Trade Adjustment Assistance for Farmers

AVOCADO
Technical Assistance Curriculum

By

Institute of Food and Agricultural Sciences, University of Florida
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Trade Adjustment Assistance for Farmers

TAA Overview
Purpose:

To assist agricultural producers & fishermen adjust to foreign import competition
Trade Adjustment Assistance

- Trade Act of 2002 (Chapter 6)
- Amended the Trade Act of 1974
- Trade Act of 1974 was created by Congress to provide business owners and their employees relief from hardships created by foreign import competition
Trade Adjustment Assistance

- Traditional TAA has provided technical assistance & labor retraining services to non-agricultural businesses and employees

- TAA for farmers expands these benefits to eligible farmers & fishermen that have experienced significant price declines as a result of increased imports

- USDA Foreign Ag Service (FAS) is the lead agency for implementation
Eligibility Requirements for the Commodity

1. Commodities must first be certified as eligible before producers can apply for benefits.

2. Average price of the commodity in the most recent 12 months must be less than 80% of the average price over the past 5 years in which data is available.
3. Imports of directly competing products must have increased during the most recent 12 month period

4. Increase in imports has to have “contributed importantly” to the price decrease
Who May Petition

• A group of raw agricultural commodity producers, or their duly authorized representative.

• Can be as few as three (3) unrelated individuals.
**Who May Petition**

- Can be on behalf of a state, region or the nation as a whole.

- If a specific state or region files, other regions can join the petition if they do so within 10 days, otherwise they must file a separate petition.
Petition Submission

• Petitions are submitted to the USDA Foreign Agricultural Service (FAS)

• Form FAS 930

• FAS does an initial screen. If the petition meets basic requirements, the petition is posted in the Federal Register
Petition Submission

• FAS has 40 days to determine if the commodity is eligible – clock starts with Federal Register posting of grower’s petition

• USDA Economic Research Service (ERS) reviews the price and import information
Grower Time Line

• If grower group’s petition is certified, then...

• Individual grower has 90 days after certification to apply to FSA for benefits

• Grower has 180 days after certification to obtain ‘technical assistance’ (at no cost to the producer) from Extension.
Application Process

• After ‘certification’ producers may apply at the FSA office where their records are kept. If the producer has had no previous contact with FSA, the producer may apply at the nearest FSA county office.

• Producers will complete form FSA-229

• FSA-229 is available at the local FSA office or at: www.sc.egov.usda.gov
Producer Benefits

1. Technical assistance training
   - Extension Service

2. Up to a $10,000 cash payment
   - USDA Farm Service Agency (FSA)
Producer Benefits

3. Career retraining & education assistance
   – Department of Labor

4. 50% cost sharing for projects like developing business plans, creating new marketing strategies, etc.
   – Department of Commerce
   – Requires a separate application
How The Payment Is Calculated

- The quantity of the commodity produced in the petition year multiplied by one half the difference between 80% of the previous 5 year average and the average price of the commodity in the most recent marketing year. Not to exceed $10,000.
How The Payment Is Calculated

Payment = \( Q \times \left( 0.8 \times AP - NP \right) \div 2 \)

- \( AP = \) previous 5 yr average price
- \( NP = \) average price in most recent marketing year
- \( Q = \) producer quantity
What Grower Must Certify

1. Certification that Extension technical assistance has been completed
2. Acceptable production documentation for commodity
3. Net farm income was less than the last year in which no adjustment assistance was received
4. That average gross revenue was less than $2.5M for preceding 3 years
What Grower Must Certify

• Each producer has a $10,000 limitation on TAA payments per Federal fiscal year

• TAA payments and counter cyclical payments must be less than $65,000 per year
Time Line Summary

Extension

Petition FAS

To ERS

Materials to Digital Center

Curriculum Development

Producer Training

Certification

Application FSA

Piggybacks

Producers
• (i) information regarding the feasibility and desirability of substituting 1 or more alternative commodities for the adversely affected agricultural commodity; and

• (ii) technical assistance that will improve the competitiveness of the production and marketing of the adversely affected agricultural commodity by the producer, including yield and marketing improvements.
Where am I?

World, U.S. & Florida Avocado Situation and Outlook
World Avocado Situation and Outlook

- The top ten world avocado producing countries and their respective shares of world production of avocados in 2004 are Mexico (33.15%), Indonesia (7.07%), United States of America (5.88%), Colombia (5.58%), Brazil (5.54%), Chile (5.10%), Dominican Republic (4.46%), Peru (3.41%), China (2.68%), and Ethiopia (2.60%).

- World production of avocados in 2004 is estimated at 3.45 million tons, slightly less than the 3.49 million tons recorded in the previous year. Between 1996 and 2004, production grew at an average annual rate of 4.1%, increasing from 2.5 million tons in 1996 to the current level.
The top five world avocado exporting countries in 2004 were:
  - Mexico
  - Chile
  - Israel
  - Spain
  - South Africa

The top five world avocado importing countries in 2004 were:
  - USA
  - France
  - Netherlands
  - UK
  - Japan
U.S. Avocado Situation and Outlook

World Major Avocado Exporting Countries, 2004

- Mexico: 27%
- Chile: 23%
- Spain: 11%
- South Africa: 6%
- Israel: 12%
- Others: 21%
U.S. Avocado Situation and Outlook

World Major Avocado Importing Countries, 2004

- United States of America: 30%
- France: 21%
- United Kingdom: 6%
- Netherlands: 6%
- Japan: 6%
- Others: 31%
World Avocado Situation and Outlook

World Avocado Outlook:

• World production of avocados expected to rise in 2005/07 period due to:
  – Increased bearing acreage in the main avocado producing countries
  – Favorable weather conditions in Mexico and Chile
• The share of world production of avocados traded (currently 16%) is expected to rise due to:
  – Increased supplies in the major avocado exporting countries
  – Improvement in phytosanitary conditions
  – Reduction in trade barriers
  – Advances in transportation and post harvest technologies
• Mexico and Chile will continue to dominate the export trade.
• U.S. imports of avocados expected to increase.
The U.S. production of avocados occurs in California (90%), Florida (9%), and Hawaii (less than 1%). Avocados grown in California are mainly of the Hass variety, characterized by “purplish-black skin.” Hass avocados are grown mainly in California’s southern coastal region in San Diego, Riverside, Ventura, and Santa Barbara Counties. Most Florida avocados have green skins and are grown mainly in the Miami-Dade County area.

The U.S. consumption of avocados has increased considerably within recent times due to imports, lower avocado prices, a rapidly growing Hispanic population, the promotion of the health benefits of avocado, and increased disposable income.
The main sources of U.S. imports of avocados are Mexico, Chile, Dominican Republic, and New Zealand.

Chile was the main supplier of avocados to United States of America, followed by Mexico. In 2005, Mexico more than tripled the amount of avocados it ships to United States (from 42,000 tons in 2004 to 148,000 tons in 2005). In comparison, imports from Chile increased by 23,000 tons (22.70%) to reach 127,000 tons for the same period. Although imports of avocados from Dominican Republic are substantially less than those from Mexico and Chile the volume has been increasing over time.
The U.S. consumption of avocados has increased considerably within recent times. A larger portion of the current domestic demand is being satisfied from imports. This Figure illustrates the changes in share of domestic consumption (production plus net imports) due to increased imports over the period 1996 to 2005. It shows that the share went from less than 15% in 1996 to 30% in 1998 and 40% in 2002. With the decision to allow Mexico access to 47 U.S. states in January 2005, the import share increased by a further 15%. Currently, imports satisfy as much as 55% of U.S. domestic consumption. Come 2007, when Mexico is allowed to ship to all 50 U.S. states, import share is expected to increase again.
U.S. Outlook:

- U.S. consumption of avocados will continue to increase driven mainly by lower prices, increased availability and a growing Hispanic population.
- Over the coming seasons, U.S. domestic production of avocados is likely to resume its ‘upward’ trend, despite setbacks to the Florida avocado industry.
- The upward trend in avocado imports is expected to continue due to:
  - Strong U.S. domestic demand
  - Increased supplies in the two main countries exporting to the U.S. (Mexico and Chile)
  - Decision to allow year round shipments of avocados from Mexico to all states in the U.S. beginning in 2007
- Despite increased consumption of avocados, the combination of increased domestic production and increased imports is likely to cause prices in the domestic market to decline further or at best remain stagnant.
Florida avocado production remained relatively flat from 1996/97 until 2002/03, when it increased by 34.78% over the previous season. The increased crop reflected new bearings from groves that were replanted with higher-yielding varieties and increased planting density. The sharp decline in the 2003/04 crop was due to extreme cold temperatures during the flowering season, which badly affected fruit settings. Production resumed an upward trend in the following season. The 2004/05 crop, estimated at 28,000 tons of avocados, was valued at approximately $14.45 million. This represents a 64.71% increase over the 2003/04 season, but less than the 31,000 tons recorded in the 2002/03 season.
Florida Avocado Situation and Outlook

• Between 1996/97 and 1999/00, prices increased from US $528 per ton ($0.26 per pound) to US $748 per ton ($0.37 per pound), or by 41.66%. However, with the exception of a slight recovery in 2001/02 and a spike in 2003/04 caused by a sharp drop in production, prices have been declining. In the 2004/05 season, growers received a price of US $516 per ton ($0.26 per pound), which represents only 76.55% of the 1999/00 to 2002/03 five-year average ($674 per ton or $0.34 per pound). The downward trend in prices becomes more obvious when prices are adjusted for inflation.
Changes in price seem increasingly less responsive to changes in production levels. For example, in the 1999/00 season, when production decreased by only 4.17%, prices increased by 22.60% (implying that a 1% reduction in quantity resulted in almost a 6% increase in the prices), whereas in 2003/04, when production decreased by as much as 45%, prices increased by only the equivalent of 45% (i.e., a 1% decrease in quantity resulted in only a 1% percent increase in prices).

Consumers are no longer willing to pay high prices when there is a shortage of Florida avocados, since total supplies remain adequate as a result of imports. This is borne out by the fact that imports of avocados totaled only 28,000 tons in the 1999/00 season but 155,000 tons in the 2003/04 season. The point being made is that growers can no longer expect to make up revenues from higher prices in years where there are significant shortfalls in production.
Florida Avocado
Situation and Outlook

Florida Outlook:

- The 2005/06 crop is projected to be 400,000 bushels (11,000 tons), or about 40% of the previous year’s crop due to damages caused by recent hurricanes.
- As a consequence, prices are expected to rise, however the increase in price will be insufficient to cover the short fall in production.
- Over the coming seasons, prices will come under pressure because of the following:
  - Increased supplies of avocados as a result of year round shipments from Mexico to all states in the U.S.
  - Increased supplies of green skin avocados coming from Dominican Republic
- There will be a gradual erosion of the “marketing window of opportunity” for Florida green skin avocados.
Where do I want to be?

• Enterprise Budget
• Production Efficiency
• Marketing Opportunities
Where do I want to be?

Enterprise Budget
An enterprise budget is a useful tool to quickly evaluate current costs and returns and/or to quickly evaluate the cost effectiveness of changes in production practices. Provided in the next three slides is a sample budget for an avocado enterprise based on a 5-year average marketable yield of 8,000 pounds per acre (assuming a pack-out rate of 94%) and the 2004/05 F.O.B. price in South Florida estimated at $0.52 per pound (the actual price you received plus the costs to harvest and market the commodity).

It should be pointed out that yields and costs for individual operations can vary widely; yields have been known to range from a low of 2,000 pound per acre in a very bad year to a high of about 10,500 pounds per acre in an extremely good year.
### Enterprise Budget

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<thead>
<tr>
<th>Category</th>
<th>($)/Acre/Year</th>
<th>($)/Pound</th>
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<tbody>
<tr>
<td>Marketable Yield (8,000 lbs./acre)</td>
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<tr>
<td>F.O.B. South Florida Price</td>
<td></td>
<td>0.52</td>
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<tr>
<td>Total Revenue</td>
<td>4,160.00</td>
<td></td>
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<tr>
<td>Operating Costs</td>
<td>1,151.00</td>
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<tr>
<td>Fertilizer</td>
<td>425.00</td>
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<td>Fungicide</td>
<td>220.00</td>
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<tr>
<td>Herbicide</td>
<td>150.00</td>
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<tr>
<td>Insecticide</td>
<td>11.00</td>
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<tr>
<td>Tree Removal and Site Preparation</td>
<td>4.00</td>
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<tr>
<td>Tree Replacement</td>
<td>12.00</td>
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<tr>
<td>Top, Head, and Prune</td>
<td>60.00</td>
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</table>
## Enterprise Budget

<table>
<thead>
<tr>
<th>Category</th>
<th>($)/Acre/Year</th>
<th>($)/Pound</th>
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<tbody>
<tr>
<td><strong>Operating Costs (Continued)</strong></td>
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<tr>
<td>Set Trees</td>
<td>2.00</td>
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<tr>
<td>Irrigation</td>
<td>50.00</td>
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<tr>
<td>Mow Middles</td>
<td>80.00</td>
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<tr>
<td>Grove Work and Hand Labor</td>
<td>25.00</td>
<td></td>
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<tr>
<td>Growers Association Fees</td>
<td>8.00</td>
<td></td>
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<tr>
<td>Interest on Operating Capital</td>
<td>105.00</td>
<td></td>
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<tr>
<td><strong>Fixed Costs</strong></td>
<td>866.00</td>
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<tr>
<td>Land Rent</td>
<td>446.00</td>
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<tr>
<td>Supervision</td>
<td>140.00</td>
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<tr>
<td>Overhead</td>
<td>280.00</td>
<td></td>
</tr>
<tr>
<td><strong>Total Pre-Harvest Costs</strong></td>
<td>2,017.00</td>
<td>0.25</td>
</tr>
</tbody>
</table>
## Enterprise Budget

<table>
<thead>
<tr>
<th>Category</th>
<th>($)/Acre/Year</th>
<th>($)/Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvest &amp; Marketing Costs</td>
<td>2,077.00</td>
<td></td>
</tr>
<tr>
<td>Pick, Haul and Pack ($0.21/lb)</td>
<td>1,661.00</td>
<td>0.21</td>
</tr>
<tr>
<td>Sales Charge @ 10% of F.O.B. price</td>
<td>416.00</td>
<td></td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td><strong>4,094.00</strong></td>
<td><strong>0.51</strong></td>
</tr>
<tr>
<td>Gross Margin</td>
<td>932.00</td>
<td>0.12</td>
</tr>
<tr>
<td>Net Returns (Total Revenue - Total Costs)</td>
<td>66.00</td>
<td>0.01</td>
</tr>
</tbody>
</table>
In addition to reducing costs of production to improve profitability, attempts can be made to influence market price through improving fruit quality. Returns can be vastly improved by increasing yields per acre. The table below shows the estimated net returns for various price and yield combinations in South Florida. The yields chosen reflect expected average yields in “low”, “medium” and “high” years, while the prices reflect the range paid in recent years.

<table>
<thead>
<tr>
<th>Price ($/lb.) F.O.B. Homestead</th>
<th>0.42</th>
<th>0.52</th>
<th>0.62</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (lbs./acre)</td>
<td>Net Returns/acre ($/acre)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6,400</td>
<td>-926.00</td>
<td>-350.00</td>
<td>225.00</td>
</tr>
<tr>
<td>8,000</td>
<td>-653.00</td>
<td>66.00</td>
<td>786.00</td>
</tr>
<tr>
<td>9,600</td>
<td>-381.00</td>
<td>483.00</td>
<td>1,347.00</td>
</tr>
</tbody>
</table>
The break-even analysis shows the minimum price you must receive for your avocados to cover or pay for all costs (operational, marketing and fixed). The table below shows the break-even prices for different levels of output. For example, with a marketable yield of 8,000 pounds per acre, the minimum F.O.B price that must be received to allow us to just clear all expenses is $0.51. Anything above that is profit. However, with a yield of 9,600 pounds per acre, the minimum price becomes $0.47.

<table>
<thead>
<tr>
<th>Yield (lbs./acre)</th>
<th>Break-Even F.O.B. Prices ($/lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,400</td>
<td>0.57</td>
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<tr>
<td>7,200</td>
<td>0.54</td>
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<tr>
<td>8,000</td>
<td>0.51</td>
</tr>
<tr>
<td>8,800</td>
<td>0.49</td>
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<tr>
<td>9,600</td>
<td>0.47</td>
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</tbody>
</table>
Where do I want to be?

Production Efficiency

• Pests and Disease Management
• Site Selection for Avocado Groves
• Avocado Cultivar Selection
• Plant Spacing and Tree Size Control
• Quality Management for Florida Avocados
Production Efficiency

Pests Management
IPM and Avocado Pests

• IPM is the use of several tactics, based on insect biology, monitoring, economic levels

• If used wisely, IPM should result in avoiding yield losses, pest problems

• IPM is not only chemical control.

• IPM is not the result of ‘fast action methods’ but the result of a continuous use of different tactics
Avocado IPM

• **Basic**: Crop phenology; Pest’s Taxonomy, origin, biology, sampling, seasonality, economic thresholds, natural enemies, cultivar tolerance.

• **Tactics**: Do nothing, Chemical, Biological,

• Pheromones, Microbial, Quarantine, Physical, etc.
Native or Resident Arthropods in Avocado in Florida, 2003

Acarina: 6%
Coleoptera: 6%
Hemiptera: 4%
Homoptera: 10%
Lepidoptera: 59%
Thysanoptera: 15%
Pests Management

Avocado Tree

FRUITS

Foliage

Roots

Trunk, Branches

FLOWERING
ROOTS

Diaprepes on Avocado-Nurseries
Ambrosia beetles, Stemborers

Pests of Trunks
Pests Management

Ambrosia Beetles:

Generalists: Many tree species
Pests of Avocado: Trunk, Branches

- Ambrosia Beetles:
- Feed on fungi which grow on tunnel walls
- Sawdust emerging from tunnels
- Stressed trees preferred, but if established...
- Chemical control is needed
Long Horned Beetles: Borers, occasional pest
Pests of Leaves and Buds
Avocado Lacebug
*Pseudacysta persea*
(Hemiptera: Tingidae)
Avocado Lace Bug Management

Biology

Sampling

Economic Damage

Biological control

Chemical control

Varietal resistance
Pseudacysta persea

Pests Management

Adult

Eggs
Port of entry for *Colletotrichum*
Avocado Lace Bug

ALB:

Chlorosis, necroses,
Leaf drop
Complete defoliation in severe cases
Avocado Lace Bug Damage

- Seasonality: Oct - March
- Damage:
  - 40% damage = 50% reduction in photosynthesis Booth 8,
  - Simmonds had the lowest yield, max & fastest defoliation
- Tolerance: Waldin
- Yield: no fruits on Simmonds
Microbial Control

- Feasible *Beauveria bassiana* can maintain high mortality through 15-30 days after treatment
Avocado Red Mite

Oligonychus yothersi
Avocado Mite

- Builds up from October through …April or May depending on weather patterns
- Dry weather = mite population build up
• Does the mite cause Economic damage?
  It reduces photosynthesis. If damage occurs continuously during several years, it may cause yield reduction
Example:

- Continuous collection of mites for 2 months together with 100% leaf bronzing may cause 36% yield reduction
Coleoptera:
Blue Green Citrus Weevils:
Pachnaeus spp.

Egg Parasitoid:
Brachyufens osborni: Trichogrammatidae
Avocado Loopers & Other caterpillars

- Loopers belong within the family Geometridae.
- The avocado loopers in Florida are:
  - *Anacamptodes defectaria* (Guenée),
  - *Epimeces detexta* (Walker),
  - *Epimeces matronaria* (Guenée),
  - *Oxydia vesulia transponens* (Walker)
  - *Sabulodes aegrotata* (Guenée)
Avocado Loopers & Other caterpillars

Oxydia vesulila
**Epimenes detexta**

**Life Cycle**

- **Egg:** ~ 5 d
- **Larva:** ~17-20 d
Reasons for current outbreaks?

• Several Reasons:
• Winter temperatures: warmer than during other years? Insects escaping natural mortality?
• Some chemicals can not be applied more than twice without resulting in insect resistance.
Why are we having these problems?

- Some chemicals applied against other pests may be eliminating any parasitoid or predator keeping the population ‘within normal’ ranges.
What are the damaging levels?

- No economic thresholds have been determined.

Suggestions:

- If the tree is young… Higher damage, need for control
- If there are small fruits, and the looper population > 20 larvae [1/2 h walk] it may result in economic damage.
Native Natural Enemies:

Predators:
- *Calleida decora*: Ground beetle
- *Podisus maculiventris*, *Alcaerrhynchus* (Predatory stink bugs)

Native Parasitoids:
- From larvae: *Parapanteles* sp. (small wasp).
- *Trichospilus diatraeae* (from pupae).
Exotic parasitoids?

Yes, during the late 80s, R. Baranowski and H. Glenn released *Trichogramma platneri* and *Telenomus* sp.

No establishment was detected at that time.
Other natural enemies

- Granulosis virus frequently infect and kill looper larvae when populations become large.
- What to do to increase the insect disease epidemic?
IPM for Geometrids

1. Sampling, sampling, sampling
2. Threat to fruits?
3. Age of tree, foliage
4. Needs: Pheromone Studies, introduction of parasitoids?
5. Use of IGR’s: practiced
Acarina

Avocado Bud Mite: *Tegolophus perseaeflorae*
Avocado: Pests of buds, flowers, fruitlets? Leaves

- Avocado bud mite:
- The phantom mite?
- Damage to buds and leaves
Tegolopus perseaflorae: Bud Damage, Flowers, fruitlets?
Aspidiotus destructor

Coccus spp.

Armored and soft scales: outbreaks due to pesticide sprays
Avocado: Pests of Flowers and fruitlets: Mirids, Thrips, Eriophyid mites, Others?
Hemiptera: Avocado Mirids

Dagbertus fasciatus

Dagbertus olivaceus
Thrips on Flowers: *Frankliniella bispinosa & F. kelliae*

- Heavy populations on flowers. Adults oviposit on peduncle.
- Oviposition and/or feeding on fruit?
Frankliniella spp. on avocado:

Eggs inserted in fruits
Avocado Pimpling and....

- Mirids? No relation?
- Thrips: Yes....but..
- Mites: Possible not demonstrated yet
## Suggested Scouting for Avocado Pests

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<th>Pest</th>
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<tr>
<td>Av Mite</td>
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<td>Lacebug</td>
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<td>Mirida</td>
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<tr>
<td>Thrips, Bud Mite</td>
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Avocado IPM: Florida

- Few pesticides are registered
- Growers prefer ‘old’ pesticides to new generation pesticides: cost? Slow acting?
- Economic Thresholds need to be determined for all pests
- Sampling and monitoring is seldom used by growers
Avocado Pests: Conclusions

- Few pests in Florida compared to other areas
- Situation in Florida: Application of chemicals, needed or not [calendar basis]
- Very little or no monitoring, result in ‘surprises” threatening avocado yields and reducing grower economic gain
Production Efficiency

Disease Management
Economically important diseases

- Phytophthora root rot
- Anthracnose
- Cercospora spot/blotch
- Avocado scab
- Powdery mildew
Phytophthora root rot

- *Phytophthora cinnamomi* Rands, attacks and rapidly kills avocado roots in poorly drained soil. Areas with less than 10 ft elevation get high ground water during the rainy season, which favors the pathogen.

- Severely infected trees show sparse foliage with pale green, often wilted leaves and dieback occurs in advanced stages.

- Feeder roots become blackened and decayed and may be almost entirely absent in advanced stages of the disease.
Phytophthora root rot
Phytophthora root rot

- Choose only disease-free nursery stock
- Do not plant in areas that are subject to flooding
- Avoid the introduction of soil or water from infested areas to clean fields on equipment or plant stock
Phytophthora root rot

- Aluminum phosphonate salt (fosetyl-Al)
  - Aliette
- Phosphorous acid or Potassium phosphite
  - Fosphite
  - Helena Prophyt
  - Agri-Fos
- Mefenoxam
  - Ridomil Gold EC
Anthracnose (black spot)

- *Colletotrichum gloeosporioides* Penx., which lives as a saprophyte or weak parasite on numerous plants in Florida.
- The fungus is considered a weakly aggressive pathogen found growing on dead or dying leaves, twigs and fruit surface.
- Infection occurs as fruit ripens and latent infection on fruit can be a problem when the fruit starts to soften if it goes untreated.
- The fungus infects wounds, rind cracks, or lesions caused by *Pseudocercospora*
Anthracnose (black spot)

- Infections are slightly sunken and nearly circular, dark brown to black and vary from tiny to 2 inches in diameter. Spore masses appear pinkish orange when active.
- Wind and insect damaged fruit should definitely be treated with copper or azoxystrobin to prevent infections from the fungus.
- On late maturing varieties Nabal, Taylor, and Choquette, a fall application of fungicide is recommended.
Anthracnose (black spot)
Anthracnose (black spot)
Cercospora spot/blotch

- *Pseudocercospora purpurea* (Cook) Deighton
- spots angular in shape 1/16 inch diameter brown to chocolate indistinct, scattered often coalesce to patches. Grayish spore bearing tufts on either surface during moist conditions
- On fruit spots are 1/4 of inch or less in diameter irregular shape and slightly sunken. The surface sometimes becomes cracked or fissured. The disease is carried over on old leaf infections and can get more severe if no control measures are taken
**Cercospora spot/blotch**

- Critical infection periods May-July, but can go to September. Damage is limited to the rind, but as the rind cracks other invaders move in.
- Controlled readily by timely applications of copper or azoxystrobin sprays. Cover both foliage and fruit.
- Application in early May and June gives effective control on varieties maturing in summer and fall.
- Recommend a third application in mid July for winter maturing varieties.
Cercospora spot/blotch
Avocado scab

- *Sphaceloma perseae* Jenk. is carried over one season to the next on leaf and stem lesions.
- When moisture and temperature are favorable, the fungus readily infects young succulent tissues of avocado leaves, twigs, fruits, forming the characteristic scab lesions in which spores are produced.
- These spores are spread by wind, rain, dew, and most likely insects.
Avocado scab

- Young leaves are susceptible, but become resistant once they mature and the tissues become more hardened.
- Fruits are extremely susceptible just after the petals fall and become more resistant as they develop.
- Individual spots on leaves are purplish to dark brown, fading to grayish brown with age. They are visible on both surfaces and often the center weathers away to leave small irregular holes.
- Infection on the underside of leaf are confined mainly to the midrib and veins.
Avocado scab

• On fruits the spots are at first raised, circular to oval and dark brown to purplish brown. They are scattered, but many coalesce to form irregular extended areas that often cover the entire fruit surface.

• Eating quality is not impacted, but under severe infection the fruit is very unattractive. Varieties vary in susceptibility to scab.

• Lula is the most susceptible commercial variety. Fuschsia, Pollock, Booth 1 and Waldin are quite resistant.
Avocado scab

• Copper fungicides seem to give good control. The *Pseudocercospora* spray program works for scab, but if you’re growing Lula it requires 3 additional sprays.

• Folpet is also labeled for avocado

• Timed as follows: just as the bloom bud opens (late Jan), near the end of the main bloom period (mid Feb-March), and 3-4 weeks after all the fruit have set in a normal season.
Avocado scab
Powdery mildew

- Oidium spp. frequently occur on avocado foliage. It can become serious on untreated trees if favorable conditions persist.
- Infections on young leaves appear as dark green areas with a powdery, white, spore-bearing growth on the undersides. Underside of infected areas on mature leaves is generally purplish brown and covered with white powdery growth. Upper side of leaves have yellowish green areas.
- Sulfur fungicides
Powdery mildew
Additional information

• Pesticides labeled for Avocado
  — http://crane.ifas.ufl.edu

• Florida Extension Plant Diagnostic Clinic
  — http://treeclinic.ifas.ufl.edu

• Additional Pesticide info can be found at CDMS
  — http://www.cdms.net/manuf/manuf.asp
Production Efficiency

Site Selection for Avocado Groves
• Soils
• Elevation
  — Surface water
  — Ground water
• Bedding and mounding
• Row orientation
• Wind breaks
### Soil characteristics

<table>
<thead>
<tr>
<th>Krome</th>
<th>Chekika</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 0-7 inches very gravelly loam</td>
<td>• 0-5 inches very gravelly loam</td>
</tr>
<tr>
<td>• 7+ inches weathered bedrock</td>
<td>• 5+ inches weathered bedrock</td>
</tr>
<tr>
<td>• 15-20% clay at 0-7 inches</td>
<td>• 15-20% clay at 0-5 inches</td>
</tr>
<tr>
<td>• Permeability (drainage fast)</td>
<td>• Permeability (drainage fast)</td>
</tr>
<tr>
<td>— 0-7 inches, 0.6-2.0 in/hr</td>
<td>— 0-5 inches, 0.6-2.0 in/hr</td>
</tr>
<tr>
<td>— 7+ inches, 2.0-20 in/hr</td>
<td>— 5+ inches, 2.0-20 in/hr</td>
</tr>
<tr>
<td>• Water holding capacity</td>
<td>• Water holding capacity</td>
</tr>
<tr>
<td>— 0.08-0.12 inches/inch</td>
<td>— 0.08-0.12 inches/inch</td>
</tr>
<tr>
<td>• Soil pH, 7.4-8.4</td>
<td>• Soil pH, 7.4-8.4</td>
</tr>
<tr>
<td>• 3-10% organic matter</td>
<td>• 3-10% organic matter</td>
</tr>
<tr>
<td>• On average the water table is at 40-60 inches below the soil surface.</td>
<td>• On average the water table is at 12-36 inches below the soil surface.</td>
</tr>
<tr>
<td></td>
<td>• Generally found in lower elevation areas (west and south).</td>
</tr>
</tbody>
</table>
Soils and elevation

• In our area the surface and ground water are one in the same (i.e., connected).

• Drainage depends upon depth to water table and varies with management and rainfall.

• Permeability is generally good if the water table is lowered.

• Recommendations:
  — Plant in areas with elevations 7 ft and above; higher is better.
  — Avocado groves already subjected to flooding and tree damage/death should be avoided or strongly considered for planting another crop (e.g., mango, guava) or other use.
• In general avocado trees are intolerant of excessively wet or flooded soil conditions.

• Presence of *Phytophthora cinnamomi* (root rot) in conjunction with wet soil conditions causes a rapid decline/death of the trees.

• Symptoms include:
  - Leaf and stem wilting
  - Leaf curling, drying, browning (death)
  - Leaf drop
  - Fruit shriveling and drop
  - Tree dieback to tree death
  - Declining trees may put out repeated weak new shoots and leaves and continue to slowly dieback.
Rockland soil profile and preparation for commercial tropical fruit groves

Soil surface

Plow layer 4”-8”

Trench layer 16”-24”

Tree roots are found in the plow and trench layers

Oolitic limestone bedrock

* Some trenches are deeper than 24 inches.
Rockland soil profile for commercial tropical fruit groves during flooding

Soil surface

Plow layer

Flooding to soil surface

4”-8”

Flooding within the soil profile

16”-24”

Trench layer

Potential excessive soil saturation by capillary movement of water from below
Recommendations for slightly low areas

- Fill in with native rock material (if economically feasible).
- Form 3 to 5 ft high beds and 6 ft wide.
- Form individual mounds of 3 to 5 ft high and 6 ft in diameter.
Row orientation

• In general, north-south rows are advantageous for maximum light exposure.

• However, if the property is longer in the east-west dimension then rows should be in an east-west direction for maximum efficiency in grove operations.
Wind breaks

Positives

- Affords some wind protection to trees (especially young trees).
- There may be some early tree growth response.

Negatives

- Takes up land area.
- Roots may be invasive and compete with avocado trees for nutrients and water.
- Wind break trees will compete for light with avocado trees adjacent to them.
- Trees may topple into the avocado grove causing additional storm damage to trees and the irrigation system.
Summary

• The most important site selection consideration is land elevation – higher is better. Lowlands <7 ft should be avoided if possible.

• Bedding or mounding may improve plant survival in some slightly marginal areas, i.e., only slightly low.

• North-south row orientation is best.

• Temporary wind breaks may be of some benefit for young tree growth.
Production Efficiency

Avocado Cultivar Selection
Considerations

- Production (yield)
- Flower type (A or B)
- Season
- Fruit quality
  - Size
  - Shape
  - Eating characteristics
  - Storage life
  - Shipping characteristics
- Disease resistance
- Marketability
Common Fruit Shapes

- Oblique
- Oval, Ellipsoid, Oblong
- Spherical, Round
- Obovate
- Pyriform, Pear
- Long pyriform, pear

*Source: Descriptors for Avocado (Persea spp.). 1995. International Plant Genetic Resources Institute, Rome, Italy. ISBN 92-9043-220-9*
## Suggested early season cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield¹</th>
<th>Flower type</th>
<th>Size²/ rating</th>
<th>Shape</th>
<th>EC³</th>
<th>Disease rating C/S⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dupuis</td>
<td>L-M</td>
<td>A</td>
<td>M-L/ good</td>
<td>Attractive, obovate</td>
<td>E</td>
<td>R/R</td>
</tr>
<tr>
<td>Simmonds</td>
<td>H</td>
<td>A</td>
<td>M-L/ good</td>
<td>Attractive, obovate to slightly pyriform</td>
<td>G-E</td>
<td>R/R</td>
</tr>
<tr>
<td>Donnie</td>
<td>M-H</td>
<td>A</td>
<td>L/ good</td>
<td>Attractive, oval to obovate</td>
<td>G</td>
<td>R/R</td>
</tr>
<tr>
<td>Bernecker</td>
<td>H-VH</td>
<td>A</td>
<td>M-L/ good</td>
<td>Attractive, oval to obovate</td>
<td>G-E</td>
<td>R/R</td>
</tr>
</tbody>
</table>

1. Yield: L, low; M, moderate; H, high; VH, very high.
2. Size: S, small; M, medium; L, large; VL, very large.
3. EC, eating characteristics; E, excellent; G, good; F, fair.
4. Cercospera/scab resistance; R, resistant; S, susceptible; MS, moderately susceptible.
## Suggested early season cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield$^1$</th>
<th>Flower type</th>
<th>Size$^2$/rating</th>
<th>Shape</th>
<th>EC$^3$</th>
<th>Disease rating C/S$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miguel</td>
<td>VH</td>
<td>B</td>
<td>M-L/good</td>
<td>Attractive, oval to obovate</td>
<td>G-E</td>
<td>MS/R</td>
</tr>
<tr>
<td>Nesbitt</td>
<td>H</td>
<td>A</td>
<td>M-L/good</td>
<td>Attractive, obovate to slightly pyriform</td>
<td>G</td>
<td>R/R</td>
</tr>
</tbody>
</table>

1. Yield: L, low; M, moderate; H, high; VH, very high.
2. Size: S, small; M, medium; L, large; VL, very large.
3. EC, eating characteristics; E, excellent; G, good; F, fair.
4. Cercospera/scab resistance; R, resistant; S, susceptible; MS, moderately susceptible.
### Suggested mid-season cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Flower type</th>
<th>Size&lt;sup&gt;2&lt;/sup&gt;/rating</th>
<th>Shape</th>
<th>EC&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Disease rating C/S&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>VH</td>
<td>B</td>
<td>M-L</td>
<td>Attractive, oval to obovate</td>
<td>G</td>
<td>R/R</td>
</tr>
<tr>
<td>Melendez&lt;sup&gt;5&lt;/sup&gt;</td>
<td>H</td>
<td>B</td>
<td>L</td>
<td>Attractive, oblong to pyriform</td>
<td>E</td>
<td>?/R</td>
</tr>
<tr>
<td>Semil 34&lt;sup&gt;5&lt;/sup&gt;</td>
<td>H</td>
<td>A</td>
<td>M</td>
<td>Attractive, slightly pyriform</td>
<td>G-E</td>
<td>?/R</td>
</tr>
<tr>
<td>Semil 43&lt;sup&gt;5&lt;/sup&gt;</td>
<td>H</td>
<td>B</td>
<td>M</td>
<td>Attractive, oblong</td>
<td>G-E</td>
<td>?/R</td>
</tr>
</tbody>
</table>

1. Yield: L, low; M, moderate; H, high; VH, very high.
2. Size: S, small; M, medium; L, large; VL, very large.
3. EC, eating characteristics; E, excellent; G, good; F, fair.
4. Cercospera/scab resistance; R, resistant; S, susceptible; MS, moderately susceptible.
5. No commercial experience in Florida.
<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Flower type</th>
<th>Size&lt;sup&gt;2&lt;/sup&gt;/ rating</th>
<th>Shape</th>
<th>EC&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Disease rating C/S&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monroe</td>
<td>H</td>
<td>B</td>
<td>L/good</td>
<td>Attractive, oval</td>
<td>E</td>
<td>S/MR</td>
</tr>
<tr>
<td>Choquette</td>
<td>M-H</td>
<td>A</td>
<td>L/good</td>
<td>Attractive, oval</td>
<td>G-E</td>
<td>S/MR</td>
</tr>
</tbody>
</table>

1, Yield: L, low; M, moderate; H, high; VH, very high.  
2, Size: S, small; M, medium; L, large; VL, very large.  
3, EC, eating characteristics; E, excellent; G, good; F, fair.  
4, Cercospera/scab resistance; R, resistant; S, susceptible; MS, moderately susceptible.
## Suggested niche market cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield¹</th>
<th>Flower type</th>
<th>Size²/ rating</th>
<th>Shape</th>
<th>EC³</th>
<th>Disease rating C/S⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell</td>
<td>H</td>
<td>A</td>
<td>L/ good</td>
<td>Curiosity, elongated pyriform</td>
<td>G</td>
<td>R/R</td>
</tr>
<tr>
<td>Catalina</td>
<td>L-M</td>
<td>A</td>
<td>L/ good</td>
<td>Attractive, obovate to pyriform</td>
<td>E</td>
<td>R/R</td>
</tr>
<tr>
<td>Kampong⁵</td>
<td>M-H</td>
<td>B</td>
<td>M-L</td>
<td>Attractive, round</td>
<td>E</td>
<td>R?/R?</td>
</tr>
</tbody>
</table>

1. Yield: L, low; M, moderate; H, high; VH, very high.
2. Size: S, small; M, medium; L, large; VL, very large.
3. EC, eating characteristics; E, excellent; G, good; F, fair.
4. Cercospera/scab resistance; R, resistant; S, susceptible; MS, moderately susceptible.
5. No commercial experience.
### Potential very late season cultivars – untested commercially and may not be available

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Yield$^1$</th>
<th>Flower type</th>
<th>Size$^2$/rating</th>
<th>Shape</th>
<th>EC$^3$</th>
<th>Disease rating C/S$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa$^5$ (patented)</td>
<td>L-M?</td>
<td>A</td>
<td>M-L</td>
<td>Attractive, ovate to obovate</td>
<td>E</td>
<td>R/R</td>
</tr>
<tr>
<td>April$^5$ (patented)</td>
<td>H</td>
<td>B</td>
<td>M-L</td>
<td>Attractive, obovate</td>
<td>E</td>
<td>R/R</td>
</tr>
</tbody>
</table>

1. Yield: L, low; M, moderate; H, high; VH, very high.
2. Size: S, small; M, medium; L, large; VL, very large.
3. EC, eating characteristics; E, excellent; G, good; F, fair.
4. Cercospera/scab resistance; R, resistant; S, susceptible; MS, moderately susceptible.
5. No commercial experience.
Early-season cultivars

‘Dupuis’

‘Simmonds’

‘Donnie’

‘Bernecker’
Early-season cultivars

‘Miguel’

‘Nesbitt’
Mid-season cultivars

- ‘Beta’
- ‘Melendez’
- ‘Semil 34’
- ‘Semil 43’
Late-season cultivars

‘Monroe’

‘Choquette’
Niche market avocados

‘Catalina’

15 cm

‘Russell’

15 cm
Potential cultivars

‘April’
Flowering types and pollination: “A” and “B” type avocados – complementary, synchronous dichogamy

- Individual avocado flowers open twice over a 2 day period – first functionally as female and second as functionally male.
- Each avocado cultivar or seedling displays a consistent pattern to their sequence of female and male opening.
- Avocados are insect pollinated (bees, flies).
- Cool temperatures can result in overlapping of female/male opening.
- Cool nights with warm, overcast days may result in overlapping.
- High temperatures may reduce the length of the flowering cycle.
- Some evidence that under certain environmental conditions (warm subtropical) some cultivars (WI types) are wind pollinated.
Pollination continued

- Generally complimentary flower types are inter-planted to “improve” fruit set and crop yields.
- ‘Dupuis’ (A) – has been observed that yields improve when planted with ‘Hardee’, ‘Beta’, and ‘Miguel’ as B-type pollinators.
- Fruit set may be influenced by:
  1. Insect pressure, e.g., mirids.
  2. Disease pressure, e.g., powdery mildew.
  3. Drought/dry windy conditions during bloom and fruit set.
  4. Cool/cold weather during bloom and fruit set and early fruit development.
Advantages of early season cultivars

• Historically higher prices.
• Lower maintenance costs (fewer sprays).
• Usually avoids hurricane season.
• Good disease resistance.
• Tree size control optimum. May be topped and hedged early and will bloom the following spring.
Advantages of mid- and late season cultivars

• Continuous Florida fruit in the market.
• Good quality Florida avocados.
• Potential for very early spring (very late cultivars) Florida fruit in the market – higher prices.
Disadvantages of mid- and late season cultivars

• More fungicide applications and higher fungicide costs.
• Potential loss of fruit due to tropical storms or hurricanes.
• Potential cold/freezing damage.
• Historically prices are lower.
• Tree size management may be more difficult.
Advantages of niche market cultivars

- Good to high quality cultivars.
- Usually command higher prices than common cultivars.
- Potentially less competition.
- Potential good prices for very late (March/April) avocados.
Disadvantages of niche market cultivars

- Potentially moderate to low yields.
- Must find and maintain specialty markets.
- Potential for over planting with subsequent reduction in prices.
Summary

• Florida grows numerous cultivars of avocado.
  — However, quality varies among them.
  — Perhaps 1 more mid-season and a few improved late and very late (or very early) season types may be advantageous to the industry.

• Florida is known for its large avocados and this identity should be maintained to differentiate Florida from the ‘Hass’ market.
Production Efficiency

Plant Spacing
and Tree Size Control
### Factors to consider with plant spacing

<table>
<thead>
<tr>
<th>Established groves</th>
<th>Proposed groves</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Climate</td>
<td>• Climate</td>
</tr>
<tr>
<td>• Current irrigation system set-up</td>
<td>• Proposed irrigation infrastructure/layout</td>
</tr>
<tr>
<td>• Cultivar growth habit and vigor</td>
<td>• Cultivar growth habit and vigor</td>
</tr>
<tr>
<td>• Size of equipment and ease of movement</td>
<td>• Size of equipment</td>
</tr>
<tr>
<td>• Mechanical and/or hand pruning program</td>
<td>• Proposed mechanical and/or hand pruning program</td>
</tr>
<tr>
<td>• Ultimate tree size desired</td>
<td>• Ultimate tree size desired</td>
</tr>
<tr>
<td>• Life expectancy of the grove</td>
<td>• Life expectancy of the grove</td>
</tr>
<tr>
<td>• Effect on light exposure</td>
<td>• Effect on light exposure</td>
</tr>
</tbody>
</table>
Climate and plant spacing

• In south Florida’s humid, subtropical climate of relatively warm to hot temperatures and abundant rainfall from April through October avocado trees have 2 to 3 potential vegetative flushes:
  — After flowering
  — During the summer (summer flush)
  — After pruning

• Thus there is potential for a substantial increase in the canopy size each year.
Climate and plant spacing

- During the late fall/winter tree growth slows or stops thus reducing the chances for fall/winter flushing. Similarly, dry soil conditions (usually fall/winter/early spring) also limits tree growth.

- Potential freezing conditions occur from Nov. through Feb. therefore tree size control is important for cold protection practices with high volume irrigation.

- From June through November we have the potential for tropical storms and/or hurricanes thus a potential for tree damage, toppling, and uprooting; therefore tree spacing and its effect on tree size and canopy management are critical to minimize the effect of high winds.
Established avocado grove

- With an established high volume overhead or under tree irrigation system close plant spacing may interfere with the wetting pattern and negatively affect cold protection practices.

- The irrigation system may need to be modified to accommodate the desired spacing; thus adding cost to using the system.

- Plant spacing may affect the irrigation rate and frequency necessary for optimum fruit production.
Re-established grove*

The established irrigation system may
- restrict or dictate the plant spacing options.
- interfere with movement of equipment.
- need to be modified to accommodate the desired spacing; thus adding cost to using the system.
- result in utilizing an undesirable plant spacing and result in excessive tree competition and tree pruning.

*The grove was planted to a different fruit crop previously.

Proposed new groves

- Opportunity to design the irrigation system to the spacing desired.
- For cold protection the high volume system should be designed to completely cover (with overlap) the grove.
- For irrigation and fertigation a low volume system may be designed to reduce energy costs and improve irrigation efficiency.
**Cultivar growth habit and vigor**

**Upright vigorous growth habit**
- ‘Lula’ (not recommended for planting)

**Moderately upright**
- ‘Dupuis’
- ‘Monroe’

**Spreading growth habit**
- ‘Bernecker’
- ‘Beta’
- ‘Catalina’
- ‘Choquette’
- ‘Donnie’
- ‘Simmonds’
- ‘Marcus’
- ‘Melendez’?
- ‘Miguel’
- ‘Nesbitt’
- ‘Russell’
- ‘Semil 34’?
- ‘Semil 43’?
Effect of light exposure - photosynthesis

Adequate light is required for

• Maintenance and retaining lower productive tree canopy.

• Flower production, fruit set and fruit development.

• Stimulating new shoots and fruited wood within the lower areas of the tree.
Plant spacing in Florida

• A general rule of thumb is that the tree height should not be allowed to be more than 2 times the drive middle spacing. For example:
  – for an 8 ft drive middle the tree height should not exceed 16 ft.
  – For a 6 ft drive middle the tree height should not exceed 12 ft.

• Range in plant spacing: 15 to 25 ft in-row; 24 to 25 ft between-row.

• Recommended: 20 to 25 ft in-row and 25 ft between rows.
### Plant spacing and tree density in Florida

<table>
<thead>
<tr>
<th>In-row spacing (ft)</th>
<th>Between-row spacing (ft)</th>
<th>No. trees per acre</th>
</tr>
</thead>
<tbody>
<tr>
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<td>15</td>
<td>25</td>
<td>116</td>
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</tbody>
</table>
## Close plant spacing

### Advantages
- More efficient light interception on a per acre basis and higher production per acre during the first 5-6 years or more.
- More efficient use of fertilizers, pesticides, and irrigation which is based on a per acre basis.
- Faster canopy closure and reduced weed pressure.
- After a hurricane, potentially more trees remaining.
- Potential faster return on investment.

### Disadvantages
- Increased cost of trees (more trees), auguring, and microsprinklers.
- Earlier and increased competition for light, nutrients, and water among plants.
- Potentially tree size management more critical and difficult, must start earlier, and potential for higher cost.
# Moderate to wide spacing

## Advantages
- Decreased cost of trees (fewer trees), augering, and microsprinklers.
- Less competition for light, nutrients, and water among plants.
- Tree size management less critical and less difficult (up to a point), and may be delayed slightly.

## Disadvantages
- Less efficient light interception on a per acre basis and lower production per acre during the first 5-6 years.
- Less efficient use of fertilizers, pesticides, and irrigation which is based on a per acre basis.
- Slower canopy closure and more prolonged weed pressure.
- Potential slower return on investment.
Avocado growth habit

- Architecturally avocado is a polyaxial species with a synchronous growth pattern characterized by alternating root and shoot growth and vegetative and reproductive growth separated in time.

- Fruit generally held on the outer 3-5 ft of canopy.
Tree training and tree size control

• Training of young trees is not common but is important; especially in close spacing's. Heading back to force lateral development and removal of misplaced and V-crotched limbs will reduce problems later.

• Trees size control may be by hand pruning and/or mechanical machinery (more common).

• Suggested tree size (14 to 16 ft) varies with environment, plant spacing, available technology, frequency of hurricanes, and cultivar growth habit and harvest season

• Reasons for tree size control – maintain light levels and lower productive canopy, improve crop production by increasing the number of shoots, increase air movement through the canopy and therefore reduce disease incidence, facilitate grove traffic, and reduce the potential for hurricane damage.
In general, the warmer the climate the more vigorous the tree growth.

In general, for terminally bearing species, pruning of large diameter stems/wood results in excessive and continuous vegetative flushing.

The wider the spacing the longer it takes to require regular pruning. The closer the plant spacing the earlier a pruning program is required and the more frequently trees are pruned.

In general, designing a pruning program for closely spaced trees is more difficult than more moderately spaced trees because of the amount of wood necessary to remove during the pruning process.

In general, designing a pruning program for cultivars with a vigorous, upright growth habit is more difficult than for less vigorous, spreading growth habit cultivars.

Recommendation for Florida, top trees to 14-16 ft and maintain a 6-8 ft middle.

Recommendation for Florida, hedge trees at a 5 to 10 degree angle (wider at the bottom).
There is sufficient time for early season cultivars pruned immediately after harvest to mature the vegetative flushing after pruning than mid- and late season cultivars.

Recommendation is cultivar dependent: prune early season cultivars immediately after harvest (some mid season cultivars too) and for mid- and late season cultivars design a program of periodic pruning, e.g., every third row canopy side every third year, top every third year.

Selective pruning to thin-out inner canopy limbs will increase light penetration, help maintain the lower productive canopy, may re-establish production on the inside lower areas of the tree, and improve air movement to reduce fruit/leaf disease problems.
Advantages to tree size control and maintenance

• Maintained and/or increased light levels along the entire canopy.
• Increased and/or maintained light exposure to the lower and inner tree canopy.
• Improved foliar spray penetration.
• Increased disease control.
• Decreased wind resistance and potential damage from strong winds.
• Improved high volume irrigation cold protection.
• Increased ease and efficiency of harvest.
Hedging angle and topping options

5° 0°

Roof top

Flat top
Hedging angle and topping options
Selective pruning

- Selectively remove secondary limbs back to their origin to limit tree height and spread.
- Open up the inner canopy to maintain or increase light penetration within the canopy.
- Again, the idea is to slightly taper the canopy to increase light levels and maintain a lower and inner canopy.
• Maintenance of the lower tree canopy depends upon tree height, the light intensity that reaches the lower canopy, number of hours of light exposure per day, and number of days of light exposure.
Selective pruning and rejuvenation of the inner and lower canopy

Rejuvenation of inner/lower canopy

- Purpose: to re-establish fruit production through re-establishing a “new” lower canopy and smaller tree.

- Entails severe cutting back to major limbs (hatracking) or to a stump with or without “nurse” limb.

- Crop production begins in 2-4 years depending upon cultivar. However, with nurse limb some production is maintained.
Hurricanes and avocado tree size

• A survey post Hurricane Andrew of 5 groves:
  — 2 to 80 acres in size
  — 10 to 46 years old
  — 15 to 25 ft in height prior to the storm

Found
• 87% of the trees survived
  — 10% toppled
  — 10% stumped
  — 67% standing
• 13% of the trees destroyed
• The percentage of standing trees increased with tree age but decreased with tree height.
Rejuvenating non-productive avocado groves

A 4 year avocado rejuvenation research project:

- 34-year-old ‘Lula’ and ‘Booth 8’ trees
- ‘Lula’ >40 ft tall; ‘Booth 8’ >25 ft tall
- 20 ft x 20 ft spacing
- Lower 1/3 to 2/3 canopy lost
- <1 bu/tree yield (~108 bu/A)
- ‘Booth 8’ - Topped at 9’ (12’+TR), 16’+TR, 22’+TR, and 22’ (TR=every other tree removed). Trt applied March.

<table>
<thead>
<tr>
<th>Trt*</th>
<th>Yield yr 2 (bu/A)</th>
<th>Yield yr 3 (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9’</td>
<td>0</td>
<td>130</td>
</tr>
<tr>
<td>12’+TR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16’ +TR</td>
<td>140</td>
<td>329</td>
</tr>
<tr>
<td>22’+TR</td>
<td>178</td>
<td>286</td>
</tr>
<tr>
<td>22’</td>
<td>119</td>
<td>130</td>
</tr>
</tbody>
</table>

*, Crop production resumes 18 months after pruning.
Rejuvenating non-productive avocado groves

‘Lula’ - Topped at 9’ (12’, 14’+TR), 11’ (16’+TR), 22’+TR, and 22’ (TR=every other tree removed). Trt applied March.

<table>
<thead>
<tr>
<th>Trt*</th>
<th>Yield yr 3 (bu/A)</th>
<th>Yield yr 4 (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9’ (12, 14’+TR)</td>
<td>0</td>
<td>43</td>
</tr>
<tr>
<td>11’ (16’+TR)</td>
<td>0</td>
<td>86</td>
</tr>
<tr>
<td>22’ (22’+TR)</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td>22’</td>
<td>0</td>
<td>108</td>
</tr>
</tbody>
</table>

*, Crop production resumes on the 4th year after treatments.

• Economic analysis for ‘Booth 8’ found
  — Highest positive returns from 16’+TR and 22’+TR.

• Economic analysis for ‘Lula’ found
  — Highest positive return from 22’ trt only.
Avocado crop production in Florida

- Young trees begin to produce on a commercial scale after 3 to 4 years.
- Historically, the recent industry average (all reported groves) has been ~200 bu/A or 110 lbs per tree. The range has been less than 55 lbs to close to 400 lbs per tree (~90 bu/A up to ~600 bu/A).
- Yields from mature trees should average 110-165 lbs per tree however, 275-385 lbs per tree are possible.
- There is a biannual cycle of higher and lower (“on” and “off”) production years in Florida.
Summary

- Plant spacing has a profound affect on tree size management strategies and potential crop yields.
- Tree size management is necessary to maintain and/or improve crop production, improve the efficiency of foliar spray applications and fruit harvest, and reduce potential damage from high winds.
- Tree size management may be done mechanically and/or by hand.
- Rejuvenating non-productive groves should be conducted in stages and take into consideration the ultimate tree size management strategy to maintain production.
Production Efficiency

Quality Management for Florida Avocados
• **GOAL**: To minimize postharvest losses by retarding senescence and decay

• Two Types of Postharvest Losses:
  — Total: out of grade (obvious losses)
    • Caused by decay, bruising, abrasion
  — Partial: salable but at a lower grade
    • Accelerated ripening/softening due to poor temperature management
Postharvest Physiology

• Avocado shelf-life (postharvest life) is affected by:
  — Respiratory activity
  — Ethylene production
  — Chilling sensitivity
  — Texture
  — Moisture loss susceptibility
  — Decay susceptibility
Respiration & Perishability

- Actively growing crops (leafy, stem, floral, immature fruit) have high metabolism
  - Very little stored energy reserves
  - Short postharvest life
- Mature crops (fruits, roots, tubers) have lower metabolism
  - Have more starch, sugar or acid reserves
  - Longer postharvest life
Avocado respiratory activity & perishability
Temperature Effects:

- **Respiration** – decreases by 1/2 to 2/3 and postharvest life increases by 2- to 3-fold *for each 18°F of cooling*

- **Ripening** – optimal at 68-75°F; lower temperatures extend postharvest life

- **Chilling injury** – Avocados are injured when stored below 54°F, depending on variety
Two primary tactics:

- Minimize mechanical injuries
- Employ Proper temperature management
Types of Mechanical Injury

• Bruises
  – Impact: Drops
  – Compression: Excessive weight

• Cuts, Punctures, Abrasion
Harvest Operations

• Picking

• Field container

• Transport method
Packing Operations

Suggested floor plan of packinghouse.

- Packing Line
  - Wash
  - Rinse
  - Sort
  - Dry
  - Packing Area

- Unload

- Cold Room
  - F.A. Cooler
  - Unloading

- Bin/Pallet Storage Area

- Room Loading

- Trailer
  - Loading Unloading

- Storage

- Trailer

- Trailer

- Trailer

- Trailer
Packing & Shipping Operations

• Transfer to packing line
  — Dry vs. wet
• Minimize drop heights
  — (e.g., < 10 cm for tomato)
• Adding wax reduces abrasions, water loss
• Shipping container
• Palletizing
• There is an optimum postharvest temperature for every product
  – Optimum temperature = Lowest safe temperature to minimize metabolism

• The ideal postharvest temperature often depends on the geographical origin of the crop

• There is also an optimum ripening temperature for fruits for best quality
Temperature Management

Cool it Fast & Keep it Cool!

• Precooling: lowering the temperature as quickly after harvest as possible
  — Slows respiration and metabolism
  — Retains higher nutrient levels
  — Slows water loss
  — Inhibits microbial growth
  • Reduces decay
  • Minimizes food safety problems
Cooling and Storage

• Precooling (Rapid Cooling) within a few hours of harvest (7/8 Cooling)

• Cooling method

• Cool effectively
Chilling Injury

• Three factors:

  1) Sensitivity of the crop
     • Most sensitive (13-15°C): e.g., banana, pineapple, sweetpotato
     • Moderately sensitive (8-12°C): e.g., avocado, grapefruit, cucumber, peppers
     • Less sensitive (4-7°C): e.g., oranges, tangerines, beans, muskmelons

  2) Exposure temperature

  3) Exposure time
Postharvest Treatments

• Promotion of Uniform Ripening
  — Ethylene Treatment

• Retarding Ripening by Ethylene Inhibition
  — Controlled Atmosphere Storage
  — Modified Atmosphere Shipping & Packaging
  — SmartFresh (1-MCP)
Postharvest Treatments

Fruit firmness (N) of ‘Simmonds’ avocado fruit stored at 68°F following SmartFresh treatment (450 parts per billion, 68°F for 24 hours). (Huber et al., 2003)
Food Safety Program

- Begins in the grove and continues through packing and shipping
Sanitation’s Importance

• Pathogens can be transmitted by direct contact (infected employee or animal) or through contaminated water or soil.

• Once infested, pathogens are difficult or impossible to remove from a fruit by any means other than cooking.
• Anytime water comes in contact with fresh produce, it has the potential to be a carrier of a number of types of microorganisms.
Recognize and Eliminate Sources of Contamination

- In the field
- At harvest
- During cooling and refrigerated storage
- During handling and shipping
Field Hazards

Field Hazards include contact with:
- Water
- Soil
- Fertilizers
- Animals, birds, and insects
- Workers
- Harvesting Equipment
Worker Hygiene

- An infected employee (showing symptoms or not) can easily contaminate fresh produce if he/she doesn’t wash his/her hands after sneezing or using the restroom.
- Proper hygiene procedures should be established and included in hygiene and health training programs.
- Toilets and hand-washing stations must be available and accessible.
Handling Hazards

• Cooling and storage facilities should always be maintained in a clean condition.
  – Water sanitation
  – Facility sanitation
  – Animal exclusion (wild & domestic)
  – Employee sanitation practices
Sanitation During Handling: Accumulated Pathogens

• Microbes survive and grow on surfaces that remain wet
• Contact of plant material with surfaces:
  – waxes and plant sap accumulate
• Partially decayed plant material:
  – sticks to surfaces
  – is loaded with microbes
Biofilms

- Sticky to slimy accumulations of fungi and bacteria that accumulate on wet surfaces
- Plant residues + moisture + microbes + warm temperatures = biofilms
- Sanitizers will prevent their formation, BUT do not penetrate existing biofilms
  - Therefore, surfaces must be regularly cleaned
Sanitation Procedures

- Sanitize facilities & equipment regularly
  - Quaternary compounds; rinse with water
  - **Daily**: Clean floors; drains; break rooms/bathrooms (particularly areas that remain wet)
  - **Monthly or between loads**: Cold room - floors, walls, ceilings, refrigeration coils, doors; and curtains
Sanitation in the Packinghouse

• Discard fruits and vegetables that fall on the floor
• No animals in packinghouse (domestic or otherwise)
• Prepare cartons only as needed
• Remove fruit and vegetable culls and debris promptly
• Provide restrooms and hand-washing stations
• Maintain sanitation records
Where Do I Want to Be?

Marketing Opportunities
Marketing Opportunities

Ways to increase returns include:

- **Direct marketing** - become popular among small producers due to advances in information technologies and consumer concerns about personal health, the environment, and food safety. Direct marketing includes community-supported agriculture (CSA), catalog and Internet sales, and local markets (http://edis.ifas.ufl.edu/FE569).

- **Adding value** - changing a product from its raw form into a form more convenient for consumer consumption. For example, sliced avocados add value to the raw fruit. Other examples of adding value to fruits include jams, wines, barbecue sauces, ice cream, dried fruits, vinegars, and chocolate-dipped fruits.

- **Niche or specialty markets** - profitable for small operations. Large businesses cater mainly to the largest, most profitable market segments and often ignore smaller, specialty market segments, which can command premium prices. Improving quality seems obvious, but it involves improving both the physical appearance of the good and production conditions.
• The market for organic foods and beverages is still growing at a rapid pace and is expected to generate sales of $32.3 billion by 2009. Fresh fruits and vegetables are in top ranks among organic food items purchased.

• Developing the organic market requires an effort by growers, shippers, wholesalers and retailers to educate consumers about the benefits of organic fresh fruits and vegetables. These efforts are costly, but are usually economically beneficial for the industry in the long term.

Photo Source: http://crane.ifas.ufl.edu/av/index.htm
Marketing Opportunities

Farmers’ Markets

- Considerable time investment required
- Require timely harvest of avocados.

Photo Source: http://crane.ifas.ufl.edu/av/index.htm
Marketing Opportunities

• Most successful vendors at farmers’ markets offer a variety of products.

• The USDA’s Agricultural Marketing Services website has a link to contact names, location addresses and hours of operation for farmers’ markets found throughout the state of Florida:
  

• In addition, the Florida Department of Agriculture and Consumer Services’ Bureau of State Farmers’ Markets has links to State Farmers’ Markets, Fairs and Expositions, and Community Farmers’ Markets, as well as how-to publications and research articles
  
  http://www.florida-agriculture.com/markets.htm

• Many South Florida farmers’ markets operate only during the months of November to May. Growers may consider these farmers’ markets for the late varieties, which are usually available during the months of November to February. It is important to contact farmers’ market managers at locations where you consider participating early on, in order to determine hours of operation and arrange for space.
Cooperative Marketing

Possible benefits

• Better price with larger volume of avocados
• Provide member-growers with marketplace bargaining power
• Take greater control of your product
• Find cooperative marketing publications at http://www.rurdev.usda.gov/

Photo source: http://crane.ifas.ufl.edu/av/index.htm
Marketing Opportunities

- Co-op members will need to make a commitment to selling their product through the co-op in order to sustain the overall group effort, and stand to gain a chance for better returns for their crops. A co-op requires skilled financial and time management, and it may be necessary to hire an experienced individual with excellent decision-making skills. The fixed costs associated with operating a farmer’s cooperative may make it infeasible if members’ aggregate production is relatively small.

- You can find information for farmers’ cooperatives by following the link http://palmm.fcla.edu/feol/ to find “Florida Environments Online.” Then use this site’s path finder entitled “Florida Agriculture and Rural Life” to search for the publication “Co-operative agriculture in Florida: a survey of the development of the cooperative ventures in Florida and the United States,” by Doyle Edgar Timmons. The entire publication is available for download and printing purposes.
Pick your own markets

- Advertise with road-side signage, in local newspapers and on the Florida Department of Agriculture and Consumer Service’s web site at http://www.doacs.state.fl.us
- Provide parking, restrooms, and pole-mounted picking aids

Photo source: http://crane.ifas.ufl.edu/av/index.htm
Marketing Opportunities

• A pick-your-own or “U-pick” operation may provide growers with more profits, but it will take considerable management time during the harvest season.

• Close supervision will be required to prevent damage to trees and to assure patrons’ safety. Particular attention should be paid to covering irrigation wells and to controlling insects such as fire ants and wasps.

• You will also need to investigate if you need to carry extra liability insurance (pick-your-own operations are often outside the bounds of regular farm liability insurance).
Marketing Opportunities

Roadside Markets

Location! Location! Location!

Example: http://www.Redlandriot.com
Marketing Opportunities

- Roadside stands or markets are a type of direct marketing system where a grower establishes a selling place near a roadway and sells directly to consumers. Produce sold in a roadside stand may be grown exclusively in the farm or may be purchased from outside sources. The advantage is that you get retail prices and that the revenues are immediate. However, costs are a significant factor. Roadside markets require increased investment in equipment and labor costs associated with running the market. Other significant costs may be the acquisition of a high-traffic location and construction of attractive, but not necessarily fancy, structures and display fixtures. In some cases, it may be feasible to augment produce sales with sales of other food items. For more information on several successful South Dade (Homestead) roadside stands, see: [http://www.Redlandriot.com](http://www.Redlandriot.com) and click on “Burr’s Berry Farm,” “Knaus Berry Farm,” and “Robert Is Here.”
Marketing Opportunities

• A fact sheet by Cooperative Extension Service of Agriculture, Oklahoma State University (OSU Extension Fact, No. 186) outlines the following for a successful roadside market:

  ─ Roadside signs should be placed far enough in advance of the market to attract customers and to provide enough time for them to stop safely at the stand.

  ─ Overripe produce should not be offered for sale unless it is marked and displayed as such.

  ─ If possible, place the stand on or near the farm or orchard to create a farm atmosphere.

  ─ Post prices clearly so all customers are treated fairly and equally.

  ─ Home-grown produce generally increases sales and the percentage of repeated customers, because it has the connotation of being fresher.

  ─ A pleasant personality with strong emphasis on courtesy, honesty and integrity are helpful in dealing with the public.
Marketing Opportunities

Online Marketing

• An individual grower can establish his or her own website
• Growers can sell through established online companies
• Several growers can establish a jointly owned website

Examples of established online companies:
http://www.lycheesonline.com
http://www.avocadonow.com
http://www.thinkavocado.com
Marketing Opportunities

• The Florida Gift Fruit Association ([http://www.fgfsa.com/](http://www.fgfsa.com/)) specializes in shipping Florida-grown citrus products nationally and internationally, and many of their member firms may consider adding avocado fruits to their gift baskets. Most gift fruit marketers are selling their products online, and this way they are able to reach out to a wider customer base.

• The Florida Department of Agriculture and Consumer Services offers promotional assistance, including website development and hosting, promotional materials, demographic consumer information, current research articles, etc. There is also extensive material available concerning the “Fresh from Florida” Florida Agricultural Promotional Campaign, which can be viewed on

Some growers sell their produce online using other companies’ websites. The online company receives the order and passes it down to the grower for packing, shipping and handling. Growers pay for the online service. Packages are usually sent via courier services, such as FedEx, UPS or Airborne to customers.

It is also possible that a grower or a group of growers can set up a website and sell their fruits online. Selling online requires availability of a variety of fruits during each season, or a number of avocado varieties to extend the season over a longer time period. Also, selling online requires that growers ship only the best quality product to command a premium price and justify the relatively high shipping costs. Commitment to the ultimate in product quality will enhance the firm’s reputation and foster repeat sales.
Export Opportunity to Europe

- Euro may strengthen relative to the dollar
- Transportation is readily available
- Europe has large numbers of immigrants from the Caribbean and Latin America that know avocados
- Willingness of Europeans to try new foods

Photo source: http://crane.ifas.ufl.edu/av/index.htm
Marketing Opportunities

Value-added (fresh-cut)

- More convenience
- Larger fruit size better
- Lower fat content for health conscience consumers

Marketing Opportunities

- Food service firms have been utilizing increasing quantities of fresh-cut produce because they offer uniform, prepackaged items that require little preparation labor, reduced injuries to preparation personnel (and reduced Workmen’s Comp claims), and significant reductions in waste disposal costs. The ultimate attraction for consumers who buy fresh-cut produce from food retailers is convenience.

- The bigger fruit size of the Florida-type avocado will yield more fresh-cut portions per fruit in comparison to the smaller Hass variety. Also, the low fat content of Florida avocados at the food service level may have appeal to chefs and customers because it can be positioned as a “healthier” alternative.

- Rapid browning after slicing of avocado fruit for fresh cut has remained an obstacle for fresh-cut processors. This obstacle is now believed to be solved because of two new formulations developed by the Westport, Conn.-based Mantrose-Haeuser Co., Inc., the makers of the NatureSeal® family of products for fresh-cut produce. NatureSeal for Avocados protects fresh-cut avocados from color, flavor and texture changes for up to two weeks. These formulations may be applied as a dip or as a spray.
Marketing Opportunities

Value - added (miscellaneous avocado products)

Health & Beauty Aids
• Therapeutic hand cream
• Soap & shampoo
• Facial cream & body lotion

Photo sources:
http://www.avocado-oil.co.nz/
http://www.pioneerthinking.com/avocadobeauty.html
http://shantimandir.com/poornasamagri/index.php?productID=153&PHPSESSID=d5f413bafa1827ef2e42f90b128c9f7f
Like many other fresh fruits, avocado is considered a perishable product with limited shelf-life. Processing perishable food items into other forms of consumer products is a way to add value and extend shelf life. An important rationale behind the concept of value-added activities in agriculture is to provide consumers with more choices in how they purchase an agriculturally-based product. In doing so, not only is a larger portion of the agricultural product used (less waste), but it is also likely that consumers will buy more of the agriculturally-based product and generate more income for producers.

Reviewing the Internet, one comes across a variety of avocado by-products that have helped the avocado industries in California and other countries, such as New Zealand and Israel, develop niche market opportunities.
Marketing Opportunities

Exotic Varieties (Minor Cultivars)

- Good niche markets for specialty items with ethnic populations
- Many of the ethnic products are becoming popular with mainstream consumers.

Photo source: [http://crane.ifas.ufl.edu/av/index.htm](http://crane.ifas.ufl.edu/av/index.htm)
Marketing Opportunities

Food Service Industry

- Total number of restaurants in Florida about 35,000
- Of the $1.50 billion in produce sales, $1.10 billion occur within 250 miles of Miami.
- In South Florida, food service produce sales are about $1.10 billion.
- There are nearly 26,000 restaurants in the southern region.

http://www.floridasportsman.com/kitchen/051274_