



Letter Report to the Florida Department of Citrus on the Review of Research Proposals on Citrus Greening, December, 2008

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December 10, 2008

Robert Norberg
Deputy Executive Director
Florida Department of Citrus
1115 East Memorial Blvd.
Lakeland, Florida 33802

Dear Mr. Norberg:

Please find attached the results of the Committee on the Review of Research Proposals on Citrus Greening. This activity was supported by Contract No. 07-27 from the Florida Department of Citrus to the National Academy of Sciences. The review process was performed under the auspices of the National Research Council's Board on Agriculture and Natural Resources.

BACKGROUND

Citrus Greening (also known as Huanglongbing or HLB) is a major threat to citrus production in Florida. In 2007, the Florida Citrus Industry Research Coordinating Council identified the disease as its number one priority problem and proposed an assessment on each box of citrus sold to be dedicated for research on ways to control the suspected causal agent—the bacterium, “*Candidatus Liberibacter asiaticus*” and its vector, the Asian citrus psyllid, *Diaphorina citri*. With revenues accrued from this assessment, the Florida Citrus Production Research Advisory Council (FCPRAC) and the Florida Department of Citrus formed a partnership and announced a research grants program to support innovative research leading to solutions for Citrus Greening and other citrus diseases.

At the request of the FCPRAC, and under contract with the Florida Department of Citrus, the National Research Council (NRC) agreed to organize an independent peer review of proposals submitted to the program in 2008. The grants program issued a Request for Proposals (RFP) in June of 2008 that attracted 236 pre-proposals, and ultimately, 205 final proposals, addressing a wide range of relevant research topics.

To conduct the independent review, the NRC appointed a nine-person Committee on the Review of Research Proposals on Citrus Greening, whose membership is listed at the end

of this letter. The Committee was assisted by 78 additional scientists, appointed to eight review panels, with collective expertise across the breadth of basic and applied expertise relevant to the problem of a vector-borne disease of this important agricultural crop. That expertise included plant pathology, plant science, molecular genetics and genomics, entomology, biotechnology and genetic transformation, horticulture, disease epidemiology, agricultural economics, agricultural engineering, and many specializations within those fields.

The organization of eight panels of reviewers (and the assignment of proposals to different panels) reflected the diversity of approaches encompassed within and among the 205 proposals to address the problem of HLB and other citrus diseases. Therefore, each review panel included a mixture of scientific expertise most appropriate for reviewing proposals grouped according to general research approach, as follows:

Epidemiology, Production Economics, Alternative Production Systems (19 proposals)
Insect Control (36 proposals)
Pathogen-Vector Relations and Disease Transmission (10 proposals)
Metabolomics, Proteomics, Transcriptomics, Host-Pathogen Interactions (24 proposals)
Genomics, Isolation, and Culture (26 proposals)
Pathogen and Disease Detection (25 proposals)
Disease Control (24 proposals)
Plant Transformation, Biotechnology, Screening for Disease Resistance (41 proposals)

Each of the eight panels was chaired by a member of the parent Committee. The chairman of the Committee served as an independent referee who was not involved in any of the panel reviews.

Roles of the Review Panels and the Committee

As noted earlier, the proposals were assigned to panels on the basis of predominant research approach, so some panels reviewed more proposals than others and, accordingly, some panels had more members than others. Each panel was tasked with conducting a review of each of the proposals assigned to it and for generating, for the purposes of assisting the Committee, a brief summary assessment of how well each proposal met the criteria of the program. In addition, to assist the Committee, each panel was asked to group those proposals considered to be worthy of funding into categories of high, medium, and low merit, and to the extent possible, to rank order the proposals within the groupings based on their evaluation. The panels were also asked to comment on the RFP and to give their sense of the quality of the process, and of the proposals themselves, in order to improve the assessment process for any future funding rounds.

The charge to the Committee was to: a) provide the review panels with guidance to ensure consistency in the review process; b) consider the recommendations of the panels as it examined the proposals; c) to evaluate the merits of each proposal relative to others similarly ranked across the panels; and, d) to develop a final list of proposals that would

be recommended to the Florida Department of Citrus and the FCPRAC for consideration of funding. The full, formal statement of task is attached as Appendix B.

Prior to their formal appointment to the Committee and/or the panels, all prospective members were screened for potential conflicts of interest, including for financial relationships with organizations and individuals involved in the review process. Each review panel and the Committee held a formal discussion of issues related to bias and conflict of interest, and each reviewed the composition of its membership relative to the expertise needed for the assessment of the proposals it had been given. None of the panel members were applicants to the grants program, although one was listed as a collaborator. In that case and a small number of other cases where institutional bias might occur, the proposal was assigned to a different panel or assigned to a different reviewer. In cases where a panel member had an institutional association with an applicant seeking a grant, the panel member did not participate in the discussion and ranking of that applicant's proposal.

The Committee met by conference call in early September to discuss a common scoring and ranking process for the panels to follow, and met in-person on November 24-25, 2008 to conduct the final review. The review panels began working in earnest in mid-September (a few days after the September 5 deadline for receipt of final proposals) and each panel held one, 2-day meeting during the time-frame of early October to early November, 2008.

REVIEW PROCESS

As the proposals were received and grouped according to panel, each proposal was assigned three principal reviewers from a given panel based on the disciplinary expertise of the panelists. These individuals were given the responsibility for providing individual written review comments and scores, leading the discussion of the proposal in the panel meeting, and preparing the panel summary evaluations following the panel discussion.

Criteria for Evaluation

Based on the review criteria described in the awards program RFP and the Committee's direction to the panels on the relative weighting of the criteria, the reviewers used a worksheet to evaluate and score three general aspects of the proposals, as follows:

1. Relevance to the fundamental objectives of the awards program (20 points):

Relevance to focus areas (priority research topics listed in the RFP)

Likelihood that the proposed research can contribute significantly to the mitigation of Citrus Greening (HLB)

Clearly articulated and justified objectives for the research

2. Scientific quality of the proposed work (60 points), including:

Appropriateness and feasibility of the experimental approach and work plan (the likelihood of accomplishing research objectives)

Consistency of timelines and milestone with the nature of the project and proposed level of effort

Scientific soundness of the research approach

Overall strength of the rationale for pursuing the proposed approach

3. Capacity of the personnel and facilities; Appropriateness of Budget (20 points)

Backgrounds, expertise, experience, of the principal investigator, co-investigators, and collaborators

Appropriateness and completeness of the research team

Adequacy of the research facilities

Appropriateness of the budget request for the proposed task and clarity of the budget narrative

Prior to the panel meetings, the reviewers submitted their scores, which were used as the initial step in organizing the proposals for discussion. At the meeting, the panel members first examined the individual scores of each proposal to understand the basis of major differences in scoring by the reviewers and to make adjustments to the major groupings of the proposals. Following individual presentations by the three principal reviewers, the full panel engaged in a discussion of the merits of each proposal on the basis of scientific quality and relevance to solving the HLB problem, and placed the proposal into increasingly refined groupings and ultimately, a rank order according to priority (or merit) for consideration. At the end of the meeting, reviewers prepared short summary statements for each proposal. The summary statements and comments from the principal reviewers were provided to the parent Committee along with a memorandum from the chair of the panel describing the panel's proposed rank ordering, suggestions for improving the RFP, and comments on issues related to the review process. (The summary statements are appended to this letter report as a non-public Appendix C).

The Committee received copies of all proposals and the panel review materials as they became available. Prior to its meeting at the end of November, the Committee chairman developed a normalized ranking of all 205 applications based on the number of proposals within a given group and its relative position in the rank order developed by the panel. This served as the starting point for discussion and re-ordering of the proposals.

Although the goal of the grants program was primarily to attract research proposals that addressed Citrus Greening, the RFP was clearly open to proposals on “other major citrus diseases” such as citrus canker. But because some aspects of the evaluation criteria were tied to a focus areas (priority research topics) related only to Citrus Greening, these proposals could not be fairly judged against the Citrus Greening proposals. Consequently, both the panels and the Committee evaluated these proposals as a separate group. In addition, during the panel reviews it was clear that a handful of proposals did not involve research but might be an important part of the infrastructure to support research and other activities related to sustaining the citrus industry; these included diagnostic services and the like. These also could not be judged using the same criteria as the research proposals, so they were separated from the others for separate discussion and commentary.

The proposals most highly ranked were discussed first, followed by those of medium or lower ranking. The chairperson of the respective panel assigned to review a given proposal gave an overview of its intended goals and his or her panel’s impression of its merits and shortcomings, according to the following questions:

- What are the major scientific (and/or other) outcomes expected from the proposed project? What are the chances of achieving the expected outcomes (scientific merit)?
- How are the expected outcomes to be applied in the control of disease in commercial citrus? What are the chances of applying the control measures successfully? Is it likely that the financial and regulatory cost of application would be acceptable (practical value)?
- Is there significant overlap with existing or proposed projects? Is the overlap of value or is it a redundancy not likely to be beneficial?
- Should a given proposal be found to be worthy of support, what parts of the proposal should be supported, and what are the recommended annual budgets and term of support?
- Should the project be supported, what ancillary benefits might be expected for commercial citrus production or to the understanding of citrus in general?

As the discussions proceeded, the Committee adjusted the order of the proposals to reach a final ranking, including, in a few instances, reassignment of specific proposals to a different category – high, medium or low. Overlapping or similar proposals were compared to each other in order to determine whether the overlap might be beneficial and, if not, to identify the best team or best approach for obtaining important information. The Committee also identified instances when budget requests seemed excessive or insufficient and made note of redundant or less meritorious elements within proposals that should be eliminated. In some cases, the Committee concluded that, given the level of uncertainty or risk involved in a particular approach, the research should be supported initially for a period that would allow the investigator to satisfy reviewers that “proof of concept” had been established. Typically, such proposals were recommended for one year of funding.

RECOMMENDATIONS OF THE COMMITTEE

Proposals for Consideration

The Committee recommends to the Florida Department of Citrus and the FCPRAC for funding those proposals that ultimately were rated as being in the high or medium categories. Based on its evaluation, this includes 83 proposals, listed in rank order of merit in Appendix A according to whether they are Citrus Greening proposals, Other Citrus disease proposals, or Infrastructure. The list in Appendix A includes the last name of the principal investigator, the title of the proposal, the proposed duration of the project and the amount of the requested budget, the recommended duration and budget (as suggested by the committee), and brief comments from the committee where it is relevant to those individuals making funding decisions. Proposals that did not meet the committee threshold for overall quality were not included in Appendix A.

The Committee believes that the portfolio of proposals it has recommended represents a diversity of high-quality approaches to understanding and ultimately controlling the problem of Citrus Greening and other citrus diseases.

The responsibility for awarding up to \$20.0 million (as indicated in the announcement of the RFP) lies with the Florida Department of Citrus and the FCPRAC. The cumulative total amount of the recommended budgets for the first year of proposals in Appendix A is equal to approximately \$11.2 million. The funders should consider that if all of these research activities proceed successfully, it should presume to be committing itself to an outlay of another approximately \$11 million one year from today and perhaps about the same in two years. Although the commitment to fund one year at a time is apparently imposed by legal structure of the box tax, the Committee is concerned that this uncertainty could ultimately interfere with the willingness and ability of the individual investigators to hire staff and purchase equipment.

For the current round of awards, the Committee suggests that the research sponsors ask potential grantees to submit revised budgets and more detailed budget justifications, perhaps along the lines of the format suggested in the subsequent section of this letter. The Committee also urges the sponsors to require that *all* pathogen and microbiome DNA and protein sequence data obtained as a result of this funding should be deposited in a public database as soon as is practical.

Other Considerations for the Future

Request more-detailed budget justifications and descriptions of the roles of the research team members.

The Florida Department of Citrus and FCPRAC are the bodies that will make decisions about funding, including partial funding of an application. A notable shortcoming of many of the proposals was the lack of detail provided in the budget justification. Many names appeared on proposals without an indication of what some of those individuals would be doing for the project. Similarly, some proposal budgets included services or consultants but sub-contractor letters were not included and consultants were not identified. The committee suggests that the applicants be given explicit instructions about what to include in a budget justification in the future. The applicant should be requested to provide, in addition to the budget justification narrative for each year, a table with columns corresponding to project objectives and rows corresponding to project cost components. Such tables, one for each year of support requested, would serve two major purposes: (1) to encourage the applicant to think through the overall project plan and (2) to provide reviewers with the connections between budget requests and the components of the proposed research and/or other activity. Specifically, column headings would be “Cost component,” “Requested dollar amount for component,” “Objective 1,” “Objective 2,” ...etc. to the final objective. Row headings might be “Personnel” (with titles of appointees listed below) and the other budget categories of the current RFP. Cells would contain the percentage of funds corresponding to each objective and each cost component such that the sum for any cost component would be 100% of the budget amount for that component.

Require collaboration and limit the number of proposals per investigator

The Committee found significant overlap in some of the submissions from individuals who are very likely aware of what other laboratories are doing. Applicants need to be strongly encouraged to collaborate with others to take advantage of comparative strengths and to reduce redundancy.

Another issue was the number of proposals submitted by a single group of researchers. Sometimes these proposals were assigned to different panels because the major thrust of the proposal was different but the proposals would contain elements that were the same on more than one proposal. In some instances, the extent of overlap and its associated possible waste of resources (or benefit) became apparent only when the proposal reached the parent Committee. This is an unacceptable situation for the review panels. Applicants should be limited to a specified number of submissions. Alternatively, the sponsors should reserve the right, clearly spelled out in the RFP, to request the withdrawal of some proposals from individuals making multiple submissions, if such submissions are viewed as unnecessarily taxing the review process. Such a declaration in the RFP may be enough (and has been sufficient in another grants program) to encourage more thoughtful combinations of submissions.

Organize a pre-proposal seminar and an annual meeting of grant recipients

The Committee suggests that if there are to be future competitions, the sponsors might consider organizing a seminar to help prospective applicants understand the requirements of the RFP and the submission forms.

The Committee further, and strongly, recommends the organization of an annual meeting of grant recipients to catalyze synergies that could lead to new insights and to allow the community working on Citrus Greening to monitor progress of the research projects.

Comments on the Request for Proposals (RFP)

The Committee was asked to make suggestions for improving the RFP and the following comments are offered in that regard:

In addition to restructuring the budget page and provision of a more organized budget justification, as recommended above, the requirement to include a timeline and milestones needs to be made explicit in the RFP.

In some cases, the proposals were marked as “continuing” but no information or progress report from that research were included. Federal agencies often allow applicants to append 3-5 additional pages of progress reports or other data to the application. It would be preferable to be able to access progress reports on-line and have them referenced in the proposal.

The Committee hopes that a wider community of investigators will apply to the program in the future and encourages the dissemination of the RFP as broadly as possible. One idea for consideration is to create a separate review category for first-time applicants. Another possibility is to make the list of priorities slightly broader so that plant pathologists and vector biologists who work on other crops and plants would be attracted to offer their expertise to the problem.

CONCLUSION

This competition for innovative proposals to address Citrus Greening is a worthwhile activity and one that has challenged research institutions in Florida, nationally, and internationally to think creatively and purposefully. The Committee expects that the quality of proposals will improve over time, as experience is gained with each new round of the awards.

I sincerely appreciate the efforts of the panel reviewers. Their insights on the proposals were invaluable to the Committee during its discussions. They provided hundreds of individual review comments that informed our deliberations, and ultimately, the selection of the most meritorious proposals. The NRC staff, particularly Robin Schoen and Camilla Ables and their assistants, allowed us to have an organized, efficient and effective review process.

Members of our Committee hope that the Florida Department of Citrus and the FCPRAC will find our recommendations and comments on the budgets useful to the efforts of the citrus industry to eliminate the threat of Citrus Greening and other diseases.

Sincerely,



George Bruening, University of California, Davis
Chairman, Committee on the Review of Research
Proposals on Citrus Greening

Members, Committee on Review of Research Proposals on Citrus Greening:

Elaine A. Backus, U.S. Department of Agriculture ARS
Henry Daniell, University of Central Florida
Dennis C. Gross, Texas A&M University
Rosemary Loria, Cornell University
Sally A. Miller, Ohio State University
Forrest W. Nutter, Iowa State University
Stuart R. Reitz, U.S. Department of Agriculture ARS
Raymond K. Yokomi, U.S. Department of Agriculture ARS

Attachments:

Appendix A—Table of rank-ordered, recommended proposals
Appendix B—Statement of Task
Appendix C (non-public)—Summary proposal evaluations

cc: Peter McClure, FCPRAC

APPENDIX A : PROPOSALS RECOMMENDED FOR FUNDING

Pro-posal #	Applicant PI	Proposal title	First year funds requested (total direct)	Requested period of funding, yrs	Estimated full term requested budget	Committee recom-mended funds, yr 1	Committee recom-mended period of funding, yrs	Committee recommended funds, full term	Cumulative (running total) of recommended funding for all proposals, First year	Comments and Explanations of Recommended Changes to Budget
122	Falk	Controlling HLB by controlling psyllids with RNA interference	\$198,274	3	\$602,507	\$198,274	3	\$602,507	\$198,274	
236	Yamamoto	Can insecticides and mineral oil avoid transmission of Candidatus Liberibacter asiaticus by Diaphorina citri?	\$39,275	2	\$78,000	\$39,275	2	\$78,000	\$237,549	
21	Brown	The citrus psyllid transcriptome and time course differential gene expression in Ca. Liberibacter-infected/free whole psyllids and organs	\$450,438	3	entry blank	\$165,000	3	\$495,000	\$402,549	Budget interpreted from proposal, assuming entries on budget page are in error.
79	Gowda	Development of sensitive,non-radioactive and rapid tissue blot diagnostic method for large-scale detection of citrus greening pathogen	\$41,040	2	\$82,500	\$41,040	2	\$82,500	\$443,589	Committee expressed some concern about sensitivity of the tissue blot method.
204	Spann	Strategies to minimize growth flushes of mature citrus trees with pruning practices and plant growth regulators to reduce psyllid feeding	\$149,238	3	\$450,000	\$137,238	3	\$411,714	\$580,827	
72	Gmitter	Assessment of the HLB Resistance and Tolerance in Citrus and Its Relatives	\$50,000	3	\$160,000	\$50,000	3	\$160,000	\$630,827	

Proposal #	Applicant PI	Proposal title	First year funds requested (total direct)	Requested period of funding, yrs	Estimated full term requested budget	Committee recommended funds, yr 1	Committee recommended period of funding, yrs	Committee recommended funds, full term	Cumulative (running total) of recommended funding for all proposals, First year	Comments and Explanations of Recommended Changes to Budget
114	Keyhani	Development of Asian citrus psyllid, Diaphorina citri, tissue culture cell lines	\$62,860	1	\$62,860	\$80,000	1	\$80,000	\$710,827	Recommend budget increase to facilitate distribution and use of cell lines.
78	Gottwald	Efficacy of interplanting citrus with guava as a control strategy for Huanglongbing	\$323,077	2	\$1,198,741	\$270,000	2	\$540,000	\$980,827	
16	Brlansky	Alternative Hosts of HLB to Assist in Disease Management	\$205,000	3	\$615,000	\$205,000	3	\$615,000	\$1,185,827	Change in select agent status should reduce costs.
40	Damsteegt	Psyllid mediated completion of pathogenicity tests (Koch's Postulates) with a pure culture of the associated Huanglongbing causal bacterium	\$175,000	2	\$350,000	\$75,000	2	\$225,000	\$1,260,827	Budget reduced unless need for Brlansky's participation can be justified; funding for year 2 requires completion of Koch's postulates in year 1.
145	Moore	Evaluate Differences in Response to HLB by Scions on Different Rootstocks	\$55,000	3	\$165,000	\$55,000	3	\$165,000	\$1,315,827	
71	Gmitter	International citrus genome consortium (ICGC): Providing tools to address HLB and other challenges	\$1,300,000	3	\$2,500,000	\$800,000	3	\$1,600,000	\$2,115,827	Committee considered budget request to be excessive for the activities proposed.
95	Hartung	Preparation of antibodies against Candidatus liberibacter asiaticus	\$242,540	3	\$714,000	\$195,540	3	\$564,000	\$2,311,367	Annual support for consultants Brlansky and Damsteegt reduced \$50K per year (\$150K total). Psyllid rearing & infectivity not well described. The recommended budget was reduced to bring it in line with the expected efforts in the various laboratories involved.
77	Gottwald	Epidemiology and disease control of HLB	\$295,251	4	\$1,198,741	\$160,000	3	\$480,000	\$2,471,367	Recommend employing US-based postdoc in place proposed UK postdoc, salary reduced from 190K to 50K; the 4 yr term requested is not allowed by the program.
45	Dawson	Examine the response of different genotypes of citrus to citrus greening (Huanglongbing) under different conditions	\$226,391	1	\$226,391	\$226,391	1	\$226,391	\$2,697,758	After much discussion, the budget as requested is considered to be reasonable.

Proposal #	Applicant PI	Proposal title	First year funds requested (total direct)	Requested period of funding, yrs	Estimated full term requested budget	Committee recommended funds, yr 1	Committee recommended period of funding, yrs	Committee recommended funds, full term	Cumulative (running total) of recommended funding for all proposals, First year	Comments and Explanations of Recommended Changes to Budget
217	Stelinski	Development of Effective Guava-based Repellent to Control Asian Citrus Psyllid and Mitigate Huanglongbing Disease Incidence	\$177,369	3	\$500,000	\$114,000	3	\$385,000	\$2,811,758	Reduced funding is recommended because the investigators have published work using a GC with sulfur detection, so the need for this equipment did not seem justified, as they presumably have access to such equipment. Furthermore, the materials and technical support budgets appear excessive to conduct the described research, so the committee recommended funding for these areas be reduced (25% and 33% respectively).
126	Lopes	Factors influencing acquisition and inoculation of Candidatus Liberibacter spp. by Diaphorina citri	\$63,200	3	\$189,600	\$63,200	3	\$189,600	\$2,874,958	
163	Triplett	Integrative approaches to discover pathogenesis-associated proteins from the causal agent of citrus greening disease and build new diagnostic tools	\$471,981	3	\$930,311	\$400,000	3	\$860,000	\$3,274,958	The cost and value of the subcontracts (\$269,570 year 1) is questioned because the salary requests in the subcontracts seem high for the activities described, e.g., well established antibody cross absorption steps.
113	Kang	Correlative microscopic and molecular characterization of the microbiome in the citrus phloem tissue	\$109,411	2	\$223,082	\$100,000	1	\$100,000	\$3,374,958	Budget was reduced based on the activities proposed; a second year of funding should be considered only following a first year result demonstrating application of the antibody.
214	Stelinski	Quantitative measurement of the movement patterns and dispersal behavior of Asian citrus psyllid in Florida for improved management	\$101,631	2	\$195,000	\$101,631	2	\$195,000	\$3,476,589	
179	Rouse	Cultural Practices to Prolong Productive Life of an HLB Infected Tree	\$181,887	3	\$290,000	\$148,290	3	\$222,808	\$3,624,879	Committee recommends reducing the personnel budget by 25% for years one and two based on anticipated workflow.
162	Duan	Dissecting the Disease Complex of Citrus Huanglongbing in Florida	\$473,512	2	\$975,608	\$250,000	2	\$500,000	\$3,874,879	Retain objectives 3 and 4 only; USDA primers should be among those applied in this research.
2	Albrigo	Characterize the roles of callose and phloem proteins in citrus Huanglongbing (HLB) symptom development	\$196,539	3	\$518,610	\$100,000	3	\$260,000	\$3,974,879	Retain objectives 1a and 2 only.
184	Salyani	Evaluation and development of effective ultra low volume spray technologies for management of the Asian citrus psyllid	\$99,058	2	\$195,000	\$99,058	2	\$195,000	\$4,073,937	

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38	Cox	Management of Pyslla in tree fruit crops using RNA interference	\$106,915	3	\$329,379	\$106,915	1	\$106,915	\$4,180,852	One year of support for proof of concept to show if there is diminution of expression due to application of RNAi.
203	Spann	Using physical and chemical property changes of citrus leaves as early indicators of HLB infection and effects of added plant nutrients	\$164,631	3	\$495,000	\$164,631	1	\$164,631	\$4,345,483	One year of support for proof of concept that any spectral or other rapid measure without tissue extraction can reflect HLB specifically.
191	Schumann	Intensively managed citrus production systems for early high yields and vegetative flush control in the presence of greening disease	\$229,552	3	\$600,000	\$229,552	3	\$600,000	\$4,575,035	The effort described should required fewer personnel than requested: Committee recommends negotiation to a reduced budget.
144	Moore	Agrobacterium-mediated Genetic Transformation of Mature Citrus Tissue	\$224,000	3	\$648,000	\$125,000	3	\$375,000	\$4,700,035	This project should be performed as a collaboration rather than using a Spanish consultant.
175	Rogers	Resistance and cross-resistance development potential in Asian citrus psyllid to insecticides and its impact on psyllid management	\$150,315	2	\$300,000	\$75,000	2	\$150,000	\$4,775,035	Fund only objectives 1 and 2.
215	Stelinski	Identification of psyllid attractants and development of highly effective trapping and attract-and-kill methods for improved psyllid control	\$180,049	3	\$500,000	\$180,049	3	\$500,000	\$4,955,084	
48	Dollet	Attempts to in vitro culture Candidatus Liberibacter asiaticus isolates in order to fulfil Koch's postulates	\$95,313	2	\$167,378	\$95,313	2	\$167,378	\$5,050,397	
42	Dandekar	Identification and modeling of early responses to HLB infection to improve disease management	\$381,636	1	\$381,636	\$250,000	1	\$250,000	\$5,300,397	Reduce expenses incurred at sites other than UC Davis; project will necessarily ramp-up, so expenses should be less than requested.
34	Cicero	Gross and fine structure localization of Liberibacter in citrus psyllid Diaphorina citri organs: elucidating the transmission pathway	\$120,000	3	\$289,620	\$120,000	3	\$289,620	\$5,420,397	
87	Grosser	Accelerating the Commercialization of Transformed Juvenile Citrus	\$178,000	3	\$534,000	\$178,000	3	\$534,000	\$5,598,397	

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125	Lin	Development of SSR markers for detection, genotyping, phenotyping and genetic diversity assessment of <i>Ca Liberibacter</i> stains in Florida	\$105,342	3	\$264,087	\$105,342	3	\$264,087	\$5,703,739	Genotyping vs phenotyping to characterize HLB strain severity is a key element to study in this proposal.
231	Wang	Characterize the microbiomes associated with <i>Candidatus Liberibacter asiaticus</i> infected citrus, psyllid, dodder, and periwinkle	\$145,114	2	\$259,000	\$145,114	2	\$259,000	\$5,848,853	
176	Rogers	Effects of nutrition and host plant on biology and behavior of the Asian citrus psyllid and implications for managing psyllid populations	\$98,333	3	\$300,000	\$66,000	3	\$200,000	\$5,914,853	Retain objectives 2 and 3 only; objectives 1 and 4 are poorly developed and should be abandoned.
93	Hall	Pathogen-Vector Relations between Asian Citrus Psyllid and <i>Liberibacter asiaticus</i>	\$213,434	3	\$616,112	\$112,000	1	\$112,000	\$6,026,853	One year for proof of concept of the feeding system; retain objectives 1 (\$100K) and part of objective 2 (\$12K) only.
213	Stelinski	Development and optimization of biorational tactics for Asian citrus psyllid control and decreasing huanglongbing incidence	\$99,778	2	\$190,000	\$90,000	2	\$180,000	\$6,116,853	Eliminate objective 3.
230	Wang	Genome sequencing of <i>Candidatus Liberibacter asiaticus</i>	\$248,916	2	\$429,600	\$248,916	2	\$429,600	\$6,365,769	
65	Gabriel	Genomic sequencing to closure of a curated Florida citrus greening strain of <i>Candidatus Liberibacter asiaticus</i>	\$680,367	2	\$892,027	\$230,000	2	\$460,000	\$6,595,769	The budget is much larger than needed to accomplish the activities proposed.

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196	Setamou	Coupling citrus flush management and dormant chemical spray as a strategy to control populations of Asian citrus psyllid	\$56,794	2	\$113,000	\$56,794	2	\$113,000	\$6,652,563	
5	Baldwin	Effects of HLB on quality of orange juice and identification of HLB-induced chemical signatures in fruit juice and leaves	\$147,567	2	\$234,634	\$147,567	2	\$234,634	\$6,800,130	
161	Powell	A Rapid Screening Process for Chemical Control of Huanglongbing	\$75,730	2	\$175,000	\$75,730	2	\$175,000	\$6,875,860	
129	Lu	Manipulating SA-mediated defense signaling to stimulate broad-spectrum resistance to HLB and other diseases in citrus	\$184,897	3	\$510,000	\$184,897	1	\$105,897	\$7,060,757	Limited success of the proposed approach in other systems indicates that the proposed research is high risk; recommend one year funding for proof of concept; no justification is provided for the requested \$79K consultant; recommended budget is reduced by \$79K but might be restored to requested amount if consultant cost is properly documented.
67	Gmitter	Surviving HLB and canker genetic strategies for improved scion and rootstock varieties	\$840,046	3	\$2,400,000	\$300,000	3	\$900,000	\$7,360,757	Cut personnel to 1 postdoc and 2 staff; collection and some other activities do not require a postdoc level appointee.
187	Schaad	Cultivation and Identification of the Causal Agent of Huanglongbing Disease of Citrus	\$643,390	2	\$1,195,400	\$200,000	2	\$200,000	\$7,560,757	Recommend funding for \$100K genome sequence analysis and \$100K culturing project but not for the greenhouse; satisfy Koch's postulates in Florida.
61	Filho	Diagnosis of Candidatus Liberibacter asiaticus in plant and vector based on molecular and serological approaches.	\$32,500	2	\$58,500	\$32,500	2	\$58,500	\$7,593,257	Can get applied information on Ca Lam as well as Ca Las plus antiserum development for a small price.

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149	Mou	Transferring Disease Resistance Technology from a Model System to Citrus	\$100,000	3	\$250,000	\$100,000	1	\$100,000	\$7,693,257	The proposed research depends on citrus transformation and regeneration having sufficient throughpup and on results from non-citrus systems being transferable or relevant to citrus and therefore is high risk; recommend one year of funding for proof of concept for the proposed approaches.
132	Machado	Analysis of transcriptome of citrus infected with Ca. Liberibacter asiaticus and Ca. L. americanus.	\$82,000	2	\$82,000	\$82,000	2	\$82,000	\$7,775,257	Applicant requested \$82K for year one and \$82K for the two year total; objectives need to be spelled out and transcriptomics methods more adequately described.
172	Roberts	Spatial and Temporal Incidence of Ca. Liberibacter in Citrus and Psyllids detected Using Real-time PCR	\$90,120	3	\$270,360	\$90,120	3	\$270,360	\$7,865,377	Considered to be an good applicable proposal.
13	Borovsky	Control of the Asian citrus psyllid, Diaphorina citri Kuwayama with protease inhibitors and RNAi.	\$196,401	3	\$606,510	\$196,401	1	\$196,401	\$8,061,778	Risky approach; one year of support for proof of concept recommended.
190	Schumann	Advanced control system for variable rate application of fertilizer and pesticide to trees in the presence of greening and canker	\$29,846	1	\$29,846	\$29,846	1	\$29,846	\$8,091,624	Considered to be a highly applicable proposal.
7	Bassanezi	Comparative epidemiology of citrus huanglongbing (greening) caused by Candidatus Liberibacter asiaticus and Ca. L. americanus	\$138,950	3	\$185,650	\$28,950	3	\$75,650	\$8,120,574	\$110K equipment budget has not been justified properly; the Committee questions whether the equipment actually is needed for this proposed project; equipment must be specifically justified if the budget is to be restored to a level above the recommended amounts.
8	Bassanezi	Reduction of bacterial inoculum and vector control as strategies to management of citrus huanglongbing (greening)	\$49,000	3	\$174,000	\$49,000	3	\$174,000	\$8,169,574	Committee expresses concern about the inadequate sampling planned in this proposed research; this proposal is not as meritorious as another on a very similar topic, but still may have a contribution to make.
90	Halbert	An effective trap for Asian citrus psyllid that can be used to monitor groves and plants for sale	\$150,968	2	\$302,000	\$100,000	2	\$200,000	\$8,269,574	The personnel requests are excessive in the investigator-proposed budget.
14	Bowman	Development of Promising New Rootstocks and Scions for Florida Citrus	\$200,953	3	\$603,000	\$150,000	3	\$460,000	\$8,419,574	The budget requests are considered to be excessive for the work proposed, but up to the original request could be restored with proper justification.

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86	Graham	Does systemic acquired resistance (SAR) control HLB disease development?	\$68,161	2	\$132,223	\$68,161	2	\$132,223	\$8,487,735	
92	Hall	Asian Citrus Psyllid - Sampling, Biological Control, and Seasonal Profile of HLB in Adult Psyllids	\$66,039	2	\$128,934	\$81,000	2	\$162,000	\$8,568,735	If this project is funded, the technician on the project should be full time.
206	Spreen	Long-Run Processed Orange Production and Price Impacts Associated with Citrus Greening in Florida and Sao Paulo, Brazil	\$51,110	2	\$102,000	\$51,110	2	\$102,000	\$8,619,845	
25	Burns	Combating symptom development in fruit from Huanglongbing-infected citrus trees: A transcriptomic, proteomic and metabolomic approach	\$211,331	3	\$631,615	\$150,000	1	\$150,000	\$8,769,845	In the context of providing information that may promote disease mitigation, this proposal is considered to be high risk; Recommend funding for objectives 3, 4 and 6 only; the requested funding has been reduced accordingly and recommended for one year only to allow the investigator to collect data that may support continuation of the project.
232	Wang	Characterization the virulence mechanism of the citrus Huanglongbing pathogen Candidatus Liberibacter asiaticus	\$171,468	3	\$398,200	\$160,000	1	\$160,000	\$8,929,845	Proposed project has potential to provide insight into HLB disease mechanism but is risky, justifying one year support for proof of concept
140	Marrs	Determining the Microbiome of Healthy and Infected Citrus Phloem Tissue, & Determining the Genome Sequence of Liberibacter	\$349,012	2	\$698,023	\$225,000	1	\$225,000	\$9,154,845	Remove specific aim 3; one year of funding for proof of concept; second year of funding, if awarded, to be on completion of Liberibacter sequence.
88	Gurley	Engineering citrus for resistance to Liberibacter and other phloem pathogens	\$113,042	3	\$335,168	\$113,042	1	\$113,042	\$9,267,887	Recommend one year of funding for proof of concept of the proposed approaches.
84	Graham	Transmission of HLB by citrus seed	\$36,561	2	\$73,123	\$36,561	2	\$73,123	\$9,304,448	
209	Stansly	Evaluation of Systemic Acquired Resistance Inducers Combined with Psyllid Control to Manage Greening in Infected groves.	\$80,471	3	\$241,413	\$50,000	3	\$150,000	\$9,354,448	Reduced funding recommended based on activities proposed.

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Citrus canker proposals recommended for funding

74	Gottwald	The importance of lesions of citrus canker on fruit	\$69,848	1	\$69,848	\$69,848	1	\$69,848	\$69,848	
233	Wang	Identification and characterization of critical virulence and copper resistance genes of Xanthomonas axonopodis pv. citri & related species	\$190,200	3	\$416,083	\$190,200	3	\$416,083	\$260,048	
186	Santra	Development of a novel nanoparticle/nanogel formulation for the prevention of citrus canker disease	\$90,000	1	\$90,000	\$90,000	1	\$90,000	\$350,048	
168	Ritenour	Pre-Grading Fresh Citrus for Canker Prior to Dumping on the Main Packingline	\$34,709	2	\$69,418	\$34,709	2	\$69,418	\$384,757	
202	Song	Engineering Resistance Against Citrus Canker and Greening Using Candidate Genes	\$115,213	3	\$330,396	\$115,213	3	\$330,396	\$499,970	
85	Graham	Survival of Xanthomonas citri ssp. citri (Xcc) to estimate risk of citrus canker transmission by infected fruit	\$124,906	3	\$245,812	\$100,000	3	\$245,812	\$599,970	Biofilm investigation is unnecessary; however objective 2 is good.
81	Graham	Systemic acquired resistance (SAR) for control of citrus canker on young trees	\$101,664	3	\$304,992	\$101,664	3	\$304,992	\$701,634	Recommendation is based on an approach worthy of pursuit but poorly described in this proposal.
76	Gottwald	Efficacy of citrus canker control strategies, leafminer interactions, and bacterial survival.	\$237,472	3	\$724,230	\$187,472	3	\$574,230	\$889,106	Over half of the first year budget is devoted to a subcontract for research to be performed in Brazil, but the justification for the Brazilian budget is incomplete; budget recommendation is reduced with the expectation of partial or complete restoration should specific and reasonable justification be provided.
102	Horvath	Genetic Resistance to Citrus Canker conferred by the Pepper Bs3 Gene	\$242,040	3	\$586,747	\$192,040	1	\$192,040	\$1,081,146	The first year budget seems to be excessive for the activities proposed; interspecific functionality of R genes is uncommon, so only one year of funding is recommended for proof of concept.

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83	Graham	Canker management in Florida citrus groves: chemical control on highly susceptible grapefruit and early orange varieties	\$134,974	3	\$404,922	\$100,000	3	\$300,000	\$1,181,146	Recommend deletion of objective 4.

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Proposals recommended for funding under special consideration because they do not propose a research project (infastructure)

4	Stansly	Creation and Maintenance of an Online Citrus Greening Database	\$25,153	1	\$25,153	\$25,153	1	\$25,153	\$25,153	
158	Pena	Development of transformation systems for mature tissue of Florida commercial varieties, and strategies to improve tree management	\$342,359	1	\$342,359	\$92,359	1	\$92,359	\$117,512	Is the requested \$250K greenhouse really needed? Committee members believe it is not and that the budget should be reduced accordingly but with an option for restoration should proper justification be provided.
108	Irey	Support for the Southern Gardens Diagnostic Laboratory	\$109,306	2	\$243,856	\$109,306	2	\$243,856	\$226,818	
119	Lee	Recovery of Citrus germplasm in Florida	\$36,970	3	\$332,817	\$36,970	3	\$332,817	\$263,788	
170	Roberts	Diagnostic Services for growers for detection of HLB to aid in management decisions	\$124,740	3	\$374,220	\$124,740	3	\$374,220	\$388,528	
199	Sieburth	Rutaceous Germplasm Preservation	\$71,000	1	\$71,000	\$71,000	1	\$71,000	\$459,528	
123	Lindeberg	Bioinformatic characterization and development of a central genome resources website for Ca. Liberibacter asiaticus	\$140,084	3	\$438,641	\$140,084	3	\$438,641	\$599,612	

Total for proposals recommended for funding \$11,135,206

APPENDIX B

A REVIEW OF RESEARCH PROPOSALS ON CITRUS GREENING

Statement of Task

NRC-appointed ad hoc panels of experts will serve as reviewers of proposals requesting support from the Florida Department of Citrus for research on different aspects of Citrus Greening, an insect-borne plant disease affecting citrus trees in Florida. The chairpersons of the panels will be appointed as the parent committee that will develop a common method for evaluating proposals and ensure consistency across the reviews.

Each panel is tasked with reviewing a set of proposals in its research area of focus and evaluating each of them for relevance and scientific merit. The panels may conduct a preliminary screening of the pertinent proposals by conference call. Although all members of a given panel will read all proposals being reviewed by that panel, each member of a panel will be assigned as a primary, secondary, or tertiary reviewer of different proposals. The final evaluation of the proposals will take place at a face-to-face meeting of each of the panels, where the proposals will be presented, discussed, and scored. Each panel will prepare a brief report to the parent committee with recommendations for proposals according to their relevance and scientific merit. The panel reports may provide comments on the overall quality and direction of the proposals. After the completion of panel reviews, the parent committee will meet to consider the panels' recommendations and to identify a single set of proposals most worthy of consideration for funding by the Florida Department of Citrus. The parent committee will prepare a report that describes the process of evaluation and provides a prioritized list of proposals recommended for consideration.