# Impact Assessment of Bean/Cowpea and Dry Grain Pulses CRSP Investments in Research, Institutional Capacity Building and Technology Dissemination in Africa, Latin America and the U.S.

**Principle Investigator**
Mywish K. Maredia, Michigan State University, USA

**Collaboratoring Scientists**
Richard Bernsten, Michigan State University, USA
Eric Crawford, Michigan State University, USA
Jim Beaver, University of Puerto Rico, Puerto Rico
Juan Carlos Rosas (EAP),
Eduardo Peralta (INIAP),
Emmanuel Prophete (Haiti),
Mathew Blair (CIAT),
Ndiaga Cisse (ISRA),
Issa Drabo (INERA),
Phil Roberts, University of California-Riverside, USA
Jeff Ehlers University of California-Riverside, USA

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**Abstract of Research Achievements and Impacts**
A systematic search of past CRSP reports and literature was conducted to compile a database of 41 studies that report impacts related to the Bean/Cowpea or the Pulse CRSP program investments. The documented evidence range from anecdotal evidence to rigorous field based substantiation. The database is developed in Access but is also available in Excel and Word. A report summarizing the content of this database will be submitted to the Management Office.

The project team organized an educational session at the "All researchers meeting" held in April 2010 in Quito, Ecuador to increase the awareness towards achieving development impacts and help them think through the impact pathways of their research activities. As a follow-up to this session and through a one-on-one consultation through email and phone calls, to date, all the project PIs have completed impact pathway worksheets for their research projects. A report summarizing the outputs of this analysis and plan for next steps is being presented to the CRSP Management Office.

Field activities to collect data and information to assess ex post economic impacts of CRSP investments in bean improvement research in Central America and Ecuador were initiated in FY 10. Researchers reported that CRSP's and CIAT's financial supports have been fundamental for the maintenance of the bean network in Central America. CRSP's support became more important after 2002, when PROFRIJOL support ended. The resources were used to keep the supply of germplasm flowing, conducting research (small grants were provided by Zamorano to other institutions), and maintaining the collaboration. Using seed production data, it was estimated that in 2009, Honduras, Nicaragua, and El Salvador distributed seed of IVs to cover 24-39 thousand hectares in each country (highest in Honduras, lowest in El Salvador). Ecuador produced the smallest quantity of seed (15,560 kg; or enough to plant 173 hectares with IVs).

Using seed production data, in 2009, it was estimated that Deorho was planted on approximately 26% of the bean area in Honduras, followed by Amadeus 77 (11% of the bean area). Amadeus 77 was also planted in three other countries: El Salvador, Nicaragua, and Costa Rica and covered 9-11% of the bean area in these countries. In El Salvador, CENTA Pipil (another CRSP variety) was the variety most widely distributed by the government program and was planted on approximately 14% of the bean area.

**Project Problem Statement and Justification**

Impact assessment is essential for evaluating publicly-funded research, capacity building and outreach programs and planning future research. Organizations that implement these programs should be accountable for showing results, demonstrating impacts, and assessing the cost-effectiveness of their implementation strategies. It is therefore essential to document outputs, outcomes and impacts of public investments in research for development (R4D) activities. Anecdotal data and qualitative information are important in communicating impact to policymakers and the public, but must be augmented with empirical data, and sound and rigorous analysis.

Methods have been developed to quantify economic impacts of agricultural research investments (e.g., Alston et al., 1998, Masters et al., 1996, Walker et al., 2008). The CRSP must make use of the best methods available in all fields, including impact assessment. The method of economic assessment is relatively well established because it can make use of secondary data collected in most countries (e.g., commodity prices, interest rates and crop production statistics). Assessment of other types of impact is less standardized and is currently the focus of methodological research by researchers and organizations active in agricultural R4D.

Impact assessments are widely recognized to perform two functions--accountability and learning. Greater accountability (and strategic validation) is seen as a prerequisite for continued support for development assistance. Better learning is crucial for improving the effectiveness of development projects and ensuring that the lessons from experience – both positive and negative – are heeded. Accountability and strategic validation has long been core concerns for **ex-post impact assessments** and learning has been primarily a concern of **impact evaluation**.[1] The primary focus of this project is on ex post impact assessment. However, attention is also devoted to finding opportunities to include impact evaluation as part of CRSP projects to be implemented in Phase II and III. In addition to measuring and evaluating impacts of past research investments, this project is also concerned with increasing impacts from current investments by examining 'impact pathways' of research projects and inculcating an impact culture within the Pulse CRSP research community.

## Planned Project Activities for April 1, 2009 - September 30, 2010

**Objective 1:** To build an inventory of past documented outputs, outcomes and impacts of

[1] Although in the evaluation profession, the terms impact assessment and impact evaluation are used synonymously, in this project we make a nuanced distinction between ex post impact assessment and impact evaluation based on the timing of when they are conducted, the scale at which they occur and the motivation for doing an assessment (Maredia 2009).

investments by the Bean/Cowpea CRSP and develop a trajectory of outputs and potential impacts of investments made by the Dry Grain Pulses CRSP

*1a. Building an inventory of past outputs and documented impacts*: A systematic search of past CRSP reports and literature was conducted to compile a database of 41 studies (i.e., theses, dissertations, impact reports, journal articles, working papers, etc.) that report impacts related to the Bean/Cowpea or the Pulse CRSP program investments. The purpose of building this 'impact' database is to ensure that documented CRSP research outputs, outcomes and impacts are available to the CRSP MO or any potential user in one place and in one common framework. The database includes an inventory of major outputs (defined as technologies, practices, goods and services, intellectual properties and policy recommendations resulting from partial or full support of CRSP investments), characteristics of those outputs, and any evidence of documented outcomes and impacts of those outputs. The documented evidence range from anecdotal evidence to rigorous field based substantiation. The database is developed in Access but is also available in Excel and Word. A report summarizing the content of this database will be submitted to the Management Office.

*1b. Develop a trajectory of outputs and potential outcomes/impacts of ongoing investments by the Pulse CRSP (impact pathway analysis)*: Pulse CRSP is responsible for quantifiably demonstrating outputs (the first node in the impact pathway) in the form of knowledge, improved materials, practices, intellectual properties, human capital improvement and policy recommendations, which are intended to increase productivity, profitability and sustainability of pulse value chains in developing countries and thus achieve 'developmental goals' set by USAID. In other words, the research conducted by the CRSP is expected to have developmental impacts. One of the tasks of this project is to inculcate an 'impact oriented research' culture among researchers involved in the Pulse CRSP and help them think through the impact pathways of their research activities. In other words, help them lay out the vision of success (impact goal) and: a) make them aware of the consecutive steps needed to achieve that vision of success; and b) incorporate these steps as much as possible in their workplan for the remainder of the grant period.

Towards this goal, the project team held a two-hour educational session at the "All researchers meeting" held in April 2010 in Quito, Ecuador. The session consisted of presentation on concepts related to impact pathway, breakout group discussions oriented towards completing an exercise, and brainstorming discussions in a plenary setting. As a follow-up to this session, each Phase II and Phase III project team was asked to complete a worksheet on impact pathways for their respective projects. Instructions on how to complete the worksheet were provided to all the lead PIs followed by a one-on-one consultation through email and phone calls to help them think through the process of what their research plans to achieve in terms of development impacts and how to reach that vision.

To date, the project PI has received completed impact pathway worksheet from all Phase II and III project teams. A report summarizing the outputs of this analysis and plan for next steps will be presented to the CRSP Management Office. This information on the trajectory of outputs and steps towards achieving the vision of success should serve as a 'logframe' for the MO (and project teams) to monitor progress on how the CRSP projects are moving towards achieving not only the outputs (in the form of new knowledge, technologies and human capital) but how those

outputs are translated into (or projected to be transferred into) developmental outcomes and impacts.

**Objective 2:** Conduct ex post impact assessment of Bean/Cowpea and Dry Grain Pulses CRSP Investments in Research, Institutional Capacity Building and Technology Dissemination in Africa, Latin America and the U.S.

*2a. Synthesis and update study on the adoption and impact of CRSP's bean improvement efforts in the LAC region.* In February, Dr. Richard Bernsten and graduate student Byron Reyes met with Dr. Juan Carlos Rosas at Zamorano, Honduras to collect names and contact information of potential key informants for each target country in Central America and to have Dr. Rosas provide a brief description of the key institutions/organizations in the bean subsector in these countries (for details see trip report, attached).

During the Dry Grain Pulses CRSP Global Meeting held in Ecuador in April 2010, CRSP PIs, CIAT scientists and Byron Reyes met to discuss and plan the study. The feedback was incorporated in the execution of the study.

Five key informant instruments were developed, one for each key informant type. Table 1 shows the number of people interviewed between June through August 2010, by informant type.

Although Haiti was originally included as a Target Country for the study, several attempts to contact the key informant in Haiti to obtain information about potential key informants and to coordinate a visit to the country were unsuccessful, given the January earthquake. Therefore, information about Haiti was not collected during the summer trips.

Table 1. Key informants interviewed, June-August, 2010.

| **Key informant type** | **Number of respondents** |
|---|---|
| Bean researchers from government/ universities | 10 |
| Seed producers | 25 |
| Officials of the government's bean seed programs (whenever applicable) | 9 |
| Wholesalers | 20 |
| Officers of the research institutions | 4 |
| **Total** | **68** |

Quantitative historical data about the bean area planted/harvested, production and prices (whenever possible) were collected from the statistical offices in each country. As part of the impact evaluation methodology, the use of molecular markers was proposed as a complementary method to estimate adoption of improved varieties (IVs) in Honduras.[2] For this, 53 bean market samples from the main three markets in Tegucigalpa were collected and sent to CIAT for analysis (*bgm-1* gene). Although the samples have been sent to CIAT, the results are not yet available. This information will be used to design the sampling methodology required to select a

[2] Because of time and financial limitations, this idea could not be implemented in each country. Therefore, it was decided to implement it in Honduras only.

representative sample of seed in Honduras (or at least the main two cities—Tegucigalpa and San Pedro Sula), if the analysis of the initial sample of seeds validates using molecular markers to evaluate farmer adoption of improved bean varieties.

Using preliminary results, two presentations were made at the *"Conferencia Regional sobre el estado actual y Estrategia Futura de la Investigacion en Frijol en Centro America y El Caribe"* conference, held in August 2010 at Zamorano.

The following are preliminary results about adoption of IVs in the bean programs in each country.

- Using *seed production data*, it was estimated that in 2009, Honduras, Nicaragua, and El Salvador distributed seed of IVs to cover 24-39 thousand hectares in each country (highest in Honduras, lowest in El Salvador). Ecuador produced the smallest quantity of seed (15,560 kg; or enough to plant 173 hectares with IVs).

- Using *seed production data*, in 2009, it was estimated that Deorho was planted on approximately 26% of the bean area in Honduras, followed by Amadeus 77 (11% of the bean area). Amadeus 77 was also planted in three other countries: El Salvador, Nicaragua, and Costa Rica and covered 9-11% of the bean area in these countries. In El Salvador, CENTA Pipil (another CRSP variety) was the variety most widely distributed by the government program and was planted on approximately 14% of the bean area (Figure 1).

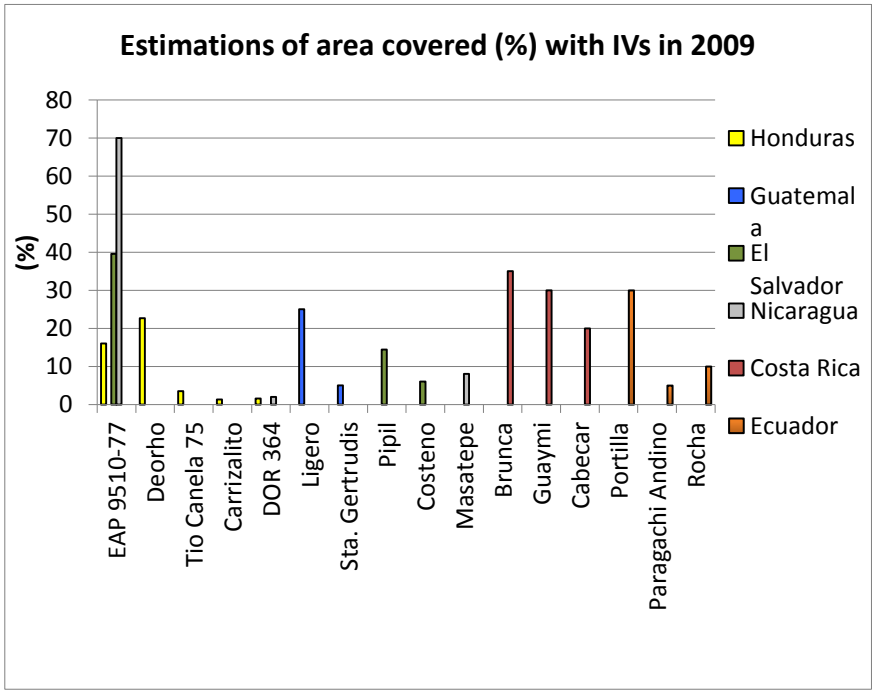


Figure 1. Most widely adopted (% bean area covered) improved bean varieties in 2009, per country (seed production data).

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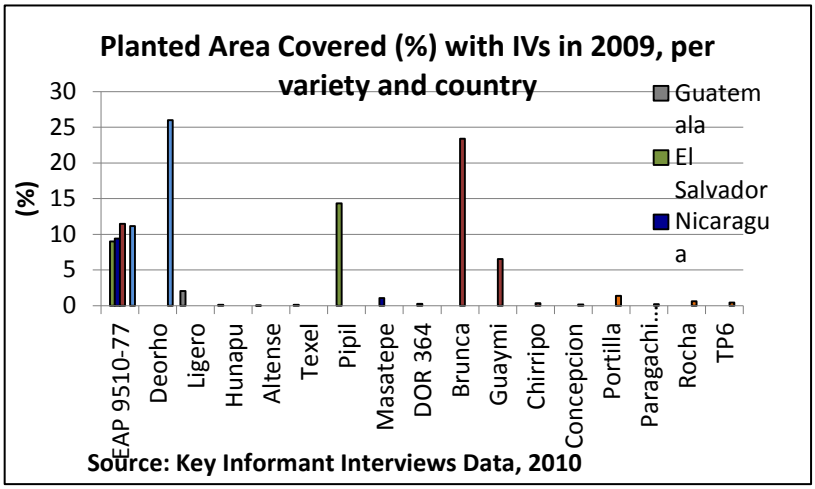


Figure 2. Most widely adopted (% bean area covered) improved bean varieties in 2009, per country (researchers' estimations).

- Researchers estimated that in 2009, Deorho was planted in approximately 23% of the bean area of Honduras, followed by Amadeus 77 (16% of the bean area). Two other bean researchers estimated Amadeus 77 was planted in 40-70% of the bean area in their country (El Salvador and Nicaragua). For Ecuador, the most widely planted variety was INIAP 430 Portilla (Figure 2). The percentage shown for Ecuador refers to each variety's share of the bush-type bean area, not the total bean area of the country).
- It was found that many of the bean researchers are close to retirement (average of 8 years to retire). While in Nicaragua the breeder will retire within one year, there is one person who will replace him. The (informal) bean network of the region is an important institution that could be used to train researchers' replacements, if no overlapping is possible in their institutions.
- Researchers reported that CRSP's and CIAT's financial supports have been fundamental for the maintenance of the bean network in Central America. CRSP's support became more important after 2002, when PROFRIJOL support ended. The resources were used to keep the supply of germplasm flowing, conducting research (small grants were provided by Zamorano to other institutions), and maintaining the collaboration.
- Detailed varietal information was collected. Table 2 shows the number of IVs released per country and the percentage that were released in the past 10 years. Except for Guatemala and Nicaragua, over one-half of the bean varieties have been released in the past ten years.

**Table 2. Number of varieties released in target countries since 1990.**

| Country | # varieties released | | % since 2000 |
|---|---|---|---|
| | since 1990 | since 2000 | |
| Honduras | 21 | 15 | 71 |
| Guatemala | 13 | 0 | 0 |
| El Salvador | 9 | 5 | 56 |
| Nicaragua | 16 | 7 | 44 |
| Costa Rica | 17 | 9 | 53 |
| Ecuador | 26 | 16 | 62 |

- Table 3 shows the prices of certified/high quality seed in target countries for 2009. Seed is most expensive in Costa Rica and least expensive in Nicaragua.

**Table 3. Price ($/quintal) of certified or high quality seed in target countries in 2009.**

| Country | Sale Price ($/qq)* | Seed Type |
|---|---|---|
| Honduras | 95 | Certified |
| Guatemala | 119 | Certified |
| El Salvador | 110 | Artisanal |
| Nicaragua | 80 | Certified |
| Costa Rica | 133 | Certified |
| Ecuador | 95 | Non-conventional |

**Note**: Non-conventional seed type refers to high quality seed produced by trained farmers (as an alternative to a formal certification process, which is inexistent in Ecuador).

- Reyes is in the process of entering and analyzing the data that was collected and will complete the analysis and report within the next six months.

*2b. Global contribution of CRSP to genetic improvement of common bean (including the U.S., LAC and SSA).* The Bean/Cowpea CRSP supported bean breeding programs in the U.S. and in host countries have contributed to the genetic improvement of common beans in the form of direct varietal releases as well as indirect contributions to the gene pool present in the pedigree of released varieties. This second type of contribution of CRSP-supported research in molecular breeding and other advanced techniques can be seen today throughout the bean producing regions of the world, including the U.S.

To take a stock of all the genetic contributions of the research supported by the bean/cowpea and the Dry Grain Pulses CRSP, following activities were conducted in FY 10. Some of these are partly complementary to activity 1a and 2a.

1. A database template has been developed to inventory varietal releases of all commercially important bean varieties (*phaseolus vulgaris)* in countries/regions where CRSP has been historically active in bean improvement research. A data solicitation excel based form was developed to solicit variety-specific information from national bean research programs and the CRSP project PIs (past and present) in respective countries. The data is being collected by each country since varietal releases are made at the national level. Although, cowpea was not included in the original scope of this sub-objective, a similar database of commercially important cowpea varieties is also being developed parallel to the bean varietal database. The cowpea varietal database partly complements activities 1a and 2c.
2. Data on varietal releases collected from 'key informants' are sufficiently detailed so that CRSP content and the dynamics of new varietal production and dissemination can be assessed. Key descriptors include the following:
    a. Official name of the release (a common name, if any)
    b. Year of the release
    c. Institutional source of the material
    d. Genetic background (parentage, genetic ancestry, pedigree)
    e. Major distinguishing traits

f. Release classification (type of material, use of participatory plant breeding or molecular techniques, NARS input, IARC input, private sector input) (mainly for beans)
g. Dissemination efforts (information on seed multiplication efforts) (for beans only)
h. Any information on the size, scale, time and location of its peak adoption by farmers and assessment on whether a variety is on an increasing or declining adoption trend in recent years.
i. Perceived adoption of improved varieties in 2009-2010 (beans only).

Once this comprehensive database is developed, the next steps are to estimate an economic value of the contribution of CRSP program in terms of value addition to genetic materials grown by bean farmers around the world. Adoption information by varieties is key to estimating an 'economic value.' The prospects of obtaining such information at a global scale and the feasibility of estimating the 'economic value' of the contribution of CRSP investments in genetic improvement research of these two important food legume crops will be explored in FY 11.

*2c. Benefits of genetic improvement of cowpea in Senegal and West Africa.* Over the past 20 years, due to collaborative efforts of CRSP researchers, several varieties of cowpeas with resistance to biotic and abiotic stresses have been released in Senegal and other countries in West Africa. Although a few studies in the past have documented the impact stories in Senegal, the evidence is still spotty when it comes to West Africa as a region. Thus, a study was initiated in FY 10 to update and document the adoption of improved cowpea varieties in Senegal and to expand the analysis to include Burkina Faso where the Bean/Cowpea and the Pulse CRSP have been active for the past 7-10 years. The goal is to document the adoption and benefits attributed to CRSP-NARS investments in cowpea improvement research.

During the Global PI meeting, the project team members discussed the objectives of this study and a data collection strategy with the PI-UCR-1 project team members. Based on a review of past documented impacts of cowpea research and subsequent follow-up discussion with cowpea breeders at the World Cowpea Conference and statistical data collection agency in Senegal, a proposal has been developed that lays out the scope and protocols of data collection efforts in Senegal and Burkina faso. Key aspects of this proposal for Senegal are presented below.

*Proposed study in Senegal:*
The focus in Senegal is to collect household level data on the adoption of improved varieties of cowpeas to achieve following objectives:

1. To identify the current extent of adoption by farmers in Senegal of improved cowpea varieties developed under the Bean/Cowpea (now Dry Grain Pulses) CRSP.
2. To gather information on the production and dissemination of improved cowpea seed, and the costs of these activities.
3. To gather information on the advantages (in the form of enhanced yield, quality, reduced yield variability, etc.) of improved cowpea varieties relative to traditional varieties, in order to estimate potential economic benefits of adoption of CRSP varieties.

The principal regions and departments in which CRSP-produced cowpea varieties have been disseminated will be identified through:

- Consultation with Ndiaga Cissé (CRSP/ISRA cowpea breeder) and representatives of NGOs and seed producer groups; and,
- Analysis of data from the 2010 DAPS national survey of farm households, which includes information on type of seed planted on each field.
- It is anticipated that Louga, Thies and Diourbel will be the main regions where improved cowpea varieties have been adopted, with Fatick, and perhaps Kaolack and Kaffrine also included.

A brief (~2 page) field survey will be carried out in the departments identified in objective 1. The sample for survey would be a sub-sample of 2010 DAPS survey farmers who indicated that they used "improved seed" for cowpea. Provisionally, we anticipate drawing a sub-sample of 500-700 households. Questions to be asked of farmers would include:

1. Name of improved cowpea variety planted.
2. What was the source of the seed?
3. Why was this variety used?
4. When was the first time the farmer used that variety?
5. Was cowpea planted in pure stand or intercropped?
6. If intercropped, what percentage of the field is in cowpea?
7. What do you believe are the advantages (drought resistance, disease or pest resistance, yield increase) of the improved variety relative to unimproved or traditional varieties?
8. How much cowpea did the farmer harvest from the plot (where improved variety was grown) last season in:
    a. Green pods
    b. As grain
    c. Any other form (i.e., fodder for animals)
9. What variety or varieties of cowpea do you intend to plant next season?
10. Reason(s) for choice of varieties to plant next season.

Interviews will be conducted with NGOs (e.g., World Vision) and seed producer groups concerning current and past seed production and dissemination activities. In addition, information will be also collected on the costs of those activities. This activity will also take place in Burkina Faso, where CRSP materials are at an early stage of dissemination and adoption.

To assess the yield advantage, experimental data from breeders or from on-farm trials will be used. Additionally, 2010 DAP yield plot data will be used, if there are sufficient observations to compare yields from plots that planted improved varieties and traditional varieties.

The data collection and analysis efforts towards this study (2c) will continue in FY 11.

**Objective 3:** Review each CRSP project activities (in Phase II and III) and advice the MO and the project team on ways to integrate data collection and impact evaluation strategies as part of the CRSP project design

The workplans of all Phase II and III CRSP projects were reviewed in FY10 and a database of outputs and projected targets by activities in the workplan has been developed. This information,

along with the impact pathway analysis is summarized in a report to be submitted to the MO in November. This report will identify and place different projects and show how the outputs of "research for development" (R4D) fall across a time and space dimension in terms of achieving developmental outcomes and impacts. This

Since resources to conduct research are scarce, many CRSP projects on the applied end of the R4D spectrum are pilot scale initiatives and programs designed to test the efficacy and effectiveness of a science-based intervention in a developing country setting with the aim of deriving lessons on what works and what doesn't. Such applied field based research initiatives are undertaken and supported by the CRSP with the goal of identifying the most effective strategy/models which can then be scaled up to achieve developmental impacts.

For a research project to be successful in achieving the developmental impacts requires some forethought on the design of field activities and a strategy for collecting appropriate data or making use of available data. Although, the Pulse CRSP projects will have only 2 years remaining in this five-year Phase, this review report identifies opportunities to integrate data collection and impact evaluation strategies as options (where feasible) for CRSP project teams to pursue. The purpose of such strategizing is to make sure that at the end of an intervention/activity, opportunity to collect data/information to assess the cause-effect relationship between a research project and indicators of outcomes/impact is not lost.

**Objective 4:** Build institutional capacity and develop human resources in the area of impact assessment research

Although this project does not include a host-country partner as in other CRSP projects, it does address the objective of institutional capacity building and human resource development through following methods:

a. Field activities under objective 2 were conducted in collaboration with HC PIs and partners.
b. Activities under objectives 1 and 3 are conducted in close collaboration with the U.S. and HC PIs from existing CRSP projects.
c. The activities planned under this project involved two graduate students in the planning and conduct of field research. These students were recruited from within the Department of Agricultural, Food and Resource Economics at MSU as research assistants (and not as participant trainees). They include:
    1. Byron Reyes, a citizen of Ecuador
    2. Nelissa Jamora, a citizen of the Philippines