# HOS 5330

# POSTHARVEST TECHNOLOGIES FOR HORTICULTURAL CROPS

# 2008 Florida Postharvest Horticulture Industry Tour

March 10-14



# **CONTENTS**

<u>Visit</u>	<u>Page</u>
Monday (03/10/2008)	
Premier Citrus Growers (Fort Pierce)	1
Tropical Research & Educational Center – TREC (Homestead)	2
Tuesday (03/10/2008)	
Banana Planting	6
'Thai' Guava Planting	7
Kerry's Bromeliad and Orchid Nursery (Homestead)	7
Accursio Vegetables (Homestead)	9
Schnebly Redland's Winery (Homestead)	9
Fresh King, Inc. (Homestead)	11
DiMare Fresh (Florida City)	13
Wednesday (03/12/2008)	
Chestnut Hill Farms and Bounty Fresh Logistics (Miami)	14
Pero Vegetables (Del Ray)	15
J&J Produce (Loxatahasse)	18
Thrusday (03/13/2008)	
Orchid Island Juice Company (Fort Pierce)	19
Egan Citrus Packing (Fort Pierce)	20
Friday (03/14/2008)	
Country Fresh, Inc. (Orlando)	21
Taylor Farms (Orlando)	22
Winn Dixie Warehouse (Orlando)	24
Winn Dixie Supermarket (Orlando)	25

# Premier Citrus Growers (Fort Pierce)

*Premier Citrus Growers* is the largest fruit grower in the State and the 2<sup>nd</sup> largest operation with grapefruit (Ruby red - red flesh, Star ruby - white flesh, Ray ruby - in between. Primary market for grapefruit was Japan for a long time, that always demanded more white grapefruits, but from 1999 on more red grapefruits. For years and years, Japan was the biggest market, but now competition with South Africa is taking some of their share. The company ships 2 million boxes (45 lbs) of fruit per year: 800 to Japan, 700 to Europe, 500 in the US.

They have 9,000 acres, being 50% for processed and 50% for the fresh fruit market. Fruit for processing are harvested mechanically, but still use manual harvesting for the fresh market. Mechanical harvesting is very limited because the utilization of trees is only 85% and hand labor picking is necessary to the other fruit left in the tree. Manual harvesting is done 2 or 3 times, depending on the market and the size that it is demanding. By the time of the visit there were not too much fruit left because the market was very good and they were at the 4<sup>th</sup> harvest.

The harvesters (Figure 1) climb a ladder to the upper stored fruit, put the fruits in a bag and unload them in the bin. They used to have wooden bins but now they have plastic bins (Figure 2). The bins are 9-box capacity, which corresponds to 85 lbs of grapefruits, 90 lbs of oranges or 95 lbs tangerines. Workers cannot pick fruit from the ground when they are for the fresh market – food safety issue. The hydraulic lift (Figure 3) picks the fully loaded bins up and stacks them up on the truck. The fruit are treated with a postharvest drench in the truck if more than 24h from harvest. They have a 4 to 6 weeks shelf-life.



Figure 1. Manual harvesting.



Figure 2. Plastic bin.



Figure 3. Hydraulic lift.

There are 250 trees per hectare and have to live with the diseases. To manage the orchard, their blocks last 10-15 years and then the trees are replaced. The main concerns are diseases, having to deal especially with citrus canker. There is a decontamination spray in the entrance of the farm, prepared with copper and quaternary ammonia, for vehicles, and other for people. Wind breaks were planted to prevent spread, a very fast growing species of Eucalyptus, but it tends to lose its leaves (losing wind break). Now they are trying permission to use cajarana, that has permanent and hairy leaves. If one tree is found with canker, they eradicate the trees 900 feet around. Besides citrus canker, HLB (greening) is another issue. But don't know yet if they can live with it. It's a big question. They are also trying higher density orchards to have quicker repair in case they lose a tree due to disease.

All blocks have to be certified for free of canker. The State gives a 30-day permit for the area (block) to run fruit in the packing. If proved that this area is free of canker, then the certified is valid for the whole season.

They also have USDA inspections in the field and packing. PrimusLabs does other certification. The company is also GlobalGap certified, providing a very safe product to customers. In case of problem, in 10 hours they can trace back to 10 acres area where this product came from. They said that certification and the capability of trace back is a great program that helps the company.

### **Tropical Research & Education Center – TREC** (Homestead)

# http://trec.ifas.ufl.edu/

*Dr. Jonathan Crane*. This station (TREC) began in 1929 with 10 hectares and now they have about 70 ha and 16 faculty members in diverse areas: enthomology, plant pathology, plant physiology, soil sciences and economics. Because diversity of the research center, is easy to have cooperative projects. People from all over the world.

The station has about 45 support staff and a house for visiting scientists and students. There are facilities including labs, faculty offices, and a disease and insect clinic, to where soil or plant samples and sent by growers and diagnosis and recommendations are made by them. There are some tropical fruit collections, including carambola (17 varieties), guava (15 varieties), mango (120 varieties) and a miscellaneous tropical fruit collection used by the nursery industry and also by the faculty. Also have litchi planting – 'Mauritius' is the main variety, avocados, longans, sapodillas, passion fruit and atemoyas. They are close to release 4 new cultivars of GMO papaya from their own breeding program. Are studying GMO Bananas resistant to Panama disease. No longer have citrus due to canker, but only some trees to research.

*Lecture – Tropical Fruit Industry in Florida – Dr. Jonathan Crane.* Tropical fruit is a very small industry, with 5,000 hectares (average farm is 5 hectares), gross sales of \$ 74 million per year, economic impact of \$ 137 mi per year and 800 commercial producers. About 60% of producers limited agricultural background, 65% part-time in agriculture, some novices, 2<sup>nd</sup> and 3<sup>rd</sup> generations, and some entrepreneurs. Multi-ethnic background.

About 90% of the production is from the Miami Dade County. This has been the main tropical fruit growing area for 80 years, but is losing space for condos and homes. The climate is warmer since and they are surrounded by water. The mean temperature is 23C, but goes from - 6C to 37C. Coldest months are December to February. There is a 70% chance to reach freezing temperatures each year, but what usually happen is 1-4 d every 8-12 years. Rainy season goes from May to October with 1650 mm of rain each year.

The main tropical fruit crops and their acreage, season and value are summarized in table 1. Other minor crops are: sapodilla, jackfruit, sugar apple, atemoya, passion fruit – all fresh fruit, pitaya, camito, white sapote, wax jambu, monstera, kumquat, pomelo – problem with diseases, mamoncillo, black sapote. About 80% of all production goes out of the county and 99.9% stays in the USA.

FRUIT CROP	ACREAGE	COMMERCIAL CULTIVARS	SEASON	VALUE (\$ MILLIONS)	COMMENT
Avocado	7,400	61	May – Mar	12-17	Main tropical fruit crop.
Longan	900	1	-	7-10	Longan has a lot of off-season production because they can be forced to flower with potassium chloride.
Litchi	700	2	-	4-10	Litchi (Brewster, Mauritius) acreage has been declining due to unreliable bearing and offshore competition.
Mamey sapote	500	2	Mar – Aug	5-7	
Mango	500	3-4	May – Sep	1.5	
Banana	500	2-3	Year-round	1-2	Problem = Panama disease. Low technology level.
Guava	400	2-3	Aug – Oct Nov – Feb Year-round	2-3+	50% pink for fresh market, 50% white crunchy guava. No processing.
Рарауа	300	2-3	Year-round	1-2	Small industry due to competition. 'Red Lady' from Taiwain is the main variety. Asian market uses it green for salads.
Carambola	180	1	Jun – Mar	8-9	'Arkin' is the main variety. All for fresh market. Acreage has declined because market doesn't buy the excessive production (150-200,000 lbs per hectare).

**Table 1.** Summary of the agricultural situation of the main tropical fruit crops grown in Florida

*Lecture – Vegetable Production in Miami-Dade County – Dr. Teresa Olczyk.* The Miami-Dade county has 2,000 square miles – 50% habitable. There are 2.3 million people now and a projection of a 3-million population by 2025. A lot of new development (houses and condos) had come in the last 5-6 years taking agricultural lands.

Agriculture is very diverse and there are 15,000 direct people employed. Mostly family farms, some of the big nursery family owned, but with commercial focus. The main challenges are hurricanes, flooding, freezes, drought.

Agricultural area is situated between two national parks (Everglades and Biscayne). There is a lot of pressure on agriculture due to environmental restrictions and specific laws. The tropical marine climate allows to have year-round agriculture. But soil is calcium carbonate (Figure 4), the water table is high and the high pH promote nutritional problems. If one dig a trench will find rock and water. They use to dynamite a hole in the soil to plant a tree.

#### Figure 4.





Vegetable production occupies 24,700 acres, decreased from 34,500 in 1997. Main crops are snap beans (15-20,000 acres), summer squash (10-15,000), sweet corn (3-4,000 acres), tomato (3,000 acres), zucchini, sweet potato, okra, peppers, herbs and few others. The county is the #1 in snap bean and summer squash production. 95% is exported out of Florida, all for fresh market – keeping the cold chain. There is a small acreage of specialty vegetables (asian people). Organic production is not easy due to pests.

The bigger impacts nowadays are the foreign workers, pests, the production costs and the fact that agriculture is losing land to urbanization. However, there is a market window for winter veggies, ethnic markets, high-added value products. New trend is the agro-tourism. The industry for ornamentals has 1400 nurseries, 1,200 of them are certified. There are 12,500 acres, including field nurseries, greenhouse production and containers and also some specialty nurseries. The main problem are the new pests – almost 1 new per month – including white fly.

# Tuesday (03/11/2008)

# Banana Planting (Homestead)

A small banana plantation (Figure 5), an ABB variety susceptible to Panama disease. Low level of technology implemented. They are not managing the mats like we see in Central and South America. Cuts the male inflorescences. Irrigation system over the trees is a high volume irrigation system (15 mm / hectare), not also for irrigation but also cold protection, working by mobile diesel pump for each 8 hectares. Remove old leaves, but do not bag the fruit because the market does not pay. Wind damage on the leaves is typical - winds there are 9 mph.

The harvest is based on the size and diameter of the fruit, when the edges become smoother - they have a feel for when to harvest (Figure 6). A brown spot is also indicative of the harvest point. This banana is to be eaten green, they don't use ethylene to promote ripening.



Figure 5. Banana planting.



Figure 6. Harvested bananas.

#### Planting <u>'Thai' Guava</u> (Homestead)

A guava planting with 40 acres but one variety ('Thai'), which is a white guava eaten green, crunchy. Due to the Caribbean fruit fly (guava is a favorite host), they bag each fruit (Figure 7) when they are about a golf ball size because applying pesticides is too expensive. Colder months use black bags and during summer, which is hotter, use white. Generally the black bags (Figure 8) are better and hasten ripening (Figure 9).

The trees are about 4 years old. Use microsprinkler irrigation. The trees are extensively pruned by hand to leave the trees about 1-1.5 m. Plant responds with leaves and flowers. Begin production within 6 months and is year-round (weekly harvest). Production is roughly 16,000 boxes (20 lbs) per year. Market only in US.



*Figure 7. Tree with bagged fruit.* 



Figure 8. Detail of a black bag.



Figure 9. Fruit removed from bag.

# Kerry's Bromeliad and Orchid Nursery

(Homestead)

http://www.kerrys.com/

Bob McMillan is in charge of R&D for the company was our host. Kerry first fell in love with Bromeliads, collecting them in the Americas and hybridizing them. They are now the world's largest mass marketing of orchids, including Holland which is small compared to them. Have two nurseries and need more land but don't have. Have 100 acres in Homestead and 80% is covered. The facility visited (Figure 10) is 10 acres in size and has 150 employees.

Bromeliads are still in natural environment. Most of them are clones, but some still seedlings and they come as finished plants. There is a planting machine for bromeliads. Another machine spaces the plants for the growing tables. Have their own breeding program. They treat the plant with ethylene to promote flowering.

Orchids (Dendrobium) – use coconut to keep moisture and help to keep the seedling on the vase – as a plant support (Figure 11). Use plastic pots for orchids to keep moisture and because the roots are green and need light. Put two plants per pot. Use a moss, pressing it and making a kind of cracker. Put the little plant between the two crackers and it is placed in the tray for shipping.

They use their own food dye and a plastic polymer that absorbs water (Figure 12). They supply in the national market for companies like Wal-Mart, Costco and Home Depot. They use a production scheme created by Toyota Motors – lean production. They use EthylBlock, especially for Dendrobium, reaching up to 6 months shelf-life.

Control panel to keep watching of the production. They import almost everything from China regarding ornaments for the pots.



Figure 10. Part of the facility.



Figure 11. Cocunut support.



Figure 12. Gel used for orchids.



Figure 13. View of the growing area.



Figure 14. Ready-to-go plants.



Figure 15. Containers for shipping.

# Accursio (Homestead)

In 1948 his dad started with tomatoes and bell peppers. In the 1960's, worked with cucurbitaceaes (squash and pickles) and now, bean, squash and pickles. They have 1700 acres of vegetables. Biggest year was 4100 acres in 1992. With NAFTA they lost money 7 years in a row and had to reduce area and costs with irrigation.

From the field, the squash comes on the plastic bins and they go to the hydro cooler. They used to use acid but it was very corrosive and now use chlorine (150 ppm). The produce travels for 20 minutes in the hydro cooler (Figure 16). He is the only grower that pre cool the squash and this is the key for success. Take the squash form the cooler and put it in the cold room (39-40F).

For the pickles cucumber use a serpentine hydrocooler for 9-10 min, which is more efficient because allows more contact with water (Figure 17).



*Figure 16.* Bins with squash coming off the hydro cooler.



Figure 17. View of the serpentine hydro cooler.

Schnebly Redland's Winery (Homestead)

http://www.schneblywinery.com/

Brand new planned building. The ceiling is painted by a local artist showing a local plant. The architecture of the tasting saloon is to remind a 100-year old winery. The tasting bar resembles a tree with the branches holding the glasses (Figure 18). Have an wedding reception area of 500 square feet, built in 14 days, with a wood that is hurricane resistant (category 3). They have pressers for wine that works with up to 6 bars of pressure (high). The farmers pick the fruit in the bins and take to Fresh King (their packing house). The best fruit stay there and the rejected fruit (20-40%) come to the Winery on a wooden bin. These fruit is put inside the presser (Figure 19). There is a big blatter inside that is filled with compressed air. When filled, it pressures the fruit extracting the juice. After the juice, they rotate the machine and reextract the juice (4-5 times), and it goes to plastic container with a bomb. Seeds and skin go off to be used as organic compost.

Measure the sugar level of the extracted juice. A problem of misconception is that a fruit wine will be sweeter than the grape wine. The fact is that every grape is sweeter than the fruit. A really good grape wine never tastes like a grape because of the fermentation. Grapes can have up to 40% sugar and fruits up to 16%. If you want to make 12% alcohol, you need to start with 24% sugar (is a 50% sugar to alcohol yield). So they have to add sugar (white sugar, molasses) to the fruit juice to get there. Some States don't allow any sugar addition, but Florida does not have this law.

The most important thing about making wine is acid. Acid is very descriptive, but sugar is not. They adjust the pH with citric acid. To ferment, add yeast. 89F is excellent for them, but not at 59F in the winery. So ferment outside the winery. Minimum of fermentation is 7 days. For a slower fermentation, start outside and move into the winery into a tank with temperature control. They use champagne yeast, but not wild (from the fruit).

The winery has a storage capacity for 20,000 gallons in a 1200 square feet facility.



Figure 18. View of the tasting bar.



Figure 19. Presser - Internal view.



*Figure 20.* Some of the wines produced by the Schneblys.

### Fresh King, Inc. (Homestead)

## http://www.freshking.com/

Not a very big company, but big sales (\$ 20 million sales). Their season is in the summer. May with litchi, than avocados, carambola, pitaya, and import papaya from Brazil (Figure 21) all year round. Growers stop there and unload the products, the company weight them and give the grower a receipt. They cool them, select and distribute to US and Canada.

They do quality control checking the temperature of the truck and the pulp temperature, making visual inspections, photographing with a digital camera. Usually don't reject the product even if the product doesn't look good, but negociate the price. In some cases, previous contract to define price. The market sets a price – what doesn't look good if the market pays, it is still expensive. Depend on the demand. Better quality fruit will find better quality product.

They have a contract with the suppliers where they sign a statement telling that they are supplying with safe products. Generally they find more certificated suppliers outside the country than the US growers. As a company they are having a big hassle to afford the costs of this monitoring because the customer don't want to pay for this. They are going to SQF 2000 for certification.

Depending on the item, package stays 4-5 days in the cold rooms (Figure 22), but want to sell and ship as fast as possible. Coconut can stay more (3-4 wks).



Figure 21. Papayas from Brazil.



Figure 22. View of a cold room.

# **Tomato harvesting**

While on the bus we saw tomatoes being manually harvested for DiMare (Figure 23). These tomatoes are transplanted, grown in plastic and they use metal sticks instead of wooden ones. Green mature tomatoes are manually harvested for further ethylene treatment. Each harvester has a bucket (about 35 fruit) and gets a ticket for each bucket to be paid later. They take the buckets to gondolas, which are later taken to the packing house (Figure 24). Usually there are two or three harvests for each field.



Figure 23. Tomato harvesting.



*Figure 24.* Workers taking the buckets to the gondolas.

# **Robert is Here**

Famous fruit and vegetables stand for milkshakes of tropical fruit (Figure 25). He was about 6 his father wanted to sell avocado, but he was little and his daddy made a sign "Robert is Here" and now is here for more than 35 years.



Figure 25. "Robert is Here" fruit stand.

### **DiMare Fresh** (Florida City)

# http://www.dimareinc.com/

From the field, the tomatoes come in gondolas, each one about 15 tons of tomatoes. Use hydro dumping to get into the processing line. People do the sorting according to quality (#1, #2 and reject), removing those with some red color or with some defect. Packaging is automated. They also have automated palletizers (8 of them) for the fruit that have some color. They used to do it by hand, but there were complains that this was a tough service.

They test for Salmonella for every single pallet of tomatoes at the University of Florida. Fedex the fruit in a bag and they fax the result (+ or -). Use warmer water to receive the fruit to avoid absorption of water and possible contamination with Salmonella. They have HACCP implemented and have at least one surprise audit per years. Besides, a lot of GMPs on the fields. Without it they can't sell for the biggest companies.

They pick tomatoes when they have a gel inside; if not, if they spill the seeds when cut, they are not ready – immature. You don't want a tomato that is white in the middle. The green mature tomatoes are treated with 150-200 ppm gaseous ethylene. This facility has 30 ripening rooms set at 68-70F, depending on the cultivar. The larger the tomato, the faster it ripens. Depending on the season, 4 days for the larger and 5-6 days (colder). Every 8 h renew the air for 30 min.

Every box has a label for tracking with the quality, grower, size of fruit, day of packing, destiny. USDA inspects. Temperature of shipping is based on fruit color and distance.

# Chestnut Hill Farms and Bounty Fresh Logistics (Miami)

http://www.bountyfresh.com/

Importer, growers and packers in Puerto Rico and Costa Rica – where have pineapple (main product), 5,000 containers exporting to Europe. Biggest US markets are California (LA) and Philadelphia. Sales office in Miami for 15 years, but now expanded to east and west coasts.

Mangos are the second product, year-round. Start in September, from Brazil (Tommy), than Ecuador, than they go to Peru (Kent), Nicaragua, Guatemala and Mexico (may to aug). If for fresh-cut market, they prefer Keitt > Kent > Tommy and Haden don't accept.

Import asparagus from Peru (mid June to end Jan). Final two products are melons from Centro America and sweet onion (july to dec).

When receive the containers, a report about the product is sent by the internet. This report is done by an independent auditing company. An example is mango. They pack 3 million boxes of mangoes in 10 weeks. The report have photographs, internal and external quality, statistical sampling (20-30 fruit per pallet), color, diseases, ripening, chilling, firmness, brix. They will not sell mangoes without the report. It is a part of the action plan for selling.

First thing they check is the temperature of the container and of the fruit, because it really affects quality. If something wrong with temperature, the insurance covers the damage. Use sensors of temperature, between two pallets in the center of the container. They have a temperature recorder in each container and for each order. This is very important.

Pesticide management begins in the farms, which are all EurepGap certified. Must have records of all applications to keep traceability.

#### **Bounty Logistics** (Miami)

An independent company holds logistics – Bounty logistics. 60% of their total volume is Chilean Salmon. The rest of volume is berries, pineapples, melons, mangoes, asparagus and others, varying according to the season. Do comply with HACCP and Primus Lab, OSHA (PPHO). This facility has over 21,000 square foot refrigerated and 7 cold rooms. All facility is cleaned and sanitized in the beginning of the day. Have cleaning machine to wash floor with FDA approved soap. Store products at low temperature because they say the turnover is very fast. They receive product 24 h but shipping is from 9 am to 9 pm. Fish during the morning and other produce throughout the day.

They use forced air cooling for fruits (Figure 26) but they have a hydro cooler system (Figure 27) for asparagus (mainly) and berries. For food safety it measure levels of pH and applies chlorine and citric acid automatically (Figure 28). Add citric acid to lower the pH since the water pH there is high. It refrigerates 1 pallet of asparagus from 75-80F to 35F in 6 min. The water temperature 32-35F. The system also helps to hydrate the asparagus since it arrives very dehydrated from shipping.



Figure 26. Forced air cooling.



Figure 27. Entrance of the hydro cooler.



*Figure 28.* Automatic application of chlorine and citric acid.

Pero Vegetables (Delray)

http://www.peroveg.com

The company is celebrating its 100<sup>th</sup> anniversary. Started in 1908 in New York with green beans and peppers. To grow year round had to move to other regions. Now they have their headquarters in Del Ray since 1980, and have farms in Georgia, Michigan, New York and greenhouses in Canada. Supplemental supplies come from Holland, Dominican Republic, Central and South America. Facilities have the same safety certified standards (Primus Lab). There is a person in charge of this inspection all around the world, which is a key for success in vegetable business. The protective cultivation was transferred to Canada and they are studying to grow organics.

**Greenhouses.** They have 7 acres of greenhouses (Figure 29) where control humidity, luminosity, irrigation, CO2 concentration automatically. Air exchange is 60 sec each minute and CO2 is very low inside. Computer controls humidity (never above 90% and never below 70%).

Use coconut fiber imported from Malaysia (\$1 each bed). A huge economy compared to an expanded volcanic rock bed (\$3.50). Since is cheap use only once per crop to avoid diseases. Grow pepper and cucurbitaceae. The pepper up to 14 feet in the air. A big plus are the monorail carts (Figure 30). Workers go in the carts harvesting the produce as the machine rolls up to the end of the line. The rails are for hot water (increase temperature during winter – all year 22C) and for harvesting. The suspended rails allow the air to flow below the root zone. This is extremely important to keep ideal temperature in the root zone to absorb water and nutrients even during the hottest months of summer. They get fertilizer everyday (fertirrigation).

Make sure that when they pick fruit they are ok. Take an own developed harvesting knife with the edges (extra thin and other extra thick) and pop the pepper off the plant from the abscission zone without bruises and damages.

Yield per plant is 15-18 lbs for pepper, 35-40,000 boxes (20 lbs) cucumber per acre. In this case, extremely higher production, since can have only 800 boxes outside the greenhouse (on the field). This is because all is controlled by temperature, since there is no condensation, and the leaves are 100% dry and hardly ever spray a pesticide there.



Figure 29. Greenhouse - inside view.



Figure 30. Monorail carts.

**Packing house.** They have 20 loading docks and always maintain cool chain using the rubbery docks (Figure 31) to put container, then temperature of product getting out is the same as the container when getting into it, avoiding condensation.

The fork lifts have computers with all the inventory and knows exactly where to put and where to take the pallets from. Is an online system. On the storage, FIFO with RFID tags.

The fruit go through a washing part, a slight chlorine bath, a sorting process by quality where they have different belts separating different types of defects.

The company has a high-added-value product session, where they use trays made of starch and shrinkable plastic. Two benefits – keeps the shrink down and lowers the handling by the consumer. And the third benefit: sell green using the price of yellow.

The company is doing an experiment with what they call the greenhouse of the future (Figure 32), to be adapted to the buildings without agricultural space. Use water and nutrients like hydroponic. Have already produced different leafy products. This is not for heavy products that might fall. The light is the same as street light – high pressure vapor sodium. The whole system costs about \$ 10,000.



Figure 31. Rubbery loading dock.



Figure 32. Experiment with the "greenhouse of the future".

# J&J Produce (Loxahatchee)

# http://www.JJProduce.com

They are in the top 50 companies in the world regarding the traceability of the product (from the seed to the consumer's fork). Can trace back within 3 minutes. Each label coming from the field contain the farmer, field number, the planting, also the variety, date of picking (Figure 33). Can trace back to within few feet from where it was picked. Maintain a gold seal for Silliker – 98% was the lower score. The company is expanding more 50,000 square feet.

Their fields are all drip irrigated and they are using GPS satellite to determine where to inject more or less solutions, detect harvesting fields, etc.

Main concern regarding quality is the wheather. Packing is ok. Everything they pack is USDA #1 standard so they can sell for their buyers. They pack / ship 60,000 boxes of peppers per day (40 trucks). They dump in water, chlorine bath, then selection and sorting. Water is 10F higher than the product to avoid infiltration. Have four quality standards. Last year incorporated a brush bed (Figure 34) that cleans and doesn't bruise the squash and pepper (specially important for the sandy soil that they have).

The peppers are packed in three different boxes, according to their quality (Figure 35). Packages are weighted automatically. Use forced air cooling, leaving the product for 1.5 h. There are sensors at 5 m and 15 m from the door informing when the product is cool.

Have cameras all over the packing and calls him if have a problem with temperature anywhere in the warehouse. Once it gets into the warehouse never break the cold chain.



Figure 33. Example of label.



Figure 34. Brush bed for transfer points.



*Figure 35.* Pallets of tree different boxes of produce.

#### **Orchid Island Juice Company** (Fort Pierce)

http://www.orchidislandjuice.com/

One of the last 4 or 5 juice companies in the country that makes unpasteurized orange juice. There is a federal regulation that says that the orange juice in the US must be pasteurized. However, there is an exception authorized by the FDA to make unpasteurized juice if they have a specific process. Has to prove to the FDA that your company is able to eliminate Salmonella and E. Coli from the surface of the fruit by 10<sup>5</sup> (have to have less than 1 UFCs if begin with 100,000 UFCs). Few companies can do this and have to have a very high sensitive microbiological testing capability. Have to filter and chlorinate all the city water that they receive because it contains enough contaminants that will turn every test fail.

Is a single operation, but sequentially organized. Begin in the morning and finishes at 6 pm. At 7 pm the cleaning crew comes. At 9 pm starts processing fruit if the bacterial requirements have been achieved (ultraviolet testing). At 4 am pull of samples for quality control. At 5 am finishes the extraction. At 6:30 am takes the orders and starts shipping. At 7 am starts packing. At 2 pm finishes. At 4 pm starts shipping.

Every thousand gallons of finish product is tested for microbiological (36-48 h). They save a sample of the product there, but they do not hold the product to ship and wait to the test result – the product is fresh. Have to prove the FDA that the process is reliable. The FDA regulation is very strict and the verification testing is rigorous. Is hard to comply this regulation.

Had a worldwide recall 3-4 years ago due to Salmonella contamination and just survive because of God. They had 13 cases of Salmonellosis related to their product but they believe that is was not their juice. 13 out of couple of millions surveys with consumers linked the case with their product. They could not revert the process because they have no voice because the fresh squeezed juice processors are few. But they won't give up. Based on traceability, the problem was not the grower, but the link between the illness and the juice. A specialized magazine in the US recently classified Tropicana Fruit Premium as recommended and their juice as highly recommended. Price differential in a grocery store is \$ 0.50 per half gallon.

Make sure that the suppliers have safe product. Analyze there and at the farm, as well as the packages. Harvest during the day and fruit are stored (5 trucks of orange and 3 of grapefruit). Have own farms, but more than 90% is from third parties.

Use phosphoric acid (300 ppm) and steam (171F for 32 sec minimum 35 s maximum). Have grading table before the sanitation of the fruit due to FDA regulation to remove all smashed and possibly contaminated fruit. Then have other two-minute contact with sanitizer before extraction. The facility has HACCP for 11 years. On the grading table there are red buttons to stop the line at any time that 3 CCPs went wrong (alarms sound): 1. Inadequate water pressure (< 30 psi); 2. Steam temperature lower than 171F; 3. Concentration of sanitizer (< 300 ppm).

Process of squeezing – 500 oranges per minute. Bottles for packing are sterile. Automated labeler, but manually fed. Shelf-life of product is 17 days. This is because they have a flash freezing (-90F) process. The bottles go through a rotary conveyer, slightly inclined, for 60-80 min. Comes out 90% frozen and finishes in the freezer at 32F. Weight and metal detector when gets out.

They are currently testing an Italian machine, a fruit peeler.

# Egan Citrus Packing

The company is active since 1914 and managed to go through the hurricanes. Import and export citrus. Main citrus operation is in Florida. Have 4 packing houses and 25,000 acres. Mainly run grapefruit.

The fruit comes from trucks and go to the degreening with ethylene (5 ppm / 95% RH). Prior to degreening, the fruit go to citrus drenching with chlorine (150-200 ppm) and thiabendazole (3 min), keeping pH at 7. When color is ok, go to process. After dry unloading (Figure 36), the bins are sanitized with peracetic acid (due to canker). The fruit go through a washer, sizing (Figure 37) and another antifungic bath. Then, manual sorting for defects (Figure 38), than dry and apply wax. The application of chlorine, thiabendazole and wax is automated.

They work with 30-40 different labels. Boxes are assembled automatically in a machine. Then goes through motor rail throughout the packing. Workers can be paid by box (\$0.17 per box – a good worker 800 boxes per day - \$14 per hour per day) or per hour (bad season - \$6 minimum).

90% goes to Europe and 10% stays in the US. Cost to put fruit in the box is \$3.50. One box in each 1,000 is taken for USDA inspection.



Figure 36. Dry dumping of fruit.



Figure 37. Sizer – inside view.



Figure 38. Manual sorting of fruit.

Friday (03/14/2008)

# Country Fresh, Inc. (Orlando)

http://www.countryfreshinc.com/default.asp

Started in the late 90s (9 years ago). They started very small in their facilities in Houston, Texas. Growing, opened another facility in Dallas and in Florida. Now they have 2 new facilities, Iowa and Pensylvania. Examples of products (Figure 39): bag of fruits, salsa sets (tomato, peppers, onions), fresh-cut vegetables. Prepared mix for snacks are a very popular product of this company.

GMPs are implemented in the facility, which is 40F and below inside. When the product arrives they check the quality (brix, acidity). They have a minimum, a good, and a maximum

value for each product. Have storage rooms exclusive for either vegetables or fruit. Then wash with chlorine (Figure 40) and pass to the other side for processing (Figure 41).

The workers in the different processing lines do the same movement all day, which may increase the risk of repetitive lesions. Some steps of processing are automated. The apple processing, for example, go through cuts, cubing (Figure 43), antioxidant bath for 3 min, then go to the dryer, and to the package (Figure 44).



Figure 39. Country Fresh products.



Figure 40. Chlorine bath.



Figure 41. Fresh-cut celery.



Figure 42. Unloading apples.



Figure 43. Apples in cubes.



Figure 44. Packing fresh-cut fruit.

<u>Taylor Farms</u> (Orlando) http://www.taylorfarms.com/

Taylor Farms has 13 years. This facility in Orlando is 1/5<sup>th</sup> of the facility in California and makes \$ 9 million a year. Inspected by FDA, USDA, Davis Fresh, Primus Lab, Silliker. They have 9 processing plants and 150 trucks shipped per week. Go through quality control when product arrive. Require grade A product from supplier. They have their own trucks. Temperatures are checked upon receipt, while they are on the line, maintain the cold chain during distribution.

Put a receiving label on the product that enables them to track the product in all steps through the process. This goes to the inventory and helps maintain traceability and evaluate supplier using a specific software. Bar code in every bag/box. They have 1,068 pallet spaces, with a turnover is 24 h.

They recycle boxes, pallets and wastes. Water is treated before going to the city. The facility has a monitoring station for water quality, that automatically adjusts chlorine and citric acid in water. There are two ships of production and a third ship for sanitation, six days a week. Sanitation technicians work from 10 pm to 6 am – dry clean, foaming all the equipment, floors, walls, ceiling. They rinse and sanitize. After sanitation randomly swab the piece of equipment and do bioluminescence microbial test; if not ok the sanitation team redo the work. They shut down on Sundays for repairs by their maintenance department.

The product comes in the bin, which is dumped in a belt for grading table to remove bad products before the process. They produce a total of 2.2 million lbs of products per week. On average yield is 80-85%. Per day, they produce 200,000 lbs of iceberg lettuce, 70,000 lbs of romaine lettuce, 50,000 lbs of cabbage, 40,000 lbs of yellow onions and 10,000 lbs of red onions, 30,000 lbs of tomatoes and 10,000 lbs of celery. Due to this volume, they are moving to automation (> 10,000 lbs per day is worthy). A number of pieces of the machines are custom made, some the maintenance department does.

Produce go through cutting deck, wash, drying basket, centrifuge 600 rpm for 2 min, scale (weight), vacuum package, metal detector. The filling of the packages is automatic (30-35 bags per minute). Nitrogen generating system to flush oxygen out of the bags for package, increasing shelf-life to 12 days. Each bag has bar codes for traceability. Pull out some bags off the line during the day to check for weight, quality, defects, shape of cut. Also hold bag for quality control and do microbial testing on finished product.

They receive the orders in the morning, make the product in the morning / afternoon, ship to customer to be there by the next day. They are big suppliers for companies like McDonalds, Burger King, Subway and KFC.

#### Winn Dixie Warehouse (Orlando)

# http://www.winn-dixie.com/

This warehouse was founded in 1923 and serves 130 stores in Orlando, Central and South Florida. It is the smaller but the largest volume of the warehouses. Fresh produce is about 8-9% of total volume. They have 14 unloading docks while other warehouses have up to 75. Buying personnel stay in Jacksonville and there they check for quality and food safety. They receive 120-200 orders per day.

First thing when the truck gets in is check temperature and food integrity. Digital temperature logger that records each second of temperature, usually 3-4 pallets after the front of the truck, and can download the information into the computer. It is the delivering company's responsibility for the load integrity.

After the load is received they inspect the product for firmness and brix. Melons and watermelons at least 10 brix. Apples, stone fruits and grapes at least 12 brix. Try to pick at least one box for each pallet from the truck, removed when start to unload. If there is a problem the load can be rejected, but is rare. In some seasons of the year, the best is not the best. A federal inspector has the final word about accepting or rejecting the load according to Winn Dixie's standards.

When the truck is unloaded, the computer system tells where (slot) to put the pallet. Put a label on the product when they receive it. It has the date of arrival, supplier. At night, they know exactly what the stores need (send orders through internet). Use FIFO.

Temperature for some products are below the recommended. They say the produce stays there for a short period and this would not be a problem for chilling. Turnover is 3-4 days, but some may last longer (15 days for potatoes) or shorter (like strawberries, one night). They recognize that these products shouldn't be there. But they want to slow down the respiration rate so they can last longer. In that room we found peppers at 3C.

There are rooms for products that need more humidity, another section for produces that don't need a lot of humidity (Figure 45). Another room at 45F, potatoes, onions, avocados. This is a #1 room for flowers (Figure 46), which it is not ideal (should be at lower temperature),

but is the best they can do. They don't have banana ripening rooms anymore. They store the banana (Figure 47) a little colder (45F) than the ideal. But the product generally stays there for less than 24 h.



Figure 45. Partial view of a storage room.



Figure 46. Fresh-cut flowers.



Figure 47. Storage of bananas.

# Winn Dixie Supermarket (Orlando)

http://www.winn-dixie.com/

Winn Dixie has 600 stores and are growing again after restructuration. They are coming with a new model of merchandise in remodeled stores using in multi-deck cases, thinner decks, more convenient for the consumer. Now they have vertical decks (Figure 48) instead of horizontal decks, saving space. Half-moon shelves (Figure 49) allow to have less product and better turns, always having fresh product on the shelf. The half-moon display cost a little more labor in the beginning, but in a long term takes less time to fill the display when they get used to them.

The average is 7-10% total sales in fresh produce, but this store makes 12% and has 450 items in this section. Banana is #1 produce, than tomatoes, apples and citrus, potatoes, onions. Produce is convenience factor, so fresh-cut is getting more and more popular. Bag salads are 15% of sales.

Depending on the neighborhood they have different products for convenience. Example, leafy products for Chinese people. They do a multi-study for every store (2-3 miles range, 5 mi range and 10 mi range). In Florida they don't want organics because they don't see value on them, they don't want to pay more. Only 3% of the fresh produce is organic in Florida. In California, 25%.

The first thing in the day, you touch everything and remove everything that is bad so the customer can find everything good in the shelves. If the stuff is no good, blemished, they select what is good, open the package, clean them up, fresh-cut and repack them. If they are not good inside, throw away. They make a tropical fruit cup with these fruit.

This store receives about 10,000 customers and makes \$ 500,000 weekly.



Figure 48. Vertical decks.



Figure 49. Half-moon shelves.



Figure 50. Closer look of the halfmoon shelves.