

FINAL REPORT

of the

**External Evaluation Team of the Feed the Future Innovation Lab for Collaborative
Research on Horticulture:**

Award Number: EPP-A-00-09-00004 -00

**Prepared by External Evaluation
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List of Acronyms

AA	Associate Awards
ADB	Asian Development Bank
APS	American Phytopathology Society
ALV	African Leafy Vegetables
AOTR	USAID Agreement Officer's Technical Representative
ASNAPP	Agribusiness in Sustainable Natural African Plant Products
ATRC	African Technical Research Center
AVRDC	The World Vegetable Center
AWARD	African Women in Agricultural Development
BARI	Bangladesh Agricultural Research Institute
BIFAD	Board for International Food and Agricultural Development
CABI	Centre for Agricultural Biosciences International
CA&ES	College of Agriculture and Environmental Sciences
CARE	Cooperation for Assistance and Relief Everywhere
CEAPRED	Center for Environmental and Agricultural Policy Research, Extension and Development
CGIAR	Consultative Group on International Agriculture
CIAT	Centro Internacional Centro de Agricultura Tropical
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
COL	Commonwealth of Learning
CB	Commercial Bank
CNP	Continuation Project
CP	Comprehensive Project
DAI	Development Alternatives International
ECHO	Educational Concern for Hunger Organization
EET	External Evaluation Team
EM	Effective Microorganism
EMINA	Effective Microorganism from Institute of Agrobiology
EP	Exploratory Project
FAO	Food and Agricultural Organization
FFS	Farmer Field School
FHIA	Fundacion Hondurena de Investigacion Agricola
FPEAK	Fresh Produce Exporters Association of Kenya
GAP	Good Agricultural Practices
GHA	Global Horticultural Assessment
GHI	Global Horticulture Initiative
HARE	Horticulture Action Research and Education Network
HC	Host Country
HCA	Horticulture Council of Africa
Hort CRSP	Horticulture Collaborative Research Support Program
HUA	Hanoi University of Agriculture
IAB	International Advisory Board
ICT	Information and Communication Technology

IDE	International Development Enterprise
IFAD	International Fund for Agricultural Development
IIP	Immediate Impact Projects
IMW	Information management Workshop
ISHS	International Society for Horticulture
KARI	Kenya Agricultural Research Institute
KU	Kasetsart University
LAC	Latin America and Caribbean Region
LAPDN	Latin American <i>Phytophthora</i> Diagnostic Network
MDGs	Millennium Development Goals
ME	Management Entity
MRL	Maximum Residue Levels
NARC	National Agricultural Research Institute
NGO	Non-Government Organization
ODA	Department for International Development, UK
OFSP	Other Food Security Programs
PI	Principal Investigator
PP	Pilot Project
PTSC	Postharvest Training and Service Center
RFA	Request for Application
RMIT	Royal Melbourne Institute of Technology
RUA	Royal University of Agriculture, Cambodia
SANREM	Sustainable Agricultural, Natural Resources and Environment management
SLM	Savings Led Microfinance
UNDP	United Nations Development Program
USAID	United States Agency for International Development

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Executive Summary

High-value horticultural crops can improve the income and health of smallholder households. Horticulture can be an avenue of empowerment for women, who often provide the labor, but frequently without pay. Women are critical to many parts of the horticultural value chain, from labor, to marketing, to value-added processing, to nutrition security at the household level. Horticultural crops are labor- and knowledge-intensive, but can provide dietary diversity if eaten, increased incomes if sold, and higher, diversified profits if processed. The opportunities for women in horticulture are not because they are labor intensive but because they are nutritious and high value, generating income for women farmers as well as men, and can be value added. Vegetables and fruit are rich in micronutrients and help in diet diversification and alleviation of nutritional deficiencies, especially in children and women. Horticultural crops are highly perishable, so postharvest losses can be very high and production is very risky. Investment in research and development of horticulture lags behind that of staple cereals and legumes. Recognizing the importance of horticulture for food security and alleviation of hunger, USAID funded the University of California, Davis, AVRDC, Michigan State University and University of Hawaii at Manoa to organize a series of consultations at University of California, Davis, Africa, Latin America and the Caribbean, and Asia and the Near East to conduct an intense in-depth analysis of opportunities and challenges for global horticultural development. The resulting Global Horticultural Assessment (GHA) made a number of important recommendations. The Horticulture Collaborative Research Support Program (Horticulture CRSP, hereafter referred to as the Horticulture Innovation Lab, was the response of the U.S. Government to the GHA. Implementation and management of Horticulture Innovation Lab was awarded to University of California, Davis and its partners, Cornell University, University of Hawaii at Manoa and North Carolina State University in October 2009. University of California, Davis organized a management team (ME).

The major themes of Horticulture Innovation Lab are:

- Information accessibility;
- Capacity building;
- Technological Innovation;
- Gender equity.

The objectives of Horticulture Innovation lab are:

- Apply “leapfrog” technologies to increase smallholder participation in markets;
- Build local scientific and technological capacity;
- Facilitate the development of policies that improve horticultural trade;

To accomplish these objectives the Horticulture Innovation Lab introduced the following types of projects:

- Immediate Impact Projects (IIPs-\$150,000 for one year)
- Exploratory Project (EP-\$75,000 for one year)
- Pilot Project (PP-\$500,000 for three years)
- Continuation Project (CNP-\$250,000 for two to three years)
- Comprehensive Projects (CP-\$1,000,000 for three years)
- Focus Projects (FP-\$100,000 for one to two years)

- Associate Awards (from Missions and CGIAR centers)

A three-member external evaluation team (EET) was commissioned in March 2013 to provide USAID and the ME with constructive feedback on the past research performance and management of Horticulture Innovation Lab. This report constitutes the extensive efforts of the EET to obtain relevant information through an in-depth review of documents, surveys, personal contacts and site visits to evaluate the Horticulture Innovation Lab program. Two members of the EET were able to visit University of California, Davis and meet with the ME and some PIs, and to visit field sites in Cambodia, Vietnam and Thailand, and the USAID Mission in Cambodia. All three members had the unique opportunity to participate in the annual meeting of the Horticulture Innovation Lab in Nairobi, Kenya and were able to meet and discuss with a large cross section of US PIs, host country PIs, collaborators, NGOs, public and private sector stakeholders, and the International Advisory Board Members (IAB) of Horticulture Innovation Lab. A survey of the host country representatives was conducted, and the results were used in the evaluation.

The EET commends the ME for their leadership in developing an open and transparent review process for selecting the projects and for efficiently managing them. Previous Director Dr. Ron Voss, current Director Dr. Elizabeth Mitcham and the Associate Director, Ms. Amanda Crump, are doing an excellent job in efficiently reviewing the projects, following work plans, evaluating research progress and attracting new partners to the program. The EET admires the Program Council in the past and currently the IAB, which were effective in providing guidance and advice to lead the ME in the right direction on programmatic and fiscal matters of the Horticulture Innovation Lab.

Within the short span of three years the Horticulture Innovation Lab has made significant progress on many fronts. They have:

- Approved 15 IIPs involving 9 US universities and 20 host countries;
- Approved 10 EPs involving 8 US universities and 18 host countries;
- Approved 9 PPs involving 3 US universities and 14 host countries;
- Approved 7 CNPs involving 7 US universities and 9 host countries;
- Approved 2 CPs involving 2 US universities and 3 host countries;
- Approved 1 FP involving 1 US university and worldwide hosts;
- Approved 25 six-months to one year Trellis Fund Projects.

Within the first two years of its existence, the Horticulture Innovation Lab became widely recognized as a valuable horticultural research and development advocate through its IIPs and EPs. The major accomplishments of Horticulture Innovation Lab as of May 2013 can be summarized as follows:

- Established collaboration with 18 US universities and 200 organizations worldwide;
- Number of new technologies under research: 100;
- Improved management implemented: 10,000ha;
- Number of households reached: 4,935;
- Number of students involved in projects: 108;
- Total number of people trained: 18,297;

- Percent of farmers/trainers who were women: 51.

In addition to the above, Horticulture Innovation lab has established Regional Center of Innovation (s) (Hereafter will be referred as Center (s)) at Kasetsart University in Bangkok, Thailand, at Zamorano University in Honduras and recently with the Kenyan Agricultural Research Institute [KARI] and the Fresh Produce Exporters Association of Kenya [FPEAK] at Thika, Kenya. The Horticulture Innovation Lab has also established a Postharvest Training and Services Center (PTSC) at AVRDC, Arusha, Tanzania.

Some of the selected specific outputs from projects to date include:

- Selection of improved virus resistant tomato and chili cultivars for Central America;
- Use of drying beads for improved seed storage;
- Promoting EMINA as a bio-fertilizer and a bio-pesticide for safe vegetable production;
- Training women entrepreneurs for producing and marketing EMINA and grafted seedlings;
- Development and use of diagnostic tools for the identification of *Phytophthora* in vegetable crops;
- Testing low-cost pest exclusion nets for safe vegetable production;
- Better understanding of the management, production, marketing and use of nutritious African Indigenous Vegetables;
- Development and use of concentrated solar drying of mango and tomato;
- Evaluating and use of CoolBot technology to preserve the postharvest quality of vegetables;
- Training and use of grafting in tomato and chilies to overcome soil-borne diseases.

An impressive accomplishment achieved through PTSC was that 36 trainers from the initial training trained 8,378 people in their countries and they in turn have trained 12,338 farmers.

The EET found that project monitoring and evaluation was carefully and methodically done by the Associate Director, Ms. Amanda Crump, and an external consultant, Dr. Paul Marcotte. Those projects that lagged behind or could not deliver were given sufficient time to catch up. So far, only one project has been cancelled since it could not move. In that case, the PI's institution had limitations related to contracting that hindered progress. It is too early to assess the impacts of many of the projects. Many projects have undertaken built-in baseline surveys, the outputs of which can be used for comparisons with final outcomes.

The ME manages the financial aspects of Horticulture Innovation Lab with the University of California, Davis Department of Plant Sciences Financial Division staff. The two staffers, Ms. Heather Kawakami and Ms. Sabrina Morgan, are doing an excellent job and should be congratulated for effectively managing the funds and addressing all of the issues that arise from the PIs and the host country institutions. They are very efficient, considering the government and university budget and accounting requirements.

The information, communication and technology dissemination unit has used a variety of means to reach clientele of Horticulture Innovation Lab. They have developed several useful tools such as the [Global Horticulture Knowledge Bank](#) and a [map of horticultural projects worldwide](#).

Considering the short time that the Horticulture Innovation Lab has been in existence, it has been very successful in making its presence known to the international scientific community. The Horticulture Innovation Lab has made serious endeavors to disseminate outputs from their program as widely as possible. The home site of the Horticulture Innovation Lab lists a wide range of information sources and types that are freely available.

The ME should be congratulated for its efforts to engage with the Missions in host countries. The EET strongly recommends that the ME continue to pursue engagement with the Missions and to possibly inform and involve Missions in the project review process. The ME also should encourage the PIs and the host country representatives to periodically meet with Missions so that they can be informed of significant outputs and can appraise the progress of the project.

The EET recommends that the ME Information Management and Communications team develop processes to enable more rapid communication of potentially successful ideas and technologies being developed in one part of the world to be communicated quickly to other PIs in different countries for evaluation and incorporation into their projects. (For example, the biological management practices using EMINA in Vietnam have application in Cambodia, Africa and Central America).

The Regional Centers of Innovation in the three different regions are high profile investments of the Horticulture Innovation Lab and they serve as research and development hubs. Although the seed money given to Regional Centers of Innovation was modest for the first phase, the EET strongly recommends that funds for the Regional Centers of Innovation be increased in the second phase.

The Director and the Associate Director spend only 50% and 75% of their time respectively for Horticulture Innovation Lab. The Director has the full responsibility of leading, administering, and decision-making, and this includes considerable domestic and international travel. Establishment of Regional Centers of Innovation adds an additional responsibility. Meeting Missions and other public and private donor agencies for fundraising is a major responsibility. Considering all of these responsibilities, the EET strongly recommends that the Director position be made full time for the second five-year phase.

The Horticulture Innovation Lab has achieved the objectives set out in the original proposal to USAID. Horticulture Innovation Lab responded with alacrity to the changes that were foisted upon them following strategic and policy changes implemented by USAID 15 months into their current tenure of the program; they demonstrated flexibility, initiative and good sense in adapting rapidly to the new guidelines to Feed the Future directions and have continued to meet deadlines and milestones. Therefore, the EET, without reservation,

recommends that the Horticulture Innovation Lab be renewed for the second five-year term, and University of California, Davis should continue to be the ME for Horticulture Innovation Lab.

Recommendations

Recommendation 1. The EET recommends that the ME carefully consider recruiting clearly accomplished people from different horticulture specialty areas from both the public and private sector as members of IAB with no conflicts of interest.

Recommendation 2. The EET strongly recommends that the ME review the results of the survey of host country PIs in setting the research priorities and developing the future research agenda.

Recommendation 3. The ME should be congratulated for its efforts to engage with the Missions in host countries. The EET strongly recommends that the ME proactively continue the engagement with the Missions and where it is possible, inform and involve the Mission in the project review process (as requested in Cambodia) so that they feel that they have an obligation and ownership for the project. The ME also should encourage the PIs and the host country representatives to periodically meet with the Mission and apprise them of the progress of the project and showcase the significant outputs. More direct integration of Horticulture Innovation Lab research into Mission value chain projects is needed.

Recommendation 4. The EET recommends that the ME regularly invite public and private donor agencies such as FAO, World Bank, IFAD, CGIAR, Gates Foundation, and NGOs to participate in their workshops and annual meetings. In addition, the ME should regularly distribute their publications, press releases and significant findings to the above agencies so that they are aware of the accomplishments of the Horticulture Innovation Lab.

Recommendation 5. The EET recommends that the USAID AOR serve as an intermediary between the ME and the Missions so that it can facilitate collaboration between the Horticulture Innovation Lab and the Missions.

Recommendation 6. We recommend that training efforts and appropriate workshops are built in as an integral component of most, if not all future projects, as this will facilitate both implementation and capacity building objectives.

Recommendation 7. The EET recommends that the Horticulture Innovation Lab, in conjunction with in-country collaborators, extend the postharvest training program, so successful in Tanzania, into other Feed the Future countries using the Regional Centers of Innovation as a base, and that the Regional Centers of Innovation be equipped appropriately to enable this to occur.

Recommendation 8. The EET recommends that the ME Information Management and Communications team and in particular the new communications coordinator work

assiduously to develop close links with news editors in all branches of the media in order to create better opportunities for wider distribution of interesting, good news and successful stories flowing from Horticulture Innovation Lab activities. Such stories are fine to have at a local level, but they need to find places in national and international outlets.

Recommendation 9. The EET recommends that the ME Information Management and Communications team further develop social media systems for communicating messages of hope and success about the role of horticulture in reducing poverty, increasing food security, improving health and nutrition of women and children, increasing household incomes, and producing safer food and vegetables for household and market consumption.

Recommendation 10. The EET recommends that the ME Information Management and Communications team establish links with the Commonwealth of Learning to determine the processes and protocols that they are using to help smallholder farmers gain knowledge of technologies, management and markets using modern ICT technologies and determine if there is any opportunity for collaborating in selected past and present British Commonwealth countries.

Recommendation 11. The EET recommends that the current protocols and practices undertaken by the ME to ensure gender equity and inclusion on all Horticulture Innovation Lab projects be commended and that efforts be maintained to ensure that a person with expertise and experience in social sciences (such as sociology, anthropology) be included in all future project teams where practicable and on a need basis.

Recommendation 12. The EET recommends that the Horticulture Innovation Lab be renewed and continued for another five-year phase and that the ME remains at University of California, Davis for the second phase with a non-competitive renewal.

Findings and Conclusions

I. Introduction

Currently there are 870 million people in the world suffering from chronic hunger. Nearly 3.5 million children die each year due to under- and malnutrition. The world population is expected to increase to more than 9 billion by the year 2050. To feed the world, food production needs to be increased by 60%. About one-third of the children younger than five years in low-income countries are stunted and almost half of all children and women in low-income countries are anemic indicating the significance of micronutrient deficiency problems in these countries (USAID, March 3, 2013 presentation in Tanzania). In developing regions of the world, an estimated 3 billion people survive on less than US\$2 per day (GHA, 2005).

Justifiably, major effort is placed and a large amount of funding is provided to support the research and development of cereals and food legumes. This will definitely address the calorie and protein needs of people in developing countries. Horticulture has been neglected for quite some time. Horticultural research and development efforts are on the decline in most of the US universities as well as educational institutions around the world. USAID's investment in horticulture crop centers between 1968 and 1996 was less than one tenth of the amount invested for staple cereal crop centers (GHA, 2005). Due to their high economic and nutritive value, horticultural crops are valuable instruments for agricultural development. Specifically for smallholder farmers, horticulture serves as an engine for agricultural and economic diversification focusing production on local, regional and international markets. Fruit and vegetable farmers in India generate five to eight times more profit than cereal farmers. In Kenya, the farmers who grow fruits, vegetables and flowers can earn six to twenty times more than maize farmers (GHA, 2005). However, the constraints to horticultural crop production, processing, marketing and consumption along the value chain are numerous and they need to be addressed to bring resolution and to help the smallholder farmers.

Vegetable and fruit consumption in the developing countries in Africa, South and SE Asia, and Central America is very low (only 30 to 40 Kg/caput/year). Farmers have difficulty in getting improved, locally adapted vegetable varieties and good quality stocks of fruit plants. Access to good quality seeds of vegetables is also a major bottleneck for vegetable production. Pests and diseases force the farmers to be at the mercy of pesticide traders, which results in vegetables with high pesticide residue. Postharvest losses due to poor handling, lack of infrastructure, poor transport and lack of knowledge on proper packaging causes losses of up to 40%. Investment in understanding the problems of vegetable and fruit production and the value chain will enable researchers to creatively resolve the issues through location specific research. The outputs of these research and follow-up development activities will vastly improve the production of quality vegetables and fruits, improve the income of the rural poor, and help alleviate the micronutrient malnutrition among young children and women in the developing countries. Invariably, women are

involved in vegetable production and marketing. Linking the vegetable producers to market will empower women to become successful entrepreneurs.

Recognizing the importance of diet diversification, micronutrients in nutrition, enhancing job opportunities especially for women, and improving income of smallholder farmers USAID funded University of California, Davis, The AVRDC (World Vegetable Center), and a consortium of US Universities (Michigan State University, Purdue University, and University of Hawaii at Manoa) in September 2004 to conduct a series of consultations at University of California, Davis and three strategic regions around the world in Africa, Latin America and the Caribbean, and Asia and the Near-East to have an in-depth analysis of the opportunities and challenges for global horticultural development. The resulting output, the Global Horticultural Assessment (GHA, 2005) was a document emphasizing the need to increase horticultural research to alleviate poverty, hunger and nutrition in developing countries. It also came up with a list of priority research areas, crops and capacity building recommendations in horticulture. Full details of the Global Horticulture Assessment can be found in the following International Society for Horticultural Science publication: Scripta Horticulturae Number 3, pp. 134, 2005 and is available on-line at <http://www.ishs.org/scripta-horticulturae/global-horticulture-assessment>.

Based on the recommendations of the GHA, USAID decided to organize a Horticulture Collaborative Research Support Program (Hort CRSP). Of the proposals received from various institutions desiring to host the Horticulture CRSP, the one from University of California, Davis was accepted by USAID. Leader with Associates Cooperative Agreement for Hort CRSP was awarded to University of California, Davis as the Management Entity (ME) from October 2009 to September 2014 with a budget of US\$15 million. As per the Feed the Future Food Security Initiative of the President Obama administration, the CRSPs have been renamed as Innovation Labs. Currently there are ten Feed the Future Innovation Labs supported by USAID. The Hort CRSP was renamed accordingly as (hereafter referred to as Horticulture Innovation Lab). Horticulture Innovation Lab is currently in its fourth year.

The USAID has organized a three-member External Evaluation Team (EET, See Appendix 1) to assess the program management, research performance to date and to provide USAID and the ME with constructive feedback on the above areas with a forward looking view. The EET should also provide recommendations based on their review, whether a second final five-year phase should be awarded. If the answer is yes then the EET should provide suggestions on the research and development focus for the second final five-year phase. The scope of work of EET is given in Appendix 2.

The EET report is based on:

1. Extensive review of documents provided by USAID, ME and documents obtained from the Internet (see list of documents in Appendix 6).
2. Conference calls EET had with the USAID team managing the Horticulture Innovation Lab, the ME and telephone conversations with ME, PIs and other stakeholders involved with Horticulture Innovation Lab.

3. Discussions with the International Advisory Board Members of Horticulture Innovation Lab (IAB).
4. The result of a survey of host country investigators arranged by Dr. Timothy Dalton of Kansas State University in consultation with the EET members (Appendix 3).
5. Visit of two EET members, Errol Hewett and S. Shanmugasundaram, to University of California, Davis and their discussion with the ME and a number of PIs.
6. Field visits of two EET members, Errol Hewett and S. Shanmugasundaram, to Cambodia, Vietnam, and Thailand.
7. Field visits of all three EET members to Tanzania and Kenya. The EET participated in the Annual Meeting of the Horticulture Innovation Lab organized at the Safari Park Hotel in Nairobi, Kenya, which provided an opportunity for the EET to interact face-to-face with the PIs, host country representatives, ME and the IAB. This helped the EET to create this report constructively.

The EET has organized the report as follows:

- Introduction
- Horticulture Innovation Lab Organization, Structure and Function
- Management of Horticulture Innovation Lab
- Research Program Focus and Output
- Alignment with Feed the Future priorities
- Human and Institutional Capacity Building
- Collaboration Outreach and Institution Building
- Gender Inclusion
- Monitoring and Evaluation
- Research and Development Focus of a Second, Final Five-Year Phase, if awarded

The USAID suggested format in the Scope of Work for the EET was closely followed in the preparation of this report.

II. Horticulture Innovation Lab

1. Horticulture Innovation Lab Organization, Structure and Function of the Management Entity

Inception of the Horticulture CRSP.

The implementation of the Horticulture CRSP was awarded to University of California, Davis and its partners, Cornell University, University of Hawaii at Manoa and North Carolina State University. In response to the question: "How were these three partners chosen?" it was indicated that these three partners had the appropriate expertise in horticulture. Although University of Florida and Texas A&M University were also considered, they were not included since they were preparing their own proposals for Horticulture CRSP. The ME may reconsider these partners for the second phase. The Horticulture CRSP is housed in the Department of Plant Sciences in the College of Agricultural and Environmental Sciences (CA&ES) and managed by a team, which will be

referred to as the Management Entity (ME). The CA&ES International Programs Office also provides support and guidance for Horticulture CRSP. The following individuals were the initial ME at University of California, Davis:

Dr. Ron Voss, Director
Dr. Elizabeth Mitcham, Associate Director
Dr. Mark Bell, Communication and Learning
Dr. Michael Reid, Innovation and Special Projects
Ms. Amanda Crump, Project Representative
Mr. Peter Shapland, Student
Ms. Diana Puccetti, Office Administrative Assistant
Ms. Heather Kawakami, Budget and Finance
Ms. Sabrina Morgan, Budget and Finance.

The Agreement Officer and Technical Representative of the USAID was Dr. Larry Paulson from 2010-2011. Dr. Jim Yazman and Dr. John Bowman replaced Dr. Larry Paulson for 2011-2012. Dr. John Bowman and Dr. Saharah Moon Chapotin succeeded Dr. Jim Yazman in 2012.

Current ME organization and responsibilities.

Dr. Ron Voss retired as the Director of Horticulture CRSP at the end of 2011. The current ME of the Horticulture Innovation Lab since 2012 is:

Dr. Elizabeth Mitcham, Director
Ms. Amanda Crump, Associate Director
Ms. Heather Kawakami, Business Unit Manager (Budget and Finance)
Ms. Sabrina Morgan, Account Manager (Budget and Finance)
Dr. Mark A. Bell, Leader Communications and Information Transfer
Dr. Michael S. Reid, Leader Innovative Technologies and Special Projects
Ms. Britta Lilley Hansen, Regional Centers of Innovation Specialist
Ms. Brenda Dawson, Communications Coordinator
Ms. Diana Puccetti, Office and Event Planning Assistant
Dr. Paul Marcotte, External Monitoring and Evaluation Consultant
Ms. Elana Peach-Fine, Graduate Assistant
Ms. Kelsey Barale, Graduate Student Intern
Ms. Azia Hasan, Student Assistant

The ME is an institution with legal status of a judicial body. The ME administers the Cooperative Agreement from USAID and manages the Horticulture Innovation Lab and all its activities, including collaborative research, education, and outreach programs. The ME has clear and well-defined responsibilities. The structure of Horticulture CRSP is presented in Fig. 1.

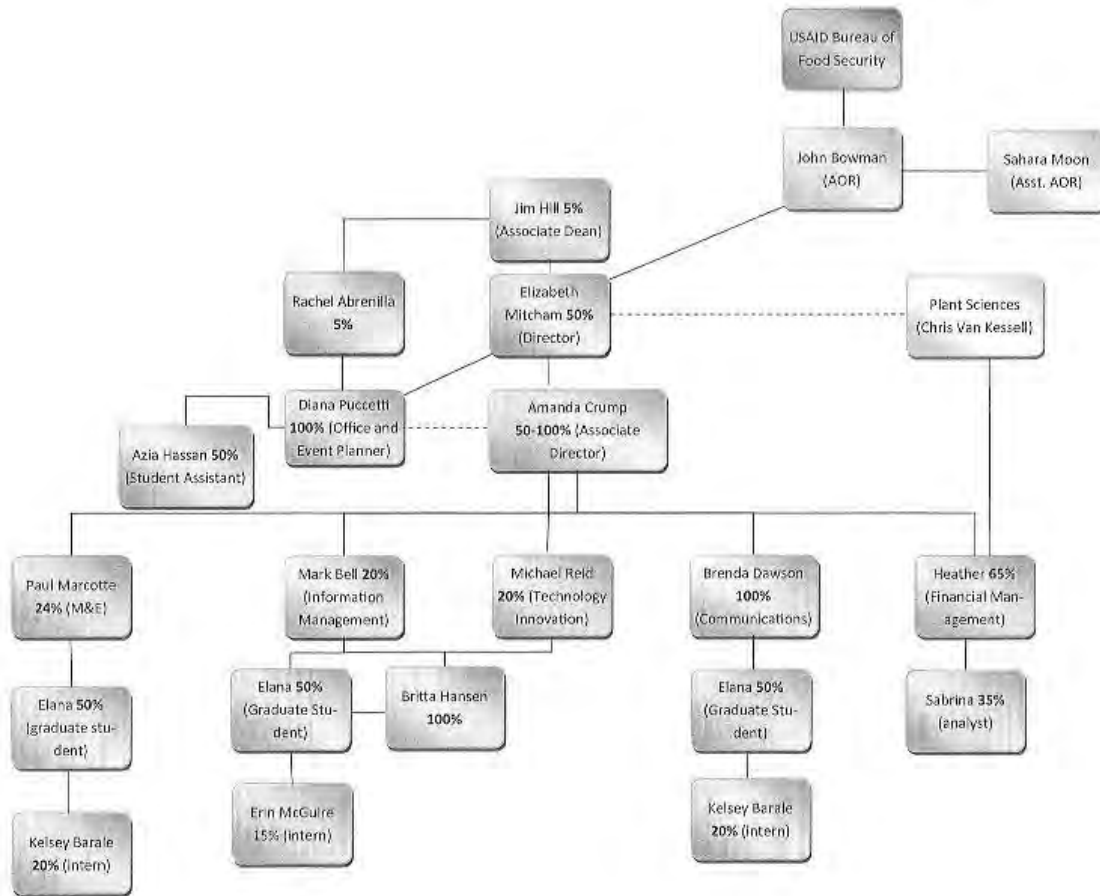
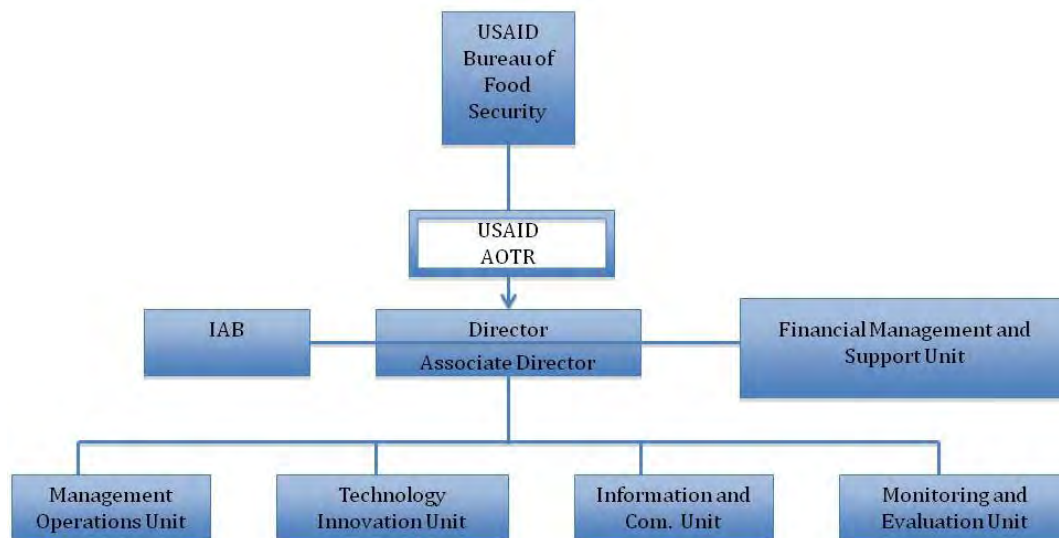


Fig.1. The Management Entity structure of Hort CRSP

The organizational structure of Horticulture Innovation Lab combines both the structure and personnel. Some of the personnel have multiple responsibilities. For example, Associate Director Ms. Amanda Crump has 75% responsibility for Horticultural Innovation Lab (although in the chart it is mentioned as 50-100%) and the rest includes teaching at the University, Ph.D. preparation for herself among other things. Therefore, it is rather confusing, and it is difficult to understand the different entities and the chain of command. A simple organizational structure can explain the clear line of authority and chain of command. Names can be inserted in each of the categories and they may change from time to time for various reasons. The EET therefore, suggests the following organizational structure, which can be modified as necessary:

Fig. 2. Suggested Organizational Structure of Horticulture Innovation Lab



The ME in consultation with USAID and the IAB plans strategic directions, defines general priorities, sets the agenda, initiates processes and systems to accomplish the priorities, allocates resources, convenes meetings and planning sessions and workshops, and modifies directions based on advice and evaluations from the IAB and USAID. It also vigorously mobilizes partners and seeks additional resources from various public and private sources. Since University of California, Davis houses and hosts Horticulture Innovation Lab, the Chancellor, Dean of the CA&ES, Associate Dean of International Programs and the Chair of the Department of Plant Sciences of University of California, Davis provide logistic support for Horticulture Innovation Lab.

The Management Operations Unit include:

- Associate Director
- Communications Coordinator
- Regional Centers of Innovation Specialist
- Graduate Student and Research Intern

The Financial Management and Support Unit include a Business Unit Manager and an Account Manager from the University of California, Davis Plant Sciences Division, and both of them are financial analysts. In addition, the Events and Office Management Assistant is also included in this unit. They are directly under the Director. The Financial Management and Support Unit provides logistical backup such as accounting, financial management, daily official chores, and events planning.

For Horticulture Innovation Lab, University of California, Davis provides an array of support functions, in addition to financial management, information systems, computer support, personnel funding, and management of awards and sub-awards, travel and sponsored programs.

A Technology Specialist and an Information and Communication Specialist lead the Technology and Information and Communications Units, respectively.

Currently, the Monitoring and Evaluation Unit utilizes the Associate Director for internal evaluation. An External Evaluator provides unbiased oversight for monitoring and evaluation.

With the foregoing descriptions, the chain of command is clear, and the responsibilities are well defined with a compact structure. The names of the people can be provided for each unit.

During the first year, the Horticulture CRSP ME organized a Program Council consisting of nine members from University of California, Davis (four of whom are from the ME serving as ex-officio members) and one each from the other three partner institutions, namely North Carolina State University, University of Hawaii at Manoa and Cornell University to guide the activities of the Horticulture CRSP. Selection of members was based on their horticultural and international experience. Members of the Program Council had three major responsibilities:

1. Select and recommend the appropriate Immediate Impact Projects [IIPs];
2. Offer counsel to the Director on technical and management issues related to the implementation of IIPs;
3. Select and appoint members of an International Advisory Board to replace the Program Council. To ensure continuity, it was envisioned that four members of the Program Council would continue as Advisory Board members.

The members of the Program Council were:

Dr. Elizabeth Mitcham, University of California, Davis, Chair
Dr. Ron Voss, University of California, Davis
Dr. Mark Bell, University of California, Davis
Dr. Michael Reid, University of California, Davis
Dr. Dianne Barrett, University of California, Davis
Dr. Alan Bennett, University of California, Davis
Dr. Patrick Brown, University of California, Davis
Dr. Steve Brush, University of California, Davis
Dr. George Wilson, North Carolina State University
Dr. Adel Kader, University of California, Davis
Dr. Robert Paull, University of Hawaii at Manoa
Dr. K.V. Raman, Cornell University

2. International Advisory Board.

The Horticulture CRSP appointed members to its International Advisory Board (IAB) in spring 2010. The IAB is the senior advisory council of the Horticulture CRSP. The purpose and role of the Horticulture CRSP IAB was to advise the ME on all major aspects of the program including setting priorities, sub-awarding of RFAs, technical and management approach to implementation, budget allocation and ensuring that USAID's Global Horticultural Assessment (GHA) and Horticultural CRSP objectives were met. The IAB looks at the big picture and offers advice and recommendations to the ME for their guidance and consideration.

Membership of the IAB ranges from eight to twelve members and covers major geographical regions, Horticulture CRSP partner universities, other US and international universities, international agricultural research centers and the private sector. The Director of Horticulture Innovation Lab and the USAID AOR will serve as ex-officio members. Members of the IAB for the first year were:

Dr. George Wilson, North Carolina State University, Chair
Dr. Lusike A. Wasilwa, KARI, Kenya, Vice Chair
Dr. Deborah Pierson Delmer, Private Consultant (Biotechnology)
Dr. Adel Kader, University of California, Davis
Dr. Poonpipope Kasemsap, Kasetsart University, Thailand
Dr. J.D.H. Keating, Director General, AVRDC
Dr. Norman E. Looney, Chair, GlobalHort
Dr. Howard Yana Shapiro, University of California, Davis
Dr. Larry Paulson, USAID, Ex-Officio

In 2011, two additional members were added to the IAB. They were:

Dr. Linus Opara, University of Stellenbosch, South Africa
Dr. Josette Lewis, Arcadia Biosciences, Inc., California (Dr. Lewis was previously Director of Agriculture, USAID).

Ex-officio members of the IAB included Dr. Jim Yazman and Dr. John Bowman from USAID (They were the AOR from USAID for Horticulture Innovation Lab). The Director of Horticulture Innovation Lab was an ex-officio member.

In 2012, Dr. Lusike A. Wasilwa became the Chair and Dr. Josette Lewis was designated as the Vice Chair of the IAB. Dr. Adel A. Kader passed away in November 2012; therefore, the IAB currently has only nine members. In 2012, ex-officio members from the USAID AOR were Drs. John Bowman and Saharah Moon Chapotin. The Director of the Horticulture Innovation Lab continues to be ex-officio.

At the end of the 2012 Horticulture Innovation Lab annual meeting Drs. Lusike A. Wasilwa, George Wilson and Poonpipope Kasemsap ended their terms of office. In their place, the newly appointed IAB members are: Dr. Julio Lopez (Director of Center in Zamorano,

Honduras, one-year term), Dr. Robert Paull, University of Hawaii at Manoa (as Partner University for a three-year term), and Dr. Sally Smith (University of Adelaide, soil biologist, three-year term).

It is odd that the Director of the Horticulture Innovation Lab and the AOR of USAID are ex-officio members of the IAB, while the Director of the Centers and the partner university staff are full members of the IAB. Members of the IAB also apply and compete for projects and funding. To the EET, this clearly represents a conflict of interest.

Recommendation 1. The EET recommends that the ME carefully consider recruiting clearly accomplished people from different horticulture specialty areas from both the public and private sectors to serve as members of the IAB with no conflicts of interest.

In personal discussions with the EET, several members of the IAB expressed that the IAB should have a stronger role and more active participation in monitoring and evaluation of the projects. However, as the name indicates, the IAB is only advisory and therefore, the IAB should review the progress and planning by the ME and offer intellectual, strategic and scholarly advice and guidance to the ME to steer them in the right direction.

III. Management of Horticulture Innovation Lab

Technical Leadership

1. What are the examples of technical leadership displayed by the ME?

USAID approved the Leader with Associates Award to University of California, Davis for the Horticulture Innovation Lab in October 2009. The ME at University of California, Davis assembled Program Council to guide the technical activities of the Horticulture Innovation Lab until the IAB was appointed. The Program Council was responsible for 1) selecting and recommending appropriate IIPs, 2) advising the Director on technical and management issues related to the implementation of IIPs and 3) appointing members of the IAB who will assume the roles and responsibilities of the Program Council. The Program Council included members based on their technical expertise in horticulture and international experience. The members were from North Carolina State University, Cornell University, University of Hawaii and University of California, Davis. Four members of the ME and the USAID AOR served as ex-officio on the Council.

Since the number of RFAs received was substantial, to ensure openness and transparency the ME assembled a large number of external, international volunteer reviewers to review the RFAs for IIPs. Through this process the ME was able to select diverse projects that covered a broad range of vegetables, fruits, and flowers, and a range of subject matter areas such as production, protection, postharvest, nutrition, food safety, gender and value chain. At the

same time they included a number of land grant universities in the US and a large number of host country participants from universities, the private sector and NGOs. Recognizing the complexity of horticulture, a number of innovative “leapfrog” technologies have been identified. These technologies can minimize or eliminate constraints, or can reduce input costs that restrict the smallholder farmers from achieving maximum profitability in the production and marketing of high-value horticultural crops. Such selection of IIPs provided wide visibility for Horticulture Innovation Lab.

Horticulture includes a wide array of crops (for example, vegetables, fruits and flowers) and a range of research areas including production systems, nutrition, postharvest technologies, processing and marketing and the value chain. Therefore, it is logical for the ME to embark initially on a large number of IIPs and EPs, which are short-term (one year) in nature but in which the adaptive research addressed is sharply focused. Nearly 60% of the IIPs were successful.

The composition of the ME changed over the years. As mentioned in the Organization, Structure and Function, Director Dr. Von Ross retired and was replaced by Dr. Elizabeth Mitcham and Ms. Amanda Crump assumed the Associate Director position. The Program Council was replaced by the IAB. Initially, Dr. George Wilson was the Chair of the IAB. When his term ended, Dr. Lusike Wasilwa became the Chair and Dr. Josette Lewis was Vice Chair for IAB. From the USAID’s side Dr. Larry Paulson was the AOR in the beginning. Dr. Jim Yazman and Dr. John Bowman replaced Dr. Larry Paulson. Currently, Dr. John Bowman and Dr. Saharah Moon Chapotin are the AOR from USAID. The ME made necessary adjustments to align themselves with the above changes. The Feed the Future alignment from USAID required the ME to see that the Horticulture Innovation Lab projects focused on the new directions and reduced number of countries around the world.

Within three-and-one-half years the ME has successfully brought together forces in three major geographical regions -SE Asia, Latin America and Africa- and organized Centers in Kasetsart University in Bangkok, Thailand, Zamorano University in Honduras and Kenya Agricultural Research Institute in Thika, Kenya. These three hubs will serve as technical and training knowledge development and dissemination innovation labs to reach the Feed the Future countries in each of the regions. The USAID Missions in the region have a mechanism to collaborate with the Horticulture Innovation Lab using the Centers as the hub.

2. *How well has the ME balanced research, implementation activities, training and capacity building given the amount of funding provided?*

In reviewing the portfolio of activities, the EET determined that the allocation of resources for research was 60%, for implementation was 20% and training and capacity building was 20%. Since the Horticulture Innovation Lab is relatively

new, the allocation for both basic and applied research is rather large and is necessary to build a knowledge base. The allocation for basic research is only 20%. It includes for example, the seed drying beads (Bradford, PI) and the diagnostic tool development for identification of *Phytophthora* in horticultural crops (Ristaino, PI) among others. The remaining 40% of resources is allocated for applied/adaptive research that has taken available technology and worked to verify its local adaptation in specific locations (improved tomato and chili varieties for Central America Nienhuis, PI, grafting technology to overcome soilborne diseases in vegetable crops Kleinhenz, PI). Implementation efforts should continue at the current level of allocation (20%) in the future. Training and capacity building is currently a small proportion (only 20%) of the budget allocation. As the research matures and the outputs are emerging, there is a need to have trained manpower to effectively disseminate the research outputs to the farmer. Also, farmers need to be linked to the markets. The proportion of training and capacity building activities is expected to slightly increase in the future. Instead of Horticulture Innovation Lab entering into dissemination directly, it should be the responsibility of the Missions and the NARS to pick up the promising outputs from research and disseminate them to the farmers. The EET feels that the ME has very well balanced research, implementation activities, and training and capacity building considering the amount of resources allocated to Horticulture Innovation Lab.

3. *How has the ME built on earlier investments? What can be done to capitalize on these to broaden or accelerate progress?*

Initially the ME approved and awarded 15 IIPs to 10 US universities for one year duration (2010-2011). There were 10 EPs awarded to eight US universities for one-year duration (2010-2011). Two of these projects were extended to two years (2010-2012). Four of the successful IIPs and EPs were extended as continuation projects. Two of them, namely Sustainable Technology for Orange and Purple Sweet Potato in Ghana (STOPS) (Bonsi, PI) and Regional Capacity Building in *Phytophthora* Diagnosis in seven Latin American countries (Ristaino, PI) were extended to two-year periods (2012-2014). Two others, namely Sustainable Development of Horticultural Crops in Zambia (Simon, PI) and Delivering Vegetable Safety Education Through Established Social Networks in Latin America (LeJeune, PI) were extended for two years (2012-2014). For the above two projects there was a one year no-cost extension given (2011-2012). Furthermore, two of the IIPs were extended to accelerate their progress and to cover a wide geographical area, and they became CP for three years (2011-2014).

Some technologies from past investments appear very promising and have relevance and application in other Feed the Future countries. For example, The HARE Network: Increasing Food Safety and Creating a Niche Market for Smallholders in Vietnam (Trexler, PI) using the EMINA as a bio-fertilizer and bio-pesticide as demonstrated in Vietnam has considerable merit and potential for

use in countries like Cambodia, Bangladesh and Nepal as well as in African countries. Information on the outcome of these technologies and the success stories should be disseminated widely to other countries to stimulate their interest so that they can examine the technologies under their conditions to assess their value to improve safe vegetable production. Research is also needed to better understand the nutrient composition and pesticide properties of the EMINA, which are largely unknown. Observations of the EMINA-applied plots demonstrated that the technology works – the vegetable and fruit crops were vigorous, healthy and productive. However, the mechanism of their action needs to be understood. Similarly, the Postharvest Training and Services Center established in the AVRDC Regional Center in Arusha, Tanzania has excellent facilities and has already trained a large number of trainers. These trainers have gone back and established their own training facilities and the trainers are training a large number of farmers. There is an excellent multiplier effect. It is a model that can be followed for other regions such as Asia and Latin America, probably in the Centers.

Partnering with the private sector is another means by which the outputs from earlier investments can be utilized to accelerate and broaden the scope of adoption by the farmers. The seed-drying project has taken this approach and has partnered with Rhino Research Group in Thailand, which is now reaching out and establishing marketing agents for drying beads for drying vegetable seeds. The private sector will develop innovative ways to market their product so that it can have broader impact. Similarly, the African Agricultural Research Center in Arusha, Tanzania is conducting research in collaboration with Horticulture Innovation Lab in Developing Low Cost Pest Exclusion and Microclimate Modification Technologies for Smallholder Vegetable Growers (Ngouajio, PI). Sumitomo Chemical Company has joined A to Z Textiles (mosquito net manufacturing company) in Arusha to establish Vector Health International, and they are now exploring the simple protective nets to exclude pests to produce safe, pesticide free vegetable crops. Such cooperation is a win-win situation for broadening the outputs of Horticulture Innovation Lab to reach the Feed the Future country vegetable farmers. This project has also leveraged additional support from CIRAD in France for graduate students. Another example is the successful CoolBot technology that has attracted the attention of CIP and has joined with Horticulture Innovation Lab, using a sub-grant from the Mission in Bangladesh, to examine and use the technology for storing potatoes.

4. How does the ME continue to be forward thinking about research ideas and plans?

The ME has regular weekly meetings to discuss the events that have occurred and the issues that have arisen in the implementation of the Horticulture Innovation Lab. One IAB member, Dr. George Wilson, joins the weekly meetings of the Horticulture Innovation Lab. During the weekly meetings the ME discusses new research ideas and plans. The Trellis Graduate Student participation in the

research and development portfolio, which has become very popular and very rewarding, is an example of an outcome of these discussions,

The IAB reviews the research progress of the projects and looks at the big picture and offers recommendations and guidance to refine and strengthen the research. One such outcome was the Comprehensive Long-term Project (CP).

The USAID AORs periodically reviews the progress of the projects and discusses with the ME and offers suggestions and new ideas for research. The Feed the Future initiative and its objectives have made the ME move forward with new ideas and align themselves with the new focus and new geographical boundaries.

The Director and Associate Director have taken part in many high level international events including the Symposium of Horticulture in Europe, the Indian Horticultural Congress, two All-African Horticultural Congresses and several other events. They have made presentations at those events and received feedback and research ideas and identified opportunities for potential collaboration with other groups. Collaboration with CIRAD on low-cost pest exclusion technology is one such outcome. Additionally, the AOR has represented the project at global research conferences (SEAVEG – Thailand 2012, ASHS 2011/2012, Global Post Harvest Vegetable Conference – Malaysia 2013, etc.), so the effort gets significantly wide global exposure.

The Director of Horticulture Innovation Lab and the AOR had discussions with the US LAC Bureau and succeeded in getting an Associate Award entitled “Assessing Constraints and Opportunities for the Horticulture Industry in Central America (Guatemala and Honduras)”. They expect additional awards from the Bureau when the assessment is over. The Horticulture Innovation Lab plans to conduct postharvest training and additional disease diagnostic training at the Center in Honduras funded by an award that the ME received from USDA-FAS in collaboration with the Center at Zamorano, Honduras.

The Director of Horticulture Innovation Lab is also currently serving as the Chair of all the Feed the Future Innovation Labs. Through this opportunity the ME is able to get a feeling for the research directions, research areas and plans of the other Innovation Labs. The ME has plans to interact with other Innovation Labs and engage in collaborative projects with other Labs. One such collaboration is a focus project with SANREM Innovation Lab on use of energy in irrigation (which is in the pipeline).

Establishment of the Centers in SE Asia, Latin America and Africa will help share horticultural research ideas within the region as well as between regions.

The ME also has an annual retreat in which they brainstorm research ideas and make appropriate plans for the next year. During brainstorming sessions the ME

looks at the technologies already available in the Global Horticulture Knowledge Bank in relation to the constraints encountered by smallholder vegetable farmers in different regions of the world and tries to identify appropriate technology for adaptive research. The Trellis Project also tries to match graduate students' expertise with host country farmer constraints to assist the farmers and local NGOs in Feed the Future countries.

5. *How has the ME promoted and maximized values such as collaboration, capacity building and outreach among sub-awardees?*

One of the best examples of the ME promoting and maximizing the value of collaboration, capacity building and outreach among sub-awardees is the train the trainer project at the Postharvest Training and Services Center (PTSC) at the AVRDC Regional Center in Arusha, Tanzania (Barrett, PI). Thirty-six postharvest specialists ("trainers", 53% women, from eight Sub-Saharan African countries) were trained over 18 months and took 10 courses offered by the PTSC in 2011. Upon return to their countries, they in turn trained 8,378 people who in turn trained an additional 3,600 farmers. In total, 12,338 people were trained and benefitted from this program.

Another example is the EMINA bio-fertilizer and bio-pesticide use in The HARE Network: Increasing Food Safety and Creating a Niche Market for Smallholders project (Trexler, PI) in Vietnam. Through a "train the trainer" approach, a women's group has trained people in neighboring villages in their commune, and they have plans to extend the technology to neighboring communes even after the program ends. The technique of producing and using EMINA for safe vegetable production is multiplied and expanded within the country mainly due to the attractiveness and benefit it brings to the smallholder farmers who produce vegetables and fruits.

The establishment of Centers in three strategic locations in SE Asia, Latin America and in Africa is a step in the right direction to promote and maximize collaboration within the region, enhance capacity building and to reach out to more smallholder vegetable and fruit farmers in Feed the Future countries in each of the region.

6. *Has the ME developed a mechanism to ensure that local, national and regional needs and priorities will continue to be incorporated into the development of the research agenda? What are these mechanisms?*

The ME has established the three Centers, one each in SE Asia, Latin America and Africa. The Latin American Center in collaboration with the LAC Bureau, through an Associate Award, has a project to Assess Constraints and Opportunities for the Horticulture Industry in Central America (Guatemala and Honduras). The results of this exercise will identify the local, national and regional needs and priorities for the LAC region.

The ME is fully aware of the studies on the constraints and needs of the horticulture value chain in the Feed the Future countries in the Africa region. In addition, the ME has the results and outputs from various IIPs, EPs and PPs. The CP on African Indigenous Vegetables (Weller, PI) has a large number of cooperators. The ME also makes field visits to various projects to get firsthand information about the progress of the projects and at the same time to assess the research priorities and farmers' needs at the local, national and regional levels. Armed with such diverse information, the ME can incorporate the research needs according to the priorities for each local, national and regional area in the research agenda.

During the horticulture needs assessment workshops in each of the three strategic regions prior to the establishment of Horticulture Innovation Lab, a wealth of information on constraints, priorities and research needs was accumulated. However, there is a need to update such information periodically, as is being done for the LAC region, to ensure that current and future needs are addressed.

The ME also gathers information on the constraints, research priorities and needs through their participation in national, regional and international horticultural symposia, workshops and meetings, and they help to shape the research agenda.

The EET has conducted a survey of the host country PIs through the help of USAID and Dr. Timothy Dalton of Kansa State University. The results of the survey provide some valuable information concerning the priority crops, priority constraints and the research needs, and we hope that USAID and the ME will take note of this information in designing the future research agenda.

Recommendation 2. The EET strongly recommends that the ME review the results of the survey of host country PIs in setting the research priorities and developing the future research agenda.

7. How well has the ME facilitated the participation of new partners?

The ME has an open and transparent policy in reviewing the RFAs using international volunteer reviewers, which helps in bringing new partners on board. The ME also widely publicizes the RFAs and provides prospective partners with detailed guidelines on the preparation of the proposals. The requirements are clearly spelled out. During their visits to various countries, the ME members discuss Horticulture Innovation Lab priorities with potential new partners who are interested in working with Horticulture Innovation Lab and encourage them to cooperate with one or more US PIs.

The ME also proactively engages themselves with other Innovation Lab teams and explores the possibility of having them as complimentary partners on joint venture projects. Such projects will have synergy and avoid duplication of efforts. Recently, Horticulture Innovation Lab has joined with the SANREM Innovation Lab to have a project on irrigation in Horticulture (Reyes, PI).

The ME has an open door policy for bringing on board new partners to strengthen the value of Horticulture Innovation Lab. Therefore, the ME encourages the US PIs to explore the possibility of including qualified and responsible new partners who can take active roles and promptly deliver outputs.

In the beginning, nearly 33% of the IIPs were from University of California, Davis, since reviewers rejected a majority of proposals from other institutions. However, now the PPs and continuation projects are from diverse US universities with new partners.

8. *How has the ME engaged USAID bilateral Missions, other donors and partners (i.e. World bank, IFAD, FAO, CGIAR, NGOs, the Private sector) in the Innovation Labs research and capacity building activities? Give examples. How might engagement be increased?*

The Horticulture Innovation Lab is only three-and-one-half years old. The ME is very much aware that they need to engage and establish a warm relationship with the USAID Missions in each of the countries where they are working. The ME has made it a point to personally meet with Mission staff whenever they visit a country – at a minimum, requests for meetings with Mission staff are always made. The ME has met with the staff of certain Missions several times. They have established good relationships with several Mission staff, and some of them have indicated to the ME that funds will be available in the future to work with Horticulture Innovation Lab. The ME was successful in getting an Associate Award from the LAC Bureau to assess the constraints to the horticulture industry in select Central American countries. After the assessment is complete, Horticulture Innovation Lab expects to have additional awards. The ME also secured a pass-through of Bangladesh Mission funds from CIP to work on cool storage using Horticulture Innovation Lab's CoolBot technology. This is considered to be Mission sub-grant through CIP.

The ME has leveraged funds from CIRAD to support graduate students working on low cost pest exclusion project in Benin and Kenya.

Due to their excellent work with Horticulture Innovation Lab Weller group (Purdue University) was able to secure support for three years from CSIRO in Australia for a project, "Best Practices for Horticultural Crop Production in Tanzania, Kenya, Mozambique, Malawi"

Similarly, for varietal development and seed systems in horticultural crops, the GTZ Global Program has provided additional support..

The EET met with the Mission staff in Cambodia and had extensive discussions. They would like the Horticulture Innovation Lab to interact more frequently with them and inform them of Horticulture Innovation Lab plans and activities regularly. They also mentioned that in their Harvest Plus program they are working with nearly 20,000 farmers in Cambodia, and most of them grow vegetables. This network of farmers is an ideal platform for Horticulture Innovation Lab to work with. In the future, the Cambodia Mission staff would like to see research proposals involving Cambodia in advance of Horticulture Innovation Lab approval so that they may provide their opinion as to whether the proposals meet with their country program objectives.

Recommendation 3. The ME should be congratulated for its efforts to engage with the Missions in host countries. The EET strongly recommends that the ME proactively continue engagement with the Missions and, where it is possible, inform and involve the Missions in the project review process (as requested in Cambodia) so that they feel that they have an obligation and ownership for the projects. The ME also should encourage the PIs and the host country representatives to periodically meet with Mission staff and apprise them of projects' progress and showcase the significant outputs.

The Director and the Associate Director participated in a number of national, regional and international symposia and conferences and met with various donor agencies, foundations, international organizations and the private sector people interested in horticulture, food security, poverty alleviation, prevention of hunger and malnutrition and apprised them about Horticulture Innovation Lab. All of them appreciated the work Horticulture Innovation Lab is doing and Horticulture Innovation Lab's accomplishments. The ME will continue to meet with them and try to establish fruitful linkages to support the Horticulture Innovation Lab.

Recommendation 4. The EET recommends that the ME regularly invite all of the public and private donor agencies such as FAO, World Bank, IFAD, CGIAR, Gates Foundation, and NGOs to participate in their workshops and annual meetings. In addition, the ME should regularly distribute their publications, press releases and significant findings to the above agencies so that they are aware of the accomplishments of Horticulture Innovation Lab.

Administration

1. What systems are in place to keep research activities on track according to program goals?

The Horticulture Innovation Lab's ME has clearly defined program goals and objectives as explained in the Organization, Structure and Function section of this document. The US PIs and the host country PIs are well aware of the program goals, and they follow them in implementing the research activities. Each project has a project implementation plan (PIP). Each activity has a schedule and detailed plan, which are easy to follow and monitor. The PIs submit half-yearly and annual reports to the ME. The ME reviews the reports carefully to see that the research activities are progressing according to the prescribed work plan and program goals (PIP). If the reported activities are in accordance with the work plan, the ME merely acknowledges the receipt of the report. If there are issues or concerns in the report or if the progress is not according to the work plan and program goals (e.g., if the project is lagging behind in its time schedule for implementing the research activities), then the ME inquires of the PI, through telephone, personal visit or email, the reasons for the issues and plans to address the problem. Extenuating circumstances such as weather, personnel issues or funding may hamper progress. The PIs usually explain such situations to the ME and request additional time to catch up with the research activities. In a majority of cases, the review system has kept track of the progress of research activities according to program goals. Problems were resolved using no-cost extensions of the projects to allow the completion of research activities. In only one case, namely, Training Urban and Peri-urban Horticultural Growers in Cropping Systems, Pre- and Postharvest Handling and Marketing Techniques in Cambodia, Vietnam and Thailand' institutional problems in the PIs institution resulted in the cancellation of the project.

The IAB also reviews the progress of the research activities and sees the big picture to make sure that the Horticulture Innovation Lab is on the right track with all the ongoing research activities. The IAB provides advice and guidance to the ME so that the system is working properly to address the goals.

The USAID AOR also visits various project sites to observe firsthand the research activities, while comparing them to Mission project activities in vegetable production and looking for synergies. He also receives regular progress reports and progress against Feed the Future indicators and targets. If there are issues, he also intervenes and provides support and guidance to resolve the issues.

2. What are the roles and functions of advisory committees? How they have been effective and efficient?

The Horticulture Innovation Lab appointed members to its International Advisory Board (IAB) in spring 2010. The IAB is the senior advisory council of

the Horticulture Innovation Lab. The purpose and role of the Horticulture Innovation Lab IAB is to advise the ME on all major aspects of the program including setting priorities, sub-awarding of RFAs, technical and management approaches to implementation, budget allocation and ensuring that the USAID's Global Horticultural Assessment (GHA) and Horticulture Innovation Lab objectives are met. Membership of the IAB ranges from eight to twelve people and covers major geographical regions, Horticulture Innovation Lab partner universities, other US and international universities, international agricultural research centers and the private sector. The ME of the Horticulture Innovation Lab and the USAID AOR serve as ex-officio members. Members of the IAB for the first year were:

Dr. George Wilson, North Carolina State University, Chair
Dr. Lusike A. Wasilwa, KARI, Kenya, Vice Chair
Dr. Deborah Pierson Delmer, Private consultant (Biotechnology)
Dr. Adel Kader, University of California, Davis
Dr. Poonpipope Kasemsap, Kasetsart University, Thailand
Dr. J.D.H. Keating, Director General, AVRDC
Dr. Norman E. Looney, President ISHS
Dr. Howard Yana Shapiro, University of California, Davis
Dr. Larry Paulson, USAID, Ex-Officio

The IAB met once in Singapore soon after the inception workshop in April 2010. The recommendations of the IAB to the ME included:

- content and format of annual conferences;
- linkages with USAID Missions;
- capacity building of institutions;
- project priorities;
- sustaining projects after the Horticulture Innovation Lab funding ends;
- regional centers of excellence;
- information management;
- linkage with CGIAR system and projects;
- linkage with nutrition and health;
- linkage with Global Horticulture Initiative (GHI).

In August 2011 at the International Horticultural Congress in Portugal, an unofficial meeting of the IAB was organized since most of the IAB members were present.

The Horticulture Innovation Lab IAB chair, George Wilson, regularly participated in the weekly meeting of the ME [by telephone connection] and offered his advice and guidance. The IAB members highlighted Horticulture Innovation Lab in various international meetings that they attended.

In 2011 two additional members were added to the IAB. They were:

Dr. Linus Opara, University of Stellenbosch, South Africa
Dr. Josette Lewis, Arcadia Biosciences, Inc., California (Previously, Dr. Lewis was Director of Agriculture, USAID.)

Ex-officio members of the IAB included Dr. Jim Yazman and Dr. John Bowman from USAID. (They are the technical representatives from USAID for Hort CRSP.)

The IAB met following the Horticulture Innovation Lab annual meeting in University of California, Davis, CA in April 2011. After reviewing progress, the IAB presented the following seven recommendations to the ME:

- Assess project impact, collect accurate and complete baseline data;
- Showcase successful technologies and redefine Regional Centers of Excellence as Demonstration and Training Centers;
- Focus on fewer subject matter areas and fewer projects with clear accomplishment goals;
- Choose and select the best among the 30 current projects and continue their funding to make an impact;
- Reserve some funds for discrete technology transfer programs;
- Create at least one signature project during the next three years;
- Be part of an important Feed the Future program by building on new technologies, strengthening partnerships and developing strong activities around institutional and human capacity building.

In 2012, Dr. Lusike A. Wasilwa became the Chair and Dr. Josette Lewis was designated as the Vice Chair of the IAB. Dr. Adel A. Kader passed away in November 2012 and therefore, currently the IAB has only nine members.

The IAB met in Nairobi Kenya on May 10, 2013. Drs. Lusike A Wasilwa, George Wilson and Poonpipope Kasemsap ended their terms. In their place Dr. Julio Lopez Montes, Zamorano University, Honduras, Dr. Sally Smith, Australia and Dr. Robert Paull, University of Hawaii at Manoa were selected as new members.

As mentioned earlier, the responsibility of the International Advisory Board, as the name indicates, is advisory in nature. They see the big picture and provide overall guidance to the ME without going into the routine management operations. The ME respects the recommendations of the IAB and acts accordingly. The membership of the IAB, in some respects, does not make sense. The members of the partner universities and the Directors of the Centers are members of the IAB. They are also competing for the funds from Horticulture Innovation Lab for projects. We see this as a potential conflict of interest. As per the organizational structure, the Directors of the Centers are under the Director of the Horticulture Innovation Lab, who is an ex-officio member of the IAB, while the Directors of Centers are full members of the IAB. This, also does not make sense. Therefore, the EET recommends that the ME recruit IAB members with no conflicts of interest. (See Recommendation 1 in the Organization, Structure and Function of the Management Entity section of this document.)

Although some of the IAB members would like to see an expanded role for the IAB, since it is not a regular board, the EET feels that the IAB's current responsibility and functions are effective and efficient.

3. *What major challenges has the ME faced and how have they been addressed? Give examples.*

At a critical point in time, at the end of 2011, Dr. Ron Voss, the founding Horticulture Innovation Lab Director, retired. The Horticulture Innovation Lab had completed its second year. It marked the transition from 15 one-year IIPs and 10 one-year EPs to a portfolio of 5 three-year PPs, 10 one-year Trellis projects and two three-year CPs. The new Director, Dr. Elizabeth Mitcham took over the challenges along with the new Associate Director, Ms. Amanda Crump. With forward-looking plans, they approved four continuation projects (which were previously either IIPs or EPs) that will be completed in 2014. In addition, they have approved two focus projects, and a new series of Trellis projects is in the pipeline for approval.

The Director has visited and met with the Mission staff in several countries and established a good working relationship between the Horticulture Innovation Lab and the Missions. Since USAID has indicated that there is nearly US\$30 million available with the Missions, which can be leveraged for Horticulture Innovation Lab, the ME has made it a point and urged its PIs to brief the Missions about the progress of the projects. The Horticulture Innovation Lab was successful with the Bureau of LAC in getting funding to assess the Horticulture Industry in Latin America. Upon completion of this assessment there may be additional Associate Awards from the LAC Bureau. A sub-grant through CIP in Bangladesh is being used to store potatoes in Bangladesh using Horticulture Innovation Lab's CoolBot Technology), while comparing performance to other storage systems.

The USAID AOR has been changed three times within the last three-and-one-half years. In the beginning, the AOR was Dr. Larry Paulson who supported the Horticulture Innovation Lab in all its initial start-up activities. Then, Dr. Jim Yazman, a livestock specialist, became the AOR, which was a challenging transition for the Horticulture Innovation Lab since his guidance and direction were minimal. Currently, Drs. John Bowman and Saharah Moon Chapotin are the AORs from USAID. They are very active and take special interest in the activities and progress of Horticulture Innovation Lab. The ME has made the necessary adjustments in spite of such frequent changes in the USAID AORs.

USAID recently announced its new Feed the Future program. The ME reacted wisely and aligned its research and capacity building activities with the Feed the Future objectives. It has also narrowed its geographical focus to Feed the Future

countries. The ME should explore avenues to exploit USAID's new alliances with the private sector (presented by USAID at the Horticulture Innovation Lab 2013 annual meeting). There are new horticulture value chain USAID projects approved for Winrock in Nepal, FINTRAC in Kenya, DAI in Liberia and Haiti and two Feed the Future programs managed by local NGOs in Guatemala. The ME should, if possible, establish linkages with these programs and complement their activities. It is a great challenge as well as an opportunity.

The ME needs to carefully study the new developments at the USAID and try to see the comparative advantage of the Horticulture Innovation Lab in developing an integrated portfolio with loss assessment surveys, needs assessment and intervention points, economic cost quantification, stakeholder consultation workshops, and technology adoption and development. The program should also address the safe and nutritious foods, agribusiness, linking smallholder farmers to markets and enabling horticultural trade.

4. *How have administrative/management problems been resolved by the ME? Give examples.*

The inception workshop was planned to be in Bangkok, Thailand. At the last minute, the local political situation and the accompanying civil unrest posed a serious problem. The ME, in consultation with USAID and the host, Dr. Poonpipope Kasemsap, quickly negotiated with the National Institute of Education at Nanyang Technical University in Singapore and made necessary arrangements to have the workshop in Singapore. Within a short span of time, the ME was able to change all of the logistic arrangements for the travel of all the participants to Singapore and arrange accommodation. The ME should be congratulated for the successful conduct of the inception workshop, May 16-18, 2010. Ninety-five participants from 34 countries joined the workshop

In opening the Regional Center of Innovation in Kasetsart University in Bangkok, Thailand, although the Center was officially opened, the agreement was not signed. The ME pursued with the Director patiently to get the agreement signed. The agreement document was extensive, and therefore the legal department at the university needed to carefully review it before the authorities could sign the document. Finally, at the end of April 2013, the agreement to establish the Center in Kasetsart University was signed.

In evaluating various projects, the ME found that the project from Tennessee State University, was not making any progress. After discussing the situation, the ME gave two extensions so that the project could get moving. However, due to institutional problems in handling the funds, the project could not make any progress, and therefore the ME had no other recourse than to cancel the project.

5. *In general, what has been the management style of the ME regarding principal investigators and sub-awardees? Are there any areas that could be improved?*

In general, the management style of the ME regarding the PIs and sub-awardees is open and transparent. The requests for proposals are widely publicized. International volunteer reviewers are utilized to provide an unbiased review of the proposals without conflicts of interest. The successful pre-proposals are asked to prepare full proposals, and they are reviewed for their merits and the final awards are made. The terms and conditions of the awards are clearly stated. The sub-awards should be clearly mentioned in the original proposal. Any deviation from proposed sub-awardees during the implementation process requires justification and approval from the ME. A half-yearly report is required from each of the PIs and progress indicators are provided to the PIs. The ME also makes on-site visits to the PIs, as well as the host country sub-awardees, to gain firsthand knowledge of the implementation of the programs. During the field visits, the ME determines any issues or concerns from the sub-awardees and tries to address those issues for smooth operation of the projects. The PIs and the sub-awardees, in general, feel that the ME is doing an excellent job. The ME gives considerable freedom to the PIs in making slight modifications that do not affect the overall output of the projects. Only when it comes to major changes in project direction or fund allocation or use, is ME approval required. When they are justified, invariably, the ME approves such requests.

6. *Is the administrative cost of the Innovation Lab appropriate for its size? Is the present structure cost effective and efficient?*

For the Horticulture Innovation Lab, University of California, Davis charges a reasonable overhead rate, which is in line with other Innovation Lab projects. The majority of the staff of the Horticulture Innovation Lab at University of California, Davis are part-time employees of the university. Office Assistant and Event Planner Diana Puccetti, Communications Specialist Brenda Dawson and Regional Center of Innovation Specialist Britta Hansen are the only full-time employees. Other ME staff spend 5% to 50% of their time for Horticulture Innovation Lab, including the Director (50%). The Financial and Accounting area is covered by two staffers, each of which has a 50% appointment. Considering the responsibility of the position, the amount of travel required, and the extent of administrative and management duties to manage the Horticulture Innovation Lab, a full-time Director should be considered for the future. Currently, the structure is cost-effective and efficient.

7. *Has communication by the ME with collaborating partners been effective?*

The ME has excellent communication with its partners. To be more effective, the ME may encourage and stimulate cross-PI communication in the US and communication and exchange of information, related to significant outputs from projects, between co-PIs within the country and between countries. Encouraging and facilitating such exchange can have a multiplier effect in disseminating promising technologies among Feed the Future countries around the world.

Financial Management

1. *How well has the ME managed the financial aspects of the Innovation Lab? Are the US and host country collaborators satisfied with financial management by the ME? How have problems been resolved? Give examples.*

The ME has managed the financial aspects of the Horticulture Innovation Lab with great care and professionalism. The Financial Division at the Department of Plant Sciences in the CA&ES at University of California, Davis handles all the financial matters related to the Horticulture Innovation Lab at University of California, Davis. Ms. Heather Kawakami, Business Unit Manager and Ms. Sabrina Morgan, the Account Manager are the two members of the ME working with the Director of Horticulture Innovation Lab.

An annual budget is allocated to the university to which the PI is attached, on a cost reimbursable basis. Most US institutions work on a cost reimbursable basis. Initially, 25% of the total budget is advanced to the PIs. The PIs should provide a cost report for 75% of the annual budget before the next advance is sent to them. Normally, the business office sends 25% of the annual budget upon receipt of the cost report. The PIs have a bank account specifically for the Horticulture Innovation Lab, and funds are sent to that bank account. This only applies to host country institutions that do not have working capital. Also, it is only University of California, Davis's policy for advancing funds for this project—non-University of California, Davis PIs have to work within the structures of their own institutions for any advancement of funds. The mechanism at each US Institution can vary based on the Policies and Procedures at that Institution. No funds are sent to any personal account either in the US or in host countries.

Any tuition advances exceeding the 25% normal advancement for host country institutions under the University of California, Davis PIs is built into the contract. All host country PIs receive funds from their US PIs. Country PIs must send invoices and cost reports for expenditures incurred (not actual receipts but they should keep the receipts in case they are required) before the next tranche of 25% funds can be sent to them. Some of the national PIs are behind and some are ahead in sending the invoices, and the accounting office has not encountered any serious problems or complaints so far. (Note: Each U.S. Institution may have their own mechanism for handling the advancement of funds; however, all should require some sort of cost report to verify expenses.)

For Regional Centers of Innovation in KARI in Kenya and KU in Thailand, 25% of the budget is advanced and the Centers have to send their invoices for expenditure for at least 75% of the amount advanced before the next 25% can be sent to them. The Center in Zamorano, Honduras has working capital and thus does not require advance payments. USAID requires a lot of paper work while the Horticulture Innovation Lab requires only minimal paper work. The ME at University of California, Davis has not encountered any problem in getting the

annual allocation from USAID. The two financial staff participate in the annual meeting where they brief and discuss financial matters with all the PIs and the host country co-investigators, listen to their concerns and try to sort out any issues so as to maintain a smooth financial flow.

Advancing funds is the biggest problem and may be risky. Delay in advancing the funds may be due to:

1. Delay in budget preparation;
2. PIs from different universities have to go through their institutional system before they can advance funds to the host country PIs/co-investigators causing some delays. For example, AVRDC is waiting for Purdue University to send the advance;
3. Sub-recipient monitoring forms are required before a contract is awarded;
4. Allocation is for each year. Some carryover from one year to the next is allowed, but it should not be too big of an amount;
5. Approval is required for partners and the PIs if the funds are not spent; otherwise they may not receive additional subsequent funding;
6. A total cost share of 25% is required from the US institution (that may in turn secure cost-sharing from their host country partners, although the Horticulture Innovation Lab does not require cost-sharing from each partner as long as the 25% is met overall).

The invoice summary for ten exploratory sub-awards from eight institutions has been reviewed. The projects operated between 2010 and 2012. Out of the ten projects, eight had no-cost extensions. All of them met the 25% cost sharing and some of them had up to 40% cost sharing.

Invariably, direct costs (which included the above costs plus the costs of salaries, fringe benefits, supplies, foreign travel, domestic travel, training travel and training) were 83 to 84% (with the exception of two projects that had 88% and one project that had 94%) of the total approved budget. Therefore, indirect costs were 6% in one case, 12% in two cases and the rest had about 16 to 17%. Five of the projects spent 98% of the funds, although some needed additional no-cost extensions to accomplish completion. One project was terminated and remaining funds were returned to the Horticulture Innovation Lab. For the four remaining projects, funds were de-obligated and returned to the Horticulture Innovation Lab after project completion.

The Centers in Thailand, Honduras and Kenya each have annual budget allocations for direct costs. The Centers charge 0 to 26.7% for indirect costs. The Centers are expected to identify partnerships and potential funding sources, which will enable them to sustain their activities beyond the initial seed money from the Horticulture Innovation Lab.

During our visit to Vietnam, the co-PI mentioned that usually the agreement comes for signature in October and that when he returns the signed agreement, the funds come to him in March-April of the following year. However, it is already April of this year, and the agreement has not come yet. The funds will also be delayed further. The EET discussed the matter with the US PI (Trexler) and learned that he is in the process of sending the agreement. Therefore, normally the delays occur on the PIs' ends rather than at the financial division. Once the invoices are received and/or other paperwork is completed, the financial division acts swiftly to send the funds.

The results of the survey, conducted by Dr. Timothy Dalton of Kansas State University, of host country sub-awardees include a number of comments. They are attached as Appendix 3. The information contained in the Appendix should be valuable for ME to consider making necessary adjustments, where possible, for improvement.

2. How are project resource allocations made? Is the allocation appropriate?

The Financial Management provides the content and format of project budgets. The project budget should contain the budget workbook and budget justification. The budget workbook provides a budget spreadsheet in which the budget information can be entered. The workbook allows up to 10 sub-awards, and each sub-award is linked to the main budget page. Each institution provides budget justification and cost-sharing narrative. The justifications are listed under the following format:

- Senior personnel
- Support personnel
- Travel
- Material and supplies
- Equipment
- Participant training
- Other
- Graduate student fees
- Sub-awards
- Indirect costs
- Cost sharing

The US institutions may claim indirect costs at the lesser of 20% of modified total direct costs (direct costs excluding equipment, tuition, participant training and sub-award expenses beyond the initial \$25,000 for each sub-award) or their institution approved rate. If no approved rate applies, then the indirect cost rate should be zero. Administration fees requested by foreign sub-awards should not exceed 8-10%. An approved indirect cost rate agreement for each institution claiming indirect costs must be provided at the time of proposal submission. A

cost sharing of 25% of federal funds is required for each project. This will be in the form of a letter and must be submitted at the time of proposal submission.

The above cost allocations made by the PIs in the proposals are reviewed by the ME for their validity and appropriateness prior to approval of the projects. The PIs have some flexibility in allocating the funds from one category to another as long as it does not alter the outcome of the objectives. However, any major changes in the budget allocation of the approved budget require the Director's approval. Specifically, the items requiring approval include international travel, purchase of equipment valued at \$5,000 or more, purchase of restricted items, and shifts in funding for participant training if the budget would result in changes to the approved training activities.

Funds cannot be carried forward from one project year to another automatically. Contingent upon the status of the prime award, requests to carry forward funds should be sent to University of California, Davis for review and approval by the ME. Similarly, requests for no-cost time extensions should be sent to University of California, Davis for review and approval by the Director.

In discussions with US PIs, we learned that the allocations were appropriate. The US PI usually asks the sub-awardee from the foreign country to prepare the budget for their part and include this in the overall budget. In discussions with the host country PIs, several of them complained that the budgets were not sufficient to carry out the project activities. But when we asked who prepared the budgets for their parts, they mentioned that they did. Therefore, they underestimated their budgets and later on they felt that the budgets were insufficient. Some of the US PIs have reserved some funds that allow them to supplement host PI research activities. For example, Weller (African Indigenous Vegetables Project) was able to supplement the budget of deserving, hard-working host PIs with additional support.

3. *Has the system for reimbursement of expenditures been efficient for all collaborators? What areas need to be improved to address pipeline issues or payment lags?*

The system for reimbursement of expenditures has been efficient for all cooperators. The PIs have no complaints about the reimbursement of expenses. The US PIs understand the USAID policies and how the system works and they are used to the procedures. Only the foreign PIs had some difficulties in getting advances from the US PIs. These issues and the causes for the delays are discussed under question 1, above.

4. *Have cost matching requirements been met by all partners? What has been the effect of these requirements?*

All partners have met the cost-matching requirements. As mentioned above, under question 2, cost-matching requirements are built into the proposals prior to approval of the projects. The cost matching provides part ownership of the projects for the host institutions, and they make a commitment to that effect through a letter. It works very well.

USAID's Role

1. *What has been the involvement and contribution of the USAID Agreement Officer's Representative (AOR)? How can it be improved?*

The USAID Agreement Officer's Technical Representatives were Dr. Larry Paulson and Dr. Jim Yazman from 2010-2011. Dr Jim Yazman and Dr. John Bowman replaced Dr. Larry Paulson for 2011-2012. Dr. John Bowman and Dr. Saharah Moon Chapotin succeeded Dr. Jim Yazman in 2012. We understand that Dr. Larry Paulson gave full freedom for the ME to implement the initial start-up of the Horticulture Innovation Lab. He wanted to have some immediate impacts. Dr. Yazman, on the other hand, was a livestock expert and had minimal influence on the management of the Horticulture Innovation Lab. Currently, Dr. John Bowman is very active with the Horticulture Innovation Lab and actively participates with the ME in the decision making process. He also visits the field sites and observes the progress and offers his constructive suggestions. He also briefs the ME with the latest developments at USAID so that the ME can align themselves with the new initiatives of the agency. For example, the Feed the Future initiative and the New Alliance with the Private Sector have implications and directions for the Horticulture Innovation Lab.

Since USAID provides substantial funding to private contractors such as FINTRAC, Winrock, DAI, and NGOs, the AOR may serve as an intermediary to help link the Horticulture Innovation Lab to complement their activities.

In the request for proposals from USAID for the Horticulture Innovation Lab, it is stated that the Horticulture Innovation Lab can access an additional US\$30 million from the Missions as Associate Awards. The ME is making concerted efforts to meet with various Missions and establish working relationships with them. The ME has succeeded in getting an Associate Award for assessment of the horticulture industry in Latin America from the LAC Bureau. Upon completion of this assessment, the Horticulture Innovation Lab can expect additional Associate Awards from the LAC Bureau. The AOR can facilitate the interaction between the Missions and the ME so that the Missions' activities can be complemented with Horticulture Innovation Lab activities in the host countries.

Recommendation 5. The EET recommends that the USAID AOR serve as an intermediary between the ME and the Missions so that it can facilitate collaboration between Horticulture Innovation Lab and the Missions.

2. *How have changes in USAID priorities impacted the management and administration of the Innovation Lab? Give examples.*

The Feed the Future initiative of the USAID has had a major impact on the management and administration of the Horticulture Innovation Lab. The Horticulture Innovation Lab's contribution to Feed the Future goals and strategies are:

- Empowering **women with access to income** by improving horticultural crop production
- Increasing household **production of nutritious foods** that are rich in micronutrients
- Dissemination of technical assistance for **increased production and market access**
- **Increased agriculture value chain** on- and off-farm through training in pre- and postharvest handling and reducing postharvest losses of nutritious foods
- Creating an **enabling policy environment** for agribusiness growth

The Horticulture Innovation Lab has supported 39 research projects in 36 countries including 14 Feed the Future countries. Projects have been located in **Bangladesh**, Benin, Bolivia, **Cambodia**, Chile, Costa Rica, Democratic Republic of Congo, Dominican Republic, Ecuador, El Salvador, **Ethiopia**, Gabon, **Ghana**, **Guatemala**, **Haiti**, **Honduras**, India, **Kenya**, Laos, **Malawi**, Mexico, **Nepal**, Nicaragua, Nigeria, Panama, Peru, **Rwanda**, South Africa, Sri Lanka, **Tanzania**, Thailand, **Uganda**, Vietnam, **Zambia** and Zimbabwe. (The countries listed in bold font are Feed the Future countries.) So far, the Horticulture Innovation Lab has supported collaborative research with more than 18 US universities and 200 organizations worldwide. In the future, the focus will be more on the Feed the Future objectives and the Feed the Future countries.

Although the Horticulture Innovation Lab started with short-term IIPs and EPs, in response to the recommendation from the IAB and in response to the guidance and advice from the AOR, the Horticulture Innovation Lab introduced the long-term PPs and CPs for two- and three-year terms with expanded funding up to US\$1 million per project. The seeds project with drying beads (Bradford, PI) and the African Indigenous Vegetables Project (Weller, PI) were the two CPs receiving US\$1 million each (three-year duration).

The Trellis Fund project has value for the money and it benefits both the US and the host countries and builds human capacity in the US as well as in the host country. The Horticulture Innovation Lab is aligned with 47 different USAID partners including host country universities, government agencies, NGOs, and USAID supported AVRDC.

IV. Research Program Focus and Output

- 1. Are the depth, breadth and rigor of the research and development activities sufficient to achieve stated program goals and objectives? How could the major themes or topics be refined to increase impact?*

The activities conducted to date have moved from short-term Immediate Impact Projects (IIPs) (one-year), to one-year Exploration and three-year Pilot Projects (EPs and PPs), and more recently to longer three-year Comprehensive Projects (CPs). The high number of IIPs (15) enabled the Horticulture Innovation lab to initially investigate a broad range of activities. Some of the successful IIPs and EPs have graduated to continuation projects (CNPs) with specified goals. Recently the ME added some focus areas, which were not covered in the portfolio such as energy related projects as new Focus Projects (FP). One such project in the pipeline is in collaboration with SANREM CRSP. Due to the focused nature of the IIPs, they were executed at some depth; although, it should also be noted that depth was not fully realized in all the IIPs, due to various difficulties encountered by the short duration of these projects. By moving to the CPs which are fewer in number, more recently, the depth of research coverage of the whole Horticulture Innovation Lab has been enhanced.. The CPs have brought together team members with different scientific backgrounds and expertise, and have integrated several research activities. However, the CPs are addressing fewer horticultural crops and fewer Feed the Future countries. Currently the Horticulture Innovation Lab has a combination of PPs, CNPs and FPs in addition to CPs. In addition, continuation of the Trellis Fund ensures that the overall balance in the depth and breadth of research activities is maintained. We believe the portfolio of projects has done a good job of achieving the stated program goals.

As to rigor, we identified varying levels of rigor in the experimental designs within the projects. Certain projects provided good quantitative data derived from well planned and executed experiments (e.g., Seed Systems – Improving Seed Quality for Smallholders; Bradford, PI; Low Cost Pest Exclusion and Microclimate Modification Technologies for Small-Scale Vegetable Growers in East and West Africa; Ngouajio, PI). However, some experiments seemed to provide more qualitative than quantitative results. While some of this is related to the difficulties encountered when using farmers' fields to run studies, we also thought the extent of expertise was insufficient at times to adequately carry out all the experiments. For instance, some of the field trial results reported for Safe Vegetable Production in Cambodia and Vietnam: Developing the Horticulture Action Research and Education Network (HARE-Network) to Enhance Farmer Income, Health, and the Local Environment; Pilot Project (Trexler, PI and his team) at the Horticulture Innovation Lab Annual Meeting in Nairobi, did not appear to have sufficient controls or conditions to fully address the objective they sought. (This was an experiment designed to test the productivity and

income generation of a new melon variety in Vietnam and the sequential plantings of pak-chai combined with several factors in Cambodia; but the experimental design seemed incomplete.) We suggest that teams that are heavy in one area of expertise (e.g., production, postharvest, or social sciences) should be certain to cooperate with individuals with expertise in other fields such as experimental design and statistics, especially if experiments in these other areas of expertise are going to be conducted as part of the project. (Trexler's team seems to be strongest in the social sciences, and appears to be conducting those types of studies scientifically) Such combination should ensure optimal attention to good experimental design, a high probability for capturing meaningful quantitative results, meaningful interpretation of outcomes and a good possibility that these results could be published in a scientific journal.

2. Is the approved research program funded appropriately? What should be changed?

As the Horticulture Innovation Lab has existed until now, we believe the mix of short- and long-term projects, Regional Centers of Innovation, and Trellis Projects have been funded as appropriately as was feasible with the overall funding available to the ME. The EET initially questioned the limited funds provided to the Regional Centers of Innovation, but upon realizing that these were somewhat virtual/conceptual Centers and were part of existing institutional facilities, the starting awards seemed more appropriate. We also recognize that these Centers should act as focal points to bring in additional funds from other partners.

We noted that the funding for Trellis Projects was quite small, but again, in light of the overall Horticulture Innovation Lab budget, these seemed appropriate as capacity building efforts (both for HC and US participants) and also to extend the visibility of the Horticulture Innovation Lab in Feed the Future countries.

Several HC participants also informed us that they believed they did not have adequate funding to complete their stated objectives. This information came to us from the Survey Questionnaire directed towards the HC investigators (see Appendix 3). We did not receive confirmation from all US PIs that they agreed with this assessment by the HC team members; however, some US PIs indicated that their HC partners had not submitted adequate initial budget requests. During our evaluation, the EET was unable to get a firm grip on the level of oversight in budget setting, either by the PIs or the ME (as a second level of review). It appeared that HC budgets were the responsibility of the US PIs. We suggest that for future projects, the ME might need to take a more active role in reviewing and evaluating each project's budget line items before final approval, in order to ensure ample funding is in place for all proposed facets of the project activities. We also suggest that the funding framework adopted by Steve Weller, PI (CP, Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers) be considered by other PIs. In this Project the PI held

some of the total funds back, in order to serve as a back-up to provide additional support to those HC members who had initially under budgeted but were showing good progress on their objectives. Some of these reserve funds were also being used for travel and meeting attendance by HC participants, but with Steve reviewing and approving these on a case-by-case basis.

3. *What have been the significant accomplishments in terms of research and technology dissemination?*

Notable accomplishments related to dissemination include the various projects that incorporated some element of farmer-focused or train-the-trainer workshop or training activities in production or postharvest practices. On the production side, these include:

- Seed/seedling production training in Central America (*Semillas de Esperanza: Vegetable Seeds for Sustainable Agriculture*; Nienhuis, PI)
- Use of insect-exclusion netting or high tunnels in Africa (Low Cost Pest Exclusion and Microclimate Modification Technologies for Small-Scale Vegetable Growers in East and West Africa; Ngouajio, PI)
- Sustainable Development of Horticultural Crops in Zambia for Food Security, Income Generation and in Support of the Tourism Trade; Simon, PI)
- Use of EM and EMINA to produce bio-fertilizer, bio-insecticide and the bio-compost for safe vegetable production in Vietnam. Women dominate in the production of vegetables in the communes and some of the trained women have become entrepreneurs in producing and marketing the above products to other farmers. Other women farmers produce and sell grafted seedlings to other farmers (Safe Vegetable Production in Cambodia and Vietnam; Trexler, PI)
- Ground-breaking research on the field agronomy of African indigenous vegetables (Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers; Weller, PI)

On the postharvest side, these include:

- the development of a postharvest extension program in Southeast Asia (Integrated Postharvest Extension Program for Cambodia and Vietnam; Paull, PI),
- food safety educational messaging in Central America (Delivering Vegetable Safety Education Through Established Social Networks in Latin America; LeJeune, PI),
- the creation of a postharvest training and service center for Africa (Extension of Appropriate Postharvest Technology in Sub-Saharan Africa: A Postharvest Training and Services Center; Barrett, PI).
- pioneering research on the nutritional quality of African indigenous vegetables (Sustainable African Indigenous Vegetable Production and

Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers; Weller, PI)

All the above projects, and others not noted here that included training components, have demonstrated that significant numbers of farmers or marketers can be reached through the Horticulture Innovation Lab activities. Of particular note is the train the trainer activity in the Barrett project, for which 36 postharvest “master trainers” from seven African countries have completed a one-year long training program. These individuals are now back in their home countries and many are in the process of setting up their own, local training facilities, as well as serving as master trainers for groups of farmers in their own countries.

Other accomplishments to mention are the seed drying technologies being studied and developed to improve and extend the storage of quality vegetable seeds in Southeast Asia (CP, Seed Systems – Improving Seed Quality for Smallholders; Bradford, PI) and the dissemination potential of the RICs. The seed project has shown dramatic increases in seed viability for production purposes, but also shows potential for use in seed storage of seed foods. Seed drying with the beads also protects the seeds from mold infection and weevil infestation as well as aflatoxin buildup. The establishment of the Regional Centers of Innovation is viewed as a significant step forward in building the infrastructure for further dissemination of outputs from the Horticulture Innovation Lab, as well as those of other partner organizations.

4. *Among the projects making significant progress, which ones are scalable for a greater impact?*

We believe the following projects are probably closest to scale up: Seed Systems – Improving Seed Quality for Smallholders (Bradford, PI) and Extension of Appropriate Postharvest Technology in Sub-Saharan Africa: A Postharvest Training and Services Center (Barrett, PI). The seed drying technology, with private partner input (Rhino Research, Thailand) could easily be expanded to other parts of the world for seed quality applications in vegetable crops, and with some additional technological development, could also show spill over value in seed storage applications of staple crops (cereals and grain legumes). The Postharvest Training and Services Center concept and model, with the involvement of master trainers, should be replicated throughout the Feed the Future countries where vegetable production is a significant component of the agricultural sector.

5. *What activities have not been as successful as planned and why?*

As noted earlier, the Horticulture Innovation Lab is still a young program, with several mid- to long-term projects ongoing. The EET found it difficult to determine the overall success of these active projects at this point in time. The

EET thus looked at the earlier IIPs and EPs to gauge their success. We noted that the IIPs had varying levels of success in meeting the stated objectives in full, with our belief that often any lack of full success was due to the one-year time frame of these projects. Issues with the release of funds, especially to HC partner institutions, reduced available project time even further in some cases. We believe these problems could be overcome in the future by having projects that are set up for a minimum of two years. Nonetheless, even for IIPs that did not complete their objectives as fully as the team had hoped, we believe that all the IIPs were successful from the standpoint of identifying a wide range of partners for future projects and providing good exposure for the Horticulture Innovation Lab in a large number of public and private institutions of host countries in Africa, SE Asia and LAC and the US.

The EET had some discussions about the perceived success of the floriculture project, Building an Ornamental Industry in Honduras (Bennett, PI). On one hand this project could be considered unsuccessful as it appears that the market, infrastructure and policy constraints were too high to enable an effective floriculture market in Honduras. However, we also believe that identifying these constraints was a very successful outcome, as the information will inform future efforts on this topic in Honduras.

The one project noted as unsuccessful was the EP, Market Oriented Sustainable Peri-Urban and Urban Garden Cropping System: A Model for Women Farmers in Thailand, Cambodia and Vietnam. The problem here was apparently a lack of action by the PI. The ME made every effort to keep the project alive. However, due to lack of response from the PI, the ME rightfully terminated this project at an early stage.

6. *In what ways are the research activities strategically sequenced to ensure targeted development outcomes within a known period?*

The ME has utilized a very interesting structure in the progression of short-term to longer-term projects, which we believe has served the Horticulture Innovation Lab quite well. The initial short-term IIPs enabled the Horticulture Innovation Lab to bring together a broad array of adaptive research and development topics and a large number of partners and to quickly assess a number of topics. This allowed all partners to assess the abilities and commitment of each other. It also provided access to networks of other potential cooperators in HC institutions, and facilitated the gathering of preliminary results that could demonstrate the feasibility of moving forward with longer-term projects. The EPs continued this process of evaluation, and then the PP and Continuation Projects served to move a limited number of these early project concepts on to longer-term status. In addition, the regrouping of some of the Horticulture Innovation Lab participants into new teams for these mid- and longer-term projects was notable as a positive outcome of the succession of

projects. Similarly, the CPs also brought different team members and a broader range of activities to bear on more refined questions.

7. *How does the ME ensure that research activities or themes supplement and not duplicate other development initiatives in the regions where the Innovation Lab is active?*

Our discussions with the ME indicated that they are using several resources to assess potential overlap with other regional projects and initiatives. The ME is talking with existing HC partners that are part of the Horticulture Innovation Lab. The broad range of individuals brought into the Horticulture Innovation Lab through various short- and long-term projects has proven very beneficial in having contacts throughout the regions where the Horticulture Innovation Lab is active. Secondly, the ME has members on the IAB as additional eyes and ears with respect to pre-existing or ongoing regional activities. Several on the IAB have large networks of colleagues in the horticultural research and private sector arenas, so we presume they would be able to provide good guidance on this issue to the ME. Thirdly, The ME and all the Horticulture Innovation Lab partners are in contact with USAID Mission staff in HCs. These contacts should also be counseling the ME on overlap potential, as the Missions gain an understanding of what the Horticulture Innovation Lab is planning. Lastly, we note that in the future, the partnerships developed through the Regional Centers of Innovation should provide another level of information on existing or planned regional activities. The Director of the Horticulture Innovation Lab, Dr. Elizabeth Mitcham is also the Chair of the USAID Feed the Future Innovation Lab Council, and she should be able to get firsthand information on all related activities in all the ten Innovation Labs. The ME may like to carefully monitor the research plan and activities of the closely related IPM and Nutrition Innovation Labs and the activities of the in-country Missions so that the Horticulture Innovation Lab projects supplement and complement their activities.

8. *Do research goals have national policy implications? If so, how are they addressed? Give examples.*

The strongest components within the Horticulture Innovation Lab that would have relevance to national policy issues are those in the areas of food safety and human nutrition and health. Several projects have focused on establishing production practices that would minimize pesticide use (e.g., Low Cost Pest Exclusion and Microclimate Modification Technologies for Small-Scale Vegetable Growers in East and West Africa; Ngouajio, PI; Sustainable Development of Horticultural Crops in Zambia for Food Security, Income Generation and in Support of the Tourism Trade; Simon, PI) or would help growers monitor food safety parameters (Delivering Vegetable Safety Education Through Established Social Networks in Latin America; LeJeune, PI). As these projects mature and more growers can produce pesticide-free products (e.g., with netting technologies), or at least have used sufficiently low levels of pesticides such that

harvested products can be certified below maximum residual levels (MRL) of acceptability, then possibilities will increase for export opportunities. This may require national governments to develop or update guidelines for monitoring food safety standards, such that these export chains can flourish.

With respect to nutritional issues, as more information is gathered on the nutritional quality of indigenous or traditional fruits and vegetables (e.g., Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers; Weller, PI), especially with respect to micronutrient minerals and vitamins, opportunities will grow for policymakers to develop strategies for promoting the consumption of these nutritious horticultural products. Furthermore, policy changes may be needed to help create more markets for their sales, especially in nutritionally at-risk population centers. The projects within the Horticulture Innovation Lab should continue to analyze the nutritional quality of generated food products, especially in response to the use of differing production or postharvest technologies, and should ensure that this information is available to policymakers.

9. *What was the process for sub-award selection? How effectively did the process yield a high quality, relevant portfolio of activities?*

It appears that initial sub-awards for the IIPs came, in many cases, from pre-existing cooperation and collaborations amongst some of the US PIs and HC partners. The IIPs served as a platform for all the Horticulture Innovation Lab participants to assess the potential contributions of other partners, and to use this network to identify other partners who were needed for specific aspects of later projects. Prior history with these partners appears to be the basis for sub-award selection in later mid- and longer-term projects. It is notable that many of the early partners were incorporated into later projects. In some cases, new team groupings were developed, presumably thanks to this earlier contact on the Horticulture Innovation Lab through annual meetings and other outlets. Some of the IIPs, such as the African Indigenous Vegetables, when applying for the second round PP, failed to meet the standards and were not approved. However, in the case of the African Indigenous Vegetables Project, the PI and the cooperating scientists and partners did not give up. They pursued their interests and competed for the bigger CP and succeeded in getting the approval of the review team and the ME and the project was awarded. Therefore, the ME carefully reviewed the projects and the sub-awards before approving them. In fact, it appears that all approved projects were selected on scientific merit, their focus to address priority objectives, their likelihood of success, and the merits of the expected outputs to address the Feed the Future objectives. The EET feels that this process was sound, and did yield a strong portfolio of activities.

10. *Assess the balance of domestic versus overseas research in terms of effectiveness of solving constraints in developing countries. Are changes needed in the balance?*

The EET believes the balance of domestic versus overseas research is quite appropriate in the Horticulture Innovation Lab. We noted that most of the US partners were actively engaged with HC partners. They were visiting HC partners and institutions on a regular basis, and were providing input for activities in overseas locations. The apportionment of funds for domestic versus overseas activities was also good. We noted that some activities were brought to the domestic side when progress was lacking on the overseas end, due to constraints with facilities, resources or personnel. This helped to move these projects along. One example of this is the CP “Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers” (Stephen Weller, PI), where the nutritional analyses of vegetables and some of the analytical methods development were moved to the US institutions, to ensure that the project stayed on course.

The EET found no need to recommend a change in the current balance of activities between domestic and overseas participants.

11. How has the United States benefited from the Innovation Lab’s research? Give examples.

The Horticulture Innovation Lab research activities have provided a number of benefits to the US. Projects dealing with indigenous vegetables have provided access to new indigenous vegetable germplasm for potential new crops in the US. The research on seed drying technologies with zeolite beads has provided good general knowledge on seed quality issues that are pertinent to US seed companies. Exposure to this technology could lead to new products or procedures for US seed companies and horticulture related industries. Much of the market value chain research that ends up in scientific publications will provide new information for social scientists on the functioning of unique market situations; this should be good general knowledge about the functioning of agricultural markets that could be used in some smaller market settings within the US. Additionally, the Trellis Projects provide a valuable experience for US students, allowing them the opportunity to gain exposure to international development and unique foreign cultures in agricultural settings. Furthermore, all of the interactions between US universities, students, or professors, with their counterparts overseas, will help to establish long-lasting research networks for future collaborations.

12. How much emphasis should occur within the Innovation Lab portfolio on basic research, applied research, implementation, and human and institutional capacity building?

The EET assessed the current distribution of effort within the Horticulture Innovation Lab of 20%, 40%, 20%, and 20% for basic research, applied research,

implementation, and human and institutional capacity building, respectively. We believe this is a good distribution of effort, and the ME should strive to keep this balance in the future or slightly increase the implementation and human and institutional capacity building. The EET recognizes the need for some basic research to identify new approaches to address the production, postharvest, and food safety objectives, but also notes that many good approaches are currently available, and they could be tested through applied research in new environments within Feed the Future countries. Implementation efforts should continue to constitute a significant portion of the Horticulture Innovation Lab portfolio.

Recommendation 6. We recommend that training efforts and appropriate workshops are built-in as an integral component of most, if not all future projects, as this will facilitate both implementation and capacity building objectives.

13. How does the Innovation Lab respond to the Title XII "Famine Prevention and Freedom from Hunger" Amendment to the Foreign Assistance Act of 1961?¹

Title XII, "Famine Prevention and Freedom from Hunger," of the Foreign Assistance Act of 1961, as amended, states that the principles of the "land grant model" will be used for improving food production and agricultural development. Title XII activities must be carried out, insofar as possible and appropriate, by Title XII institutions, with any additional non-Title XII resources as may be needed, under sub-agreements. Missions must identify Title XII activities at an early stage in the development of a planned results framework. The Horticulture Innovation Lab has responded to this Act by enlisting the assistance of investigators from a number of land grant institutions (e.g., University of California, Davis, Purdue University, The Ohio State University, Rutgers University, University of Wisconsin, University of Hawaii, Cornell University, Michigan State University and others). The ME has also conversed with Mission staff on their ongoing activities throughout the life of this project.

V. Alignment with Feed the Future Research Priorities

1. How has the Innovation Lab aligned with Feed the Future research and development priorities? Give examples. In what areas has the Innovation Lab not aligned with Feed the Future priorities and why?

The Horticulture Innovation Lab has done a very good job of reacting to Feed the Future priorities, especially in light of the fact that these priorities were thrust upon them in mid-course, at an early stage of this Innovation Lab's lifetime. The ME has been attentive to directing their efforts towards Feed the Future focus

¹ <http://www.aplu.org/page.aspx?pid=587>

countries. The Horticulture Innovation Lab has addressed the three Feed the Future research priorities in the following ways:

(1) Advancing the Productivity Frontier. The Immediate Impact Project (IIP): Sustainable Production and Marketing of Vegetables in Central America (Nienhuis, PI) tested a broad range of tomato germplasm to help identify varieties that were productive in local environments within Honduras, Guatemala, Nicaragua, and El Salvador. The IIP: Indigenous African Leafy Vegetables (ALV) for Enhancing Livelihood Security of Smallholder Farmers in Kenya (Weller and Marshall, CO-PIs) has similarly assessed the productivity of different cultivars of plants, in this case amaranth, African nightshade, and spider plant (33 cultivars in total, over two seasons). Also, the IIP: Deployment of Rapid Diagnostic Tools for *Phytophthora* on Horticultural Crops in Central America (Ristaino, PI) used morphological and molecular tools to conduct field surveys to identify the major *Phytophthora* species (plant pathogens) responsible for production losses in several horticultural and floriculture crops. It should be noted that these one-year projects provided good data that was leveraged for subsequent longer-term projects.

(2) Transforming Key Production Systems. Several projects focusing on postharvest issues, including those that tested available technologies or emphasized training, are good examples of how the Horticulture Innovation Lab addressed this Feed the Future priority. The IIP: Biologically Based Postharvest Quality Maintenance and Disease Control for Mango and Papaya (Paull, PI) used controlled experiments and technology transfer (train-the-trainer workshops) to assess the effectiveness of coatings and essential oils, as alternatives to fungicides, in the control of postharvest diseases in mango and papaya. The Long-Term Pilot Project (PP): Increasing the Capacity of Smallholder Farmers to Produce and Market Vegetable Crops in Uganda and the Democratic Republic of the Congo (Scow, PI) is developing a participatory extension model to enhance marketing and production of horticultural crops by linking the Farmer Field School (FFS) method with the Participatory Market Chain approach; is researching and developing integrated soil fertility management practices for tomatoes and indigenous leafy vegetables; and through their training of facilitators for the FFS, is helping to expand the region's capacity in research, education, and extension. As another example, the Long-Term PP: Safe Vegetable Production in Cambodia and Vietnam: Developing the HARE-Network to Enhance Farmer Income, Health, and the Local Environment (Trexler, PI) is using a participatory approach, with the help of local universities, to teach improved technologies for better horticultural production, postharvest quality, and food safety to smallholder farmers (mostly women), and to expand their knowledge in marketing as a means to gain more income. Also, the CP: Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers (Weller, PI) is assessing diverse germplasm, various

fertilization strategies, insect pests, and several agronomic characteristics to help develop and transform African indigenous vegetable production.

(3) Enhancing Nutrition and Food Safety. All of the projects, being in one way or another focused on postharvest quality, are directly or indirectly realizing impact in the areas of nutrition and food safety. One example is the Continuation Project: Sustainable Technology for Orange and Purple Sweet potato (STOPS) in Ghana (Bonsi, PI), which is using GAP and decision analysis tools to strengthen the value chain in three sweet potato growing regions in Ghana, in order to improve food security, agricultural productivity and economic value; and to increase the consumption of foods high in pro-vitamin A and antioxidants for good health. Another example is the Continuation Project: Delivering Vegetable Safety Education through Established Social Networks in Latin America (LeJeune, PI), which is using participatory research and outreach activities to reduce food contamination, improve farmer health and produce quality, open new markets for the sale of safe produce, and to deliver additional nutritional education to farmers. Also, the CP: Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers (Weller, PI) is assessing the nutritional quality of various indigenous or traditional vegetables, especially with respect to micronutrient minerals and vitamins.

As to areas within this Horticulture Innovation Lab that are not aligned with Feed the Future priorities, we have looked closely at all the projects, but can find none that fall outside the scope of Feed the Future. The ME appears to have been very attentive to this. We also believe that the nature of this Horticulture Innovation Lab, being focused on nutritious, horticultural crops and postharvest processes, allows it to fit nicely within the Feed the Future framework.

2. *How well do the Innovation Lab research and capacity building activities fit under one or more of the seven programs of the Feed the Future Food Security Innovation Center? What are the relevant program areas? How can this fit be improved?*

The seven programs of the Feed the Future Food Security Innovation Center are the following:

- 1) Increase cereal yields and adapt to climate change
- 2) Increase productivity and availability of legumes
- 3) Protect animals and tropical staples from major pests and diseases
- 4) Sustainably increase production and consumption of highly nutritious foods and diversify diets
- 5) Fundamentally transform key production systems
- 6) Create supportive agricultural policy environments and
- 7) Professional and organizational capacities are inadequate to address agricultural challenges and opportunities.

The Horticulture Innovation Lab addresses two of these program areas quite nicely: (4) Sustainably increase production and consumption of highly nutritious foods and diversify diets and (5) Fundamentally transform key production systems, through its efforts to increase the production of safe horticultural food crops and to increase market opportunities for these foods. We believe that if the Horticulture Innovation Lab stays on their current course of projects, they will continue to firmly contribute to these two program areas. In addition, through the three recently created Regional Centers of Innovation (in Southeast Asia, Africa, and Central America) the Horticulture Innovation Lab has the opportunity to contribute to program areas (7) Professional and organizational capacities are inadequate to address agricultural challenges and opportunities, and perhaps to program area (6) Create supportive agricultural policy environments. These Regional Centers of Innovation are just getting started, so there is little track record to draw upon. However, we believe the potential is there and improvements can be made through the Regional Centers of Innovation which can act as the focal points for establishing strong collaborations with local private industries, government entities, USAID Mission Offices, and others, to help cultivate professional and organizational capacity in these regions and to help policymakers develop governance and regulations that will increase market opportunities for smallholder farmers.

VI. Human and Institutional Capacity Building

1. *How has the Innovation Lab been effective at building the capacity of host country researchers, policymakers and practitioners?*

The Horticulture Innovation Lab has funded 15 US partners and has worked in 14 (of 19) Feed the Future countries. The range of IIP, EP, PP, CP projects and other activities have reached or affected more than 18,500 individuals since the Horticulture Innovation Lab commenced in 2009. About 87 individuals or organizations have been involved actively as co-investigators or collaborators in Horticulture Innovation Lab projects since 2009 (Table 1; next page). The majority of these (68%) have been individuals at universities and/or research institutions, but there are a growing number of private sector firms becoming involved particularly in assisting with provision of new technologies with potential use in horticulture production and postharvest systems. A full list of all PIs, partners and collaborators can be found in Appendix 8.

It was interesting for the EET to observe the enthusiasm with which local PIs interacted with the US PIs. Clearly there was a great deal of mutual respect and confidence in the ability of partners to undertake responsibilities for their parts of programs. There are certainly personal and professional benefits to be achieved by being involved in such programs.

Table 1. Number of co-principal investigators or collaborators from different regions of the world that have been involved in Horticulture Innovation Lab projects since 2009.

Region	*Number of collaborators	No. in universities or research organizations	No. in NGOs
Africa	43	28	15
SE Asia	19	14	5
Latin America and Caribbean	16	12	4
Europe and US	9	5	4
Total	87	59	28

* This list includes people or organizations that have been either co-principal investigators or collaborators in an Horticulture Innovation Lab project to date. A total list would also include numerous farmer leaders involved beyond the organizations counted here.

Regrettably, we were not able to ascertain the influence of the Horticulture Innovation Lab on policymakers within host countries. One exception to this was with Dr. Stephen Mbithi, CEO of Fresh Produce Export Association of Africa (FPEAK) in Kenya as well as on the Board of the Kenyan Horticultural Council and the Horticulture Council of Africa (HCA). FPEAK is a serious and committed partner to the Regional Center of Innovation, Thika, Nairobi. His organization plays a very important role and is a strong advocate of horticultural growth for African countries facilitating horticultural exports from Kenya. Horticultural exports are very important sources of overseas funds for Kenya; Mbithi firmly believes that other neighboring countries have the potential to be similar to Kenya once appropriate infrastructure and policies have been developed. FPEAK is strongly and publicly supportive of the work of the Horticulture Innovation Lab. Dr. Mbithi would like to see Horticulture Innovation Lab increase its efforts in undertaking appropriate research, especially for the fruit industry, which together with flowers, is the main export earner. He has a strong belief that the Horticulture Innovation Lab will be able to make significant innovative inputs to horticultural producers in the future directed towards assisting the smallholder farmer to reduce costs of production and to reduce postharvest losses and wastage. Mbithi wants to see much more interaction between the private and public sector research and development communities (including Horticulture Innovation Lab) and would welcome opportunities for further collaboration.

The Horticulture Innovation Lab has actively encouraged development of grower associations and cooperatives within and between regions, and facilitated the training of these groups. Regular meetings have promoted effective transfer of knowledge and experience among groups. In some regions, women-only groups have been engaged to ensure active participation by and

empowerment of women. Several projects include ‘train-the-trainers’ programs that allow the knowledge to be extended to many more individuals. The trainers are encouraged to be champions of their topic in their areas, meeting regularly with other members and faculty and particularly with local extension agents and NGOs to share knowledge and experience within and across regions. The postharvest training of the trainers project at the Postharvest Training Services Center at AVRDC in Arusha, Tanzania (Barrett, PI) is an excellent example of this accomplishment.

While the majority of collaborative efforts have been made with faculty at universities, a number of projects do include individuals from local extension services and NGOs. This is particularly so in the Trellis Fund projects; in 2013 it appears that the majority of host organizations are NGOs working with smallholder farmers and particularly women’s groups. The relationships that emerge from these Trellis Fund projects are mutually beneficial to all concerned: the smallholders are exposed to current thinking on agricultural production and postharvest systems, the NGOs benefit from the relationship by having more ‘hands’ available to carry out specific projects and the students benefit by gaining real life experience in development activities in a foreign country – very useful also for future CVs. Successful students are chosen carefully by the ME to match the best applicants for specific projects. To date this has been very successful.

2. *How has a pipeline of students been cultivated for long-term degree training opportunities?*

The pipeline for education and training students is being cultivated. To date at least 108 students have been involved in Horticulture Innovation Lab projects (Table 2). Of these, 29 received full funding while others received partial funding. About 58% of these students were female. For the advanced degrees (Masters and PhDs), 62% of the candidates were female.

Table 2. Number of students trained with partial or full Horticulture Innovation Lab funding through 2012.

Degree studied	Female number	Male number	Total	Percentage
Bachelor	25	22	47	43.5
Masters	29	15	44	40.7
PhD	9	8	17	15.7
Total	63 (58.3%)	45 (41.7%)	108	

Forty-two (39%) of the students were trained in the US and more than 65% of students were educated in host countries. At the PhD level, ten students were educated in the US and seven were educated in host countries. Many BS and MS

students work on specific projects with the Horticulture Innovation Lab. For example, one of the undergraduate classes at RUA in Phnom Penh was involved in assisting with baseline surveys for the Savings Led Microfinance project (Miller, PI), while other students were involved in analyses of soil physical, nutrient and microbial attributes in the Safe Vegetable Production project (Trexler, PI). Such experience will be invaluable in future as these students will have gained experience and skills in basic experimental design, interacting with people, collecting and helping with analysis and interpretation of data, as well as gaining confidence in working with PIs from different countries.



Fig. 3. Graduate students from RUA, Phnom Penh collecting soil samples.

The EET believes that there will be a need for an increased number of MS students in host countries as the new technologies and management practices are proven and adopted and as horticulture becomes more important economically. The US PIs could and should be active members of their advisory committees. For long-term sustainability there is a need for a greater number of host country students to have the opportunity to undertake their full PhDs in the US, or alternatively, be funded for postdoctoral studies after they have graduated at home. It is possible to establish 'sandwich' PhD programs whereby the students spend the first part of the program in the US, return to their home country for research on local problems – specifically associated with Horticulture Innovation Lab projects – and then return to the US for the final stages of the degree process. In-country university faculty would be co-supervisors in this process and would visit the US at least once during the tenure of the student in the US. This exposure to the US academic and scientific environment is highly desirable to develop personal and professional confidence as well as to establish extensive networks that will be invaluable on the students' return to their home countries.

One of the issues confronting graduates in some Feed the Future countries is the lack of job opportunities after graduation. This applies particularly, but not exclusively for BS graduates who often find it impossible to get adequately paying jobs in some countries (such as Cambodia). With the changes in curricula that are being planned in SE Asia and in some African countries such as Kenya, it is hoped that the quality of BS graduates will improve and that they will have the skills and abilities desired by employers. In their interaction with any private sector partners, PIs should endeavor to get them to employ such students during

school vacations in order to get to know the students and to give them some real world work experience.

3. *Has the program been successful in selecting the right mix of students from appropriate institutions? Are these trained students returning to their home countries to continue work in their trained fields?*

It is too early to be fully confident about answering this question. Horticulture Innovation Lab funds supported more than 30 university students through 2012. Students are selected on a competitive basis by the PIs, the host institutions and/or the Horticulture Innovation Lab and thus are top students meeting specific criteria required for entry into programs. No host country PhD students have graduated to date.

Six scientists from universities in Vietnam and Cambodia were mentored for one year and received extensive postharvest training at short courses held at both University of Hawaii at Manoa and University of California, Davis. One of these has benefitted from the information and information sources (including postharvest texts and product pamphlets) that she was able to obtain during this experience. She has been using this material to upgrade and modify her lecture notes for both undergraduate and postgraduate lecturing at Hanoi Agricultural University. This will enhance the quality of teaching. Five scientists from Benin went to attend a short course at MSU in relation to the Agronet pest exclusion project (Ngouajio, PI) and they benefitted greatly from interaction and networking with a range of faculty and other attendees.

The Trellis project has been very successful in providing small-scale, in-country development organizations access to US graduate student expertise, with benefit to both. The Horticultural Innovation Lab has funded two rounds of Trellis Fund projects through 2012, for a total of 24 projects. A further round has been called for in 2013 and is in the process of being finalized. In the first completed round of Trellis projects, 10 organizations working with 10 graduate students produced 124 training and extension meetings, 1,935 farmer participants (including 1,492 female farmers trained), and 10 demonstration plots. The 2013 round was extended to a wider range of NGOs and the response has been excellent; more than 150 applications were received and from these a tentative decision has been made to award 13, in eight countries with the likelihood that 10 will be awarded to NGOs, two to universities and one to a government research institute. There is real potential in extending this scheme to allow some host country graduate students to obtain work experience on selected US farms where they would have the opportunity to gain knowledge and experience in innovative production, postharvest and/or marketing (supply chain) systems. There is great value in this Trellis scheme; for very little money (~\$4,500 per project, \$2,000 for the host organization and the rest to cover student airfares and subsistence) it introduces keen motivated young people who have demonstrated an interest in international agricultural development to become

familiar with a new country, gain valuable experience and bring their expertise to bear on solving real problems with committed organizations working with small farmers. The young people involved in this scheme will undoubtedly be valuable for the USAID Feed the Future program in the future.



Fig. 4. Dr. Johnson Odera (ATRC) and Dr. Michael Grusak (EET) in ATRC.

Because of the newness of this Horticulture Innovation Lab it is too early to determine if all students educated in the USA will return home to meaningful employment. However there is no evidence available to indicate that they will not. The resurgence of horticulture in many countries and the increasing emphasis by governments to increase agricultural education spending up to 10% of GDP heralds promise for changes at the tertiary level that hopefully will increase employment opportunities. One notable example of a returning graduate student is Dr. Johnston Odera, African Technical Research Centre (ATRC) in Arusha, Tanzania – a research and development unit of Vector Health International. [Vector Health International is a joint venture of Sumitomo Chemical Co. (Japan) and A to Z Textile Mills (Tanzania)]. Dr. Odera did his PhD at Iowa State University, postdoc in the US, and then returned to Tanzania where he now holds this very responsible position leading agronomic research involving agronets and agro shades for pest exclusion and possible pest deterrence.

4. *Compared to the research activities, what has been the level of effort and investment in training and institutional capacity building? Is it sufficient?*

The level of investment in training for human capacity development has been appropriate considering the comparative ‘youth’ of the Horticultural Innovation Lab compared with other similar organizations. The balance between research and training has been appropriate with many local students at the bachelor and masters levels having good opportunities to interact with the projects by obtaining information and data from the field experiments for their own practical reports and dissertations. Because of the potential need for an increased supply of MS graduates in Feed the Future countries, the ME and any new PIs are encouraged to include this component in their proposals.

When in-country PIs are energized and mentored whilst undertaking Horticulture Innovation Laboratory research projects, they become better faculty members gaining confidence and ultimately having the capability to take

increasingly responsible roles within their own institutions. The EET was not able to obtain factual data on progress made in institutional capacity building by the Horticultural Innovation Lab. It is also hoped that any new postgraduates who are involved in Horticultural Innovation Lab projects will return to secure positions in universities and/or polytechnics thus strengthening the teaching and research capacities of those institutions.

The creation of the Regional Centers of Innovation in three separate regions surrounded by Feed the Future countries has been successful to date and will open doors, as the Regional Centers of Innovation will serve as hubs for further institutional capacity building. These will involve in-country partners and collaborators and provide an ideal opportunity for further exposure and contributions to Horticultural Innovation Lab and national programs. This will enhance institutional capability as personnel in the host, and other, institutions work together in introducing, demonstrating and promoting new technologies for horticulture as well as organizing and implementing training programs for local and regional participants.

The establishment of the Postharvest Training and Services Center was an impressive example of institutional capacity building. This facility has been used on several occasions since it was established in 2012 with training programs being delivered originally by US PIs but now being organized and run by local partners and collaborators. The scale up following the original postharvest training project (Barrett, PI) was impressive with a large multiplier effect occurring in seven countries following the one-year advanced training program that was undertaken by 36 trainers through the Postharvest Training and Services Center (PTSC) at Arusha. It is estimated that the solid and updated training that these individuals received has impacted their normal professional programs of work in their institutions and influenced a large number of smallholder farmers mostly women. It also enabled professional enhancement and capability of the institutions that had been lacking hitherto. The intention of the PIs was to replicate such PTSCs in different countries so that local training can be undertaken without the expenses involved in transport and accommodation for courses to be held in one central location. The EET strongly endorses this proposition.

Recommendation 7. We recommend that the Horticultural Innovation Lab, in conjunction with in-country collaborators, extend the postharvest training program, so successful in Tanzania, into other Feed the Future countries using the Regional Centers of Innovation as a base and that the Regional Centers of Innovation be equipped appropriately to enable this to occur.

5. *Should there be greater focus on institutional capacity building? If so, in what areas?*

The EET suggests that there should be a slightly increased emphasis on institutional capacity building during the second phase. This should not be a dominating theme as the Horticultural Innovation Lab will not be able to afford any large programs and it is recognized that other educational development programs exist within USAID and other international and national agencies. However, training and mentoring of local faculty should continue as has occurred in the past four years.

The EET recognizes that there are numerous efforts on agricultural/horticultural educational development being undertaken by a number of international agencies, NGOs and national governments to improve the access to and standards of education in general. However, in the course of our study we did not come across details of any of these. The ME should become aware of these efforts with a view toward seeing if they can complement or add to existing Horticultural Innovation Lab projects. There is no doubt that a small agency such as the Horticulture Innovation Lab cannot afford to become sidetracked from its main goals and hope to have a major impact on widespread institutional capacity building. Notwithstanding this, there are some topics that could be addressed by the Horticultural Innovation Lab in their efforts to increase institutional capacity in Feed the Future countries:

- a. Assist in efforts to remodel, modernize and enhance the curricula involved in tertiary horticultural education. Localized attempts are undertaken at several universities and there could be real benefit in working with host universities in all major focus regions of the Horticultural Innovation Lab (Central Africa, SE Asia and Central America) to establish some uniformity (but not duplication) across the undergraduate and postgraduate curricula.
- b. A suggestion has been made that agricultural universities in South and East Asian countries could join together to form a Masters program similar to the one that exists in Europe that enables students to undertake specific courses in different universities during the study for their degree. It is possible that US horticulturalists or program specialists could assist in formulating this process, perhaps through an Horticultural Innovation Lab initiative.
- c. In addition, there are opportunities to arrange local or regional workshops that could organize hands-on experiential activities related to topics such as preparation of research proposals, how to write a scientific paper, how to write a paper to get it accepted into a high impact journals and how to prepare a targeted curriculum vitae. Recently an international group organized a workshop on these topics in Thailand. Initially, there were 20 enrolments from staff at a local university, but when the course commenced about 75 people turned up. Subsequently, there was a demand for more such courses to be held in different parts of Thailand. In addition, workshops

could be organized on how to set up, implement, and analyze data from an 'ideal' experiment to obtain optimal results.

- d. The Horticultural Innovation Lab should work closely with other international agencies including FAO, World Bank, the Asian Development Bank, the Technical Centre for Agricultural and Rural Cooperation ACP-EU [CTA], CIRAD and with USAID to provide funding for selected graduate students and/or faculty members to attend selected international symposia, congresses and/or training workshops on specific subjects of value personally and institutionally.
 - e. Increase South to South exchanges enabling junior and mid-rank faculty to spend short-term visiting appointments at institutions or NGOs in other regions to learn of different approaches to adaptive research to create horticulture production and postharvest management packages that include innovative technologies, to establish personal linkages, to see other countries that may be more or less advanced than their own. They should then return to their own institutions with a renewed sense of urgency and commitment that would, hopefully, be of benefit to their colleagues as well. This could be a competitive project with the best proposals (maybe five per year) getting the prize visits.
 - f. The Horticultural Innovation Lab, together with USAID, should sponsor selected individuals to attend relevant international workshops especially if they are organized in conjunction with an international conference. The International Society for Horticultural Science (ISHS) is organizing several training workshops, workshops and seminars to be held within the International Horticultural Congress, August 2014 in Brisbane, Australia.
6. *How can impact of institutional capacity building be captured and measured more effectively?*

The simplest way to measure impact is to have a numerical system that counts numbers above or below an initial baseline. This is essentially what the USAID requires for the Innovation Labs in their annual accounting. Such a system may well include some or all of the following:

Student performance:

- Number of students graduating/passing in year in each degree program as a proportion of those initially enrolling;
- Number of students who graduate as a proportion of those who originally enrolled in each program;
- Number of dissertations (bachelor, masters and PhDs) successfully passed with appropriate honors grades (from none to 3rd, to 2nd to 1st class honors);
- Age/salary distribution of faculty and how this changes with time.

Staff performance:

- Number of refereed papers in international impact factor journals;

- Number of patents applied for;
- Number of publications in non-impact journals such as reviewed conference proceedings;
- Number of invitations to present papers/posters at national and international professional conferences;
- Peer esteem: number of times asked to review manuscripts or to examine masters or PhD theses;
- Number of farmer field days, farmer workshops or seminars organized for local industry (smallholder horticultural farmers);
- Number of times asked to undertake consultancy tasks either locally, nationally or internationally;
- Number and value of external grants obtained for research;
- High rankings for teaching expertise, as ranked by students and by an independent assessment process;

Departmental or university ranking

- Is the vision and mission of the department and university being achieved?
- Number of academic staff with PhDs or masters degrees;
- Number of technical staff with bachelor or masters degrees or technical equivalents;
- Ranking of university in international lists of quality universities (such as the Times Educational Supplement list or US News World's Best Universities);
- Quality of mentoring programs for students in difficulty;
- Proportion of courses/papers that are being taught on-line or by distance education mechanisms;
- Number of faculty that are allowed to undertake sabbatical leave every five to eight years with some funding provided;
- Availability of ready, reliable, consistent, full and free access to the internet for all faculty
- Faculty members have access to their 'own' personal computer (at least there is one in each office);
- Quality and maintenance of buildings, classrooms and laboratories;
- Access to outdoor field laboratories by undergraduate and graduate students for agricultural/horticultural practical studies and experiments.

Once appropriate baselines are established, development of institutional capacity is reflected in gradual and consistent increases in some or all of the above indices. The above points measure numbers; it is a greater challenge to measure sociological improvements (including staff relations; mentoring systems; health provision systems for staff, students; student association systems; number and activity of student teams in sports and cultural activities; cafeterias; sports fields and so on) and the benefits that are likely to follow from students and staff having access to such facilities. In addition, personal aspects (such as confidence, sense of worth, leadership, motivation and commitment) within individuals and departments are more challenging to assess in the short

and medium term, but they are very important in building momentum for academic and scientific growth.

Some of the above points may be ‘tagged’ to Horticultural Innovation Lab activities but essentially any institutional capacity building will be a ‘numbers game’ involving a relatively small number of students and staff at each institution and the degree of increase in a number of the points above over time.

There is a real need to focus attention on strengthening the ability of host country universities to train future generations of scientists, but given the scarce resources allocated to the Horticultural Innovation Lab and the number of horticultural crops and problems in the sector, it would not be appropriate for a major shift in funding from the Horticultural Innovation Lab to be used in an attempt to embrace major institutional capacity building programs. The best option would be to continue embracing in-country collaborators and partners and involve them fully in proposal generation, research planning, implementation, data collection, analyzing, interpreting, giving workshops and seminars of deliverables and writing up for publication.

VII Collaboration, Outreach and Technology Dissemination

The Horticultural Innovation Lab has an information management team whose goal is to strengthen the capacity of intermediaries to better deliver credible, relevant information to help smallholder horticultural farmers. To achieve this goal the team captures and analyzes outputs of Horticultural Innovation Lab activities, conducts workshops and creates information materials. It provides guidance and develops tools to help Horticultural Innovation Lab projects and the ME to disseminate horticultural information. This team conducts research on the use of extension in horticulture and assesses gaps in information systems worldwide. They have developed several useful tools such as the [Global Horticulture Knowledge Bank](#) and a [map of horticultural projects worldwide](#). (Fig. 5; see next page).

The team is working to organize the extension deliverables of Horticultural Innovation Lab projects into useful extension outputs for appropriate use by in-country trainers and farmers. Links were provided to the EET to delve into the Horticultural Innovation Lab [Information Management Internal Website](#) (includes information management research on assessing information access gaps). This was very informative, and much of the information would be of interest to PIs. However, it seems that much of it is in a preliminary form and cannot be accessed by external viewers, although quite a lot of the information contained in this internal web site is available in a transformed state on the open Horticultural Innovation Lab web site.



Click and drag map to view project locations in Africa, Asia and Latin America with brief descriptions and links to project pages. Or view [Horticulture CRSP Projects](#) within Google Maps.

Fig. 5. Worldwide horticulture projects

Considering the short time that the Horticultural Innovation Lab has been in existence, it has been very successful in making its presence known to the international scientific community. It has a large list of project reviewers from many countries and institutions who obviously became aware of the Horticultural Innovation Lab through contacts with the ME and the proposal reviewing processes. In addition, members of the IAB and the ME have participated and made presentations at national and international conferences about the aims, objectives and accomplishments of the Horticultural Innovation Lab.

1. *What outreach strategies have been integrated into project design to increase likelihood of uptake and utilization of research results? What have been the most effective strategies for outreach at the country level?*

All projects are scrutinized by the ME review panel, which includes Mark Bell, Leader of the Horticultural Innovation Lab Information and Communication Unit, to ensure that they contain appropriate dissemination and outreach components. Critical to this success is the choice of in-country PIs, who have a large responsibility for interacting with farmers, organizing extension events such as farmer field days, and preparing appropriate material containing

relevant and useable technical explanations for farmers. PIs are provided with key criteria that are necessary for successful dissemination of information.

The Horticultural Innovation Labhas gained considerable experience about information transfer and dissemination of results since its inception three-and-one-half years ago. They have found that over and over, some key points emerge. For success in information dissemination and extension, the following topics must be addressed in each project and they should be integral to any outreach program:

1. ***Demand driven.*** Programs have to be client/needs driven.
2. ***Farmer engagement.*** Farmers need to be engaged from the start from identifying needs through to generating content.
3. ***Credibility of information.*** Ensure credible sources of information and provide validated recommendations.
4. ***Project driver.*** Projects need local champions who will guide, direct and push activities.
5. ***Market and finance access.*** Consider markets and financing as an integral part of extension/outreach. These elements need to be integrated with extension information supply systems for success. Mobile money, for example, is making a range of associated support services more efficient (e.g. input suppliers having inputs more readily available as they are paid more promptly). Market information provides viable outlets for increased produce.
6. ***Trust.*** Build trusted "delivery" mechanisms to help people move from accessing information to testing and then adoption.
7. ***Integration.*** Use existing communication channels and where possible, integrate the use of traditional (e.g., field demonstrations) and "new" (e.g., video, radio, cell phones) approaches, like the efforts in Ghana to combine use of cell phones with radio programs. Remember that "seeing is believing."
8. ***Sustainability.*** Sustainability is a major issue for emerging services. For example, it is known that many ICT projects such as those involving Tele-Centers cease as soon as project funding stops. Charging for services is increasing as a means to improve sustainability and to validate service value.
9. ***Input suppliers.*** Input suppliers increasingly appear as promising major players for enhanced information delivery. However a major task will be create an environment for input providers to build trust through providing sound and honest advice and consistent return service. In many countries, there is farmer interest in disease and insect diagnostics, and (sometimes) nutrient problems and understanding their control options.

Regional differences. While radio, cell phone and cinema (use of video) seem very promising across Africa, radio seems to be less used in Asia. Electricity can be an issue, but charging stations may be a potential focal point for information distribution. It appeared that PIs have made little progress toward establishing close links with the different media outlets in host countries in order to ensure that news on successful technical innovation can be highlighted in ways that are

readily and immediately available to smallholders and trainers. The exception to this would be the success of Dr. Vong in Hanoi who has established close contact with a local TV company that broadcasts agricultural news and information (Safe Vegetable Production in Cambodia and Vietnam, Trexler, PI).

From information provided to the EET, it appears the FFS, hands-on activities and demonstrations, and participatory workshops have been the most successful ways of transmitting knowledge to small farmers or trainers. This has been successful in most of the projects undertaken to date including: postharvest training at the Postharvest Training Service Center (Barrett, PI), the Savings Led Microfinance Scheme (Miller, PI), the introduction of improved African indigenous vegetables (Weller and Simon, PIs), the introduction of nets to protect plants from insects (Ngouajio, PI), the development of EMINA and other technologies for enhanced safe vegetable production in Cambodia and Vietnam (Trexler, PI) and the project on development of diagnostic tools for rapid detection of *Phytophthora* (Ristaino, PI).

2. *How have research outputs been disseminated at the regional and global level? What tools have been used (i.e. hosted events, publications, web sites) and how effective have they been? Give examples.*

The Horticultural Innovation Lab has made serious endeavors to disseminate the outputs from their program as widely as possible. The Horticultural Innovation Lab web site lists a wide range of information sources and types that are freely available. These include:

- Brochures
- Newsletters
- Fact sheets by theme (Fact sheets on extension are being translated in Arabic and Bangla)
- Fact sheets by region
- Videos about projects
- Project overviews
- Partners, researchers and organizations
- Overview of RICs
- Trellis Fund projects
- Technologies overview
- Project list
- Project narratives by region/country
- Annual reports
- Conference posters



Tomato Grafting Guide
Preparing Grafted Tomato Plants using the Cleft Graft Method

Matthew D. Krenn, Monica Weigert, Mark Edrington, and Saly A. Miller
Photos by Deana Wells and Michelle Young

HortCRSP
BioNetAgro
The Horticulture and Horticulture Research Program
The Horticulture and Horticulture Research Program
The Horticulture and Horticulture Research Program

Rapid Diagnostic Tools for Phytophthora on Horticultural Crops
Implementación de herramientas de diagnóstico rápido para Phytophthora en cultivos agrícolas en Centro América
Universidad de Costa Rica
(June 2011 – July 2, 2011)

A combination of tools has been used for disseminating information arising from the projects. At a regional level these include: farmer field days, seed fairs, demonstration plots on farms, lectures and hands-on learning generally provided by in-country personnel as well as visiting US PIs, videos, a comprehensive Horticultural Innovation Lab web site, CDs, TV and radio. Videos for some projects are available from the Horticultural Innovation Lab web site; they are quite simple stories outlining the fundamental reasons for undertaking the investigations and indicating the expected outputs that will benefit

smallholder farmers. In addition, a manual has been produced in Spanish on procedures to diagnose *Phytophthora* soils in Central America, and there is a manual/guide on tomato grafting for smallholder farmers in Kenya and neighboring countries (Fig. 7). One project has created its own web site using the title 'BioAgroNet' where information is available to a wide audience (Low Cost Pest Exclusion and Microclimate Modification Technologies for Small Scale Farmers in Africa; Ngouajio, PI); this project has been featured in articles written about the technology in local horticultural trade magazines including the East African Fresh Produce Journal Horticultural News and The Daily Nation, a major metropolitan daily in Nairobi (Fig. 8).



Fig. 8. News item in the Kenyan newspaper The Daily Post, May 2012, on the pest exclusion nets project.

Tools used for dissemination are broad and attempt to be appropriate for the intended audience. They include presentations and hands-on activities at Farmers Field Schools, trials involving demonstrations of new technologies on smallholder farms, demonstrations of new technologies including improved seed varieties and fruit selections at seed fairs and field days at local institutions, hands-on demonstrations of equipment use, videos, articles in newsletters, discussions with USAID Missions and local NGOs. In addition, a number of scientific papers in local and international journals are now beginning to appear; this output will increase as the projects are completed and final data sets have been analyzed. Some examples include:

- The project New Technology for Postharvest Drying and Storage of Horticultural Seeds (Bradford, PI) used posters, PowerPoint presentations to seed industry personnel, publications and showcased the project and the drying beads in front of Her Royal Highness Princess Sirindhorn at Kasetsart University on the occasion of the launching of the Regional Center of Innovation in Bangkok; the occasion received widespread TV and newspaper coverage, enhancing the reputation of both the Horticultural Innovation Lab and the host university. Kent made another presentation at the launching of the Regional Center of Innovation in Kenya in front of farmers and other private sector people with very favorable feedback.

- Another successful PP involved postharvest training of 36 trainers from six countries in Sub-Saharan Africa (Extension of Appropriate Postharvest Technology in Sub-Saharan Africa: A Postharvest Training and Service Center; Barrett, PI). After an 18-month training program, each individual was provided with a CD containing all the training material (readings, data sets for analysis, product postharvest information) that they retained and used as a basis for subsequent training activities in their own countries. As of October 31, 2012, the original 36 trainees estimated that they had trained more than 8,500 other people in postharvest technologies in their own countries using the CDs, demonstrations, workshops and field days. In addition, Dr. Lisa Kitinoja created a very successful Linked In web site to which some of the trainees belong and on which she has established an online postharvest training course (fee payable) and information portal, both of which are proving very popular.
- The pilot project Safe Vegetable Production in Cambodia and Vietnam: Developing the HARE Network to Enhance Farmer Income, Health and the Local Environment (Trexler, PI) used a combination of techniques for information dissemination. Working very closely with the in-country PI, Dr. Vong, and his staff and students at the Hanoi University of Agriculture, they embarked on an information transfer program that included: hands-on learning to develop EMINA products (bio fertilizers, and bio pesticides); hands-on learning and demonstrations of modifying melon plant architecture to eliminate the costly use of wooden trellis structures; hands-on learning to produce seedlings for transplanting as a more effective alternative to broadcasting seeds; establishment of “Photo Voice” whereby



Fig. 9. EET meeting with farmers using EMINA and other new technologies in Vietnam

farmers photograph a sequence of management systems and options and then learn to develop the correct sequence in which these must be used on the farm to optimize yield and quality of their products. At least two farmers have established independent businesses, one supplying EMINA stock solutions and the other producing seedlings for transplants, for sale to other farmers in their own and other villages. In addition, Dr. Vong has established

an excellent relationship with a local TV company; whenever Dr. Vong is organizing a farmer field day, or has distinguished visitors, the TV company accompanies the team, films and then shows a short documentary on local TV – a great way to highlight the project, the local partners, the Horticultural Innovation Lab and USAID.

At a global level, IAB members and the Director attend meetings at which they promote the existence of the Horticultural Innovation Lab and outline its major goals and objectives as well as extol the success stories achieved to date. For example, Dr. George Wilson was a keynote speaker at an International Society for Horticulture Science meeting on postharvest science and spoke on the role and activities of the Horticultural Innovation Lab. It is expected that PIs will also indicate their involvement with, and advocate for the Horticulture Innovation Lab whenever possible, but the effectiveness of this aspect was not possible to check.

Although the Horticultural Innovation Lab is relatively new, many PIs have made poster presentations at international and national meetings as well as the annual meetings of the Horticultural Innovation Lab. Some PIs have commenced publication of results obtained in international, peer-reviewed journals, and a number of papers have been submitted pending successful review and acceptance. The number of published papers is expected to increase over the next two years as projects are completed within the next 12 months.

The appointment of a full-time person responsible for communications should enhance the value of the Horticultural Innovation Lab to promote its activities and successes more widely. It was disappointing not to see a reference to the Horticulture Innovation Lab in a recent (2012) CRSP publication “Harnessing science to ‘Feed the Future’, the CRSP contribution to achieving food security and improving nutritional status.” Major basic and adaptive research and development activities involving African Indigenous Vegetables are currently underway (Weller and Simon, PIs). It is very important that the other nine CRSPs are fully aware of the project outputs from the Horticultural Innovation Lab and more effort is required to produce success stories of interest to a wider audience outside the Horticultural Innovation Lab.

It has been found that the best method of communicating research outputs to farmers varies according to country. For example, radio and video are preferred in Tanzania, Ghana and Ethiopia, while use of mobile phones is rapidly gaining in popularity throughout the region. Use of other methods, such as cheap, streaming laptop computers has not been evaluated in the Horticulture Innovation Lab project to date. However international agencies, such as the Commonwealth of Learning (www.col.org), which is based in Vancouver and works exclusively with past and present British Commonwealth countries, claim to have had success in communicating important and relevant information to

smallholder farmers using modern information technologies that are available through personal communication devices such as smart phones. This organization has been at the forefront of developing cheap (<\$50), reliable, solar-powered laptops that can be used by smallholder farmers. Although the ME is well aware of the potential of these technologies, there seems to be no concerted effort to develop and adopt such technologies for making project information available to farmers and trainers. It is suggested that this aspect should be emphasized more prominently in the next five-year phase.

The successful launch of the Regional Center of Innovation in Bangkok, Thailand, with the widespread national publicity generated about the Horticultural Innovation Lab and the drying beads project, highlighted the real positive advantage in having a celebrity (in this case Her Royal Highness Princess Sirindhorn) associated with any major event being organized at the Regional Center of Innovation or activity such as a field day to introduce new technological advances. Although it is recognized that there are difficulties involved in getting important national figures to appear at local functions, it is strongly suggested that the Horticultural Innovation Lab senior members, together with the Directors of Regional Centers of Innovation, make serious attempts to attract a minister of the government, an ambassador, or some visiting dignitary who is committed to solving hunger, poverty, nutrition and health problems in developing countries.

The Regional Centers of Innovation have the potential to generate information of both local and regional significance. The Directors should be encouraged to develop close associations with individuals in local news media outlets (including newspapers, radio and TV), utilize the facility to showcase new technologies, host seminars and workshops on relevant topics taking advantage of the presence of visiting experts or dignitaries, and to ensure that a series of interesting items about the Regional Centers of Innovation and Horticultural Innovation Lab emerges regularly.

3. Does the Innovation Lab have a plan for technology dissemination? What is it?

The Horticultural Innovation Lab has a comprehensive plan for technology dissemination. The ME provides a great deal of detailed information on a web site separate from the Horticultural Innovation Lab site. The information management program ensures programmatic integration by capturing and sharing lessons learned, analyzing activities, responding to needs and identifying priorities within the projects and centers. Information management activities are integral to the Horticultural Innovation Lab model and provide a platform to continue building future activities based on past successes and challenges.

Information management is an essential component of all programs. It is closely allied with all funded projects and the Regional Centers of Innovation. Its objectives include:

- Providing a clear summary of information management activities and key outputs;
- Improving access to information on useful technologies and where they can best be applied;
- Improving access to information on enhanced and novel dissemination methods.

Its outputs include:

- Clear summaries of information management activities and lists of key outputs;
- Documents listing and activities promoting information useful technologies (with key indicators of where best applied) available;
- Documents listing and activities promoting information on improved dissemination methods that become available.

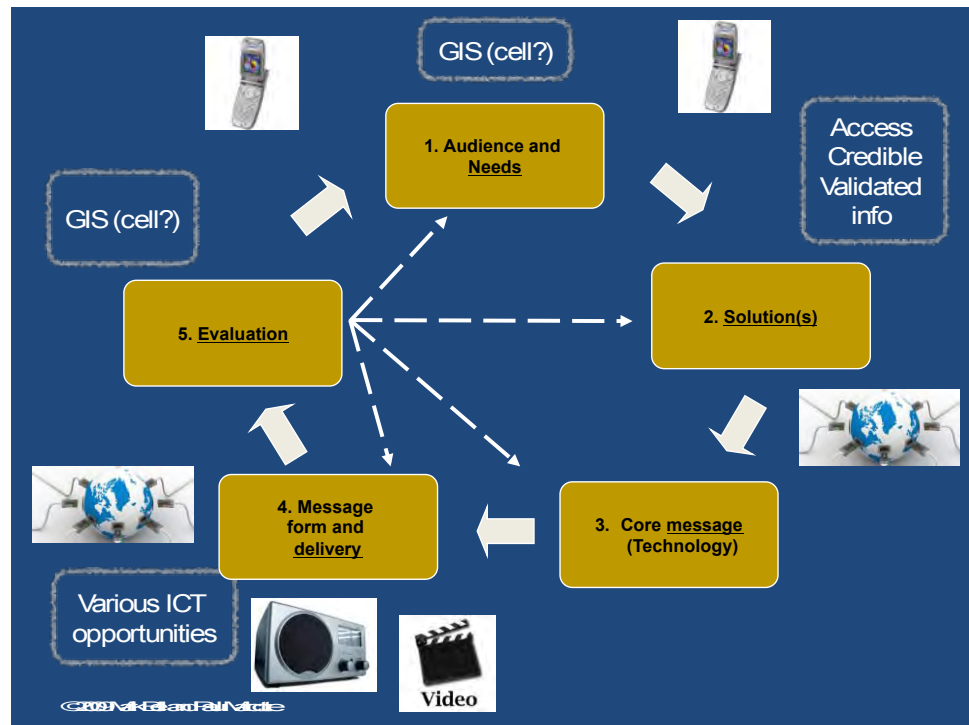


Fig. 10. An outline of the model used by the Horticultural Innovation Lab in the development and delivery of their communication and dissemination outputs.

These outputs are disseminated at workshops organized with PIs involved in specific projects, at the annual meetings that many of the PIs attend, through the web site, through the Regional Centers of Innovation, and through meetings and communication with partners.

In addition, the Horticultural Innovation Lab has recently created a very important position and employed a full-time information and communications person who will increase the output of prepared success stories and new developments for inclusion in the quarterly newsletter. This person is responsible for public relations, information management, web site management, preparing newsletters, taking care of social media, preparing fact sheets and working with external news media. She also prepares information packages for USAID, partners and others. She is planning to produce a list of publications, presentations and reports from Horticultural Innovation Lab personnel, and she is preparing a list of conference proceedings and presentations. She is able to plug into the University of California, Davis and USAID information Internet systems. She has plans to include the Horticultural Innovation Lab in social media such as Facebook, Twitter, Flickr and include a photo showcase. All of the above is done in close collaboration with Mark Bell, the ME member in charge of the Information and Communication Unit and other senior members of the ME. This is an important position that will facilitate dissemination of critical information to the science community, to USAID, to the subscribers to the Horticulture Newsletter, to PIs and to the general public.

4. Evaluate the dissemination of research results and the effectiveness of their utilization as a measure of the appropriateness of the research.

With more than 18,000 individuals (>50% women) having been exposed to, or influenced by, Horticultural Innovation Lab training sessions, workshops and farmer field days, either directly by attendance or indirectly through subsequent training by the trainers, the dissemination of research results has been impressive in the short time since the inception of the Horticultural Innovation Lab. The projects have reached 4,935 rural households, and more than 5,000 people have adopted about 40 new technologies and/or management practices. More than 75% of farmers who have adopted new practices and 61% of farmers trained have been women. Horticulture Innovation Lab PIs and their ~80 partners interacted with more than 40 women's groups, 100 private enterprises and 40 community based organizations. More than 10,000 ha are now under improved management regimes following Horticultural Innovation Lab interventions.

The Horticultural Innovation Lab has supported research along the horticultural value chain. While many projects are still in progress and final results will not be available until 2014, projects to date have:

- Found tomato and chili varieties from Taiwan that grow well in Central America and certain species of leafy green vegetables that perform well in Kenya, Tanzania and Zambia. New varieties of the above two vegetables are resistant to disease and are accepted by local growers and families;

- Developed and improved BIOAGRONETs for pest exclusion together with modified production management protocols;
- Developed a reflective system that concentrates the sun for use with typical solar dryers and reduces drying time while being easily built and transported under developing country conditions;
- Developed and tested a weaning food made with orange-fleshed sweet potato puree;
- Developed GAPs for tomato production in Nigeria;
- Tested information management strategies. In Central America, it was found that food safety information was not being transferred through typical extension channels. In Africa, it was learned that it might take more than a typical farmer field school to extend horticultural technologies and good practices.

At least three new technologies have been evaluated enough and are ready for scale up. These include:

- The CoolBot temperature control system for low cost cool storage;
- Seed drying beads;
- Pest exclusion nets.

Each of these technologies continues to be refined and improved, but each has demonstrated great potential for commercial adoption and uptake. User manuals are being prepared for these three technologies.

Other technologies that have great promise for scale up but await final test results include:

- Solar drying of vegetables;
- Solar soil sterilization;
- OFSP drying for flour;
- Vegetable grafting;
- *Phytophthora* spp. diagnostics;
- Solar powered irrigation;
- Effective microorganisms (EM) as bio fertilizers, bio pesticides and for speeding compost preparations;
- Zero- cost cooling chambers.



Fig. 11. New technologies demonstrated with potential for application and scale up to small farmers. Solar dryer, Thika, Nairobi (left); preparation of EMINA, Hanoi, Vietnam (center); zero cost cooling chamber, Arusha, Tanzania (right).

In general, the dissemination of results is done effectively and efficiently, but in some cases in-country PIs indicated to us that they were not trained in how to communicate directly with smallholder farmers. They understood the Horticulture Innovation Lab strategic requirements and the steps that should be taken, but they expressed uncertainty about how best to transfer information at the final stage of the process to the farmer. This indicates that there may be a gap between the theory and application of effective communication technologies. It is suggested that the Information Management and Communications team consider organizing some workshops in different regions in order to instruct and demonstrate the most effective methods for transferring new knowledge and technologies to smallholder farmers. This should involve role playing and participant involvement rather than lectures. It should also demonstrate ways and means to stimulate private companies to become involved in providing, marketing and hopefully adapting new ideas and technologies to farmers in their respective regions.

A limited amount of feedback from smallholder farmers, who had participated in projects, was available to the EET. Both technical and personal benefits followed the development of the project: Increasing Capacity of Smallholder Farmers to Produce and Market Vegetable Crops in Uganda (Scow, PI). Responses from some of the women who benefited from their involvement in this project are listed as follows:

- Developing community seed systems: Most FFS groups developed local supply systems in response to poor availability and quality;
- Adoption of fertility amendments for vegetables: About 75% of participants that grew crops began using some kind of fertility amendment they learned in the FFS;
- Women's economic empowerment: About 60% of participants that grew the crops are now selling a portion; about 70% of those selling are women; a number of participants reported improved self-esteem and personal dignity;

- Improved Diets and Household Health: About 1/3 of participants reported improved diet/health as one of the most important changes caused by participating;
- Improved household income and consumption: Participants reported a major change and better access to income for both daily needs (such as soap, sugar, medication) (~40%) and school fees (~12%);
- Friendship: The most commonly reported positive change.

The EET is convinced that many of these personal reflections of participants in this project apply to those who have been involved in other projects as well. Personal anecdotes from the PIs of the “Seeds of Hope” project in Central America, the Postharvest Training in Rwanda and Arusha, Tanzania, the Safe Vegetable production project in Vietnam and the African Indigenous Vegetable project all received similar comments from participants. These reflections provide a positive reinforcement of the value of the technical information generated and transferred to smallholder farmers; in addition, they demonstrate that other very positive sociological and economic benefits flow from participation in such projects.

5. *Has the Innovation Lab partnered with the right collaborators to implement and disseminate the outputs of the research program? Who else should they partner with?*

In general, the collaborators chosen by the US PIs have been very effective in their involvement in the experimental programs and have been fully involved in organizing and undertaking most of the farmer field days and other training programs. While most of the partners have been at local universities, research institutions (such as KARI in Kenya) or private companies (such as Rhino Research Ltd in Bangkok), there should be an opportunity to link with local university personnel. For example, an individual at Jomo Kenyatta University was not included in the original team despite the fact that she was working on AIVs. Whilst participating at the opening of the Regional Center of Innovation she was able to make personal contact with Weller and Simon and they were very willing to include her in the team for the remainder of the project. The EET was told that this involvement brought prestige and some recognition to both the individual and the institution. It was clear to the EET that those in-country PIs who had had postgraduate experience abroad seemed to have the most confidence and drive to mount expansive, broad based and effective information transfer systems to deliver the outputs to their audiences. In addition they seemed to have generated contacts with others in the supply chain, such as marketing personnel, and the media.

This point underlines the importance of international experience and exposure of host country PIs. It also indicates that long-term advantages will follow from educational programs that send high quality students to undertake PhD training

at the US land-grant universities. It suggests that as funds permit, there should be an increase of scholarships/fellowships to enable a greater number of host country PhD scholars to be educated in the US.

It is also important that strong links be made with host country universities to assist with the training of MS students. Many universities in Africa are re-evaluating their curricula for plant science and horticulture degrees to ensure that graduates have the appropriate training for their eventual employment within country. There is a real opportunity for the US land-grant university faculty to join with other agencies involved in education and training to assist with these objectives perhaps through linking Horticulture Innovation Lab PIs with others involved in projects such as InnovATE (Innovations in Agricultural Training and Education) and AWARD (African Women in Agricultural Research and Development).

There are opportunities for involving other collaborators to undertake collaborative research, as well as to implement and disseminate research outputs; these are indicated under question #6, below. Briefly, collaborations should be made as follows:

- Within the Horticultural Innovation Lab by ensuring that relevant results are made available quickly so they can be evaluated in other regions;
- With other Innovations Labs for appropriate collaborative research;
- With other Innovation Labs for dissemination of relevant information through their respective networks;
- With USAID Missions and their implementation agencies such as FINTRAC and DAI;
- With other international development and funding agencies including the World Bank, FAO, CGIAR institutes and NGOs such as OXFAM and CARE just to name a few.

While significant steps have been made to develop and demonstrate new technologies and practices that are of value to smallholder farmers, there must be further attention given to the idea of scale up. It is suggested that at the project proposal stage all applicants for projects be requested to indicate how results and technologies that might flow from their projects could best be scaled up for wider adoption in a host country. All prospective PIs should give some consideration to this point. To enable PIs to grasp the significance of this aspect of the Feed the Future program, it might be necessary for the Horticultural Innovation Lab /USAID to organize some interactive workshops involving some Mission personnel as well as implementing partners such as FINTRAC or DAI, to provide guidance and elucidation to all PIs.

6. *Are there any unexplored areas of collaboration between projects that are feasible and have potential? Give examples.*

Within the Horticultural Innovation Lab. In the next five-year phase, the Horticultural Innovation Lab should explore mechanisms for more rapid transmission of ideas and preliminary results among PIs within the H Horticultural Innovation Lab. For example, in the project on Safe Vegetable Production in Vietnam (Trexler, PI), the EET was very impressed with the performance of the biological control systems using EMINA solutions that appeared to provide a sustainable pest control system and thus major reduction or elimination of chemical residues from fresh vegetables. Yet there was no evidence that this exciting development was being used elsewhere within the Horticultural Innovation Lab, not even in the partner project in Cambodia let alone in any of the African projects on indigenous vegetables. It is understood that this experiment has not been completed yet, but promotion of preliminary results could and should have been shared with other PIs.

Between Innovation Labs. The main issues that are being tackled by the Horticultural Innovation Lab relate to sustainable production and postharvest systems for nutritious fruit and vegetables in developing Feed the Future countries as designated by USAID.

It is clear that the Horticultural Innovation Lab has overlapping interests with some other Innovation Labs, namely Integrated Pest Management (IPM), Global Nutrition, Sustainable Agricultural and Natural Resource Management (SANREM) and BASIS Assets and Market Access (AMA). Considering the health ramifications of nutrition on health of children and women particularly, there is every incentive for collaboration and communication among several of the Horticultural Innovation Lab projects, such as Postharvest Technologies, Safe Vegetable Production and African indigenous vegetables with Global Nutrition projects. Similarly, the Horticultural Innovation Lab emphasis on sustainable production of safe healthy fruit and vegetables by minimizing application of synthetic pesticides and encouraging biological methods of control has much overlap with certain objectives of the IPM CRSP and SANREM. The CP, African Indigenous Vegetables (Weller and Simon, PIs) has an entomologist on the team to look into the pests and disease problems. Similarly, the educating smallholder vegetable farmers in grafting and microclimate management techniques in Kenya, Tanzania and Uganda (Kleinhenz, PI) project has Sally Miller, a plant pathologist on the team and she has presented the results of grafting in vegetables to overcome soil borne diseases at the IPM Innovation Lab meetings. Such examples clearly indicate that the ME is well aware of the value of synergies between different Innovation Labs. Recently, the ME has also entered into an arrangement for a joint award for a project with the SANREM Innovation Lab. The ME is keen on promoting such inter-Innovation Lab collaboration wherever possible and applicable to complement and enhance the value and outcomes, and to avoid duplication of efforts.

With the USAID Missions. The Missions are the implementers of agricultural innovations and technologies and are responsible for scaling up of promising outputs in farming systems in target countries. They have very large budgets at their disposal especially in comparison to the Horticultural Innovation Lab. In general, the relationships between the PIs and the Missions are adequate; the ME has developed a protocol for ensuring PIs communicate with Missions prior to visiting host countries and set up meetings well in advance of their visits. However, the Horticultural Innovation Lab has had little success in direct integration with Mission value chain projects in Horticulture. In the next five-year phase, such relationships need to be pursued more aggressively. Many opportunities exist since many Feed the Future Missions have horticultural value chains as a top priority (e.g., Kenya, Tanzania, Cambodia, Nepal, Bangladesh, Guatemala, Honduras, etc.). The ME was successful in working with the Mission in Honduras and has an Associate Award for Horticulture Value Chain Assessment. (See Recommendation 3.)

With other international agencies. There are many other international agencies and NGOs operating in the development arena. Most of these have agendas similar to that of the USAID Feed the Future program. Some important agencies including the United Nations Food and Agriculture Organization (FAO), The World Bank, the Asian Development Bank, the United Nations Development Program (UNDP), relevant CGIAR institutes, OXFAM and CARE, are all actively involved in the same countries as the Horticultural Innovation Lab. The Director of Horticultural Innovation Lab has met with representatives of a number of these agencies and briefed them on the activities of the Horticultural Innovation Lab. The ME is planning to continue to seek their collaboration with the Horticultural Innovation Lab. The Horticultural Innovation Lab has now established the Regional Centers of Innovation in the three regions, and they are expected to serve as conduits to engage with several of these international and regional donor agencies and NGOs. Again, there are a number of agencies involved in capacity building, of both personnel and institutions in the Feed the Future countries. Education, learning and training are key platforms in the Horticultural Innovation Lab projects, so awareness and possible collaboration with other major regional programs may prove beneficial in the future.

For the Horticultural Innovation Lab to increase and develop relationships/associations with other Innovation Labs and national and international agencies, the Director of the Horticultural Innovation Lab is taking an active role through participation in national, regional and international conferences that are involved with food production, food security, the role of women, health and nutrition of women and children and even in events that target education and training of those in the food chain. If the Director became a full-time position then this advocacy and promotion role could be further expanded.

Recommendation 8. We recommend that the ME Information Management and Communications team and in particular the new communications coordinator work assiduously to develop close links with news editors in all branches of the media in order to create better opportunities for wider distribution of interesting, good news and successful stories flowing from Horticultural Innovation Lab activities. Such stories are fine to have at a local level but they need to find places in national and international outlets.

Recommendation 9. We recommend that the ME Information Management and Communications team further develop social media systems for communicating messages of hope and success related to the role of horticulture in reducing poverty, increasing food security, improving health and nutrition of women and children, increasing household incomes, producing safer food and vegetables for household and market consumption.

Recommendation 10. We recommend that the ME Information Management and Communications team establish links with the Commonwealth of Learning to determine the processes and protocols that they are using to help smallholder farmers gain knowledge of technologies, management and markets using modern ICT technologies and determine if there is any opportunity for collaborating in selected past and present British Commonwealth countries.

VIII Gender Inclusion

The Horticultural Innovation Lab program has been very successful, in general, in ensuring that strong gender inclusion/equity emphasis is maintained throughout their portfolio of activities. By way of example, the IAB has four female members out of a total membership of 12 (33%). The ME has a staff of 11 (many part time) comprising nine women and two men.

1. *Does the Innovation Lab have a formal plan for gender inclusion in all of its activities?*

Being one of the most recently established Innovation Labs, the Horticultural Innovation Lab has a strong strategic and tactical emphasis on gender inclusion and equity in its programs. The Innovation Lab does have a plan for gender inclusion. Associate Director Amanda Crump leads the gender inclusion aspect of all projects. It is recognized that women are the traditional cultivators and marketers of horticultural crops with up to 80% percent of the labor force in many countries where vegetables, fruits, and cut flowers are considered to be "women's crops". Although women represent a large reservoir of production

and marketing knowledge of these crops, they are usually compensated with lower wages and less permanent positions than men. Lacking knowledge of how finance works and where to get it, as well as collateral to insure it, women have unequal access to technology.

When provided with appropriate and equitable training, women growers are well poised to increase productivity and expand horticultural markets. All projects must consider gender and enabling environment issues. Project proposals specifically addressing gender inequality are expected to evaluate gender-based constraints, provide leadership and technical training, and provide outreach or policy assistance to develop solutions. Some training activities are expected to target women, including training for female extension specialists. The Horticultural Innovation Lab Gender Equity strategy ensures that women are reached in meaningful and empowering ways.

It is the role of the gender specialist in the ME to ensure that all programs are fully accessible to women. That means more than just simply training more women than men, but actually working with all projects to ensure that women who are trained are able to access technologies and information. For example, simply getting women to attend a training session does not ensure information is transferred to them in a meaningful way that works for them (for example, they may have different literacy needs). The ME specialist works closely with each project during the funding stage to ensure that their gender plans make sense. For example, in the seed-drying project, the project team initially proposed to try to understand how to create small businesses for drying seeds. During the proposal revision process, the ME gender specialist worked with the PI to adjust that goal to create small businesses for women. To do this, the PI had to understand how laws around creating small businesses might not favor female participation in creating these businesses. But the PI was set up to do that with appropriate resources. Some of the projects have very strong gender specialists as collaborators and those usually require little adjusting, but the ME gender specialist makes sure that everything that is done with people gives access to both men and women alike by tackling barriers that keep either gender from participating in and benefiting from Horticultural Innovation Lab activities. The ME specialist is very much in tune with the current USAID gender team and their gender strategies and also relies heavily on gender strategies developed by the World Bank and the UN. Recently, the ME gender specialist was invited to attend a gender global learning exchange where she shared ideas with and learned from other gender specialists.

2. *How has gender been taken into consideration in research design, training and outreach strategies? What have been the results? What areas could be improved and how?*

Every Horticultural Innovation Lab project must include a plan for gender equity in the original proposal. Guidance is provided during project planning to ensure

that the needs of women and men are appropriately addressed within each project. Gender equity plans are developed with project leaders while ensuring that Horticultural Innovation Lab projects result in increased learning and empowerment for women. Gender equity training is also provided. At the end of the first three years, more than 18,000 farmers had been reached with the Horticultural Innovation Lab training and research projects with more than 50% of these farmers being women. More than 4,900 households have been affected by training and more than 100 new technologies have been adopted by trainees (60% women). In some projects, women dominate. For example, in the Savings Led Microfinance (SLM) project in Cambodia more than 80% of the participants are women, and in the Safe Vegetable Production project in Vietnam the most successful uptake and development of new production technologies appeared to be done by women. The impact of the project was seen in the development of two small independent businesses arising from the new technologies being used in the project, including production of stock solutions of the bio pesticide, bio fertilizer and bio-composting media as well as the production of seedlings for transplanting, both for sale to other farmers in their local and neighboring villages and communes.

Thirty-six postharvest specialists (19 women, 17 men) from eight neighboring countries undertook advanced hands-on training, taking 10 courses over 18 months at the Postharvest Training Services Center based at the AVRDC campus, Arusha, Tanzania. Since the end of the project in 2011, these trainees have indicated that they have trained a further 8,738 people involved in postharvest businesses in their home countries including smallholder farmers. In addition, these latter trainees have trained 3,600 additional people thus adding a further multiplier effect resulting in a total of 12,338 benefitting from this postharvest training project.

Reports from the PIs indicate that women are very keen learners and adopters of new technologies. They are keen to learn. In doing so, they gain confidence in their abilities to produce fresh and processed horticultural food products. In addition, they gain personal pride, confidence and dignity in accomplishing new activities.

Women trained. In three-and-one-half years, the Horticultural Innovation Lab has trained more than 18,000 people of whom at least 51% were women (Table 3; next page). Data gathered was not disaggregated to provide details on the categories of people/women trained. For example, it is not possible to determine the proportion of farmers, extension officers, university staff, or individuals from the private sector who were trained or what numbers of women were in each of these categories. However, nearly 140 women's organizations or associations were assisted because of project intervention. Almost every project has a train the trainer component, but the numbers requested by USAID are simply for number of people receiving short-term (which is non-degree) training. All numbers (including the student numbers) are current as of October 1,

2012. Reporting on indicators is done annually at the end of fiscal year in October.

Table 3. Number of people trained over three years (2010, 2011 and 2012) of the Horticultural Innovation Lab program indicating number of women's groups, females and males trained.

Category	2010	2011	2012	Total
Number of women's organizations/associations assisted as a result of USG interventions.	47	49	42	138
Number of Females who have received USG supported short-term agricultural sector productivity training	1,258	1,300	3,158	5,716
Number of Males who have received USG supported short-term agricultural sector productivity training	1,035	1,462	1,968	4,465
Number of Females who have received USG supported long-term agricultural sector productivity training	4	15	23	42
Number of Males who have received USG supported long-term agricultural sector productivity training	4	12	12	28
Disaggregation not available			8,132	8,132
Total people trained	1,266	2,789	13,293	18,383

University (long term) training. Not only is training of women farmers a priority, higher education opportunities for women is an important element of capacity building and sustainability for future academics (teachers and researchers), extension officers and skilled graduate personnel for the private sector. At least 108 students were being trained at universities in the US (42 students or 39% of the total) while 66 students (61% of the total) were being educated and trained in host countries, all with partial or sometimes full funding. Students have been involved in diverse projects undertaken by the Horticulture Innovation Lab. A list of participating universities and project PIs is provided in Appendix 8. There were slightly more females being trained (58%) than males (42%) for bachelor, masters and PhD degrees (see Table 2, pg. 55).

Social science input into projects. The ME does a very good job in ensuring that gender issues are satisfied in all successful projects. However, in the future it is suggested that when proposals are solicited that it is stated clearly in the conditions that each project team should include, where necessary, a person with social science expertise preferably one from each of the US and in-country

project teams.

The ME is to be congratulated on developing a strong strategic direction and implementation for gender inclusion in their overall program. The current Associate Director is a strong and able leader for this Gender Inclusion part of the Horticulture Innovation Lab program.

There is a need to identify the specific economic and social benefits that flow from Horticulture Innovation Lab projects. This could be achieved by using social scientists involved into relevant projects or collaboration with social scientists and/or agro-economists from other appropriate Innovation Labs. Such involvement would enable the benefits to households and communities emerging from adoption and application of specific horticultural technologies to be determined

Recommendation 11. The EET recommends that the current protocols and practices undertaken by the ME to ensure gender equity and inclusion on all Horticultural Innovation Lab projects be commended and that efforts be maintained to ensure that a person with expertise and experience in social sciences (such as sociology, anthropology) be included in all future project teams where practicable to ascertain benefits emerging to households and communities from adoption of innovative horticultural technologies..

IX. Monitoring and Evaluation

- 1. What types of monitoring and evaluation have been undertaken by the ME? Are social scientists used to conduct broad impact assessments?*

The ME has instituted a Monitoring and Evaluation (M&E) team, composed of an internal advisor (Amanda Crump, Horticulture Innovation Lab Associate Director) and Dr. Paul Marcotte (University of California, Davis, International Programs Office); Erin McGuire, a project intern, has also been helping with the evaluations. The team has training in both natural and social sciences and the members are able to conduct both qualitative and quantitative assessments. The M&E team has been active from the start of the Horticulture Innovation Lab Program and serves as a mechanism to evaluate progress of the projects, provide comments and recommendations to the ME, and to provide guidance to Horticulture Innovation Lab team members on data collection methods for baseline surveys, project monitoring, and reporting.

The M&E team has a work plan that includes the monitoring and evaluation of four main components:

- Assessing project progress towards objectives.

- Assessing outputs – project activities, products, trainees, and other items.
- Assessing outcomes – the direct changes seen in people or production systems as a result of Horticulture Innovation Lab projects.
- Assessing impact – the changes that are beyond the outcomes or the things that have changed in the community or ecosystem as a result of Horticulture Innovation Lab projects.

Specific methodology includes the following:

Assessing Project Progress

At the proposal stage, projects funded by Horticulture Innovation Lab develop a log frame monitoring and evaluation plan based on their objectives. The projects address their objectives through defined activities that have specific outcomes and measures of success. The M&E team requests that project teams critically think about how they will measure and document their success and how they envision the impact of their project.

Every six months, project leaders are asked to advise the Horticulture Innovation Lab M&E team about the progress they have made towards their objectives. In addition to reporting on their objectives, the project leaders are asked to complete a standardized project report. Annually, this report is assessed to ensure that projects are making timely progress.

At the midpoint of each project, project leaders are contacted by Paul Marcotte to assess their satisfaction with their project and with the Horticulture Innovation Lab ME. Because Paul is outside the ME, he has been able to suggest changes to the management system through his reports of this interaction. At the end of a project, several steps occur including a detailed review by the entire M&E team of the project to determine if the project achieved its objectives, which project aspects were successful and could possibly be scaled up, and how the project contributed to the overall mission and goals of the Horticulture Innovation Lab.

Assessing Outputs

Outputs are assessed utilizing Feed the Future agricultural indicators selected by the Bureau for Food Security at USAID. In addition, the Horticulture Innovation Lab has developed a set of indicators for capacity building, with specific questions pertaining to agricultural production, postharvest, marketplace, or 'other' issues. These indicators are assessed every six months and reported to USAID annually in October. At the beginning of projects, the project leaders propose output (indicator) targets that are appropriate for their projects. It is this list of targets that projects are judged against. Project leaders, in consultation with the Horticulture Innovation Lab ME, are allowed to revise their indicators on an annual basis. Assessing outputs in this way is quantitative and gives the Horticulture Innovation Lab ME the ability to measure a number of

different indicators quickly. While not indicating impact, these outputs do inform the ME of how projects are progressing and the overall effect the entire Horticulture Innovation Lab portfolio is having and where there may be gaps.

Assessing Outcomes

If a member of the ME visits one of the Horticulture Innovation Lab projects in the field, they are asked to interview project team members. A standardized set of interview questions is provided for this activity. These interviews are recorded, transcribed and then analyzed qualitatively to understand the direct changes that the projects are having for the people involved in the project. Horticulture Innovation Lab team members are also asked to assess the project on the ground. In addition to these on-the-ground assessments, the M&E team measures outcomes from the report narratives that the project leaders write every six months. These project narratives and on-the-ground reports help them understand what is happening to the people and the production systems in the projects. These outcomes also guide the ME as they decide which projects to target for potential scale up and where to invest in upcoming years.

Assessing Impact

Measuring impact is one of the more difficult propositions for the M&E team to assess. The approach proposed has been to visit the project sites at least one year after the end of the project. These site visits are used to determine the impact of the project's efforts in capacity building, developing collaborations, and technology implementation. These visits also allow the M&E team to understand how people beyond the reach of the project have been impacted and how the community or ecosystem beyond the direct reach of the project has changed.

At the beginning of the later stage Horticulture Innovation Lab projects (i.e., after the IIPs), the project leaders were asked to implement a baseline survey. It is partially against these baseline surveys that the M&E team will measure the Horticulture Innovation Lab's long-term impact and success.

2. *Are the indicators used effective at capturing and communicating the outcomes and impacts of research activities? Are there appropriate indicators for each stage in the "research continuum"? Have indicators capturing impacts and outcomes on higher levels been developed?*

The ME, through the M&E team, has established a broad set of benchmark indicators that have been used to capture and report the outcomes and potential impact of the Horticulture Innovation Lab projects. These indicators cover a wide range of issues and do appear to effectively capture all stages of the research continuum. Furthermore, higher level indicators are evident in their attention to benchmarks for long term goals, such as: sustainability, response to demands and constraints in the value chain, building capacity, improvement of key infrastructure, and development of production, postharvest and market

mechanisms to ensure food security and improve the welfare of individuals, their communities and their country.

Examples of some research activity indicators and benchmarks that the M&E team is using are the following:

Increased production of selected horticulture products in host countries

Improved germplasm: Existing horticultural products evaluated by researchers/stakeholders; alternative/improved germplasm developed; indigenous crops and cultivars selected for nutritional and postharvest characteristics.

Benchmarks: Greater knowledge of inheritance of important traits; alternative cultivars developed or recommended with improved traits; release of cultivars and hybrids with higher yield; improved adaptation to biotic and abiotic stresses; enhanced value for producers, marketers and consumers; genetic resources available and distributed.

Improved integrated crop management: Constraints and enabling environment to production assessed; alternative inputs identified; Good Agricultural Practices (GAPs) for production identified and recommended.

Benchmarks: GAPs information and technology developed; extension agents and producers trained in GAPs; increases in production.

Enabling environment: Build institutional capacity; develop financial opportunities for value chain stakeholders; develop appropriate information/technology delivery systems; identify best-adapted crops.

Benchmarks: Stakeholders have greater wealth and improved livelihood; can invest in expansion.

Gender equity: Increase women's access to financing and information about markets; access to production information and improved germplasm; recruit female farmers.

Benchmarks: Increase in women's disposable income; dependability of farmland access or ownership; women informed in food quality and safety; women's knowledge of finance and marketing systems increased; numbers of female scientists and extension agents; new opportunities for women in the horticulture value chain.

Increased value-addition of selected horticulture products in target countries.

Assess constraints to market access: Identify public policies and infrastructure needed for market access; develop enabling credit options for stakeholders; deliver information on finance, marketing and standards.

Benchmarks: Development of policies that improve local horticultural trade and export capacity; improved access of small producers to high value markets.

Investment in host country agri-industry that increases employment and economic development: Assessment of current practices; regional centers established; identify infrastructure changes needed; assess market impediments; work with policymakers toward investing in change; develop interventions to improve postharvest infrastructure; build capacity in tertiary education and research centers in postharvest methods and food standards.

Benchmarks: Reduction in product losses; higher quality produce; training centers fully staffed; 'train the trainer' programs instituted; regional training centers established; food-borne illnesses reduced and nutrition improved; increase in rural income; jobs generated.

Activities across value chains to create employment: Introduce technologies that create local high-skill employment; identify novel products that combine high value with demand; develop domestic seed and plant sources and propagation.

Benchmarks: New technology adoption; poverty reduction; increased rural incomes; new market opportunities; higher skill levels.

3. *Have baselines been established? If not, why?*

The gathering of baseline data was executed more effectively in later stages of the Horticulture Innovation Lab program, than at the beginning. With the one-year IIPs, the ME decided that baseline data collection would be too difficult, in light of the short nature of those projects. Nonetheless, each IIP was asked in the proposal stage to set benchmarks and then report on them throughout the project. With these reports in hand, the M&E team is planning to go back to the IIP locations in the coming year and look at what changes and progress has occurred since the last report. The M&E team also plans to do post-hoc baseline data gathering in some of these locations, using government data and other sources of information; all of this will contribute to their post-project assessments.

All later projects were required to budget for and conduct more extensive baseline surveys. At the completion of each project, the M&E team will re-measure the parameters captured at baseline to determine if a difference has been made with the research. An example of baseline data collection is that of the AIV project's baseline household survey, which included questions on such things as: land use and revenue; what was being grown; input costs; yield; what types of processing (if any) were being employed; household preferences for the

consumption of AIVs; buyer preferences for AIVs; what credit opportunities existed; what were the levels of savings.

4. *Are data collected valid and of proper quality for reporting?*

The M&E team has put together very specific guidelines on reporting, having created templates for the PIs to fill out at each stage of their projects. This has given the M&E team an adequate and complete set of information for each project, enabling their evaluation of the project's ongoing progress, or level of success at its completion. Furthermore, the standardized reporting structure has facilitated the ME's requirements to report the progress made on various Feed the Future indicators to USAID.

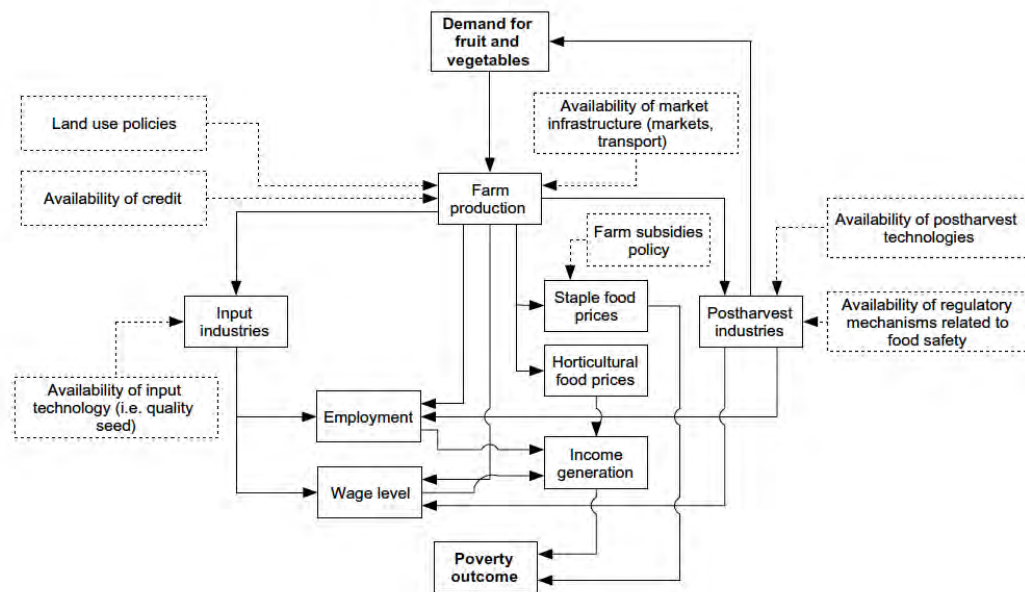
X. Research Focus of a Second, Final Five-Year Phase if Awarded

1. *Do the results achieved to date justify awarding a second, final five-year phase of the Innovation Lab in the same research area? Why or why not?*

Yes, the EET strongly recommends renewal and continuation of the Horticulture Innovation Lab for another five-year period.

Horticulture is a vitally essential production sector that has the potential to change lives, livelihoods, income, nutrition and health in developing Feed the Future countries. It is a challenging topic as there are many crops with hundreds of genera, species and cultivars available for production, many of which are underutilized and not yet commercialized. In addition, horticultural crops are perishable, fragile and often have very short shelf lives. Therefore, developing an integrated and efficient supply/value chain from farm to market is critically important.

The following is a model that could be applied to demonstrate the complex interactions involved in diversification into production and marketing of high value horticultural crops for poverty alleviation [K. Weinberger and T.A. Lumpkin, "Diversification into Horticulture and Poverty Reduction: a research agenda". *World Development* 35(8): 1464-1480. 2007]



Future Horticulture Innovation Lab projects should endeavor to include all relevant aspects likely to cause bottlenecks or constraints in the supply chain and deliver integrated holistic information packages that can be undertaken on smallholder farms and scaled up for implementation by other players such as the USAID Mission and their contractors.

The Horticulture Innovation Lab has achieved the objectives set out in the original proposal to USAID. They responded with alacrity to the changes that were foisted upon them following strategic and policy changes implemented by USAID 15 months into their current tenure of the program; they demonstrated flexibility, initiative and good sense in adapting rapidly to the new guidelines to Feed the Future directions and have continued to meet deadlines and milestones.

The ME at University of California, Davis has done an excellent task of managing the program. Almost without question, PIs have expressed their praise for the manner in which the ME has managed the projects including calls for proposals, reviewing and deciding on successful applicants, managing the financial and reporting aspects and providing expert advice and assistance to PIs at all phases of their projects. There has been unanimous support from the PIs questioned that University of California, Davis should continue to serve as the ME of this program.

Recommendation 12. The EET recommends that the Horticulture Innovation Lab be renewed and continued for another five-year phase and that the ME remains at University of California, Davis for the second phase with a non-competitive renewal.

2. If a second five-year phase is funded:

a. What should be the research focus?

- The second phase should focus on conserving input resources including water, safe vegetable production, reducing food losses and wastage, improving family incomes and improving nutrition of families, with the aim of fulfilling Millennium Development Goals and Feed the Future objectives. Activities should build on results obtained in the first phase, where appropriate, with particular emphasis on introducing adaptive new technologies and demand driven production and postharvest packaging technologies.
- Value chain analysis of horticultural enterprises should continue to be a major focus of the Horticulture Innovation Lab portfolio in providing information on rate limiting steps and constraints (road blocks).
- Appropriate postharvest storage and processing and value added technologies in both vegetable and fruit crops.
- Nutrition and health aspects of horticultural foods for consumption with special reference to Asian and African indigenous vegetables and fruit; this would include the effects of plant stresses on growth and nutritional components; attention to nutrients bioavailability should also be considered.
- Develop production management packages incorporating innovative technologies (including improved cultivars, seed preservation techniques, transplanting, mulching, raised beds, management of plant architecture, micro-irrigation, use of bio pesticides and bio fertilizers, precise fertilizer placement, water storage devices) demonstrated to enhance production of safe vegetables and fruits; these should be developed to a stage for application by extension officers and for scale up.
- Included in any postharvest and/or postharvest management package to be promoted should be a preliminary business development and marketing plan.
- Projects should be designed so results establish key principles that can be transferred to other regions. The ME should encourage PIs to become familiar with new USAID directives and strategy (including New Alliance, Water for Food).

b. Should there be an emphasis on fewer high performing activities?

- The EET believes that the Horticulture Innovation Lab should maintain a balanced portfolio of projects of different sizes and durations.
- The Trellis Fund should be maintained, perhaps extended, depending on finances. It is accepted as being very valuable for introducing young graduates to development horticulture and for host country institutions and NGOs to work with young people who wish to make a difference to smallholders in developing countries.

- Continue to have two to three large projects, each of about \$1 million over three years phased in during the five-year period, each with potential renewal for two years.
 - Introduce discovery projects, each of \$150,000 – \$200,000 over two years; opportunities for extension will depend on budget, technical review committee and ME. (The EET was impressed with the success achieved in the first IIPs and EPs where seven out of fifteen projects were extended subsequently into PPs, CPs and continuation projects; this will enable new people to apply with different innovative projects and with new partners in host countries. The EET believes that the Horticulture Innovation Lab needs both expansion and renewal.)
 - Introduce an annual prize each year (say \$10,000 - \$5k for the prize and \$5k for development) for the best idea for a new and innovative technology that will enhance and advance the aims of the Horticulture Innovation Lab; this could have a different theme each year. Funds for this purpose could be solicited from prospective and interested donor agencies.
- c. *Should the research focus be on one or both of the following, as recommended by the BIFAD Review of Collaborative Research Support Program (CRSP) Model: A Report Commissioned by BIFAD at the Request of USAID, August 2012: (i.) Strategic research on a global problem, or (ii.) demand driven research to enhance food security at the country and regional level.*

As food security, human health and nutrition and reduction of food losses are global problems, both strategic and tactical approaches to research should form the core aims of the next phase of the Horticulture Innovation Lab. However, proposals accepted in the next round of applications should focus on research to accomplish practical and scalable outputs that will impact at country and then regional levels. In addition, the EET would like to see processes introduced to facilitate the transfer of technological innovations to other Feed the Future countries as soon as practicable for local evaluation and implementation.

Global issues are many but include the following that have been core to Horticulture Innovation Lab activities during the past 3.5 years.

- Improve nutrition, health, welfare and income of families through intensification of production of high value horticultural crops;
- Reduce postharvest losses and wastage in the supply chain;
- Develop sustainable and profitable production and postharvest systems with special reference to local indigenous vegetable and fruit crops;
- Capacity building of both individuals and institutions (degree of effort depends on country; should be built into every project).
- Safe fruit and vegetable production to reduce pesticide residues, preserve water quality and enhance environmentally sustainable management practices;

- Provide appropriate information and communication systems and technologies for transferring new technologies to extension officers, university faculty and smallholder farmers, especially women, using modern ICT methods.
 - Water for Food – Manage water for agriculture/horticulture sustainably and more productively to enhance food security.
- d. *What activities from the current Innovation Lab should be continued, refocused and/or eliminated?*

Horticultural research and development needs for developing Feed the Future countries include the following topics:

Genetic improvement. Focus should be on obtaining already available selected advanced breeding lines and cultivars from agencies such as AVRDC for vegetables and selected breeders for fruit, rather than Horticulture Innovation Lab undertaking its own breeding from scratch, that will result in improvements in productivity. The yield stability and environmental concerns can be addressed through rigorous selection for genetic resistance to diseases, pests, heat and drought. Other objectives would include nutritional enhancement in both exotic and indigenous crops of both fruit and vegetables through selection and evaluation of under utilized local vegetables and fruit.

Safe fruit and vegetable production. Objectives are to reduce pesticides, avoid heavy metal and microbial contamination while enhancing yield of quality crops. Such technologies will also protect water quality.

Horticultural systems development.

- **Enabling institutions.** Encourage the formation of farmer associations or cooperatives including development of credit schemes for smallholders such as the Savings Led Microfinance program (Miller, PI) through collaborating agencies such as OXFAM. Horticultural crop production is more expensive and riskier than staple crop production but the rewards per unit area of land utilized can be much greater. Information about flows of product onto the market needs to be developed so that scheduling of production can be organized to meet market demand. There is a critical need to enhance the efforts in building more human capacity with education scholarships required for MS and PhD training, both locally and in special cases to the US. In addition, institutional capacity building is needed through a range of activities to improve academic and scientific outputs and to enhance sustainable employment patterns.
- **Seed sector development.** Work with the private sector to overcome problems associated with lack of quality open pollinated seeds, lack of storage knowledge and poor storage facilities that lead to poor germination and poor plant stand. Scale up of the drying beads technology is required.

- **Market systems.** Rapid changes in the marketing sector do occur once supermarkets enter a country, as urbanization progresses and the agri-food sector is being transformed in many Feed the Future countries. Smallholder farmers need to adapt to provide crops of the required quality produced under GAP standards; smallholder producers find it difficult to get produce to market.
- **Postharvest facilities.** Training of basic postharvest knowledge and tools for smallholder farmers, extension officers, junior faculty and private sector players in the value chain is an urgent requirement as horticultural crops are very perishable, cannot be stored for long and losses can be as high as 60% especially in hot humid tropical regions. Appropriate, locally adapted, economical and efficient handling, transport and marketing systems are required.
- **Peri-urban production.** Local production of vegetables and fruit in home gardens year-round is potentially an important way to improve nutrition of children in urban areas. Adaptive research is needed to reduce risks associated with crop contamination from dirty water, and there is a need for application of innovative small-scale technologies (clean water; irrigation; management; cultivars; fertilizers; nutrition) that could be recommended by practical horticultural expertise.

Continuation of Horticulture Innovation Lab projects.

- Activities should continue to be focused on the Feed the Future countries.
- Enhance efforts to select appropriate seeds and planting stock for microclimates and soils in Feed the Future countries.
- More attention should be devoted to nutrition and health of horticultural crops [such as AIVs (Weller, PI)] that form the basis of Horticulture Innovation Lab projects where applicable.
- African indigenous vegetables have dominated activities in Africa; work should continue to develop information packages for production, postharvest and processing for availability for scale up.
- Postharvest training should be continued on an ongoing basis using the PTSC in Arusha, initially. Attempts should be made to replicate such Centers in other Feed the Future countries; although it is likely that they could be organized at the Regional Centers of Innovation. This would continue capacity building to create understanding of postharvest in the value chain, present key principles and technologies as well as develop understanding of techniques to reduce losses and wastage and maintain freshness and micronutrient density after harvest.
- Eliminate further projects on floricultural crops. While flower production has the potential to increase small farmer income, and thus allow families to improve nutrition and health, because of the limited funding available to the Horticulture Innovation Lab, we recommend that future effort be directed to horticultural food crops; an exception to this would be Trellis Funds that could be used for a flower project if justified.

Refocusing of Horticulture Innovation Lab projects.

- Ensure that all funded projects have clear researchable, testable problem statements that will provide data for questions being asked.
- Ensure that all projects have an appropriate balance of plant science/horticultural science and social science (such as agro-economist, statistician, sociologist) so that properly designed production and market chain activities can be analyzed both quantitatively and qualitatively
- Seed project (Nienhuis, PI) in Central America should follow reliable accepted protocols for introduction and evaluation of new seed cultivars to new microclimates. If this cannot be refocused properly, then terminate.

Termination of Horticulture Innovation Lab projects

- Terminate drying beads as a priority activity. It is a high value project and it has made very good progress to date. However, it is now ready for adoption/scale up for further development by the private sector partner.

3. What lessons learned should be taken into consideration if a second, final five year phase is awarded?

- Increased funding should be allocated to the Horticulture Innovation Lab to enable completion of existing projects and initiation of new projects in the next five year phase (25% increase suggested).
- Director of the Horticulture Innovation Lab should be a full-time appointment to enable enhanced responsibilities to be undertaken.
- The EET suggests that the ME should attempt to work with universities to develop a process whereby annual renewal of contracts and associated financial allocations are streamlined to avoid delay in advancing the funds. Too much of a delay has occurred in some projects in allocating funds to in-country PIs. (A PI should not have to wait nearly six months for funds to arrive, or pay the research costs out of his own pocket for six months.)
- The ME should be more aggressive and proactive in developing partnerships with new partners. The EET encourages the ME to continue to engage in dialogue with Missions, other Innovation Labs and AVRDC, as well as contractors such as FINTRAC, Winrock, CGIARs and NGOs. The ME should encourage the PIs of projects to develop participation with other interested partners.
- The EET recommends that ME approach other donor and partner agencies such as World Bank, FAO, IFAD, CGIAR, ODA, CTA, ADB, COL and the private sector for strengthening partnerships, especially for the Regional Centers of Innovation and supplementing available funds. This will also ensure that an increased number of horticultural students are provided with opportunities to obtain advanced degrees in various horticultural fields to strengthen the intellectual and knowledge base of the institutions. To accomplish additional capacity building there is a need to strengthen the horticultural curriculum of

the tertiary sector in Feed the Future countries in SE Asia, Africa and Central America.

- In order to develop relationships with other external agencies, some of which are indicated above, it is suggested that during the next five-year phase the Horticulture Innovation Lab devote more resources to developing collaborative relationships with appropriate partners in development. This may include some entities on the social science side of the development spectrum that have limited traditional contact with organizations such as the Horticulture Innovation Lab, which is devoted more to R&D and implementation at the smallholder farmer level.

4. *What are the opportunity costs of not continuing the research of this Innovation Lab?*

- Relationships/contacts and collaborators gained over the past four years will be lost.
- Visibility of the Horticulture Innovation Lab, and horticultural emphasis of the USAID program will be lost.
- Programs abandoned before complete production and postharvest packages can be defined and delivered to smallholder farmers and to Missions for scale up; premature termination of promising programs.
- Value of initial \$15 million investment to Horticulture Innovation Lab will be markedly reduced.
- Reputation of the Horticulture Innovation Lab and USAID would be sullied; having built up the hopes, dreams and expectations of smallholder farmers, especially women, that the horticultural projects managed by the Horticulture Innovation Lab encouraged, then termination of the program would be a devastating blow and US reputation would be irrevocably tarnished.
- The costs of, and promise heralded with the creation of the Regional Centers of Innovation and the Postharvest Training and Services Center will be wasted if funding is not continued to undertake their exciting development and training programs.

XI. Recommendations

Recommendation 1. The EET recommends that the ME carefully consider recruiting clearly accomplished people from different horticulture specialty areas from both the public and private sector as members of IAB with no conflicts of interest.

Recommendation 2. The EET strongly recommends that the ME review the results of the survey of host country PIs in setting the research priorities and developing the future research agenda.

Recommendation 3. The ME should be congratulated for its efforts to engage with the Missions in host countries. The EET strongly recommends that the ME proactively continue the engagement with the Missions and where it is possible, inform and involve the Mission in the project review process (as requested in Cambodia) so that they feel that they have an obligation and ownership for the project. The ME also should encourage the PIs and the host country representatives to periodically meet with the Mission and apprise them of the progress of the project and showcase the significant outputs. More direct integration of Horticulture Innovation Lab research into Mission value chain projects is needed.

Recommendation 4. The EET recommends that the ME regularly invite public and private donor agencies such as FAO, World Bank, IFAD, CGIAR, Gates Foundation, and NGOs to participate in their workshops and annual meetings. In addition, the ME should regularly distribute their publications, press releases and significant findings to the above agencies so that they are aware of the accomplishments of the Horticulture Innovation Lab.

Recommendation 5. The EET recommends that the USAID AOTR serve as an intermediary between the ME and the Missions so that it can facilitate collaboration between the Horticulture Innovation Lab and the Missions.

Recommendation 6. We recommend that training efforts and appropriate workshops are built in as an integral component of most, if not all future projects, as this will facilitate both implementation and capacity building objectives.

Recommendation 7. The EET recommends that the Horticulture Innovation Lab, in conjunction with in-country collaborators, extend the postharvest training program, so successful in Tanzania, into other Feed the Future countries using the Regional Centers of Innovation as a base, and that the Regional Centers of Innovation be equipped appropriately to enable this to occur.

Recommendation 8. The EET recommends that the ME Information Management and Communications team and in particular the new communications coordinator work assiduously to develop close links with news editors in all branches of the media in order to create better opportunities for wider distribution of interesting, good news and successful stories flowing from Horticulture Innovation Lab activities. Such stories are fine to have at a local level, but they need to find places in national and international outlets.

Recommendation 9. The EET recommends that the ME Information Management and Communications team further develop social media systems for communicating messages of hope and success about the role of horticulture in reducing poverty, increasing food security, improving health and nutrition of women and children, increasing household incomes, and producing safer food and vegetables for household and market consumption.

Recommendation 10. The EET recommends that the ME Information Management and Communications team establish links with the Commonwealth of Learning to determine the processes and protocols that they are using to help smallholder farmers gain knowledge of technologies, management and markets using modern ICT technologies and determine if there is any opportunity for collaborating in selected past and present British Commonwealth countries.

Recommendation 11. The EET recommends that the current protocols and practices undertaken by the ME to ensure gender equity and inclusion on all Horticulture Innovation Lab projects be commended and that efforts be maintained to ensure that a person with expertise and experience in social sciences (such as sociology, anthropology) be included in all future project teams where practicable and on a need basis.

Recommendation 12. The EET recommends that the Horticulture Innovation Lab be renewed and continued for another five-year phase and that the ME remains at University of California, Davis for the second phase with a non-competitive renewal.

XII. APPENDICES

Appendix 1. External Evaluation Team members:

2) Michael Andrew Grusak

3) Errol W. Hewett

Appendix 2.

Scope of Work: External Evaluation of the Feed the Future Food Security Innovation Lab: Collaborative Research on Horticulture² Award Number: EPP-A-00-09-00004

Purpose

The purpose of this external evaluation of the Feed the Future Food Security Innovation Lab: Collaborative Research on Horticulture (hereafter referred to as the Hort Innovation Lab) is to assess the program management, research performance, and to provide recommendations on possible program direction for the U.S. Agency for International Development (USAID). This evaluation will help inform USAID on whether to extend the Hort Innovation Lab for a second, final five year phase, or end funding at the conclusion of its current five year phase.

Background

The Feed the Future Food Security Innovation Lab: Collaborative Research Programs with U.S. Universities (formerly called CRSPs) were created under Title XII of the International Development and Food Assistance Act of 1975, which authorized USAID to engage U.S. land grant and other eligible universities to address the needs of developing nations while also contributing to U.S. food security and agricultural development. In 2000, Title XII was reauthorized, enabling the continuation of the CRSPs as one of several types of U.S. university research efforts helping “to achieve the mutual goals among nations of ensuring food security, human health, agricultural growth, trade expansion, and the wise and sustainable use of natural resources”.

The U.S. University led collaborative research Innovation Labs are an integral part of the new Feed the Future Food Security Innovation Center, established to respond to two key recommendations from a Board for International Food and Agricultural Development (BIFAD) commissioned CRSP review³:

- To develop an overarching and coordinated strategy for engaging U.S. universities in agriculture and food security research and human and institutional capacity development that includes the CRSPs as a central component; and
- To leverage the impact of CRSP investments by strengthening links across universities, U.S. government, global programs, foundations, and other donors.

The Food Security Innovation Center will enable USAID to manage its research, policy and capacity-strengthening portfolio by thematic area rather than by institutional home. To this point, CRSP programs have been renamed as Innovation Labs. This name change does not alter USAID’s commitment to funding the integrated research and training exemplified by CRSPs and other types of research and capacity strengthening programs with U.S. universities. On the contrary, USAID is significantly expanding opportunities for Title XII universities and their partners to compete for cooperative grant awards in a number of the Food Security Innovation Center program areas. Each of the former CRSP programs are now included in one of the following seven Center programs:

² Formerly called the Horticulture (Hort) Collaborative Research Support Program (CRSP)

³ http://transition.usaid.gov/our_work/agriculture/bifad/BIFADREVIEW_CRSP_August2012.pdf

1. *Program for Research on Climate Resilient Cereals* – helps smallholder farmers adapt to climate change and build resilience by developing new cereal varieties with enhanced yield and tolerance to drought, heat, salinity and low soil fertility and delivering these varieties in diversified, sustainable farming systems.
2. *Program for Research on Legume Productivity* – increases the production and consumption of critical, protein-rich legumes, by developing disease and stress tolerant, high-yielding varieties, improving market linkages and postharvest processing and integrating legumes into major farming systems to improve household nutrition and incomes, especially for women.
3. *Program for Advanced Approaches to Combat Pests and Diseases* -- harnesses US scientific expertise and emerging molecular tools to develop new animal vaccines and crops and animals resistant to pests and diseases that cause significant production losses in tropical systems.
4. *Program for Research on Nutritious and Safe Foods* -- addresses under nutrition, especially in women and children, by increasing the availability and access to nutrient dense foods through research on horticulture crops, livestock, fish and dairy, food safety threats such as mycotoxins and other contaminants and on household nutrition and food utilization.
5. *Program for Markets and Policy Research and Support* -- works to achieve inclusive agricultural growth and improved nutrition through research on enabling policies, socioeconomics and technology targeting and by building the capacity of partner governments to effect sustainable change in areas such as land tenure, financial instruments, input policies and regulatory regimes.
6. *Program for Sustainable Intensification* -- works with smallholder farmers to incorporate sustainable, productivity enhancing technologies and farming practices into major production systems where the poor and undernourished are concentrated, and through intensification and diversification of these systems, to enhance resilience, nutrition and agricultural growth.
7. *Program for Human and Institutional Capacity Development* -- strengthens individuals, scientists, entrepreneurs, educators and institutions, ensuring that food and agriculture systems in developing countries are capable of meeting the food security challenge and that women especially are poised to take advantage of new opportunities and provide critical leadership in agricultural research, private sector growth, policy development, higher education and extension services.

Description of the Horticulture Innovation Lab

Purpose

The Hort Innovation Lab meets the food needs and improves nutrition and human health in the developing world, while providing opportunities for diversification of income and consequent economic and social advancement of the rural poor, particularly women, through horticulture development. The results of research and training activities increase food security and improve the quality of life of people

in developing countries while bringing an international focus to the research, teaching, and extension efforts of U.S. institutions. The Hort Innovation Lab builds capacity at national research institutes, trains farmers and horticultural stakeholders in improved practices, links farmers to markets and develops a range of innovative technologies aimed at significantly improving the profitability of horticultural production in over 30 countries throughout Africa, Central America, and Asia.

2012 Activities

The cultivation and marketing of high-value fruit, vegetable and flower crops—horticulture—offers the promise of increased incomes and enriched diets for both growers and consumers in developing countries. To that end, the Hort Innovation Lab builds international partnerships for fruit and vegetable research that improves livelihoods in developing countries. Successful horticulture is heavily knowledge-dependent, therefore the Horticulture Innovation Lab partners with organizations in three different ways to build capacity while supporting research outcomes. First, the Hort Innovation Lab supports research projects led by top U.S. public university scientists with international collaborators that solve horticultural problems along the value chain. In addition to research projects, the Hort Innovation Lab has established three Regional Centers of Innovation—one in Thailand, Honduras and Kenya—each of which supports horticulture at existing international research centers with a multi-country reach. Finally, Hort Innovation Lab is building capacity among smaller organizations in the developing world and U.S. graduate students, through projects that pair the two together for mutual benefit.

2012 Geographic focus

Feed the Future Countries: Guatemala, Haiti, Honduras, Nicaragua, Bangladesh, Nepal, Cambodia, Ghana, Kenya, Malawi, Rwanda, Tanzania, Uganda, Zambia

Non-Feed the Future Countries: Bolivia, Chile, Costa Rica, Dominican Republic, Benin, Democratic Republic of Congo, Gabon, India, Laos, Panama, Sri Lanka, Thailand, Vietnam, Mexico, Nigeria, South Africa, Zimbabwe

Status of Cooperative Agreement

An Associates Cooperative Agreement with Leader was awarded to the University of California, Davis as the Management Entity (ME) for the Hort Innovation Lab. The Hort Innovation Lab is in its fourth year of its first five year phase which ends on September 30, 2014. For this fourth year, \$3,000,000 was added to the Cooperative Agreement. The Hort Innovation Lab is one of ten Innovation Labs conducting collaborative research with eligible U.S. Universities⁴ that are supported by USAID's Bureau for Food Security.

Additional information on the Hort Innovation Lab can be found on their web site:

<http://hortcrsp.ucdavis.edu>.

Scope of Work

⁴ Eligible universities are land-grant universities, sea-grant colleges, Native American land-grant colleges and others as spelled out in Section 296(d) of Title XII. Ineligible universities and colleges cannot respond to the RFA but can participate as a partner.

This evaluation will provide USAID and the ME with constructive feedback on the past research performance and management of the Hort Innovation Lab. Furthermore, since this Innovation Lab will be completing its first five year phase in the near future, the External Evaluation Team (EET) should take a forward looking view and provide recommendations if a second, final five year phase should be awarded. If recommended, suggestions should be provided on the research focus of a second phase.

Specifically, the EET will: A) assess the management of the Hort Innovation Lab by the ME, B) evaluate the research program focus and outputs against the stated research and development program, C) consider how the research program is aligned with Feed the Future research priorities, D) assess the level and effectiveness of human and institutional capacity building, E) examine how collaboration, outreach and technology dissemination is accomplished and its results, F) explore how gender is incorporated into the research and capacity building programs, G) assess the degree and adequacy of project level monitoring and evaluation, and H) recommend if a second, final five year phase should be awarded and what it's research focus should be in accordance with the Feed the Future Food Security Innovation Center programs.

A) Management

Technical leadership

1. What are examples of technical leadership displayed by the ME?
2. How well has the ME balanced research, implementation activities, training and capacity building given the amount of funding provided?
3. How has the ME built on earlier investments? What can be done to capitalize on these to broaden or accelerate progress?
4. How does the ME continue to be forward thinking about research ideas and plans?
5. How has the ME promoted and maximized values such as collaboration, capacity building and outreach among sub-awardees?
6. Has the ME developed mechanisms to ensure that local, national and regional needs and priorities will continue to be incorporated into the development of the research agenda? What are these mechanisms?
7. How well has the ME facilitated the participation of new partners?
8. How has the ME engaged USAID bilateral Missions, other donors and partners (i.e. World Bank, IFAD, FAO, CGIAR, NGOs, the private sector) in the Innovation Lab's research and capacity building activities? Give examples. How might engagement be increased?

Administration

1. What systems are in place to keep research activities on track according to program goals?
2. What are the roles and functions of advisory committees? Have they been effective and efficient?
3. What major challenges has the ME faced and how have they been addressed? Give examples.
4. How have administrative/management problems been resolved by the ME? Give examples.
5. In general, what has been the management style of the ME regarding principle investigators and sub awardees? Are there any areas that could be improved?
6. Is the administrative cost of the Innovation Lab appropriate for its size? Is the present structure cost effective and efficient?
7. Has communication by the ME with collaborating partners been effective?

Financial management

1. How well has the ME managed the financial aspects of the Innovation Lab? Are the U.S. and host country collaborators satisfied with financial management by the ME? How have problems been resolved? Give examples.
2. How is project resource allocations made? Is the allocation appropriate?
3. Has the system for reimbursement of expenditures been efficient for all collaborators? What areas need to be improved to address pipeline issues or payment lags?
4. Has cost matching requirements been met by all partners? What has been the effect of these requirements?

USAID's role

1. What has been the involvement and contribution of the USAID Agreement Officer's Technical Representative (AOTR)? How can it be improved?
2. How have changes in USAID priorities impacted the management and administration of the Innovation Lab? Give examples.

B) Research program focus and output

13. Are the depth, breadth and rigor of the research and development activities sufficient to achieve stated program goals and objectives? How could the major themes or topics be refined to increase impact?
14. Is the approved research program funded appropriately? What should be changed?
15. What have been the significant accomplishments in terms of research and technology dissemination?
16. Among the projects making significant progress, which ones are scalable for a greater impact?
17. What activities have not been as successful as planned and why?
18. In what ways are the research activities strategically sequenced to ensure targeted development outcomes within a known period?
19. How does the ME ensure that research activities or themes supplement and not duplicate other development initiatives in the regions where the Innovation Lab is active?
20. Do research goals have national policy implications? If so, how are they addressed? Give examples.
21. What was the process for sub-award selection? How effectively did the process yield a high quality, relevant portfolio of activities?
22. Assess the balance of domestic versus overseas research in terms of effectiveness of solving constraints in developing countries. Are changes needed in the balance?
23. How has the United States benefited from the Innovation Lab's research? Give examples.
24. How much emphasis should occur within the Innovation Lab portfolio on basic research, applied research, implementation, and human and institutional capacity building?

25. How does the Innovation Lab respond to the Title XII “Famine Prevention and Freedom from Hunger” Amendment to the Foreign Assistance Act of 1961?⁵

C) Alignment with Feed the Future research priorities

3. How has the Innovation Lab aligned with Feed the Future research and development priorities? Give examples. In what areas has the Innovation Lab not aligned with Feed the Future priorities and why?
4. How well does the Innovation Lab research and capacity building activities fit under one or more of the seven programs of the Feed the Future Food Security Innovation Center? What are the relevant program areas? How can this fit be improved?

D) Human and institutional capacity building

1. How has the Innovation Lab been effective at building the capacity of host country researchers, policymakers and practitioners?
2. How has a pipeline of students been cultivated for long-term degree training opportunities?
3. Has the program been successful in selecting the right mix of students from appropriate institutions? Are these trained students returning to their home countries to continue work in their trained fields?
4. Compared to the research activities, what has been the level of effort and investment in training and institutional capacity building? Is it sufficient?
5. Should there be greater focus on institutional capacity building? If so, in what areas?
6. How can impact of institutional capacity building be captured and measured more effectively?

E) Collaboration, outreach and technology dissemination

1. What outreach strategies have been integrated into project design to increase likelihood of uptake and utilization of research results? What have been the most effective strategies for outreach at the country level?
2. How have research outputs been disseminated at the regional and global level? What tools have been used (i.e. hosted events, publications, web sites) and how effective have they been? Give examples.
3. Does the Innovation Lab have a plan for technology dissemination? What is it?
4. Evaluate the dissemination of research results and the effectiveness of their utilization as a measure of the appropriateness of the research.
5. Has the Innovation Lab partnered with the right collaborators to implement and disseminate the outputs of the research program? Who else should they partner with?
6. Are there any unexplored areas of collaboration between projects that are feasible and have potential? Give examples.

F) Gender inclusion

1. Does the Innovation Lab have a formal plan for gender inclusion in all of its activities?

⁵ <http://www.aplu.org/page.aspx?pid=587>

2. How has gender been taken into consideration in research design, training and outreach strategies? What have been the results? What areas could be improved and how?

G) Monitoring and evaluation

1. What types of monitoring and evaluation have been undertaken by the ME? Are social scientists used to conduct broad impact assessments?
2. Are the indicators used effective at capturing and communicating the outcomes and impacts of research activities? Are there appropriate indicators for each stage in the “research continuum”? Have indicators capturing impacts and outcomes on higher levels been developed?
3. Have baselines been established? If not, why?
4. Are data collected valid and of proper quality for reporting?

H) Research focus of a second, final five year phase if awarded

1. Do the results achieved to date justify awarding a second, final five year phase of the Innovation Lab in the same research area? Why or why not?
2. If a second five year phase is funded:
 - a. What should be the research focus?
 - b. Should there be an emphasis on fewer high performing activities?
 - c. Should the research focus be on one or both of the following, as recommended by the *BIFAD Review of Collaborative Research Support Program (CRSP) Model: A Report Commission by BIFAD at the Request of USAID, August 2012*:
 - i. Strategic research on a global problem,
 - ii. Demand driven research to enhance food security at the country and regional level.
 - d. What activities from the current Innovation Lab should be continued, refocused and/or eliminated?
3. What lessons learned should be taken into consideration if a second, final five year phase is awarded?
4. What are the opportunity costs of not continuing the research of this Innovation Lab?

Evaluation Methodology

The evaluation will be based the following: A) a desk review of Hort Innovation Lab project documents, publications and web sites, B) telephone conference call with the USAID AOTR and other relevant USAID officers, C) telephone conference call with ME staff, D) telephone interviews with Innovation Lab principal investigators and stakeholders, E) a survey of host country principle investigators, ; and F) international travel⁶ by the EET to visit host country partner programs. Specifically, the EET will do the following:

A) Desk review

The EET will review key Hort Innovation Lab documents including, but not limited to, the Leader Cooperative Agreement, annual reports, work plans, program operation documentation, funded

⁶ All domestic and international travel arrangements, including airfare, are to be handled by the U.S. Department of Agriculture/Foreign Agriculture Service/Office of Capacity Building and Development Resources and Disaster Assistance and must be in accordance with U.S. Government travel regulations.

research proposals, a list of principal investigators and key stakeholders, and Innovation web sites. The material will be made available by the AOTR and the ME. The purpose of the desk review is to provide background, context and determine necessary interviews and travel sites to successfully complete the Evaluation.

B) Conference call with USAID

The EET will schedule a conference call with the USAID AOTR or their representative and other USAID staff as deemed necessary after a preliminary desk review. This call will be informational to discuss USAID's role in the funding and management of the Innovation Lab and to answer questions concerning the implementation and delivery of the Evaluation.

C) Conference call with Management Entity

The EET will schedule a conference call with the ME which includes the Innovation Lab Director and other key staff, to discuss the ME's responsibilities, request needed information and answer questions. The ME serves as the lead U.S. University for the Innovation Lab and is responsible for program implementation, financial and administrative management, reporting and quality of research results.

D) Telephone interviews with principle investigators and other stakeholders

The EET will select no less than six principle investigators and stakeholders combined to interview over the telephone. The purpose of these interviews is to help gather the needed information to answer the questions listed above in the Scope of Work.

E) Survey of host country principle investigators

The EET should use an internet-based survey of host country principle investigators. The survey has been developed by Dr. Timothy Dalton of Kansas State University and used in three previous Innovation Lab external evaluations. The survey will be provided to the team by the USAID evaluation manager. The EET can modify the survey as needed to make it relevant for the Hort Innovation Lab evaluation. The survey results will be tallied by Dr. Dalton and provided to the EET.

F) Visit to host country partners

Based on the above telephone consultations and interviews, the EET will determine which host country partner programs would be most advantageous to visit. The purpose of these visits will be to gather the needed information to answer the questions posed above in the Scope of Work. No more than two international trips are to be made (one EET member per trip only).

Evaluation Report

The evaluation report will be a synthesis of the topics and questions outlined in this Scope of Work. The EET may include other topics that are deemed relevant. The report should also discuss the merits of granting the Hort Innovation Lab a 5-year funded extension and what the research focus should be.

The report may be submitted in any format that effectively addresses the substance of this Scope of Work. The report should include the following components:

Title Page

Table of Contents

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Executive Summary

Synthesis of Findings and Conclusions Regarding:

- Program Management
- Research Performance
- New Innovation Lab Development

Recommendations

Appendices

- A. Statement of work
- B. Itinerary
- C. List of persons contacted
- D. List of materials reviewed
- E. Locations and dates of field visits
- F. Survey results

A draft report will be submitted electronically in MS Word format to the USAID Evaluation Manager by May 10, 2013. USAID will review the draft and return comments and suggestions for consideration to the EET by May 24, 2013. The final report should be submitted to USAID by June 7, 2013. All USAID comments should be sufficiently addressed in the final report. An oral presentation of the final report may also be requested by USAID via conference call at a mutually agreed time in June 2013. USAID will share the draft and final reports with the Innovation Lab ME. The final report will be made publicly available.

Level of Effort and Time Frame

The level of effort for the entirety of this Scope of Work will consist of no more than 30 billable days for the Team Leader and 25 billable days for each of the other EET members. All billable work is to be performed between March 1 and June 7, 2013. The USAID evaluation manager will be made available to the EET as a resource person but will not contribute directly to the preparation of the report.

Team Composition and Qualifications

The technical qualifications of EET members must be matched with the technical areas of focus of the Hort Innovation Lab. Team members must have the expertise necessary to evaluate the Innovation Lab and to address the questions in the Scope of Work. Team members must familiarize themselves with USAID's priorities and objectives in the economic growth sector and particularly the Feed the Future research strategy. USAID will designate one team member as the Team Leader.

Administrative/management member (1): A senior administrator with a minimum with ten years of experience managing multifaceted international development research and/or university-based programs. The preferred candidate will be familiar with both university-based programs and USAID (or other donor) funded programs. A background in agricultural development is preferred. The candidate would also have: a) demonstrated capacity to conduct program evaluation; b) an understanding of USAID's foreign assistance goals, and its particular objectives related to collaborative research, agricultural development and food security; and c) the ability to analyze issues and formulate concrete recommendations orally and in writing.

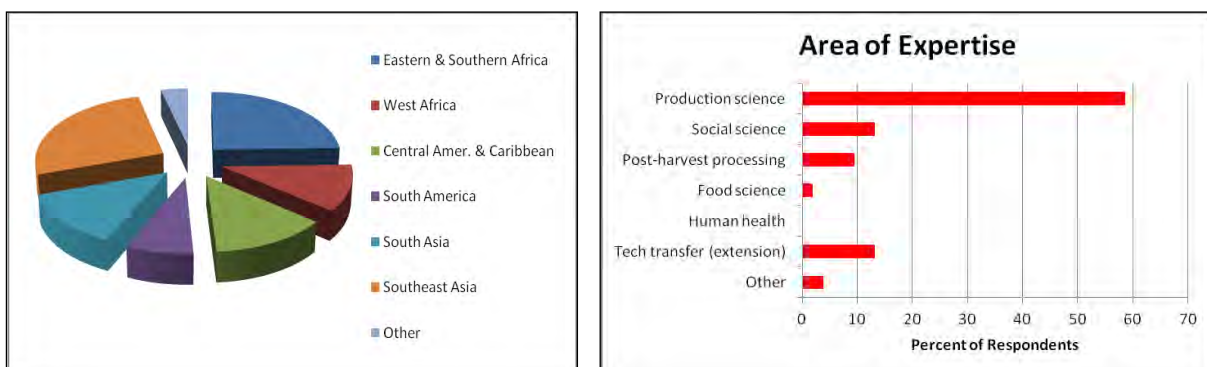
Technical team members (2): Must be recognized experts in international development related to agriculture with specific expertise in horticulture. Team members will be chosen from those who have experience in such areas as sustainable agriculture production, agricultural economics, and/or natural resource management. Technical team member candidates will also have demonstrated the following: a) the capacity to conduct program evaluation; b) a thorough understanding of research methodology; c) experience in effectively conducting outreach and dissemination to policymakers, development practitioners and/or the private sector; and d) the ability to analyze issues and formulate concrete recommendations orally and in writing.

Appendix 3. Summary of Responses to the AXIO SURVEY for Host Country Participants Involved in the Horticulture Innovation Lab

The questions for the AXIO survey were developed by Drs. Grusak, Hewett, and Shanmugasundaram. With the help of Dr. Timothy Dalton (Kansas State University) the survey instrument was constructed and a request to complete the survey was sent to 117 potential host country respondents. Fifty-six people started the survey and 46 people completed it (i.e., all the way to the last question). There were 26 questions in the survey; respondents were given an opportunity to provide comments for most of these questions. Interestingly, the average time to complete the 26 questions in the survey was over 8 hours. This suggests respondents were either thinking about answers and coming back to the survey later, or perhaps were dealing with poor/intermittent internet connections. No matter the reason, many respondents provided comments, in addition to the check-box selections; thus, the survey appeared to provide a robust set of answers and information.

Characteristics of the Respondents

Of the 56 who started the survey, 55 were engaged in some collaborative research/development activity with the Horticulture CRSP. Respondents were well distributed between Africa (36%), Central and South America (21%), and South/Southeast Asia (40%).

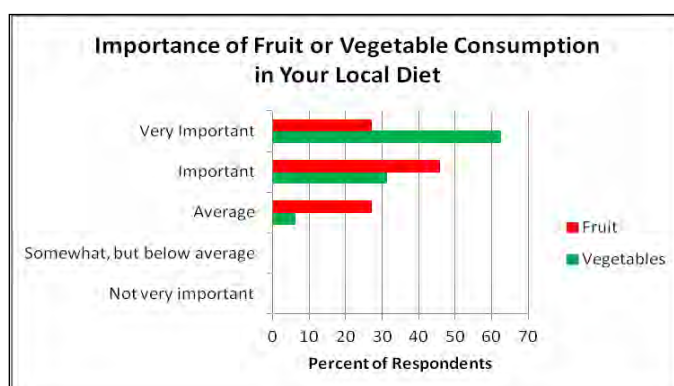


Most respondents were engaged in some aspect of production science (55%), with social science, technology transfer (extension), and postharvest science being practiced by 9-13% each. Poorly represented were respondents acknowledging expertise in food science (1 of 56) or human health (0). Note that 'Food Science' was also stated to include: nutrition, food safety, and new product development.

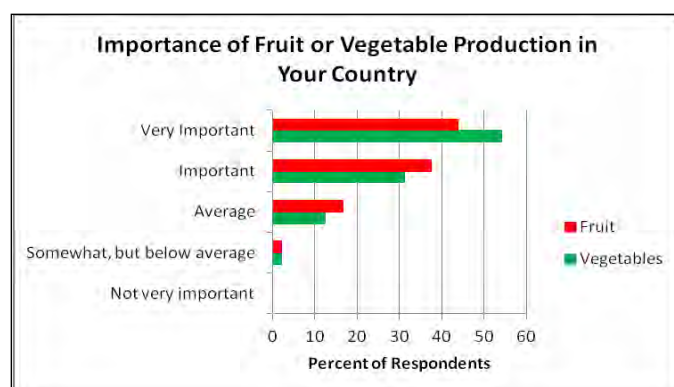
Fruit and vegetable perspectives

Keeping in mind that these are composite results from all regions, where fruit and vegetable intake/availability may vary, it was interesting to note that more respondents chose "very important" as the top choice (63%) for the importance of vegetables in their

local diet, whereas “important” (46%) was the top selection for the importance of fruit in the local diet.



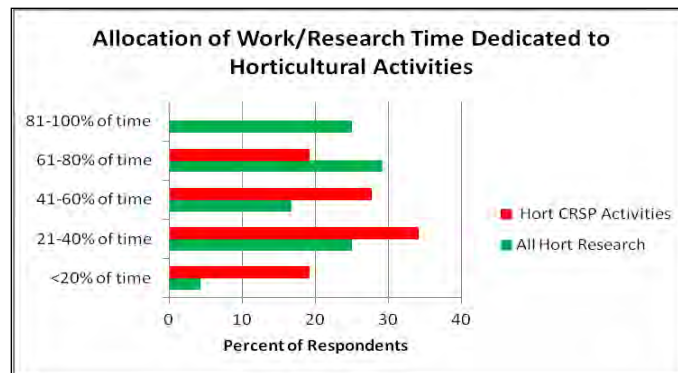
Nonetheless, when asked whether the production of vegetables or fruit were important in their country, “very important” was the top choice for both vegetables and fruit.



Furthermore, horticultural trade (with other countries) was believed to be “important” to “very important”, and a strong majority (77%) believed it was “very important” for horticultural activities to continue to grow over the coming 5 years.

Allocation of Time and Funding

Several questions were designed to understand the extent to which the survey participants were engaged in any horticultural activities (more broadly) and Horticulture CRSP activities (more specifically). Most respondents (96%) acknowledged that from 20% to 100% of their time was engaged in horticultural research activities. Time allocated specifically to Horticulture CRSP activities was skewed downward, with a range from <20% to 80%.



Furthermore, a majority of respondents (53%) indicated that Horticulture CRSP funding contributed <20% to 40% towards their annual research budget. It would appear that this group of participants is actively engaged in some aspect of horticulture research, with additional funding coming from one or more other sources, and that the Horticulture CRSP funds are adding to their overall research portfolio. This would appear to be a good sign, as it suggests that active, appropriate individuals are being engaged as partners by the Horticulture CRSP team.

Gender Integration

Almost 90% of the respondents indicated that a gender integration strategy had added value to their project's development and implementation. Thirty-seven respondents provided comments on this topic. While several issues were raised, there was a very strong recognition for including women in program activities. Their role in the horticultural trade was recognized, as was the fact that their standing in some societies limited their opportunities for decision-making or entrepreneurial possibilities. Nonetheless, several respondents acknowledged that women brought ideas and value to their projects. Contributions of men were also recognized. It would appear that all participants were attempting to do what they could in terms of gender integration.

At the same time, most respondents (81%) indicated that no funds were specifically allocated for gender integration activities/interventions. It would appear from the comments provided (17) that gender issues are ingrained in their activities, even without direct funding. This was evidenced by the involvement of women farmers or female students in various programs. Interestingly, this level of "gender integration" would have no inherent added costs. Nonetheless, many host country participants were interested in expanding activities toward gender-based issues (predominantly women focused) and indicated that they would like to see direct allocations for this in their budgets.

Nutrition and Health

When asked if there was a specific allocation of funds for nutrition or health activities, 69% of those who provided a response said "no". Amongst the 13 comments provided, there was general agreement that nutrition/health issues should be incorporated into the Horticulture CRSP. However, the nature of what was meant by nutrition or health was quite diverse. Comments ranged from: the reduction of pesticides to help farmer's health, to a focus on nutritional quality of fruit/vegetable products, to the improvement of

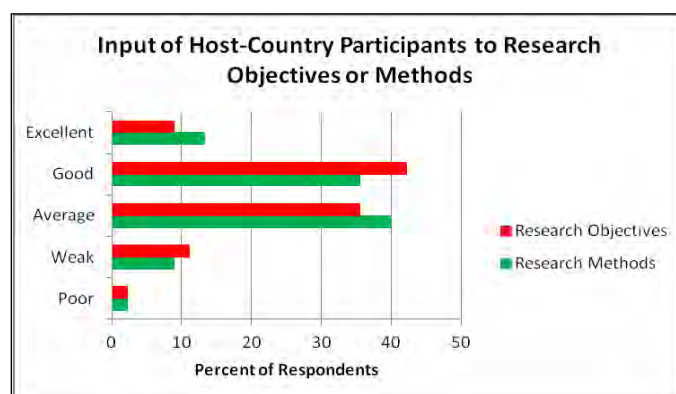
“quality” with better postharvest practices, to improving general nutrition of consumers by having more fruit/vegetables available. It seems that the development/incorporation of future health and nutrition activities in the Horticulture CRSP may require some thoughtful attention to what this topic might include. Some education of the project participants regarding health/nutrition issues, along with the inclusion of more food science, nutrition, or health science participants are probably warranted.

Impact Assessment

Slightly more than half of the respondents indicated they were carrying out an impact assessment. Comments given on this topic (23) suggested there were differing levels of attention to this, with some assessments perhaps more formal and others more of a cursory nature. No strong sense of what respondents thought about impact assessment (e.g., was it worthwhile) could be drawn from the comments. There also seemed to be some differences in the understanding of what an impact assessment was.

Involvement of Host Country Participants in Project Leadership

Most respondents indicated that their involvement in setting research objectives, hypotheses, or goals was average to good. Twelve comments were given on this topic; these ranged from: being given the project as a sub-contract, to being the lead collaborator. Most responded that they had at least some input. Similarly, a majority of the respondents indicated that their input into research methods was average to good. Nine comments on this topic ranged from: being given the methods, to being the lead on methods; however, most comments seemed to indicate that the host country participants were highly involved with decisions on research methods.



On the topic of writing research papers or project reports, most respondents appeared to have had some level of involvement with this. About 7% of those who answered this question indicated that they initiated the writing, while 16% indicated no involvement in writing reports or papers.

Suggestions for Improvement and Future Work

Sixteen comments were provided on the topic of “how to improve your research and development collaboration”. The main thrust of these were requests to improve communication (four comments), presumably with US PIs, and especially more face-to-face interactions (three comments). There were also requests for more expertise to support project activities and to ensure achievement of goals (two comments). Apparently, this expertise was not available from the US PI institution, or was not being provided by the US institution. Two comments were also made concerning more private sector interactions.

When queried about the importance of each respondent’s Horticulture CRSP project to local or national research priorities, over 80% of those who responded selected the choice: “important” or “very important”. Respondents were asked to provide up to five research projects for their region, which they thought the Horticulture CRSP should fund. Answers varied, but the following list captures many ideas that were received by multiple individuals:

- Mitigation of climate change-related effects on horticultural production
- Improving postharvest technologies
- Reducing pesticide use
- Conserving horticultural genetic resources
- Expanding the use of underutilized crops
- Improving seed systems and improving responsiveness to farmer needs
- Food security, safety, nutrition, and health
- Breeding activities
- Methods for disease/pest surveillance

Respondents were also asked to provide up to five priority vegetables for their region, for which they thought the Horticulture CRSP should provide funding. Answers varied, but the following list captures many listings that were received by multiple individuals:

- Tomato
- Various leafy vegetables (including indigenous species)
- Onion
- Pepper
- Potato
- Sweet potato
- Cucumber
- Vegetable legumes

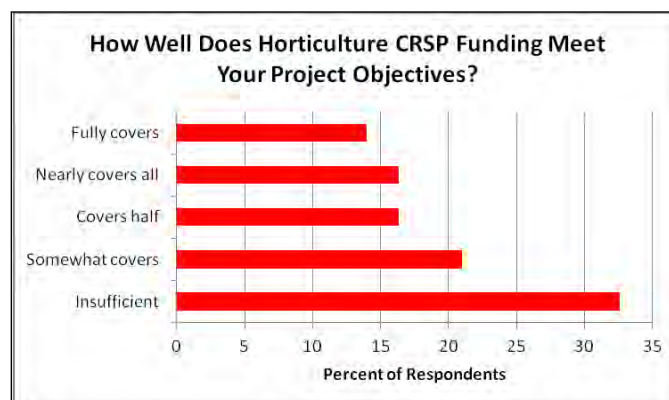
Respondents were asked to provide up to five fruit for their region, for which they thought the Horticulture CRSP should provide funding. Answers varied, but the following list captures many listings that were received by multiple individuals:

- Banana

- Mango
- Orange/other citrus
- Papaya
- Avocado
- Passion fruit
- Guava
- Apple
- Melon
- Passion fruit
- Strawberry
- Pineapple

Finances and Administrative Reporting

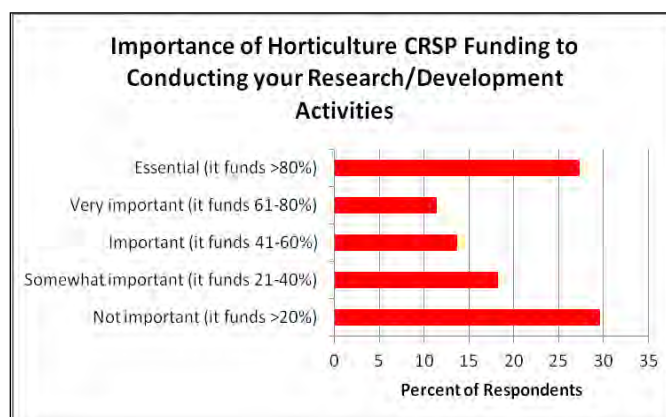
It was interesting to note that only 14% of respondents indicated that the funds allocated to them were sufficient to cover all the costs of their proposed objectives. In other words, a majority of respondents (86%) reported that Horticulture CRSP funding was insufficient to meet the project objectives, with 33% suggesting that the allocated funds covered less than 20% of the project costs.



It is not clear why there was such disconnect between proposed objectives and the (presumably) agreed upon budgets – at least from the viewpoint of the host country collaborators. Were some of the uncovered costs related to salaries that were covered by host country institutions? Were unforeseen expenses encountered during the course of the work? Were PI and cooperators setting unrealistic work plans for the budget that was available? Were PI and cooperators using poor judgement in the establishment of their budgets? Similarly, it is not clear who oversaw the establishment of these budgets. Was it merely left up to the US PI's, or were host country budgets reviewed by the ME to ensure sound budgeting before projects began? And as follow-up to this, one wonders to what extent the ME took the available budgets into account when the progress or success of a project was being reviewed?

Eighteen comments were submitted on the topic of finances: these comments were quite varied in nature, mostly reiterating that funds were insufficient to cover all their needs. One individual provided a very lengthy critique of the two Continuation Projects that were funded at \$USD 1 million each. The question was raised as to whether moving from 30 small (50K/year) projects to just two large projects was a justifiable strategy for the Horticulture CRSP program.

The question “How important is Horticulture CRSP funding to conducting your research and development activities?” yielded nearly equal rates of response between “essential” and “not important”.



The difficulty of complying with financial reporting requirements, or complying with administrative requirements (related to USAID guidelines) was about average for most respondents.

Finally, eighteen comments were provided relative to financial issues. Most of those mentioned were problems pertaining to delayed release of funds. The fact that only a portion of the funds were released up front was also noted to cause difficulties in executing projects. However, some individuals commented that there were no problems with financial management.

Appendix 4. Itineraries

- 2/26/2013 Teleconference with USAID team members-Carole Levin, John E. Bowman, Saharah Moon Chapotin, Angela Records and EET members-Errol Hewett, Mike Grusak and S. Shanmugasundaram. Discussion on logistics, travel, and review process
- 3/10/2013 Informal discussion with Elizabeth Mitcham, Amanda Crump and Jim Hill in University of California, Davis.
- 3/11/2013 University of California, Davis. Discussion with Elizabeth Mitcham, Amanda Crump, Mark Bell, Paul Marcotte (via conference call), Brenda Dawson and Diana Puccetti- Overview of Horticulture Innovation Lab, EET web site, printed materials and discussion. Financial management with Heather Kawakami and Sabrina Morgan and Elizabeth Mitcham. Jim Hill about University of California, Davis relations. Ken Bradford and Kate Snow PIs from University of California, Davis on their projects and Horticulture Innovation Lab
- 3/12/2013 Meet with David Miller, (PI) EET member joins teleconference with Amanda Crump, Mark Bell (Information management. Michael Reid and Britta Hansen via teleconference discussion on Regional Center of Innovation in Honduras. Meet with Alan Bennett, PI
- 3/13/2013 Sundar and Errol closing discussion with Amanda on travel plans to Asia and Africa. Sundar leaves for NJ. Errol discusses with Elizabeth Mitcham. Discussion with Brenda Dawson.
- 4/3/2013 Errol and Sundar arrive Phnom Penh, Cambodia.
- 4/4/2013 Ms. Neda Yousefian, Frederick Sagemuller, picks up Errol and Sundar and visits OU Rumcheck village. Mr. Lor Lytour, Assoc. Prof. Thong Kong, Mr. Borarin Buntong, Mr. Tho Kim Eang, accompanied us. Visited farmer's field. Sequential planting of vegetables. Observed savings group meeting. Visited Royal University of Cambodia. Met with Vice Rector Dr. Men Sarom. Discussed postharvest project. Discussion on safe vegetable project
- 5/4/2013 visit OXEAM and met Brian Lundand discussed savings linked microfinance. Visited USAID Cambodia Mission. Met with Dr. Kimberly Lucas, Mr. William Bradley, Mr. Teffera Betru and Mr. Sak Sambath. Discussed HarvestPlus and Horticulture Innovation Lab
- 6/4/2013 visit vegetable market in Phnom Penh and travel to Hanoi, Vietnam
- 7/4/2013 Report writing
- 8/4/2013 Met with Dr. Vong, Ms. Do trinh Luong, and TV crew. Visited Dong Xuan Commune in Soc Son District. Farmers training by themselves on EMINA production, Photovoice, Visit farmers field and observe safe cucumber production using bio-fertilizer and bio-pesticide. Visit with farmers and commune staff. Visit Hanoi University of Agriculture. Visit Dr. Paull's postharvest training project. Discussion with postharvest staff.
- 9/4/2013 Travel to Bangkok, Thailand
- 10/4/2013 Visit Regional Center of Innovation at Kasetsart University, Bangkok, Thailand. Meet with the Director of Regional Center of Innovation, Dr. Poonpipope Kasemsap. Visit the postharvest Lab of Dr. Jingtair and Dr.

Kietsuda at Kamphaengsaen campus of Kasetsart University. Meet Dr. Robert Holmer, AVRDC Regional Office and visit their cucurbit field and nutritional garden

11/4/2013 Visit Rhino Research Group (VCenter Thai) Drying Beads project (Bradford, PI). Met with Johan Van Asbrouck, Patcharin Tridno (Ann), Bart Schatteman and Ganesh Shivakoti from AIT. Errol left for airport in the afternoon for New Zealand.

12/4/2013 Sundar left for NJ

30/4/2013 Errol, Sundar and Mike left for Kilimanjaro, Tanzania

1/5/2013 Arrived Arusha late at night

2/5/2013 Visit AVRDC Regional Center fields and the PTSC. Meet with Dr. Ngoni Nenguwo, Dr. Fekadu, FufaDinssa, Mr. Hassan Mndiga, Dr. Tsvetelina Stoilova and Ms. Nadine Kwazi. Postharvest training activities and African indigenous vegetables and seed storage facilities.

3/5/2013 Visit Africa Technical Research Center and the mosquito Net factory. Discussion with Dr. Johnson Odera and observe his low-cost net for safe vegetable production. Discussion with AVRDC staff

4/5/2013 Report writing

5/5/2013 Leave for Nairobi, Kenya and arrive Safari park Hotel, Nairobi, Kenya

6/5/2013 Horticulture Innovation Lab annual meeting

7/5/2013 Horticulture Innovation Lab annual meeting

8/5/2013 Horticulture Innovation Lab annual meeting

9/5/2013 Grand Opening of Regional Center of Innovation at FPEAK in Thika

10/5/2013 Report writing and depart for home

11/5/2013 to 24/5/2013 Report preparation

Appendix 5. List of Persons Contacted

1. *University of California, Davis, CA, Horticulture Innovation Lab.*

Dr. Elizabeth Mitcham, Director
Ms Amanda Crump, Associate Director
Ms. Diana Puccetti, Office and Event Planning Assistant
Ms. Britta Lilley Hansen, Regional Center of Innovation Specialist (via telephone)
Ms. Brenda Dawson, Communications Coordinator
Dr. Michael S. Reid, Leader, Technology Innovation (via telephone)
Ms. Heather Kawakami, Budget Analyst
Ms. Sabrina Morgan, Budget Analyst
Dr. Mark A. Bell, Leader, Information and Communication
Dr. Kent Bradford, PI
Mr. G. David Miller, Co-PI
Dr. Alan Bennett, PI
Ms. Elana-Peach-Fine, Graduate Assistant
Ms. Kelsey Barale, Graduate, Intern
Dr. James Hill, Assoc. Dean, University of California, Davis
Dr. Kate Scow, PI
Dr. Paul Marcotte consultant (Via telephone)

2. *Phnom Penh, Cambodia*

Mr. Borarin Buntong, postharvest, RUA
Mr. Lor Lytour, Vice Dean, RUA
Mr. Thong Kong, Ass. Prof. RUA
Prof. Dr. Men Sarom, Vice Rector, RUA
Mr. Tho Kim Eang, Lecturer, RUA
Mr. Chuong Thart, Project Coordinator, RUA
Mr. Brian Lund, Regional Director, OXFAM
Dr. Kimberley Lucas, Director FSE USAID
Mr. William Bradley, Agricultural Officer, FSE USAID
Mr. Teffera Betru, Agricultural Officer, FSE, USAID
Mr. Sak Sambath, Agricultural Economist, FSE, USAID
Mr. Frederik Sagemueller, Horticulture Innovation Lab
Ms. Neda Yousefian, Horticulture Innovation Lab

3. *Hanoi, Vietnam*

Dr. Nguyen Quoc Vong, HUA
Dr. Nguyen Thi Bich Thuy, HUA
Dr. Pham Thi Huong, HUA
Ms. Do Trinh Luong, Duc Trung Co., Ltd.
Ms. Pham Hoai Quyen, VTC 10 TV

Dr. Vu Kim Oanh, HUA
Nguyen Thu Huong
Pham Ngoc Hung
NguyenTrong Thang
Pham Bao Duong
Dang Xuan Phi
Tran Thi Nhu Ngoc
Pham Van Hung
Do Truong Lam
Chu Duc Tuan
Dr. Vu Thi Kim Qanh
Mr. Xuan Lie, Leader of the Dong Xuan commune
Mr. Lien, leader of the Dong Xuan cooperative
Also met 24 farmers

4. Bangkok, Thailand

Dr. Poonpipope Kasemsap, Director, Regional Center of Innovation
Dr. Thammasak Thonghet, Assoc. Prof. KU
Dr. Jingtair Sirapanich, Professor, Postharvest Technology Center
Dr. Kietsuda Luengwilai, Researcher, Postharvest Technology Center
Dr. Teeranud Romphopphak, Researcher, Postharvest Technology Center
Dr. Peerapong Sangwanangkul, Researcher, Head Assistant, Postharvest Technology Center
Mr. Siwalak Pathaveerat, Asssitant Professor, Agricultural Engineering Department.
Dr. Robert Holmer, Director, AVRDC Regional Center
Mr. David Brar, Project Manager, Toshuva Agricultural Projects
Mr. Johan van Asbrouck, Rhino Research (Centor Thai)
Ms. Patcharin Taridno (Ann), Rhino Research (Centor Thai)
Mr. Bart Schatteman, Rhino Research
Dr. Ganesh Shivakoti, Professor, AIT

5. AVRDC, Arusha, Tanzania

Dr. Ngoni Nenguwo, PTSC, AVRDC, RCA
Dr. Tsvetelina Stoilova, Genetic Resources, AVRDC RCA
Dr. Fekadu Fufa Dinssa, Vegetable Breeder, AVRDC RCA
Mr. Hassan S, Mndiga, Training and Outreach Coordinator, AVRDC RCA
Ms. Nadine Kwasi, Executive Assistant, AVRDC RCA
Dr. Rajendran Srinivasulu, Postdoctoral Economist, AVRDC RCA

6. African Technical Research Center (ATRC)

Dr. Johnson O. Odera, Director, (ATRC)

7. Nairobi, Kenya

Dr. John Bowman, Senior Agricultural Advisor, USAID (AOTR)
Dr. Angela Records, Research Fellow, USAID
Dr. Lusike Wasilwa, Assistant Director, KARI and Director, Regional Center of Innovation, Kenya
Ms. Grace G. Kithusi Kyallo, Ag. Manager, Horticultural Crops Authority
Dr. George Wilson, IAB
Dr. J.D.H. Keatinge, Director, AVRDC, IAB
Dr. Josette Lewis, Chair, IAB
Dr. Norman E. Looney, IAB
Dr. Stephen Weller, PI, Purdue University
Dr. Robert Paull, PI University of Hawaii
Dr. Steve Yaniek, Professor and Head, Dept. of Entomology, Purdue University
Dr. Maria I. Marshall, Small Business Development, Purdue University
Dr. Jim Simon, Rutgers State University, PI
Dr. Eunice Bonsi, Tuskegee University, PI
Dr. Jeffrey LeJeune, Ohio State University, PI
Dr. Vance Baird, MSU, PI
Dr. James Nienhuis, University of Wisconsin, PI
Dr. Dianne Barrett, University of California, Davis, PI
Dr. Cary J. Trexler, University of California, Davis, PI
Dr. Julio Lopez Montes, Zamorano University, Director, Regional Center of Innovation
Ms. Mary Onsongo, USAID/East Africa
Ms. Margaret Hutchison, University of Nairobi
Ms. Monicah Waiganjo, KARI
Mr. Stephen Mbithi, FPEAK
Mr. Ian Chesterman, FINTRAC
Ms. Millie Gadboi/USAID/Kenya
Dr. Linus Opara, IAB
Dr. Thibaud Martin, CIRAD

Appendix 6. List of Documents Reviewed/Consulted

Website: <http://hortcrsp.ucdavis.edu> (includes project videos, reports, factsheets, etc.)
Evaluation Portal (will be offline in June 2013): <http://hortlabevaluation.weebly.com/>

- Policies and Operating Procedures
- Request for Proposal for a Horticulture CRSP from USAID
- Grant proposal from University of California, Davis to USAID for Horticulture CRSP
- Rational for Horticulture Research
- Information Management Strategy
- Innovative Technology Strategy
- Gender Strategy
- Capacity Building Strategy
- Horticulture CRSP's vision
- Organizational Chart
- Management Entity duties and responsibilities
- AOR responsibilities
- International Advisory Board bylaws and meeting minutes
- External review procedures
- Program Council responsibilities
- Program Structure and Mode of Operations
- Process for selecting sub-awards
- Rationales for each type of project
- Procedures for Enacting Organizational Changes
- Procedure to Initiate New RFPs
- Project Reporting Requirements
- Regional Centers of Innovation Overview, Policies Manual, and Technology Toolbox
- Accounting and Financial Policies
- Travel Policies and Trip Reports
- Participant Training Policies
- Communications Policies (including Branding and Marketing)
- Event and Annual Meeting Policies
- Monitoring and Evaluation Plan
- Immediate Impact Projects - Rationale for RFP, RFP, Initial Proposals Received, Reviewers (CVs and Reviews), Full Proposals Solicited and Received, Letters to PIs, Progress Reports, Final Reports
- Exploratory Projects - Rationale for RFP, RFP, Initial Proposals Received, Reviewers (CVs and Reviews), Full Proposals Solicited and Received, Letters to PIs, Progress Reports, Final Reports
- Pilot Projects - Rationale for RFP, RFP, Initial Proposals Received, Reviewers (CVs and Reviews), Full Proposals Solicited and Received, Letters to PIs, Progress Reports

- Comprehensive Projects - Rationale for RFP, RFP, Initial Proposals Received, Reviewers (CVs and Reviews), Full Proposals Solicited and Received, Letters to PIs, Progress Reports
- Focus and Continuation Projects - Rationale for RFP, RFP, Initial Proposals Received, Reviewers (CVs and Reviews), Full Proposals Solicited and Received, Letters to PIs, Progress Reports
- Trellis Projects - Proposal to the Hort CRSP ME and USAID for Trellis, RFPs, Full Proposals Received, Call for student Proposals, Student Applications, Reviewers, Review Sheet (Criteria), Reviews, Acceptance and rejection letters, Final Report Form to organizations, Overall 2011 Final Report
- ME trip reports
- ME Meetings and Notes
- International Meetings - Annual Meetings, Agenda, List of Attendees, PowerPoints, Posters, Shared Materials, Photos, Reports, and Follow-up
- ME Retreat records
- Technology Transfer/Approach and Results
- Horticulture CRSP promotional materials
 - a Newsletters
 - i January 2013: Volume 4, Issue 1
 - ii January 2012: Volume 3, Issue 1
 - iii October 2011: Volume 2, Issue 3
 - iv August 2011: Volume 2, Issue 2
 - v February 2011: Volume 2, Issue 1
 - vi November 2010: Volume 1, Issue 3
 - vii June 2010: Volume 1, Issue 2
 - viii February 2010: Volume 1, Issue 1
 - b Annual Reports
 - i 2009-2010
 - ii 2010-2011
 - iii 2011-2012 (in part)
 - c Factsheets and brochures
 - i Brochure
 - ii Horticulture CRSP partners with top scientists
 - iii Horticulture CRSP Regional Centers of Innovation overview
 - iv Trellis Fund projects
 - v Innovative technologies for horticultural development (PDF)
 - vi Ongoing and completed projects table (PDF)
 - vii Feed the Future and Horticulture CRSP
 - viii The Role of Horticulture in Alleviating Nutritional Deficiencies in the Developing World
 - ix Postharvest Technology in the Developing World
 - x The Promise of High Value Horticulture for Poverty Reduction
 - xi Horticulture CRSP in Central America
 - xii Horticulture CRSP in East Africa
 - xiii Horticulture CRSP in Asia

Appendix 7. Publications/Presentations from Horticulture Innovation Lab PIs

Stiling, James; Li, Simon; Stroeve, Pieter; Thompson, Jim; Mjawa, Bertha; Kornbluth, Kurt; Barrett, Diane M. 2012. Performance Evaluation of an Enhanced Fruit Solar Drying Using Concentrating Panels. *Energy for Sustainable Development* 16: 224-230

Bates, R.; Bicksler, A.; Burnette, R.; Gill, T.; Meitzner-Yoder, L.; Srigiofun, Y. 2010. Improving the Preservation and Promotion of Underutilized Crop Species in Southeast Asia. *Combined Proceedings International Plant Propagators' Society*.60: 151-154.

Ristaino, J.B. 2012. A Lucid Key to the Common Species of *Phytophthora*. 2012. *Plant Disease* 96:897-903.

E.O. Gogo, M. Saidi, F.M. Itulya, T. Martin, and M. Ngouajio 2012. Microclimate Modification Using Eco-Friendly Nets for High Quality Tomato Transplant Production by Small-Scale Farmers in East Africa. *HorTechnology* 22 (3): 292-298.

Bicksler, A.; Bates, R.; Burnett, R.; Gill, T.; Meitzner Yoder, L.; Srigiofun, Y. 2011. Methodologies for Strengthening Informal Indigenous Vegetable Seed Systems in Northern Thailand and Cambodia. *Acta Horticulturae* (Accepted}.

Bates, R.; Bicksler, A.; Burnette, R.; Gill, T. 2011. Designing Strategies and Systems to Identify, Preserve and Promote Underutilized Crop Species. *Acta Horticulturae* (Accepted).

Muleke E.M., M. Saidi, F.M. Itulya, T. Martin, and M. Ngouajio. 2012. The assessment of the use of eco-friendly nets to ensure sustainable cabbage seedling production in Africa. *Agronomy* (Manuscript submitted).

Ngouajio, M. T. Martin, L. A. Wasilwa, F. A. Komlan, M. Saidi, E. O. Gogo, S. Simon, S. Subramanian, M. Kasina, F. Omari, A. Adegbidi, L. Parrot, D. Ahouangassi, P. Guillet 2012. Improved Small-scale Vegetable Production and Productivity in Africa with the Use of Agricultural Nets. Presentation at ASHS Annual Meeting July 2012 Orlando Fla.

F. Vidogbéna, J. Akodogbo, A. Adégbidi, R. Tossou, F.Assogba-Komlan, M. Ngouajio, T. Martin, S. Simon, L. Parrot. 2012. Farmer's perceptions of Eco-friendly nets adapted to vegetable production in Benin. *ISHS European Horticulture Symposium*. Angers France 1-5 July 2012.

Appendix 8.

Partners and Collaborators in Horticulture Innovation Lab projects during initial five year phase

Project	Role	Name	Country	Email
Seed Systems – Improving Seed Quality for Smallholders - Comprehensive Projects	PI	Kent Bradford	USA	kjbradford@ucdavis.edu
	Partner	Peetambar Dahal	USA	pdahal@ucdavis.edu
	Partner	Luke Colavito	Nepal	lcolavito@idenepal.org
	Partner	Jwala Bajracharya	Nepal	seedtech@wlink.com.np
	Partner	Indra Raj Pandey	Nepal	indra.pandey@ceapred.org.np
	Partner	Keshavulu Kunusoth	India	keshava_72@yahoo.com
	Partner	Johan Van Asbrouck	Thailand	johan.rhino@gmail.com
	Partner	Ganesh Shivakoti	Thailand	ganeshshivakoti@yahoo.com
Semillas de Esperanza: Vegetable Seeds for Sustainable Agriculture - Pilot Projects	Partner	Roger Day	Kenya	r.day@cabi.org
	PI	James Nienhuis	USA	nienhuis@wisc.edu
	Partner	Suzanne Dove	USA	sdove@bus.wisc.edu
	Partner	Peter Hanson	Taiwan	peter.hanson@worldveg.org
	Partner	Paul Gniffke	Taiwan	paul.gniffke@worldveg.org
	Partner	Doris Hernandez	El Salvador	dora.hernandez@ca.care.org
	Partner	Claudia Eugenia Flores de Leon	Guatemala	claudia.flores@ca.care.org
	Partner	Edgar Ascencio	El Salvador	edgar.ascencio@ca.care.org
	Partner	Martha Moraga	Nicaragua	martha.moraga@una.edu.ni
	Partner	Maria de los Angeles	Nicaragua	unknown
	Partner	Francisco Salmeron	Nicaragua	fsalmeron99@yahoo.com
	Partner	Tomas Laguna	Nicaragua	unknown
	Partner	Donald Breazeale	Honduras	breazealedonald@gmail.com
	Partner	Javier Diaz	Honduras	fjdiaz15@gmail.com
New Technology for Postharvest Drying and Storage of Horticultural Seeds - Immediate Impact Project	PI	Kent Bradford	USA	above
	Partner	Peetambar Dahal	USA	above
	Partner	Jwala Bajracharya	Nepal	above
	Partner	Bhartendu Mishra	Nepal	ednarc@ntc.net.np
	Partner	Keshavulu Kunusoth	India	above

	Partner	Johan Van Asbrouck	Thailand	above
Sustainable Production and Marketing of Vegetables in Central America - Immediate Impact Project	PI	James Nienhuis	USA	above
	Partner	Peter Hanson	Taiwan	above
	Partner	Paul Gniffke	Taiwan	above
	Partner	Doris Hernandez	El Salvador	above
	Partner	Donald Breazeale	Honduras	above
	Partner	Martha Moraga	Nicaragua	above
Strengthening Indigenous Informal Seed Systems in Southeast Asia - Exploratory Project	PI	Ricky Bates	USA	rmb30@psu.edu
	Partner	Thomas Gill	USA	tbg12@psu.edu
	Partner	Rick Burnette	Thailand	echoasia@echonet.org
	Partner	Laura Meitzner Yoder	Thailand	lyoder@isdsi.org
	Partner	Abram Bicksler	Thailand	abram.bicksler@gmail.com
	Partner	Yongyooth Srigiofun	Thailand	yysgf@mju.ac.th
Low cost pest exclusion and microclimate modification technologies for small scale vegetable growers in East and West Africa - Pilot Project	PI	Mathieu Ngouajio	USA	ngouajio@msu.edu
	Partner	Thibaud Martin	France	thibaud.martin@cirad.fr
	Partner	Francoise Komlan	Benin	fassogbakomlan@gmail.com
	Partner	Lusike Wasilwa	Kenya	lwasilwa@gmail.com
	Partner	Anselme Adegbidi	Benin	anselmeadegbidi@hotmail.com
	Partner	Damien Ahouangassi	Benin	apretect@yahoo.fr
	Partner	Serge Simon	Benin	serge.simon@cirad.fr
	Partner	Mwanarusi Saidi	Kenya	mwanarusi@yahoo.com
	Partner	Pierre Guillet	Tanzania	pierre@vectorhealth.com
	Partner	Laurent Parrot	France	laurent.parrot@cirad.fr
Deployment of Rapid Diagnostic Tools for Phytophthora on Horticultural Crops in Central America - Immediate Impact Project	PI	Jean Ristaino	USA	Jean_Ristaino@ncsu.edu
	Partner	Kelly Ivors	USA	kelly_ivors@ncsu.edu
	Partner	Carrie Harmon	USA	clharmon@ufl.edu
	Partner	Peter Bonants	Netherlands	peter.bonants@wur.nl
	Partner	Monica Blanco Menenses	Costa Rica	monicablmn@gmail.com
	Partner	Jose Melgar	Honduras	jmelgar@fhia.org.hn
Improving Fruit Postharvest Quality through	PI	Bielinski Santos	USA	bmsantos@ufl.edu

Best Management Practices for Perishable Vegetable Production in Protective Structures in Nicaragua, Haiti, Honduras, Dominican Republic and Costa Rica - Immediate Impact Project	Partner	Teresa Salame	USA	tsalame@ufl.edu
	Partner	Maricruz Ramirez-Sanchez	USA	unknown
	Partner	Craig Stanley	USA	unknown
	Partner	Jack Rechcigl	USA	unknown
	Partner	Henner Obregon-Olivas	Nicaragua	hennerobregon@gmail.com
	Partner	Jessie Inestroza	Honduras	jeynestroza@yahoo.com
			Dominican Republic	
	Partner	Maria Cuevas		mcuevas@idiaf.org.do
	Partner	Marco Saenz	Costa Rica	marco.saenz@ucr.ac.cr
	Partner	Jean-Robert Estime	Haiti	jestime@winner.ht
Indigenous African Leafy Vegetables (ALV) for Enhancing Livelihood Security of Smallholder Farmers in Kenya - Immediate Impact Project	PI	Stephen Weller	USA	weller@purdue.edu
	Partner	Dharma Pitchay	USA	dpitchay@tnstate.edu
	Partner	Mathieu Ngouajio	USA	above
	Partner	Pamela Obura	Kenya	pobura@purdue.edu
	Partner	Grace Cheserek	Kenya	gcheserek@yahoo.com
	Partner	Elizabeth Omami	Kenya	elizabethomami@yahoo.com
	Partner	Julius Ochuodho	Kenya	juliusochuodho@yahoo.com
	Partner	Christine Ndinya	Kenya	christinendinya@yahoo.com
	Partner	Chris Ojiewo	Tanzania	Chris has left his job
Agricultural Technology Transfer in Kenya; A New Approach to Training and Engagement - Exploratory	PI	Steve Fennimore	USA	safennimore@ucdavis.edu
	Partner	Jeff Mitchell	USA	jpmitchell@ucanr.edu
	Partner	Peter Mutua	Kenya	shekinamf@gmail.com
Toward increasing Smallholder-Vegetable Farmer Utilization of Grafting and Low and High Tunnel Microclimate Management Tools - Exploratory	PI	Matthew Kleinhenz	USA	kleinhenz.1@osu.edu
	Partner	J. Mark Erbaugh	USA	erbaugh.1@osu.edu
	Partner	Sally Miller	USA	miller.769@osu.edu
	Partner	Monicah Waiganjo	Kenya	monicahwaiganjo@yahoo.com
	Partner	Peter Kanyuiro	Kenya	ngigi_peter@yahoo.com
	Partner	Jeremiah Njuguna	Kenya	jeremiah.njuguna@yahoo.com
Cell Phone Enabled Personalized Agro-Advisory Services for Horticultural Crops in South Asia - Exploratory	PI	Mywish Maredia	USA	maredia@msu.edu
	Partner	Sangita Ladha	India	ihitc.director@gmail.com
	Partner	Karim Mardia	USA	kmaredia@msu.edu
	Partner	Cholani Weebadde	USA	weebadde@msu.edu

Market Oriented Sustainable Peri-Urban and Urban Garden Cropping System: A Model for Women Farmers in Thailand, Cambodia and Vietnam - Exploratory Project	Partner	Nanda Joshi	USA	joshin@msu.edu
	Partner	Rajesh Urkude	India	unknown
	PI	Dharma Pitchay	USA	above
	Partner	Surendra Singh	USA	ssingh@tnstate.edu
	Partner	Sammy Comer	USA	scomer@tnstate.edu
	Partner	Juan Carlos Diaz-Perez	USA	jcdiaz@uga.edu
	Partner	Robert Holmer	Thailand	robert.holmer@worldveg.org
	Partner	Yingyong Paisooksantivatana	Thailand	yp2624@yahoo.com
Geographic Information Accessibility for Improving Horticultural-Based Income Generation in the Mzimba District of Malawi - Exploratory	Partner	Pariyanuj Chulaka	Thailand	agrpnc@ku.ac.th
	Partner	Prabhat Kumar	Thailand	pkipm@ait.asia
	PI	Darcy Boellstorff	USA	dboellstorff@bridgew.edu
	Partner	Gibson Nkanaunena	Malawi	gnkanaunena@wr.org
Extension of Appropriate Postharvest Technology in Sub-Saharan Africa: A Postharvest Training and Services Center - Pilot Project	Partner	Moses Jemitale	Malawi	mjemitale@wr.org
	Partner	Hudson Kaunda	Malawi	hkaunda@wr.org
	PI	Diane Barrett	USA	dmbartlett@ucdavis.edu
	Partner	Lisa Kitinoja	USA	kitinoja@hotmail.com
Sustainable Development of Horticultural Crops in Zambia by Introducing Postharvest Technologies and Practices for Food Security, Income Generation and in Support of the Tourism Industry - Continuation	Partner	Rob Shewfelt	USA	shewfelt@uga.edu
	Partner	Victor Afari-Sefa	Tanzania	victor.afari-sefa@worldveg.org
	PI	James Simon	USA	jesimon123@gmail.com
	Partner	Rodolfo Juliani	USA	hjuliani@rci.rutgers.edu
	Partner	Petrus Langenhoven	South Africa	petrusl@sun.ac.za
	Partner	Newton Phiri	Zambia	pnewton73@yahoo.com
	Partner	Elke Crouch	South Africa	elke@sun.ac.za
	Partner	Bill Sciarappa	USA	sciarappa@aesop.rutgers.edu
	Partner	Ramu Govindasamy	USA	govindasamy@aesop.rutgers.edu
	Partner	Albert Ayeni	USA	ayeni@aesop.rutgers.edu
	Partner	Rick VanVranken	USA	vanvranken@rci.rutgers.edu
	Partner	Stephen Weller	USA	above
Concentrated Solar Drying of Mango and Tomato - Immediate Impact Project	Partner	Richard Tracy	USA	rtracy@gcca.org
	Partner	Lisa Kitinoja	USA	above
	PI	Diane Barrett	USA	above
	Partner	Pieter Stroeve	USA	pstroeve@ucdavis.edu

	Partner	Jim Thompson	USA	jftthompson@ucdavis.edu
	Partner	Kurt Kornbluth	USA	kkorn@ucdavis.edu
	Partner	Bertha Mjawa	Tanzania	bmjawa@yahoo.com
Biological-Based Postharvest Quality Maintenance and Disease Control for Mango and Papaya - Exploratory Project	PI	Robert Paull	USA	paull@hawaii.edu
	Partner	Nancy Chen	USA	jungc@hawaii.edu
	Partner	Shanthi Wilson Wijeratnam	Sri Lanka	shanthi@iti.lk
Coolrooms and Cool Transport for Small-Scale Farmers - Immediate Impact	PI	Michael Reid	USA	msreid@ucdavis.edu
	PI	Jim Thompson	USA	above
	Partner	Cecilia Chi-Ham	USA	clchiham@ucdavis.edu
	Partner	Neeru Dubey	India	needub@gmail.com
	Partner	Royce Gloria Androa	Uganda	androarga@gmail.com
	Partner	Dinie Espinal-Rueda	Honduras	drueda@zamorano.edu
Integrated Postharvest Extension Program for Cambodia and Vietnam - Exploratory	Partner	Ron Khosla	USA	ron@storeitcold.com
	PI	Robert Paull	USA	above
	Partner	Nancy Chen	USA	above
	Partner	Nguyen Quoc Vong	Vietnam	nqvong@hua.edu.vn
Delivering Vegetable Safety Education through Established Social Networks in Latin America - Continuation	Partner	Men Sarom	Cambodia	msarom@gmail.com
	PI	Jeffrey LeJeune	USA	lejeune.3@osu.edu
	Partner	Alfredo Rueda	Honduras	Alfredo has left his job
	Partner	Julio Lopez	Nicaragua	unknown
	Partner	Eduardo Pretzanzin	Guatemala	edu.pretza@gmail.com
Enhancing Trade in Horticultural Crops Through Food Safety and Phytosanitary Measures - IIP	Partner	Yordana Valenzuela	Honduras	unknown
	PI	Sally Miller	USA	above
	Partner	Jeffrey LeJeune	USA	above
	Partner	J. Mark Erbaugh	USA	above
A Regional Approach to Food Safety for Fruits and Vegetables in Bangladesh - Exploratory	Partner	Kenneth Shenge	Nigeria	kcshenge@gmail.com
	PI	Ronnie Coffman	USA	wrc2@cornell.edu
	Partner	K. Vijayaraghavan	India	vijay@sathguru.com
	Partner	K.V. Raman	USA	kvr1@cornell.edu
	Partner	Anusuya Rangarajan	USA	unknown
	Partner	Glenn Young	USA	gmyoung@ucdavis.edu
	Partner	Shirazul Islam	Bangladesh	unknown

Sustainable African Indigenous Vegetable Production and Market-Chain Development for Improved Health and Nutrition and Income Generation by Smallholder Farmers – IIP	PI	Stephen Weller	USA	above
	Partner	Maria Marshall	USA	mimarsha@purdue.edu
	Partner	James Simon	USA	above
	Partner	Pamela Obura	Kenya	above
	Partner	Chris Ojiewo	Tanzania	Chris has left his job
	Partner	Petrus Langenhoven	South Africa	above
Safe Vegetable Production in Cambodia and Vietnam: Developing the HARE-Network to Enhance Farmer Income, Health, and the Local Environment - Pilot	PI	Cary Trexler	USA	cjtrexler@ucdavis.edu
	Partner	Johan Six	USA	Johan has left his job
	Partner	Glenn Young	USA	above
	Partner	Mark Van Horn	USA	mxvanhorn@ucdavis.edu
	Partner	David Miller	USA	gdmiller@ucdavis.edu
	Partner	Nguyen Quoc Vong	Vietnam	above
	Partner	Nguyen Thi Bich Thuy	Vietnam	unknown
	Partner	Pham Thi Huong	Vietnam	ptong@hau1.edu.vn
	Partner	Pham Bao Duong	Vietnam	pbduong@hua.edu.vn
	Partner	Pham Van Hung	Vietnam	ntnthuy@hua.edu.vn
	Partner	Thong Kong	Vietnam	kthong73@yahoo.com
	Partner	Borarin Bunton	Cambodia	bborarin@rua.edu.kh
	Partner	Asikin Yoeu	Cambodia	asikinyoeu@yahoo.com
	Partner	Lyda Hok	Cambodia	hoklyda@rua.edu.kh
	Partner	Lor Lytour	Cambodia	lor_lytour@yahoo.com
	Partner	Lam Thanh Hien	Vietnam	lamthanh_hien@hcm.vnn.vn
	Partner	Phan Thi Giac Tam	Vietnam	ptgtam@hcm.fpt.vn
	Partner	Thai Anh Hoa	Vietnam	tahoa@hcm.vnn.vn
	Partner	Pham Thi Minh Tam	Vietnam	phamminhtam@gmail.com
Sustainable Production of Specialty Horticultural Crops in Ghana for Income Generation and Increased Export Value - IIP	PI	James Simon	USA	above
	Partner	Dan Acquaye	Ghana	dacquaye@gmail.com
	Partner	Juliana Asante-Dartey	Ghana	jadartey@hotmail.com
	Partner	Charles Quansah	Ghana	cquansah2002@yahoo.co.uk
	Partner	Rodolfo Juliani	USA	above
	Partner	Ramu Govindasamy	USA	above

	Partner	Joe-Ann McCoy	USA	jmccoy@ncarboretum.org
Sustainable Development of Horticultural Crops in Zambia for Food Security, Income Generation and in Support of the Tourism Industry - IIP	PI	James Simon	USA	above
	Partner	Bismarck Diawuo	Zambia	bhadbad@yahoo.com
	Partner	Elton Jefthas	South Africa	ejeftas@sun.ac.za
	Partner	Petrus Langenhoven	South Africa	above
	Partner	Rodolfo Juliani	USA	above
	Partner	Ramu Govindasamy	USA	above
Evaluating the Support Structure for Production and Marketing of Tomatoes and Paprika Among Smallholders in Zimbabwe - Exploratory	PI	Hans Christian Wien	USA	hcw2@cornell.edu
	Partner	Edward Mabaya	USA	em37@cornell.edu
	Partner	Beth Medvecky	USA	bam44@cornell.edu
	Partner	Ralph Christy	USA	rdc6@cornell.edu
	Partner	Themos Ntasis	Zimbabwe	tntasis@ird-dc.org
	Partner	Isatou Jack	Zimbabwe	ijack@ird-dc.org
Sustainable Technology for Orange and Purple Sweetpotato (STOPS) in Ghana - Continuation	PI	Eunice Bonsi	USA	ebonsi@mytu.tuskegee.edu
	Partner	Conrad Bonsi	USA	cobonsi@mytu.tuskegee.edu
	Partner	Prosper Doamekpor	USA	doamekpor@mytu.tuskegee.edu
	Partner	Desmond Mortley	USA	mortleyd@mytu.tuskegee.edu
	Partner	Robert Zabawa	USA	zabawar@mytu.tuskegee.edu
	Partner	Thomas Gill	USA	above
	Partner	Leland Glenna	USA	llg13@psu.edu
	Partner	Janelle Larson	USA	jbl6@psu.edu
	Partner	Sjoerd Duiker	USA	swd10@psu.edu
	Partner	Kwami Offei	Ghana	agricdean@ug.edu.gh
	Partner	Wisdom Plahar	Ghana	waplahar@fri.csir.org.gh
	Partner	Hans Adu-Dapaah	Ghana	cridirector@cropsresearch.org
	Partner	Stephen Nutsugah	Ghana	sknutsugah@hotmail.com
	Partner	Fafali Azaglo	Ghana	selasiefarms@yahoo.co.uk
	Partner	Joseph Apedo	Ghana	pledi@yahoo.com
	Partner	Hawa Musah	Ghana	hawamusah2@yahoo.com
	Partner	Nana Ayim Poakwah	Ghana	nanayim@yahoo.com
Concentrated Nutritional and Economic Enhancement of Ghanaian Diets Using	PI	Eunice Bonsi	USA	above
	Partner	Conrad Bonsi	USA	above

Orange-Fleshed Sweetpotato Products - IIP		Robert Zabawa	USA	above
		Prosper Doamekpor	USA	above
		Ellene Kebede	USA	kebede@mytu.tuskegee.edu
		Curtis Jolly	USA	cjolly@auburn.edu
		Kwami Offei	Ghana	above
		Felix K. Forfoe	Ghana	fkforfoe@yahoo.com
		Wisdom Plahar	Ghana	above
		Marian Dorcas Quain	Ghana	md.quain@cropsresearch.org
		Fafali Azaglo	Ghana	above
Increasing the Capacity of Smallholder Farmers to Produce and Market Vegetable Crops in Uganda and Democratic Republic of Congo - Pilot		Joseph Apedo	Ghana	above
	PI	Kate Scow	USA	kmscow@ucdavis.edu
	Partner	Johan Six	USA	Johan has left his job
		Mark Van Horn	USA	above
		Heidi Ballard	USA	hballard@ucdavis.edu
		Stephen Boucher	USA	boucher@ucdavis.edu
		Edith Naggenda	Uganda	nagenda@yahoo.com
		Ignitius Bwoogi	Uganda	binkokoster@gmail.com
		Michael Masanza	Uganda	mmasanza@ucu.ac.ug
		Beatrice Akello	Uganda	Beatrice has left her job
		Peter Lusembo	Uganda	mknardc@africaonline.co.ug
		Harriet Nsubuga Mpanga	Uganda	harriet.nsubuga@gmail.com
		Prossy Isubikalu	Uganda	ikalu@agric.mak.ac.ug
		Dennis Yiga	Uganda	dyiga@yahoo.com
		Karel Van Laer	DRC	charlesvanlaer@yahoo.fr
Innovative Energy Solutions in Horticulture – Focus	PI	Kurt Kornbluth	USA	above
	PI	Jim Thompson	USA	above
	PI	Michael Reid	USA	above
Building an Ornamental Plant Industry in Honduras - IIP	PI	Alan Bennett	USA	abbennett@ucdavis.edu
	Partner	Cecilia Chi-Ham	USA	above
	Partner	Michael Dobres	USA	mdobres@novaflora.edu
	Partner	Dinie Espinal-Rueda	Honduras	above
	Partner	David Flemmin	USA	david@coenesa.com

Improving Market Access for Emerging South African Rooibos Farmers - IIP	PI	Laura Raynolds	USA	laura.raynolds@colostate.edu
	Partner	Andries du Toit	South Africa	adutoit@uwc.ac.za
	Partner	Douglas Murray	USA	douglas.murray@colostate.edu
	Partner	Jennifer Keahey	USA	jennifer.keahey@colostate.edu
	Partner	Sandra Kruger	South Africa	kruger.sandra@gmail.com
Promoting Fruit and Vegetable Production to Improve Nutrition in Nkokonjeru, Uganda – IIP	PI	Kate Scow	USA	above
	Partner	Edith Naggenda	Uganda	above
	Partner	Ignitius Bwoogi	Uganda	above
	Partner	Charles Jjemba	Uganda	jchlwanga@yahoo.co.uk
	Partner	Michael Masanza	Uganda	above
Improving extension methods for horticultural outreach among small-stakeholder farmers in Latin American countries - Exploratory	Partner	Peter Lusembo	Uganda	above
	PI	Jeffrey LeJeune	USA	above
	Partner	Juan Antonio Canumir	Chile	jcanumir@udec.cl
	Partner	Rudi Radrigan	Chile	rradriga@udec.cl
	Partner	Maria Gonzalez	Chile	mariaegonzalez@udec.cl
	Partner	Patricia Contreras	Chile	pattymarcelacu@gmail.com
	Partner	Sandra Kruger	South Africa	above
	Partner	Andres Cases Diaz	Peru	cda@lamolina.edu.pe
	Partner	Eduardo Mendoza Garcia	Bolivia	edudoza@yahoo.com
	Partner	Mario Montenegro-Jimenez	Ecuador	mariomonte2004@hotmail.com
	Partner	Eduardo Pretzanzin	Guatemala	above
	Partner	Gerardo Agresta	Uruguay	agresta@ricaldoni.org.uy

Appendix 9. Students Trained with Partial or Full Funding from the Horticulture CRSP

Name of Student	Native Country	Institution Trained At	Degree Attained/ Working On	Partial of Full Funding Provided by HortCRSP	Year Expected to Graduate	Project	Project Dates	Sex	Year Started
Blake Ringelsen	USA	University of California, Davis	M.S.	Partial	2011	Barrett IIP	2010-11	Male	
James Stiling	USA	University of California, Davis	M.S.	Partial	2013	Barrett IIP	2010-11	Male	
Simon Li	USA	University of California, Davis	B.S.	Partial	2011	Barrett IIP	2010-11	Male	
Zaine Venter	South Africa	Bridgewater State University	B.S.	Partial	2011	Boellstorff EP	2010-11		
Joel Chongela	Tanzania	ANGRAU, Hyderabad	Ph.D.	Outside Funding	2013	Bradford CP	2011-14	Male	
Krishna Timsina	Nepal	Asian Institute of Technology	Ph.D.	Partial	2014	Bradford CP	2011-14	Male	
Mathura Yadav	Nepal	ANGRAU, Hyderabad	M.S.	Outside Funding	2011	Bradford CP	2011-14	Male	
Peter Jackson	Tanzania	ANGRAU, Hyderabad	M.S.	Outside Funding	2012	Bradford CP	2011-14	Male	
			B.S. Computer Science						
Dylan Owen	USA	University of California, Davis	Partial	Partial	2014	ME	2009-2014	Male	
Elana Peach-Fine	USA	University of California, Davis	M.S. IAD	Full	2013	ME	2009-2014	Female	
Kelsey Barale	USA	University of California, Davis	M.S. IAD	Partial	2013	ME	2009-14	Female	
Peter Shapland	USA	University of California, Davis	M.S. IAD	Full	2011	ME	2009-2014	Male	
Gayeon Won	South Korea	The Ohio State University	Ph.D.	Partial	2012	Miller IIP	2010-11	Male	
Carlos Ramirez	Costa Rica	Instituto Tecnológico de Costa Rica	Ph.D.	Outside Funding	2011	Neinhuis PP	2010-13	Male	
Xiomara Mata	Costa Rica	Instituto Tecnológico de Costa Rica	Ph.D.	Outside Funding	2013	Neinhuis PP	2010-2013	Female	
			M.S. Plant Pathology						
Abel Too	Kenya	Moi University	Partial	Partial	2014	Ngouajio PP	2010-13	Male	2012
Carolyn Achieng'a	Kenya	Kenyatta University	M.S.	Partial	2012	Ngouajio PP	2010-2013	Female	
Catherine Gacheri	Kenya	Kenyatta University	M.S.	Partial	2012	Ngouajio PP	2010-2013	Female	
Elisha Otieno Gogo	Kenya	Egerton University	M.S.	Partial	2013	Ngouajio PP	2010-2013	Female	
Everlyne M'mbone Muleke	Kenya	Egerton University	M.S.	Partial	2013	Ngouajio PP	2010-2013	Female	
Faustin Vidogbéna	Benin	University of Abomey-Calavi	Ph.D.	Partial	2014	Ngouajio PP	2010-2013	Male	
Gildas M. Adjovi	Benin	University of Abomey-Calavi	B.S.	Partial	2011	Ngouajio PP	2010-13	Male	
			Ph.D. Plant Pathology						
Ginette Azandeme	Benin	Montpellier University	Partial	Partial	2015	Ngouajio PP	2010-13	Female	2012
Hilaire Agonsè	Benin	GASA Formation (Private University)	B.S.	Partial	2012	Ngouajio PP	2010-2013		
Jane Gateri	Kenya	Egerton University	M.S. Horticulture	Partial	2013	Ngouajio PP	2010-13	Female	
Judith Kiptoo	Kenya	Moi University	M.S.	Partial	2012	Ngouajio PP	2010-2013	Female	
Lauriane Yehouenou	Benin	University of Abomey-Calavi	B.S.	Partial	2011	Ngouajio PP	2010-13	Female	
			M.S. Crop Protection						
Miriam Kungu	Kenya	JKUAT	Partial	Partial	2013	Ngouajio PP	2010-13	Female	2012

Name of Student	Native Country	Institution Trained At	Degree Attained/ Working On	Partial of Full Funding Provided by HortCRSP	Year Expected to Graduate	Project	Project Dates	Sex	Year Started
Patrick Muthee	Kenya	Egerton University and Auvergne University	Ph.D. Agribusiness Management	Partial	2015	Ngouajio PP	2010-13	Male	2012
Rustique J.G. Akodogbo	Benin	University of Abomey-Calavi	B.S.	Partial	2011	Ngouajio PP	2010-13	Male	
			M.S. Crop Protection						
Rebecka Sakwa	Kenya	University of Nairobi	M.S. Crop Protection	Partial	2014	Ngouajio PP	2010-2013	Female	2012
Samuel Machuki	Kenya	University of Nairobi	Protection	Partial	2014	Ngouajio PP	2010-2013	Male	2012
Sandrine S.S.L. Segla	Benin	University of Abomey-Calavi	B.S.	Partial	2011	Ngouajio PP	2010-13	Female	
Undergrad 1	Benin	University of Abomey-Calavi	B.S.	Partial	2014	Ngouajio PP	2010-2013	Female	
Undergrad 2	Benin	University of Abomey-Calavi	B.S.	Partial	2014	Ngouajio PP	2010-2013	Male	
Undergrad 3	Benin	University of Abomey-Calavi	B.S.	Partial	2014	Ngouajio PP	2010-2013	Male	
Victor Agohoundjè	Benin	University of Abomey-Calavi	B.S.	Partial	2012	Ngouajio PP	2010-2013	Male	
Victor Juma	Kenya	Kenyatta University	M.S.	Partial	2012	Ngouajio PP	2010-2013	Male	
Julissa Alcazar	Costa Rica	University of Wisconsin, Madison	B.S.	Partial	2010	Nienhuis IIP	2010-11	Female	
Linnzi Hodel	USA	University of Wisconsin, Madison	M.S. Horticulture	Partial	2011	Nienhuis IIP	2010-11	Female	
Paulina Quesdada	Costa Rica	University of Wisconsin, Madison	B.S.	Partial	2011	Nienhuis IIP	2010-11	Female	
Raul Guerra	Nicaragua	University of Wisconsin, Madison	M.S. Plant Breeding	Full	2013	Nienhuis PP	2010-13	Male	
Mai Vu Thi	Vietnam	Kasetsart University	M.S. Horticulture	Outside Funding		Pitchay EP	2010-2011	Female	
Ong Socheath	Cambodia	Royal Agriculture University	M.S. Agronomy	Partial		Pitchay EP	2010-2011	Female	
Tan	Thailand	Kasetsart University	M.S. Horticulture	Partial		Pitchay EP	2010-2011	Female	
Jennifer Keahey	USA	Colorado State Univeristy	Ph.D.	Full	2012	Raynolds IIP	2010-11	Female	
Ariana Rundquist	USA	University of California, Davis	M.S.	Partial	2012	Reid IIP	2010-11	Female	
Barbara Wanyanya	Uganda	Uganda Christian University	B.S.	Partial	2013	Scow PP	2010-13	Female	
Daniel Ntale	Uganda	Uganda Christian University	B.Sc.	Outside Funding	2013	Scow PP	2010-13	Male	
Jones Muhindo	Uganda	Uganda Christian University	B.Sc.	Partial	2012	Scow PP	2010-13	Female	
Lauren Pincus	USA	University of California, Davis	Ph.D.	Full	2014	Scow PP	2010-13	Female	
Leah Nandudu	Uganda	Uganda Christian University	B.S.	Partial	2014	Scow PP	2010-13	Female	
Nassib Mugwanya	Uganda	Makerere University	M.S.	Full	2012	Scow PP	2010-13	Male	
Ruth Buteme	Uganda	Uganda Christian University	B.S.	Partial	2014	Scow PP	2010-13	Female	
Sebastian Walugembe	Uganda	Uganda Christian University	B.S.	Partial	2012	Scow PP	2010-13	Male	

Name of Student	Native Country	Institution Trained At	Degree Attained/ Working On	Partial of Full Funding Provided by HortCRSP	Year Expected to		Project Dates	Sex	Year Started
					Graduate	Project			
Shakira Nakasagga	Uganda	Uganda Christian University	B.S.	Partial	2013	Scow PP	2010-13	Female	
Stellah Kukunda	Uganda	Uganda Christian University	B.Sc.	Partial	2012	Scow PP	2010-13	Female	
William Sekamate	Uganda	Makerere University	M.S.	Partial	2012	Scow PP	2010-13	Male	
Allison Ferry	USA	University of California, Davis	Ph.D. Plant Pathology	\$2000 Trellis Fellowship	2014	Trellis	2010-11	Female	
Eduardo Gutierrez-Rodriguez	Costa Rica	University of California, Davis	Ph.D. Horticulture and Agronomy	\$2000 Trellis Fellowship	2012	Trellis	2010-11	Male	
Gina Garland	USA	University of California, Davis	M.S. Horticulture	\$2000 Trellis Fellowship	2011	Trellis	2010-11	Female	
Jenna Rodriguez	USA	University of California, Davis	M.S. Hydrological Sciences	\$2000 Trellis Fellowship	2013	Trellis	2010-11	Female	
Juliet Braslow	USA	University of California, Davis	M.S. IAD	\$2000 Trellis Fellowship	2012	Trellis	2010-11	Female	
Kate Fuller	USA	University of California, Davis	Ph.D. Agricultural Economics	\$2000 Trellis Fellowship	2014	Trellis	2010-11	Female	
Larisa Jacobson	USA	University of California, Davis	M.S. IAD	\$2000 Trellis Fellowship	2011	Trellis	2010-11	Female	
Mark Lundy	USA	University of California, Davis	Ph.D. Horticulture and Agronomy	\$2000 Trellis Fellowship	2013	Trellis	2010-11	Male	
Michael Wolff	USA	University of California, Davis	Ph.D. Soil Science	\$2000 Trellis Fellowship	2013	Trellis	2010-11	Male	
Cao Thi Nhan	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Female	
Hoang Thi Minh Thuy	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Female	
Huynh Thi Nhu Quy	Vietnam	Nong Lam University	M.S.	Partial	2012	Trexler PP	2010-13	Female	
Kham Phang	Laos	Nong Lam University	M.S.	Partial	2012	Trexler PP	2010-13	Male	
Le Minh Nhut	Vietnam	University of Agriculture and Forestry, Vietnam	B.S.	Partial	2012	Trexler PP	2010-13	Male	
Le The Bao	Vietnam	Nong Lam University	B.S.	Partial	2012	Trexler PP	2010-13	Male	
Luu Vann Huy	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Male	
Ly Tuong Vy	Vietnam	Nong Lam University	B.S.	Partial	2012	Trexler PP	2010-13	Female	
Mai Thanh Dai	Vietnam	Nong Lam University	B.S.	Partial	2012	Trexler PP	2010-13	Male	
Mai Thi My Duyen	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Female	

Name of Student	Native Country	Institution Trained At	Degree Attained/ Working On	Partial of Full Funding Provided by HortCRSP	Year Expected to Graduate	Project	Project Dates	Sex	Year Started
Mr Đặng Xuân Phi	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Male	
Mr Đỗ Trường Lâm	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Male	
Mr Nguyễn Anh Đức	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Male	
Mr Phạm Tiến Đạt	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Male	
Ms Nguyễn Thị Lý	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Ms Nguyễn Thu Hương	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Ms Phạm thị Hương Giang	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Ms Phạm Thị Xuân	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Ms Trần Như Ngọc	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Ms Vũ Thị Duyên	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Ms Vũ Thị Mai Liên	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Female	
Nguyen Pham Hong Lan	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Female	
Nguyễn Trọng Thắng	Vietnam	Hanoi University of Agriculture	B.S.	Full	2014	Trexler PP	2010-13	Male	
Nguyen Van Nam	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Male	
Pham Duy	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Male	
Pham Luong Thien	Vietnam	Nong Lam University	B.S.	Partial	2011	Trexler PP	2010-13	Male	
Pham Thi Tuyet Mai	Vietnam	Nong Lam University	M.S.	Partial	2013	Trexler PP	2010-13	Female	
Sara Ashley Sparks	USA	University of Georgia	M.S.	Partial	2013	Barrett PP	2010-13	Female	
Carrie Teiken	USA	University of California, Davis	M.S.	Partial	2014	Trellis	2012-13	Female	
Bob Johnson	USA	University of California, Davis	M.S.	Partial	2013	Trellis	2012-14	Male	
Whitney Brim-deForest	USA	University of California, Davis	PhD	Partial	2014	Trellis	2012-15	Female	
AJ Campbell	USA	University of California, Davis	PhD	Partial	2015	Trellis	2012-16	Female	
Graham Savio	USA	University of California, Davis	M.S.	Partial	2014	Trellis	2012-17	Male	
Ephrem Rukundo	Rwanda	University of California, Davis	PhD	Partial	2015	Trellis	2012-18	Male	
Sarah Sahlaney	USA	University of California, Davis	M.S.	Partial	2014	Trellis	2012-19	Female	
Rachel Suits	USA	North Carolina State University	M.S.	Partial	2014	Trellis	2012-20	Female	
Arun Jani	USA	North Carolina State University	M.S.	Partial	2014	Trellis	2012-21	Male	
Amanda McWhirt	USA	North Carolina State University	PhD	Partial	2016	Trellis	2012-22	Female	
Angel Cruz	USA	North Carolina State University	M.S.	Partial	2014	Trellis	2012-23	Female	
Bryan Sobel	USA	Cornell University	M.S.	Partial	2013	Trellis	2012-24	Male	
Brian Flanagan	USA	Cornell University	M.S.	Partial	2014	Trellis	2012-25	Male	
Gabe Sachter	USA	University of Hawaii at Manoa	M.S.	Partial	2014	Trellis	2012-26	Male	

Name of Student	Native Country	Institution Trained At	Degree Attained/ Working On	Partial of Full Funding Provided by HortCRSP	Year Expected to Graduate	Project	Project Dates	Sex	Year Started
Erin McGuire	USA	University of California, Davis	M.S. B.A.	Partial	2014	ME	2012-	Female	
Azia Hasan	USA	University of California, Davis	Communications	Partial	2014	ME	2012-2014	Female	

Appendix 10. Outstanding Extension Publication Award (Website) from the American Society for Horticultural Science 2010.

The American Society for Horticultural Science

Outstanding Extension Publication Award

Horticulture Collaborative Research Support Program (CRSP)

<http://hortcrsp.ucdavis.edu/>

Ronald E. Voss

2010 Outstanding Website Award

Presented at the ASHS Annual Conference, August 2–5, 2010, Palm Desert, California



Richard E. Duhan

ASHS Extension Division Vice President

Appendix 11. Information Management Outputs

Some Project Outputs in different formats

Seed systems and germplasm

- Fact sheets + video: [Introducing new seed storage technologies](#): India, Nepal, Thailand
Kent Bradford of UC Davis, led "New Technology for Postharvest Drying and Storage of Horticultural Seeds" (~\$150,000).
Deliverables: [Posters](#), [Powerpoint](#), [Informational Flyers](#), [Publications and Research](#), [FAQs](#)
- Video: [Evaluating local tomato and chili varieties for disease resistance](#): El Salvador, Honduras, Nicaragua
James Neinhuis of University of Wisconsin-Madison led "Sustainable Production and Marketing of Vegetables in Central America" (~\$150,000)
- Fact sheets + video: [Strengthening indigenous seed systems](#): Bangladesh, Cambodia, Laos, Thailand, Vietnam
Rick Bates at Penn State led "Strengthening Indigenous Informal Seed Systems in Southeast Asia" (~\$75,000)

Sustainable production of horticultural crops

- Fact sheet: [Demonstrating nets and floating row covers](#): Benin, Kenya
Mathieu Ngouajio of Michigan State University leads "Developing Low-Cost Pest Exclusion and Microclimate Modification Technologies for Small-Scale Vegetable Growers" (~\$500,000)
- Video + Manual: [Training plant diagnosticians](#): Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Mexico, Panama
Jean Ristaino of North Carolina State University led "Deployment of Rapid Diagnostic Tools for Phytophthora on Horticultural Crops in Central America" (~\$150,000)
- Video + poster: [Improving bell pepper production in passively ventilated structures](#): Costa Rica, Dominican Republic, Haiti, Honduras, Nicaragua
Bielinski Santos of University of Florida led "Improving Fruit Postharvest Quality through Best Management Practices for Perishable Vegetable Production in Protective Structures" (~\$150,000)
- Video + poster: [Increasing production of indigenous African leafy vegetables](#): Kenya, Tanzania
Stephen Weller of Purdue University led "Indigenous African Leafy Vegetables (ALV) for Enhancing Livelihood Security of Smallholder Farmers in Kenya" (~\$150,000)
- Video + posters: [Testing a gender-tailored extension model](#): Kenya
Steve Fennimore of University of California, Davis leads "Employing a Novel Gender-Based Extension Model to More Effectively Train and Engage Horticultural Farmers" (~\$75,000)
- Video + poster: [Testing cell phone-based extension services](#): India, Nepal, Sri Lanka
Mywish Maredia of Michigan State University leads "Cell Phone Enabled Personalized Agro-Advisory Services for Horticultural Crops in South Asia" (~\$75,000)

- Video: [Establishing GIS data for horticultural projects](#): Malawi Darcy Boellstorff at Bridgewater State University led "Geographic Information Accessibility for Improving Horticultural-Based Income Generation in the Mzimba District of Malawi" (~\$75,000)

Postharvest practices

- Video + poster: [Developing a concentrated solar dryer](#): Tanzania Diane Barrett of University of California, Davis led "Concentrated Solar Drying of Mango and Tomato" (~\$150,000)
- Video: [Developing a postharvest alternative to fungicide](#): Sri Lanka Robert Paull of University of Hawaii at Manoa led "Biological-Based Postharvest Quality Maintenance and Disease Control for Mango and Papaya" (~\$150,000)
- Video + poster: [Demonstrating low-cost cooling technology](#): Honduras, India, Uganda Michael Reid of University of California, Davis led "Coolrooms and Cool Transport for Small-Scale Farmers" (~\$150,000)
- Video: [Strengthening local expertise in postharvest practices](#): Cambodia, Vietnam Robert Paull of University of Hawaii at Manoa leads "Integrated Postharvest Extension Program for Cambodia and Vietnam" (~\$75,000)

Food safety

- Videos: [Improving tomato production through local GAPs](#): Nigeria Sally Miller of The Ohio State University led "Enhancing Trade in Horticultural Crops through Food Safety and Phytosanitary Measures" (~\$150,000)

Marketing

- Video (Life as a cucumber): [Creating a market niche for 'food-safe' vegetables](#): Cambodia, Vietnam Cary Trexler at University of California, Davis leads "Increasing Food Safety and Creating a Niche in the Market for Smallholders by Educating Them in Production, Postharvest, Food Safety, and Marketing and Branding their Produce According to Specific Food Safety Standards" (~\$500,000)
- Video: [Improving marketing capacity for specialty crops](#): Ghana James Simon at Rutgers University led "Sustainable Production of Specialty Horticultural Crops in Ghana for Income Generation and Increased Export Value" (~\$150,000)
- Video: [Improving vegetable quality with local market support](#): Zambia James Simon at Rutgers University led "Sustainable Development of Horticultural Crops in Zambia for Food Security, Income Generation and in Support of the Tourism Industry" (~\$150,000)

Nutrition

- Video: [Increasing nutrients in traditional diets with orange-fleshed sweet potatoes](#): Ghana Eunice Bonsi of Tuskegee University led "Concentrated Nutritional and Economic

Enhancement of Ghanaian Traditional Diets, Using Orange-Fleshed Sweetpotato Products" (~\$150,000)

Enabling environment

- Video + Facebook: [Expanding the floral industry](#): Honduras
Alan Bennett of University of California, Davis led "Building an Ornamental Plant Industry in Honduras" (~\$150,000)
- Video: [Integrating Rooibos tea farmers with fair-trade markets](#): South Africa
Laura Raynolds of Colorado State University led "Improving Market Access for Emerging South African Rooibos Farmers" (~\$150,000)
- Video: [Strengthening farmer groups to increase fruit and vegetable production](#): Uganda
Kate Scow of University of California, Davis led "Promoting Fruit and Vegetable Production to Improve Nutrition in Nkokonjeru, Uganda" (~\$150,000)

Appendix 12. Information Management List of Links to Gaps, Events, Meetings and Workshops.

Information Access - Gaps, Events and Workshops



Major lessons learned [Summary](#)

Note - These activities link with those in eAfghan Ag and MEAS projects.

Framework questions to ask
[Link](#)

ICT reviews

- Extension Framework - [Link](#)
- ICT and Extension - MEAS, Mark et al [Link](#)
- G8 Consultation -MEAS, Mark et al [Report](#)
- eAfghan Ag "ICTs in Ag" [Link](#)

1. Cell Phones - Elana, Curran, Kelsey, Jappy [Link](#)
2. On-Line learning - Maria Paz
3. Radio - Jessica
4. Social Media (and gender) - Heather
5. Video development and use - Nick
6. Internet - interactive animation - Hussain
7. Use of the internet - Mark et al. Example site [eAfghan Ag](#) ; Guidelines for developing your own Knowledge Bank [Manual](#)

Thailand (February 2012) (Peter)

- [Survey](#)

Thailand (October 2012) (Mark)

- **Trade Fair survey** - Project [link](#) - Kent Bradford, Johan Van Asbrouck, Rhino Research, Thailand
- World Vegetable Regional course: [AVRDC IVTC](#)
- Grant Singleton, IRRI
- [Survey](#) [questions](#)
- [Extension observations](#)
- IVTC Class (12 participants from throughout Asia) ([Participant list](#))

Cambodia (October 2012) (Mark)

- Survey - Project [link](#) - Miller, Trexler, FINTRAC, CARDI, RUA, Oxfam, Ministry,
- [Survey questions](#)
- [Summary outputs/lessons learned](#)
- Farmer village meetings and field visit with Freddy and Neda (15 farmers)

Tanzania (October 2012) (Amanda)

- Post Harvest - [Project Link](#) - Diane Barrett
- Course structure
- [Summary outputs](#)/lessons learned

Bangladesh (MEAS December 2012) (Mark)

- ICT in Extension [observations](#)
- Workshop with over 40 participants; subsequent farmers group meetings in 3 villages (68 participants) and meetings with regional extension offices (3 offices) and farmers field visit

- [Survey Analysis](#)

Uganda (May 2012) (Peter and Elana)

- Workshop - Project [link](#) - Kate Scow
- [Course structure](#)
- [\(Activity 1\) \(Activity 2\)](#)
- [Give away materials at trainings](#)
- Summary outputs/lessons learned

Wisconsin (August 2012) (Elana and Britta)

- Workshop - Project [link](#) - Jim Nienhus
- [Course structure](#)
- [\(Activity 1\) \(Activity 2\)](#)
- [Give Away Materials at Trainings](#)
- Summary [outputs](#)/lessons learned

Honduras (August 2012) (Beth and Amanda)

- Survey - Link to Center opening - questions for USAID and others
- [Survey questions](#) and Course structure
- [Brief summary Mission discussion](#)



Team: Mark Bell, Amanda Crump, Elana Peach-Fine, Britta Hansen

Appendix 13. PIs and Partners Located in the US.



Horticulture CRSP partners with top scientists

Do you know a Horticulture CRSP partner? To date, Horticulture CRSP has collaborated with exceptional researchers whose expertise lies not only in horticulture, but also in plant pathology, soil science, sociology, biotechnology, agricultural education, tropical plants, resource economics, engineering and more. We continue to further strengthen the capacity of our research network with new collaborators. Each Horticulture CRSP project has partners from developing countries and is led by a principal investigator at a U.S. public university, including:



Jean Ristaino
North Carolina State University
Dept: Plant Pathology
Dir., Global Plant Health Program;
2012 Jefferson Science Fellow



James Simon
Rutgers, The State University of
New Jersey
Dir., New Use Agriculture and
Natural Plant Products Program



Kate Scow
University of California, Davis
Dept: Land, Air & Water Resources
Dir., Russell Ranch Sustainable
Agriculture Facility



Mathieu Ngouajio
Michigan State University
Dept: Horticulture



Cary Trexler
University of California, Davis
Dept: Education



James Nienhuis
University of Wisconsin-Madison
Dept: Horticulture



Kent Bradford
University of California, Davis
Dept: Plant Sciences
Director, Seed Biotechnology
Center



James Thompson
University of California, Davis
Dept: Biological and
Agricultural Engineering



Bielinski Santos
University of Florida
Dept: Vegetable and Small Fruit
Horticulture



Ronnie Coffman
Cornell University
Dept: Plant Breeding & Genetics
Dir. of International Programs;
World Food Prize Advisory
Council



Diane Barrett
University of California, Davis
Dept: Food Science & Tech.
Site Dir., Center for Advanced
Processing & Packaging



Alan Bennett
University of California, Davis
Dept: Plant Sciences
Exec. Dir., Public Intellectual
Property Resource for Agriculture



Eunice Bonsi
Tuskegee University
Dept: Plant Biotechnology



Sally Miller
The Ohio State University
Dept: Plant Pathology



Darcy Boellstorff
Bridgewater State University
Dept: Geography



Stephen Weller
Purdue University
Dept: Horticulture and
Landscape Architecture



Ricky Bates
Penn State
Dept: Plant Science



Laura Raynolds
Colorado State University
Dept: Sociology
Co-Dir., Center for Fair and
Alternative Trade



Michael Reid
University of California, Davis
Dept: Plant Sciences



Steve Fennimore
University of California, Davis
Dept: Plant Sciences



Matthew Kleinhenz
The Ohio State University
Dept: Horticulture & Crop
Science



Jeffrey LeJeune
The Ohio State University
Dept: Food Animal Health
Research Program



Mywish Maredia
Michigan State University
Dept: Agricultural, Food, and
Resource Economics



Robert Paull
University of Hawaii at Manoa
Dept: Tropical Plant & Soil
Sciences
Department Chair



Dharma Pitchay
Tennessee State University
Dept: Agricultural and
Environmental Sciences



Hans Christian Wien
Cornell University
Dept: Horticulture



Kurt Kornbluth
University of California, Davis
Energy Efficiency Center
Dir., Program for International
Energy Technologies

Visit <http://hortcrsp.ucdavis.edu> for opportunities to partner with Horticulture CRSP.



Horticulture CRSP partner organizations

Each Horticulture CRSP project engages partners in developing countries, including researchers, private enterprise, non-governmental organizations, national agricultural research institutes and universities:

Latín America

- CARE, El Salvador
- Centro de Investigación Agropecuaria San Antonio, Nicaragua
- City Council Chillan, Chile
- Corporación Dinant, Honduras
- Universidad de la República, Uruguay
- Fundación Hondureña de Investigación Agrícola, Honduras
- Instituto Dominicano de Investigaciones Agropecuarias y Forestales, Dominican Republic
- Project Haiti WINNER, Haiti
- Universidad de Costa Rica, Costa Rica
- Universidad de La Molina, Peru
- Universidad de San Carlos, Guatemala
- Universidad Mayor de San Simón, Bolivia
- Universidad Nacional Agraria, Nicaragua
- Universidad Tecnológica América, Ecuador
- University of Concepcion, Chile
- Zamorano University, Honduras

Africa

- AtoZ Textile Mills International, Tanzania
- Abomey Calavi University, Benin
- Agribusiness in Sustainable Natural African Plant Products, Ghana, South Africa, and Zambia
- Agribusiness Initiative Trust, Uganda
- Agro Farm Services, Kenya
- Ahmadu Bello University, Nigeria
- Association des Personnes Rénovatrices des Technologies Traditionnelles, Benin
- AVRDC - The World Vegetable Center, Tanzania

- Council for Scientific and Industrial Research, Ghana
- Crops Research Institute, Ghana
- Egerton University, Kenya
- Food Research Institute, Ghana
- Ghana Polytechnic Institutes, Ghana
- icipe, Kenya
- Institut National des Recherches Agricoles du Bénin, Benin
- International Institute of Tropical Agriculture, Benin
- International Relief and Development, Zimbabwe
- Institut des Sciences Agronomiques du Rwanda, Rwanda
- Institut Gabonais d'Appui au Développement, Gabon
- Kangai Tisa Horticultural Farmers Group, Kenya
- Kenya Agricultural Research Institute, Kenya
- Kigali Independent University, Rwanda
- Kigali Institute of Science and Technology, Rwanda
- Kwame Nkrumah University of Science and Technology, Ghana
- Makerere University, Uganda
- Ministry of Agriculture, Food Security, and Cooperatives, Tanzania
- Moi University, Kenya
- Mukono District Council, Uganda
- Mukono Zonal Agricultural Research and Development Institute, Uganda
- Our Lady Queen of Apostles Nkokonjeru Parish, Uganda
- Reach Your Destiny Consult, Ltd., Uganda
- Rural Agency for Sustainable Development, Uganda
- Sandra Kruger and Associates, South Africa
- Scheut Tshilomba, Democratic Republic of the Congo
- Selasie Farms and Groceries, Ghana

- South Eastern University College, Kenya
- Stellenbosch University, South Africa
- Uganda Christian University, Uganda
- Umatara Polytechnic, Rwanda
- University of Cape Coast, Ghana
- University of Ghana, Ghana
- University of the Western Cape, South Africa
- World Relief, Malawi

South and Southeast Asia

- Acharya N G Ranga Agricultural University, India
- Asian Institute of Technology, Thailand
- Amity International Centre for Post Harvest Technology and Cold Chain Management, India
- AVRDC - The World Vegetable Center, Taiwan
- Bangladesh Agriculture Research Institute, Bangladesh
- ECHO Asia Regional Office, Thailand
- Hanoi University for Agriculture, Vietnam
- Industrial Technology Institute, Sri Lanka
- International Horticulture Innovation and Training Center, India
- Kasetsart University, Thailand
- Link Natural Products Pvt. Ltd., Sri Lanka
- Maejo University, Thailand
- Nepal Agricultural Research Council, Nepal
- Nong Lam University, Vietnam
- Punjab Agricultural University, India
- Rhino Research, Thailand
- Royal University of Agriculture, Cambodia
- Sathguru Management Consultants, Pvt. Ltd., India
- TATA Consultancy Services, India

Horticulture CRSP management entity

Horticulture CRSP is managed by a team at the University of California, Davis, with funding from USAID. Official partner institutions are North Carolina State University, University of Hawaii at Manoa and Cornell University.



NC STATE UNIVERSITY



This factsheet is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of Horticulture CRSP and do not necessarily reflect the views of USAID or the United States Government.

Appendix 14. Management Entity Response.

Thank you for the opportunity to respond to the External Evaluation Team's review of the Horticulture Innovation Lab. It is clear that the reviewers were very thorough in their evaluation and we are generally very pleased with the findings of this review. We would like to specifically respond to a few of their comments and recommendations.

Recommendation 1: Recruit International Advisory Board (IAB) members with no conflicts of interest.

The reviewers were concerned about potential conflict of interest for some of our board members, including the rotating position for the center directors. We recognize that there could be some conflicts of interest among the board members. This would be especially true of the AVRDC and GlobalHort members who potentially receive funding from the Horticulture Innovation Lab, as well as the center directors. However, our board is advisory in nature and has never voted on any issues pertaining to accepting or rejecting projects. The management entity (ME) listens to the advice of the board members on a range of topics, considers the source, and determines the best way to utilize that advice.

Recommendation 3: Mission Engagement and Review of Proposals before Funding.

We would like to clarify that the Horticulture Innovation Lab already has practices in place to address this recommendation. Every project that is submitted must include a letter of support from the Mission(s) in the countries they propose to work in. Missions are often asked to comment on projects we intend to fund prior to final funding decisions. John Bowman assists with this request. Finally, all of our PIs are requested to meet with the Mission when they visit the countries they are working in, at least once a year and as often as possible. The Mission is notified in advance of the visit and a request for an appointment is made. Only in rare cases does such a meeting not take place. It would assist our ME if we have access to a consistently accurate list of personnel in each Mission with their email addresses.

Recommendation 5: AOR should serve as an intermediary between the ME and the Missions.

The ME appreciates the assistance provided by John Bowman in building relationships with the Missions. We find this very helpful in many instances, especially before the ME has established a rapport with Mission personnel. However, we would not want this to be a requirement for communication with the Missions and preclude direct contact and communication between the Horticulture Innovation Lab ME and Missions. In addition, the ME has expertise that goes beyond our USAID programs that may be of interest to Missions. We are very willing to serve as a resource for the Missions. This may help to foster better collaboration.

Recommendation 7: Extend Postharvest Training Program to other Countries using Regional Centers of Innovation.

The ME agrees with the spirit of this recommendation and we believe that the Centers are well positioned to take on this role. However, due to challenges faced at AVRDC in Tanzania, we have not fully tested the sustainability of the postharvest training and

services center (PTSC) concept because we were not able to sell supplies from the AVRDC center. We recommend that the PTSC be replicated, perhaps at our center in Kenya, to test the full sustainability platform before we replicate to additional sites.

Percentage time of Director and Structure of ME: The reviewers recommended that the Director position be a full time position. We believe that our program can be just as effective with a full time director or a part time director, so long as there is sufficient support from the Associate Director and other ME staff. There are benefits to either structure, and the ME would prefer to decide on ME personnel percentages as a package rather than focusing on one position. There were also questions about the non-linear structure of the ME and a recommendation to develop a linear model. We feel that our model works well and empowers our staff to reach their highest potential. A linear model is not necessarily a better model.

Clarification of Role of Jim Yazman: There are several places in the document (p. 40, for example) where the role of Jim Yazman as AOR is discussed. We do not agree that Jim Yazman's role was minimal. While he was not a horticulturalist, he was very experienced in USAID procedures and was a tremendous help to the ME in many ways, including monitoring and evaluation and reporting mechanisms. He was always a strong champion for our program.

Additional Funding for Centers: We agree with the recommendation to increase funding to the centers and will be developing plans to do this in a way that assures eventual sustainability of the centers beyond the existence of the Horticulture Innovation Lab.

Enhanced Communication among PIs Across Projects and Countries: The reviewers (p. 35) suggested we enhance communications among all of our PIs and collaborators in the U.S. and in host countries. We agree with this recommendation and will be developing mechanisms for such communications.

EMINA bio fertilizer: Several times in the report, the EMINA bio fertilizer is mentioned. Apparently the review team learned about this during one of the site visits. The ME has not been informed through project reports or correspondence about this material, and cautions against plans to disseminate results widely ahead of thorough testing and evaluation.

Plan of Work for next five years: We agree with the recommendations from the review team for the research focus during the next five-year phase. We are pleased that the reviewers support a portfolio including many types of projects, as we have had during the first five-year phase. We have heard some discussion of possibly limiting our program going forward to a small number of countries. If we are going to be limited, we request to have the opportunity to select the counties ourselves based on where we see the strongest needs and opportunities in horticulture.

We are pleased that the reviews suggested additional funding for the Horticulture Innovation Lab program. Increased funding would allow us to make a stronger impact in human and institutional capacity building, along with our research portfolio.