



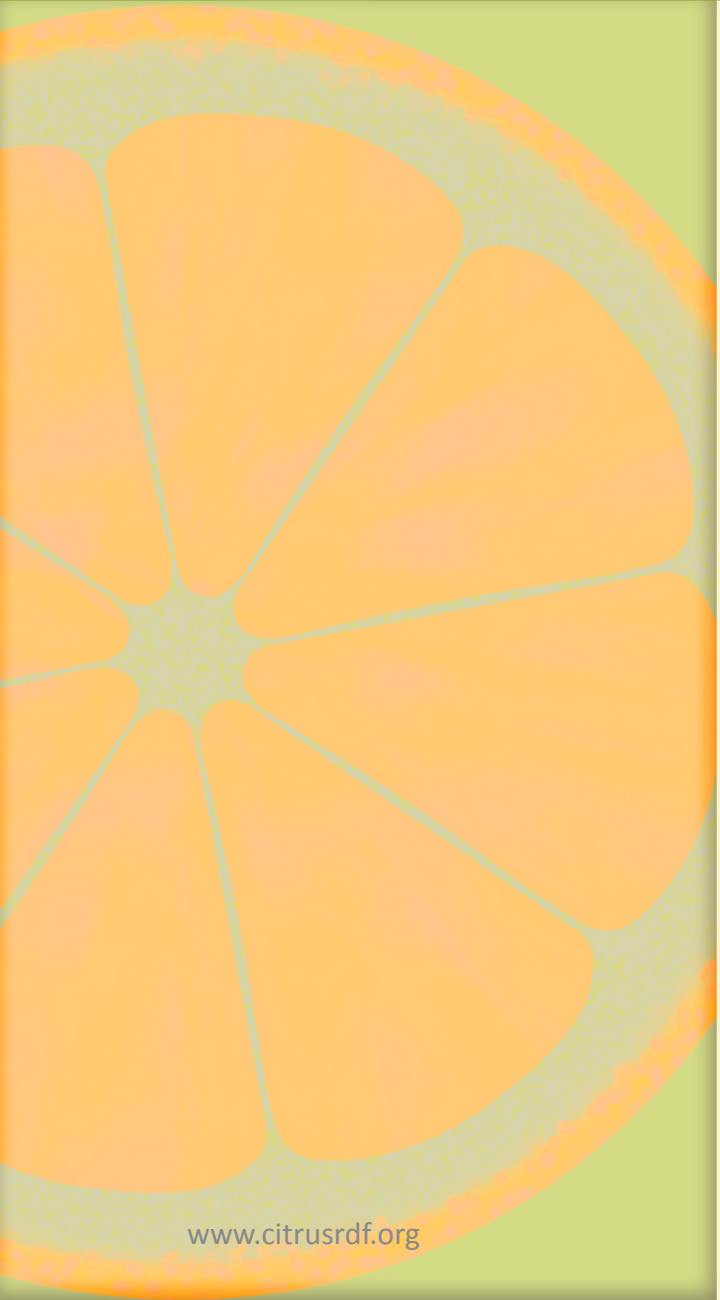
**HLB Workshop:
Planning for the
Legislative HLB Funding,
FY 2013-14**

**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

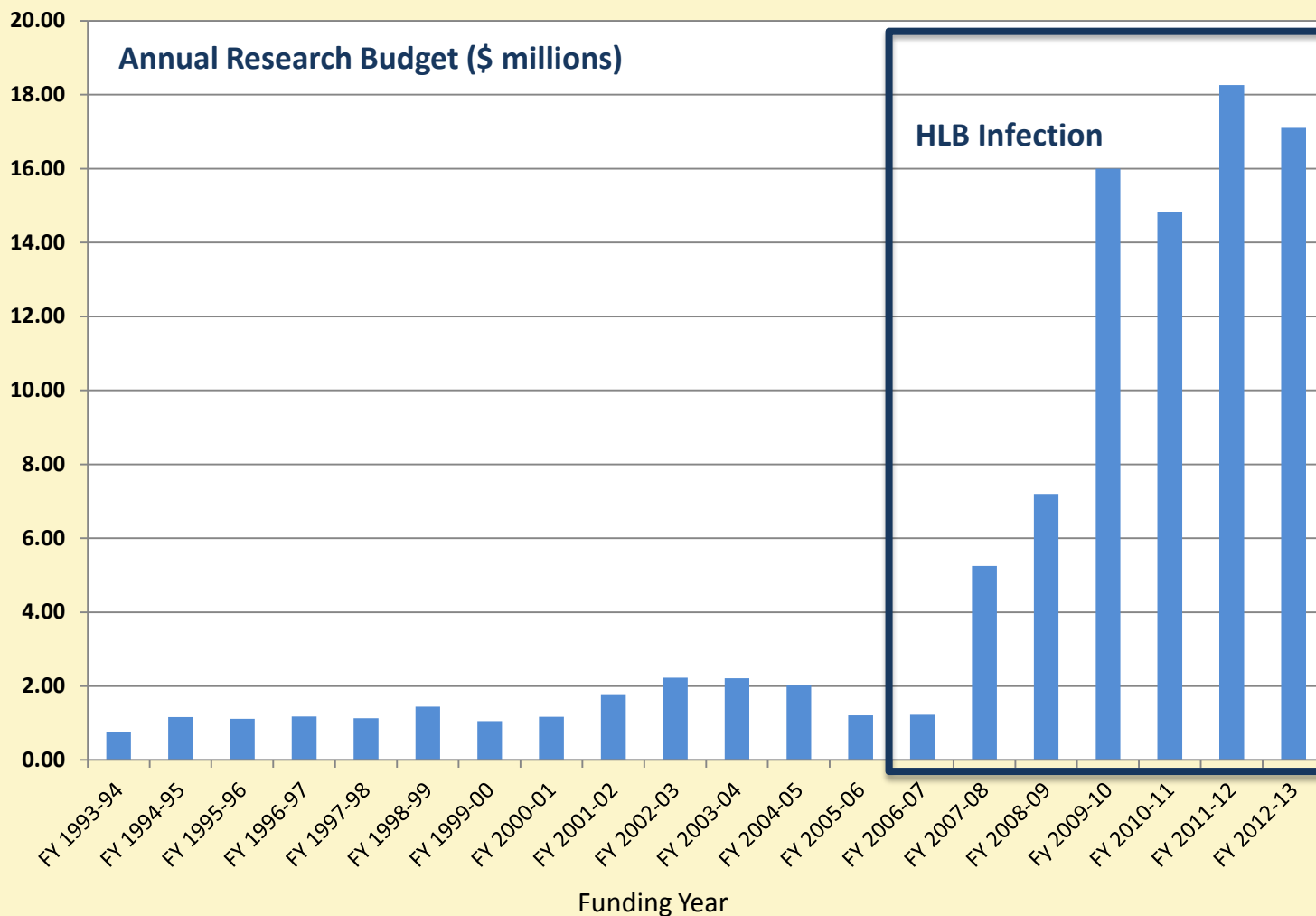
Research Projects at a Glance

- 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

Category	Research Area	# Projects	Total Cost (\$)
1	HLB Infection	2	\$ 196,500
2	CLas Culture, Genomics	14	\$ 3,705,967
3	Response to Infection	10	\$ 2,040,821
4	Disease detection	5	\$ 1,414,168
5	Epidemiology	22	\$ 5,107,024
6	ACP monitoring, biology	9	\$ 1,700,588
7	ACP management	16	\$ 4,660,858
8	ACP trap plants	0	\$ -
9	Citrus genetics	2	\$ 1,317,780
10	Conventional Breeding	10	\$ 4,497,315
11	Transgenic Resistance	21	\$ 7,529,681
12	Model systems	3	\$ 687,078
	Total	114	\$ 32,857,780

Citrus Industry Research Expense Summary - Historical

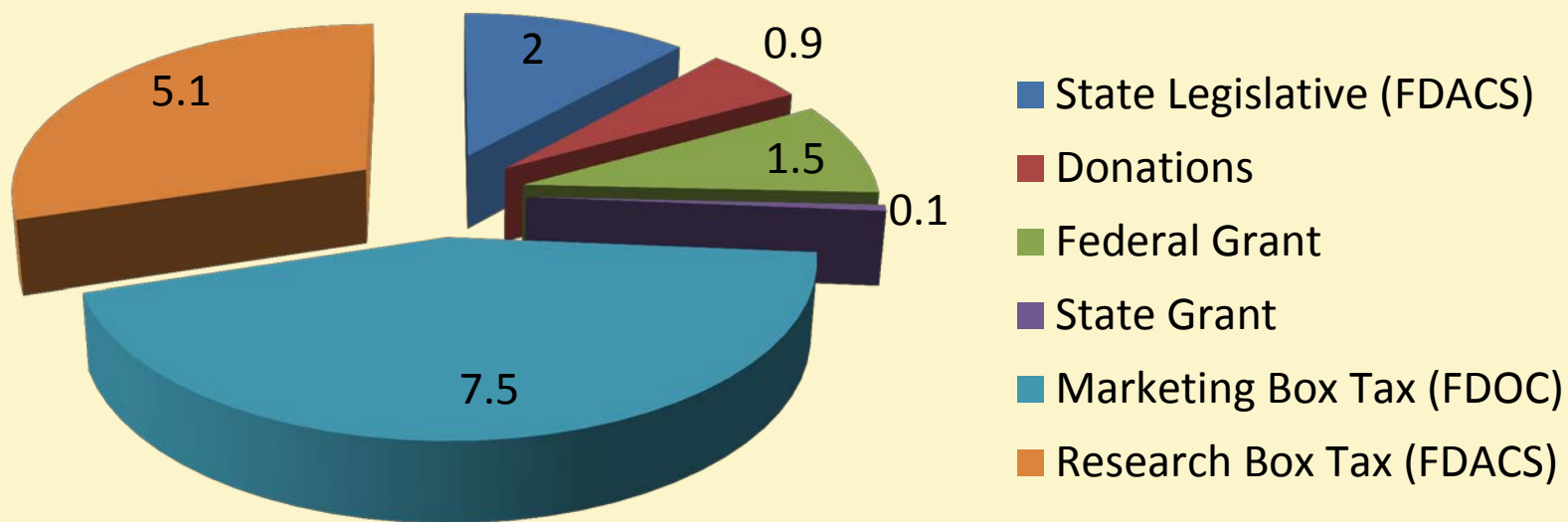


Research Funding Levels to Date

	# Projects	Total Amount Awarded All Years
FCATP08	113	\$ 37,805,991
CATP09	25	\$ 4,729,270
CATP10	21	\$ 3,274,907
CATP11	69	\$ 20,253,127
CATP12	<u>33</u>	\$ <u>7,086,812</u>
Total	228	\$ 73,150,107 *

*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



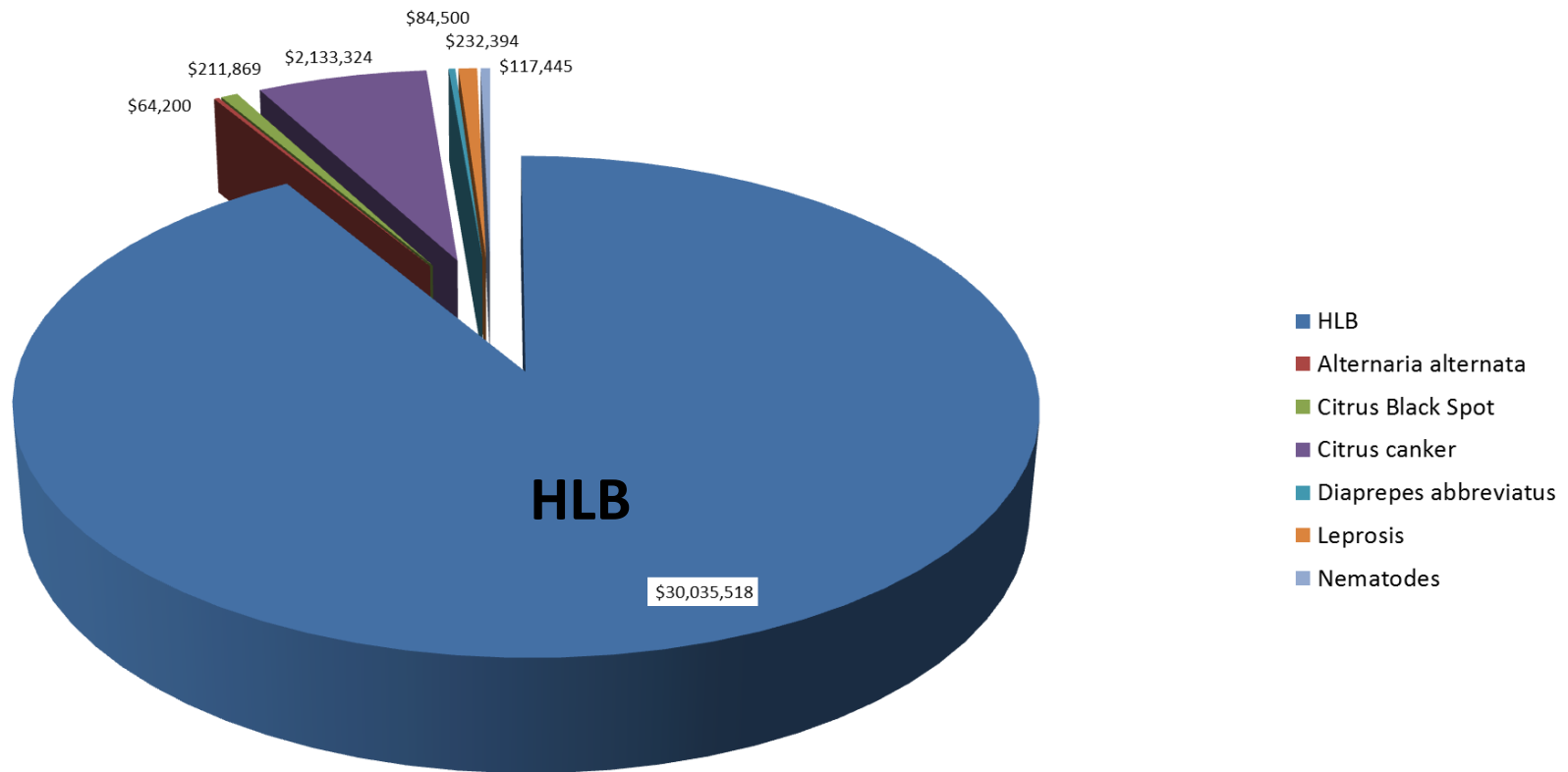
Total Budget \$17.1 million

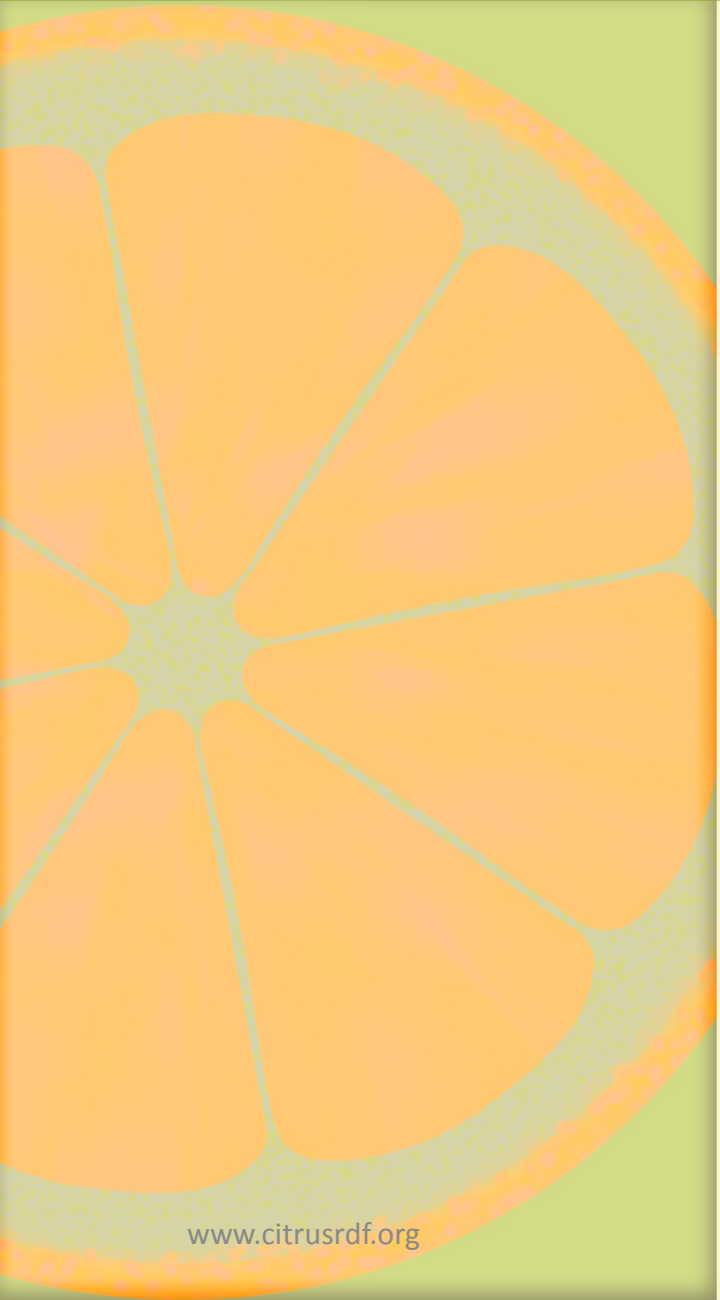
Donor Recognition

- 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!

HLB, disease portfolio of 114 research projects





INDIAN RIVER REGION - RESEARCH PROJECTS FUNDED BY CRDF

USDA, ARS Projects - CRDF

<u>Project #</u>	PI	Project Title	Category	Total Contract Amount
<u>5</u>	Baldwin	Effects of HLB on quality of orange juice and identification of HLB-induced chemical signatures in fruit juice and leaves	1	\$ 87,067.00
<u>14</u>	Duan	Dissecting the Disease Complex of Citrus Huanglongbing in Florida	2	\$ 640,444.00
76	Duan	Characterization of a putative insect-transmission determinant/virulence gene (Hyp1) of 'Candidatus Liberibacter asiaticus'	3	\$ 203,924.00
77	Gottwald	Efficacy of citrus canker control strategies, leafminer interactions, and bacterial survival.	5	\$ 336,208.00
<u>78</u>	Gottwald	Epidemiology and disease control of HLB	5	\$ 506,502.00
<u>91</u>	Powell	Rapid and Efficient Delivery of Effective Compounds into Citrus Phloem for Treatment of HLB Bacteria	5	\$ 199,402
<u>93</u>	Baldwin-I	Investigate effect of nutritional sprays on healthy and HLB-diseased orange fruit and resulting juice quality	5	296,414
162	Hall	Pathogen-Vector Relations between Asian Citrus Psyllid and Liberibacter asiaticus	6	\$ 295,414.00
<u>220</u>	Hall	Efficacy of Seasonal Insecticide Programs for Suppressing HLB in New Citrus Plantings	7	\$ 199,402.00
<u>221</u>	Shatters	Targeting the Asian Citrus Psyllid Feeding Mechanism as a Means of Blocking Psyllid Feeding on Citrus	7	\$ 475,000.00
<u>310</u>	LaPointe	Automated application of semiochemicals for control of citrus leafminer and citrus canker disease with application for control of Asian citrus psyllid and HLB.	7	\$ 300,000
315	Lapointe	Application of an aggregation pheromone for management of the Diaprepes root weevil.	7	\$ 497,503
330	LaPointe	Determination of attractive host plant volatiles and sex pheromones of the Asian citrus psyllid using electroantennograms and coupled gas chromatograph-electroantennographic detection	7	\$ 483,000

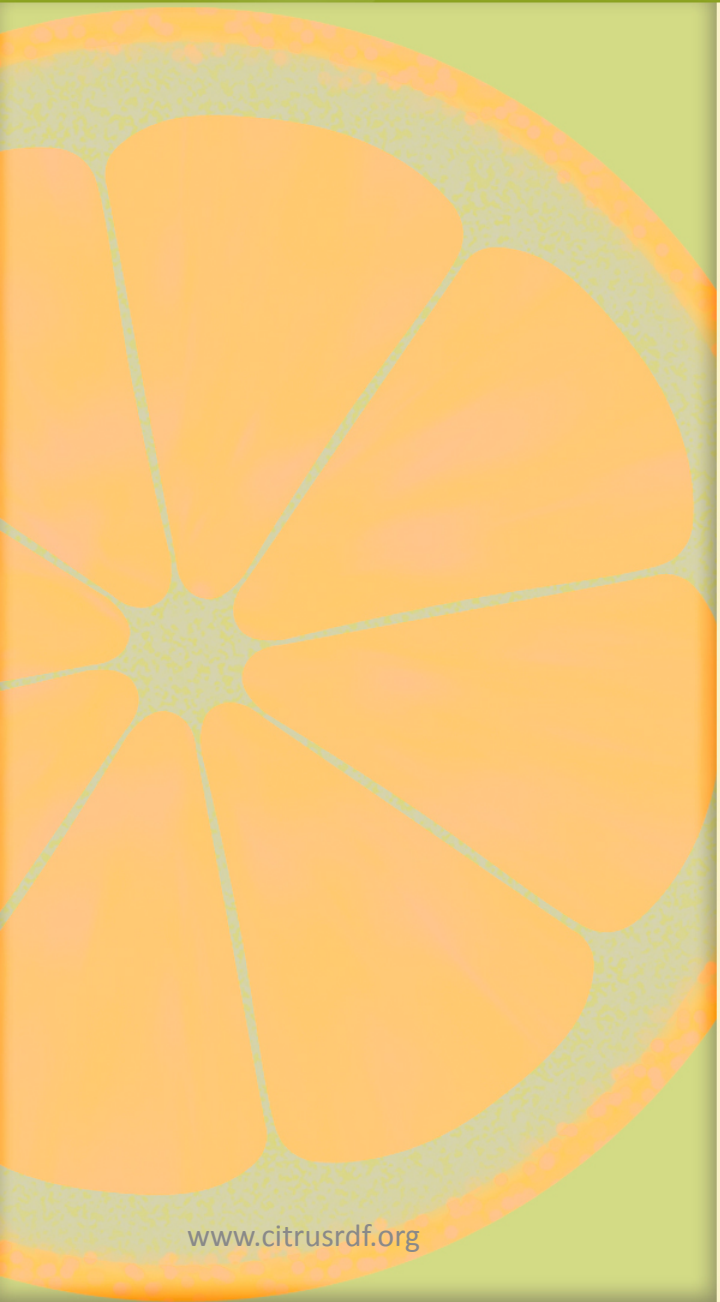
USDA, ARS Projects - CRDF

422	Gottwald	Efficacy of interplanting citrus with guava as a control strategy for Huanglongbing	8	\$	240,193.00
502	Duan	Screening and Cloning of Resistance Related Genes by RNA-Seq in Huanglongbing (HLB) Resistant and Susceptible Citrus Breeding Lines	10	\$	190,200
508	Bowman	Development of Promising New Rootstocks and Scions for Florida Citrus	10	\$	401,906.00
523	Hall	Speedy evaluation of citrus germplasm for psyllid resistance	10	\$	477,502.00
560	Bowman	Development of Promising Supersour and Other Rootstocks Resistant to HLB	10	\$	84,500
561	Stover	Development of Promising New Scions for Florida Citrus: Exploiting HLB Resistance and Tolerance	10	\$	161,500
584	Stover	A secure site for testing transgenic and conventional citrus for HLB and psyllid resistance	11	\$	168,800
605	Stover	Production of Transgenic Commercial Cultivars Resistant to HLB and Canker	11	\$	208,650
606	Arnold	High-Throughput Screening of Transgenic Citrus for HLB Resistance	11	\$	480,753
607	Stover	Production of Transgenic Commercial Scion Cultivars Resistant to HLB and Canker: Continued AMP Approaches and Novel Transgenic Strategies	11	\$	249,219
702	Stover	A secure site for testing transgenic and conventional citrus for HLB and psyllid resistance	11	\$	110,000
717	Duan-p-1	Control citrus HLB by blocking the functions of two critical effectors encoded by 'Candidatus Liberibacter asiaticus'	11	\$	148,536
			25	\$	7,442,039.00

UF, IFAS Projects - CRDF

<u>Project #</u>	PI	Affiliation	Project Title	Category	Total Contract Amount
13	Ritenour	UF	Pre-Grading Fresh Citrus for Canker Prior to Dumping on the Main Packingline	1	\$ 34,709
<u>161</u>	Powell	UF	Screening effective chemical compounds against citrus HLB bacterium Candidatus Liberibacter--Further evaluation of selected compounds in greenhouse and field	2	\$ 76,000
<u>168</u>	Powell	UF	Top 100 Antibiotics: Screening Effective Chemical Compounds Against Citrus HLB Bacterium, Candidatus Liberibacter asiaticus	3	\$ 245,613
<u>400</u>	Powell SA	UF	Services Agreement Antimicrobials	3	\$ 245,613
<u>401</u>	Borovsky/Powell	UF	Control of the Asian citrus psyllid, Diaphorina citri Kuwayama with protease inhibitors and RNAi.	7	\$ 392,802
13-01	Powell	UF	Top 100 RNAi: Cloning, Expressing and Testing Key RNAi Molecules Against Asian Citrus Psyllid, Diaphorinia citri	7	\$ 250,000
617	Gruber-b-2	UF-IRREC	Expedited Indian River Evaluation of Tetrazyg Rootstocks Surviving the HLB-Gauntlet	10	\$ 339,430
618	Powell	UF	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	11	\$ 487,383
736	Powell	UF	A Rapid Screening Process for Chemical Control of Huanglongbing	12	\$ 76,000

9 \$ 2,147,550

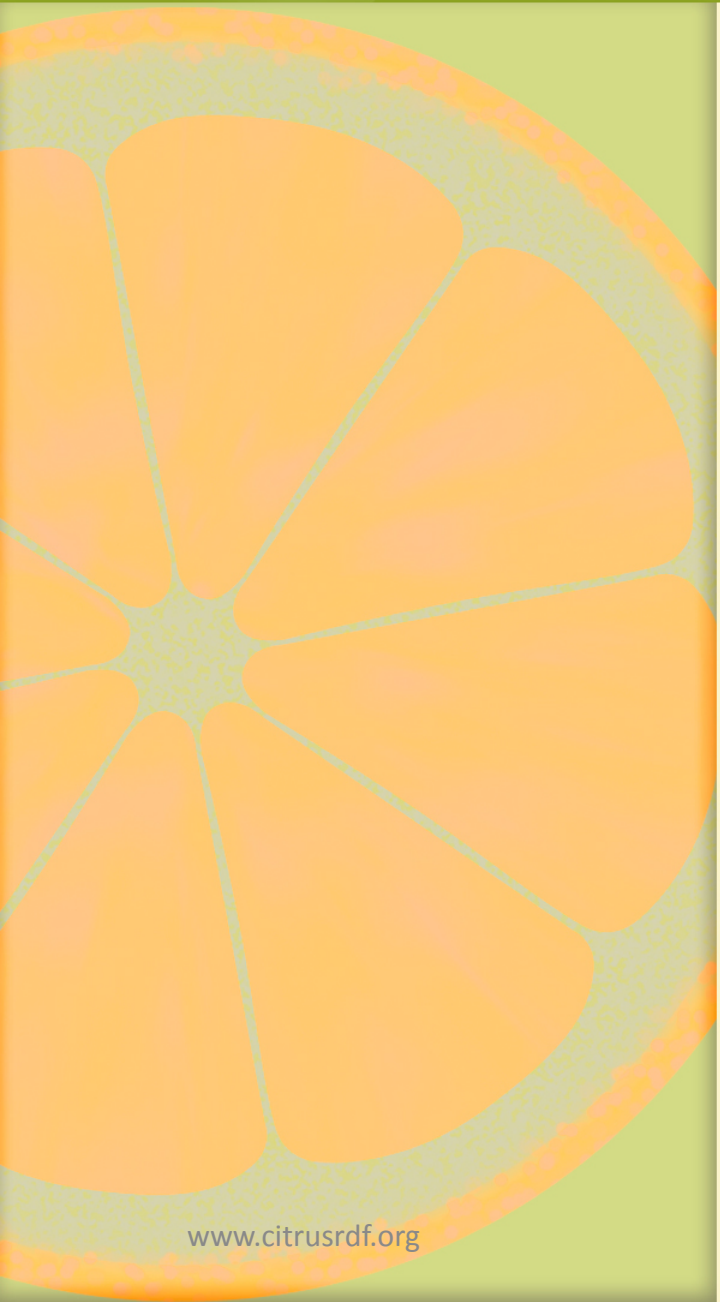


COMMENTS FROM CITRUS RESEARCH LEADERS

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

CRDF Near-Term Research Projects, May 2013

Category	Research Area	# Projects	Total Cost (\$)
1	HLB Infection	1	\$ 50,000
2	CLas Culture, Genomics	2	\$ 206,404
3	Response to Infection	5	\$ 241,525
4	Disease detection	2	\$ 160,967
5	Epidemiology	12	\$ 970,518
6	ACP monitoring, biology	5	\$ 353,910
7	ACP management	11	\$ 1,091,008
8	ACP trap plants	0	\$ -
9	Citrus genetics	0	\$ -
10	Conventional Breeding	3	\$ 609,087
11	Transgenic Resistance	2	\$ 160,838
12	Model systems	0	\$ 0
	Total	43	\$ 3,844,256

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 anti-microbial 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

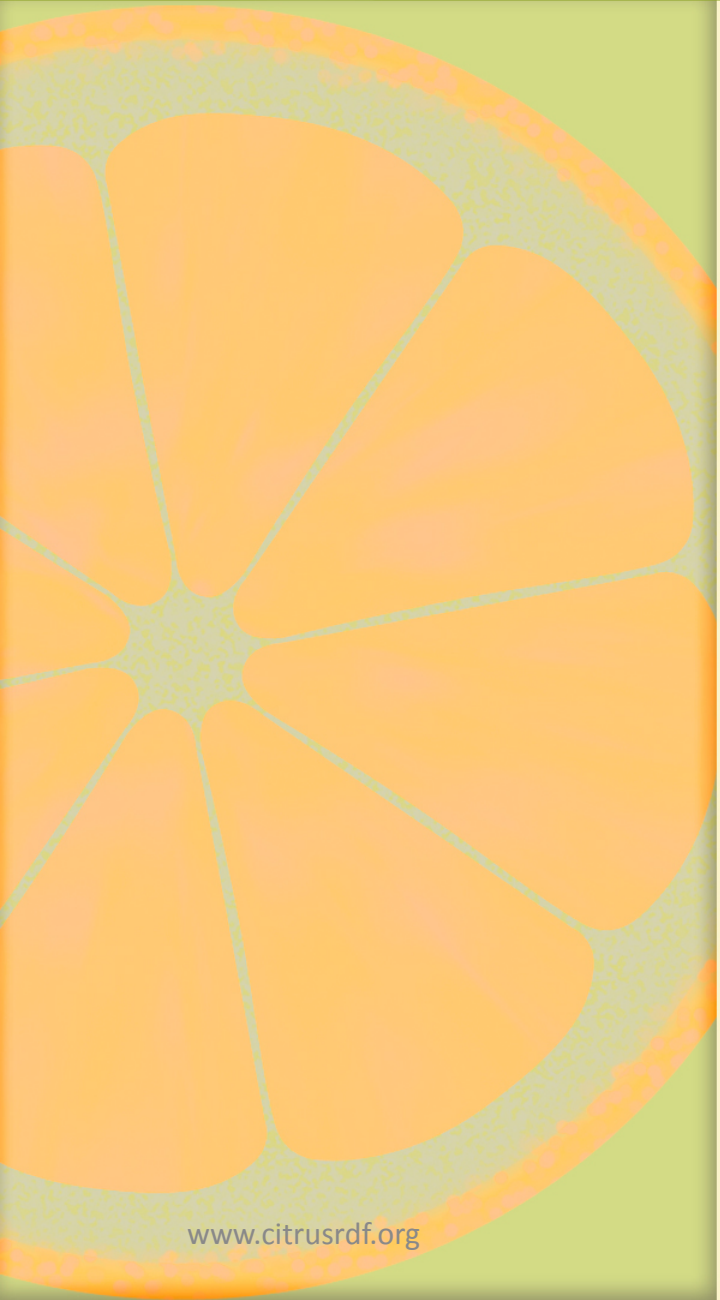
Looking Forward - CPD

- 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





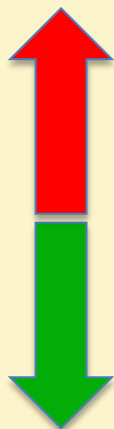
Final Thoughts

**WHAT ARE THE
COMPONENTS OF
FUTURE HLB
MANAGEMENT?**

Disease System Balance

Asian Citrus Psyllid
Population

High



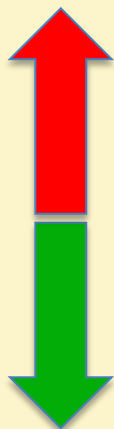
Low

Transmission
Inoculation

X

Clas Bacterial
Innoculum

High



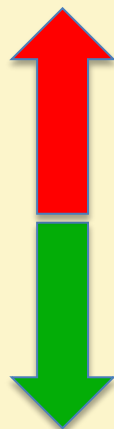
Low

Infection

X

Tree Susceptibility
To HLB & Injury

High



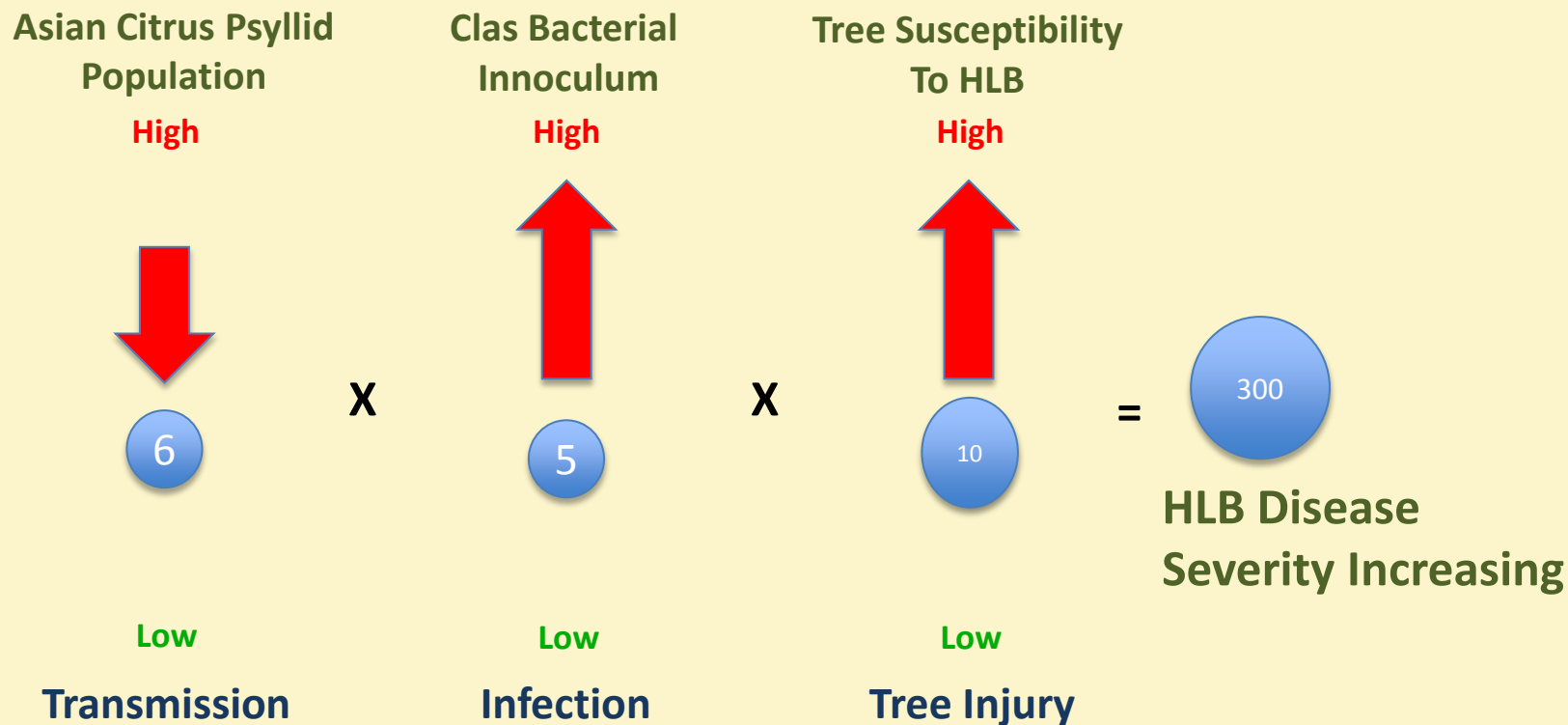
Low

Tree Injury

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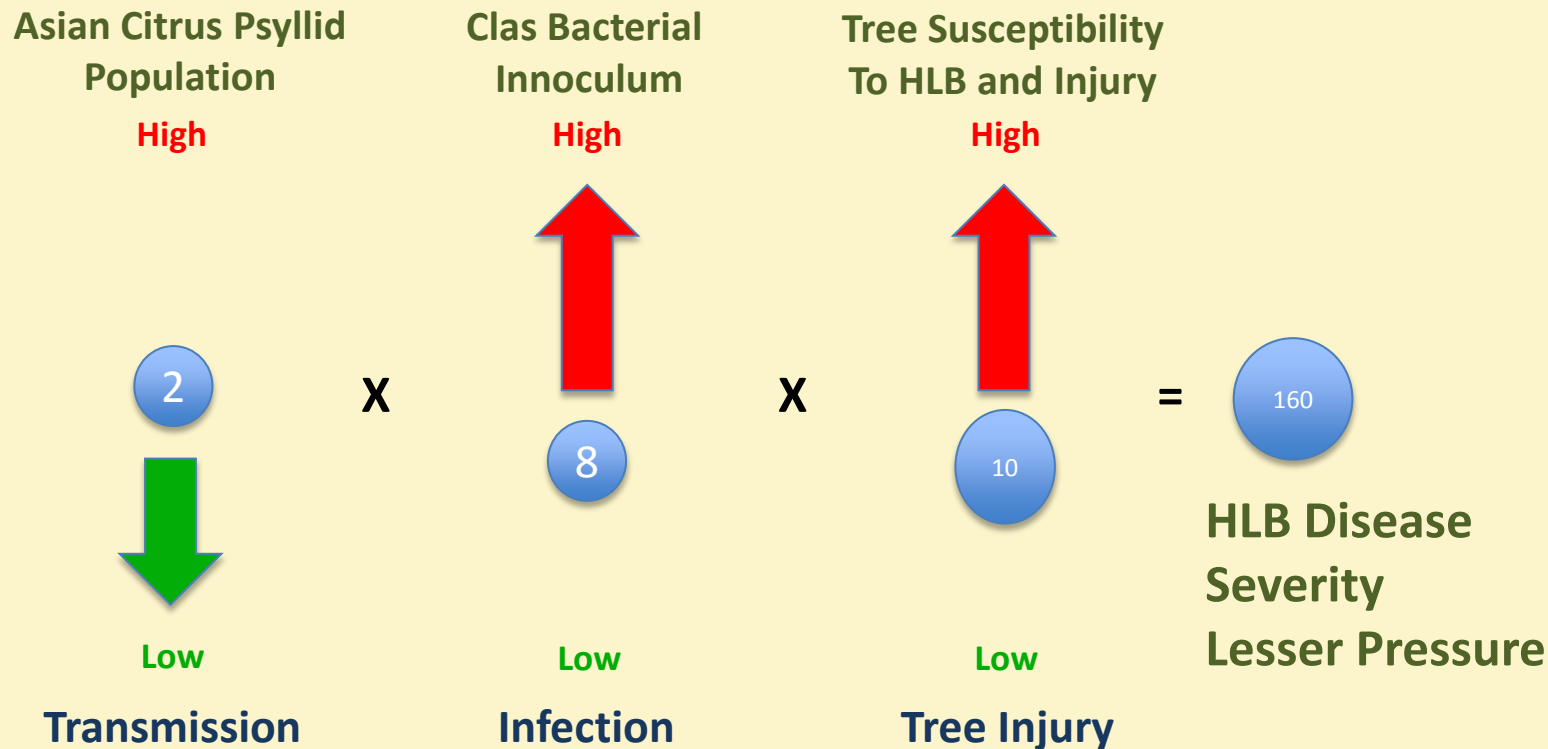
HLB Disease
Severity

2006-2009



This was the most important time for disease spread and state-wide infection

2013



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
Inneculum**

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



Low

Transmission

X



Low

Infection

X



Low

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

.5

X

3

X

3

=

4.5



Low

Transmission



Low

Infection



Low

Tree Injury

HLB Disease
Severity
Lesser Pressure

With improved ACP Control, New Infection is Decreased

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!