Changes in the California Citrus Industry

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Overview of Presentation

- CA Citrus Overview: where we have been and where are we going?
- Dealing with change and addressing the challenges
- Role of Citrus Research - the long view; planning for the future

Where we fit into the big picture of citrus production

Crop Season for CA Citrus

Statistics for CA Citrus - 2001

<table>
<thead>
<tr>
<th></th>
<th>CA Ranking (350 Crops)</th>
<th>CA Share of US Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grapefruit</td>
<td>50</td>
<td>11%</td>
</tr>
<tr>
<td>Lemons</td>
<td>22</td>
<td>86%</td>
</tr>
<tr>
<td>Navel Oranges</td>
<td>13</td>
<td>21%</td>
</tr>
<tr>
<td>Valencia Oranges</td>
<td>57</td>
<td>25%</td>
</tr>
<tr>
<td>Tangerines</td>
<td>57</td>
<td>25%</td>
</tr>
</tbody>
</table>

Source: CDFA, CA Agricultural Statistics Service
Where do we grow Citrus?

- Grown commercially throughout state
- Historical Base is southern CA
- Industry has moved north (~70%) to SJV
- Wide range of soils, climate and other environmental constraints
**Navel Orange**
- Expanded rapidly including pigmented navels: market stretched to nearly 10 months
- Mainly fresh
- Primarily San Joaquin Valley
- Increasing urban pressure; environmental constraints; air pollution

**Valencia Orange**
- Older trees in southern CA: small fruit size; crease/puff problems
- Competition from navels and other fruit during summer months
- Rapid loss of southern CA acreage due to increasing urban pressure and alternative cropping

**Lemons**
- Production +/- stable
- ~45% processed
- Intl. Competition????
- Primarily coastal CA, north of Los Angeles, Southern CA deserts
- High urban pressure

**Grapefruit**
- Production +/- stable
- Mostly fresh market
- Returns poor
- Mainly Southern CA deserts and warm Inland valleys
- High urban pressure

**What a difference 4 years makes**

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**CA Citrus Acreage 2002**
- Source: 2002 California Citrus Acreage Report, CA Agricultural Statistics Service

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**Valencia Orange Production, 1988-2001**

**Lemon Production, 1988-2001**

**Grapefruit Production, 1988-2001**

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**Navel Orange Production, 1988-2001**

**Lemon Returns, 1988-2001**

**Grapefruit Returns, 1988-2001**

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**Valencia Orange Utilization, 1988-2001**

**Lemon Utilization, 1988-2001**

**Grapefruit Utilization, 1988-2001**

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**Navel Orange Utilization, 1988-2001**

**Lemon Returns, 1988-2001**

**Grapefruit Returns, 1988-2001**

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**Value ($/carton)**

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**Source:** CDFA, CA Agricultural Statistics Service; 37.5 lb carton

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**Source:** CDFA, CA Agricultural Statistics Service; 37.5 lb carton

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**Source:** CDFA, CA Agricultural Statistics Service; 38 lb carton

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**Source:** CDFA, CA Agricultural Statistics Service; 33.5 lb carton

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**Source:** CDFA, CA Agricultural Statistics Service; 37.5 lb carton
Many new plantings – knowledge base lacking
Playing catch-up
New UC releases – unknown potential
Plantings statewide – will know more in a few years

Source: CDFA, CA Agricultural Statistics Service; 37.5 lb carton

Increased planting
More diversified
No varieties for future – unknown potential

Dealing with change
and addressing the challenges
Considerations:

- Regional Concerns
- Statewide Concerns
- National Concerns
- Global Concerns

Regional considerations

- Crop Issues
  - Varietal/Rootstock selection
  - Fruit quality
  - Environmental adaptation
- Environmental
  - Water - availability/quality
  - Ground water - pollution
  - Pesticide regulations
  - Air pollution (San Joaquin Valley)
- Urban Encroachment/Attitude
  - Increased regulations
  - Competition for resources

Nitrate Groundwater Pollution and management of yield and quality

- Project funded by CRB; 1997 - 2002

Summary

- Increasing N results in increasing NO₃-N below root zone
- Method of application can influence this
- Maximum yield, less NO₃-N below root zone with combination of foliar and soil applied
- Peel thickness increases, peel firmness decreases with increasing N
- No other consistent differences in fruit quality were detected following storage.

Statewide considerations

- Pesticide Registration
  - Maintaining current materials
  - Registration of new materials
- Exotic Pests
  - Exclusion/Public Education
- Disease Containment
- Research Funding
  - Citrus Research Board
Citrus Peelminer, *Marmara gulosa* prefers to infest fruit but will also attack leaves and twigs.

Bean thrips inside navel orange revealed after thin slices are cut through the fruit. They may appear black with few distinguishing characteristics (banding is not visible).

Adult bean thrips bodies are uniformly dark grayish-black. The front wings have transverse white bands with brown tips. Newly emerged adults are a dirty yellowish-brown with a darker head and retain the crimson blatches from the pupal stage for a short period of time.

When feeding, the glassy-winged sharpshooter excretes copious amounts of watery excrement, which dries to give plants a whitewashed appearance.

The insect is one of the largest sharpshooters found in California. At about 12 mm (1/2 inch) in length, it is twice as large as other common species. Overall it is brown to blackish in color. The eyes are yellow with dark speckles and the abdomen is yellow and black.

Citrus Thrips

California Red Scale

Controlled in field by:
- biological control
- chemical control

High Pressure Washer augments field control measures and has allowed for increasing of field "economic threshold"
High Pressure Washer

- HPW technology developed in South Africa and Israel
- Introduced commercially into CA approximately 5 years ago
- Most orange houses now have a HPW unit
- Houses w/out HPW may use OPP (orthophenylphenate) over first few brushes or detergent with neutral cleaner

Green mold  Blue mold  Sour rot
Penicillium digitatum  P. italicum  Geotrichum candidum

Wound pathogens are CA’s biggest concern - always looking for control alternatives

Green and Blue molds

Before harvest
- Minimize wounds
- Reduce grove inoculum
- Prompt transport to packline

After harvest
- Minimize wounds and fruit drops
- Reduce packinghouse inoculum
- Use soak tanks & fungicides
- Store at 50°F or below as soon as possible

Sour rot

Before harvest
- Minimize wounds, avoid fruit to soil contact
- Harvest in afternoon, avoid wet periods
- Prompt transport to packline

After harvest
- Minimize wounds and packline inoculum
- Use carbonate soak tanks, wash with SOPP; wax with GA and/or 2,4-D
- Store at 50°F or below as soon as possible, use boxes that isolate fruit into small groups

Brown rot Phytophthora spp.
Brown rot

**Before harvest**
- Copper or fosetyl-Al fungicides
- Avoid splashing or standing water, good drainage under trees, skirt pruned up
- Prune tree to open canopy
- Prompt transport to packline

**After harvest**
- Use heat in soak tanks

**Maintaining existing fungicides and registering new materials**

Re-visiting old methodologies, improving what we have – Dr. J. Smilanick
- Optimizing tank/drench treatments
- Near harvest grove treatments (Topsin)
- Optimizing biocontrol agents in the postharvest environment
New fungicides and resistance management strategies – Dr. J. Adaskaveg

**Fungicide dissolved in**

- WARM/HOT WATER: HIGHEST
- AMBIENT TEMPERATURE WATER:
- LIGHT WAX: ↓
- HEAVY WAX: LOWEST

**Resulting effectiveness**

J. Smilanick – USDA,ARS

**Fungicide applied to fruit by**

- Immersed in or pressure washed with solution: HIGHEST
- Float in or drenched with solution
- Brief overhead spray: LOWEST

J. Smilanick – USDA,ARS

**Grove spray fungicide to protect fruit during degreening**

A thiophanate methyl (Topsin M) application one week before harvest effectively protected the harvested fruit from green mold infection during degreening or during storage.

J. Smilanick – USDA,ARS
Grove spray fungicide to protect fruit during degreening

It would greatly facilitate management of the development of benzimidazole-resistant molds that occurred as a result of grove applications if more postharvest fungicides of other mode-of-action classes were available.

New classes of fungicides for postharvest decay control in the US

<table>
<thead>
<tr>
<th>Elite (tebuconazole)</th>
<th>Scholar (fludioxonil)</th>
<th>Elevate (fenhexamid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone &amp; Pome fruit, Kiwi, Citrus, Pomegranate</td>
<td>Stone &amp; Pome fruit, Kiwi, Citrus, Pomegranate</td>
<td></td>
</tr>
<tr>
<td>Abound (azoxystrobin, pyraclostrobin)</td>
<td>Endura (boscalid)</td>
<td>Mixture: Pristine (stone fruit)</td>
</tr>
<tr>
<td>Citrus, Stone &amp; Pome fruit, Kiwi, Pomegranate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Reduced risk fungicides

Scholar (fludioxonil)

- Sweet cherry
- Pomegranate
- Kiwi, Citrus, Pomegranate

J. Adaskaveg – USDA, ARS

Cnipiculide against postharvest decay

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Fungicide class</th>
<th>Penicillium decay</th>
<th>Sour rot</th>
<th>Gray mold</th>
<th>Brown rot</th>
<th>Rhizopus, Mucor, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imazalil</td>
<td>SI-Triazole</td>
<td>+++</td>
<td>-</td>
<td>+++</td>
<td>+++</td>
<td>-</td>
</tr>
<tr>
<td>TIZ</td>
<td>Benzimidazole</td>
<td>+++</td>
<td>-</td>
<td>+++</td>
<td>+++</td>
<td>-</td>
</tr>
<tr>
<td>SOPP</td>
<td>Phenolic</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Tebuconazole</td>
<td>SI-Triazole</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Fludioxonil</td>
<td>Phenylpyrrole</td>
<td>+++</td>
<td>-</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Fenhexamid</td>
<td>Hydroxyanilide</td>
<td>-</td>
<td>-</td>
<td>+++</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Azoxystrobin</td>
<td>Strobilurin</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>BAS516</td>
<td>Strobilurin/Pyridine</td>
<td>+</td>
<td>-</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>PH-066</td>
<td>Anilinopyrimidine</td>
<td>+++</td>
<td>-</td>
<td>+++</td>
<td>+++</td>
<td>-</td>
</tr>
</tbody>
</table>

J. Adaskaveg – UC, Riverside

Anti-Resistance Strategies for Postharvest Fungicides

- Post-Registration Strategies -
- Follow the RULES of Fungicide Stewardship-

- Rotate between different classes of fungicides or use mixtures prior to the development of resistance.
- Use labeled rates and use only when needed.
- Limit total number of fungicide applications of any one class to 1 per fruit lot.
- Educate yourself about fungicide activity, mode of action, and class.
- Sanitation with the use of multi-site mode of action materials (sanitizers and fungicides) is essential in an integrated management program.

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National Considerations

- Competition for market share
  - With other commodities and Citrus Imports
- Marketing and Promotion
  - TX and FL Promotional Campaigns
  - Imports
- Trends in Produce Consumption
  - 5 a Day Program: Convenience Foods
  - Food Safety
- Pesticide Regulations/EPA
- Exotic Pests

Global Considerations

- Trends in Citrus Production
  - Increase plantings of soft citrus
- Export Markets - How secure is the Pacific Rim?
  - The Japanese - Increased competition
  - Hong Kong/China - What’s the future
- Global Trade Agreements
- Changes at CODEX
**Coordinating strategic planning and meeting the challenges**

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**Citrus Research Board**

The Citrus Research Program (officially, the California Citrus Improvement Program) is a grower-funded and grower-directed program established in 1968 under the California Marketing Act as the mechanism enabling the state’s citrus producers to sponsor and support needed research. Administered by the Citrus Research Board, the program has three components:

- **General Research**
- **Quality assurance (CCQC)**
- **Variety improvement and registration (Citrus Clonal Protection Program)**

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**CA Citrus Quality Council (CCQC)**

**Mission**

Act as an advocate for the CA citrus industry in response to programs or problems which arise in state, national or international arenas and which affect the industry generally in areas of quality control, quarantine matters, technical assistance, international compliance or other related issues.

Oversight of regulatory and registration activity that impacts citrus quality.

Reregistration of SOPP, 2,4-D and Section 18 activity.

Works with NAPPO/CODEX.

Deals with quality assurance issues that arise.

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**CRB funds ongoing research and activities in**

- Plant Management and Physiology
- Plant Improvement
- Plant Pathology
- Entomology
- Exotic Pests
- Postharvest
- Citrus Clonal Protection Program (CCPP)

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**Funding responds to needs and strategic planning objectives**

Funding has increased ~10 fold since 1968.

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**The role of CRB COORDINATION and VISION**

- With decreasing state and federal funds, the CRB provides or assists in procuring funding for critical research efforts.
- Funds both short and long-term research.
- Funds both research to solve today's "real-life" problems and also the "look to the future".
- Increasing coordination and assistance in outreach programs:
  - Grower Seminars, "Breakfast With..."
  - Postharvest Seminars for packinghouses
  - Subtropical Fruit News and other printed materials
Thank you for your attention