HLB Workshop: Planning for the Legislative HLB Funding, FY 2013-14

Presented to Indian River Citrus League, Vero Beach, FL
May 31, 2013

Harold Browning, Chief Operations Officer
Topics

• CRDF Program Overview
  – Organization, Funding, Process

• Indian River Region Research Projects
  – USDA, ARS, Ft. Pierce
  – UF, IFAS, IRREC, Ft. Pierce

• Comments from Research Institutions

• Overview of State Legislative Budget and its Implementation to address short-term solutions
OVERVIEW OF CRDF PROGRAMS, FUNDING, PROCESSES
National Research Council
HLB Research Recommendations, 2009

Organizational
• Identify one organization and empower it to have oversight responsibility over HLB research and development efforts
• Create “Citrus Health Management Areas” in Florida

Research
• Near to intermediate solutions to keep groves alive
• Long-term solutions for industry survival

Communication
• Keep growers informed continuously and make results available as soon as available
WHAT IS CRDF?

To address the need for an organization to manage research, the Citrus Research and Development Foundation (CRDF), a non-profit corporation was formed in April, 2009.

The organization is headed by a 13-member board of directors that includes individuals from industry (10), UF (2) and Florida Department of Agriculture & Consumer Services (1).

The Mission of CRDF

Advance disease and production research and product development activities to ensure the survival and competitiveness of Florida citrus growers
CRDF Board of Directors

• Tom Jerkins, *Pres.*
• Ricke Kress, *VP*
• Jerry Newlin, *Sec.*
• Hugh Thompson, *Treas.*
• Bobby Barben
• Larry Black
• Joe L. Davis

• Dr. Mary Duryea
• Dr. Joseph C. Joyce
• Ben McLean III
• Shannon Shepp
• Wayne Simmons
• Bob Stambaugh
Research Management Committee

• Bobby Barben, Chair
• Tom Jerkins
• Wayne Simmons
• Bill Barber
• Larry Davis
• Steve Farr

• David Howard
• Peter McClure
• John Merritt
• Tim Dooley
• Jim Snively
• George Walker

Support to the Research Management Committee
Research Program Manager
Scientific Advisory Board (SAB)
Ad hoc Scientific Reviewers
Commercial Product Development Committee

- Ben McLean III, Chair
- Ricke Kress
- Jerry Newlin
- Shannon Shepp
- Bob Stambaugh
- Hugh Thompson
- Mary Duryea

NON-BOARD MEMBERS:
- Tim Anglea
- Mark Colbert
- Peter McClure
- Andy Rackley

Support to the Product Development Committee
Product Development Program Manager
Industry Research Coordinating Committee

• Wayne Simmons, Chair
• Mark Colbert
• Peter McClure
• Tim Anglea
• Kevin Gaffney
• Mitch Willis
• John Veldhius
• Paul Genke
• Carson Futch
• Paul Meador
• V. C. Hollingsworth
• Frank Hunt, III
• Tom Kirschner
• Phil Rucks

Primary Activities
Establish Annual Citrus Research Priorities
Generate Annual Research Project Inventory
Conduct Gaps Analysis – What isn’t being done?
HLB Research Goals

• Goals for Research: Short Term
  – Preserve capacity of current tree inventory
  – Preserve fruit marketing opportunities
  – Enable replanting to renew tree inventory

• Goals for Research: Long Term
  – Resistant Plants and durable management tools
  – Less reliance on increased inputs
  – Return to managing citrus, not HLB

• Delivery of Solutions to Growers
CRDF Project Funding Process

• Open Call for Pre-Proposals
• SAB Review, RMC Review, BOD > Full Proposals
• Full Proposals Received, Reviewed
  – Ad hoc and SAB > quality of science, validity
  – RMC > Priority and applicability to growers
  – BOD > Match Review Recommendations with $$
• Each approved contracted (1-3 years)
CATP12 Cycle Proposal Processing

• 99 pre-proposals in Fall, 2012
• 66 invited to submit full proposals
• 63 full proposals received
• Ad hoc peer review and Scientific Advisory Board (SAB) evaluation
• Research Management Committee recommended, Board approved 33 projects
• Projects contracting is complete
• 2013 Cycle will begin in August
Research Projects at a Glance

• Current portfolio of about 140 projects
• FY2013-14 continuing costs - $11.8 million
• CATP13 within year costs - $800,000
• Research Project Enhancements -
  – Accelerate short-term completion and delivery
  – Review current projects for opportunities
• Breadth of project objectives
## CRDF Research Project Portfolio, March, 2013

<table>
<thead>
<tr>
<th>Category</th>
<th>Research Area</th>
<th># Projects</th>
<th>Total Cost ($)</th>
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<tr>
<td>1</td>
<td>HLB Infection</td>
<td>2</td>
<td>$196,500</td>
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<tr>
<td>2</td>
<td>CLas Culture, Genomics</td>
<td>14</td>
<td>$3,705,967</td>
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<tr>
<td>3</td>
<td>Response to Infection</td>
<td>10</td>
<td>$2,040,821</td>
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<td>4</td>
<td>Disease detection</td>
<td>5</td>
<td>$1,414,168</td>
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<td>5</td>
<td>Epidemiology</td>
<td>22</td>
<td>$5,107,024</td>
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<tr>
<td>6</td>
<td>ACP monitoring, biology</td>
<td>9</td>
<td>$1,700,588</td>
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<td>7</td>
<td>ACP management</td>
<td>16</td>
<td>$4,660,858</td>
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<td>8</td>
<td>ACP trap plants</td>
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<td>-</td>
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<td>9</td>
<td>Citrus genetics</td>
<td>2</td>
<td>$1,317,780</td>
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<td>10</td>
<td>Conventional Breeding</td>
<td>10</td>
<td>$4,497,315</td>
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<tr>
<td>11</td>
<td>Transgenic Resistance</td>
<td>21</td>
<td>$7,529,681</td>
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<tr>
<td>12</td>
<td>Model systems</td>
<td>3</td>
<td>$687,078</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>114</strong></td>
<td><strong>$32,857,780</strong></td>
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</table>
Citrus Industry Research Expense Summary - Historical

Annual Research Budget ($ millions)

Funding Year

FY 1993-94
FY 1994-95
FY 1995-96
FY 1996-97
FY 1997-98
FY 1998-99
FY 1999-00
FY 2000-01
FY 2001-02
FY 2002-03
FY 2003-04
FY 2004-05
FY 2005-06
FY 2006-07
FY 2007-08
FY 2008-09
FY 2009-10
FY 2010-11
FY 2011-12
FY 2012-13

HLB Infection
Research Funding Levels to Date

<table>
<thead>
<tr>
<th># Projects</th>
<th>Total Amount Awarded All Years</th>
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<tbody>
<tr>
<td>FCATP08</td>
<td>$37,805,991</td>
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<tr>
<td>CATP09</td>
<td>$4,729,270</td>
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<td>CATP10</td>
<td>$3,274,907</td>
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<tr>
<td>CATP11</td>
<td>$20,253,127</td>
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<tr>
<td>CATP12</td>
<td>$7,086,812</td>
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<tr>
<td>Total</td>
<td>$73,150,107 *</td>
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</table>

*The total of $73 Million represents the total research cost once ALL current Projects have been completed (FY 2016-17)*
FY 2012-13 Funding Sources

Total Budget $17.1 million

- State Legislative (FDACS): 5.1
- Donations: 2
- Federal Grant: 1.5
- State Grant: 0.1
- Marketing Box Tax (FDOC): 7.5
- Research Box Tax (FDACS): 0.9

Total Budget $17.1 million
Donor Recognition

• The Coca-Cola Corporation
• Cutrale Citrus Juices USA
• Peace River Citrus Products
• Florida Citrus Processors Association
• Florida’s Natural Citrus Growers – Citrus World
• Dow AgroSciences and Valent USA

Thank You, on Behalf of the Industry!
Overview of the CRDF Research Program

HLB, disease portfolio of 114 research projects

The pie chart illustrates the distribution of the research projects by disease type, with HLB accounting for the majority of the $30,035,518 total funding. Additional funding is allocated to other diseases, such as Alternaria alternata, Citrus Black Spot, Citrus canker, Diaprepes abbreviatus, Leprosis, and Nematodes.
INDIAN RIVER REGION - RESEARCH PROJECTS FUNDED BY CRDF
<table>
<thead>
<tr>
<th>Project #</th>
<th>PI</th>
<th>Project Title</th>
<th>Category</th>
<th>Total Contract Amount</th>
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<tbody>
<tr>
<td>5</td>
<td>Baldwin</td>
<td>Effects of HLB on quality of orange juice and identification of HLB-induced</td>
<td>1</td>
<td>$87,067.00</td>
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<tr>
<td></td>
<td></td>
<td>chemical signatures in fruit juice and leaves</td>
<td></td>
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<tr>
<td>14</td>
<td>Duan</td>
<td>Dissecting the Disease Complex of Citrus Huanglongbing in Florida</td>
<td>2</td>
<td>$640,444.00</td>
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<tr>
<td>76</td>
<td>Duan</td>
<td>Characterization of a putative insect-transmission determinant/virulence gene</td>
<td>3</td>
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<tr>
<td></td>
<td></td>
<td>(Hyp1) of 'Candidatus Liberibacter asiaticus'</td>
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<tr>
<td>77</td>
<td>Gottwald</td>
<td>Efficacy of citrus canker control strategies, leafminer interactions, and</td>
<td>5</td>
<td>$336,208.00</td>
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<tr>
<td></td>
<td></td>
<td>bacterial survival.</td>
<td></td>
<td></td>
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<tr>
<td>78</td>
<td>Gottwald</td>
<td>Epidemiology and disease control of HLB</td>
<td>5</td>
<td>$506,502.00</td>
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<tr>
<td>91</td>
<td>Powell</td>
<td>Rapid and Efficient Delivery of Effective Compounds into Citrus Phloem for</td>
<td>5</td>
<td>$199,402</td>
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<tr>
<td></td>
<td></td>
<td>Treatment of HLB Bacteria</td>
<td></td>
<td></td>
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<tr>
<td>93</td>
<td>Baldwin-I</td>
<td>Investigate effect of nutritional sprays on healthy and HLB-diseased orange</td>
<td>5</td>
<td>$296,414</td>
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<td></td>
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<td>fruit and resulting juice quality</td>
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<td></td>
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<td>162</td>
<td>Hall</td>
<td>Pathogen-Vector Relations between Asian Citrus Psyllid and Liberibacter</td>
<td>6</td>
<td>$295,414</td>
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<tr>
<td></td>
<td></td>
<td>asiaticus</td>
<td></td>
<td></td>
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<tr>
<td>220</td>
<td>Hall</td>
<td>Efficacy of Seasonal Insecticide Programs for Suppressing HLB in New Citrus</td>
<td>7</td>
<td>$199,402</td>
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<td></td>
<td></td>
<td>Plantings</td>
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<td>221</td>
<td>Shatters</td>
<td>Targeting the Asian Citrus Psyllid Feeding Mechanism as a Means of Blocking</td>
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<tr>
<td></td>
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<td>Psyllid Feeding on Citrus</td>
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<tr>
<td>310</td>
<td>LaPointe</td>
<td>Automated application of semiochemicals for control of citrus leafminer and</td>
<td>7</td>
<td>$300,000</td>
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<tr>
<td></td>
<td></td>
<td>citrus canker disease with application for control of Asian citrus psyllid</td>
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<tr>
<td></td>
<td></td>
<td>and HLB.</td>
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<td>315</td>
<td>Lapointe</td>
<td>Application of an aggregation pheromone for management of the Diaprepes root</td>
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<td>$497,503</td>
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<td></td>
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<td>weevil.</td>
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<tr>
<td>330</td>
<td>Lapointe</td>
<td>Determination of attractive host plant volatiles and sex pheromones of the</td>
<td>7</td>
<td>$483,000</td>
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<tr>
<td></td>
<td></td>
<td>Asian citrus psyllid using electroantennograms and coupled gas chromatograph-</td>
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<tr>
<td></td>
<td></td>
<td>electroantennographic detection</td>
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<tr>
<td>Project Number</td>
<td>Investigator</td>
<td>Title</td>
<td>Year</td>
<td>Budget</td>
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<td>--------------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
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<tr>
<td>422</td>
<td>Gottwald</td>
<td>Efficacy of interplanting citrus with guava as a control strategy for Huanglongbing (HLB)</td>
<td>8</td>
<td>$240,193.00</td>
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<td>502</td>
<td>Duan</td>
<td>Screening and Cloning of Resistance Related Genes by RNA-Seq in Huanglongbing (HLB) Resistant and Susceptible Citrus Breeding Lines</td>
<td>10</td>
<td>$190,200</td>
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<td>508</td>
<td>Bowman</td>
<td>Development of Promising New Rootstocks and Scions for Florida Citrus</td>
<td>10</td>
<td>$401,906.00</td>
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<tr>
<td>523</td>
<td>Hall</td>
<td>Speedy evaluation of citrus germplasm for psyllid resistance</td>
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<td>$477,502.00</td>
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<td>560</td>
<td>Bowman</td>
<td>Development of Promising Supersour and Other Rootstocks Resistant to HLB</td>
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<td>$84,500</td>
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<td>561</td>
<td>Stover</td>
<td>Development of Promising New Scions for Florida Citrus: Exploiting HLB Resistance and Tolerance</td>
<td>10</td>
<td>$161,500</td>
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<td>584</td>
<td>Stover</td>
<td>A secure site for testing transgenic and conventional citrus for HLB and psyllid resistance</td>
<td>11</td>
<td>$168,800</td>
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<td>605</td>
<td>Stover</td>
<td>Production of Transgenic Commercial Cultivars Resistant to HLB and Canker</td>
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<td>$208,650</td>
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<td>606</td>
<td>Arnold</td>
<td>High-Throughput Screening of Transgenic Citrus for HLB Resistance</td>
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<td>$480,753</td>
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<td>607</td>
<td>Stover</td>
<td>Production of Transgenic Commercial Scion Cultivars Resistant to HLB and Canker: Continued AMP Approaches and Novel Transgenic Strategies</td>
<td>11</td>
<td>$249,219</td>
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<td>702</td>
<td>Stover</td>
<td>A secure site for testing transgenic and conventional citrus for HLB and psyllid resistance</td>
<td>11</td>
<td>$110,000</td>
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<td>717</td>
<td>Duan-p-1</td>
<td>Control citrus HLB by blocking the functions of two critical effectors encoded by 'Candidatus Liberibacter asiaticus'</td>
<td>11</td>
<td>$148,536</td>
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Total Budget: $7,442,039.00
## UF, IFAS Projects - CRDF

<table>
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<tr>
<th>Project #</th>
<th>PI</th>
<th>Affiliation</th>
<th>Project Title</th>
<th>Category</th>
<th>Total Contract Amount</th>
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<tr>
<td>13</td>
<td>Ritenour</td>
<td>UF</td>
<td>Pre-Grading Fresh Citrus for Canker Prior to Dumping on the Main Packingline</td>
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<td>161</td>
<td>Powell</td>
<td>UF</td>
<td>Screening effective chemical compounds against citrus HLB bacterium Candidatus Liberibacter--Further evaluation of selected compounds in greenhouse and field</td>
<td>2</td>
<td>$76,000</td>
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<tr>
<td>168</td>
<td>Powell</td>
<td>UF</td>
<td>Top 100 Antibiotics: Screening Effective Chemical Compounds Against Citrus HLB Bacterium, Candidatus Liberibacter asiaticus</td>
<td>3</td>
<td>$245,613</td>
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<td>400</td>
<td>Powell SA</td>
<td>UF</td>
<td>Services Agreement Antimicrobials</td>
<td>3</td>
<td>$245,613</td>
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<tr>
<td>401</td>
<td>Borovsky/Powell</td>
<td>UF</td>
<td>Control of the Asian citrus psyllid, Diaphorina citri Kuwayama with protease inhibitors and RNAi.</td>
<td>7</td>
<td>$392,802</td>
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<td>13-01</td>
<td>Powell</td>
<td>UF</td>
<td>Top 100 RNAi: Cloning, Expressing and Testing Key RNAi Molecules Against Asian Citrus Psyllid, Diaphorinia citri</td>
<td>7</td>
<td>$250,000</td>
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<td>617</td>
<td>Gruber-b-2</td>
<td>UF-IRREC</td>
<td>Expedited Indian River Evaluation of Tetrazyg Rootstocks Surviving the HLB-Gauntlet</td>
<td>10</td>
<td>$339,430</td>
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<tr>
<td>618</td>
<td>Powell</td>
<td>UF</td>
<td>RNAi InnoCentive Project Extension (Phase II): In planta Characterization of dsRNA Effect on all Psyllid Life Stages and Selection of Target(s) to Advance to Commercialization</td>
<td>11</td>
<td>$487,383</td>
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<tr>
<td>736</td>
<td>Powell</td>
<td>UF</td>
<td>A Rapid Screening Process for Chemical Control of Huanglongbing</td>
<td>12</td>
<td>$76,000</td>
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9 $ 2,147,550
COMMENTS FROM CITRUS RESEARCH LEADERS

Calvin Arnold, USDA, ARS, USHRL
Peter Stofella, UF, IFAS, IRREC
Jackie Burns, UF, IFAS Citrus Program Leader
FY 2013-14 STATE LEGISLATIVE SUPPORT $9.5 MILLION
FY 2013-14 Legislative Initiative

- Accelerate Short-Term Delivery of Solutions to HLB $8,000,000 CRDF
- CHMA Program Support $500,000 FDACS
- Budwood Protection $500,000 FDACS
- Germplasm Introduction $500,000 FDACS

Total $9.5 Million
Legislative Budget Utilization - CRDF

- Current Near-Term Research Projects $3,844,256
- Current CPD Near-Term Projects $194,872
  Current Commitment Total $4,039,128
- Near-Term HLB Research Enhancements
  - Committed
  - To be Determined
- Commercial Product Delivery Enhancements
  - Tolerant Rootstocks, Escapes, etc.
  - Other Project Acceleration

Total $8,000,000
<table>
<thead>
<tr>
<th>Category</th>
<th>Research Area</th>
<th># Projects</th>
<th>Total Cost ($)</th>
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<tr>
<td>1</td>
<td>HLB Infection</td>
<td>1</td>
<td>$50,000</td>
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<tr>
<td>2</td>
<td>CLas Culture, Genomics</td>
<td>2</td>
<td>$206,404</td>
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<td>3</td>
<td>Response to Infection</td>
<td>5</td>
<td>$241,525</td>
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<td>4</td>
<td>Disease detection</td>
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<td>Epidemiology</td>
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<td>$970,518</td>
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<td>ACP monitoring, biology</td>
<td>5</td>
<td>$353,910</td>
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<td>7</td>
<td>ACP management</td>
<td>11</td>
<td>$1,091,008</td>
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<td>8</td>
<td>ACP trap plants</td>
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<td>Citrus genetics</td>
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<td>10</td>
<td>Conventional Breeding</td>
<td>3</td>
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<td>Transgenic Resistance</td>
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<td>$160,838</td>
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<td>12</td>
<td>Model systems</td>
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<td><strong>Total</strong></td>
<td><strong>43</strong></td>
<td><strong>$3,844,256</strong></td>
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Delivery of Results

Commercial Product Delivery (CPD)

- 8 Projects in 2012-13: Research to next steps
  - Neonicotinoids – support for ACP control
  - Anti-Microbials – therapy for infected trees

- 3 new projects added in March, 2013
  - Tolerant Rootstock Candidates
  - Plant Growth Regulators & Role with HLB
    - Phloem Restoration and Fruit Drop
    - HLB Escapes – Look for surviving trees

- Looking for other projects ready for acceleration
Tiered View of Delivery Projects

**Tier 1: Active Projects**
- Area-wide insect management (Insecticide label changes and CHMAs)
- Anti-bacterial materials
- Tolerant Rootstock Plantings
- Genetic technology (MCTF) – Deploying Canker-Resistance Genes

**Tier 2: Facilitate and Monitor Projects**
- RNAi Molecules
- CTV Vector
- Diaprepes Pheromone
- Canine Detection of canker (HLB and CBS under development)

**Tier 3: Information Projects**
- Advanced Citrus Production Systems
- Plant Growth Regulator Interactions with HLB
- HLB Escapes
- nuPsyllid NIFA grant
Potential Enhancements FY2013-14

Discussion of Potential Delivery Project Enhancements

For each CPDC project listed below, the current status of Research and CPD investment is followed by potential enhancements for FY 2013-14
Potential Enhancements FY2013-14

Neonicotinoids and other Insecticides for ACP

- **CRDF Background investment:** Considerable investment in projects since initiation of HLB response. Products, rates, timing, ACP response. CRDF also is supporting research on issues of importance to registrants, EPA
- **CRDF working with registrants, FDACS and EPA to consider expanded use of basal trunk applications**
- **New products/AIs are moving forward**
- **Opportunity to add new tools protect from overuse**
Potential Enhancements FY2013-14

Rootstocks for New Plantings

• **CRDF Background investment**: Significant investment in UF and USDA citrus breeding programs (over $1 million per year) has set the stage for the field evaluation of rootstock genotypes under severe Significant HLB pressure.

• Near term expansion possibilities for Rootstocks for New Plantings initiative include facilitation of propagation of promising candidates for near-term large scale grower field trials, which could scale up over time. In addition, consideration is being given to overcoming barriers to availability of rootstock propagation materials of promising candidates in the near future as testing advances.

• Other new plantings initiatives
Potential Enhancements FY2013-14

Antimicrobial Therapies

- **CRDF Background investment**: CRDF-funded development of antimicrobial screens has enabled comparative data development on a long list of candidate materials, and this work continues through a Research Services Agreement. Recent research also has focused on development of methods to evaluate soil microbial materials for their effects on HLB/citrus roots. A parallel Research Services Agreement is in place to facilitate testing of candidate materials in this screen.

- Expansion of graft-based chemotherapy lab capacity for Powell, Wang, possible 3rd party labs
- Consideration of Field Trials for selective candidates
- 3rd party assistance on regulatory environment and roadmaps, candidate commercial partner identification
Potential Enhancements FY2013-14

HLB Escapes

- **CRDF Background investment**: Projects have been supported to investigate potential surviving genotypes of citrus in areas of China and India, and the current project focuses on investigating occurrence of HLB escapes in Florida.
- Provide support, as required, to assist Gmitter, Wang, and citrus extension agents in overcoming barriers to successful implementation of escape trees process.
- Expand soil microbial testing capacity for Dr. Wang.
Potential Enhancements FY2013-14

PGRs and Fruit Drop

• **CRDF Background investment:** A 2012 project was approved to evaluate the role of PGRs on growth of phloem in HLB-infected trees, and possible implications for fruit drop. Other funded research has provided methods to evaluate and quantify phloem dynamics.

• Additional Enhancements are under consideration

• Possible new research on fruit drop may be suggested by examination of current PGR labels.

• Based on research results, it may be possible to first evaluate, then launch label change efforts later in the fiscal year
Potential Enhancements FY2013-14

Thermal therapy field tests

- **CRDF Background investment:** A current project is focused on evaluating thermal conditions that may lower CLas titer in infected field-planted trees. Similarly, a two-year Specialty Crop Block Grant Project also is investigating this potential (Duan, USDA, ARS).
- Refine Heat Requirements (temperature and time)
- Field trials with low-tech solutions
- Develop more technical heat treatment options
Potential Enhancements FY2013-14

Poncirus-based HLB-tolerant scions

- **CRDF Background investment**: Ongoing UF and USDA scion development research projects hold promise for candidate HLB-resistant scions.
- Identification of need for additional effort to accelerate availability of these materials
- Consider additional field trials and fruit quality assessments
Potential Enhancements FY2013-14

Enhanced Nutritional Programs

• **CRDF Background investment:** Current investment to date on nutrition in relation to HLB includes 14 projects for a total investment of $1,638,554.

• A project that just ended sought to capture grower trial observations and results, and to determine how to find the most valuable components of ENPs that influence tree health.

• Additional trials to evaluate role of nutrition in health of HLB-infected trees
Looking Forward - CPD

- Looking for projects to move forward
  - From research project results
  - From outside sources
    - Adaptation from other uses/crops
    - Submission of new solution ideas (e.g., Innocentive)
- Removing Obstacles – Research, Regulatory
- Funding Enhancement – Legislative Funds
Support for New Plantings

- Rootstock/Scion
- Location of plantings
- Management of HLB
- Quality nursery stock
- Aggressive early growth
- Psyllid Management
- Implement new tools

6/3/2013

www.citrusrdf.org

A. Schumann, UF, IFAS
Final Thoughts

WHAT ARE THE COMPONENTS OF FUTURE HLB MANAGEMENT?
Disease System Balance

Asian Citrus Psyllid Population
- High
- Low

Clas Bacterial Innoculum
- High
- Low

Tree Susceptibility To HLB & Injury
- High
- Low

Transmission Inoculation

Infection

Tree Injury

X X X = HLB Disease Severity
Asian Citrus Psyllid Population
High

Clas Bacterial Innoculum
High

Tree Susceptibility To HLB
High

Transmission
Low

Infection
Low

Tree Injury
Low

= 300

HLB Disease Severity Increasing

This was the most important time for disease spread and state-wide infection
With improved ACP Control, New Infection is Decreased
Ultimate HLB Management

Asian Citrus Psyllid Population
- Pesticides
- Novel Suppression
- Biological Control
- Attract/Repel
- Defective ACP
- CHMAs

Clas Bacterial Innoculum
- Better Detection
- Tree Removal
- Antimicrobials
- Tree Defense
- Thermal Therapy
- Other Therapy

Tree Susceptibility To HLB and Injury
- Optimal Nutrition/Irrigation
- Tolerant Rootstocks
- Increase Plant Defense
- Breeding for Resistance
- Incorporate Anti-HLB genes
- Accelerate Production
- Replant Citrus Trees

Transmission X Infection X Tree Injury = Reduced HLB Disease Severity
Future Target Situation

Asian Citrus Psyllid Population  
High

Clas Bacterial Innoculum  
High

Tree Susceptibility To HLB and Injury  
High

Transmission  
Low

Infection  
Low

Tree Injury  
Low

With improved ACP Control, New Infection is Decreased

HLB Disease Severity  
Lesser Pressure

Formula:

\[ 0.5 \times 3 \times 3 = 4.5 \]
CRDF Website

- Approved Research Projects List
- Individual Projects – Progress Reports
- Notice and Process for New Proposals
- 2011-12 Research Gaps Analysis Report
- Commercial Product Development Projects
- Newsletters, other updates
CRDF is proud to provide support to the industry

Thank you!