Importance of awareness to growers, nursery growers and residents for the control of citrus quarantine pests

Holly L. Chamberlain

Pest & Disease Management, LLC

Background Situation

- The Problem
  - CCEP manpower and resources limited
- The Need
  - Key role of industry: (1) decontamination of personnel and equipment, and (2) a self survey of citrus groves for CC symptoms
- Expectations
  - Meet the requirements of DPI CCEP Schedule 27 (aka CCEP Bizplan)

Background Situation

- Expectations
  - Timely detection of the disease crucial to limiting the further spread
  - Minimize the number of new CC foci and reduce the acreage of tree removal
  - Develop and adopt CC BMPs - survey cycles

Methodology

- Collaboration between industry, state and federal agencies
- Development of educational products
  - PowerPoint presentation for grove self-inspection
  - Laminated ID sheets
- Implementation teams
  - UF/IFAS, DPI-CCEP, USDA-APHIS
- Distribution

Cooperating Agencies

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Citrus BMPs

Fresh from Florida
Division of PLANT INDUSTRY
Protection through Detection
Florida Department of Agriculture & Consumer Services

FLORIDA CITRUS MUTUAL

practice SAFE CITRUS
DECONTAMINATE TO STOP CITRUS CANKER

USDA

Public Outreach on Regulated Plant Disease: University of Florida, IFAS Citrus Canker Extension Education Program

Holly L. Chamberlain & L.W. “Pete” Timmer

Partnerships

- Public Relations Specialists, Research Scientists, Extension Agents, Regulatory Employees, Media
- Cooperating agencies
  - UF/IFAS
    - Research & Education Centers (RECs)
    - County Extension
  - USDA
    - ARS
    - APHIS
  - FDACS-DPI, CCEP
  - Industry support groups
    - Florida Citrus Mutual
    - Highlands Citrus Growers Assoc
    - Peace River Citrus Growers Association
    - Gulf Coast Citrus Growers Association
    - Indian River Citrus League

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USDA

Fresh from Florida
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FLORIDA CITRUS MUTUAL

Setting The Stage

- 3rd battle with citrus canker
  - 1910-1933
  - 1984-1994
  - 1995-present
- 1995 detected in Miami, residential tree
- Legal battles obstacles for eradication program (CCEP)
- February 12, 2004, FL State Supreme Court
  - Valid use of state's police powers
  - Compensation unresolved ($100 GC WalMart, $50)
  - Grower comp based on crop value
- 2004 Hurricane Season
- Limited regulatory resources (survey/inspection, compensation, removal of ***infected*** **and** ***exposed*** **trees**)

Reason for Education

- 27 International ports of entry in FL
- Civilian movement of plant material
- Unregulated movement of commercial plant material
- Spread on equipment & personnel
- Weather events, i.e. hurricanes

Background Situation

- Citrus Canker Biology
  - Bacterium, *Xanthomonas axonopodis* pv *citri*

- The CCEP
  - CCEP began 1995
  - Travel, extreme weather events, legal disputes, movement of infected plant material by home owners, and spread by equipment and personnel of the commercial citrus industry
  - Shortage of manpower for detection and timely removal of infected and exposed trees post-2004 hurricane season

Project Objective

- The goal of this project was to educate all client groups to develop and adopt behaviors, which would successfully prevent the spread of citrus canker.
  - Citrus canker ID
  - Increase awareness/understanding of disease spread
  - Decrease plant movement
  - Increase decontamination

Client Groups Identified

- Residential
  - Permanent and/or seasonal
  - Master Gardeners
- Commercial citrus industry
  - Growers, caretakers, harvesters, nurserymen, packers, processors
- Non-citrus commercial businesses
  - Lawn and landscape maintenance
  - Utility
  - Fish & Wildlife
  - Water Management Districts

The Challenges

- Diverse audiences
- Diverse languages
- Cultural considerations
- Knowledge level
- Audience availabilit
  - Easily reached
  - Difficult to reach

- Educating to modify human behavior
- Overcoming misinformation
- Emotionally & politically charged subject
- $$$

Considerations

- Sensationalism
- Scintillation
- Props count
- Demos-
  - Set an example, personal habit
- Timing matters
- REPEAT…REPEAT…REPEAT
- NO NEED TO RE-INVENT THE WHEEL
- UTILIZE PARTNERED RESOURCES

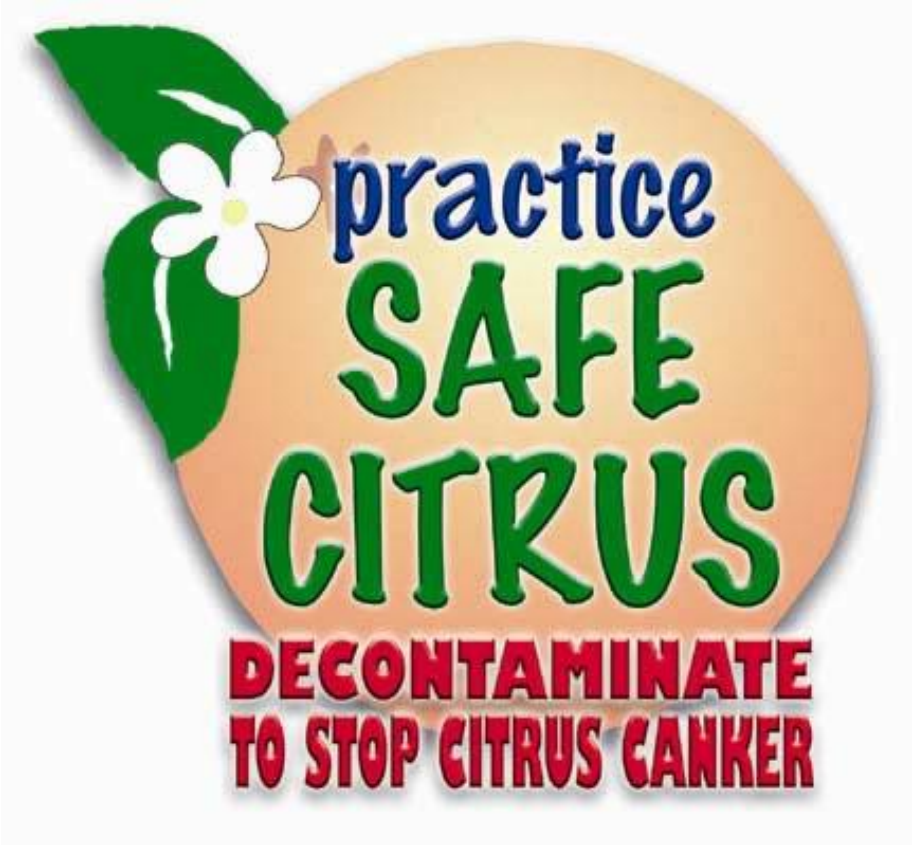

Grapefruits of Wrath

Violations – Case Studies

- One citrus canker infected grapefruit tree from Miami to Cape Coral ($5,000.00)
- One citrus canker infected key lime tree from Miami to Orlando ($2,500.00)

Why Decontaminate?

First and Foremost . . .



Program Assessment

- Program measures & accountability
  - Certificates of training
  - Survey
    - Homeowners in quarantines (phone)
    - Lawn & landscape in quarantines (phone)
    - Commercial citrus (mailing)
  - Knowledge surveys
    - Pre- & post-tests
    - Quizzes

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Institute of Food and Agricultural Sciences

Certificate of Training

_____

has satisfactorily completed the Citrus Canker Self-Survey Training Course for Citrus Grove Workers.

_____ date

Dean for Extension and Director of Florida Cooperative Extension Service

_____ Trainer

UF/IFAS Extension

_____ Organization

Citrus Canker Workshop/Seminar

Please take a few minutes to answer the following questions. Your responses will be kept confidential, and the results will be used to measure our effectiveness in providing information on citrus canker awareness and eradication programs in Florida.

The Citrus Industry

Please answer the following questions using a scale from 1 to 5, where 1 is "*Not at All Important*" and 5 is "*Very Important.*"

1. How important do you think the Citrus Industry is to Florida agriculture?
   1 2 3 4 5 Don't Know

2. How important do you think the Citrus Industry is for your business interests?
   1 2 3 4 5 Don't Know

Citrus Canker

3. Which of the following are ways that citrus canker spreads from one tree to another? [*Please mark all that apply.*]

   [ ] Wind [ ] Wind driven rain [ ] Rain [ ] Insects
   [ ] Humans [ ] Wind driven spores [ ] Other _____
   [ ] Don't know

4. Which of the following are symptoms of citrus canker? [*Please mark all that apply.*]
   [ ] Raised, corky spots on fruit [ ] Tan to brown corky spots on leaves
   [ ] Major rot of tree roots [ ] Rough-looking spots on twigs
   [ ] Other _____ [ ] Don't know

5. Please note whether each of the following statements about citrus canker is "*True*" or "*False*" by circling the appropriate response.

Citrus canker is a bacterial disease that infects citrus trees & fruit.	True	False
Chemical sprays, such as those containing copper, can be used in place of tree removal to eliminate all canker infection in trees.	True	False
Citrus canker ultimately kills infected trees.	True	False
Nothing can cure citrus canker in infected trees.	True	False
Citrus canker is a threat to human health.	True	False
Citrus canker affects residential trees & commercial groves.	True	False
The only way to stop citrus canker is to cut down all citrus trees within 1900 feet of an infected tree.	True	False
Citrus canker is not native to Florida; it is brought in by travelers or shippers.	True	False
Infected residential trees can infect other residential or commercial trees.	True	False

Research Center Use Only: Please Do Not Write in This Box

ID# _____ **County:** _____ **Date:** _____ **Pre** ☐ **Post** ☐

Knowledge Surveys

- Pre- & Post Tests
- Opinion
- Multiple Choice
- True / False
- Florida Survey Research Center, GNV (UF)

Deliverables

- Fact sheets
  - (~800 hits per year)
- ID decks (laminated)
- Workbooks/folders
- Training Modules
- Video/DVDs
- Flipcharts
- Stickers
- Artificial training limb
- Pamphlets
- Bookmarks
- Website: www.canker.ifas.ufl.edu
  - Peaked Apr 04 ~7200 total hits
- Spray bottle

Material Development

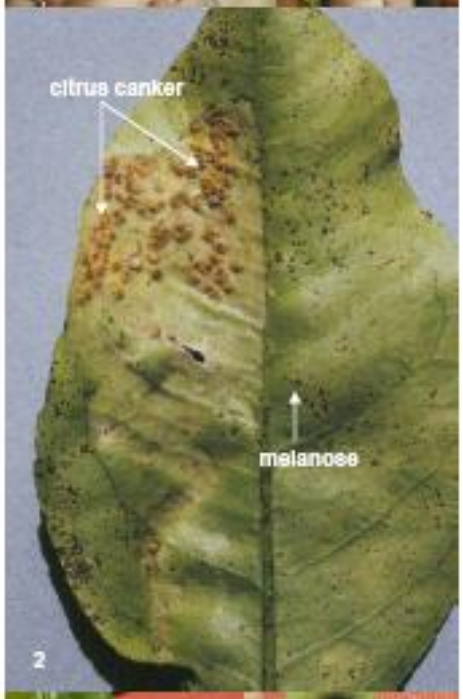
- Self-survey DVDs
- *Citrus Industry* articles / EDIS
- ID decks / Laminated ID sheets
- Websites
- CC & HLB Exhibit

IFAS Education Program

- Materials developed
  - HLB, CC, & Nursery CC DVDs for identification
  - Decontamination video
  - CC & HLB field ID decks
  - PwPt and articles on canker management

Canker ID Training

- Canker symptoms vs. other diseases
- To Date (2 mos.)
  - 1587 E
  - 448 S



Similar Diseases to Citrus Canker

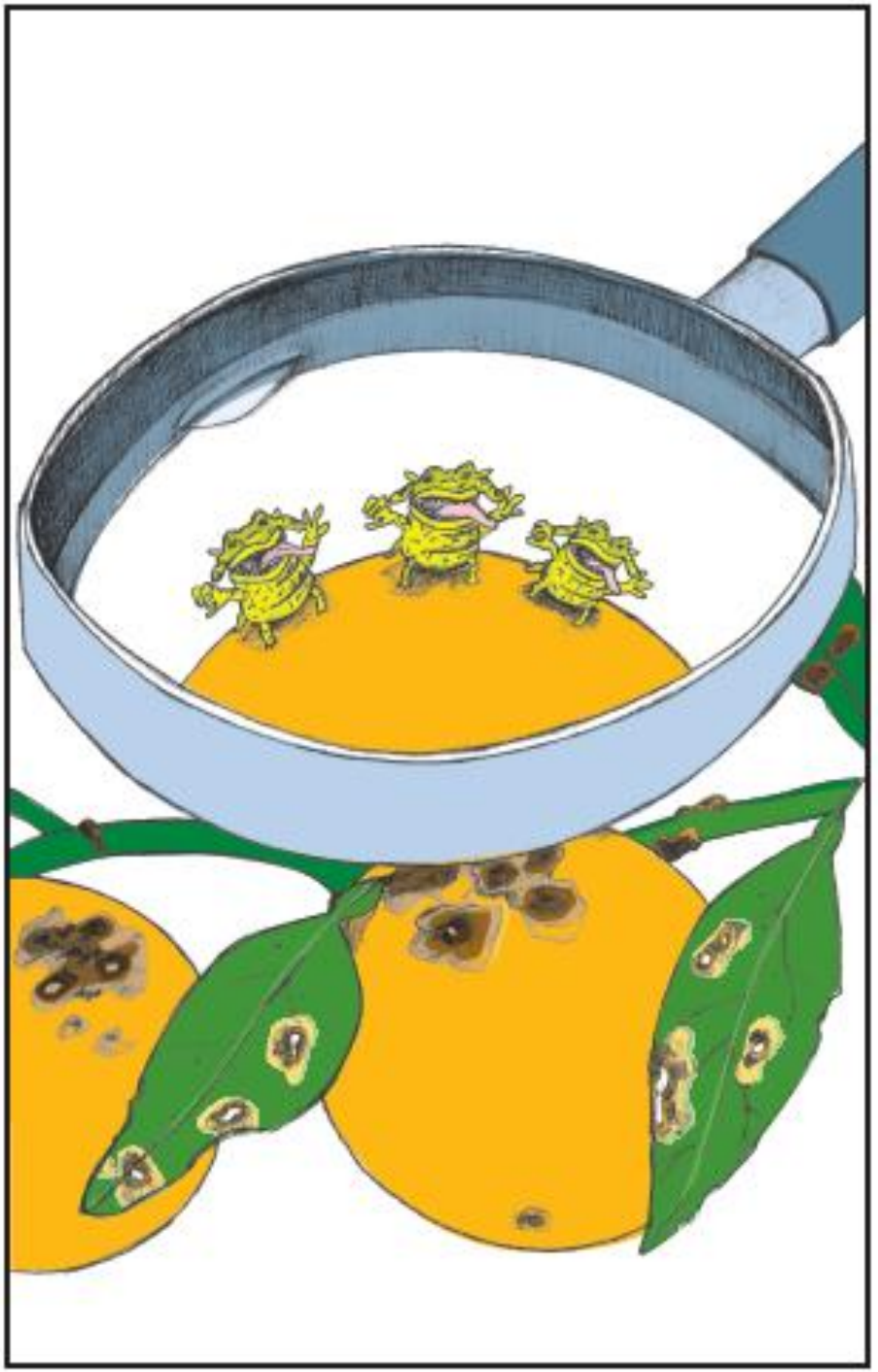
1. Citrus canker front and back on left, greasy spot front and back on right
2. Citrus canker in leaf miner wounds in upper left, small dark lesions caused by melanose
3. Scab, upper surface, and lower surface, scab in leaf miner wounds
4. Alternaria
5. Citrus bacterial spot

Enfermedades Similares Al Cancro Cítrico

1. Cancro Cítrico al frente y en la parte posterior a la izquierda, punto graseso al frente y en la parte posterior a la derecha
2. Cancro Cítrico en lesiones causadas por el Leaf Miner en la parte izquierda superior, lesiones obscuras y pequeñas causadas por la Melanosa
3. Cubierta en la parte superior, y en la parte inferior, cubierta en las lesiones causadas por el Leaf Miner
4. Alternaria
5. Punto de la bacteria cítrica

Decontamination Training

- Flipchart
- Video/DVD
- English & Spanish
- Portable
- Train the trainer

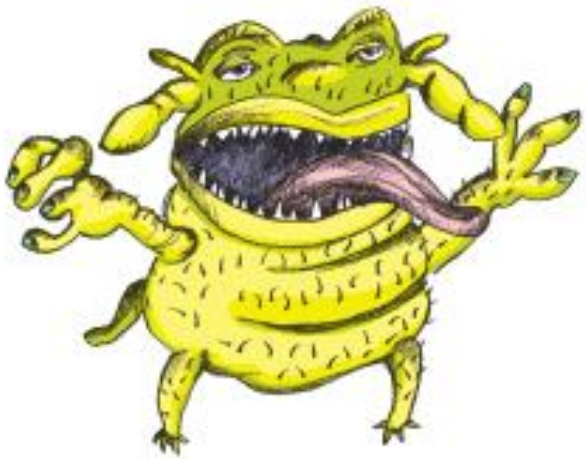


DECONTAMINATE

because it's the law!

DESINFECTAR

porque es la lay!



Decontamination Training

DECONTAMINATE

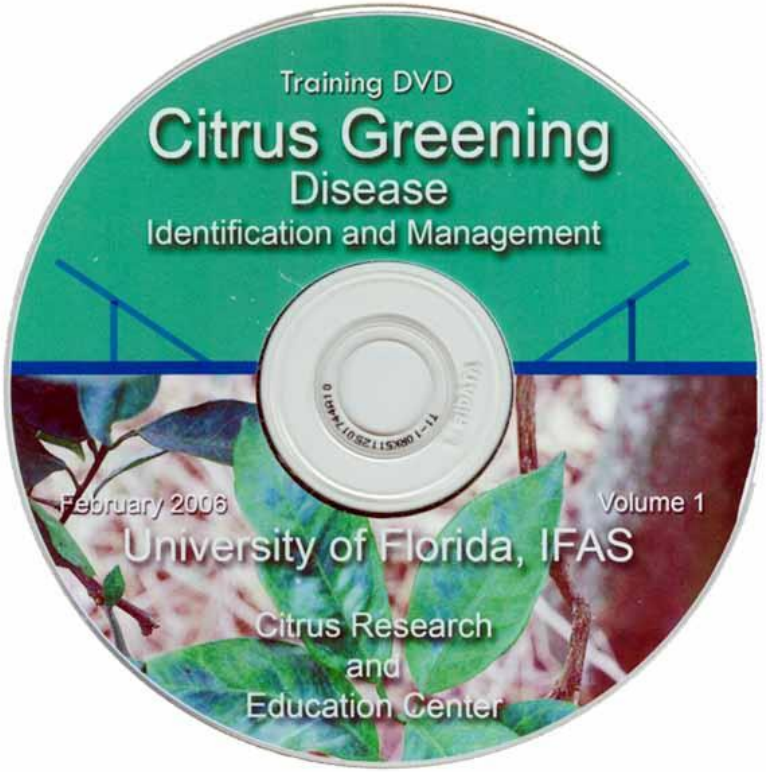
because it's the law!

DESINFECTAR

porque es la lay!

DVDs

- Citrus Canker
- Nursery
- Citrus Greening
- Dooryard Citrus
- Packinghouse Grader ID Training
- Decontamination



Citrus Industry

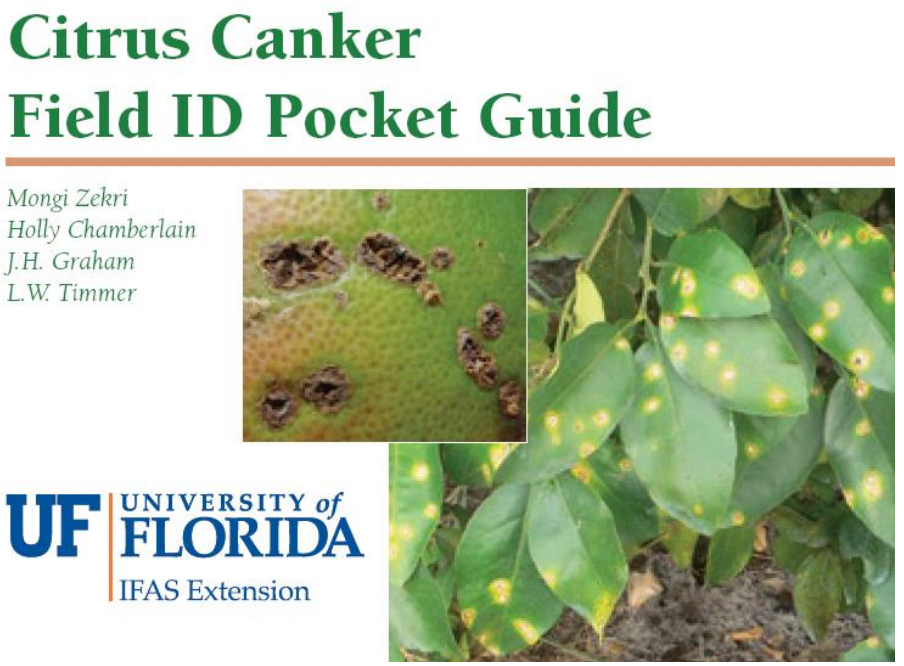
- January 2006
  - 2006 Florida Citrus Pest Management Guide Update. Rogers, Timmer, Futch.
- February 2006
  - Spring production tips. Futch, Zekri, Oswalt.
- March 2006
  - Progress report ot the citrus industry: Florida Citrus Plant Protection Committee (FCPCC). Graham, Gaddis, Irey.
  - Managing Asian citrus psyllid populations. Stansly, Rogers.
  - Citrus best management practices – water and nutrient management. Morgan, Boman, Chamberlain.
- April 2006
  - Management of citrus leafminer. Rogers, Stansly.
  - Crop considerations for citrus lands. Futch, Sellers.
- June 2006
  - Fundamentals of citrus canker management. Timmer, Graham, Chamberlain.
  - The potential threat of exotic diseases to Florida citrus. Chung.
  - Summer production practices. Futch, Zekri, Oswalt.
  - Footsteps: The best thing to put in your grove. Stansly.
- July 2006
  - Learning in Brazil. Graham, Chamberlain, and Barber.
- August 2006
  - Florida growers visit Brazil – Part II. Graham, Chamberlain, Barber.
  - To push or clip? That is the question. Futch, Graham, and Duncan.
  - Important fall practices and concerns in groves. Zekri, Futch, Oswalt.
- October 2006
  - Stem pitting citrus tristeza. Brlansky
- November 2006
  - Citrus Expo follow-up: Canker and greening – lessons from South America. Rouse and Roka.
- January 2007
  - Copper, copper, copper…The only effective product for canker control is also effective for many fungal diseases. Timmer, Graham, Chamberlain.
  - 2007 Florida Pest Management Guide Update. Rogers, Timmer.

EDIS (a sampling)

- Field Identification of Citrus Canker Symptoms and Decontamination Procedures (PP214)
- Fundamentals of Citrus Canker Management (PP231)
- Tree removal for citrus canker control
- 2007 Florida Citrus Pest Management Guide: Citrus Canker (PP182)
- Citrus Diseases Exotic to Florida Series:
  - Witches' Broom Disease of Lime (WBDL) (PP228)
  - Citrus Tristeza Virus – Stem Pitting (CTV-SP) (PP227)
  - Citrus Leprosis (PP226)
  - Sweet Orange Scab (SOS) (PP224)
  - Black Spot (PP213)
  - Huanglongbing (Citrus Greening) (PP210)

ID Decks & Laminated Sheets

- Citrus Greening
  - ID Deck / Sheets
    - English & Spanish
    - Mimics
- Citrus Canker (revised)
  - ID Deck / Sheets
    - English & Spanish
    - Foliar mimics
- Grader ID sheets



HLB/Citrus Greening Symptoms

1. HLB blotchy mottle with 'green islands'
2. HLB blotchy mottle
3. Psyllid damage
4. HLB blotchy mottle with Psyllid notching
5. Severe fruit drop
6. Severe leaf drop
7. Seed abortion with yellow staining at base of fruit button
8. Reduced fruit size and color inversion

Report high suspects to Greening Hotline 1-800-850-3781 or call local extension office

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Citrus Greening Field ID Pocket Guide

Mongi Zekri
Holly Chamberlain
L.W. Timmer
Ron Brlansky
Michael Rogers

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Citrus Canker Field ID Pocket Guide

Mongi Zekri
Holly Chamberlain
J.H. Graham
L.W. Timmer

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IFAS Extension

Guía para Identificar el Greening (Huanglongbing) de los Cítricos

Mongi Zekri
Holly Chamberlain
L.W. Timmer
Ron Brlansky
Michael Rogers

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Websites

www.crec.ifas.ufl.edu

- Citrus Canker
- Citrus Greening
- Windbreaks

- Postharvest

postharvest.ifas.ufl.edu

IFAS Education Program

- Programs
  - 4 HLB & CC statewide meetings (200)
  - Extension meetings and IRCS (350)
  - Grove worker training (780E, 420S)
  - Windbreak Short Course (60)
  - Grower trip to Parana to observe canker management and exclusion (150-200K acres represented by the group)

Citrus Canker *Program* Delivery Information (Jan 2003-August 2005)

Year	Programs	Attendance
Jan-Dec 2003	25	1514
Jan-Dec 2004	27	3414
Jan-August 2005	46	2870
TOTALS	**98**	**7798**

Delivery 2006 - 2007

- Indian River Citrus Seminar (January)
- Self-survey Trainings
- Statewide Extension Meetings (Spring)
  - CC & HLB Mngmt
- Grower CC & HLB Exp of Brazil (March)
- Windbreak Shortcourse (April)
- FSHS & FCM Annual Meetings (June)
- Greening Field ID Course (June)

Delivery 2006 - 2007

- Citrus Expo (August)
- Statewide Extension Meetings (Fall)
  - CC & HLB Mngmt in Brazil
- Grower Discussions (Bartow & Arcadia)
  - Defoliation / CC Mngmt
- Packinghouse Trainings (October / Nov)
- FNATS / Master Gardener Annual Conference / Collier County Yard & Garden Show / Farm City BBQ (Sept / October / November)

Delivery 2006 - 2007

- Citrus Safety Training Program and Tractor Rodeo (Bartow, November)
- Florida Ag Expo (December)
- Greening Sampling (December, Futch, Arcadia)
- CC / HLB Field ID Course (Atwood)
- Greening Sampling (December, Futch, Sebring)
- Mailings
- Grove Visits / Sampling

Program Totals

- 128 programs (not including mailings)
- 5627 English
- 1699 Spanish

Regulatory Interaction

- Cooperative trainings
- Websites
- 2006 – 2007 Compliance Agreements
- CHRP

IDENTIFICATION OF DISEASES, PEEL INJURIES AND BLEMISHES OF FLORIDA FRESH CITRUS FRUIT

G. Eldon Brown, Ph.D.
Scientific Research Department
Florida Department of Citrus
CREC, 700 Experiment Station Road
Lake Alfred, FL 33850

WIND SCAR - Cicatriz de viento

ANTHRACNOSE

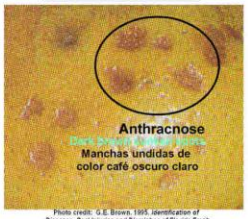


Photo credit: G.E. Brown, 1995. *Identification of Diseases, Peel Injuries and Blemishes of Florida Fresh Citrus Fruit*. 1998. Florida Dept. Citru , Lake Alfred, FL

SCAB Costra

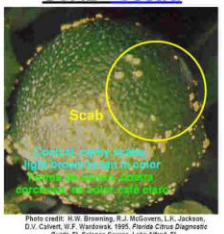
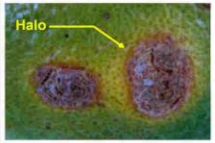


Photo credit: H.W. Browning, R.J. McGovern, L.R. Jackson, D.V. Calvert, W.F. Wardowski. 1995. *Florida Citrus Diagnostic Guide*, FL Science Source, Lake Alfred, FL

CITRUS CANKER

When in doubt . . .
. . . Throw it OUT!!

Raised & rough lesions
Lesions do not scrape off
May have halo or water-soaked ring



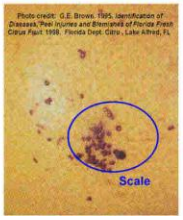
Cancro de los Cítricos

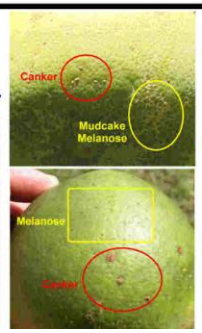
Lesiones levantadas y ásperas
Las lesiones no se remueven fácilmente
Pueda que tenga un halo amarillo o húmedo

¡Cuando hay duda. . .
. . . Descarte la fruta!!

SCALE Escama

Small circular, red-brown to black raised pimples, easily removed
Espinillas pequeñas circulares de color cafe-rojizo a negro y elevadas, se remuevar facilmente





MELANOSE

Very small sandpaper-like dark lesions, can cluster to form mudcake pattern
Bien pequeño café rojiso a negro como papel lija, puede agruparse para formar una mancha grande

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B. J. Boman[1], J. W. Hebb[2], D. E. Gunter[1], Jr., D. Cole[1], & H. Chamberlain[3]

[1]UF/IFAS, Indian River Research & Ed. Ctr.
[2]UF/IFAS, St. Lucie County Extension Office
[3]UF/IFAS, DeSoto County Extension Office

SOOTY MOLD
Moho Ennegresido

Dirty-looking, smooth, flat, dark blotches on fruit that will generally wash off
Lisas, chatos, manchas oscuras, la apariencia de la fruta sucia, al lavarse se remueve de la fruta

Photo credit: Hall, E. G. and K. J. Scott. 1977. *Storage and Market Diseases of Fruit*. CSIRO, Australia

Packinghouse Citrus Canker Fruit ID

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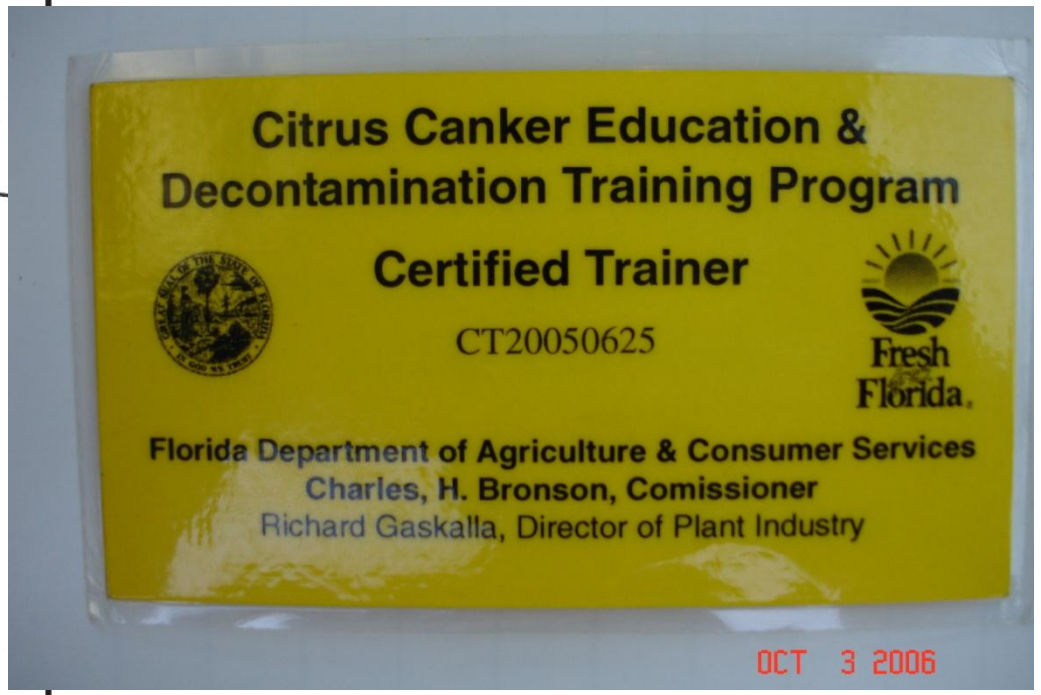
21 Days of Packinghouse Training

DECONTAMINATE

because it's the law!

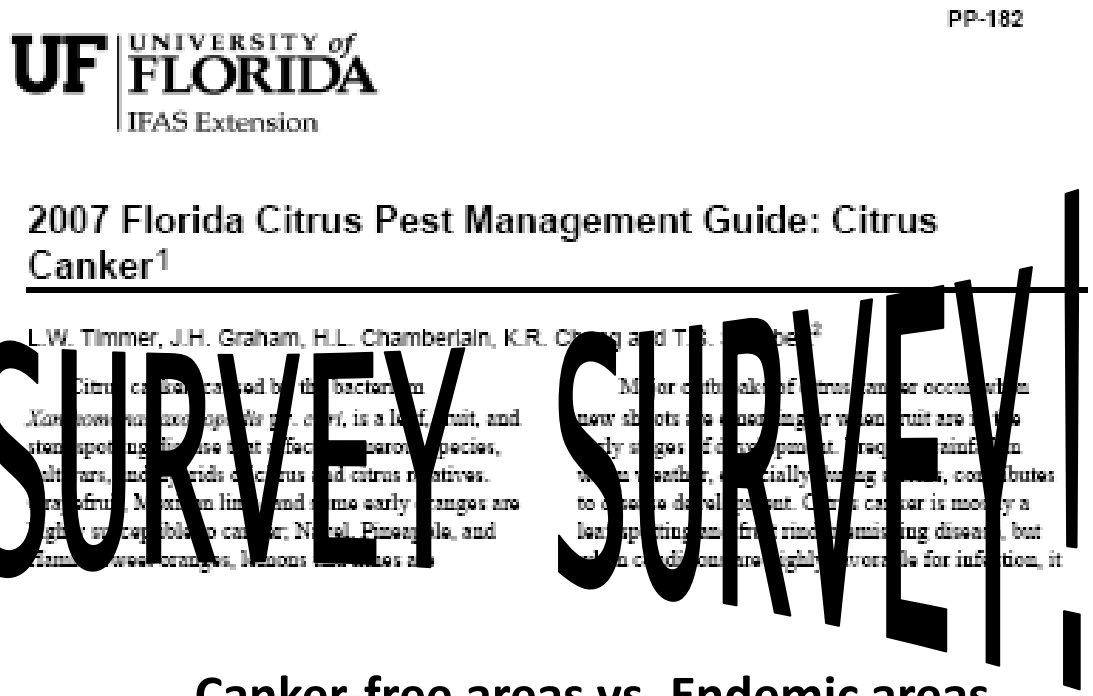
DESINFECTAR

porque es la lay!



Message

- Self regulate with the oversight of FDI, USDA
- Training
- Record keeping
- Management



Canker-free areas vs. Endemic areas
Decontamination / survey
Tree removal
Copper sprays
Windbreaks
Defoliation
Leafminer control

Development

- Transitioning to Train – the – Trainer program to every 3-5 years for Harvester, Self-Survey, and Packinghouse Grader ID
  - WPS every 5 years
- Sampling for greening
- Spray protocol (early 2007)
- Exotic disease ID
- Additional field ID trainings
- Monitoring program
- Continued web development

Opportunities for Education

- Master Gardener class
- County fairs
- Flower & garden shows
- Workshops, seminars
- Trade shows (Citrus Expo, IR Citrus Seminars, FNATS, Yard & Garden, TPIE)
- Training rodeos
- Newsletters
- Industry support groups
- Train the trainer
- Group specific trainings (Commercial citrus, Utilities, F&W, WMD)
- World wide web
- Phone

Citrus
Company
Training

Utility
Company
Training


EPI


APR 18 2006

Take Home Points

- The status of leafminer and psyllid as minor pests is a thing of the past…
- We *CANNOT* live with citrus greening
- Educational programs, training, DVDs available through UF/IFAS
- 2006 dry spring very good for canker management on processed oranges

Results 2007

- CC educational activities have been carried out in twenty Florida counties
- 7 workshops : 895 English speaking, 239 Spanish speaking
- Total to date: 2457 English-speaking, 641 Spanish-speaking

Upcoming / Ongoing Extension Activities

- Harvester Training
- Packinghouses (cont. grader training / decon)
- Indian River Citrus Seminar, grove worker training and ID rodeo (January, Hebb/Boman)
- GCGA Membership Luncheon
- Osceola HLB ID Training / Sampling
- FVMA

Indian River Citrus Seminar Rodeo

Many thanks to
Turksen Shilts and Darren Cole

Canker management practices post 1900-ft eradication program

Citrus Canker Management

- Inspection
- Decontamination
- Inoculum suppression
- Windbreaks
- Copper sprays
- Defoliation where applicable
- Leafminer control
- Varietal susceptibility
- Tree removal where applicable


MAY 25 2006

Decontamination

Windbreaks & Copper Sprays

Essential for fresh fruit production; recommended for most susceptible varieties (ie GF); single most effective measure for canker management

Leafminer Control

Leafminer control on young trees reduced inoculum build-up on early season leaf flushes

Defoliation and Buckhorning

Tree Removal Where Applicable

- Case – by – Case basis, not part of the regulatory plan
- Per individual risk assessment; thorough survey & market destination
- Proximity of neighboring canker incursions
- Susceptibility of the variety

Citrus Health Response Plan (CHRP)

- Registration of all groves
- Continued emphasis on decontamination
- Fresh fruit market products must be certified canker-free within 90 days of harvest
- Grove self-survey, annual government inspection
- Replanting only with certified nursery stock

Citrus Nursery Regulations

- Industry in transition
- Fundamental to production survival
  - Location
  - Structures
  - Sanitation practices
  - Budwood program
  - Inspection

Location

New nurseries must be located 1 mile away from commercial citrus, 0.25 mile from residential citrus

Structures

Registration of all nurseries and budwood facilities, including approval of all sites; All production indoors in approved structures

Sanitation


MAR 27 2006


Everyone
Must enter through Spray
Station!
1) Push Button
2) Step in pan & walk through mist
3) Spray turns off automatically

Bureau of Citrus Budwood Registration

Relocating Dundee site to Chiefland, FL

Inspection

- Plants must be inspected every 30 days and be certified disease-free before shipping
- Nursery environ surveys – FDACS, DPI
- Nursery self-survey (IFAS Nursery Citrus Canker Self Survey DVD)
- IFAS Nursery Disease Management Guide

Citrus Greening Management

- Disease – free nursery stock
- Scouting / Survey
- Tree removal
- Psyllid suppression


MAR 29 2006
MAR 29 2006

Disease-Free Nursery Stock

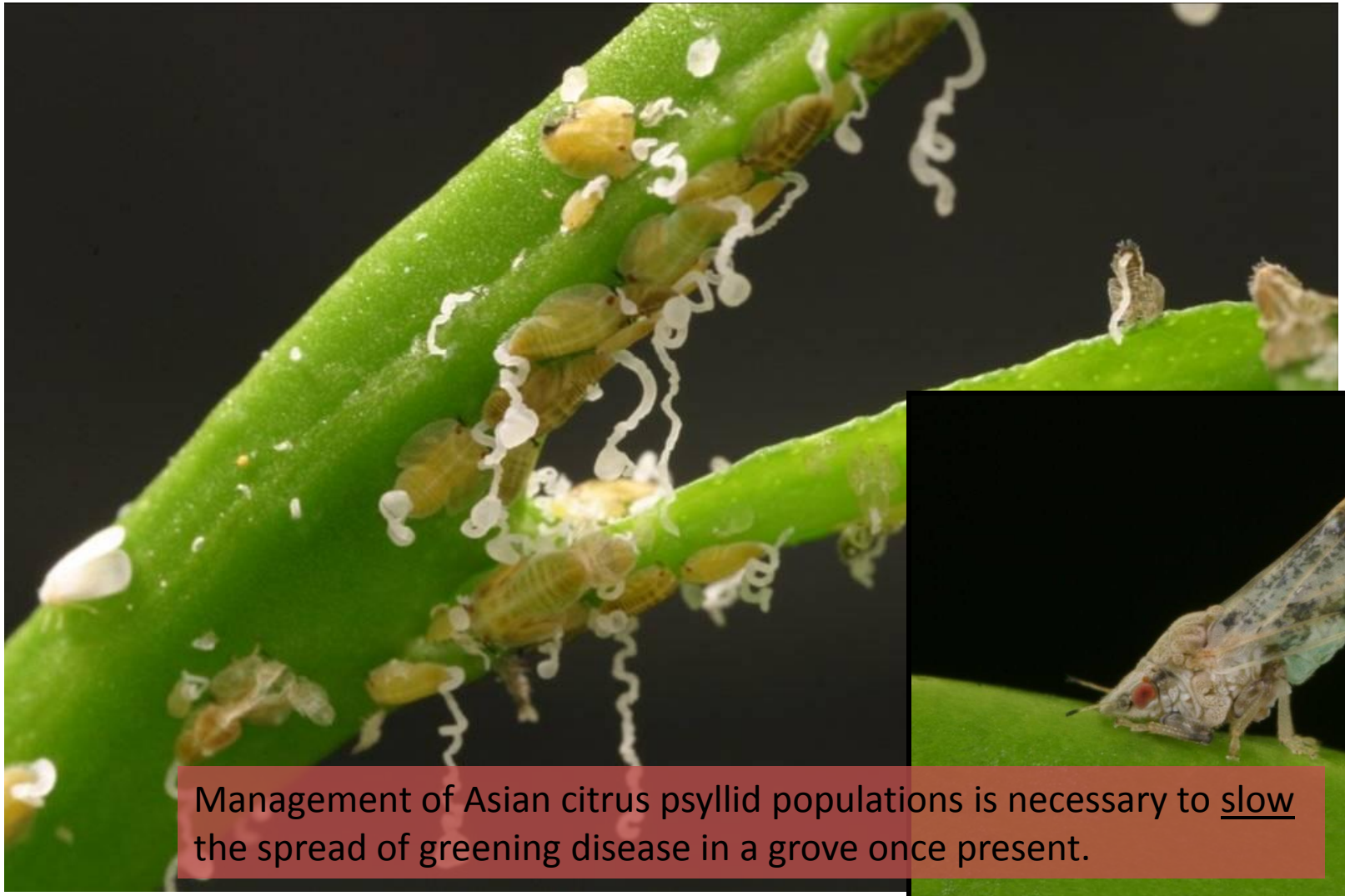
Insect excluding structures for nursery production are essential

Scouting for Psyllids and Survey for Citrus Greening

HLB Infected Tree Removal

No regulatory plan for tree removal

Psyllid Suppression



Management of Asian citrus psyllid populations is necessary to slow the spread of greening disease in a grove once present.

Huanglongbing (Greening) Sample Submission Form

(► Required Information)

Submission Information

►Date Sample Collected:_____ ►Date Sent:_____

►Submitter name:_____ Affiliation:_____

►Address:_____

_____

►City:_____ ►State:_____ ►Zipcode:_____

Email address:_____

Phone Number:_____ Fax Number:_____

►Results To Be Returned By: Mail ☐ Email ☐ Fax ☐

Grove/Nursery/Sample Information

►Grove/Nursery Name:_____

►Address/Location Where Specimen Was Collected:_____

_____

►City:_____ ►County:_____

►Block/Row/Tree Designation *(must provide enough information to be able to loca*

specific tree sampled) :_____

Latitude:_____ Longitude:_____

Section/Township/Range:_____ Sample Id (local id):_____

►Host Plant Name/Variety:_____

Additional Comments:_____

_____

_____

Do not write in this area

Date Received:_____ Lab Id:_____

Shipping/Delivery Address: United States Sugar Corporation, Technical Operations laboratory, 500 Saginaw Avenue, Clewiston, FL 33440, 863-902-2249 (Mike Irey)

HLB SAMPLING PROTOCOL

Conclusions

- The overall benefits of these activities have been
  - an increased statewide awareness of citrus canker biology and citrus greening knowledge across all client groups
  - increased emphasis on the importance of decontamination practices
  - Increased grower knowledge = increased grower self-regulation
  - augment regulatory agencies' survey efforts to increase the timeliness of disease detection