Understanding and Managing the Impact of Climate Change on Tree Fruit Production; Case Study Peach



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What is climate change?

"Climate change is a change in the pattern of weather, and related changes in oceans, land surfaces and ice sheets, occurring over time scales of decades or longer"

- Natural processes, such as changes in the Sun's radiation, volcanoes or......
- Internal variability in the climate system
- Human influences such as changes in the composition of the atmosphere or land use



https://www.science.org.au/policy/climatechange.html

"Global temperatures have already increased by an average of 1°C since industrialization. Climate change scientists predict that by 2050, air temperatures will increase further by between 2-4°C depending on mitigation activities (Measham and Quentin, 2014)."

- **Ecosystems:** Climate warming causes land and ocean life to migrate away from areas that have become too warm, and towards areas that previously were too cool.
- **Bushfires:** The number of extreme fire risk days has grown over the past four decades.
- Food security: Human influences such as changes in the composition of the atmosphere or land use.
- **Health:** Heatwaves are among the highest-impact climate events in terms of human health in Australia. In very hot conditions, people can suffer from heat stress.

Climate change

- Chilling hour
- Heat accumulation
- Effective pollination
- Affecting crop growth
- Frost damage
- Drought
- Rainy days near harvesting
- Diseases and insects

Waterlogging/flooding



- Chilling unit/hour
 1 chilling unit=1 hour 0°C 7.2°C (32°F-45°F)
 It is cultivar specific/"chilling requirement"
- Insufficient chill unit
 Delayed and prolonged bud burst
 Abnormal growth in trees such as apical dominance
 Uneven shoot development, flowering and fruit maturity

UF Stonefruit Breeding Program

- Bred peaches with chilling requirements of 350 to 450 chilling units
- Developed varieties into subtropical climates around the world
- Developing varieties requiring less than 200 chilling units for Central FL
- Developing root-stock 'Flordaguard'





Ralph H. Sharpe, 1952-1975



Wayne B. Sherman1966-2004



Jose X. Chaparro, 2004- present

Production History

- Peaked in the 1980s
- Medium-chill varieties
- Lack of overhead irrigation
- Marketing challenges
- Domestic competition



Production Window for FL



UF Peach Cultivars



Production



'UFBest'

'Tropicbeauty'





Walmart





The Fresh Market



Whole Foods Market

Chilling unit based on temperature: 32-45 F, http://agroclimate.org/tools/chill-hours-calculator/								
Season/County	Indian River	Polk	Hillsborough	Pasco	Orange	Lake	Marion	Alachua
2018-2019	76	106	209	188	127	229	345	406
2017-2018	141	163	281	304	203	302	418	524
2016-2017	61	59	104	113	86	167	241	327
Historic average	211	233	288	267	282	420	417	625



• Fully dormant peach tree



• Apical dominance



Uneven shoot development, flowering and fruit maturity





- Overcome insufficient chill
 - 1. Short-term adaptation strategies
 - 1.1. Climatic factors that contribute to a lack of chilling
 - 1.2. Use dormancy breaking agents
 - 2. Long-term adaptation strategies
 - 2.1. Variety selection
 - 2.2. Rootstock selection

Shading



East windbreak looking South

Shading



Middle row looking North

Shading



West windbreak looking South

Shading



Data logger





Data logger map Growing stage: 1)Chill hour/dormancy Oct 15th to Jan 15th

2) Flowering/ harvest Jan16th to May 15th

3) Postharvest

May 16th to Oct 15th







Average minimum daily temperature



Chilling Hour Use dormancy breaking agents

- Plant bio-regulators, e.g. Gibberellic Acid (GA 3, GA 4 & 7), Ethephon, Dormex,...
- Fertilizers, e.g. Potassium nitrate (KNO3), ERGER (mono-, di- and poly-saccharides, proteins and nitrogen),...
- Registration
- Application time and rate
- Safety for both human and plant

Chilling Hour Foliar application of ERGER

- ERGER is a mineral fertilizer specially designed to be sprayed on dormant wood in a specific period of time.
- ERGER is intended to supplement a standard fertility program with a source of Nitrogen and Calcium prior to the new growing season.
- It ensures the supply of nitrogen to plant tissues in the first stages of development, such as buds.
- It is beneficial to plant development even prior to bud break.

ERGER



Application rates: control, 6gl/100gl of water, 8gal/100 gal of water

ERGER on 'Tropicbeauty' in Citra

01. 22. 2019





Accumulated 109 CU

ERGER on 'Tropicbeauty' in Citra





Control

6 gallon ERGER/ 100 gallon

8 gallon ERGER/ 100 gallon

Accumulated 137 CU

ERGER on 'Tropicbeauty' in Citra

01. 22. 2019 Third application, 01.02.19



Control

6 gallon ERGER/ 100 gallon

8 gallon ERGER/ 100 gallon

Accumulated 146 CU

ERGER on 'UFGem' in Bartow

01. 14. 2019





Control

6 gallon ERGER/ 100 gallon

8 gallon ERGER/ 100 gallon

Accumulated 43 CU

ERGER on 'UFGem' in Bartow

01. 14. 2019





Control

6 gallon ERGER/ 100 gallon

8 gallon ERGER/ 100 gallon

Accumulated 51 CU

ERGER on 'UFGem' in Bartow

01. 14. 2019

Third application, 01.03.19



Control

6 gallon ERGER/ 100 gallon

8 gallon ERGER/ 100 gallon

Accumulated 51 CU

ERGER



Application rates: control, 6gl/100gl of water, 8gal/100 gal of water

Waterlogging Rootstock Evaluation



Waterlogging Rootstock Evaluation



Photo: Leah Millis

Waterlogging



Financial losses in crop production due to environmental stresses in the US from 2000 to 2011, Bailey-Serres et al., 2012)

Waterlogging



'Flordaguard' peach tree



Differences between peach tree root infected by root-knot nematode, *Meloidogyne floridensis* (a), and non-infected root (b).

Root stock

'Nemaguard'
'Guardian'
'Flordaguard'
'P-22'
'MP-29'
'R5064-5'

Objective

To investigate whether there are varietal differences between rootstocks in their response to destructive waterlogging trial.

<u>Scion</u> 'UFSun'







- Photosynthetic parameters, e.g. photosynthetic rate (AN), stomatal conductance (gs), intercellular CO2 concentration (Ci), transpiration rate (E), etc. (LI-6400XT)
- Chlorophyll concentration parameter (SPAD 502)
- Proline content parameter
- Soluble sugar determination
- Electron Microscopy

























Field Waterlogging Rootstock Evaluation



Root stock

Flordaguard MP-29 Nemaguard P-22 R5064-5 SC3-17-7

Objective

To investigate whether there are varietal differences between rootstocks in their response to waterlogging in a field.



Fruit quality and size

- Cv.: UFSun
- Location: Citra and Ft. Pierce



- Objectives:
- Determine the influence of fruit location within the canopy on fruit size and quality
- Identify PGRs and biostimulante approaches on fruit size and quality

Determine the influence of fruit location within the canopy



Identify PGRs and biostimulante approaches

PGRs: ReTain {Aviglycine hydrochloride (AVG)} and Mxcel **Biostimulant:** McExtra 20%K+1%N





Vegetative growth

-Producing high-quality fruit

- -Pests management
- -Improving spray coverage and penetration
- -High density orchard
- -Reducing production cost
- -Simplify operational practices







2/26/2020





Fungal Gummosis



Peach Leaf Rust 2/26/2020

Peach diseases





Peach Scab



Brown rot

Peach Insects



Plum Curculio



Citrus root weevil





White Peach Scale







Peach Tree Borers

2/26/2020

Caribbean fruit fly

Thank you



"I cannot do all the good that the world needs. But the world needs all the good that I can do."-Jana Stanfield