Solving Preharvest Fruit Drop by Understanding Abscission in HLB-Affected Citrus Trees: A Hormonal and Nutritional Approach

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Fruit drop is a natural developmental process that may be influenced by other causes.
HLB is a major cause of increased preharvest fruit drop

<table>
<thead>
<tr>
<th>Fruit drop (% of total fruit)</th>
<th>IPC</th>
<th>No IPC</th>
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</thead>
<tbody>
<tr>
<td>HLB-negative healthy trees</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>HLB positive trees</td>
<td></td>
<td>60%</td>
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</table>
Other possible causes?

Endogenous

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

Exogenous

- Other diseases
- Warmer and drier than normal weather

These factors may interact

All related to HLB
Previous year’s crop | Next year’s crop

March

Late season harvest
Dec-Jan

VALENCIA

March

1 year for fruit development

April-May

Previous year’s crop

Next year’s crop

HAMLIN

March

Late season harvest
Dec-Jan

Previous year’s crop

Next year’s crop

VALENCIA
Fruit retention in healthy Hamlin and Valencia trees

Hamlin

FDF (Kg)

Days

Sept October November December January

Valencia

High competence for resources

Auxins

Main bloom

Natural senescence starts

PLA2 activation

Fruit senescence and drop (the right signal at the right time)

January February March April May
The situation under HLB
Environmental stress

Off blooms

The wrong signal at the wrong time

Massive preharvest fruit drop

Spring flush

Summer flush

Fall flush

Fall-Winter harvest
Diversity of developmental stages affects hormonal interactions within the tree.

The wrong signal at the wrong time
Context
Climatic conditions
Disease pressure
Environmental stress

Sender
Off-Blooms
Developing fruit

Channel (tree)

Message (DROP)
(signal)

Receiver
(Mature fruit)

Interrupt the message

Change the message
Interfering the message

AT, competitive inhibitor of PLA2
TIBA, Auxin transport inhibitor

But we can’t use AT or TIBA in our groves
What can we do?
Changing the message
Auxin levels and signaling, and stress alleviation, depend on Zn levels

- Zn Deficiency
  - Not enough Zn
  - Oxidative stress
  - Lipid peroxidation
  - PLD and PLA2 activities
  - Membrane Leakage
  - Abscission
  - Tissue Necrosis
  - Root loss
  - Oxidative IAA degradation
  - Growth inhibition

- +Zn
  - SOD CAT
  - Detoxification

- +K
  - Better fruit peel integrity
  - and larger fruit size
  - No abscission
  - No Root loss
Zn treatment in Hamlin on Swingle and US942

- ZnSO4 (50 grams per tree, foliar spray)
- K2SO4 (60 grams per tree, foliar spray)
- ZN+K combined treatment

3 applications:
- After fruit set and physiological drop (June)
- Fruit enlargement phase (July)
- Fruit color break (September)
Seasonal effects of Zn treatment on fruit drop in Hamlin
YIELD (all treatment dates pooled)

<table>
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<tr>
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<th>Hamlin on Swingle</th>
<th>Hamlin on US942</th>
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</thead>
<tbody>
<tr>
<td></td>
<td># fruit/4 trees</td>
<td>Boxes/acre</td>
</tr>
<tr>
<td>Control</td>
<td>952</td>
<td>231</td>
</tr>
<tr>
<td>Zn</td>
<td>1029</td>
<td>256</td>
</tr>
</tbody>
</table>
Maximizing the effect of our treatments

- June treatment
- July treatment
- September treatment
- Nov/Dec harvest
Conclusions

• We can improve fruit retention with feasible treatments than can be adopted now.
• These treatments may increase fruit yield and quality.
• Time of application is critical for treatment success. This must be defined for each variety and treatment and depends on the physiological status of the fruit.
• Planned work will allow to develop a management strategy to maximize effects of Zn and K treatments.
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