

Preharvest fruit drop – HLB relationships 2013-14 Season

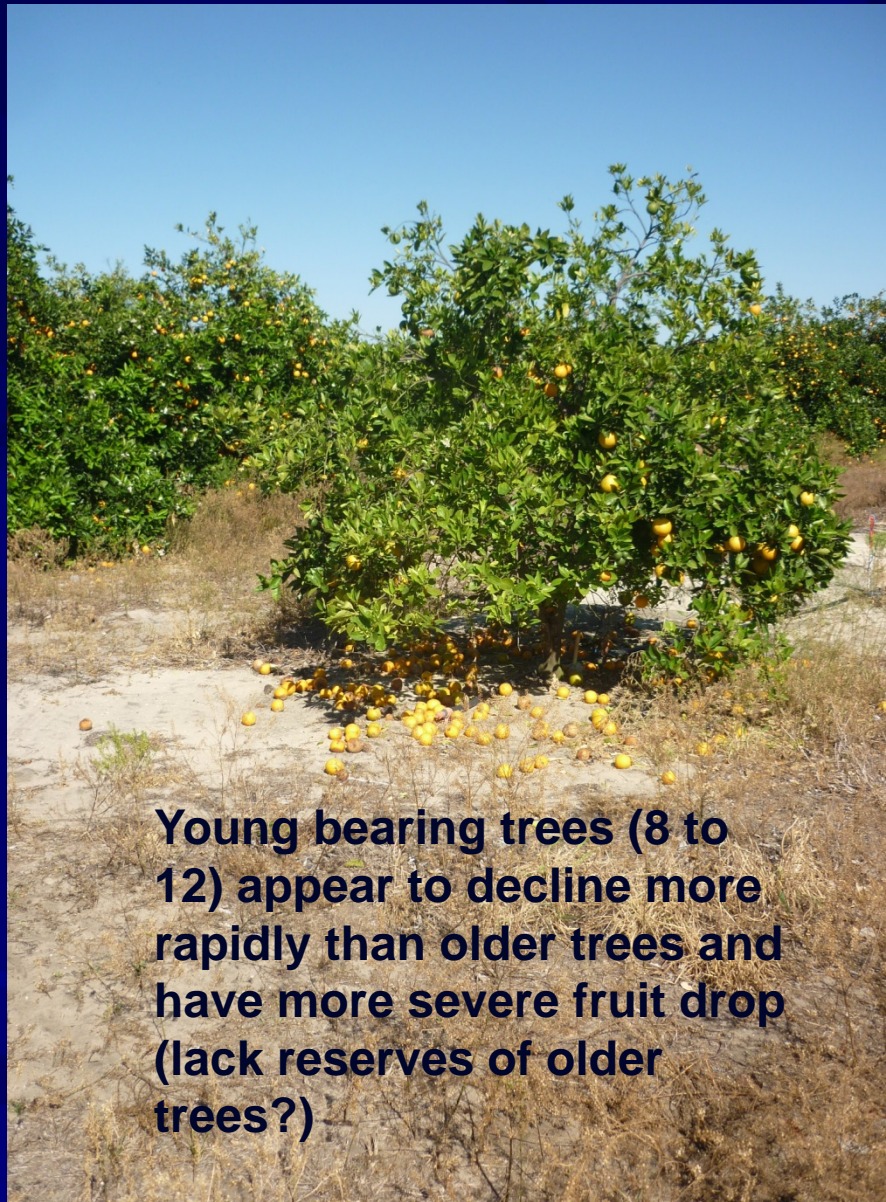
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Background

- Preharvest fruit drop is known to vary from year to year
- NASS (FASS) reported that 2012-13 was worst since 1969-70, then worst ever without freeze or hurricanes?
 - **In the past**
 - High or low drop year established before harvest season
 - Normally, drop rate increases 2-3 % per month during harvest

Some observations about HLB and fruit drop



Young bearing trees (8 to 12) appear to decline more rapidly than older trees and have more severe fruit drop (lack reserves of older trees?)



Dropping fruit often have necrosis and/or decay around button (Weakened fruit from low carbohydrate supply?)

2012-13 Season

Moderate declining tree with heavy fruit drop in March



2013-2014 season fruit drop



In September, most trees like one on left, but some heavy Sunburst crops had heavy drop.

Canker affected trees had significant drop early. Split fruit common and some drop noticeable by late September

2013-14 season



Drop increased from October on.



Growers now reporting increased drop



Some Valencia blocks severe, but in some blocks drop is just accelerating

Background – Fruit Drop

- Fruit drop very high in 2012-13
- Weak trees (HLB?) more loss than healthy trees
- NASS reduced yield estimate more than 12 % due to excess drop and small fruit size, overall drop was about 23-24 %

- Fruit drop started slow & erratic in 2013-14
- NASS numbers now similar to last season
- Drop from Valencia trees in many cases delayed, late bloom & cool spring?

Summary of 2012-13 harvest season?

- Percentage drop – 24 %
- Valued at about \$150 million
- More drop on declining trees

**Little previous experience with HLB
effects on fruit drop**

**Last year was first year with
significant numbers of HLB
declining trees throughout the
state?**

NASS Drop Statistics Two Seasons

Cultivars	October 2012	March 2013	November 2013	March 2014
Oranges – Early & mids	12	18 ^z	18*	23
Oranges - Late	17	22	18	26
Grapefruit - white	18	22	20	29
Grapefruit - colored	15	20	20	25

^z Last drop count on Early-mid cultivars was in January

* No October data due to US government furlough

Fruit drop process

Stress induced fruit drop

Stress >>> Ethylene >>> Cell wall breakdown >>> Abscission
Fruit abscission zone

- Water stress- root loss
- Carbohydrate deficiency
- Clas produced toxin or signal
- Fruit peel senescence
- Herbicides?
- Nutrient imbalance

- **HLB + additional stress**



Fruit drop

Abscission Zone & Drop



Preharvest herbicide tests - Valencia

- Growers reporting less drop if fall herbicide avoided
- Two tests on Valencia – Steve Futch and Gene Albrigo
- Seven treatments applied 2/14 or 2/17
- Glyphosate and Paraquat applied with and without trunk covers

Drop % in herbicide trial

Herbicide applied	Site 1	Site 2
Control	20.6	23.2
Glyphosate	21.1	21.2
Glyphosate w/ trunk covered	16.2	23.7
Paraquat	10.8	23.7
Paraquat w/ trunk covered	27.9	24.2
Saflufenacil	23.4	25.1
Sethoxydim	20.2	23.2

No consistent affect between sites for late winter application on Valencia fruit drop
Tests will be run again this Fall on Hamlin and Valencia trees.

Tests of 2, 4-D on preharvest drop of oranges in 2013

- Three tests reported – late applications
- No positive results
- Expand tests – earlier & more chemicals
 - Cooperation and support of Valent Biosciences

Test plant growth regulators

- **2, 4-D** – inhibits up-regulation of cell wall dissolving enzymes, reduces abscission
- **NAA** – another auxin substitute, but traditionally used for fruit thinning
- **Gibberellic acid** – delays peel color change & retains firmness (delays senescence?), blocks some phases of ethylene production from drought
- **ABA** – anti-gibberellin, slows growth
- **AVG** – reduces early apple drop, anti-ethylene
- **MCP-1** – Blocks ethylene action
- **Cytokinins** – cell division, essential for flowers

Fall applications of PGRs

- Treated Pineapple, Valencia, Grapefruit and Murcott
- Two applications September and October
- Used Citrus Fix (2, 4-D), ProMaxa (NAA), ProGibb (GA) in all combinations +Kinetic
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Fall PGR Tests - % Drop

Treatment	Pineapple	Grapefruit	Murcott	Valencia
Control	10.5	23.0	37.5	31.8
ProGibb	12.3	27.3	47.6	31.3
Citrus Fix	7.7	19.9	38.3	28.5
ProMaxa	13.1	22.8	42.0	28.9
Citrus Fix + ProMaxa	7.6	23.5	41.3	24.5
ProGibb + Citrus Fix	<u>8.4</u>	17.8	26.0	22.4
ProGibb + ProMaxa	9.0	22.5	37.4	26.8
ProGibb + Citrus Fix + ProMaxa	9.8	22.8	32.1	29.5

Data not statistically analyzed nor is tree decline ratings of trees considered

Fall Applications to Valencia

- ProGibb, Citrus Fix and combined-2 sites
- GA in two formulations, S-ABA, Retain (AVG), ProGibb + Retain, ProGibb + Citrus Fix
- All treatments applied twice, 45 days apart

Valencia – Comprehensive Trial

Treatment	% Drop to 4/4/14
Control	24.1
ProGibb 4%	17.7
ProGibb LV	21.0
S-ABA	27.4
Retain (AVG)	29.5
ProGibb 4% + Retain	20.0
ProGibb 4% + Citrus Fix	17.4

A grower trial has reported a reduction in fruit drop of Hamlin oranges with the application of ProGibb in the fall

Additional PGR tests

- Winter applications of PGRs
 - ProGibb, Citrus Fix, Retain, 1-MCP – 2 sites
 - Citrus Fix, Retain and combined – 4 sites
 - Data not summarized yet
- Low concentration – auxin-cytokinin-GA season long test (grower & research trials)
- Repeat & expansion of fall and winter applications (Grower and research trials)

Important observations

- Almost all blocks receiving enhanced foliar program
- Not all blocks have high fruit drop
 - Is it ingredients in foliar program?
 - More likely additional stress factors
- Root loss early = water stress, hormones↓
- Carbohydrates to fruit limited = stress
- Need more attention to additional stresses in each grove

Additional Stresses

- Poor root systems = water stress
 - January bloom evidence of general water stress
 - Can we alleviate by irrigating more frequently?
 - Need cooperators to run irrigation trials, split blocks
- Stresses in your blocks?
 - Water quality and soil pH (not in many blocks)
 - Minor element deficiencies (some Fe cases?)
- What else?

Trial Plans

- Are herbicides in Fall contributing?
 - We will expand those trials into early cultivars
- Can PGRs reduce preharvest drop?
 - These trials are expanding
- How much is HLB induced water stress contributing to preharvest drop?
 - Plan to set up comparison trials of different irrigation frequencies
- What else should we do?
 - Grower interviews

Summary

- SCRI Block Grant for 2 year study of preharvest drop associated with HLB
- Characteristics of normal drop – baseline
- Continue survey of growers
- What stresses are operative?
- Effects of production practices
- PGR tests
- **CRDF Grant support for several PGR trials**