# Citrus Flowering and Fruit Set Recommendations for 2022


- Paul Cronje
  - paulcronje@sun.ac.za
- Citriculture - CRI
- June 2022


citrus research international

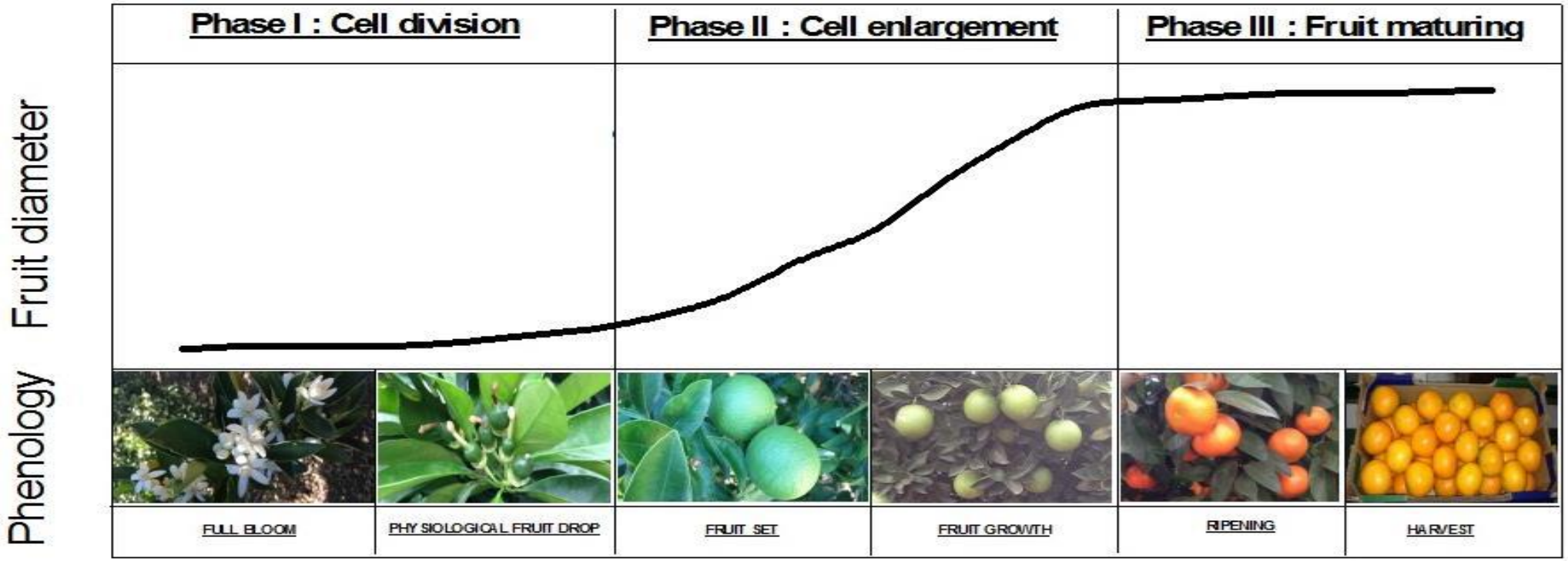
# Why do you need to ***constantly*** think about crop manipulation?

- But profitable citrus farming = **distil** all information to **solve two equations**:
  - **EXPORT CARTONS *per* HECTAR**
    - High volume in the ideal window
    - Fruit as per market requirements
  - **RAND *per* CARTON**
    - Blemish free, good colour and size
    - Without any decay or defect


- Crop manipulation will **directly** influence these equations
- **But how do you decide on what crop manipulation actions?**

# How do you decide on what crop manipulation actions to apply when?

- 1st principle: Know your orchard, tree and fruit phenology
  - Before acting, know what is happening when in the orchard, tree and fruit, and what you want to see happen
    - Root - Shoot flush – Flowering – Set - fruit growth I/II/III

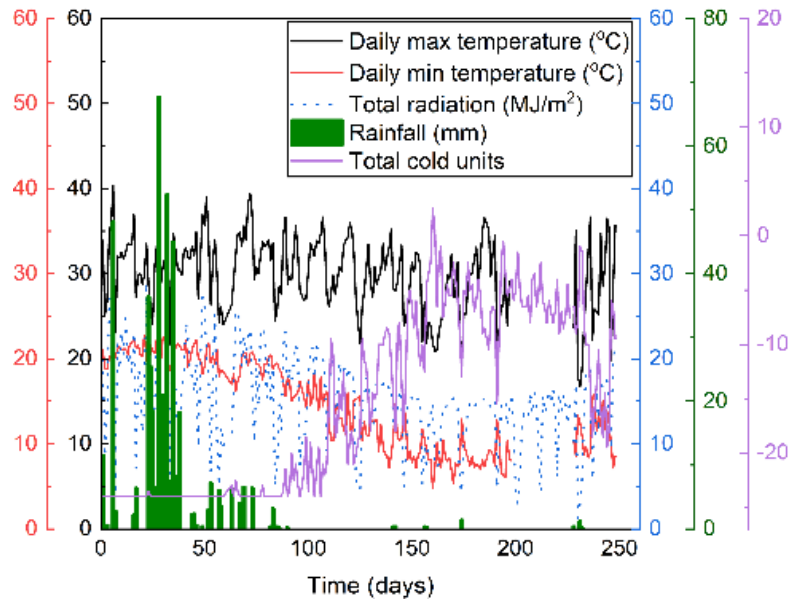


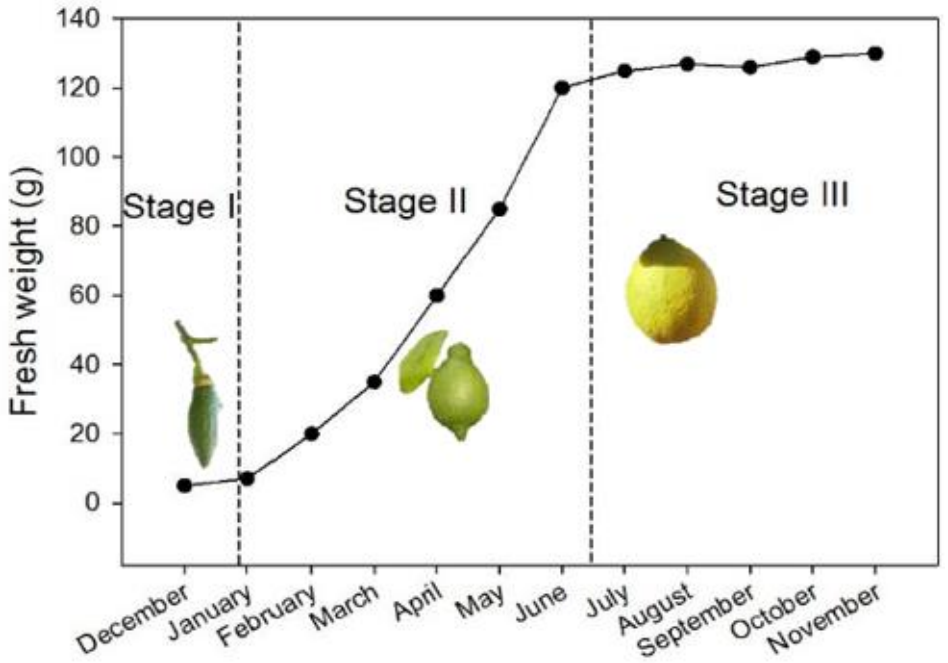

citrus research international

# How do you decide on what crop manipulation actions to apply when?

- 2st principle: Measure and analyze
  - The environment
  - Tree and fruit response

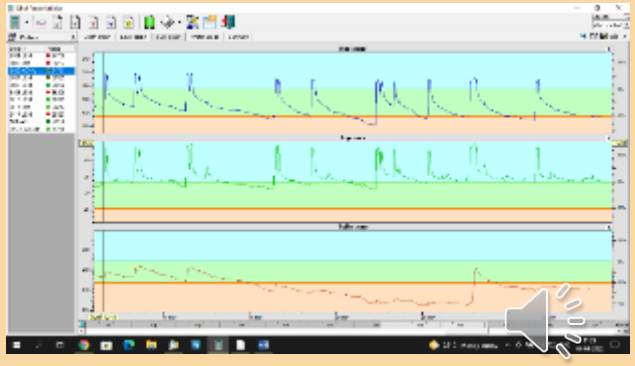
- Develop **own database** on conditions and responses for each crops manipulation technique



# Options for crop manipulation

| Direct influencers of Carton/ha, R/Carton | Preharvest | At harvest | Quantification of action/ effect |
|---|---|---|---|
| **Fruit size** | **<u>Long term</u>**<br>• Rootstock/Scion<br>• Site/Area<br>• Shade netting<br>**<u>In season</u>**<br>• Thinning (PGR's/Hand)<br>• Nutrition<br>• Irrigation | • Packline sorting | • Hand measurements<br>• Packline grading |
| **Rind colour** | **<u>Long term:</u>**<br>• Rootstock/Scion<br>• Site/Area<br>• Shade netting<br>**<u>In season</u>**: Delay harvest | • Degreening | • Packline grading<br>• None preharvest |
| **Kg/Tree** | **<u>Long term</u>**<br>• Rootstock/Scion<br>• Site/Area<br>• Shade netting<br>**<u>In season</u>**<br>• Fruit set (GA3)<br>• Thinning (PGR's/Hand)<br>• Nutrition<br>• Irrigation | • Packline sorting | • Hand recordings<br>• Leaf norms<br>• Soil water<br>• New scanning tech.? |



# Aim is to optimize your export cartons: What affects fruit set and drop?

- Fruit drop- **self thinning mechanism** that adapts fruit number
- Climatic regions and season influence severity
- Seedless: Cool area, extended fruit drop
- Warmer area (peak in weeks 1-6 a.f.b.)
- GA3 (postpones further) - effect on fruit size
- **Post flower drop (90% of flowers)**
  - Insufficient pollination, water and temp. stress, low N levels
- **November/December drop ("June drop") or "physiological" fruit drop**
  - Large impact on yield for producers even only ± 10% of flowers drop
  - Competition for carbohydrates, N, water and hormones
  - High temperatures, water/plant stress = high abscission
  - Normally little or no fruit drop after this (most cultivars)

citrus research international

# Factors affecting fruit set

**Floral intensity/quality-leafy vs. leafless**

- leafy set 4-6 times more fruit than leafless

**Climate**

- High temperatures (>40°C), heat waves during set, low humidity, high VPD, water stress - low set (Navels, Clementines)
- Fast growing fruit - high set potential
- Cooler - better set, smaller fruit, more creasing

**Water stress: irrigation**

- Amount and frequency, soil type, time of year,
- Tree size (age): water requirement higher for bigger trees

**Optimal N-levels (navels)**

- <1.9 (deficient), 2.4-2.6% (optimal), >2.8 (excess)
- Regulate water loss through stomata, dehydration

**Too strong shoot vigour**

- Cause competition for nutrients with fruit (high sink strength)
- Reduce by uniconazole application (anti gibberellic acid)

# Fruit set strategy *i.e., keep required fruitlets on tree* - Improve blossom quality

**a) Pruning**

- Winter (more severe when on-year is expected),
- Increase inflorescence leafiness, not too late

**b) Pre-blossom Urea (too cold for soil-applied)**

- Uniform flowering and set
- High leaf N (2.8-3%) enhance set, increase the proportion of leafy inflorescences

# Fruit set strategy - Gibberellic acid ($GA_3$)

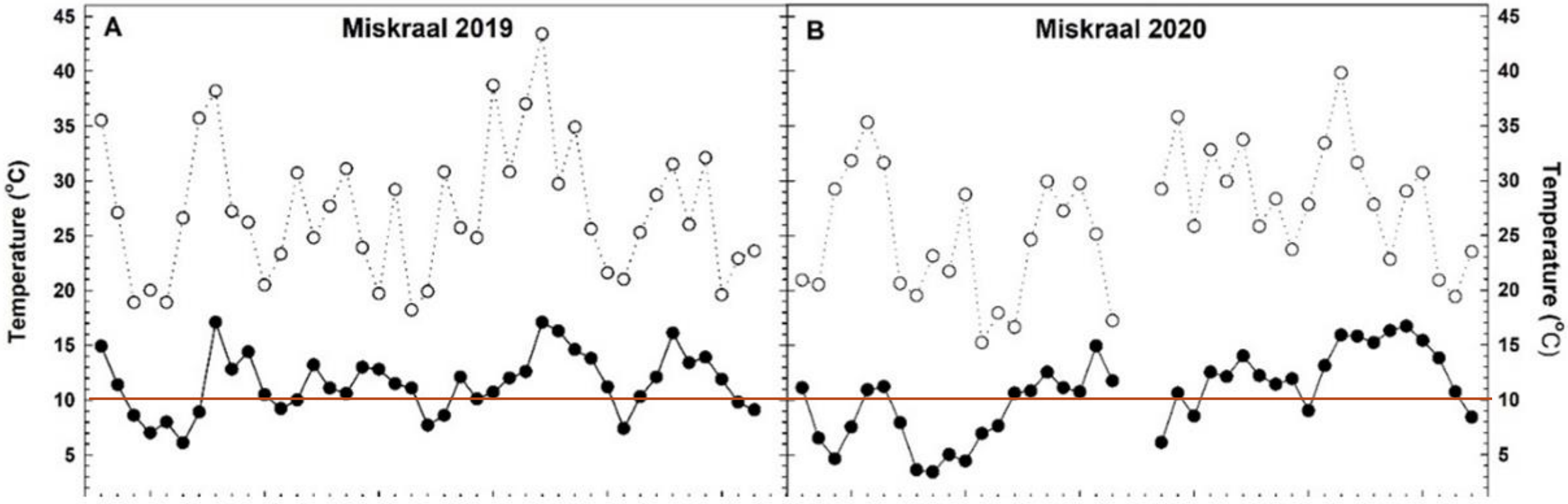
## Weak parthenocarpic cultivars – e.g. Clementines need GA3

- FB to 100% petal drop, 5-10 ppm, 1 or 2 sprays
- Early - higher set; later - less effective
- No stress, coverage, spray penetration, need to cover the fruit
- Do not apply >25-26°C
- Timing, concentration, no. of sprays:
  - Blossom quality, intensity: leafy, low number - spray earlier at higher conc.
  - very low number and extended - 2 sprays at lower conc.
  - Tree age, young trees - yes
  - Climate: cooler - lower conc. - E Cape and cooler areas - 7.5 ppm
  - Higher conc. in hot areas - Navel and Valencia, Star Ruby - 10 ppm, 100 %PD, hotter areas
  - N, previous crop - low flower due to AB = higher concentration
  - low N, low flower number, previous crop heavy - earlier spray, higher conc.

# Shoot dieback on Cara Cara, Cambria navels 2020 SRV


citrus research international

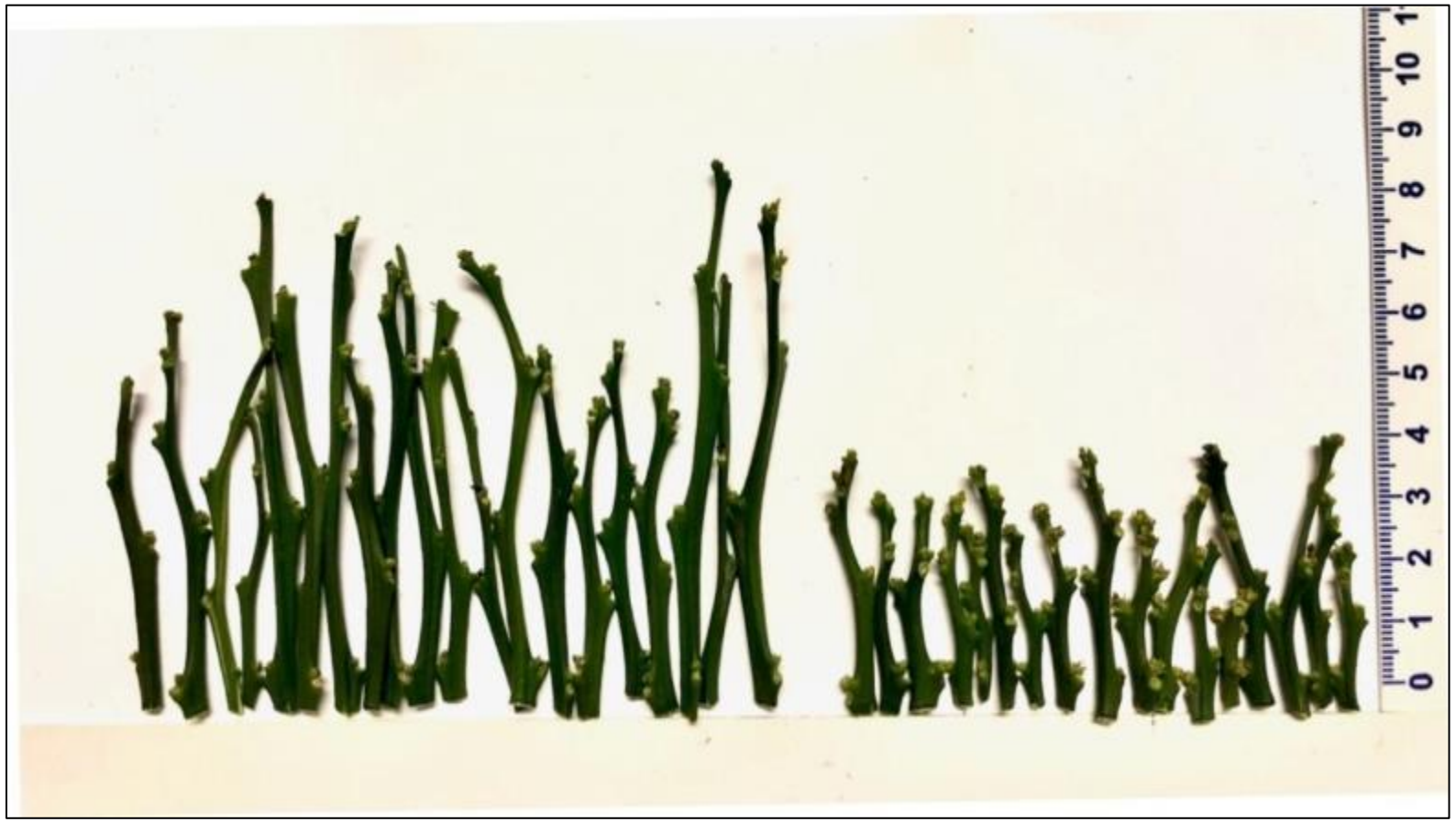
# Example of too low temperatures to apply GA3



# Key recommendations
# (from review and GA3 product labels)

- Sensitivity to $GA_3$ application and phytotoxicity are different between navel **cultivars and is influenced by rootstock**.
- Record any incidence of shoot dieback– *record exact* ***weather conditions when spraying***.
- Strictly follow the instructions on the label as to **rate, volume, timing, and mixing** of chemicals with $GA_3$.
- Use the recommended **adjuvant** for the product.
- Only apply **mineral oil a minimum** of 14 days before and 5 - 10 days after $GA_3$ application.
- Do not apply $GA_3$ to trees under **visible stress of** any kind e.g., low vigour trees and/or stress (pest, nutritional, or water), increased dieback severity
- The pH of $GA_3$ tank-mix not be higher than 7, and ideally between **pH 5.5 to 6.5**.
- Do not apply **copper fungicides within 3 weeks** after $GA_3$ application.
- Apply **irrigation to orchards 24 hours before $GA_3$** application.
- Do not apply $GA_3$ during nights when temperatures **are below 10 °C. It** is important to not solely depend on predictive weather applications but to measure (and record) actual conditions in each orchard prior to application.

# The use of gibberellin-biosynthesis inhibitors in citrus: Effects on vegetative shoot growth of ‘Nadorcott’



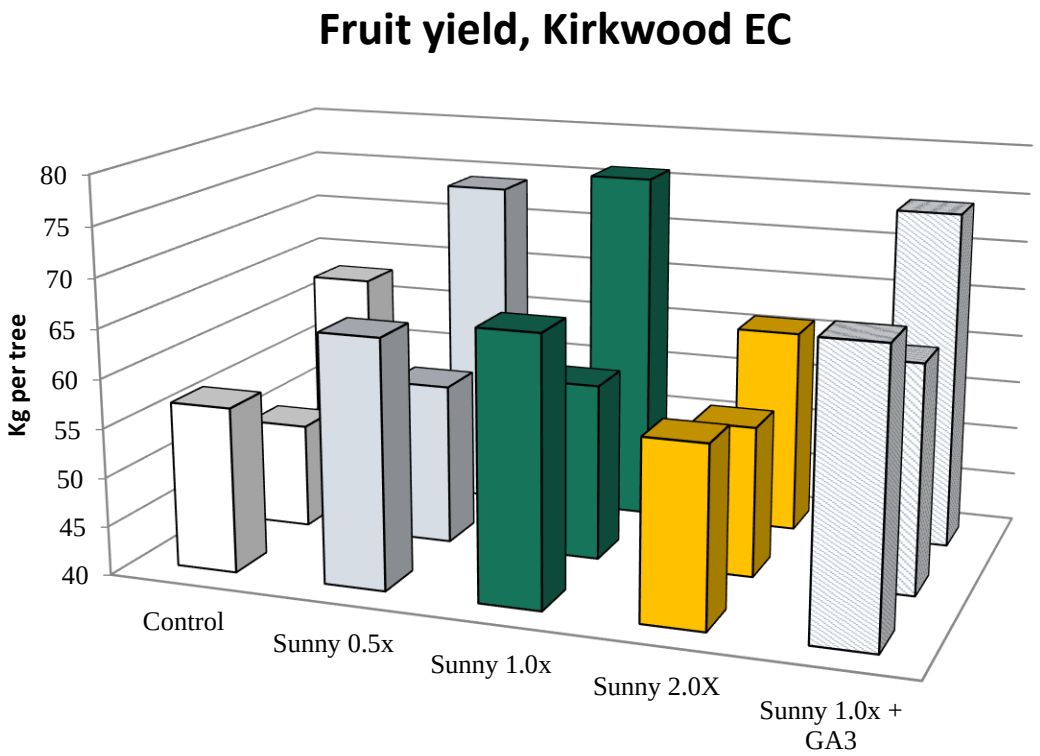
Untreated control

2 ml Sunny 50 SC

From: J Stander

citrus research international

# Effects of Sunny 50 SC on mandarin fruit yield




- All treatments except 2.0x Sunny 50 SC increased fruit set %

| Treatment | Fruit set % | Fruit diameter |
|---|---|---|
| Control | 11 | 57 |
| Sunny 0.5x | 13 | 60 |
| Sunny 1.0x | 14 | 58 |
| Sunny 2.0x | 11 | 60 |
| Sunny 1.0x + $GA_3$ | 15 | 58 |

The effects of Sunny 50 SC applications were similar in both “on” and “off” seasons (relative to control)

Application of 1.0x Sunny 50 SC and 5 g Progibb 40% SG increased fruit set compared the untreated control and 1.0x Sunny 50 SC applied alone.

From: J Stander

citrus research international

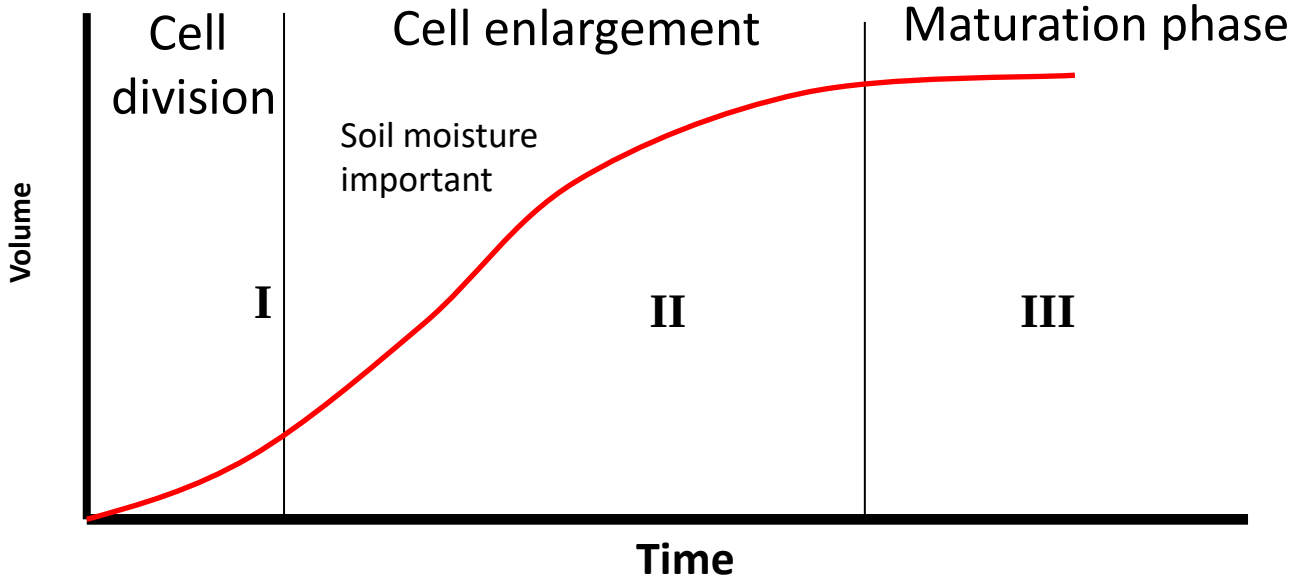
# Fruit set strategy - Girdling

Some difficult to set mandarins - where GA is unsuccessful, not commonly used

- Eliminate competition of roots for carbohydrates
- FB to 2 WAPD
  - Avoid additional stress in tree, only on healthy trees
  - Good set can lead to small fruit that split
  - Nadorcotts, Orri do not like girdling in cold production areas, chlorosis, poor blossom and set next season

# Next key decision after adequate fruit set: Thinning

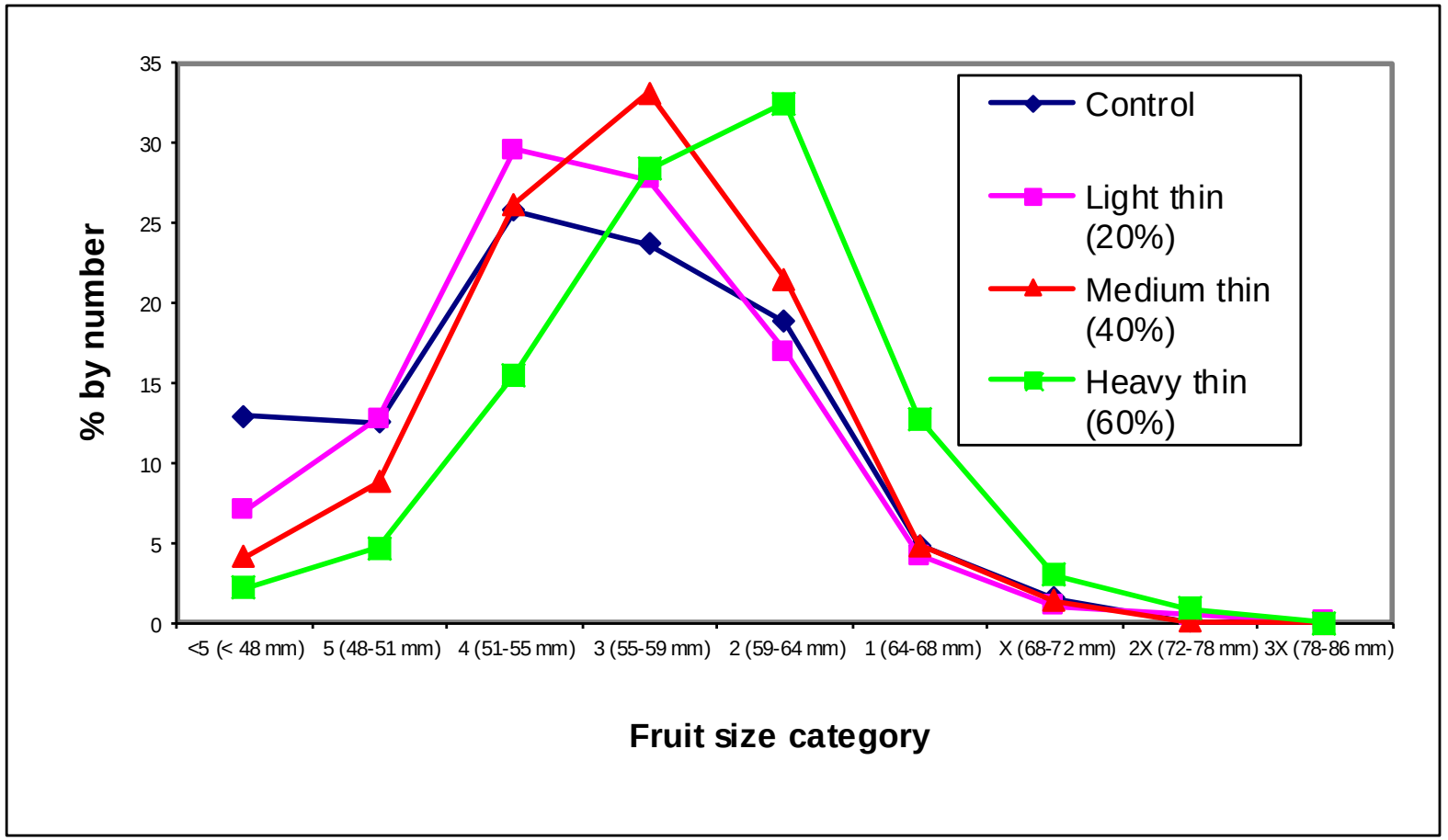
- Before physiological fruit drop determine required number of fruit on the tree
- Follow a fruit size strategy to maintaion the fruit
  - Nutrition and irrigation optimal
- Key part is a thinning plan:
  - Consist of chemical and or hand thinning




# Fruit thinning to obtain export cartons/ha

Depending on set - fruit size, alternate bearing

- Chemical: Corasil P (2.4-DP), Maxim (3,5,6-TPA)
- Hand thin according to predicted final size

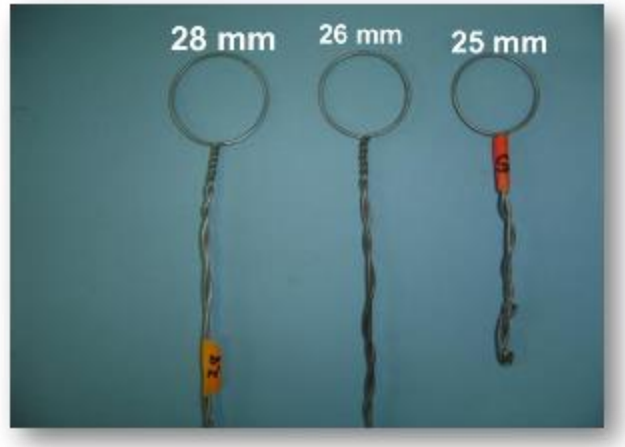


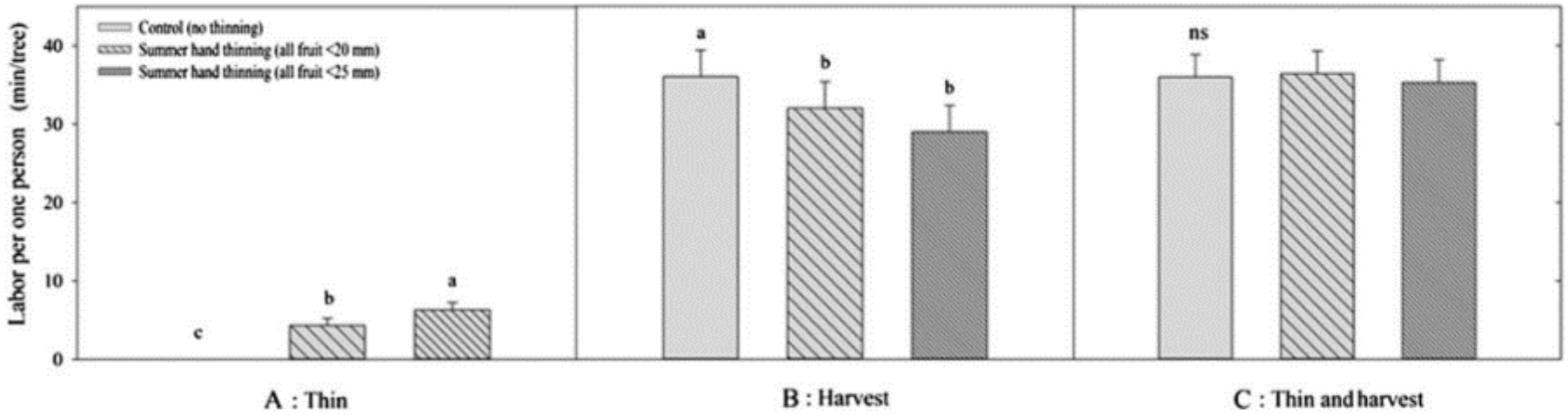
# Hand thinning

- Fruit has to be removed, either hand thin or clipping at harvest (more expensive)
- Small fruit is a drain of reserves

<u>Option if:</u>

- Auxins didn't have desired thinning effect on heavy crop
- Other positive effects of hand thinning
  - Reduce severity of alternate bearing
  - Allow vegetative growth = reduce AB
  - Reduce possible source of decay and pest




From: J Stander 2018

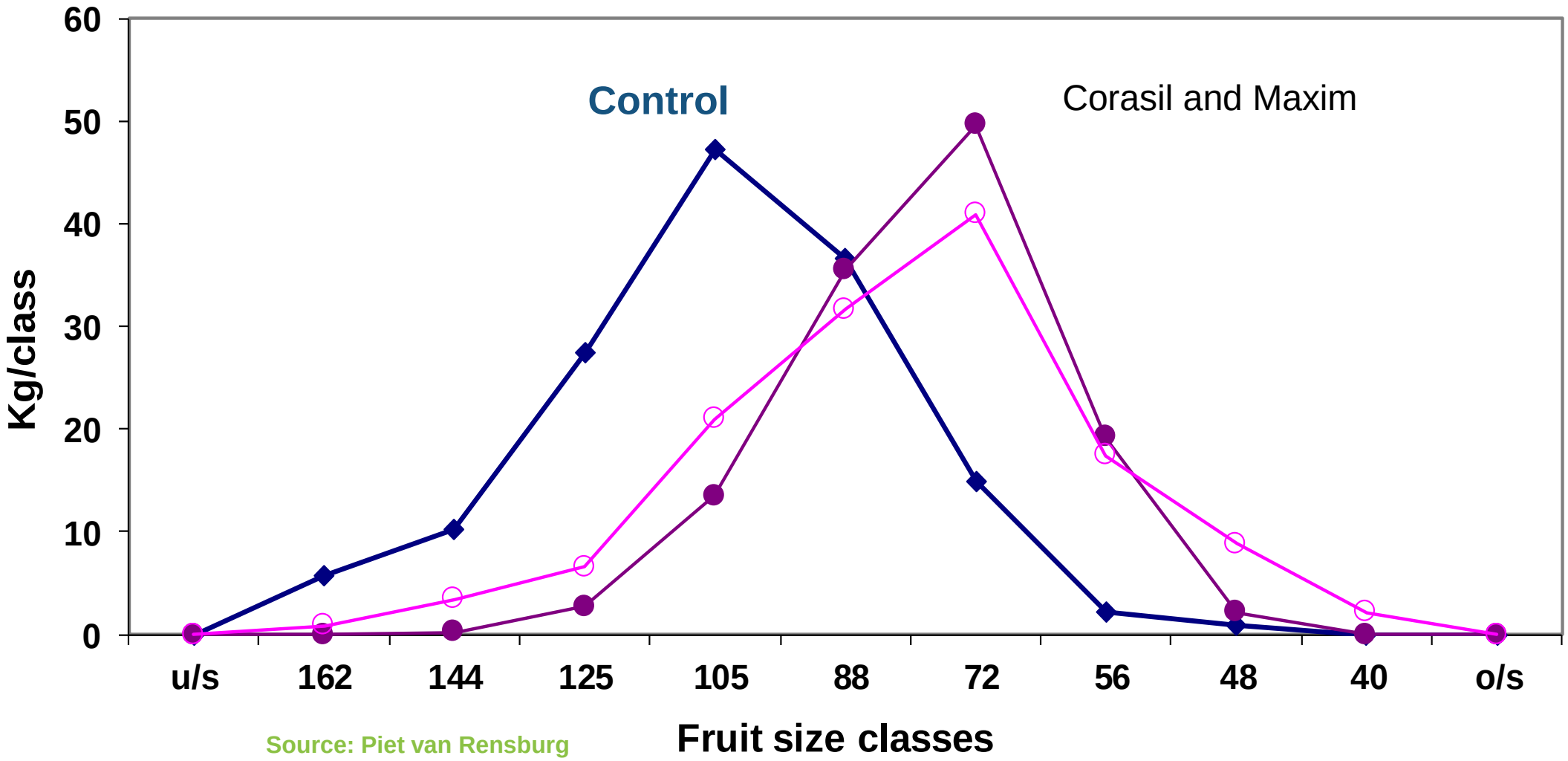
citrus research international

# Effect of specific auxins (PGR's) on fruit thinning

- Dichlorprop (2,4-DP) **[Corasil]**
  - Thin small fruit & increase size of the remaining fruit
  - Medium coverage application
  - 90 days withholding period; 150 mL/100 L (37.5 ppm) + wetting agent
- 3,5,6 TPA [**Maxim]**
  - Not on Grapefruit
- **Warnings on the labels**:
  - Not together with K foliar applications, rough rind, sand soils, single drip, high K levels, combinations
  - Trees in good condition: no stress, drought and floods
  - Economics – crop reduction vs. fruit size improvement

| Product information | Corasil®P | Maxim® |
|---|---|---|
| Registration holder | Nufarm Agriculture (Pty) Ltd | Arysta LifeScience SA (Pty) Ltd |
| Active ingredient | 25 g/L Dichlorprop (2,4-DP) | 100g/kg Trichlopyr (3,5,6-TPA) |
| Withholdig period | 90 days | 120 days |
| Dosage | 150 ml/100L water | 10 g/100L water |
| Timing | | |
| Satsumas | 15-20 mm | |
| Clementines | | |
| Nules | 8-12 mm | 15-18 mm |
| Oroval | 12-15 mm | 15-18 mm |
| SRA | 8-10 mm | 12-15 mm |
| Marisol | None | 15-18 mm |
| Nova, Mor, Affourer | 11-14 mm | None |
| Oranges | | |
| Delta Valencia | 18-25 mm | 20-24 mm |
| Seeded Valencias | | 16-20 mm |
| Navels | | 20-24 mm |
| Grapefruit | 16-28 mm | Do not use |
| Application instructions | | |
| Wetting agent | Non-ionic (i.e., Breakthru etc.) | Any |
| Optimal water pH (before adding product) | 4.5-5 | |
| Spray volume | 4-5 litre per canopy height (m) | 2000-4000 L per ha |
| Cautions | Do not apply in conjunction with potassium | Do not apply in conjunction with potassium |

# Effect of Maxim and Corasil on Delta fruit size




Source: Piet van Rensburg

# Side - effects of synthetic auxins

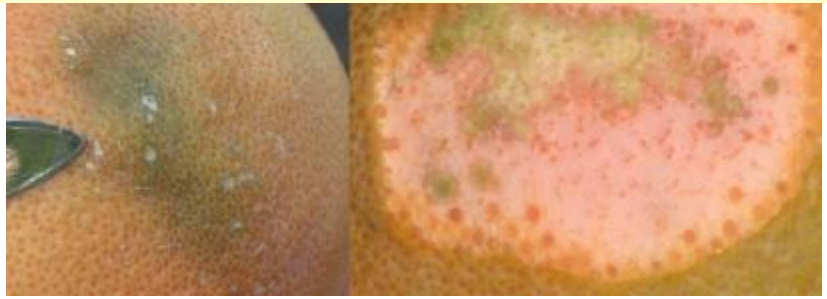
Thick stems

Water stress and high spray volumes

Granulation

Small fruit remain

Outside registration high rates & volumes



# Recommendations - June 2022

- **Focus on what you want to achieve i.t.o. carton/ha and R/carton in 2023**
- **June-Aug:** Harvest fruit as soon as possible in the current season
  - Reduce negative effect on flower initiation
- **July-Aug:** Apply urea
- **Sept:** Prior to shoot growth apply uniconazole
  - Reduce shoot length to increase set %
- **Sept-Oct:** After petal fall
  - Apply GA3
  - Reduce N until set to prevent vegetative development
- **After set (Oct) start to determine #fruit /tree**
  - Decide on fruit thinning strategy
  - Chem (Nov) + hand  (Dec-Jan) is ideal

# Acknowledgements


- Dr Graham Berry - XLnT Citrus
- Dr Jakkie Stander - Philagro
- Johane Niemann (CRI)