


**Changes in the
California Citrus Industry**

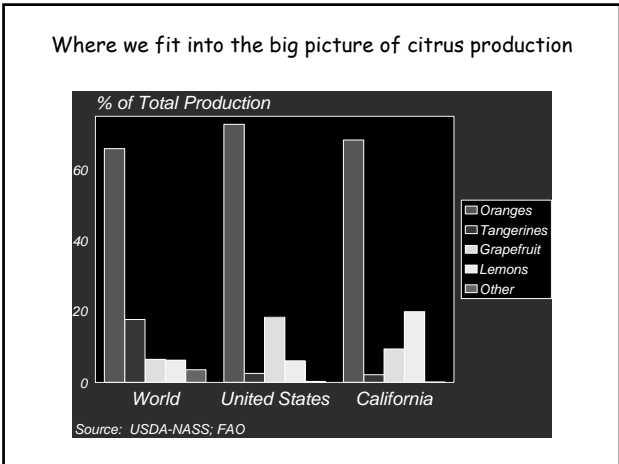
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Overview of Presentation

- 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




*California Citrus Industry; where we have been and where are we going?
Has it always been blue skies?*



Crop Season for CA Citrus

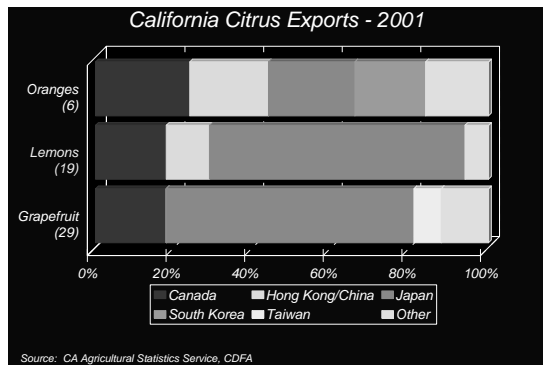
	J	F	M	A	M	J	J	A	S	O	N	D
Grapefruit												
Lemons												
Navel Oranges												
Valencia Oranges												
Tangerines												

Source: CDFA, CA Agricultural Statistics Service

Statistics for CA Citrus - 2001

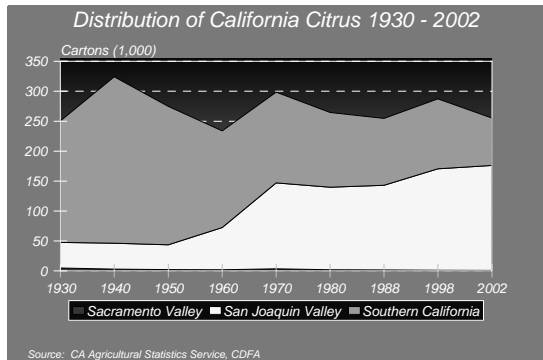
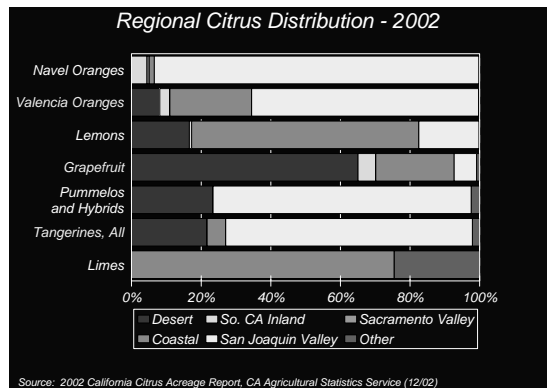
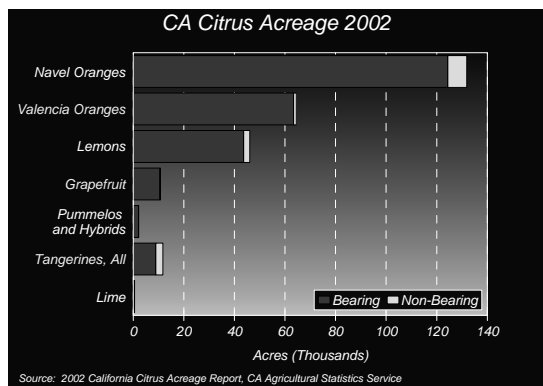
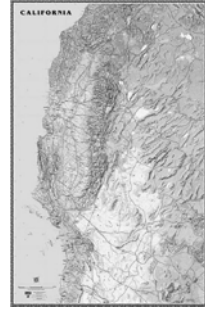
	CA Ranking (350 Crops)	CA Share of US Production
Grapefruit	50	11%
Lemons	22	86%
Oranges, All	13	21%
Tangerines, All	57	25%

Source: CDFA, CA Agricultural Statistics Service

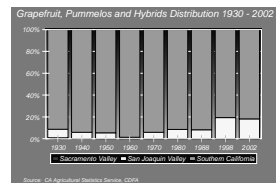
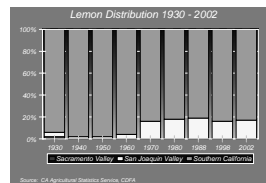
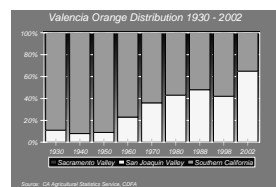
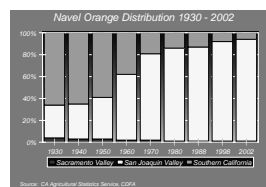


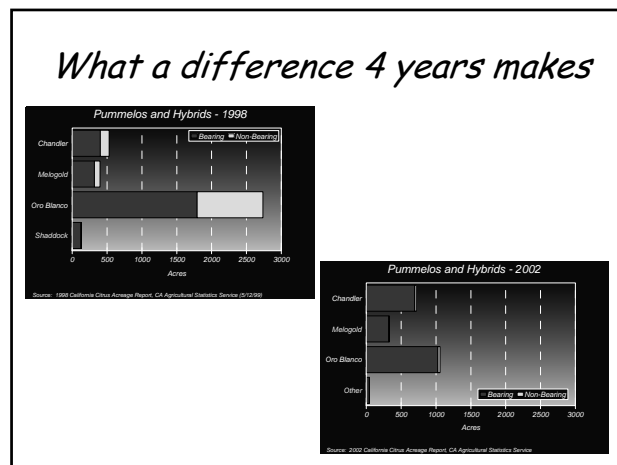
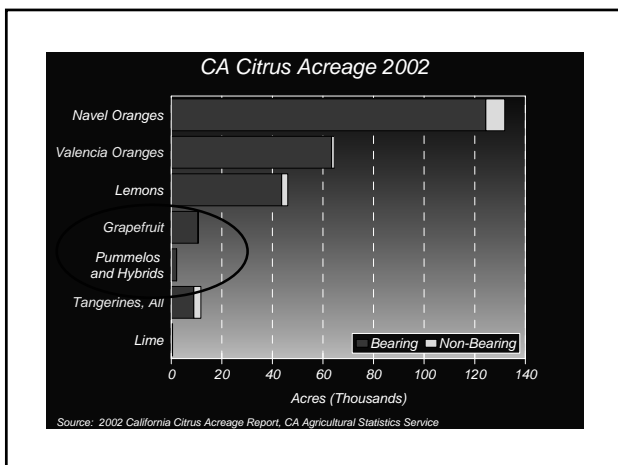
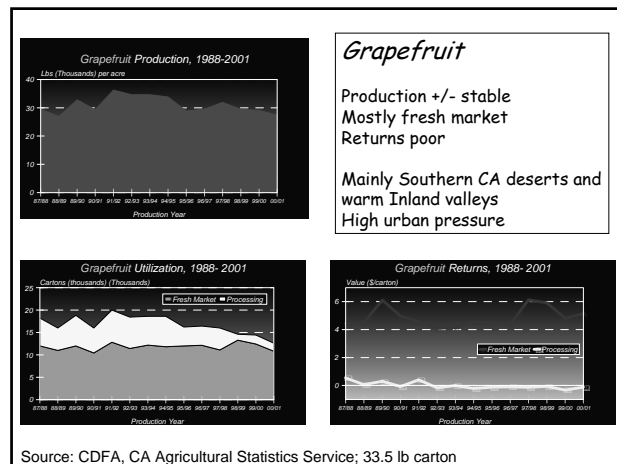
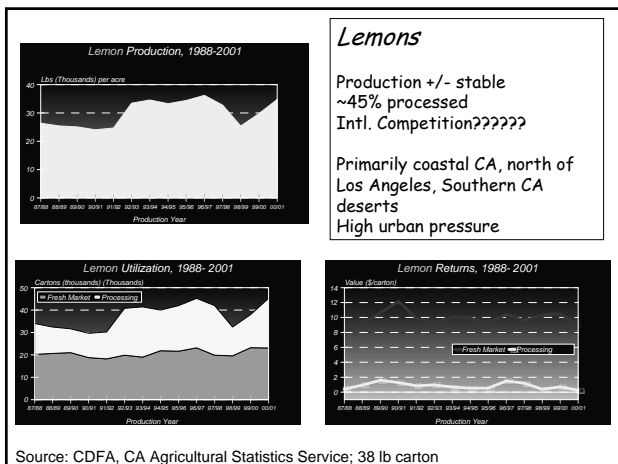
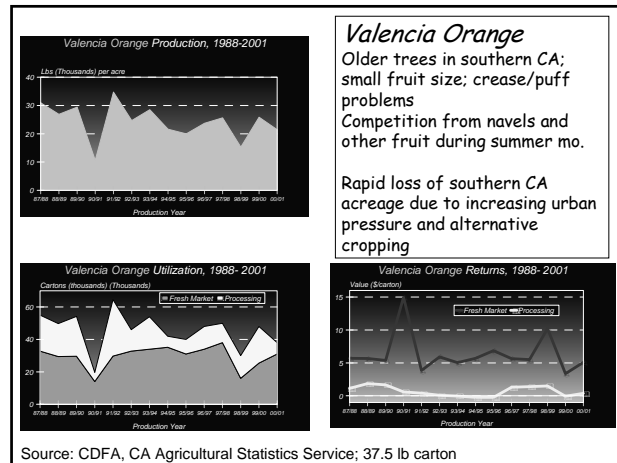
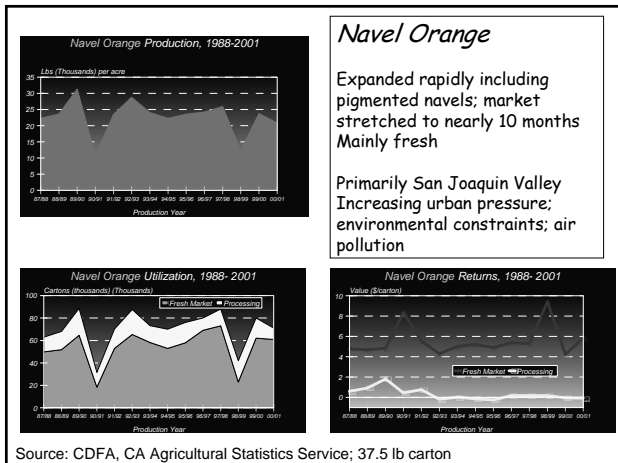
Where do we grow Citrus?

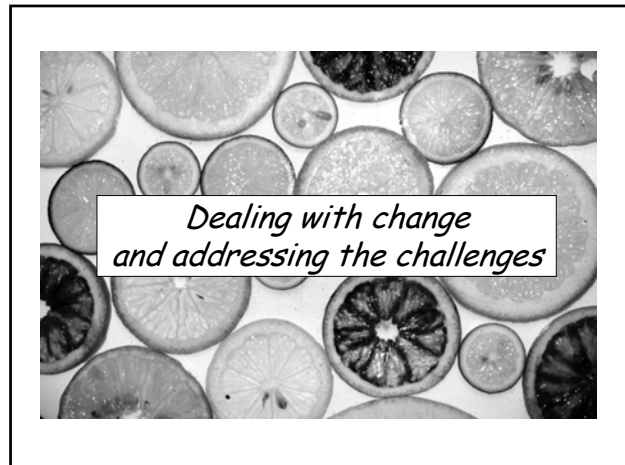
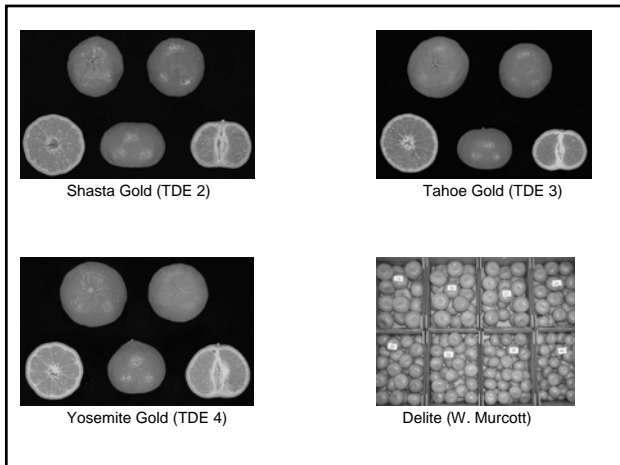
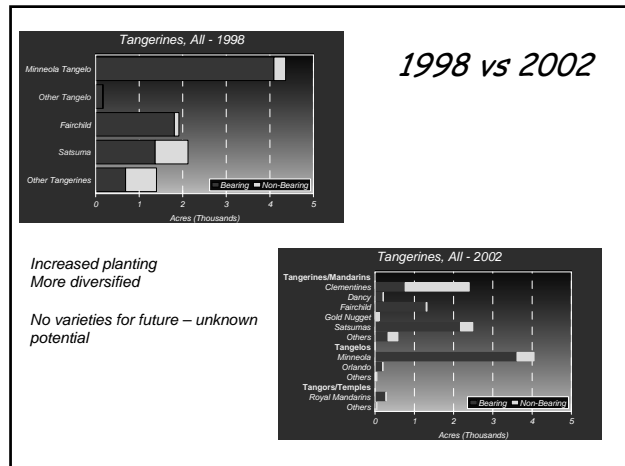
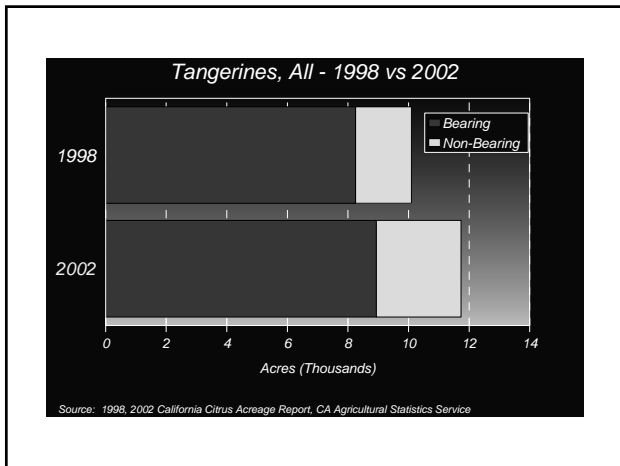
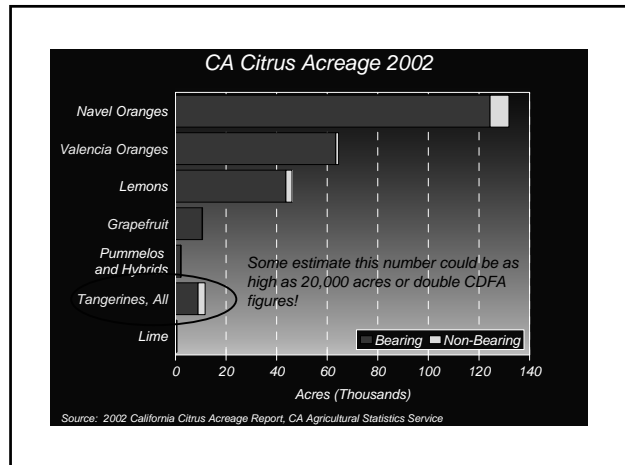
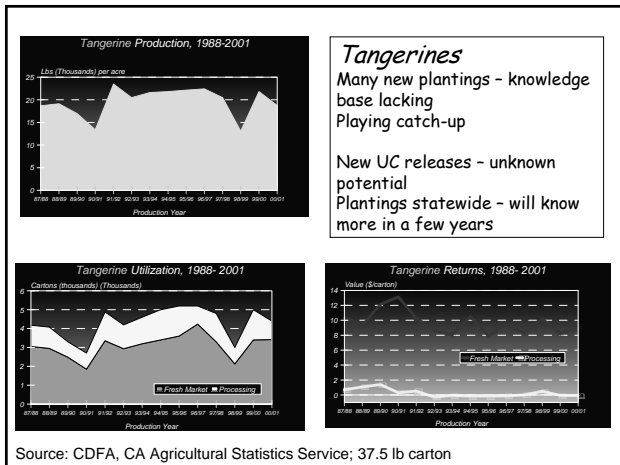
- Grown commercially throughout state
- Historical Base is southern CA
- Industry has moved north (~70%) to SJV
- Wide range of soils, climate and other environmental constraints



Total peak acreage in 1940's
Shift to San Joaquin Valley starting in 1950's due to increased water availability and urban pressure in southern CA







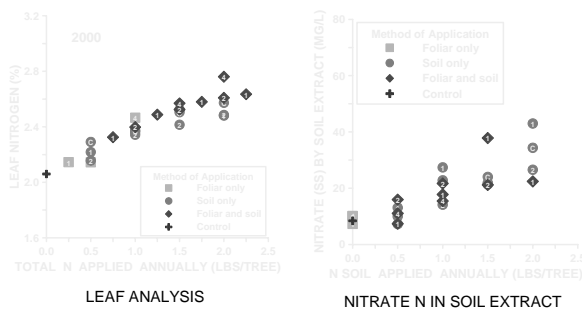
Considerations:

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

Regional considerations

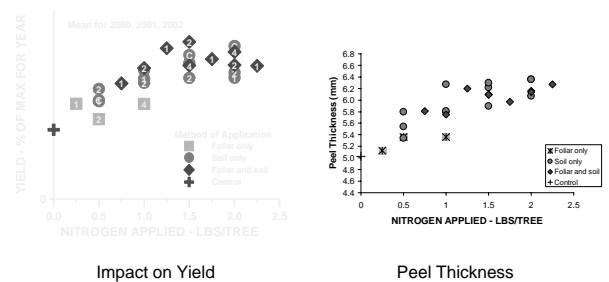
- ✓ Crop Issues
 - Varietal/Rootstock selection
 - Fruit quality
 - Environmental adaptation
- ✓ Environmental
 - Water - availability/quality
 - Ground water - pollution
 - Pesticide regulations
 - Air pollution (San Joaquin Valley)
- ✓ Urban Encroachment/Attitude
 - Increased regulations
 - Competition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

Nitrate Groundwater Pollution and management of yield and quality



Project funded by CRB; 1997 - 2002

Nitrate Groundwater Pollution and management of yield and quality



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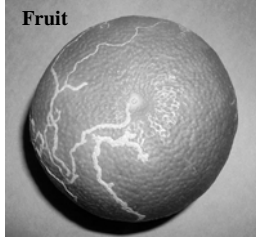
Summary

- Increasing N results in increasing $\text{NO}_3\text{-N}$ below root zone
- Method of application can influence this
- Maximum yield, less $\text{NO}_3\text{-N}$ 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.

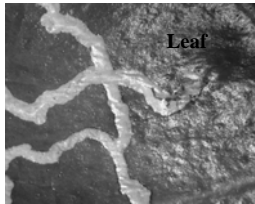
Statewide considerations

- ✓ 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



Fruit

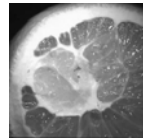


Leaf



Twig

BEAN THRIPS - quarantined pest in Australia



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 blotches from the pupal stage for a short period of time.

Glassy-winged Sharpshooter



Can be found in bins of harvested fruit



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.

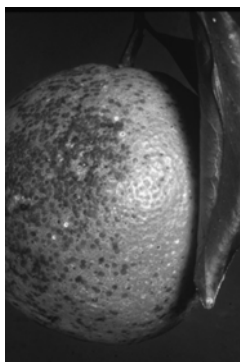
When feeding, the glassy-winged sharpshooter excretes copious amounts of watery excrement, which dries to give plants a whitewashed appearance.



Citrus Thrips



UC Statewide IPM Project © 2000 Regents, University of California



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

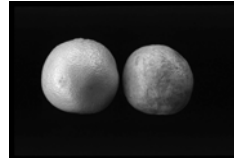


High Pressure Washer

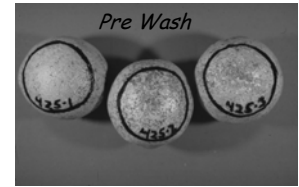
- HPW technology developed in South Africa and Israel
- Introduced commercially into CA approximately 5 years ago
- Most orange houses now have a HPW unit
- Houses w/out HPW may use OPP (orthophenylphenate) over first few brushes or detergent with neutral cleaner

Scale Removal

Pre Wash

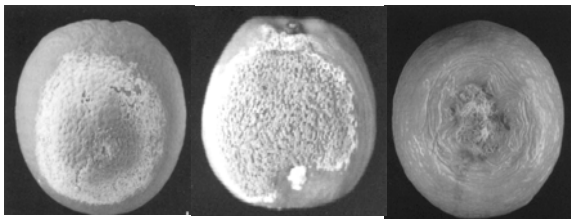


HPW Damage



Post Wash

Green mold *Penicillium digitatum* Blue mold *P. italicum* Sour rot *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

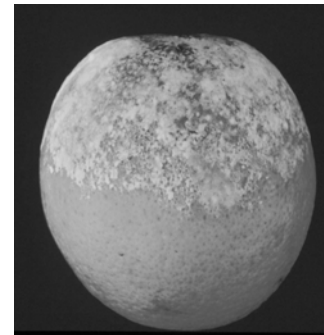
Before harvest

- 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 Resulting effectiveness

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

J. Smilanick - USDA,ARS

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Fungicide applied to fruit by Resulting effectiveness

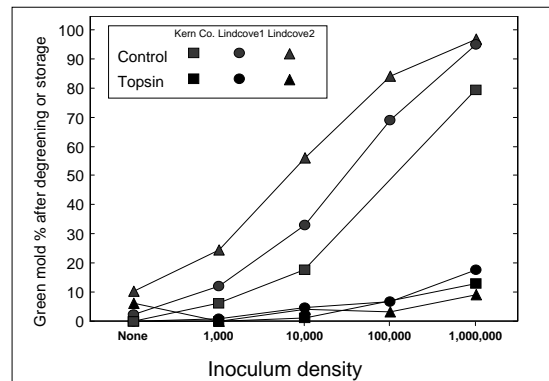
Immersed in or pressure washed with solution	HIGHEST
Float in or drenched with solution	↑
Brief overhead spray	LOWEST

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



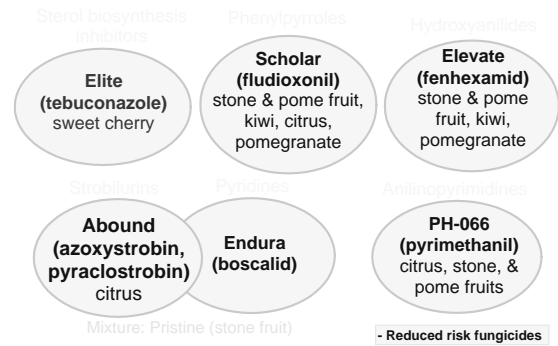
J. Smilanick - USDA,ARS

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.

J. Smilanick – USDA,ARS

New classes of fungicides for postharvest decay control in the US



J. Adaskaveg – UC, Riverside

Efficacy of fungicides against postharvest decays

Fungicide	Fungicide class	Penicillium decay	Sour rot	Gray mold	Brown rot	Rhizopus, Mucor, etc.
Imazalil	SI-Triazole	+++	-	+++	+++	---
TBZ	Benzimidazole	+++	-	+++	+++	-
SOPP	Phenolic	++	++	++	-	+
Tebuconazole	SI-Triazole	+++	++	+++	+++	+
Fludioxonil	Phenylpyrrole	+++	-	+++	+++	+++
Fenhexamid	Hydroxanilid	-	-	+++	++	-
Azoxystrobin	Strobilurin	++	-	+	+	+
BAS516	Strobilurin/Pyridine	+	-	+++	+++	+++
PH-066	Anilinoimidine	+++	-	+++	++	-

Overall ratings based on our efficacy evaluations during field and lab studies.
 Rating: +++ = excellent, ++ = very good, + = some activity, - = not active.
 Color code: Pink = reduced risk, gray = not reduced risk.

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.

Postharvest guidelines for the three new fungicides and currently registered fungicides will be in place for the 2003-2004 season.

J. Adaskaveg – UC, Riverside

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

Citrus Research Board

The Citrus Research Program (officially, the California Citrus Improvement Program)

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

3 components to the program

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

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

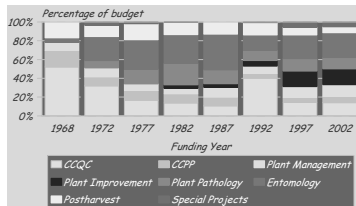
Oversight of regulatory and registration activity that impacts citrus quality
Reregistration of SOPP, 2,4-D and Section 18 activity

Works with NAPPO/CODEX

Deals with quality assurance issues that arise

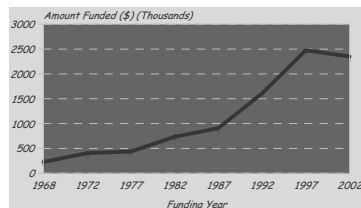
CRB funds ongoing research and activities in

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



Funding responds to needs and strategic planning objectives

Funding has increased ~10 fold since 1968



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

