

# Managing a Large Avocado Crop

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#### Large Crop Management

### Situation

- ➤ "OFF" year:
  - Light flowering (spring 2013) resulting in a light crop
    - ➤Small number of fruit
    - Increase spring and summer growth



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#### Followed by an "ON" year:

- Intense flowering in spring (2014) resulting in a heavy crop.
  - Large number of small fruit
  - ➢More sunburn fruit
  - Reduced vegetative growth in spring and summer (especially summer)
  - ➢ Reduced root flushes (especially autumn)



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#### Avocado Growth Cycle (California, Carol Lovatt)



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#### **Management Strategies**

Fruit Set Irrigation > Nutrition ➢ Pruning ► Harvest Tree Health Girdling

FRESH



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### Fruit Set

- Target: Improve fruit set to control the trees.
- Pollinations: First step to setting a commercial crop.
- High correlation found between fruit set and honeybee activity (Ish – Am, 1994).



#### IMPORTANT TO SET THE CROP



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#### Fruit Set





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#### Fruit Set

Hive strength: 4 to 5 standard frames of brood in all stages. 8 to 12 standard frames well covered with bees. 1 to 3 full depth frames of honey. A good queen.

Bring in the bees when the avocado trees have reached 10% flowering (flower heads have fully expanded and open flowers can be seen).

### Fruit Set

Number of hives per acre: 4 to 5. Use more hives for large trees and more competing bloom.

Spread out in groups of 8 to 10 hives with a distance of 900 feet between each group. Bees don't like to move between rows of avocado trees when they are large and dense.

### Fruit Set

# Monitoring bee activity: Working in the avocado flowers. Weekly (12:00 to 13:00)



Bees per tree	Self- fruit set	Cross-fruit set	Adding hives
0	none	none	necessary
1 - 4	none	none	necessary
5 - 9	few	none	necessary
10 - 25	many	few on the 1 <sup>st</sup> row	recommended
26 - 55	many	on 1 <sup>st</sup> to 2 <sup>nd</sup> rows	may be helpful
more than 55	many	up to the 4 <sup>st</sup> row	not needed

Source: Ish-Am, 1994. PhD Thesis

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### Fruit Set

Provide alternative sources of pollen to ensure increase in bee numbers.

> Place hives near pollinizer trees.

Place hives in a warm and sunny position.

Ensure trees are well watered to encourage good nectar flow.

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### Fruit Set

> Keep "CLEAN" water close to the beehives.

Light inside the orchard improves bee activity.

Bees need to be present at all times during flowering.





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### Irrigation

Critical Growth stages: Bud Break **Flowering**  $\geq$  1º Leaf Growth and Root Growth ➢ Fruit Drop ▶ 2º Leaf Growth Dormancy and 2º Root Growth

### Irrigation

Bud Break: Improve root activity
 Roots have a high oxygen requirement.
 Crop Factor (kc) 0.6 - low requirement



### Irrigation

Flowering: Water requirements rise due to the warmer weather and the flowers (increases the area that can lose water). Limited water during this time can reduce the proportion of flowers setting to fruit. Crop factor (kc) 0.8, moderate to high requirement.

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# Under limited water conditions, the flowers are the first to stress





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### Irrigation

> Monitoring soil moisture: > Tensiometers: When a reading of: 20kPa on Sandy soils > 30 to 40kPa on Loamy soils Irrigation should begin Soil profile: Testing by "Hand" Check before the next irrigation > Have to keep "humidity" in your hand. Ratings: Saturation, Field Capacity and Wilting Point



### Nutrition

- Objective: VEGETATIVE REPRODUCTIVE BALANCE MAINTENANCE
- Nutrition depending on:
  - Yield / Crop Load: 10 v/s 20 t/ha
  - Soil type and Fertility; Organic Matter rich, Clay loams v/s Sandy soils
  - Leaching; Rainfall
  - Management Philosophy
  - Rootstock and Scion combination

### Nutrition

- Nitrogen (N): Manipulatory element to Control Vegetative / Reproductive Balance
  - Normally, applying N stimulates Vegetative flush.
  - TIMING of N fertilizing becomes critical in balance.
  - Small flowering and crop set: Significantly reduce N application for the season.

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#### "ON" Crop

N: 50-100 lbs / acre P2O5: 15 – 30 lbs / acre K20: 150 - 250 lbs / acre

#### "OFF" Crop

N: 0-50 lbs / acre P2O5: 0 - 10 lbs / acre K20: 50 -100 lbs / acre







### Nutrition

Demand of young developing and mature fruit for N and K (Rosecrance, Faber and Lovatt, unpublished).



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### Nutrition

#### Nutrient Balance: Vegetative Phase



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### Nutrition

#### Nutrient Balance: Reproductive Phase



### Nutrition

Boron leaf levels above 30 ppm. Important for developing flowers and fruit set - pollen quality.

Zinc leaf levels above 20 ppm. Needed for fruit and healthy leaves - growth hormones.





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# Pruning

IMPORTANT management intervention to reduce Alternate Bearing.

#### Objectives:

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- ➤Tree size control
- Improve light interception and penetration
- Improve efficiency of harvesting and spraying
- Maintain yields and fruit quality

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Light Interception: 30 – 35% of total incoming daily radiation has to reach ground level (Whiley et al, 2001)





### Pruning

- To avoid AB pattern Create a balance between Vegetative and Reproductive Growth. WE HAVE TO START NOW.
- ≻AB:
  - "Off" year: Increase flowering sites for spring 2015 by pruning the tree this season.









# Pruning

- How: Selective Limb Renewal
  Guidelines:
  - The height of the tree should not exceed 70% of the distance between tree rows.
  - Tree height should be less than 2.5 times the width of the canopy free inter row space.
  - ➢No part of the tree canopy should be more than 6.5 to 8.2 feet from direct sunlight.



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#### **Desired Orchard**

















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### Pruning

#### ➢ Procedure:

➢ Remove or cut back individual branches.

Remove or cut back the tallest branch or south side.

Remove or cut back branches that protrude into the inter-row space and on row (neighbor tree).

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### Pruning

> Procedure (continued):

Remove poorly positioned branches such as overlapping and crossing over branches.

➢ Remove low branches (skirted).











![](_page_44_Picture_2.jpeg)

![](_page_45_Picture_2.jpeg)

![](_page_45_Picture_3.jpeg)

![](_page_46_Picture_2.jpeg)

![](_page_47_Picture_2.jpeg)

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# Pruning

When: Spring – summer ?
 We have to look:
 Overcrowded or crowded situation
 Levels of Flowering and Fruit Set. Avoid allowing too much growth during flowering.

![](_page_48_Picture_4.jpeg)

![](_page_49_Picture_2.jpeg)

![](_page_49_Picture_3.jpeg)

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#### Harvest

Essential to begin the harvest as soon as fruit reaches commercial maturity.

Cover the orchard - size-picking to significantly reduce crop load. This allows the opportunity to follow "ON" flowering, especially for trees with a heavy crop.

![](_page_50_Picture_5.jpeg)

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#### Harvest

AZ – Hass: Early harvest, with 25% to 30% flesh Dry Matter (DM), sustained high productivity; but a delayed harvest up to 4 months later, at 35% flesh DM, eventually depressed yield and precipitated Alternate Bearing. (Whiley et al, 1996)

![](_page_51_Picture_4.jpeg)

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![](_page_52_Figure_2.jpeg)

**Fig.** Effect of time of harvest on the sustainability of yield of 'Fuerte' avocado trees growing in south-east Queensland over 6 consecutive years. *I* values (alternate bearing index) for each harvest time based on dry matter values are given in parentheses. Columns are mean values (n = 6) and vertical bars indicate LSDs ( $P \le 0.05$ ) determined by ANOVA. (Reprinted from Whiley *et al.* (1996a), with permission of Elsevier Science (1996<sup>®</sup>).)

#### Harvest

Earlier removal of fruit leads to a significant increase in the total number of inflorescences that develop the following spring. Removal should be done before September. (Lovatt)

![](_page_53_Figure_4.jpeg)

![](_page_53_Picture_5.jpeg)

### Tree Health

- Especially root health, as poor root function limits the ability of the tree to produce shoot flush.
- Affected by: Soil conditions, oxygen content of the soil, organic matter layer, disease pressure.

For effective management, Phytophthora cinnamomi control is non-negotiable.

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### Tree Health

- Preventive and Curative management.
- > Methods:

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- Good Irrigation and drainage. Mound or ridges.
- Phosphorous acid: Trunk injection or foliar spray.
- ➤ Mulch: Wood chip (cellulose).
- ➢ Gypsum: 25 lb./tree.
- Clonal Phytophthora tolerant rootstock.

![](_page_56_Picture_2.jpeg)

# Girdling

Single knife/saw cut around the branch Build up of carbohydrates above the cut Increase flowering and fruit set Only use on healthy and vigorous trees Timing – Autumn ➢ Use with caution − Root starvation

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# Girdling

#### Scored Branch 77 fruit – 265g

Non-Scored Branch 30 fruit – 275g

(Leonardi, 2009)

![](_page_58_Picture_6.jpeg)

![](_page_58_Picture_7.jpeg)

![](_page_59_Picture_2.jpeg)

![](_page_60_Picture_2.jpeg)

![](_page_61_Picture_2.jpeg)

![](_page_61_Picture_3.jpeg)

![](_page_62_Picture_2.jpeg)

![](_page_63_Picture_2.jpeg)

![](_page_64_Picture_2.jpeg)

![](_page_65_Picture_2.jpeg)

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### Summary

- > Main Objective: UNIFORM trees. Same stage.
- We have to start now to "PREVENT" Alternate Bearing.
- Improve bee activity Monitoring.
- > Control the nutrients levels, especially N.
- Control Pc Phosphorous acid at the right time.

### Summary

- Ensure high lights levels inside and around the tree.
- Control competition for Carbohydrate (CH):
  Harvesting strategy
  Growth conditions
  CH levels must be enough for fruit, flowers, new vegetative growth and new root growth.

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#### Summary

Avoid water stress:
 Irrigate according to need.
 Mulch – maintain a layer of wood material under the tree.

![](_page_68_Picture_4.jpeg)

#### Large Crop Management

#### Summary

![](_page_69_Figure_3.jpeg)

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#### **Thank You for Your Attention**

![](_page_70_Picture_3.jpeg)

![](_page_70_Picture_4.jpeg)