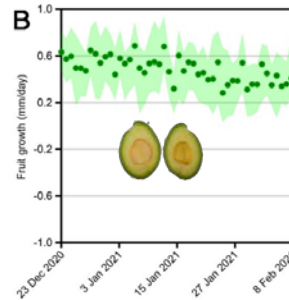




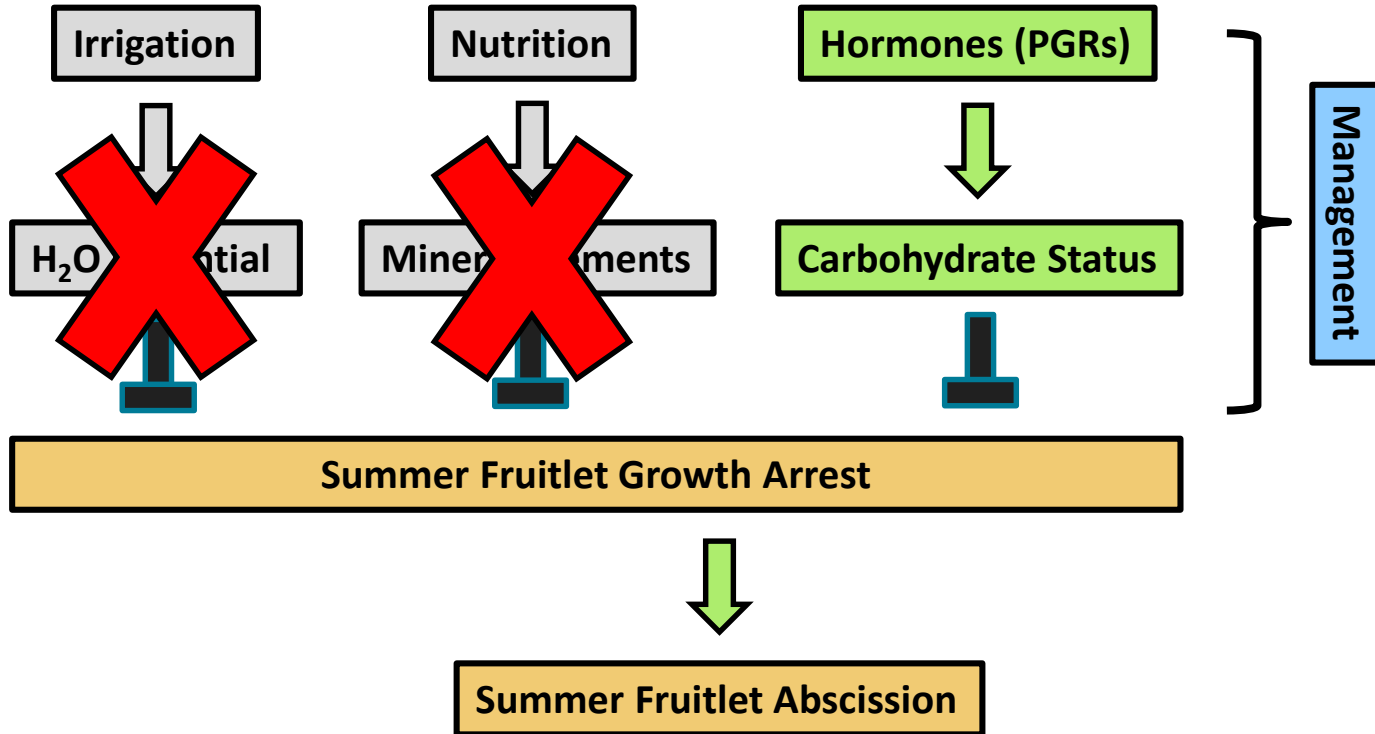
# What are the hormones associated with early fruitlet growth arrest?



Plant Growth Regulators



# Summary





Marc Goetz  
CSIRO



Christine Böttcher  
CSIRO

Sue Maffei  
CSIRO



Amnon Haberman  
QDAF



Jacinta Foley  
Jasper Farms



Declan McCauley  
DPIRD, WA



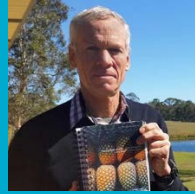
Sam Nixon  
Jasper Farms



Christine Beveridge  
UQ



Lindsay Shaw  
UQ



Simon Newett  
QDAF



Bridie Carr  
QDAF



Elizabeth Dann  
UQ/QAAFI

- ❖ Jasper Farms (WA)
- ❖ Delroy Orchards (WA)
- ❖ West Pemberton Avocados (WA)
- ❖ Thiel Orchards (SA)
- ❖ Costa Orchards (SA)



# Thank you

## CSIRO Agriculture & Food

Harley Smith

AV16005 Project Leader/Team Leader

+61 8 8273 8131

[Harley.smith@csiro.au](mailto:Harley.smith@csiro.au)

<https://people.csiro.au/S/H/Harley-Smith>

Australia's National Science Agency

# Hort Innovation





Marc Goetz  
CSIRO



Christine Böttcher  
CSIRO

Sue Maffei  
CSIRO



Amnon Haberman  
QDAF



Jacinta Foley  
Jasper Farms



Declan McCauley  
DPIRD, WA



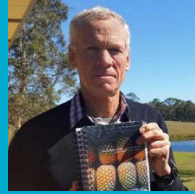
Sam Nixon  
Jasper Farms



Christine Beveridge  
UQ



Lindsay Shaw  
UQ



Simon Newett  
QDAF



Bridie Carr  
QDAF



Elizabeth Dann  
UQ/QAAFI

- ❖ Jasper Farms (WA)
- ❖ Delroy Orchards (WA)
- ❖ West Pemberton Avocados (WA)
- ❖ Thiel Orchards (SA)
- ❖ Costa Orchards (SA)



# Thank you

## CSIRO Agriculture & Food

Harley Smith

AV16005 Project Leader/Team Leader

+61 8 8273 8131

[Harley.smith@csiro.au](mailto:Harley.smith@csiro.au)

<https://people.csiro.au/S/H/Harley-Smith>

Australia's National Science Agency

# Hort Innovation

