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Assessing the Impact of the Bean/Cowpea CRSP
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ASSESSING THE IMPACT OF THE BEAN/COWPEA CRSP GRADUATE DEGREE TRAINING

By

Nelissa Vibar Jamora

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ABSTRACT

ASSESSING THE IMPACT OF THE BEAN/COWPEA CRSP
GRADUATE DEGREE TRAINING

By

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The Bean/Cowpea Collaborative Research Support Program (B/C CRSP) was established in 1980 to address constraints to increasing bean/cowpea production, consumption, and utilization. To this end, the CRSP has allocated a substantial share of its resources to training scientists/researchers in order to strengthen agricultural research capacity in Africa, Latin America, and the U.S. This study evaluated the impacts of the graduate degree training (GDT) component of the CRSP. The results were drawn from a survey of 76 former trainees and 25 former and current U.S. principal investigators (PIs), supplemented by face-to-face interviews with bean scientists and administrators at universities with faculty trained by the CRSP.

One of the important findings was that over 86 percent of host country (HC) trainees returned to their home countries (or at another developing country). In their enhanced capacity, trainees were making contributions to the advancement of bean/cowpea research that can be attributed to their GDT and CRSP research. Trainees felt that that their GDT was necessary for their professional development (100%) and was highly relevant to their current work/job responsibility (92%). Moreover, the study found that there were higher rates of collaboration and continuous bean/cowpea research for HC trainees (versus U.S. trainees), for trainees in the plant sciences, and for Ph.D. trainees (versus M.S. trainees).

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I leave MSU with wonderful friends and experiences that I will always cherish.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AFGRAD	African Graduate Fellowship Program
ARI	Agricultural Research Institute
ATLAS	Advanced Training for Leadership and Skills
B/C CRSP	Bean/Cowpea Collaborative Research Support Program
BIOEARN-SIDA	Biotechnology Research and Policy Development for Eastern Africa
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical; also, the International Center for Tropical Agriculture
CRSP	Collaborative Research Support Program
DANIDA	Danish International Development Agency
DRD	Directorate of Research and Development
ECABREN	Eastern and Central Africa Bean Research Network
ESA	East/Southern Africa
FAO	Food and Agricultural Organization
FS	Food Science
GDT	Graduate Degree Training
GF	Graduate fellows
HC	Host Country
HC-PI	Host Country Principal Investigator
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute

KSAs	Knowledge, skills, and attitudes
LAC	Latin America and the Caribbean
MO	Management Office
MSU	Michigan State University
NARS	National Agricultural Research Systems
OSU	Oregon State University
PABRA	Pan-Africa Bean Research Alliance
PI	Principal Investigator
PS	Plant Science
SABRN	Southern Africa Bean Research Network
SS	Social Science
SUA	Sokoine University of Agriculture
TPRI	Tropical Pesticide Research Institute
UMN	University of Minnesota
USAID	U.S. Agency for International Development
USDA-ARS	U.S. Department of Agriculture-Agricultural Research Service
US-PI	U.S. Principal Investigator
WA	West Africa
WSU	Washington State University

CHAPTER I
Introduction

The Bean/Cowpea Collaborative Research Support Program (B/C CRSP) was established in 1980 to address the problems of food insecurity in developing countries by enhancing the knowledge base necessary to achieve substantial improvements in addressing the constraints to bean and cowpea production, consumption, and utilization. This was to be achieved by enhancing the capabilities of host country (HC) scientists and research institutions to solve problems related to bean and cowpea production and consumption. Thus, the CRSP has allocated a major part of its resources to training scientists and researchers at selected universities and national agricultural research organizations in Africa and Latin America.

The CRSP represents one of the models of university engagement in long-term degree training. Trainees usually conduct research under the guidance of the CRSP scientist while studying at a university and many continue to collaborate after returning to their home country. During 1980 to 2005, the CRSP has fully, partially or indirectly supported 496 trainees for undergraduate or graduate degrees in the U.S. and in developing-country universities. Degree training has direct impacts on the trainees by advancing their professional careers, as well as indirect impacts on building capacity at the institution they join after completing the training. The interactions between CRSP scientists and training participants, after receiving their graduate degrees, help ensure that they continue to make professional contributions in their home country or elsewhere.

To date, the contribution of these trainees and the impact of the CRSP training model on institutional capacity building have not been systematically documented. Thus,

the purpose of this study is to evaluate the impacts of the graduate degree training (GDT) on trainees and on universities/research institutions in host countries from both the perspective of U.S. scientists who mentored the trainees and the individuals who received graduate degrees with CRSP funding. In doing this assessment, the study adopted the modified Kirkpatrick framework as a guide in evaluating training impacts from four different perspectives: Reaction (whether trainees like the training), Learning (whether they learned something from the training), Performance (whether trainees applied what they have learned), and Results (what are the impacts).

Impact on trainees can be any changes in their personal and professional lives as a result of their GDT. Institutional capacity building involves improvements in the ability of an organization to perform its teaching and research mandate effectively, efficiently and sustainably. Other commonly used terms and their working definitions which are used in this study are defined, as follows:[1]

- **Degree Training:** Any program at a college or university leading to a degree (e.g., License/Associate of Arts/Science, Bachelor of Arts/Sciences, Masters of Arts/Sciences, or Ph.D.).
- **Graduate Degree Training (GDT):** Masters of Arts/Sciences and Ph.D. programs at a college or university
- **Host Country (HC):** The country in which a USAID-funded activity takes place.
- **Principal Investigator (PI)**: A scientist who is responsible for a bean/cowpea research component
- **Research:** A systematic investigation, including basic or applied, designed to develop or contribute to general knowledge.

[1] Adapted from the "Amended Training Policy of the B/C CRSP", approved on June 20, 2005 by the Board of Directors of the B/C CRSP

- **Trainee**: All students fully, partially or indirectly supported by the CRSP to undertake degree training.

- **Training:** A learning activity taking place in the U.S., a host country, or a third country, in a setting predominantly intended for teaching or imparting certain knowledge and information to the participants with formally designated instructors or lead persons, learning objectives, and outcomes, which maybe conducted full-time or intermittently.

Chapter II reviews relevant studies on training assessment. Chapter III describes the structural organization of the CRSP and provides details of its graduate degree training (GDT) and some trainee-specific information. From this, an analytical framework is built to evaluate the training program. Chapter IV outlines the methodology used to examine the impacts of GDT on trainees and on universities and research institutions in host countries and presents the research objectives. Chapter V describes the impacts of GDT and B/C CRSP research on the trainees' personal and professional lives. Chapter VI presents the PIs' assessment of the training program. Chapter VII presents a case study on institutional capacity building. Finally, Chapter VIII summarizes key findings and recommendations of this study.

CHAPTER II
Review of related studies on impact assessment

This study is influenced and motivated by five recent assessments of graduate training programs, which were sponsored by the CGIAR (2006), ATLAS/AFGRAD (2004), the Fulbright Student Program (2005), ILRI in Kenya and Ethiopia (2001), and IRRI (1996).[2] These studies varied greatly in terms of the time period covered and methodology (Table 1). In terms of magnitude, the ATLAS/AFGRAD and the Visiting Fulbright Program studies were impressive in that they obtained responses from 1,921 (60% response rate) and 1,609 (70% response rate) of the former trainees, respectively. The ILRI study was unique in that it extended the analysis to include trainees' supervisors to gain a more comprehensive picture on the impact of training. Both studies adopted a modified Kirkpatrick model as a methodological framework to maintain focus on the objectives and to enhance analysis of the data. The CGIAR study was especially comprehensive as it looked beyond the impacts of training on the individual to include also the capacity building impacts on national research institutions. The Fulbright program, of which the Fulbright Student program is one component, is remarkable in that it is funded by the U.S. government for more than US$200 million a year. Key findings of these studies included the importance of non-technical competence and non-monetary benefits that trainees gained, including critical thinking and research skills, as well as increased prestige, self-confidence, and changes in their attitude towards work.

[2]This review also acknowledges the study by Howes in 1992 on the B/C CRSP Training Program in Malawi and Tanzania.

Table 1. Comparison of Training Program Assessment Studies

Program	Year of Study	No. of Respondents	Program Period
ATLAS/AFGRAD	2004	1,921	1963-2003
Visiting Fulbright	2005	1,609	1980-2000
ILRI: Kenya-Ethiopia	2001	60	1978-1997
IRRI	1996	374	1974-1987
CGIAR	2006	359	1990-2004

A. ATLAS/AFGRAD Programs

Established at the time of independence for many African nations, the USAID-funded AFGRAD Program (African Graduate Fellowship Program, 1963-1990) and its successor, the ATLAS Program (Advanced Training for Leadership and Skills, 1991-2003) came to a close in April 2003. This assessment study analyzed the development impact of investing US$182 million over a span of four decades for the U.S.-based graduate training of more than 3,000 African professionals. While the evaluators used the Kirkpatrick Framework to guide the impact assessment, they modified the model to expand the areas where impact might occur, by adding a "top level" which included sectoral, community, regional, national and international impacts in order to capture impact outside of an institution.

A major strength of the study is that the assessment team was able to solicit responses from 1,921 participants, or 60 percent of the actual universe of 3,219 graduates. The evaluators also visited seven of the largest "sending countries" which led to discoveries of instances where the U.S. training made a critical difference in an institution, sector or community. The evaluators also searched the internet to obtain

relevant information about former participants that could not be found in traditional media.

Of the many findings of this study, the main conclusion was that the USAID's monetary investment in this long-term training produced significant and sustained changes that enhanced development in African countries in measurable ways. Over 95 percent of the trainees reported making changes at their institutions and a majority believed that long-term degree training at U.S. institution was critical in creating the necessary foundations for significant impact to occur. Many respondents also reported that changes in institutional performance were attributable to U.S. training and that these impacts were unlikely to have occurred without the long-term academic program. Moreover, because participants that were selected for ATLAS/AFGRAD generally had some work experience, it promoted closer linkages between the academic program that the participant undertook and the development needs of their home country or institution.

The respondents considered competence in critical thinking and research skills as more relevant to achieving impact than improvement in technical and scientific knowledge. Changes in trainees' attitudes towards work consistently appeared as one of the perceived benefits. Many participants developed a strong commitment for their work and credit this aspect to their ability to implement change. One of the most important findings was that almost all of the participants (90%) returned to their home country after their U.S. training. Thus, long-term U.S.-based training did not contribute to a brain-drain of African professionals.

B. Fulbright Student Program

The Fulbright Student Program -- one of the several programs administered under the J. William Fulbright Program -- provides awards to non-U.S. citizens to pursue non-degree graduate and graduate degrees (M.S. and Ph.D.) in the U.S. Grantees are selected in an open and merit-based competition, either through bi-national Fulbright Commissions/Foundations or through the U.S. Embassies. The principal goal of the program is to increase mutual understanding between the people of the United States and the people of other countries. What sets the Fulbright Program apart from the other training programs is the extremely large budget allocated to this endeavor. The U.S. Congress, alone, allocates more than US$100 million a year for the Fulbright Program. In 2004, the U.S. Department of State, through its Congressional allocation, apportioned an additional US$148 million. This was supplemented by nearly US$13 million by the U.S. Department of Education and almost US$80 million from foreign governments and private donors. [3] Under the Fulbright Student Program, 2,125 foreign students studied at a U.S. university in 2004.

The study focused on assessing the impacts of the Fulbright Student Program through four indicators: (1) Satisfaction (the over-all satisfaction with the grant); (2) Educational/professional and cultural learning (personal and professional activities at the host institutions and learning about the U.S. culture and society); (3) Effects on behavior (personal and professional enhancement/attainment; professional contributions to home or host institutions; and sharing new knowledge/skills); and (4) Linkages, ties, and institutional change (development and maintenance of personal, professional, and

[3] J. William Fulbright Foreign Scholarship Board. Annual Report 2004-2005. http://exchanges.state.gov/education/fulbright/ffsb/annualreport/2004/Fulbright12005.pdf. (Last accessed August 2006)

institutional linkages and ties; and participatory activities designed to foster international cooperation and/or educational exchange).

Although more than 100 countries around the world are represented in the Fulbright Student Program, the assessment study focused only on a sample of 14 countries. Survey questionnaires were sent through e-mail to alumni who received their grants between 1980 and 2004. E-mail addresses were obtained for 2,310 of the 4,943 participants (47%) from the 14 study countries in the 1980-2004 period. Out of the 2,310 alumni with valid contact information, 1,609 respondents returned the survey – a 70 percent response rate.

Grantees (92%) expressed a high level of satisfaction with their grant experiences. Many respondents felt that their "Fulbright experience" was the most important personal and professional experience of their lives. Almost all (95%) said it gave them greater insight into their professional fields and contributed to their subsequent educational or career decisions. Most (64%) reported that as a result of participating in the program their view of the world has become more internationally focused. The study also found that more than 81 percent of the respondents have maintained active personal and professional relationships that they established during their study in the U.S.

C. ILRI: Kenya-Ethiopia

The International Livestock Research Institute (ILRI) sponsors a graduate fellowship program for scientists from developing and developed countries; in partnership with universities in African and Asian countries, Europe, Australia and North America. To assess the value of this training, ILRI conducted an impact study of 60

graduate fellows from Kenya and Ethiopia who undertook the research component of their degrees at ILRI between 1978 and 1997. Graduate fellows (GF) were staff members of national agricultural research systems (NARS), who registered for a graduate degree. The GF undertook a major part of the research component of their degree at ILRI, where they worked in an ILRI research project and were supervised by an ILRI staff member.

The major goal of ILRI's training program was to increase research capacity within the NARS. In the graduate degree training context, the training of existing or future NARS researchers increases this capacity. ILRI emphasized the importance of graduate study as part of its research program, as it directly benefits ILRI through the contribution of the student's research towards its own research outputs, and subsequently through the creation of partnerships with the former trainees and their NARS.

The ILRI impact assessment study stands out in its attempt to interview the GF's academic and work supervisors to gain a broader picture of the impact of training on the individual and his/her work environment. Specifically, the survey developed six separate questionnaires which were designed for different respondents, including 1) the training participants, 2) representatives from ILRI and universities who supervised the trainees, and 3) potential beneficiaries of the training, i.e. the users or clients of the graduate fellows' knowledge and skills. Through a combination of both questionnaires and face-to-face-interviews, data were collected from all 60 trainees from Kenya and Ethiopia. The preliminary results indicated that the graduate training program contributed to capacity-building in NARS and that ILRI provided a high quality environment for graduate students.

D. IRRI's Training Program

The International Rice Research Institute (IRRI) has pursued a dual but complementary mandate that includes rice-related agricultural research and training since its establishment in 1960. Candidates accepted into IRRI's graduate degree training programs complete their coursework in one of the many universities throughout the world with which IRRI has a formalized memorandum of agreement. Trainees receiving full scholarships tend to come from countries with relatively less developed educational systems and they generally attend the University of the Philippines Los Baños for their coursework. In addition, a "thesis only" scholarship is available to students who are interested only in thesis supervision. However, IRRI's evaluation of its training program was not as concerned as much about the "why" of impact as it was with determining if impact has taken place. The evaluators' main interest was to see if IRRI alumni were making a difference and whether or not this could be attributed in some degree to their participation in IRRI's training program.

All IRRI scholars are required to conduct and write up a piece of original scientific research that is of interest to IRRI and to the student. This requirement directly contributes to the global knowledge base of rice science, which is a primary objective of IRRI's degree training program. Outstandingly, a majority of the alumni felt that the IRRI training program influenced their subsequent achievements and had introduced specific innovations and changes in their jobs and research, which provided evidence of institutional impact.

Nearly 7,000 individuals, about 90 percent from Asia, were trained under the IRRI training program. Thus, many of the national rice programs in the world,

particularly in Asia, are staffed with IRRI-trained scientists and researchers. In addition, a survey of more than 1,000 group training alumni revealed that more than 85 percent of these individuals were still working in rice or rice-based research activities one year after returning home and about 80 percent maintained this association with rice some years later after completing their training at IRRI. Overall, this evaluation indicated that alumni are playing significant roles in shaping the future of domestic and international rice research.

E. CGIAR

The Consultative Group on International Agricultural Research (CGIAR) Training evaluation differs from the previously discussed studies, as it focused on assessing the effectiveness of investments in training on capacity building in national research institutions that had collaborated with CGIAR Centers. However, it also used training information gathered from the IRRI and ILRI studies, since both Centers are members of the CGIAR system. The scale of the study was remarkable. The evaluators conducted seven country-based studies covering Latin America, Asia Pacific and Sub-Saharan Africa and surveyed ex-trainees, research collaborators, center researchers, and center training officers. The evaluators defined training as both learning within the CGIAR and other learning opportunities such as their work experience. Thus, their definition of training incorporated a very broad expression of learning in different settings.

Due to the difficulty in getting concrete data on impacts, the CGIAR study was innovative in identifying observable indicators of impacts on institutions, such as: (1)

new research networks established, (2) existing networks becoming more effective, (3) knowledge and techniques more widely available, (4) knowledge that was not previously applied that is now being applied, (5) new research priorities that have been identified by researchers, and (6) new courses/curricula that have been established. The study also documented initiatives in strengthening capacity building, which resulted in (1) the transfer of existing technologies, (2) the introduction of new crop varieties, (3) more effective means of crop protection, (4) sustainable agricultural practices, (5) increases in farmers' incomes, and (6) increases in productivity.

CHAPTER III
The B/C CRSP Training Program

The CRSP, which is now completing its twenty-sixth year, has been funded through three major grants. The first grant extended from 1980 to 1986, the second one extended from 1986 to 2002. In mid-2002, the CRSP began a new five-year grant entitled, ***"Regional Partnerships to Enhance Bean/Cowpea Production and Consumption in Africa and Latin America"***. The fundamental vision for the CRSP was to generate new knowledge and technological outputs through collaborative research and training by U.S. and HC scientists, with the ultimate goals of enhancing bean and cowpea production, consumption, and utilization in Africa, Latin America and the U.S.[4] Specifically, the global program for grant period 2002-2007 envisions the "development of the human and institutional capacity of agricultural universities and national research systems through training and collaborative research so that institutional programs can be self-sustaining and contribute to the long-term development of bean and cowpea sub-sectors in both the U.S. and Host Countries" (B/C CRSP, 2002a). The goal was to develop a research and training program of worldwide scope, which enabled U.S. and developing country scientists to address constraints to the production, consumption and utilization of beans and cowpeas. This was to be achieved through graduate training of men and women from the U.S. and host countries and by providing financial support to scientists in both the U.S. and developing countries to conduct both basic and applied research.

Prior to 1997, the CRSP was implemented as bilateral projects (U.S.-HC) between U.S. university scientists and host country scientists. In 1997, these bilateral projects

[4] http://www.isp.msu.edu/crsp/home.htm. (Last accessed August 2006)

were integrated into regional projects [i.e., West Africa (WA), East and Southern Africa (ESA), and Latin America and the Caribbean (LAC)] for the formulation and implementation of research and training activities (B/C CRSP, 2002c). In each region, the value-chain approach, which was implemented in 2002, has facilitated the alignment of global program strategy with demand-driven research. It begins by first identifying consumer needs and desires, then designing research to relax constraints in key components of the value chain, including retail and wholesale marketing, processing, packaging, handling and storage, and production of beans or cowpeas by small-scale farmers.

The motto of the CRSP, *"**Applying Cutting-edge Science, Developing Value Chains, Building Human Resources**"*, represents the three pillar priorities which guide the program's global mission and strategy for prioritizing research and training activities (B/C CRSP, 2004b). The CRSP has allocated a significant share of its budget to building human resources in developing countries. Recognizing limited expertise and research capacity in the beans and cowpeas sectors in Africa and Latin America, the CRSP has sought to address this constraint by supporting 496 trainees from the U.S. and host countries in 554 academic degrees from 1980 to 2005.[5]

A. The B/C CRSP U.S.-based graduate degree training model

The CRSP graduate degree training model is depicted in Figure 1.[6] All degree training is closely linked to research activities and aligned with the research objectives of

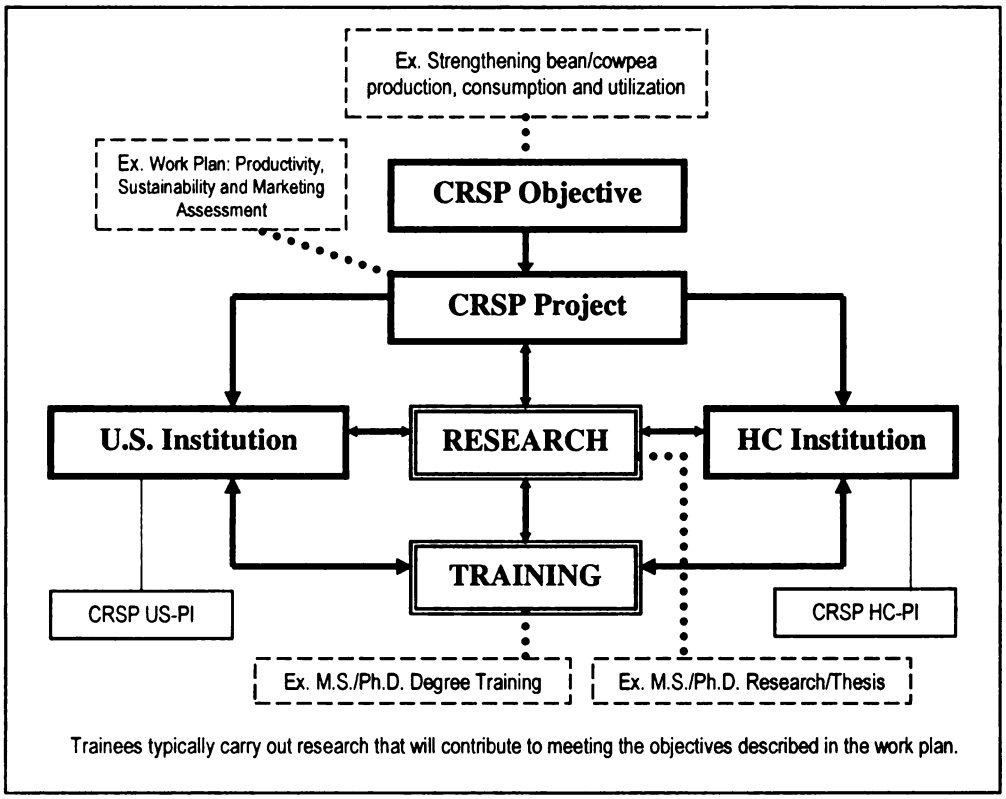
[5] Some trainees were supported for more than one academic degree.
[6] As the study focused only on the graduate degree training (M.S./Ph.D.) component that occurred in the U.S., this model is only a subset of the over-all CRSP training program. In addition to U.S.-based graduate training, the CRSP also supports short-term, B.S., M.S., and Ph.D. training in host countries.

the CRSP research projects. Collaborators identify the trainees based on the HC training needs and university admissibility criteria. Training occurs under the direct supervision of CRSP Principal Investigators (PI), which ensures that the training activity directly contributes to CRSP research goals and objectives, as well as to institutional capacity building in partner host countries. Involvement in the CRSP research program also fosters the student-mentor relationship between the trainee and the university professor, which leads to a continued collaborative research relationship between the U.S. and the HC institution after the formal training program is completed. In many cases, the integration of training with a professor's on-going research program leads to cost-leveraging (e.g., reduced tuition costs, reduction in overhead costs and/or partial support from other sources to fund the trainee's thesis research costs).

The CRSP takes pride in its training program. Table 2 illustrates the salient features of the CRSP training model, which is significantly different than the training programs discussed in the previous section. By recruiting trainees based on the demand of CRSP projects, the training program provides internal synergies and support for accelerating changes in targeted research institutions. Also, the CRSP realizes that targeting individuals from collaborative institutions increases impact and help sustain capacity-building. Program participants are usually working on a bean/cowpea-related topic prior to training. This training strategy enhances continued collaboration with CRSP scientists after trainees complete their CRSP-funded degree training. Moreover, the value-chain approach, which the CRSP has adopted as a guide in formulating and implementing research and training activities, facilitates the alignment of the program strategy with the selection of trainees and in planning of their respective programs of

study. Thus, trainees are usually recruited based on the recommendations of U.S. and HC principal investigators and collaborators who are involved in CRSP research projects.

Figure 1. B/C CRSP's U.S.-based graduate degree training model



Note: As the study focused only on the graduate degree training (M.S./Ph.D.) component that occurred in the U.S., this model only depicts a subset of the over-all CRSP training program. In addition to U.S.-based graduate training, the CRSP also supports short-term, B.S., M.S., and Ph.D. training in host countries.

Table 2. Comparing salient features of the B/C CRSP degree training with other training programs (Fulbright, ATLAS/AFGRAD, CGIAR, IRRI, ILRI)

B/C CRSP	*vs* Fulbright / ATLAS/AFGRAD	*vs* CGIAR/IRRI/ILRI
• Trainees are usually recruited from collaborating U.S. and host country institutions.	• Targeted are selected from targeted institutions (ATLAS-AFGRAD). • Trainees are selected competitively at the national level. (Fulbright).	• Trainees are selected competitively at the international level.
• Trainees attend universities with CRSP-funded projects.	• Trainees may attend any U.S. university.	• Trainees may attend any university, but usually conduct their thesis/dissertation research at IRRI/ILRI.
• Trainees' research is related to beans/cowpeas.	• Trainees' research is not sector-specific.	• Trainees' research is related to the rice/livestock sector.
• Trainees are selected and supervised by CRSP PIs, usually university professors, who ensure that the training/research directly contributes to CRSP research goals and objectives.	• Trainees are selected by the sponsors and are supervised by a U.S. university professor.	• Trainees are selected and supervised by IRRI/ILRI scientists who ensure that the research directly contributes to IRRI/ILRI research goals and objectives.
• Trainees work on CRSP-related topics for their thesis/dissertation.	• Trainees identify the focus of their thesis/dissertation.	• Trainees work on rice/livestock-related topics for their thesis/dissertation.

One of the hallmarks of the ATLAS/AFGRAD project was its commitment to restrain the brain-drain – a criticism of some scholarship programs -- by targeting African institutions, rather than qualified individuals, for capacity building. However, ATLAS/AFGRAD only managed the administrative aspect of the scholarship grant.

Under the CRSP, the US-PI serves as both the trainee's academic advisor and thesis/dissertation research supervisor. Taking on this dual role ensures that the total training experience is geared towards the attainment of CRSP objectives. In contrast, under IRRI's and ILRI's training program, institute scientists only supervise the trainee's research.

B. B/C CRSP Training Outputs

To date, the CRSP has supported a total of 496 students who earned 554 academic degrees (an average of 22 degrees per year from 1981 to 2005) at universities in the U.S. and host countries (Table 3). The CRSP emphasized training students from the developing world. About 81 percent of the trainees were non-U.S. students – mostly from Latin America (33%), West Africa (30%), and East/Southern Africa (11%). Most trainees specialized in plant science (50%), followed by food science (42%), and social science (8%). The largest share of trainees earned M.S. degrees (41%), followed by B.S./Lic. (32%) and Ph.D. (27%) degrees. Almost all B.S. degrees were earned in a host country, while almost all M.S. and Ph.D. degrees were earned in the U.S. About 23 percent of the trainees were **fully** supported (i.e., commitment from the CRSP for the entire duration of a degree program, including thesis research), 57 percent were **partially** supported (i.e., for one or more semesters to complete field thesis research or partial support throughout the program) from CRSP resources, and 21 percent were supported through **indirect** funding (i.e., through leveraged funding from other sources). About 56 percent of the trainees were male and 44 percent were female.

Table 3. Overview of the B/C CRSP degree training, 1980 to 2005

Region	N[a\]	Percent	n[b\]	Percent
Latin America	183	33%	56	30%
East and South Africa	62	11%	25	13%
West Africa	163	30%	17	9%
U.S.	101	18%	89	48%
Other	45	8%	n.a.	n.a.
Discipline	**N[a\]**	**Percent**	**n[b\]**	**Percent**
Food Science	231	42%	39	21%
Plant Science	280	50%	123	66%
Social Science	43	8%	25	13%
Highest CRSP Degree	**N[a\]**	**Percent**	**n[b\]**	**Percent**
Ph.D.	152	27%	95	51%
M.S.	225	41%	92	49%
B.S./Lic.	177	32%	n.a.	n.a.
Funding	**N[a\]**	**Percent**	**n[b\]**	**Percent**
Indirect	116	21%	35	19%
Partial	312	57%	80	43%
Full	126	23%	72	39%
Gender	**N[a\]**	**Percent**	**n[b\]**	**Percent**
Female	244	44%	78	42%
Male	310	56%	109	58%
Total	**554**		**187**	

a\ N=population; total number of CRSP supported degrees, including B.S., M.S., and Ph.D. degrees earned in host countries

b\ n=target population; only includes U.S. and HC nationals who received their M.S. and/or Ph.D. degrees from U.S. universities

c\ n.a. – data not available

However, for the purpose of this study, the target population includes only trainees from both the U.S. and HC who pursued graduate level education, i.e. M.S. or Ph.D., at U.S. universities. This reduces the population to 187 trainees from 18 different

countries (see Appendix 1). The study focused on M.S. and Ph.D. graduates from U.S. universities because of their potential to conduct agricultural commodity research in developing countries. The ATLAS/AGRAD study emphasized the importance of graduate degree training in the U.S. in establishing the scientific and research capacity for significant impacts to occur.

Although the CRSP has supported students and trainees since its inception in 1980, the budget for training was not reported separately until the beginning of the second grant in mid-1986. During the last two decades, the CRSP allocated nearly US$7 million on both degree and non-degree training activities (Table 4). This funding supported 377 (68%) graduate and 177 (32%) undergraduate degrees for trainees around the world. Since 1980, the annual budget (in nominal US$) for the CRSP has greatly decreased -- from an all-time high of US$4.6 million in 1984 to US$2.9 million in 2005.[7] This pales in comparison with the $182 million budget of ATLAS/AFGRAD and the US$100 million per year for the Fulbright Program. Despite this trend, the CRSP has sustained its commitment to education and training, as indicated by the fact that budget allocated to training activities increased more than three times since the mid-1980s-- from US$129,000 in 1986 to US$608,000 in 2005. In percentage terms, total budget allocated to training steadily increased from 10 percent in the period between 1987 to 1997, to 15 percent between 1998 to 2002, and about 20 percent in the third grant period (2003-2006). However, this marked increase in the training budget can be partially explained by the rising costs of university education. For instance, in-state tuition at Michigan

[7] Converted to 2005 dollars, the budget has declined by 63%, from US$7.7 million (1984) to US$2.9 million (2005)

Table 4. B/C CRSP Training Budget (in nominal US$), 1981 to 2005

	Years	Training Budget[a\]	% Spent on Training	Total Budget	No. of Trainees[b\]	Percent of Trainees
Grant 1	1980-1981	n.a.	n.a.	470,531	0	0%
	1981-1982	n.a.	n.a.	1,833,792	2	0%
	1982-1983	n.a.	n.a.	2,743,329	10	2%
	1983-1984	n.a.	n.a.	4,191,717	17	3%
	1984-1985	n.a.	n.a.	4,647,231	27	5%
	1985-1986	n.a.	n.a.	2,736,275	42	8%
	Sub-total			**$16,622,874**	**98**	**18%**
Grant 2a	1986-1987	128,958	13%	980,141	30	5%
	1987-1988	318,330	12%	2,578,864	33	6%
	1988-1989	199,846	8%	2,613,661	30	5%
	1989-1990	25,861	8%	2,597,569	29	5%
	1990-1991	169,428	6%	2,849,053	20	4%
	1991-1992	228,782	8%	2,856,990	20	4%
	1992-1993	221,846	8%	2,851,731	18	3%
	1993-1994	189,768	7%	2,819,542	22	4%
	1994-1995	278,122	10%	2,770,552	26	5%
	1995-1996	289,686	13%	2,210,466	26	5%
	1996-1997	281,637	12%	2,352,430	24	4%
	Sub-total	**$2,522,265**	**9%**	**$27,480,998**	**278**	**50%**
Grant 2b	1997-1998	647,593	27%	2,414,228	19	3%
	1998-1999	397,139	14%	2,800,555	12	2%
	1999-2000	299,254	11%	2,799,061	38	7%
	2000-2001	310,690	11%	2,754,967	22	4%
	2001-2002	245,119	11%	2,213,585	27	5%
	Sub-total	**$1,899,795**	**15%**	**$12,982,395**	**118**	**21%**
Grant 3	2002-2003	655,433	18%	3,694,828	11	2%
	2003-2004	638,680	22%	2,900,000	21	4%
	2004-2005	644,376	22%	2,900,000	15	3%
	2005-2006	607,873	21%	2,900,000	13	2%
	Sub-total	**$2,546,362**	**21%**	**$12,394,828**	**60**	**11%**
	Grand Total	**$6,968,422**	**10%**	**$69,481,095**	**554**	**100%**

a\ Training budget not reported separately until beginning of second grant (May 1986); includes both degree and non-degree training in the U.S. and host countries

b\ Number of trainees completing their degrees by the corresponding year, 1981 to 2005.

c\ n.a. – data not available

State University increased from US$28 per credit in 1980 to US$233 in 2005.[8] Consequently, the number of trainees who graduated annually declined from an average of 20 to 25 trainees per year in the first and second grant period to 15 trainees per year in the third grant period. The decrease in the number of trainees supported was inevitable, given the waning financial support from the U.S. Agency for International Development (USAID).

Beginning in 1997, the CRSP reported budget data for both degree and non-degree training activities in each regional project (Table 5). From 1997 to date, the CRSP has supported 178 degrees through full (21%), partial (56%) or indirect (22%) support. The LAC regional project received the largest budget allocation (US$7.77 million, 41%), followed by WA (US$7.29 million, 39%), and ESA (US$4.4 million, 19%). Both the LAC and WA regional projects allocated 24 percent of their total budget to training (compared to 20% for ESA) and, correspondingly, have trained more trainees than the ESA regional project. ESA spent roughly US$50,000 per trainee, more than twice the average costs of training for the LAC. This difference is partly because LAC was able to lower the costs of degree training by getting leveraged funds – which either indirectly or partially supported for more than 80 percent of its trainees. The CRSP Management Office (MO) often highlights this unique aspect of the CRSP – by obtaining leveraged funds, PIs have been able to support additional trainees. On the other hand, ESA fully supported 65 percent of its trainees and focused 100 percent of its training budget on supporting graduate degree training (M.S. and PhD.), which partly explains why its cost per trainee was much higher than for the other regional projects.

[8] PIs typically appoint trainees as a research assistant which makes them eligible for in-state tuition. Source: History of MSU's tuition per credit amounts (Undergraduate Instate Lower Division) http://www.ctlr.msu.edu/studrec/history.htm (Last accessed July 2006)

Table 5. Training Budget and Outputs, by regional project (in nominal US$), 1997 to 2005 [a\]

	LAC		ESA		WA		Total	
Total Regional Budget	**$7,772,460**		**$4,357,497**		**$7,290,070**		**$19,420,028**	
Training Budget[b\]	**$1,843,505**	41%	**$856,294**	19%	**$1,746,358**	39%	**$4,446,157**	100%
% Spent on Training	**24%**		**20%**		**24%**		**23%**	
Number of Trainees	**105**		**17**		**56**		**178**	
Average Cost per Trainee	**$17,557**		**$50,370**		**$31,185**		**$24,978**	
By Degree								
B.S.	26	25%	0	0%	27	48%	53	30%
Lic.	16	15%	0	0%	0	0%	16	9%
M.S.	41	39%	10	59%	13	23%	64	36%
Ph.D.	22	21%	7	41%	16	29%	45	25%
By Discipline code								
Food Science	24	23%	2	12%	41	73%	67	38%
Plant Science	68	65%	9	53%	8	14%	85	48%
Social Science	13	12%	6	35%	7	13%	26	15%
By CRSP Support								
Full	17	16%	11	65%	10	18%	38	21%
Indirect	33	31%	5	29%	2	4%	40	22%
Partial	55	52%	1	6%	44	79%	100	56%
By Training Location								
In Host Country	45	43%	7	41%	41	73%	93	52%
In U.S.	60	57%	10	59%	15	27%	85	48%
By Origin of Student								
Host country	53	50%	10	59%	52	93%	115	65%
Non-host country	26	25%	4	24%	2	4%	32	18%
U.S.	26	25%	3	18%	2	4%	31	17%
By Gender								
Female	55	52%	4	24%	22	39%	81	46%
Male	50	48%	13	76%	34	61%	97	54%

a\ LAC=Latin America and the Caribbean, ESA=East/Southern Africa, WA=Western Africa
b\ includes both degree and non-degree training in the U.S. and host countries

Most of the LAC and ESA trainees specialized in plant science (65% and 53%, respectively), while about 73 percent of the trainees supported by the WA regional project pursued degrees in the food science discipline. This is an interesting finding as it reflects research priority setting in the region -- LAC and ESA focused more on plant science fields such as plant breeding, while WA focused on food science fields such as food processing. About 93 percent of WA project-supported trainees were HC nationals, compared to 59 percent for ESA and 50 percent for LAC. Most of the WA trainees pursued their degrees at HC universities (73%), while 59 percent of ESA and 57 percent of LAC project-supported trainees pursued their degrees at U.S. universities. In both the ESA and WA regional projects, more degrees were earned by men (76% and 61%, respectively) than women. In contrast, the gender distribution for LAC was 52 percent females and 48 percent males, a ratio that has steadily increased during the past 25 years.

C. Collaboration between U.S. and host country institutions

A special issue of the Field Crops Research (2003:82) highlighted the research contributions of the CRSP. The introduction section emphasized the collaborative efforts of U.S. and HC scientists in building U.S. and national bean/cowpea research programs. The importance of 'collaboration' was stressed when the CRSP was conceptualized -- emphasizing that the initiative should benefit both the U.S. and host countries. For U.S. scientists, this means having opportunities to become involved in international research and development in host countries which are aligned to their U.S. research programs and educational goals of their respective universities (Hall, 2003). In particular, having access to the diverse sets of bean and cowpea germplasm in Africa and Latin America is a

distinct advantage for U.S. scientists. For host-country scientists, CRSP projects complemented and sometimes dominated bean/cowpea national research programs in host countries (Adams, 2003). In 1981, Hall (2003) observed that solving agricultural problems in the developing world requires long-term research programs conducted by HC scientists and enhanced by CRSP and other International Agricultural Research Centers that have long term commitment to support such programs. Moreover, the CRSP model fosters collaboration among different scientific disciplines (i.e., plant science, food science, and social science). In an article by Murdock (2005) from Purdue University, he describes the "collaboration, cooperation and complementarity" between the CRSP and the International Institute of Tropical Agriculture (IITA) in Nigeria. As a result of this institutional linkage, both organizations were able to help farmers in Africa increase cowpea production in the region. Moreover, the CRSP and IITA have worked together in sponsoring three World Cowpea Conferences which were held in 1985, 1996 and 2000. Furthermore, an internal B/C CRSP MO (2003) document also noted the complementarity between the CRSP and CIAT (in bean research) and the inherent differences, in terms of strengths and focus. The CRSP, in addition to collaborating with national agricultural research institutions (NARS), has worked closely with local universities in an effort to strengthen higher educational institutions and provide degree training for professionals. In contrast, CIAT has largely collaborated with NARS. Also, a key strength of CIAT is its gene bank, with more than 30,000 accessions of wild and cultivated beans. Furthermore, the CRSP takes a broader multi-disciplinary approach to bean and cowpea research, drawing on a wide range of experts in different disciplines, who are based in both the U.S. and host countries. The CRSP long-term collaborative,

inter-country, and inter-disciplinary efforts have contributed to achieving significant progress in bean and cowpea research (see Appendix 2 for a list of collaborating institutions in host countries).

While training *per se* does not automatically lead to institutional capacity building, it is one of the cornerstones of organizational capacity development.[9] Horton, et al. (2003), who conducted research on capacity development in Bangladesh, Cuba, Ghana, Nicaragua, Philippines and Vietnam, referred to organizational capacity as the "resources, knowledge and processes employed by the organization to achieve its goals," Horton, et al. broadly categorized factors associated with institutional capacity into two groups: (1) Resources (which includes the staffing, physical infrastructure, technology and financial resources) and (2) Management (which includes strategic leadership, program and process management, and networking and linkages). In this typology, graduate degree training contributes to capacity development by recruiting highly qualified individuals (human resources) and through the application of their knowledge, skills and attitudes (management). Individuals who receive graduate degree training may possess capacities in the form of knowledge, skills and attitudes. However, if trainees do not return to their organization, they do not contribute to institutional capacity building. Thus, it is important to look at impacts of the training program on host country institutions.

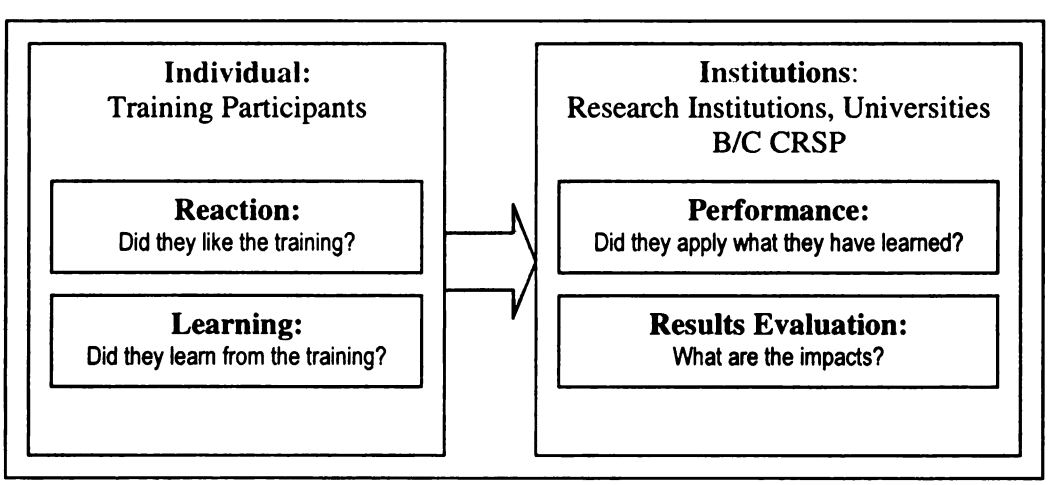
[9] In this study, 'Capacity development' is used interchangeably with 'institutional development' and 'organizational development', although many studies have used those three terms distinctively.

CHAPTER IV
Methodology

A. Analytical Framework

Evaluation is the means used to determine the worth or value of a training program. It serves a guide for deciding how to improve a training process or in deciding whether or not to continue it. This assessment study mainly employs Kirkpatrick's evaluation framework, which is one of the most widely used models for evaluating training. First published by Donald Kirkpatrick in 1959 as part of his dissertation, Kirkpatrick later redefined and updated his training evaluation model -- reaction, learning, behavior, results – in his 1998 book, "Evaluating Training Programs: The Four Levels". The four levels actually refer to different perspectives, not levels, and are not hierarchical. Rather, each level evaluates a different aspect of training and answers different questions. Figure 2 depicts the analytical framework used to evaluate the B/C CRSP graduate degree training program.

Figure 2. Training Evaluation Framework



- REACTION

Reaction refers to the participants' opinions about the training program. However, because this level only measures how the participants react to the training, it does not reveal what new skills and knowledge the trainees have acquired or what they have learned that they will apply to their work environment. Nevertheless, the interest and motivation of the trainees are important to the success of any training program. This level seeks to determine the trainees' general satisfaction with the training program and the perceived relevance of their training on their personal and professional lives.

- LEARNING

Learning refers to knowledge (principles, facts, and techniques), skills, and attitudes (KSAs) that the participants gained from the training program. This evaluation component looks into participants' change of attitudes, improvement in knowledge, and increase in skill as a result of attending the program. Measuring the learning that takes place in a training program is important in order to validate the learning objectives.

- PERFORMANCE

This refers to changes in the participants' work performance that could be attributed to the training program. This is the link between learning and workplace performance. In Kirkpatrick's original four-levels of evaluation, he names this level "behavior." However, behavior is the action that is performed, while the final result of the behavior is performance. Gilbert (1998) noted that performance has two aspects -- behavior being the means and its consequence being the end. The consequence of the

behavior (performance) is what evaluation is really attempting to measure. This criterion assesses the trainees' capabilities to perform acquired KSA in a work environment. It is important to measure performance because the primary purpose of training is to improve results by having the students learn new KSA and then actually applying them to the job. Since level three measurements (Performance) must take place after the trainees have returned to their jobs, the actual evaluation will typically involve assessment by someone closely involved with the trainee, such as his/her supervisor.

- RESULTS EVALUATION

Results evaluation refers to the impact of the training program on the performance of the organization. It measures the program's effectiveness, as it seeks to answer what impacts have the training achieved. In this study, impact provides information about returns to the individual trainee, to the research and/or academic institutions, and to the bean/cowpea sector as a result of training. This study looks at impact from two perspectives: qualitative and quantitative. Hard results are usually reported in quantitative terms (e.g., monetary return or improvement in wages), while soft results are more qualitative in nature (e.g., non-monetary return or trainees' perceived impacts of training).

B. Research Objectives

Specific Objectives:

Following the Kirkpatrick's Evaluation Model, the specific objectives of this study are arranged based on the four evaluation categories: Reaction, Learning, Performance and Results Evaluation.

a) Reaction

1. To determine the trainees' general satisfaction with their GDT
2. To assess the relevance of GDT on trainees' personal and professional lives

b) Learning

1. To identify knowledge, skills and attitudes (KSA) that trainees acquired during their GDT
2. To determine problems that trainees encountered during their GDT

c) Performance:

1. To evaluate whether trainees were able to apply acquired KSA in their profession
2. To identify noticeable and measurable changes in the trainees' work performance that can be attributed to the GDT
3. To determine factors that may have contributed to and/or limited the trainees' effectiveness as bean/cowpea scientists after completing their GDT

d) Results Evaluation:

1. To identify monetary and non-monetary benefits of the GDT on trainees' personal and professional lives
2. To identify trainees' contributions in the advancement of the bean/cowpea sectors
3. To determine if the GDT enhanced research capacity building at the HC research institutions, particularly at SUA (case study)
4. To assess if the GDT strengthened research collaboration between CRSP scientists in the U.S. and scientists working at HC research institutions, particularly at SUA

C. Research Questions

To maintain the focus on the objectives of the study, the following research questions were explored, following the adapted training evaluation model.

a) Reaction

1. What aspects of the GDT did trainees like and enjoy?
2. What aspects of the GDT did trainees consider relevant/useful?

b) Learning

1. What knowledge did trainees acquire?
2. What skills did trainees develop or enhance?
3. What changes occurred in trainees' attitudes?
4. What major problems did trainees encounter during their GDT?

c) Performance:

1. Did trainees utilize their learning and newly acquired KSA when they retuned to work after completing the GDT?
2. Were there noticeable and measurable changes in the trainees' activity and performance when they retuned to work after completing the GDT?
3. What factors have contributed to and/or limited trainees' effectiveness as bean/cowpea scientists after completing their GDT?

d) Results Evaluation:

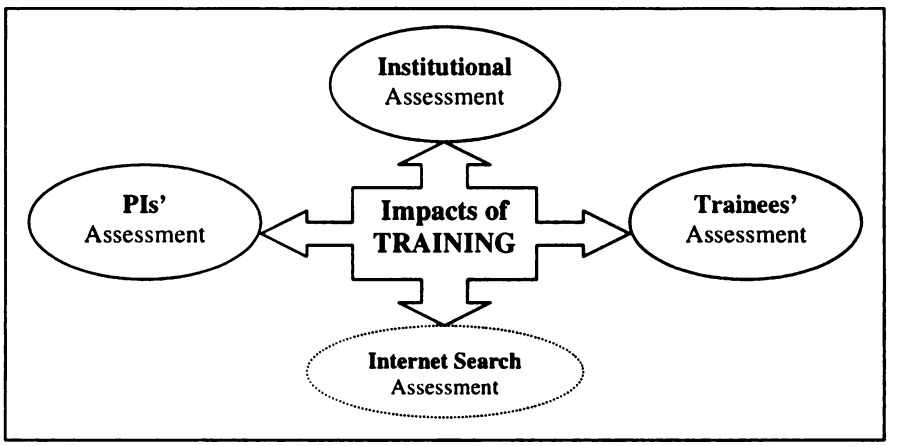
1. As a result of the GDT, what monetary and non-monetary benefits did trainees gain that improved their personal and professional lives?
2. Did trainees contribute to the advancement of the bean/cowpea sectors?
3. Did the GDT enhance research capacity building at the trainees' HC research institution (SUA)?
4. Did the GDT strengthen research collaboration between CRSP scientists in the U.S. and scientists working at HC research institutions (SUA)?

D. Approaches and Methods

This study was undertaken to assess the impact of the CRSP's U.S. based graduate degree training program, which the CRSP has supported since 1980. A four-pronged approach is adapted to evaluate impacts of training (Figure 3). Aside from the records and reports from the CRSP MO, this study gathered data from four sources to assess impacts of training: (1) the trainees, (2) the US-PIs involved in the CRSP GDT

program, (3) via an internet search, and (4) individuals at a collaborating university in a host country (as a case study).

Figure 3. Training Evaluation Approach



1. Trainee survey

The target population for the trainee survey included all of the 187 trainees who completed their GDT in the U.S. during the period 1981-2005. Given a population of 187 trainees, a sample of 126 respondents is required to obtain a 5 percent margin of error in the construction of a 95 percent confidence. However, it was not possible to obtain contact information for all of the target population. Although the CRSP MO maintains a database of trainee-related information, contact information was out of date, especially for trainees who graduated in the early years of the program. While the MO's database included 42 (22%) e-mail addresses and 122 (64%) mailing addresses, most of these contact information had not been recently verified. Thus, to aid the process of contacting trainees, PIs, affiliated with 18 U.S. academic institutions where the GDT took place, were contacted (see Appendix 3 for the list of U.S. institutions).

All trainees, for whom an e-mail address was found, were e-mailed the trainee questionnaire, which solicited information regarding their assessment of the impacts of GDT on their personal and professional lives (Reaction and Learning) and on the institutions where they are working (Performance and Results Evaluation). Moreover, the questionnaire solicited information regarding (1) their assessment of their graduate training program, (2) their professional history (i.e., current employment, employment before and after graduate training), (3) their reasons for returning (or not returning) to their home country, and (4) constraints to and suggestions for building institutional capacity in their home country (see Appendix 4 for a copy of the trainee survey).

2. US-PI survey

In addition, a key-informant questionnaire was e-mailed to all CRSP supervisors (or US-PIs directly in-charge of the trainees) to validate and supplement trainees' answers to questions on Performance and Results Evaluation. Although including the trainees' supervisors in evaluating training is not a widely-used methodology, recent work in the area of training impact assessment emphasizes the need for and importance of this type of feedback (Abernathy, 1999). It was anticipated that the trainee's supervisor and/or adviser would reveal a complementary perspective on training impacts. The US-PI questionnaire solicited information regarding the supervisor's (1) role in the CRSP, (2) assessment of the strengths/weaknesses of the CRSP graduate training program, (3) rationale for selecting trainees, (4) assessment of the trainees' outstanding contributions to bean/cowpea research, (5) collaborative research activities (i.e., between the trainee and the CRSP supervisor), and (6) assessment of constraints faced and suggestions for

building institutional capacity in countries where he/she had worked (see Appendix 5 for a copy of the US-PI survey).

3. Internet Search

An internet search was conducted to supplement other methods used to locate former trainees. This strategy, recommended by the ATLAS/AFGRAD study, was also used to look for significant contributions that the trainees or their supervisor may not have reported. Information found on the internet was compared with information found in the CRSP database (e.g., current employer, university affiliation, etc.) to determine if the hit referred to the actual trainee. These three search engines were used for this activity -- Google (www.google.com), Dogpile (www.dogpile.com), and Altavista (www.altavista.com).

4. Case Study

Finally, an institutional case study was conducted at Sokoine University of Agriculture (SUA) in Tanzania to document the capacity-building impacts of the CRSP-funded training. In addition to interviewing former trainees and collaborators at SUA, interviews were conducted with key institutional administrators to obtain an independent assessment of the contribution of CRSP-supported training to capacity building at the university.

E. Data Collection

1. Preliminary US-PI Survey

To confirm the name of each trainee's adviser, an e-mail inquiry was sent to all former and current US-PIs from December 2005 to May 2006. This step was crucial because the CRSP trainee database did not have information that matched all trainees with their corresponding supervisor. The e-mail inquiry, which successfully matched 160 students (84%) with their respective CRSP supervisor, significantly augmented the database of information associating US-PIs with their former students.

2. Pre-testing the Questionnaire

In December 2005, two questionnaires were pre-tested, one for the former trainees and another for the US-PIs. For the draft trainee questionnaire, constructive comments were received from seven randomly selected respondents. The final e-mail surveys were sent out in April 2006, and reminders were continuously sent to non-respondents until the last week of July 2006. The US-PI questionnaire was sent to two active US-PIs for pre-testing and the final PI survey was sent out in April 2006.

3. Survey Methods

a. Trainee Survey

The study attempted a complete census of the target trainee population (N=187). However, because of difficulty in getting contact information for all trainees, the population frame was redefined as all trainees with valid e-mail addresses (N=126) for the following reasons. First, for trainees without e-mail addresses, no mailing address

was available. Second, since all of the population earned graduate degrees in the U.S., it was assumed that they were computer literate and had access to the internet. Many studies have confirmed individuals with college degrees or higher are highly likely to have internet access (NTIA, 1999). Third, e-mail correspondence is the quickest, cheapest, and the easiest way to administer a survey.

Administering the trainee survey involved several stages. First, the MO's database was reviewed to obtain trainees' e-mail addresses. Second, the internet was used to search for e-mail addresses of missing trainees. Third, US-PIs were sent a preliminary survey to solicit information on the whereabouts of their former trainees. Fourth, former trainees (who responded) and current collaborators in the U.S. and HC institutions were requested to help locate their missing colleagues. Fifth, some trainees were contacted by telephone and asked to participate in the e-mail survey. Finally, to solicit greater participation, Dr. Richard Bernsten[10] sent an introductory e-mail to the trainees. When an e-mail address was verified, the researcher sent the questionnaire to the trainee as an e-mail attachment.

The frame population (N=126), individuals with valid e-mail addresses, represented 67 percent of the target population (N=187). Out of the 126, 76 trainees returned the survey. This translates to a remarkable 60 percent response rate. In contrast, while the CGIAR training study reported a 49 percent response rate for current NARS researchers, the response rate for all former trainees was only 13 percent. With 76

[10] Dr. Richard Bernsten is the lead US-PI for the B/C CRSP Training Evaluation.

respondents, the results reported in this study have a margin of error of +/- 7.11 percent in the construction of a 95 percent confidence level.[11]

b. US-PI Survey

The study attempted a complete census of the target US-PI population (N=31), based from the results of the preliminary US-PI survey. The target population was defined as all current and former US-PIs who played a role in the GDT of a CRSP trainee -- either as major professor, thesis/dissertation adviser, or as member of thesis/dissertation committee. To solicit greater participation, Dr. Irvin Widders[12] sent an introductory e-mail message to the US-PIs. After an e-mail address was verified, the researcher sent the questionnaire to each US-PI, as an e-mail attachment.

Twenty-eight of the 31 US-PIs returned the questionnaire – a remarkable 90 percent response rate.[13] However, three questionnaires were discarded because these US-PI respondents reported that they did not play a role in a trainee's GDT program. This reduced the target population to 28 and the sample size to 25. With 25 respondents, the results reported in this study have a margin of error of +/- 6.53 percent in the construction of a 95 percent confidence interval.[14]

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[11] For the frame population = 126, confidence interval = +/- 7.11 was computed for 95% confidence level. For the target population = 187, confidence interval = +/- 8.68 was computed for 95% confidence level. See http://www.surveysystem.com/sscalc.htm.

[12] Dr. Irvin Widders is the current Director of the B/C CRSP (2002-2007).

[13] This high response rate was made possible through the help of the CRSP MO, particularly Dr. Irvin Widders, who sent out e-mails to PIs to explain the purpose of the study.

[14] Confidence interval = +/-6.53 computed for 95% confidence level, population=28, sample=25, percentage=50. See http://www.surveysystem.com/sscalc.htm.

c. Case Study

The main purpose of the case study was to collect information about impact to supplement the questionnaire-based trainee and US-PI surveys. An institutional visit to Sokoine University of Agriculture (SUA) in Morogoro, Tanzania was made to interview former trainees and HC-PIs, both in group and individual settings, from July 11 to 15, 2006.[15] This visit was carried out to solicit anecdotal information and qualitative information that would enrich the impact information that trainees reported in the participant survey. Meetings were also held with other university administrators to solicit the perspective of outsiders regarding the CRSP's impact on strengthening research and teaching capacity at SUA. Further, face-to-face interviews with 'second-generation trainees' were held on July 17, 2006 at Selian Agricultural Research Institute (ARI) and at the Tropical Pesticide Research Institute (TPRI) in Arusha, Tanzania to determine multiplier impacts of the CRSP training investment.[16]

F. Limitations of the Study

In assessing the impact of training, the study acknowledged several issues and problems that inherently limit the analysis.

First, because the lags involved in observing the impacts of training on final outcomes are substantial, it takes many years for the true quality and value of training to become evident.

Second, it is difficult to attribute outcome 'effects' to a particular training 'cause'. This is because there are many unaccounted external factors that affect impact, including

[15] See Appendix 6 for a complete list of participants.
[16] Second-generation trainees refer to students directly trained or supervised by former B/C CRSP trainees.

the quality of training and the extent to which the trainees apply their KSAs to generate impacts. Moreover, it is difficult to isolate the contribution of GDT sponsored by the CRSP from training received elsewhere.

Third, this study also anticipated the problem of separating training outputs and research outputs, since the CRSP sees training as an inherent component of the research program. For the sake of simplicity, this study assumed that training prepares individuals to utilize enhanced research methods. Therefore, enhanced research capacity can be attributed to improved individual capacity, as a result of training.

Fourth, the study recognizes that identical sets of indicators may not be applicable for all disciplines. Thus, the linkages between outputs and impacts may well differ across academic fields and discipline.

Finally, the study anticipated several sources of survey errors. These errors can be grouped into three major categories – coverage, non-response, and measurement (Couper, 2000). Coverage error is considered one of the biggest problems in doing a web survey, as it represents the divergence between the target population and the frame population. The target population is the ideal set to which the study wants to make an inference; a frame population refers to the "materials or devices which delimit, identify and allow access to the elements of the target population" (Wright & Tsao, 1983). In this study, the target population is the 187 former CRSP trainees who completed their graduate study in the U.S. However, our frame population was limited to 126 trainees (67% of the target population) for which valid e-mail addresses were obtained. Individuals who were not contacted included trainees without e-mail addresses. Further, because trainees from the

U.S. usually have better access to internet than their counterparts from developing countries, the sample population may not be fully representative of the target population.

Non-response error, sometimes considered a selection bias, is expected when certain groups of individuals return the survey and other groups do not. This leads to problems with statistical inference and with the robustness of results. For example, trainees who do not want to divulge their income status may choose to ignore the survey, despite guarantees of strict confidentiality. The study also anticipates a positive response bias from Michigan State University (MSU) alumni. As the e-mail was sent using MSU e-mail address of the researcher, MSU alumni are more likely to respond to an e-mail message from MSU. A positive bias is also expected for trainees who are still active with the CRSP.

Measurement error refers to the deviation of the respondent's answers from their true values (Couper, 2000). This could arise from the respondent's lack of motivation, problem in comprehension, or deliberate distortion of answer. It could also arise from the survey questionnaire's poor wording or design or from technical problems encountered while answering the survey.

CHAPTER V
Results: Trainees

A. Internet Search

The internet search confirmed probable matches for 136 (73%) of the 187 trainees (Table 6). Thirty (16%) cases were inconclusive, as the information obtained was insufficient to confirm a correct match. For another 21 (11%) trainees, no positive matches were found. For these matched individuals, the internet search found information such as the trainees' names referred to in research papers; journal articles or books written or co-authored by trainees (34%); and their names listed in national or international conferences programs (25%), institutional directories or personal web pages (69%), and in news articles (38%) citing or reporting trainees' activities and accomplishments.

Table 6. Results of Internet Search Impact for Trainees

Internet Search Result	**Female**	**Male**	**Total**	**Percent**
No hit	10	11	21	11%
Positive hit	53	83	136	73%
Inconclusive	15	15	30	16%
Number of trainees (with at least one hit)				
Publication	23	41	64	34%
Award	3	6	9	5%
Conference papers/programs	16	31	47	25%
News articles	22	49	71	38%
Directory/Has personal webpage	50	79	129	69%

B. Descriptive analysis of respondents

Seventy-six trainees (60%) returned the e-mail survey. From this total, 73 sent their completed questionnaires by e-mail, one returned it by regular post mail, one returned it by fax, and another personally gave the researcher a hard copy of the completed questionnaire. Table 7 provides an overview of the sample, based on those who responded to the survey. More than one-half of the respondents were male (66%), from host countries (55%), and had specialized in plant science discipline (61%). About 62 percent of the respondents were supported for Ph.D. degrees, while 46 percent were fully funded by the CRSP during their graduate study.

Although a higher response rate was expected from U.S. citizens, with the assumption that they had better access to the internet, the response rate did not differ much between U.S. trainees (62% response rate) and host country nationals (59% response rate). As expected, the response rate was highest for trainees who were fully funded (74% response rate) for the duration of their graduate study, compared to trainees who were partially (59% response rate) or indirectly (39% response rate) supported by the CRSP. More than 75 percent (17 out of 22) of the social science trainees responded to the survey. Furthermore, 11 out of these 17 received their degrees from Michigan State University, all in the Department of Agricultural Economics. A major reason for this high response rate was because the study was supervised by a professor from the Department of Agricultural Economics. While more males (62%) responded to the survey, there appears no large difference in the response rates by gender. Finally, almost all trainees (17 out of 19, 89%) who finished their degrees in the last three years returned the questionnaire.

Table 7. Overview of the B/C CRSP trainee respondents

Region	Target population	%	Frame population	%	Respon-dents	%	Response Rate[b/]
Latin America	56	30%	41	33%	23	30%	56%
East/South Africa	25	13%	18	14%	10	13%	56%
West Africa	17	9%	12	10%	9	12%	75%
U.S.	89	48%	55	44%	34	45%	62%
Discipline							
Food Science	39	21%	21	17%	13	17%	62%
Plant Science	123	66%	83	66%	46	61%	55%
Social Science	25	13%	22	17%	17	22%	77%
Highest B/C CRSP-supported degree							
Ph.D.	95	51%	71	56%	44[a/]	58%	62%
M.S.	92	49%	55	44%	32	42%	58%
Funding							
Indirect	35	19%	28	22%	11	14%	39%
Partial	80	43%	51	40%	30	39%	59%
Full	72	39%	47	37%	35	46%	74%
Gender							
Female	78	42%	45	36%	26	34%	58%
Male	109	58%	81	64%	50	66%	62%
Grant Period							
1 (1981-1986)	46	25%	22	17%	14	18%	64%
2a (1987-1997)	93	50%	62	49%	30	39%	48%
2b (1998-2002)	28	15%	23	18%	15	20%	65%
3 (2003-2005)	20	11%	19	15%	17	22%	89%
Total	**187**		**126**		**76**		60%

a/ This number represents the trainees' highest CRSP-supported degree. Many trainees who were supported for their M.S. degrees had gone on to continue studying for their Ph.D. degrees with financial support from other sources. Considering the highest degree received by trainees, regardless of funding source, 58 (76%) respondents have Ph.D. degrees and 18 (24%) have M.S. degrees.
b/Percent of frame population who returned the questionnaire.

Given the divergence between the target population (N=187), frame population (N=126) and the trainees who returned the survey (N=76), an effort was made to see how the characteristics of the sample respondents differed from the characteristics of the target and frame population. Such an assessment is needed in order to determine if the respondents were representative of the target population – a requirement for making meaningful inferences about the target population. The percentage of trainees who responded by region was very similar compared to the target and frame population. However, a higher percentage of trainees from the social science trainees (77%) returned the survey, compared to the target (13%) and frame (17%) populations. Although the percentage of male respondents (66%) closely represents the frame population (64%), men were over represented compared to the target population (58%). Also, a greater percentage of trainees who were fully supported (74%) during their CRSP training returned the survey, compared to the target (39%) and frame (37%) populations. The percentage of respondents supported for their Ph.D. degrees (62%) closely matched the frame population (56%), but was slightly higher compared to the target population (51%). While the make-up of the frame population by grant period mirrored the target population, trainees who finished their degrees recently (2003-2005) were slightly more represented among trainees who returned the questionnaire.

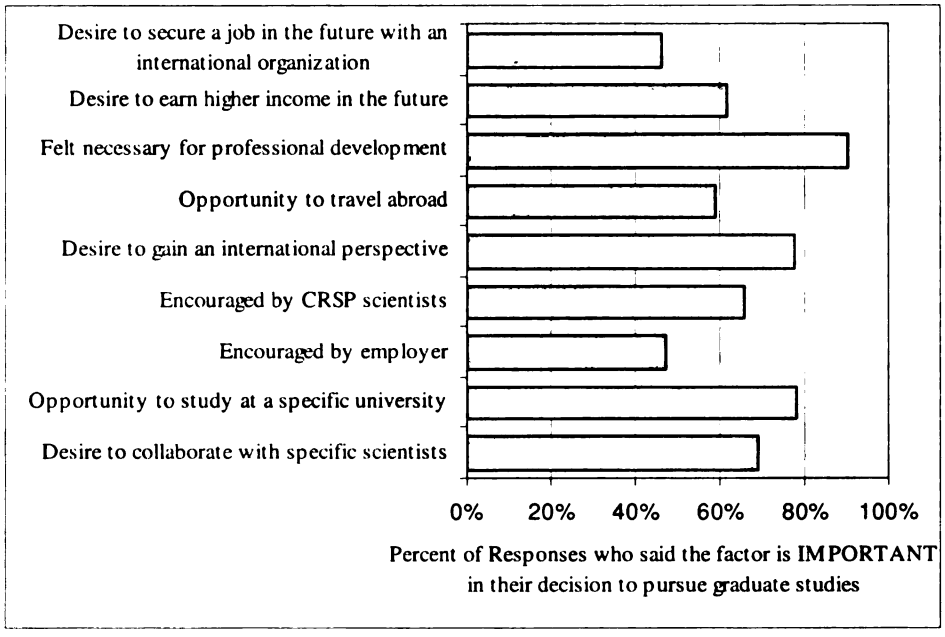
These results were not surprising and confirmed a priori. Trainees who were fully supported would be more likely to respond to a request coming from the CRSP than those who were indirectly or partially supported. Also, trainees with higher degrees would be more likely to return the survey because a higher degree correlates to other factors such as possibly greater knowledge, greater appreciation of the importance of studies like this,

higher income, and better access to the internet. Further, trainees who finished their degrees recently would be more likely to participate because of their recent affiliation with the CRSP. Thus, while the characteristics of the respondents diverged slightly from the target and frame populations, the respondents are generally representative of the CRSP graduate degree training participants. Despite the above described limitations, the survey provided valuable information about CRSP trainees GDT experience.

C. Decision to pursue the CRSP-funded graduate degree in the U.S.

The questionnaire asked respondents to rank factors that influenced their decision to pursue a CRSP-funded graduate degree. For this question, several possible reasons were listed and the respondent was asked to rank each factors on a scale from 1 (very important) to 4 (not important). Most trainees -- both male (91%) and female (88%) -- felt that that graduate degree training (GDT) was necessary for their professional development. Also high on the list was the opportunity to study at a specific university (78%) (usually at the home university of the recruiting US-PI), as well as the desire to gain an international perspective (78%). Other factors that respondents considered important in their decision to take advantage of the CRSP training opportunity are presented in Figure 4. The factor ranked lowest by women respondents (68%) was 'being encouraged by employers', while more male respondents (58%) ranked the "desire to secure a job with an international organization" as least important.

Figure 4. Question: How important was each of the following in your decision to pursue this CRSP-funded graduate degree in the U.S.?



D. Trainee assessment of graduate program and their CRSP research

Following Kirkpatrick's model, questions were included to determine trainees' general satisfaction with their GDT (Reaction). Separate questions were included to allow trainees to assess the relevance of the trainees' graduate degree program coursework and their CRSP research on both their personal and professional lives. Almost all respondents considered their graduate program (97%) and CRSP research (99%) as interesting and challenging, that they receive sufficient professional guidance from their CRSP supervisors (86%) and major professors (95%), that their graduate program (92%) and CRSP research (83%) was relevant to their current work/job responsibility, and that their graduate program (100%) and CRSP research (97%) provided excellent preparation for their future work.

Overall, more men "agreed" or "highly agreed" to the list of positive statements about their academic program and CRSP research. All male respondents (100%) felt that: (1) the graduate program provided excellent preparation for their future professional work; (2) the CRSP research provided an opportunity to gain valuable professional expertise and experience; (3) the CRSP research was interesting and challenging; (4) the work requirements of the CRSP research were reasonable; (5) and that the CRSP research provided excellent preparation for their future professional work.

This high satisfaction rate was comparable to several studies on graduate degree evaluation. In a survey by the Graduate Division of the University of California Santa Barbara (UCSB), 92 percent of respondents were "satisfied" to "very satisfied" with their UCSB over-all graduate experience[17]. Among Ph.D. recipients, 95 percent were "satisfied" to "very satisfied" with their overall academic experience. In the Fulbright Student study, 92 percent of the respondents were "mostly" or "very satisfied" with their grant experiences and almost 95 percent said their experiences gave them greater insight into their professional fields and contributed to their subsequent educational or career choices and decisions.

Only 11 respondents (14%) reported having had some academic-related problems during their GDT. Out of the 11, five respondents felt that they did not have a good working relationship with their adviser or major professor. Over one-half (59%) of the respondents were married during their CRSP-funded GDT and 33 (43%) respondents had at least one child. Moreover, majority of the respondents had their spouses (32 out of 45, 71%) and their children (24 of 33, 73%) living with them during their training. Having children was positively correlated with experiencing non-academic problems during their

[17] http://www.graddiv.ucsb.edu/study/climate/gas.htm) Last accessed: October 2006)

graduate study (1% significance level). Thus, it was not surprising that about one quarter of the respondents (29%) reported non-academic related problems -- usually involving family or financial matters. Further, a correlation analysis indicated that trainees who reported non-academic problems also reported academic problems (1% significance level).

E. Acquisition of KSAs

Trainees must first acquire the knowledge, skills, and attitudes (KSAs) from the training program before any impacts can occur. This section looks into the second level or the learning stage of the Kirkpatrick's model. The goal was to identify the KSAs acquired during training and determine any problems encountered by trainees during their training. To meet this goal, respondents were asked to identify the three most important KSAs that they acquired during their GDT.

Seventy-five out of 76 respondents identified at least one KSA acquired during their GDT. Because the question presented some concrete examples of KSAs, most of the answers revolve around them.[18] While this format possibly introduced some bias, it helped respondents to better understand the question, as the pre-test found that it was difficult for respondents to identify a specific KSA. Only two additional categories were identified by the respondents -- the ability to do statistical analysis and an increased international focus. Also, because it is difficult to attribute a KSA to a specific graduate

[18] Sample KSAs -- e.g., designing/conducting/analyzing scientific research, scientific methods/tools, attitude towards work, computer skills, critical thinking, time management, language fluency, communication skills -- were based on previous studies on impact assessment. These were the KSAs most commonly reported by respondents.

degree (M.S. or Ph.D.), respondents were asked to consider the KSAs acquired from the highest degree they attained, regardless of funding source.

Important KSAs which respondents reported that they acquired during GDT are reported in Table 8. Overwhelmingly, trainees considered the ability to "design/ conduct/analyze scientific research" (87%) as the most important KSA acquired from their GDT. About one-half (51%) reported "analytical/critical thinking" in solving problems, followed by "scientific methods and tools" (47%). Nearly one-third of the respondents cited "language fluency and communication skills". This is not surprising, since about one-half of the respondents were from Africa and Latin America. Similarly, about one-third of the trainees identified "attitude towards work/collaborative work" as an important KSA. This was likely due to their exposure to the CRSP model of research collaboration. These acquired KSAs were reaffirmed during the visit (case study) at Sokoine University of Agriculture (SUA).

Table 8. Most important KSAs acquired during graduate degree training[a\]

	Knowledge, Skills, and Attitudes	Number	Percent
1	designing/conducting/analyzing scientific research	66	87%
2	analytical/critical thinking	39	51%
3	scientific methods/tools	36	47%
4	language fluency/communication skills	27	36%
5	attitude towards work, collaborative work	25	33%

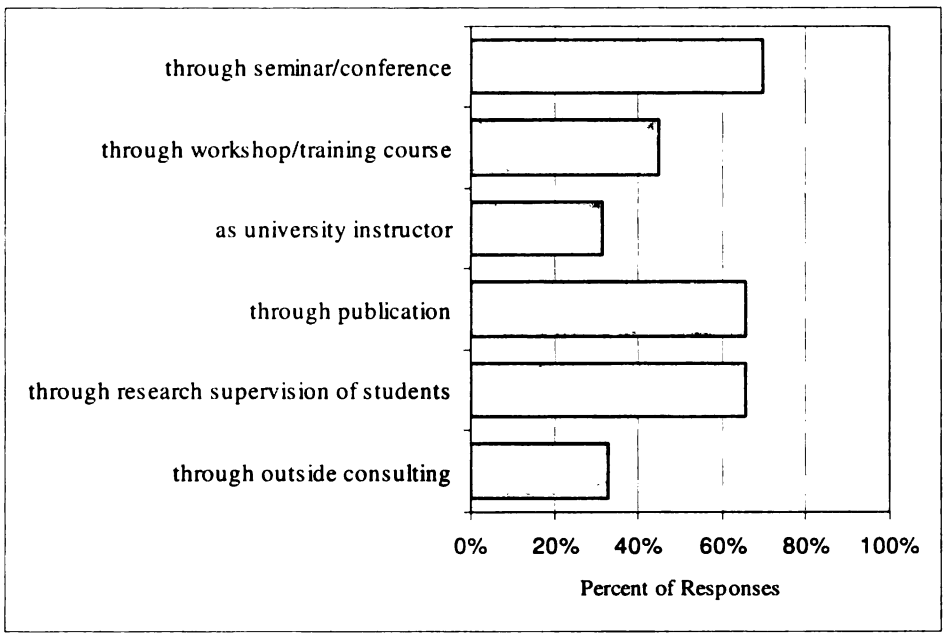
a\ According to frequency of mention; Total number of responses = 221 out of 76 respondents

F. Employment Details

Respondents were asked if they encountered any problems in applying these KSAs in the job that they held immediately after receiving their highest degree. This question attempted to find out if trainees were able to apply their acquired KSAs in their profession, as part of the Performance level of the Kirkpatrick's model. About one-fifth (18%) of the respondents reported having problems in applying their acquired KSAs in their workplace. Problems cited included a lack of support or interest from colleagues (3%) and a lack of infrastructure/equipment (7%). Several respondents (8%) changed their line of work and, consequently, were not able to apply their acquired KSAs.

To validate respondents' answers on previous questions on KSAs, trainees were asked to select from a list of specific choices how they applied the acquired KSAs. Trainees provided 255 responses to this question, an average of three answers per respondent. About two-thirds of the trainees said that they shared their KSAs through seminar/conference (70%), research supervision of students (66%), and publication (66%) (Figure 5). This finding implies that many of the former trainees are or have been university professors with the capacity to supervise students' research or that many are or were active in research after completing their graduate training.

Figure 5. Question: How have you shared your knowledge, skills, and attitudes with others?



Note: Total number of responses = 255 out of 76 respondents

1. Current Employment

Trainees were asked about their current or most recent employment. Eighty-eight percent of the respondents were currently employed, either full-time (84%) or part-time (4%). About one-half (48%) of the respondents were working in a host country. The largest share of trainees worked at universities (44%). Most were doing research (84%), coupled with some administration/management work (40%), while some were teaching (29%) in conjunction with their other assignments. Forty-nine percent of the currently employed respondents were still doing work related to beans/cowpeas. This continued effort on beans/cowpeas usually involved collaborative work on plant breeding/pathology. About 26 percent said that they supplemented their income from their primary job with outside consulting.

2. Employment after receiving highest degree

The respondents were asked to describe their employment details immediately after receiving their highest degree, and to skip the question if that job was the same as their current or most recent employment. Of the 67 trainees who indicated they are currently employed, 31 answered this question. Assuming that respondents did not intentionally skip this question, 54 percent of the trainees were still employed by the same institution at which they were employed immediately after receiving their graduate degrees.

While about 61 percent of the respondents worked in the U.S. immediately after receiving their highest degree, most of whom (84%) were U.S citizens. About one-half (47%) of all respondents worked at a university, 43 percent did work related to beans/cowpea, and 27 percent said they supplemented their income from their primary job with outside consulting.

3. Employment before starting graduate program

The questionnaire also solicited information from the trainees about their employment before they began their graduate studies. Prior to their GDT, most were either employed (74%) or were students (25%). Of those who were previously employed, the largest share worked for the government (41%) and worked in a developing host country (66%). Slightly more than one-half of the respondents noted that they were working on a bean/cowpea-related job prior to their GDT (52%). Understandably, a large number of the respondents (84%) did not have any outside consultancies before they

began their graduate program, since a graduate degree and extensive experience are often pre-requisites for outside consultancies.

4. Employment trends

Regarding their present employment location, almost all U.S. respondents were working in the U.S (97%) and most of the HC respondents were working in a host country (81%). Prior to their graduate study, HC trainees were mainly employed by the government (49%), the private sector (28%), or a university (24%). After their GDT, most HC trainees found work with the government (36%) or at a university (31%). In contrast, after completing their graduate degree, most U.S. trainees (63%) found work at a university, usually as professors/instructors. Before their GDT, a majority (59%) of the U.S. respondents were employed in the private sector.

While only 12 percent of the U.S. respondents worked on a bean/cowpea-related project prior to beginning their GDT, most of the HC trainees (71%) were previously working on a bean/cowpea-related project. Remarkably, 49 percent of respondents -- 69 percent of HC trainees and 23 percent of U.S. trainees -- continue to work on a bean/cowpea-related project.

G. Significance of degree level

This section analyzes the difference in impact according to the graduate degree obtained. As it is usually at least twice as expensive to fund Ph.D. degree training, compared to M.S. degree training, it is sometimes argued that training funds should be prioritized towards funding M.S. students.

This analysis makes a distinction between the highest CRSP-supported degree (M.S.=32, Ph.D.=44) and the highest degree obtained regardless of funding source (M.S.=18, Ph.D.=58). Fourteen respondents who were supported by the CRSP for their M.S. programs went on for Ph.D. degrees, with support from another funding source. Most of the M.S. respondents were from the U.S (61%), while most Ph.D. respondents come from host countries (60%) (Table 9). More than one-half of the respondents, both M.S. and Ph.D. trainees, specialized in plant science (e.g., plant pathology, plant breeding and horticulture)

- *Do M.S. trainees experience more problems during their GDT than Ph.D. trainees?*

There was no significant difference between the rates of academic (M.S.=17%, Ph.D.=14%) and non-academic (M.S=22%, Ph.D.=32%) related problems experienced by Ph.D. and M.S. graduates.[19] This implies that trainees in M.S. and Ph.D. programs encounter similar problems while studying in a U.S. university. Again, these problems related to family and financial problems and conflict with their supervisors.

- *Is there any difference in career advancement between M.S. and Ph.D. trainees?*

About half of the respondents with Ph.D. degrees currently work at a university (50%). This is not surprising, since a Ph.D. degree is usually a requirement for a job at a university, especially for academic positions. The other half of the respondents with Ph.D. degrees currently work for the government (23%), in the private sector, (9%), and at an international organization (12%). In contrast, 31 percent of the M.S. graduates were

[19] Pearson chi-square test confirms that the difference is not statistically significant between occurrence of non-academic problems and highest degree attained.

now working in the private sector, while 25 percent work for the government, 25 percent are at a university, and another 12 percent were at an international organization. Notably, most Ph.D. respondents (57%) were still active in beans/cowpeas-related activities, compared to only one-fourth of the M.S. trainees (24%). This difference is statistically significant at the 5 percent confidence level.

Table 9. Overview of the B/C CRSP trainee respondents, by highest degree[a\]

Gender	M.S.		Ph.D.		Total	
Female	9	50%	17	29%	26	34%
Male	9	50%	41	71%	50	66%
Region	**M.S.**		**Ph.D.**		**Total**	
LAC	5	28%	18	31%	23	30%
ESA	2	11%	8	14%	10	13%
WA	0	0%	9	16%	9	12%
U.S.	11	61%	23	40%	34	45%
Discipline	**M.S.**		**Ph.D.**		**Total**	
Food Science	5	28%	8	14%	13	17%
Plant Science	9	50%	37	64%	46	61%
Social Science	4	22%	13	22%	17	22%
CRSP Funding	**M.S.**		**Ph.D.**		**Total**	
Indirect	3	17%	8	14%	11	14%
Partial	6	33%	24	41%	30	39%
Full	9	50%	26	45%	35	46%
Total	**18**		**58**		**76**	
	24%		**76%**			

Note: a\ Highest degree reported by respondent, regardless of funding source

Only 6 percent of M.S. graduates sought outside consultancy to augment their income from their principal job, compared to 32 percent of the Ph.D. respondents. A correlation analysis affirmed that outside consultancy and highest degree attained is significantly correlated and the relationship is positive, meaning Ph.D. graduates are more likely than M.S. graduates to have outside consultancy projects.

While Ph.D. training is more expensive than M.S. training, Ph.D. graduates have greater impact in the long-run. First, most CRSP-funded Ph.D. graduates secured an academic position at a university. Consequently, they serve as multipliers, as generations of students are trained by CRSP trainees. Second, M.S. trainees, who most often took positions in the private sector, seldom continued to collaborate with their CRSP supervisor. Finally, a higher percentage of Ph.D. graduates continued to work in the field of beans/cowpeas. Thus, if the objective of the GDT program is to develop a cadre of developing country scientists who continue to conduct bean/cowpea-related research, investing in Ph.D. training is a high priority endeavor.

- *Do M.S. graduates have more or less difficulty in applying their knowledge and skills at their workplaces?*

More Ph.D. respondents (22% versus 6% for M.S. respondents) indicated problems in applying their acquired KSAs. The differences in the jobs that Ph.D. versus M.S. respondents took after completing their GDT may have been a factor in trainees' difficulties in applying their acquired KSAs. Common problems that respondents identified related to a lack of resources (funding, equipment, and infrastructure) to carry out their work responsibilities.

H. Gender considerations of training

This section assesses the differences in impact according to gender. Although the number of male respondents was about twice the number of female respondents, there was no major difference in response rates by gender (Female: 58%, Male: 62%). The number of male respondents who earned Ph.D. degrees was about twice the number of women (Table 10). Not surprisingly, 65 percent of women respondents were from the U.S. About one-half of the female respondents were partially supported (50%) by the CRSP, whereas slightly more men were fully supported (52%) to pursue their graduate studies.

- *Do women trainees experience more problems during their GDT than men?*

The questionnaire asked whether trainees experienced any problems during their graduate study. For academic-related problems, there was no difference between the rates experienced by men (14%) and women (15%). However, for non-academic problems, more men (39% versus 12% for female respondents) admitted to having problems while studying.[20] Problems cited usually involve money or financial hardship (36%). Some also mentioned the difficulty of being apart from family members while studying (43%). The higher rate (non-academic problems) for male respondents was not surprising because 40 percent of the male respondents had children living with them during their GDT, compared to only 15 percent of the female respondents.

[20] Pearson chi-square test confirms that the difference is statistically significant at 95 percent confidence.

Table 10. Overview of the B/C CRSP trainee respondents, by gender

Region	Female		Male		Total	
LAC	6	23%	17	34%	23	30%
ESA	1	4%	9	18%	10	13%
WA	2	8%	7	14%	9	12%
U.S.	17	65%	17	34%	34	45%
Discipline	**Female**		**Male**		**Total**	
Food Science	8	31%	5	10%	13	17%
Plant Science	14	54%	32	64%	46	61%
Social Science	4	15%	13	26%	17	22%
CRSP funding	**Female**		**Male**		**Total**	
Indirect	4	15%	7	14%	11	14%
Partial	13	50%	17	34%	30	39%
Full	9	35%	26	52%	35	46%
Highest Degree	**Female**		**Male**		**Total**	
Ph.D.	17	65%	41	82%	58	76%
M.S.	9	35%	9	18%	18	24%
Total	**26**		**50**		**76**	
	34%		66%			

- *Are there differences in career advancement between men and women?*

A majority of the female respondents (62%) were working at a university, compared to 38 percent of the male respondents. This may suggest that there is a wider array of jobs available to men outside the university system, or that women prefer university jobs rather than working for the government or the private sector. Further, only 8 percent of the female respondents (versus 35% for male respondents) secured outside consulting opportunities to augment their principal job. In addition, a smaller percentage

of female trainees were still working in a bean/cowpea-related field (39% versus 55% for male respondents).

- *Do women have more or less difficulty in applying their KSAs in their workplaces?*

The questionnaire asked whether trainees experienced any problems in applying their acquired KSAs in their workplaces. A smaller portion of female respondents (12% versus 22% for male respondents) said they had problems applying their acquired KSAs. While this was incongruent with the ATLAS/AFGRAD study -- which found that women had more difficulty in applying KSAs than men -- the differences in the jobs that male and female respondents take (e.g., 31% of female respondents earned food science degrees versus 10% of male respondents) after completing their GDT may have been a factor in trainees' difficulties in applying their acquired KSAs. Also, all of the ATLAS/AFGRAD trainees were from Africa, while 45 percent of CRSP respondents were from the U.S. -- 65 percent of which are female trainees.

I. Significance of field of study

This section assesses the differences in impacts by discipline or field of study. Fields of study are broadly grouped into three categories: plant science (PS), food science (FS) and social science (SS). As a majority of CRSP trainees were in the field of PS, it is not surprising that more than one-half of the respondents specialized in this field (61%) (Table 11). Most of the PS and SS respondents came from LAC and the U.S, while most FS trainees were from the U.S (69%). More than 60 percent of the FS respondents were female, while about three-fourths of the PS (70%) and SS (76%) respondents

were male. Sixty-two percent of the FS trainees were fully supported, compared to 46 percent for PS, and 35 percent for SS.

Table 11. Overview of the B/C CRSP trainee respondents, by field of study

Gender	Food Science		Plant Science		Social Science		Total	
Female	8	62%	14	30%	4	24%	26	34%
Male	5	38%	32	70%	13	76%	50	66%
Region	**Food Science**		**Plant Science**		**Social Science**		**Total**	
LAC	1	8%	16	35%	6	35%	23	30%
ESA	1	8%	7	15%	2	12%	10	13%
WA	2	15%	5	11%	2	12%	9	12%
U.S.	9	69%	18	39%	7	41%	34	45%
CRSP Support	**Food Science**		**Plant Science**		**Social Science**		**Total**	
Indirect	1	8%	7	15%	3	18%	11	14%
Partial	4	31%	18	39%	8	47%	30	39%
Total	8	62%	21	46%	6	35%	35	46%
Highest Degree	**Food Science**		**Plant Science**		**Social Science**		**Total**	
M.S.	5	38%	9	20%	4	24%	18	24%
Ph.D.	8	62%	37	80%	13	76%	58	76%
Total	**13**		**46**		**17**		**76**	
	17%		**61%**		**22%**			

- *Are there differences in problems experienced by discipline?*

Trainees in PS experienced higher rates of both academic (20%) and non-academic problems (37%), followed by SS respondents (13% academic, 25% non-academic). Surprisingly, not a single one in the FS indicated having faced academic-related problems, and only one respondent reported facing non-academic problems. However, these differences may be due to factors unrelated to a trainee's discipline. For example, 69 percent of the FS respondents were from the U.S., compared to 35 percent of the PS respondents. Thus, it is likely that FS trainees were better prepared for GDT than PS trainees, more likely to be fluent in English, and faced fewer cultural adjustment problems than PS respondents.

- *Are there differences in career advancement by discipline?*

There were minimal differences by discipline, regarding where trainees found employment after their graduate program. The largest share of the PS (50%) and SS (40%) trainees are now working at a university, while most of the FS trainees (46%) are employed in the private sector. Remarkably, more than one-half of the PS respondents (61%) are still active in beans/cowpeas-related research, compared to 41 percent of the SS and only 17 percent of the FS respondents. Furthermore, about one-third of the FS (33%) and PS (28%) trainees reported having outside consultancy projects, compared to 13 percent of the SS trainees.

- *Are there differences in the level of difficulty in applying KSAs at workplace by discipline?*

The PS graduates reported experiencing the most problems (11 of 46, 24%) in applying their acquired KSAs after completing their GDT – mostly due to a lack of resources, particularly laboratory equipment. Again, no trainee in FS reported difficulty in applying their KSAs. Similarly, these differences may be due to factors unrelated to a trainee's discipline. To highlight, more than half of the PS graduates (57%) are employed in a host country, while almost all of the FS respondents (92%) are employed in the U.S. Thus, it is likely that FS trainees have better working conditions in better equipped offices. On the other hand, laboratory equipment is expensive and is not readily available in most developing countries.

J. Significance of participant location

An important purpose of this assessment is to analyze differences in impact by trainees' region of origin. Since 1980, the CRSP has supported collaborative projects in LAC, ESA, WA, and the U.S -- the main bean/cowpea-consuming regions of the world.

- *Are there differences in problems that trainees experienced by location?*

More international trainees (18% LAC, 30% ESA, 11% WA) reported having academic problems than U.S. trainees (9%). The differences were even greater for non-academic problems -- 23 percent of the LAC trainees, 70 percent of the ESA trainees and

44 percent of the WA trainees reported experiencing non-academic related problems (e.g., financial and family) versus 18 percent of the U.S. respondents.[21]

- *Are there differences in career advancement by location?*

There were differences by location regarding where trainees found employment after completing their GDT. Most U.S. (66%) and ESA (70%) respondents are now working in universities, while the largest share of the LAC (45%) and WA (35%) trainees are employed by the government. Overwhelmingly, most HC trainees (69%) are still active in beans/cowpeas research (74% LAC, 60% ESA, 67% WA), compared to only 23 percent of U.S. trainees. Furthermore, 31 percent of the HC respondents have outside consulting jobs (10% LAC, 56% ESA, 56% WA), compared to 19 percent for U.S. trainees. To a large extent, these differences reflect where the trainees were recruited, as most trainees returned to the institution where they worked (e.g., university, NARS) prior to beginning their GDT.

- *Are there differences in the level of difficulty in applying KSAs at workplace by location?*

As expected, HC respondents reported more problems in applying their acquired KSAs (26% LAC, 20% ESA, 22% WA) than U.S. trainees (12%). Although many of the HC respondents reported difficulties in applying their KSAs due to resource constraints, two of the four U.S. graduates who reported problems said they do not need the acquired KSAs for their current job.

[21] Pearson chi-square test confirms that the difference between the number of non-academic related problems faced by U.S. and HC trainees is statistically significant at 95 percent confidence.

K. Significance of type of employer

The ATLAS/AFGRAD study found that participant location can be an indicator of potential impact and the level in which impact takes place. The findings reported in the previous section showed that many of the graduates were currently working at a university (44%), for the government (24%), in the private sector (14%), and at international organizations (13%). Almost all (82%) of the respondents who were working for the government continue to work on a bean/cowpea-related project, compared to 44 percent for trainees at universities, 20 percent for trainees in the private sector, and 33 percent for trainees at international organizations. Twenty-two percent of trainees working in the private sector and about one-third of trainees working at a university (32%) and for the government (31%) had outside consultancies. For government and university employees, low salaries possibly drive trainees to seek outside consultancies.[22] On the other hand, trainees employed at international organizations do not have outside consultancies.

L. Monetary and Non-monetary Impacts of Training on Participants

Employing the Kirkpatrick Model, two types of impacts on individual trainees were assessed -- monetary and non-monetary.

1. Monetary Impacts

Monetary benefits, such as salary and outside consulting opportunities, are the easiest to quantify, but usually difficult to obtain because many people consider this to be

[22] A correlation analysis confirmed the negative relationship between income level and having outside consultancies. This suggests that the higher the trainees' income, the less likely the respondents sought consultancies. This is statistically significant at 0.05 confidence level.

a sensitive question. Respondents were asked to approximate the annual salary (US$) that they earned from their previous job (i.e., job prior to GDT), their first job after completing their GDT, and their current job. Remarkably, 62 of the 76 respondents (82%) provided salary details for their current or most recent job. Of the 67 who were employed before they began their GDT, 42 trainees (75%) provided information on their prior salary.[23]

Table 12 shows the salary levels of former trainees in three different periods -- prior to their graduate study (Before), immediately after receiving their highest graduate degree (After), and their current or most recent employment (Current). Not surprisingly, prior to their GDT, a large share (64%) of the trainees earned less than US$15,000 per year. At their present or most recent employment, majority (73%) of the respondents reported earning more than US$15,000. Moreover, 62 percent of U.S. trainees reported earning more than US$60,000 per year.

As the cost of living and the salaries differ widely, it is necessary to distinguish between salaries received by HC and U.S. nationals. The average current salary of a U.S. trainee is double the average salary of a HC trainee. As expected, the acquisition of a graduate degree greatly increased trainees' salaries – both for U.S. and HC nationals. Prior to GDT, 78 percent of HC nationals and 40 percent of U.S. nationals were earning less than US$15,000 per year. At their present or most recent employment, 57 percent of HC nationals and 97 percent of U.S. nationals were earning more than US$15,000 a year. For U.S. trainees, their average salary increased by 298 percent (Before versus Current),

[23] To avoid having to convert local currencies to US$, respondents (for trainees who were employed in a host country) were asked to estimate their salary in US$. However, the questionnaire did not specify if the trainees should use the current exchange rate or the exchange rate that prevailed during their past employment.

compared to 246 percent for HC trainees. Accounting for inflation, real wages for U.S. nationals increased by about 160 percent from 'Before' to 'Current' salary level.[24]

Table 12. Salary levels (in nominal US$), by period and by location (HC/U.S.)

		Before		After		Current	
		Number	Percent	Number	Percent	Number	Percent
HC	<15,000	21	78%	4	33%	16	43%
	15,000-35,000	5	19%	4	33%	6	16%
	35,000-45,000	0	0%	3	25%	3	8%
	45,000-60,000	1	4%	1	8%	3	8%
	>60,000	0	0%	0	0%	9	24%
HC	**Total**	**27**		**12**		**37**	
	Average Annual Salary	**$9,454**		**$23,408**		**$32,723**	
U.S.	<15,000	6	40%	1	7%	1	3%
	15,000-35,000	9	60%	6	40%	0	0%
	35,000-45,000	0	0%	2	13%	6	21%
	45,000-60,000	0	0%	3	20%	4	14%
	>60,000	0	0%	3	20%	18	62%
U.S.	**Total**	**15**		**15**		**29**	
	Average Annual Salary	**$19,003**		**$41,109**		**$75,650**	
	Real Salary (2005=100)	$29,130		$47,203		$75,746	
ALL	<15,000	27	64%	5	19%	18	27%
	15,000-35,000	14	33%	10	37%	6	9%
	35,000-45,000	0	0%	5	19%	8	12%
	45,000-60,000	1	2%	4	15%	7	11%
	>60,000	0	0%	3	11%	27	41%
ALL	**Total**	**42**		**27**		**66**	
	Average Annual Salary	**$12,864**		**$33,242**		**$51,585**	

Note: Salaries that trainees reported Before and After GDT refer to different years.

[24] Ideally, the real salary data should be used to estimate salary increases. However, for HC nationals, it is difficult to estimate real salaries because of uncertainty regarding the foreign exchange rates that should be used. Thus, the analysis only calculates real values for salaries received by U.S. nationals in US$.

However, all of the difference between the salaries that the trainees earned prior to GDT, compared to their current salaries, can not be attributed to training. First, salaries that trainees reported prior to GDT are for different years. Also, even if the trainees had not earned a graduate degree, their salaries would have increased due to additional time in service. Finally, trainees reported their salaries prior to and after GDT in nominal dollars. Thus, some of the increase in their salaries can be attributed to inflation.

The difference in salaries received by respondents was also analyzed based on the academic degrees they received. Because salaries of U.S. and HC nationals diverged greatly, the two groups were analyzed separately. Table 13 illustrates the increase in salaries from B.S. to M.S. to Ph.D. Before GDT, a HC respondent with a B.S. degree earned (on average) about US$9,000 a year. At their present or most recent employment, HC respondents with M.S. degrees earned US$21,000 a year, while those with Ph.D. degrees earned US$35,000 a year. On the other hand, U.S. nationals with a B.S. degree earned about US$19,000 a year prior to GDT. At their present or most recent employment, U.S. trainees with a M.S. degree earned US$65,000 a year, while those with Ph.D. degrees earned US$81,000 a year. These numbers represented an increase of about 180 percent from B.S. to M.S. and about 300 percent increase from B.S. to Ph.D. Interestingly, the difference between HC and U.S. salaries decreased with a Ph.D. degree.

Table 13. Current average salary of trainees, by academic degree (in US$)

Degree[a\]	HC		U.S.		(HC-U.S.)
	n	Average	n	Average	% diff
B.S. (a)	27	$ 9,454	15	$ 19,003	101%
M.S. (b)	5	$ 20,688	10	$ 64,932	214%
Ph.D. (c)	32	$ 34,604	19	$ 81,290	135%
% difference B.S. to M.S. [(b-a)/a]		119%		242%	
% difference B.S. to Ph.D. [(c-b)/b]		266%		328%	

Note: B.S.=salary received by trainees in the job they held prior to GDT, M.S.=Current salary of trainees with M.S. degrees, Ph.D.=Current salary of trainees with Ph.D. degrees; n = number of respondents.

In addition, the survey asked HC trainees to approximate the average annual entry salary for nationals who received their academic degrees in the U.S. and from a local university. Table 14 presents these data by region, by degree, and by university location. The wage differentiation between U.S. degrees and degrees (B.S., M.S., Ph.D.) earned from a local university is greatest (222% - 249%) in the WA region. Similarly, there is a wage premium (53% - 75%) in LAC for U.S. graduates. On the other hand, in ESA, there appears to be no wage differentiation for a degree earned in the region, versus a U.S. degree. Also, because the entry level salary in Table 14 does not consider the years of experience or level of expertise of a host country national, the numbers are generally lower than the current salary reported by respondents in Table 13.

A less obvious monetary benefit to GDT is the opportunity to secure outside consulting opportunities, which enables trainees to supplement the salary that they receive from their primary job. While a majority of the respondents did not have outside projects, the percentage of trainees who secured outside consulting opportunities increased after their GDT (16% Before, 27% After, 26% Current). However, some

trainees may not have pursued consultancies because their employer does not allow outside consulting or consulting opportunities were not available.

Table 14. Trainees' estimate of entry level annual salaries paid to U.S. and local graduates, by region and by degree (approximate in current US$)

	Entry Level Annual Salary				
	(a)		(b)		[(b-a)/a]
Region	Local B.S.	n	U.S. B.S.	n	Difference (%)
LAC	$ 7,435	15	$ 13,037	12	75%
ESA	$ 1,941	7	$ 1,941	7	0%
WA	$ 2,063	4	$ 6,650	5	222%
Average	**$ 5,130**	**26**	**$ 8,470**	**24**	65%
Region	Local M.S.		U.S. M.S.		
LAC	$ 11,943	15	$ 18,782	13	57%
ESA	$ 3,076	7	$ 3,076	7	0%
WA	$ 2,825	4	$ 9,860	5	249%
Average	**$ 8,153**	**26**	**$ 12,600**	**25**	55%
Region	Local Ph.D.		U.S. Ph.D.		
LAC	$ 18,995	10	$ 29,067	14	53%
ESA	$ 4,486	7	$ 4,486	7	0%
WA	$ 3,775	4	$ 12,620	5	234%
Average	**$ 11,260**	**21**	**$ 19,286**	**26**	71%

Note: n= number of respondents

2. Non-monetary Impacts

Respondents were asked to describe and give concrete examples of any changes or impacts on their personal and professional lives that they could attribute to their CRSP-funded graduate degree. Sixty-four out of 76 respondents (84%) cited at least one positive impact of the GDT.

With respect to changes on their personal lives, most of the responses evolved around improved financial status, greater self-confidence, an opportunity to learn a second language, and winning new friends outside their home country (Table 15). Professionally, aside from the KSAs that they acquired from their GDT, trainees frequently reported that GDT was an important factor that enabled them to secure their desired job (Table 16). In addition, the respondents noted that their GDT helped them to develop or widen their professional networks, particularly among beans/cowpeas scientists. Further, many trainees reported that as a result of having been involved in research in a developing country, they were able to broaden their perspective on agricultural development.

Table 15. Selected changes/impacts on personal life reported by CRSP trainees

- I learned to appreciate diversity in all its aspects (cultural, ways of thinking, etc).
- It allowed me to become proficient in a second language.
- Conducting primary survey research in a poor country and seeing the challenging environment under which CRSP research was conducted has given me a "can-do" attitude that has benefited me greatly in my career.
- I am more confident academically and I have been receiving invitations to lecture in other universities within my country and outside Tanzania. This of course has meant more dollars in my pocket & indeed has greatly enriched my academic/professional life
- I grew a great deal as a person by wrestling with the challenges in my research. For sure, I gained a great deal of confidence.
- I had the opportunity to interact with people from other Latin American countries and understand their difficulties in promoting science in places where funding is a major constraint for research.
- I have met so many people from all over the world and learned to appreciate and respect all cultures. It has made me a better person by being more open to others.
- I was able to provide my children with the opportunities that would have not have been possible, had I not been associated with the university.
- My research was very intense. It challenged me to go beyond I ever thought I could achieve. It was an excellent learning experience and I am very thankful and grateful for the opportunity.
- I have developed a network with scientists from different disciplines and expertise. My current research is multidisciplinary because of earlier experiences built working with CRSP.
- The availability of CRSP funding was a major factor why I pursued a Ph.D. degree. I have a clearer perspective of nutritional problems that face developing countries.
- The CRSP-funded degree improved my life and that of my family, arising from higher income as a result of my Ph.D.. Personally, the higher degree has also put me on a higher pedestal as an opinion leader in my village and society.
- I came to graduate school with very little research experience. I left able: to read scientific articles critically; to develop ideas based on work in fields that were not my own; to make some headway in independent research.
- I have a healthy appreciation for beans! The international travel experience benefited me both professionally and personally. I never realized how important a staple beans are in the Latin American diet.
- It deeply broaden my knowledge and tolerance as far as working in a multi-cultural environment
- My interest in working in international organizations job has increased since I got engaged on CRSP-funded research

Table 16. Selected changes/impacts on professional life reported by CRSP trainees

- I founded my own company due to my long standing interest in international development to contribute to improve food security and human health.
- I gained expertise in writing grants with international perspective and in obtaining externally funded projects.
- It taught me look at my work more critically.
- I am more confident academically and I have been receiving invitations to lecture in other universities within my country and outside Tanzania. This of course has meant more dollars in my pocket and indeed has greatly enriched my academic/professional life
- I have a faculty job. Without a Ph.D. that would be impossible
- I was able to see the impact of poverty on people's lives and better appreciate the value of my field in reducing poverty.
- My CRSP-funded degree had a major influence on my being hired with an international organization. I've been able to use my rigorous training with the CRSP at my current place of work.
- It enabled me to participate in field survey research and socio-economic assessment of bean technologies in the Dominican Republic and Honduras. It also provided incredibly valuable hands-on experience in assessing the impact of international development projects.
- The degree program sharpened my knowledge and adequately prepared me in the field of entomology. It also prepared me very well in scientific writing and I have since published my work in scientific journals
- The scientific training and communication skills development helped me to be successful in my current position. I have also trained scientist throughout the globe, thus, I was able to share my acquired knowledge to others.
- The training and the degree I received with CRSP funding opened professional doors for me and allowed me to get exactly the job I had always wanted.
- It gave me the opportunity to develop long lasting professional contacts and collaboration with bean scientists from other countries.
- It gave me more access to updated literature on agricultural technology and other development initiatives.
- Being involved on a collaborative project gave me a new perspective and broadened my view of how scientific communities can work together to reach common objectives.
- I helped establish a bean breeding program that is in place and successful until today.
- I had the opportunity to participate in international meetings which allowed me to meet highly recognized researchers

3. Achievements/Contributions

While the previous section looked into personal impacts of the GDT, respondents were also asked to describe their significant accomplishments -- especially those related to the beans/cowpeas sectors. This question sought to identify impacts of training beyond the individual level (i.e., Results evaluation stage of the Kirkpatrick model).

Because the question focused on accomplishments that only related to beans/cowpeas, fewer respondents answered this question. Forty-three out of 76 respondents (57%) reported at least one bean/cowpea-related accomplishment. Significant accomplishments that trainees cited include their role in the release of varieties, awards or recognition received from their bean/cowpea research, papers published, and the important positions or jobs they held as a result of their GDT (Table 17).

Because trainees frequently cited having papers or articles published as one of their achievements, research outputs from the trainees' CRSP-supported research (during their degree program) were analyzed. Most of the M.S. and Ph.D. trainees published their research in journals/books (83% for Ph.D., 58% for M.S.) and also presented their research at a conference/seminar (89% for Ph.D., 76% for M.S.). As expected, this impact is greater for Ph.D.-supported trainees.

Table 17. Selected professional accomplishments reported by CRSP trainees

- Advanced the knowledge of heat tolerant varieties adaptation in tropical areas of Senegal
- Developed a bean-based composite supplementary foods for undernourished children, now being commercialized
- Developed a simple method of screening beans for resistance to root-knot nematodes, identified high level of resistance for the first time and explained its genetic basis
- Development and release of several bean varieties which are currently among the most cultivated varieties in Latin/Central America
- Development of drought resistant black bean line that is used in breeding for yield in Latin America and the United States
- Helping a small business in USA to adopt the germination process that I co-developed. This process can be designed to produce flatulence-free bean flour for variety of food applications.
- Initiated an on-going lima bean breeding program at the University of Delaware
- Promoting production efficiency through introduction of new cultural techniques and technological inputs in Malawi
- Release of five common bean germplasm lines resistant to common bacterial blight
- Release of IPM strategies for cowpea production in Northern Cameroon; Release of bruchid resistant cowpea varieties; Release of sweet cowpea; release of 3 storage technologies
- Setting up the Agricultural Market Information System in Honduras
- Conducted an investigation into the inheritance of resistance to lima bean downy mildew (Phytophthora phaseoli) and presented results at the 2005 Bean Improvement Cooperative Meeting.
- Designed an IDB-financed Agricultural Research Fund in Guatemala
- External Adviser to Frito Lay Company on legume based snack project
- Identified serious diseases and prevented their spread therefore saving millions of pesos in yield losses in the San Juan Valley, the grain producer area in the Dominican Republic
- Received President award for science and technology
- Recognition for outstanding contribution to bean breeding in Mexico, 1999
- Award received from the University of Nebraska for contribution in bean research
- Editor of Special Edition on Beans of the Bunda Journal of Agriculture, Science and Technology
- Named Scientific Adviser to Pulse Innovation Project/Pulse Canada
- Received the 'Outstanding Ph.D. Thesis Award 2003' from the Dept. of Ag Economics, Michigan State University for my CRSP-funded dissertation research
- Commendation letter for best research at SUA, Certificate of recognition by USAID, Founder and Coordinator of the African Seed Health Center, Tanzania representative to the TC for Biotechnology Research and Policy Development for Eastern Africa (BIOEARN-SIDA)
- Responsible for the release of several new common bean varieties and coordinated two book publications on Common Beans in Brazil
- Appointed member of Technical Advisory Committee of the CGIAR from 1993 to 1997.

4. Significance of time/grant period on impacts

Because impacts require several years to be fully realized, data on selected impacts were tabulated by grant period [Grant 1 (1981-1986), Grant 2a (1987-1997), Grant 2b (1998-2002), and Grant 3 (2003-2005)] to assess impacts over time (Table 18). While graduates who finished their degrees most recently (2003-2005) reported fewer changes/impacts, a similar percentage of the respondents in the three earlier grant periods reported at least one professional accomplishment (57% - 67%), a change/impact on their personal life (71% - 80%), and a change/impact on their professional life (79% - 87%).

In monetary terms, Table 18 indicates that trainees who finished their degrees during the first grant period were currently earning a much higher income than trainees who finished their degrees most recently. On average, trainees from the first grant period currently earn US$71,000 a year (M.S.=$69,000, Ph.D.=$71,720), while recent graduates (2003-2005) are earning US$29,000 a year (M.S.=$21,000, Ph.D.=30,478). Across all grant periods, HC trainees currently earn substantially less than U.S. trainees, ranging from 39 percent (of U.S. trainee's average salary) for 1987-1997 graduates to 69 percent for 2003-2005 graduates. The differences in current salaries between grant periods were more pronounced for U.S. respondents. U.S. trainees who finished their GDT in the early 1980s were earning 130 percent more than recent graduates.

Table 18. Impacts by grant period

	1 1981-1986	2a 1987-1997	2b 1998-2002	3 2003-2005
Number of respondents	14	30	15	17
Reported at least one professional accomplishment (related to beans/cowpeas)	57%	60%	67%	41%
Reported at least one change/impact on personal life	71%	73%	80%	59%
Reported at least one change/impact on professional life	79%	80%	87%	65%
Average Current Salary (in US$)	$71,301	$55,746	$42,893	$28,755
By Degree				
M.S. trainees	$69,000	$58,640	$44,184	$21,000
Ph.D. trainees	$71,720	$54,957	$42,175	$30,478
By Location				
HC trainees	$41,720	$33,730	$31,883	$26,589
U.S. trainees	$89,790	$85,100	$53,903	$38,500

M. Returned to home country

Brain drain is a matter of concern to program administrators and donors, since the goal of capacity building in developing countries is not achieved if trainees stay in the U.S. Incidental evidences indicate that some students from developing countries who earn graduate degrees in the U.S. do not return home because political strife and instability make it impossible for them to work or even live peacefully back in their home country, while others do not return due to very low wages and poor socio-economic

conditions. However, the apprehension about brain drain, particularly in Africa, is not supported with reliable data.[25]

Table 19 presents an overview of HC trainees who returned and did not return to their home country after finishing their highest degree in the U.S. The questionnaire asked trainees if they returned to their home country immediately after the GDT and if not, where they went and why they did not immediately return to their home country. It is important to note that while some former trainees did not return home immediately, almost all eventually returned and are currently working in their home country or at another country in the region. Also, although the questionnaire asked trainees if they returned to their home country, the study is primarily interested in whether they returned to a developing country.

In the case of the CRSP, 86 percent (36 out of 42) of HC respondents returned to their home country or in another developing country after completing their GDT (Table 19). Out of the six respondents who did not return, four stayed in the U.S. permanently and two are still in graduate school. However, four trainees who returned to their home countries at some point in the past are currently working in the U.S. These numbers are consistent with information gathered about the current employment location of the 42 HC respondents. At their current employment, eight (19%) HC trainees were working in the U.S. and 34 (81%) were employed in a developing country. Almost all trainees who stayed in the U.S. cited having work opportunities or job offers in the U.S. as major reason for not returning home after completing their GDT.

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[25] UN Economic Commission for Africa. 2000. Report of the Regional Conference on Brain Drain and Capacity Building in Africa. 20-22 February 2000. Addis Ababa, Ethiopia. http://www.iom.int/africandiaspora/pdf/Braindrain.pdf. (Last accessed August 2006)

Table 19. Overview of HC trainee respondents who returned/did not return to their home country after completing their GDT

Gender		No		Yes	Total	Return rate
Female	2	33%	7	19%	9	78%
Male	4	67%	29	81%	33	88%
Highest degree		**No**		**Yes**	**Total**	**Return rate**
M.S.	2	33%	5	14%	7	71%
Ph.D.	4	67%	31	86%	35	89%
Discipline code		**No**		**Yes**	**Total**	**Return rate**
Social Sciences	2	33%	8	22%	10	80%
Food Sciences	1	17%	3	8%	4	75%
Plant Sciences	3	50%	25	69%	28	89%
CRSP Support		**No**		**Yes**	**Total**	**Return rate**
Indirect	1	17%	6	17%	7	86%
Partial	2	33%	9	25%	11	82%
Full	3	50%	21	58%	24	88%
Region		**No**		**Yes**	**Total**	**Return rate**
LAC	5	83%	18	50%	23	78%
ESA	1	17%	9	25%	10	90%
WA	0	0%	9	25%	9	100%
Total	**6**		**36**		**42**	**86%**
	14%		**86%**			

The 86 percent return rate is based on data provided by the trainees who returned the questionnaire (40% of the HC trainee population). However, information obtained from the CRSP MO, US-PIs, and some of the respondents confirmed that most of the trainees who were not contacted or did not respond to the survey actually returned to their home countries or were currently working in another developing country.[26] Out of the 56 HC trainees who did not return the questionnaire or were out-of-contact, only nine (16%)

[26] The search for 'lost' trainees was carried out by Dr. Mywish Maredia and Dr. Richard Bernsten.

stayed in the U.S. permanently. Thus, almost all HC trainees (83 out of 98, 85%) eventually returned home or to another developing country after completing their GDT.

Most of the returnees earned a Ph.D. degree (86%) and specialized in plant sciences (69%). Five of the respondents who did not return home were in the social sciences. With respect to the return rate by region, all of the nine respondents from WA, nine out of ten respondents (90%) from ESA, and 18 of the 23 respondents from LAC returned to their home country (78%).

HC trainees who returned to their home country were also asked whether or not they returned to the same institution where they were employed prior to studying in the U.S. Out of the 29 responses who answered this question, 23 trainees (79%) returned to the same institution – mainly the government (36%) or a university (31%) – and 72 percent are working in a bean/cowpea-related field. Furthermore, about one-half of the returnees (43%) are currently involved in a bean/cowpea-related organization (e.g., the Bean Improvement Cooperative) and 62 percent had collaborated with their former CRSP supervisor on at least one research project after completing their GDT. These results demonstrate that the CRSP GDT program has been successful in strengthening the capacity of host countries to carry out bean/cowpea research. Moreover, 36 percent of the returnees have found outside consulting opportunities to supplement their income from their primary job.

Salary differences between jobs in the U.S. versus their HC may explain why some trainees choose to stay in the U.S. Forty-four percent of returnees were earning less than US$15,000 per year, while all three of the non-returnees (excluding the two trainees who are still in graduate school) were earning more than US$45,000 per year.

N. Continued collaboration with B/C CRSP

This section analyzes the characteristics of respondents who continued to and did not continue to collaborate with a CRSP scientist (i.e., their U.S. GDT supervisor) after completing their GDT. Twenty-nine out of 74 (39%) trainees reported that they had collaborated with their supervisors at least once since completing their GDT (Table 20). Most of these trainees were plant sciences graduates (76%) and from host countries (60%). In contrast, most U.S. trainees (29 of 34, 85%) reported that they did not collaborate with a CRSP scientist after graduation. However, as one trainee commented, non-collaboration does not necessarily mean that a trainee does not want to collaborate. In some cases, there are limited opportunities to collaborate, due to differences in career advancement, change in career priorities, and the difficulty of long-distance collaboration.

A majority of trainees who collaborated with a CRSP scientist at least once since completing their GDT are either currently working for the government (38%) or a university (38%), whereas most of those who did not collaborate are either employed at a university (49%) or in the private sector (20%). Eighty-six percent of trainees who had collaborated with their former CRSP supervisor are currently working on a bean/cowpea-related project. Further, 55 percent of those who collaborated are currently associated with one or more bean/cowpea-related organizations.

Table 20. Overview of HC trainee respondents who continued/did not continue to collaborate with the CRSP after their GDT

Gender	No		Yes		Total	Collaboration rate
Female	18	40%	8	28%	26	31%
Male	27	60%	21	72%	48	44%
Highest degree	**No**		**Yes**		**Total**	**Collaboration rate**
M.S.	14	31%	4	14%	18	22%
Ph.D.	31	69%	25	86%	56	45%
Discipline code	**No**		**Yes**		**Total**	**Collaboration rate**
Social Sciences	11	24%	5	17%	16	31%
Food Sciences	11	24%	2	7%	13	15%
Plant Sciences	23	51%	22	76%	45	49%
CRSP Support	**No**		**Yes**		**Total**	**Collaboration rate**
Indirect	6	13%	4	14%	10	40%
Partial	19	42%	11	38%	30	37%
Full	20	44%	14	48%	34	41%
Region	**No**		**Yes**		**Total**	**Collaboration rate**
LAC	7	16%	15	52%	22	68%
ESA	5	11%	4	14%	9	44%
WA	4	9%	5	17%	9	56%
US	29	64%	5	17%	34	15%
Total	**45**		**29**		**74**	**39%**
	61%		**39%**			

CHAPTER VI
Results: Principal Investigators

A complementary survey was sent out to US-PIs and other scientists who had supervised or supported at least one graduate student under the CRSP graduate degree training program. The results of the PI survey are based on information provided by 25 current and former US-PIs who returned the questionnaire. The PIs, who responded to the survey, matched 117 students with their respective supervisors and provided contact information for many 'lost' trainees.

- **Characteristics of PI respondents**

Of the 25 PIs who returned the questionnaire, 22 (88%) worked at a university, two worked for the U.S. Department of Agriculture and one worked at Seminis Vegetable Seeds, a private company. Thus, it is not surprising that a majority of the PIs reported that their job responsibilities included teaching (72%) or doing research (92%) in their capacity as professors (72%), university administrators (12%), or research scientists (16%). More than one-half (56%) of the respondents were currently involved with the CRSP either as a PI/co-PI or a collaborator who directly received funding from the CRSP. About 67 percent of the respondents' research focused on beans, while 20 percent were involved in cowpea research. All PIs surveyed had served as a trainee's major professor, thesis adviser, or thesis committee member.

- **PIs' collaborative work**

US-PI respondents were asked to list the countries where they had worked under the CRSP. The respondents reported having collaborated with scientists in 21 host countries, which verified the extensive U.S. and HC partnerships fostered by the CRSP (see Appendix 6 for a list of the US-PIs home institution and the host countries and institutions in these countries with which the PIs have had collaborative projects). Michigan State University is most represented with seven PIs who have worked in several countries -- mainly in LAC. The large number of PIs from MSU is not surprising, considering that 41 out of 187 CRSP-funded trainees attended MSU for their GDT, followed by the University of Puerto Rico at Mayaguez with 23 trainees.

- **Problems and suggestions for capacity building**

PIs were asked to describe the major constraints to institutional capacity building and propose suggestions for relaxing these constraints up to three host countries where they had worked most intensively (Table 21). Regarding constraints to institutional capacity building, many PIs cited administrative difficulties in dealing with host country governments (91%), particularly with regards to the bureaucracy and political uncertainty, insufficient funding (61%), very low wages in developing countries (30%), and the poor level of infrastructure (43%).

Regarding suggestions for strengthening capacity building, many PIs cited the need for greater funding to support training (26%) and research (35%). Almost all PIs (91%) explicitly cited the need to train more HC nationals, particularly at the Ph.D. level.

Table 21. Major constraints to institutional capacity building and suggestions for relaxing these constraints, as cited by PIs

Problems	%	Suggestions	%
Inadequate funding, delays in receiving grant funds	61%	More funding to training	26%
Poor infrastructure, lack of resources (e.g., vehicles, lab equipment)	43%	More funding to research	35%
Low wages in host countries	30%		
Problems dealing with the institution/government, political instability	91%	Train more HC nationals	91%

Note: Total number of responses = 44 out of 23 respondents

- **PI's assessment of the B/C CRSP graduate degree training**

The recruitment of promising trainees is critical to the success of a GDT program. As US-PIs are primarily responsible for recruiting trainees, PIs were asked to identify the factors that influenced their decision to fully or partially support a trainee under the CRSP. The primary reasons cited for fully supporting a trainee was because the individual was from a host country (31%) and that he/she could not pursue a graduate program without full funding (27%). The main reason PIs gave for partially supporting a trainee was because leveraged funds were available, either from the department (39%) in which the trainee was enrolled, or from an external source (25%), such as foreign scholarship or another research grant.

- **Problems PIs encountered while sponsoring students**

Regarding significant problems encountered while sponsoring students under the GDT program, PIs most frequently cited delays in receiving funds from the CRSP

management office (20%) -- due to the delays in the MO receiving its funding from USAID – and that the budget for training was insufficient (16%) (Table 22).

Table 22. Selected problems encountered while sponsoring students and suggestions for the B/C CRSP Training Program, as cited by PIs

Problems	Suggestions
Funds were not available in a timely fashion due to delay in receiving the funds from USAID and then getting the paper work completed through the university system.	Electronic processing of forms/reports
Bridge funding between CRSP phases – Although in the end we have always found solutions to keep students in their programs, but unnecessary worry and frustration has been experienced.	A priority on bridge funding for students during transition between project phases
Funding international students adequately	Increase stipend, consider insurance and other living expenses
High administrative costs of CRSP, limit funds for graduate training	Find ways to reduce administrative cost
Recent requirements by USAID for the J-1 visa will raise the cost of training	Permit students to continue to study under a more flexible visa

- **Strengths of the B/C CRSP graduate degree training**

Many of the PIs (79%) recognize the capacity-building impacts of the GDT on the trainee and on the institution where they go after completing their graduate study (see Table 23 for examples of PI's comments). This capacity-building effort opens up opportunities for future collaboration between the CRSP and former trainees (32%). Further, CRSP's strong commitment to long-term training (42%) had paved the way for the recruitment of excellent students around the world, who are now distinguished agricultural scientists and research collaborators of the CRSP. In many instances, PIs noted that the CRSP has supported both the trainees' coursework and thesis or

dissertation research (32%), which enabled trainees "*to work on real problems and research topics relevant to the needs of the host country*".

Table 23. Selected strengths of the B/C CRSP Graduate Degree Training, as cited by PIs

Strengths of the B/C CRSP Graduate Degree Training
• Funding for conference attendance or participation in various workshops. This is a real strength of the program. The program recognizes that students must have the widest possible exposure to the U.S. system of research, presentations, conferences
• Graduate student education is funded and graduate students are involved in various aspects of the projects in which they work. The program encourages the professional development of graduate students via funding for conference attendance.
• After receiving their degrees from the U.S. institution, these students have gone back to their countries and became leaders in their respective fields of endeavor, i.e., plant breeding, nutrition, agronomy, etc.
• Opportunity to bring bright young students to a major U.S. research institution for graduate training. Many of these students would never have the opportunity to do graduate work in their own countries or the U.S. without CRSP support.
• Ability to work on a real problem area and research topic relevant to country needs
• Provides long-term funding, so it's possible to plan research for a several-year horizon
• Provision of both stipend and operating funds
• Training students in U.S. institutions helps create an enormously strong bond between major professor and student, a bond of mutual interest, commitment and benefit that can/will often outlast the CRSP relationship and lead to additional research/training
• Attracted high quality students, Maria Jose Zimmerman, Charles Omwega, Eric Stockinger, Dave Garvin, Brian Scully, Claire Federici, who are a credit to Brazilian, African, and U.S. agricultural research.
• Linkages/long-term relationships are established between U.S. & HC scientists.
• The Bean/Cowpea CRSP also supports the training of U.S. students strengthening bean research capabilities in the U.S
• Adequate funding to train large numbers of students
• Excellent fundamental and applied training combined in CRSP
• Returning degree holders are able to contribute to crop improvement, and institutional building

- **Limitations of the B/C CRSP graduate degree training**

PIs cited many of the same problems they encountered while supervising students, such as the lapses in funding and the high cost of training students in U.S. universities (20%).[27] In addition, some PIs raised concerns regarding the overtaxing administrative duties they have to accomplish to satisfy USAID's requirement in supporting trainees (16%), the difficulty in identifying students from host countries "*with the requisite background and talents necessary to be sure they will be successful in graduate study in the U.S.*" (16%), including knowledge of the English language.

- **PIs perspective on trainees' bean/cowpea-related achievements**

PIs were asked to identify bean/cowpea-related achievements or accomplishments of their former trainees (Table 24). Most of the PIs (64%) reported significant jobs held by their former trainees, including positions such as 'Dean', 'Department Chair', 'Director', 'Manager', 'Professor'. Several PIs cited specific research contributions (15%) (e.g., '*becoming the authority in bacterial disease research in Dominican Republic*', '*contribution to the understanding of root rot mechanisms and the role of nitrogen fixation and bio-control agents in root rot control*') and publications and awards that resulted from the trainees' bean/cowpea-related research (6%).

[27] Many of these problems are inherent to training programs that recruit HC nationals to study in the U.S.

Table 24. Selected trainees' achievements, as cited by PIs

Trainees' achievements from PIs' perspective
• Chair of his department; numerous research/consulting grants
• Dean, College of Botany, University. of Dar es Salaam, Tanzania
• Helped restore banana and pineapple plantations for Dole after crops were lost to Hurricane Mitch - he used tissue culture to generate plantlets in both crops when Dole decided to stay in Honduras after losing all their plantations to the storm
• Hired at International Potato Center (CIP) within 1 month of graduation with Ph.D..
• Has published several journal articles, including one article from his dissertation.
• Named the coordinator for ISRA social science programs; this makes her the third ranked administrator at ISRA immediately below the DG and DDG. She also recently had a second journal article accepted from her dissertation.
• Lead breeder for squash crops in a large international horticultural seed company
• He developed two cowpea varieties that were released in Ghana
• Professor of Evolution in Brazil, TAC member, FAO Rep for Colombia, Bogota
• Authority on aluminum toxicity in wheat.
• Global Sensory Director, Givaudan Flavors - responsible for all sensory analyses of new and improved flavors developed by Givaudan worldwide
• Manager, Product Development and Nutrition, Chick-fil-A, Inc. – responsible for development and introduction of new menu items for national restaurant chain
• Senior Manager, Product Development, KFC - responsible for national launches of both limited time and permanent menu items available in KFC restaurants nationwide.
• Currently Head of Plant Pathology, INIAP Ecuador
• Co-developed the Rhizobium Research Laboratory website which is a major point of contact between students in applied nitrogen fixation from all over the world and our laboratory
• Developed two sustainable agriculture companies after graduation; contributions to foundations such as Winrock, Bush, Kellogg and their initiatives; Awarded Lindbergh Fellowship in 2002; Currently Director-Regional Sustainable Agri Dev Program
• Made major contribution to understanding root rot mechanisms and the role of nitrogen fixation and bio-control agents in root rot control
• Experiment Station Head, Regional Research. Director; release of bean varieties for Dominican Republic
• Head of Costa Rica Bean Program, President of American Phytopath Society - Caribbean Division, Head of Biotechnology Education Program at the University of Costa Rica
• Served as the Director of the Horticulture Department and has recently co-authored a book about tropical fruit.
• Provided leadership in the development of an integrated genetic map for the common bean
• Currently serving as the Chief for the Brazilian team that is part of an exchange program between EMBRAPA and U.S.D.A./ARS

CHAPTER VII
Results: Case Study at SUA

This section focuses on the fourth stage of the Kirkpatrick model, the Results Evaluation. A case study was carried out to assess to what extent trainees had enhanced teaching and research capacity building at a partner HC institution and to document the kind of collaboration that had occurred between former trainees and U.S. and HC institutions. The institution selected for the case study was Sokoine University of Agriculture (SUA, in Tanzania) -- an institution with which CRSP scientists had been collaborating with for over 20 years.

SUA was selected for a case study based on the recommendations of current CRSP US-PIs -- particularly Dr. James Myers, an active PI, bean breeder, and professor at Oregon State University, who felt that the CRSP investment in training had greatly strengthened SUA's capacity in teaching and research.

Institutional assessment is defined as "a comprehensive approach for profiling institutional capacity and performance" (Morgan and Taschereau, 1996). Capacity building is defined as "any improvements in the ability of the institution, either singly or in cooperation with other organizations, to perform appropriate tasks effectively, efficiently and sustainably" (Hilderbrand and Grindle, 1994). Impact is defined as "any consequences that result from an investment or intervention that occurred at the personal, institutional, sectoral, community, national, or regional level" (Gilboy, et al., 2004). In thinking about impacts, two counter-factual situations were considered – (1) What was the institution's capacity to conduct research/training before the CRSP training investments, compared to now? (Before and After Scenario) and (2) What would have

been the institution's capacity to carry out teaching, research, and extension if the CRSP had not funded graduate training for the institution's staff/faculty? (With and Without Scenario).

Impacts vary depending on the type of institution. This study acknowledges that training investments have different impacts at national agricultural research systems (NARS) versus universities. Observable indicators of impacts for former trainees who are now university professors include, for example, the types and number of courses they teach and/or developed, the number of students they supervised, number of publications, and new technologies developed. For former trainees who are now researchers at NARS, the indicators commonly considered include the number of publications; and for plant breeders, the number of crop varieties released and the impacts of these crop varieties on increasing productivity.

- **Background information: Tanzania**

Tanzania is one of the poorest countries in the world. The economy is highly dependent on agriculture, which accounts for over 50 percent of the country's GDP and 75 percent of its export earnings – primarily from coffee, cotton, and cashew nuts. Furthermore, over 85 percent of the population depend on agriculture as their source of employment and income (Magola, 2006). Although Tanzania is a very large country, with nearly 900 million hectares (has) of land, topography and climatic conditions limit cultivation to about four million has. Beans, which are typically intercropped with maize, are grown mainly by small-scale farmers, on farms ranging from 0.5 to 2.0 has

(Mohamed & Teri, 1998). In 2004, Tanzania produced 332,000 metric tons of beans on 524,880 has (FAOSTAT, 2007).[28]

Frequent organizational changes characterize Tanzania's agricultural research system (Johnsen, et al., 2004). In 1970s, livestock and crop research centers were under the Ministry of Agriculture. In the following decade, the government created several parastatal institutions, including the Tanzania Agricultural Research Organization, the Tanzania Livestock Research Organization, and the Tanzania Pesticide Research Institute. In the 1990s, the Directorate of Research and Development (DRD) of the Ministry of Agriculture became the lead institution for both crops and livestock research.

- **Background information: SUA**

SUA, the CRSP partner institution in Tanzania, was established in 1984, as a separate institution from the University of Dar es Salaam and given the mandate to be the country's center of excellence in agriculture. SUA is situated in the municipality of Morogoro, which is about 200 kilometers west of Dar es Salaam. The main campus lies on the foothills of the Uluguru mountains and has a total land area of 3,350 has, of which about 2,300 are reserved for the university farm (SUA, 2006). SUA offers undergraduate and post-graduate training, leading to a M.S. and Ph.D. in the fields of Agriculture, Agricultural Economics and Agribusiness, Food Science, Human Nutrition, Forestry, Management of Natural Resources and Sustainable Agriculture, Veterinary Medicine, and Rural Development. The CRSP has primarily collaborated with scientists associated with the Faculty of Agriculture, consisting of seven departments. More than 80 percent of the staff in the Faculty of Agriculture have either a M.S. or a Ph.D. degree (Table 25).

[28] FAO only reports statistics for dry beans, which includes both common beans and cowpeas.

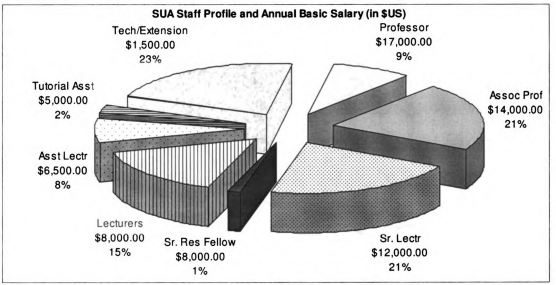
Key informants noted that in the past, low salaries were a constraint to retaining faculty. However, several SUA faculty mentioned that in recent years, the government has increased faculty salaries to make them more competitive with the salary level in other countries in the region, in the effort to retain professionals. Furthermore, in July 2006, the government announced a proposal to increase civil servant's minimum wage by 50 percent. Figure 6 shows the basic annual salary by job title in the Faculty of Agriculture.

Table 25. Staff Profile at the Faculty of Agriculture, SUA, Tanzania, by highest degree attained, 2006

Department	Ph.D./ D.Phil	M.S./ M.Phil	B.S.	Cert/ Dip	Total Staff	
Agricultural Economics and Agribusiness	14	6	1		21	**13%**
Agricultural Education and Extension	6	7	1		14	**9%**
Agricultural Engineering and Land Planning	17	3	1	3	24	**15%**
Crop Science and Production	10	9	2	5	26	**16%**
Food Science and Technology	19	4	1	4	28	**17%**
Soil Science	11	4		6	21	**13%**
Animal Science and Production	22	1		7	30	**18%**
Total Staff	**99**	**34**	**6**	**25**	**164**	
%	**60%**	**21%**	**4%**	**15%**		

Source: 2005-2006 Prospectus of SUA

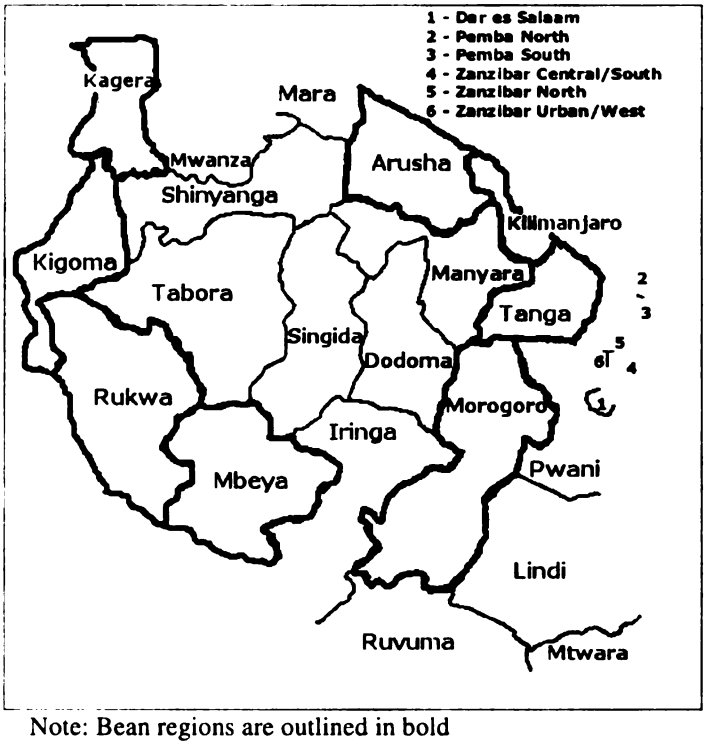
Figure 6. Annual Basic Salary (in US$) at the Faculty of Agriculture, SUA-Tanzania, by position/job title, 2006



Source: 2005-2006 Prospectus of SUA; Salary estimate from key informant at SUA; US$1 = Tsh 1,200

There are eight major bean-growing regions in Tanzania, classified by altitude; (1) Mbeya (high), (2) Arusha (mid), (3) Kigoma (mid), (4) Kagera (mid), (5) Morogoro (low), (6) Rukwa (high), (7) Kilimanjaro (mid), and (8) Tanga (low) (Figure 7). SUA, which works closely in partnership with the National Beans Research Program, has a mandate to test lines and conduct performance trials for the low altitude ecosystem (<1,000m). The other major partners of the national bean program, Selian Agricultural Research Institute (ARI) and Uyole ARI, have a mandate to test bean lines for mid-level (1,000-1,500m) and high-level (>1,500m) ecosystems, respectively. SUA also contributes and exchanges germplasm with other national bean program partners.

Figure 7. Regional map of Tanzania



Note: Bean regions are outlined in bold

- **B/C CRSP Collaboration**

The CRSP has collaborated with SUA faculty since 1981, before it became a separate institution from the University of Dar es Salaam. US-PI Dr. Matthew Silbernagel (USDA-ARS, Washington State University) began and led the program, which is now known commonly within the campus as the "bean project". Table 26 describes the research projects that have been carried out in collaboration with SUA since 1981.

Table 26. B/C CRSP research projects in Tanzania

Grant Period	U.S. Institution[a\]	U.S. PI	Project title
1981-1986	WSU	Matt Silbernagel	Breeding beans for disease and insect resistance and determination of economic impact on smallholder farm families
1986-2002	WSU	Lorna Butler	A participatory research approach to breeding and evaluating high yielding disease and insect resistant beans for low input sustainable farming systems in which women are major contributors
	OSU	James Myers	Genetic improvement of beans in East Africa
2002-2007	Purdue	Jess Lowenberg -DeBoer	Market Assessment of Bean and Cowpea Grain and Processed Value-Added Products, and Determination of both Constraints to and Potential for Growth of Markets in the ESA Region
	MSU	Maurice Bennink	Enhancement of Child Survival and Rehabilitation of Malnourished Children through the Development of Inexpensive Bean/Sorghum/Maize Foods
	UMN	Peter Graham	Edaphic Constraints to Bean Production in Eastern Africa: The Selection of Bean Cultivars and Rhizobium having Tolerance to Low N and P, and Able to Grow at Acid pH
	WSU	Carol Miles and David Holland	Development of Cost-Effective and Sustainable Seed Multiplication and Dissemination Systems for Improved Bean Cultivars that Meet the Needs of Limited- Resource Bean Farmers
	OSU	James Myers	Develop Bean Cultivars for East and Southern Africa with Enhanced Resistance to Diseases and Insects

a\ WSU=Washington State University, OSU=Oregon State University, Purdue=Purdue University, MSU=Michigan State University, UMN=University of Minnesota

While the program initially focused on plant breeding, its research focus was expanded in subsequent years. For the current grant (2002-2007), the project supports research on five themes: (1) plant breeding, (2) adaptive factors (abiotic stress), (3) seed multiplication, (4) food science and nutrition, and (5) marketing.

SUA staff and US-PIs meet to develop annual workplans, which determined the direction of the collaborative research activities. According to SUA staff, the main

problem that they have faced in collaboration involved delays in receiving funds from U.S. institutions – due to delays in USAID making funds available to the CRSP MO.

Over the last 25 years, SUA, in collaboration with the CRSP, developed four improved bean varieties (Table 27). However, while limited data are available to document the level of adoption of these varieties, two of the varieties were only released in 2006. According to SUA collaborators, adoption has been greatly limited by constraints to seed production and multiplication. Government-led efforts in seed multiplication have been largely unsuccessful and private seed companies have not engaged in bean seed production because they do not consider it to be profitable. Although NGOs and donor organizations are now beginning to play an active role in the seed multiplication system, there exists a need to train seed producers regarding how to produce high-quality seed. Recently, a community-based seed production project was established to produce "quality declared seeds". Under this scheme, selected farmers, who have been trained in seed multiplication, are supplied with foundation seed which they then multiply under the supervision of extension workers. Also in 1998, the SUA-CRSP project initiated a small-scale bean seed multiplication program in collaboration with a NGO. However, there exists limited information regarding the adoption or success rates of this program.

Table 27. Bean varieties developed by SUA in collaboration with the CRSP

Variety	Year released	Characteristics
SUA 90	1990	Drought tolerance; Bean Golden Mosaic tolerant; higher yield, tan (color)
Rojo	1997	Same as SUA 90 but red (color)
Mschindi	2006	Faster cooking time; soft; good taste; gray-mottled (color)
Pesa	2006	Same as Mschindi but red (color)

- **B/C CRSP Training Investment**

The CRSP has supported a total of 20 students from Tanzania in 25 academic degrees. Eleven of these trainees went to the U.S. for their graduate study, while the other eight pursued their graduate degrees at SUA (see Appendix 7 for the complete list of trainees from Tanzania). For U.S. degree training, the US-PIs, in collaboration with SUA staff, identified the training and research needs of a project component. Then, the US-PIs asked their collaborators at SUA to recommend candidates who were qualified for admission to the U.S. partner university. Trainees usually went to the home university of the component's US-PI, where the trainee worked on a bean/cowpea-related research topic for his/her thesis or dissertation. Since almost all of the trainees had worked at SUA prior to beginning their U.S. graduate program, SUA benefited from these staff development opportunities.

For SUA-based degree training, HC-PIs identified disciplines and departments with a shortage of bean scientists. Also, HC-PIs consulted with the National Bean Program to determine training and research needs at the national level. To date, the CRSP has supported nine students in Tanzania for M.S. and Ph.D. degree training at SUA. Largely as a result of CRSP support, SUA has become the key institution in Tanzania for bean/cowpea-related degree training.

Trainees, who were SUA employees, were usually granted study leave before going to the U.S. for GDT, which benefited both the trainee and SUA. First, the trainee continued to receive compensation while studying. Second, because the trainees were required to return to their home institution after completing their graduate program, this helped ensure that KSAs acquired from the trainees' GDT supported capacity building at

the university. For example, the CRSP supported the training of SUA's two plant breeders. Third, upon returning to Tanzania, trainees were assured of being appointed to a faculty position at SUA. These reasons serve as significant incentives for Tanzanian trainees to return home. Contrary to the popular notion that trainees from Africa rarely return to their home countries, 10 out of the 11 CRSP-supported trainees from Tanzania returned home after completing their GDT in the U.S. and a majority was still working at SUA. Furthermore, the returning trainees have become the main CRSP collaborators at SUA.

While the GDT, not the CRSP *per se*, has contributed to the capacity building at SUA, the CRSP has facilitated this endeavor by awarding scholarships to SUA staff and through its support of collaborative research. Because of the scholarship opportunity made available by the CRSP to SUA, its teaching and research capacity has been strengthened. For instance, three former CRSP trainees are now Senior Lecturers, two are Associate Professors, and one is a Professor. Moreover, Tanzania's first plant breeder to earn a Ph.D. degree, Prof. Robert Mabagala, is a product of the CRSP, and is still a CRSP collaborator. Further, through their teaching and research activities, these CRSP-supported trainees have produced "second-generation" trainees who hold key bean research-related position at the national level. For example, the bean breeders at the Selian ARI and at the TPRI in Arusha were CRSP-SUA sponsored students. Former CRSP trainees have also been successful in getting externally-funded bean-related projects to complement and enhance their existing CRSP projects. For example, Dr. Mabagala recently received a grant from the Danish International Development Agency (DANIDA) to help build the Seed Health and Training Center for Africa, which is

located on SUA's campus. Furthermore, SUA's CRSP collaborators are active participants in other research networks in Africa, especially the Southern Africa Bean Research Network (SABRN) and the Eastern and Central Africa Bean Research Network (ECABREN) under the Pan-Africa Bean Research Alliance (PABRA). Table 28 lists additional accomplishments of former CRSP Trainees.

An important question is, what would have been SUA's capacity to carry out teaching and research -- if the CRSP had not funded GDT for SUA? To address this question, research and training impacts were assessed separately.

Prior to 1980, very little bean research was conducted in Tanzania. Thus, the entry of the CRSP greatly enhanced Tanzania's capacity to conduct bean-related research. Furthermore, the CRSP's long-term commitment to capacity building – which is unique, compared to other organizations and research networks in the region – has sustained this momentum. Currently, at the regional level (East Africa), the Centro Internacional de Agricultura Tropical (CIAT) plays a dominant role in applied bean research. For example, CIAT helped establish and provides leadership to ECABREN and SABRN – research networks that conduct on-farm trials and evaluate bean lines and varieties – and funds and coordinates several bean research projects in Tanzania and the region. However, within Tanzania, SUA still plays a major role in the national bean program, as the institution with a mandate for conducting bean research for the low level elevation ecosystem.

For training *per se*, the CRSP and SUA are the major players in training bean scientists. The success can be attributed to both the availability of CRSP funding over the past 20 years to support GDT for SUA staff and SUA's ability to retain these former

trainees. Clearly, the CRSP investment in GDT has definitely had a major impact on capacity building at SUA.

Table 28. Examples of the achievements/contributions of SUA's CRSP-funded trainees

- Dr. Robert Mabagala is the first plant breeder in Tanzania, and is now a Professor at the Dept of Crop Science and Plant Breeder at SUA. He is also one of the founding members of the Tanzania Association of Phytopathologists (TAP) and the Tanzania Society for Microbiology. Currently, he is the editor of the Tanzania Journal of Agricultural Sciences (TAJAS) and the African Journal of Plant Protection/OAU. Inter-African Phytosanitary Council Journal. He also coordinates the Field Research Project in Seed Bacteriology funded by DANIDA and is the HC-PI for the CRSP's adaptive factors component at SUA.
- Dr. Susan Nchimbi-Msolla, who has been with the Dept. of Crop Science since 1982, is now an Associate Professor. She has supervised more than 100 undergraduate and graduate students at SUA and is the HC-PI for the CRSP's breeding component at SUA.
- Dr. Theobald Mosha is an Associate Professor at the Dept. of Food Science and Technology. He has been with the university since 1989. He is responsible for the CRSP's nutrition component at SUA.
- Mr. Sosthenes Kweka, a former student of Dr. Nchimbi-Msolla and Dr. Mabagala, is now the plant pathologist/breeder at Selian ARI.
- Dr. Afihini Ijani, Dr. Mabagala's first Ph.D. student, is the principal plant pathologist at the Tropical Pesticide Research Institute in Arusha.
- Dr. Catherine Madata, who was indirectly funded by the CRSP, is now the Head of Bean Research Program based in Uyole ARI. She is also a CRSP collaborator in Tanzania.

In contrast, the research impacts of the CRSP's investment in Tanzania were difficult to document. Over the 25 years of CRSP involvement at SUA, SUA has developed only four bean varieties, two of which were released in 2006. Furthermore, farmer adoption of these varieties is, to a great extent, unknown.

In summary, since initiating collaboration with SUA in the early 1980s, the CRSP has played a major role in helping the university develop its research and teaching program, particularly in the area of crop science. The launch of the "bean project", matched with the CRSP's commitment to training host country nationals, has made SUA

one of the three institutions that make-up the national bean program -- Uyole ARI, Selian ARI, and SUA. The CRSP has been instrumental in developing this indigenous capacity in bean research, as indicated by the fact that CRSP trainees now hold significant professional positions at all of these institutions (e.g., Catherine Madata in Uyole, Sosthenes Kweka in Selian, and several professors in SUA).

However, scientists at SUA are, first and foremost, university professors, who usually teach four courses a year -- which limits their time for conducting bean research. Although key informants at SUA noted that research publications are an important factor for promotion, time availability for conducting bean research is limited due to their heavy teaching responsibilities. Also key informants cited unreliable access to the internet and electrical black-outs as constraints to doing research and factors that make collaboration with US-PIs difficult. Despite these challenges, SUA's CRSP trainees have published numerous research papers in major journals, proceedings, and books, and have authored extension bulletins and manuals that are currently used by farmers and students. For example, Dr. Msolla-Nchimbi has supervised the thesis/dissertations of 16 graduate students at SUA, published 13 papers in newsletters/journals, written three books, published 36 papers in conference proceedings, and produced three extension publications. Dr. Mabagala has authored 32 journal articles, 13 conference proceeding papers, and eight extension bulletins.[29]

[29] Information obtained from the trainee's curriculum vitae.

CHAPTER VIII
Overview, Key Findings, Recommendations, and Future Research

A. Overview

Since 1981, the CRSP has invested more than US$69 million to support global bean/cowpea research. About US$7 million of the total was spent on training, in order to develop a critical mass of bean/cowpea scientists. To this end, the CRSP has supported nearly 200 students for M.S. and Ph.D. degrees at U.S. universities in the fields of plant sciences, food sciences and social sciences -- fields critical to the development of bean and cowpea research in host countries in Latin America and Sub-Saharan Africa and the U.S. The priority placed on funding training demonstrates the CRSP's long-term commitment to capacity-building at HC institutions. However, given the decline in the availability of donor funding to support graduate degree training (GDT) for students from developing countries, there is a need to assess the impacts of this type of investment. This study is the first major attempt to document and assess the impacts of the B/C CRSP graduate degree training program, from the perspectives of the trainees and the U.S. scientists who supervised the trainees.

The thesis first summarizes recently completed studies on the impact of GDT. Key features of the CRSP training model were highlighted and compared with other major training programs. The CRSP is not solely a scholarship-granting-body, like ATLAS/AFGRAD and Fulbright. Rather, its training program is similar to that of the CGIAR, which includes ILRI and IRRI. The methodologies, findings and the lessons learned from these previous reports were influential in setting the direction of this study. Recent impact studies point to the intrinsic complementary relationships between

training, research, and institutional capacity building. Although impacts are difficult to quantify, these studies found that GDT has been a highly productive investment.

The next section explored the features of the CRSP training program in greater details. Typically, CRSP trainees conduct research under the guidance of the CRSP scientist (US-PI) while studying at a U.S. university and many continue to collaborate with their CRSP supervisor after returning to their home institution.

A modified Kirkpatrick's framework was presented and training impacts to be explored were identified. The assessment utilized several approaches to gather information about impacts from the perspectives of the trainee and the trainee's supervisor (US-PI). Two survey questionnaires were developed -- one for the former trainees and another for the US-PIs or the scientist who supervised the trainee during his/her CRSP-supported GDT. In addition, a case study was carried out, which highlighted the impacts of the CRSP investment at Sokoine University of Agriculture in Tanzania. Further, an internet search was carried out to collect information about the trainees that would complement evidence of impacts that were missed through other approaches.

The results reported in this study were based on the analysis of questionnaires returned by 76 former trainees, representing 60 percent of our frame population (or 41% of our target population), and 25 former and current US-PIs, supplemented by face-to-face interviews with former trainees and HC-PIs at Sokoine University of Agriculture.

One of the key findings is that almost all (86%) of the HC trainees returned to their home country and most of them are still involved in bean/cowpea research. Moreover, the study revealed that after completing their GDT, a much higher percentage

of the HC trainees continue to collaborate with CRSP scientists and conduct bean/cowpea research, compared to U.S. trainees. Similarly, a much higher percentage of Ph.D. trainees continue to collaborate with CRSP scientists and conduct bean/cowpea research, compared to M.S. trainees. Additional major findings from the (1) trainee survey, (2) US-PI survey, and (3) case study are outlined in the next section.

B. Key Findings

From the survey of former B/C CRSP trainees, the study found that:

- Trainees felt that that their GDT was necessary for their professional development (100%) and was highly relevant to their current work/job responsibility (92%).

- Trainees felt that that their CRSP research was necessary for their professional development (97%) and was highly relevant to their current work/job responsibility (83%).

- Trainees considered the ability to "design/conduct/analyze scientific research" (87%) as the most important knowledge, skills, and attitudes (KSAs) acquired from their GDT.

- Most trainees shared their acquired KSAs through publication (66%), seminar/conference (70%), and research supervision of students (66%).

- Most of the respondents with Ph.D. degrees currently work at a university (50%), while 23 percent were working for the government, 9 percent were in the private sector, and 12 percent were working at international organizations. Thirty-one percent of the M.S. graduates were now working in the private sector, while 25 percent were working for the government, 25 percent were working at a university, and another 12 percent were working at international organizations.

- Most of female respondents (62%) worked at a university, compared to 38 percent of male respondents.

- Most respondents who earned degrees in the plant sciences were still active in bean/cowpea research (61%), compared to 41 percent for the social sciences and 17 percent for food sciences degree recipients.

- Most HC trainees were still active in bean/cowpea research (69%), compared to 23 percent for U.S. trainees.

- Most trainees (78% HC, 40% U.S.) earned less than US$15,000 per year prior to their GDT. At their present or most recent employment, a majority of the respondents (57% HC, 97% U.S.) reported earning more than US$15,000 per year.

- The acquisition of a graduate degree greatly increased trainees' salaries. Before GDT, a HC respondent with a B.S. degree earned about US$9,000 per year. At their present or most recent employment, HC respondents with M.S. degrees earned about US$21,000 per year, while those with Ph.D. degrees earned

US$35,000 per year. A U.S. national with a B.S. degree earned about US$19,000 per year prior to GDT. At their present or most recent employment, U.S. trainees with M.S. degrees earned US$65,000 per year, while those with a Ph.D. degree earned US$81,000 per year.

- There was large wage differentiation between a degree (B.S./M.S./Ph.D.) received from a U.S. university versus from a local university, especially in the LAC and WA regions. In the ESA region, there appears to be no wage differentiation by university location.

- Few of the U.S. (19%) and LAC (10%) trainees had outside consultancies, while 56 percent of trainees from ESA and WA had outside projects to augment their income from their principal job.

- Most of the trainees (71%) reported changes in their personal lives, including improved financial status, greater self-confidence, an opportunity to learn a second language, and gaining new friends from outside their home country.

- Most of the trainees (78%) cited changes in their professional lives that evolved around improved capacity or enhanced KSAs to perform well in their desired jobs.

- Most of the trainees (57%) considered their role in the release of varieties, awards or recognition received from their bean/cowpea research, papers published, and the important positions or jobs that they held as important bean/cowpea-related achievements.

- Trainees who finished their degrees during the first grant period (1981-1986) were currently earning a much higher income than trainees who finished their degrees recently. On average, trainees from the first grant period currently earn US$71,000 a year, while recent graduates (2003-2005) were earning US$29,000 a year.

- Most of the HC respondents (86%) returned to their home country or to another developing country after receiving their highest degree (78% LAC, 90% ESA, 100% WA). Furthermore, 79 percent of the returnees returned to the same institution at which they were employed prior to their GDT.

- Most of the returnees earned a Ph.D. degree (86%), specialized in plant sciences, (69%) and either worked for the government (36%) or at universities (31%).

- Most of the returnees (72%) were now working in a bean/cowpea-related field, compared to 50 percent of the non-returnees.

- Many of the returnees (36%) were able to get outside consulting opportunities to supplement their income from their primary job.

- Most of the HC trainees (60%) continued to collaborate with their CRSP supervisor after their GDT (68% LAC, 44% ESA, 56% WA), while only 15 percent of the U.S. trainees continued to collaborate with their CRSP supervisor after their GDT.

From the survey of former and current US-PIs, the study found that:

- Almost all of the PIs (79%) recognize the capacity-building impacts of the GDT on the trainees and on the institution where they go after completing their graduate study.

- Almost all of the PIs (91%) highlighted the need for greater funding support for graduate degree training, particularly at the Ph.D. level.

- The primary reasons that PIs fully supported a trainee were because he/she was from a host country (31%) and that the trainee could not pursue a graduate program without full funding (27%).

- The main reason that PIs partially supported a trainee was because leveraged funds were available, either from the department (39%) in which the trainee was enrolled, or from external sources (25%), such as a foreign government scholarships or another research grant.

- The most significant problems that PIs encountered while sponsoring students under the CRSP were delays in receiving funds from the CRSP MO (20%) – due to delays in USAID providing funds to the MO -- and insufficient funding to support graduate training (16%).

- Most of the PIs (64%) reported significant jobs held by their former trainees as important bean/cowpea-related achievement. Several PIs cited their trainees' research contributions (15%) and some noted the publications and awards that resulted from the trainees' bean/cowpea-related research (6%).

From the SUA case study, the assessment found that:

- Ten out of the 11 CRSP-supported trainees from Tanzania returned home after completing their GDT in the U.S. and majority were still working at SUA. Furthermore, the returned trainees were the CRSP's principal collaborators at SUA.

- The CRSP has played a major role in helping SUA develop its research and teaching program, particularly in the area of crop science and production. The launch of the "bean project", matched with its commitment to training host country nationals, has made SUA one of the key institutions that make-up the national bean program -- Uyole ARI, Selian ARI, and SUA.

- While the Centro Internacional de Agricultura Tropical (CIAT) plays a leading role in applied bean research in the East Africa region, the CRSP is the major player in training bean scientists. Its strong and continued commitment to long-term training is a strength of the CRSP.

- The research impacts of the CRSP's investment in Tanzania were more difficult to document. In the 25 years of CRSP involvement at SUA, SUA has developed only four bean varieties -- two of which were released in 2006. Furthermore, farmer adoption of these varieties is, to a great extent, unknown. Key informants noted that adoption has been greatly limited by constraints to seed production and multiplication.

- The institutional visit to SUA confirmed that former trainees were now inducing impacts through teaching and supervising of students who now hold key research positions in Tanzania's national bean program. Furthermore, former CRSP trainees have been successful in getting externally-funded bean-related projects to complement and enhance their existing CRSP research projects.

C. Recommendations

The study documents that the B/C CRSP has been playing an important role in strengthening teaching and research capacity in beans and cowpeas, both in the U.S. and in host countries. The following recommendations are proposed in order to build on and sustain these successes.

Recommendations for the B/C CRSP MO:

- Continue the commitment to GDT and continue to put high priority on supporting HC trainees;

- Require trainees to submit a short report at the end of each training year, as part of a routine assessment of the training program;

- At the end of their GDT, require trainees to complete an exit survey and provide future contact information;

- Create an e-mail group (listserve) in order to facilitate communications between PIs and former trainees and to encourage future collaboration;

- Continue to support trainees after completing their GDT, perhaps by maintaining a link in the B/C CRSP website that identifies grant, scholarship, and employment opportunities for bean/cowpea scientists; and

- Update data and contact information of trainees on a regular basis.

Recommendations for US-PIs:

- Continue to be considerate of the constraints (e.g., poor infrastructure, unstable source of electricity, limited internet connection) faced by HC partners; and

- Continue to maintain contact with former trainees.

Recommendations for HC-PIs:

- Continue to aggressively seek leverage money to supplement funds available from the CRSP for local bean/cowpea research; and

- In the ESA region, develop stronger linkages with the NARS.

Recommendations for USAID and other donors:

- Recognize that almost all CRSP-funded HC trainees returned to their home countries after completing their GDT, where they assumed important roles in building research and teaching capacity at HC institutions;

- Recognize that the CRSP graduate degree training has been successful in developing scientific capacity on bean/cowpea research in both the U.S. and in host countries; and for these reasons,

- Increase financial support for GDT, particularly for HC nationals.

D. Future Research

The main contribution of this study is the documentation of impacts of the B/C CRSP graduate degree training program -- from the perspectives of the trainees and U.S. scientists who supervised the trainees. It is hoped that the evidence presented showed that CRSP trainees have successfully contributed to bean/cowpea research in the U.S. and in host countries.

While this study documents the impacts of GDT, it has several weaknesses. First, the analysis is based on the responses of 76 of the 126 former trainees for whom contact information was available. Contact information was not available for 61 out of 187 former trainees. With a greater number of respondents, the results would have been more reliable. Second, for trainees who earned a CRSP-funded and a non CRSP-funded degree, it was not possible to separate the impacts of CRSP-funded GDT from the impacts of training received elsewhere. Third, the assessment of the impact of GDT on trainees' income did not take into account some actors (e.g., year that the "before training salary" was received, annual salary increases that the trainee would have received even if he/she had not pursued GDT) that might have contributed to the difference in the salaries that trainees earned "before" and "after" GDT training. Finally, while many trainees

completed GDT in a host country, only the trainees who completed GDT in the U.S. were surveyed.

Nonetheless, the findings, as well as the limitations of the study, suggest avenues for future research, including a more rigorous quantitative analysis of the costs and benefits of GDT to the trainee and to the B/C CRSP, and an analysis of the impact of GDT on trainees who pursued their graduate study in host country institutions.

APPENDICES

Appendix 1. Number of trainees who received M.S./Ph.D. degrees from U.S. universities, by country and gender

Country	Female	Male	Total	Percent
Latin America	**15**	**41**	**56**	**30%**
1. Brazil	2	5	7	4%
2. Costa Rica	3	3	6	3%
3. Dom. Republic	6	10	16	9%
4. Ecuador	1	5	6	3%
5. Guatemala	0	3	3	2%
6. Honduras	1	7	8	4%
7. Mexico	2	6	8	4%
8. Peru	0	2	2	1%
East/Southern Africa	**5**	**20**	**25**	**13%**
1. Botswana	1	1	2	1%
2. Kenya	1	2	3	2%
3. Malawi	1	6	7	4%
4. Mozambique	0	2	2	1%
5. Tanzania	2	9	11	6%
Western Africa	**8**	**9**	**17**	**9%**
1. Cameroon	0	3	3	2%
2. Ghana	5	3	8	4%
3. Nigeria	2	1	3	2%
4. Senegal	1	2	3	2%
U.S.	**50**	**39**	**89**	**48%**
Grand Total	**78**	**109**	**187**	**100%**

Appendix 2. Host Country Partner Institutions

East/Southern Africa	
1. Malawi	Bunda College of Agriculture; Chancellor College
2. Mozambique	Instituto de Investigacao Agraria de Mocambique; World Vision-Mozambique; Eduardo Mondane University
3. South Africa	ARC-Grain Crops Institute; University of the Free State; University of Pretoria
4. Tanzania	Sokoine University of Agriculture; Agriculture Research Institute, Uyole, Selian

West Africa	
1. Benin	Programme de Technologie Aricole et Alimentaire; Agricultural Research Institute
2. Burkina Faso	Institut de l'Environmentet des Recherches Station de Kamboince/CRREA Centre/Saria
3. Cameroon	Institu de la Recherche Agronomique pour le Developpement
4. Ghana	Savanna Agricultural Research Institute; University of Ghana-Legon
5. Niger	Ecologiique, Institu National de Recherches Agronomiques du Niger
6. Nigeria	Abubaker Tafawa Balewu University; Ahmadu Bello University
7. Senegal	Institut Senegalais de Recherches Agricoles; Centre National de Recherches Agronomiques
8. Zimbabwe	University of Zimbabwe

Latin America/Caribbean	
1. Colombia	Centro Internacional de Agricultura Tropical
2. Costa Rica	Univerity of Costa Rica; Centro de Investigaciones en Tecnologia de Alimentos
3. Ecuador	Instituto Nacional de Investigaciones Agropecuarias
4. El Salvador	National Center for Agriculture, Livestock and Forest Technology
5. Dominican Republic	CEntro para el Desarrollo AGropecuario y Forestal, Inc.
6. Guatemala	Instituto de Ciencia y Tecnologia Agricoles; El Programa Cooperativo Regional de Frijol para Centro América, México y El Caribe
7. Honduras	Escuela Agricola Panamericana-Zamorano
8. Jamaica	University of the West Indies-Mona Campus
9. Nicaragua	Instituto Nicaraguense de Tecnologia Agropecuaria
10. Mexico	Instituto Nacional de Investigaciones Forestales y Agropecuárias

Appendix 3. Number of Trainees by U.S. Training Location

	U.S. Training Location	Female	Male	Total	Percent
1	Auburn University	0	1	1	1%
2	Clemson University	0	1	1	1%
3	Cornell University	2	9	11	6%
4	Colorado State University	2	3	5	3%
5	Kansas State University	3	0	3	2%
6	Michigan State University	14	27	41	22%
7	Pennsylvania State University	0	1	1	1%
8	Purdue University	6	5	11	6%
9	University of Arizona	1	0	1	1%
10	University of Illinois-Urbana	2	5	7	4%
11	University of California-Davis	4	5	9	5%
12	University of California-Riverside	5	10	15	8%
13	University of Georgia	11	5	16	9%
14	University of Minnesota	5	5	10	5%
15	University of Nebraska-Lincoln	5	6	11	6%
16	University of Puerto Rico	8	15	23	12%
17	University of Wisconsin	6	4	10	5%
18	Washington State University	4	7	11	6%
	TOTAL	**78**	**109**	**187**	**100%**

Appendix 4.

Trainee Survey Questionnaire[30]

[30] This survey was approved by the Social Science/Behavioral/Education Institutional Review Board (SIRB) at Michigan State University. Approved 3/31/06 – valid through 3/30/07. IRB # 06-142.

DIRECTIONS: Please type your answer in the shaded areas of the questionnaire. For questions with pre-coded responses, click on the box to mark your answer. You can use TAB (or your mouse) to go to the next question or space. Press ENTER if you want to add another row or need more space for your answer.

I. EDUCATION

Please provide details on both your Ph.D. and MS graduate degrees.
If your highest degree is a MS, GO to Q#12.

Ph.D. Program Information

(1) **University** (Name and Location)	(2) **Department**	(3) **Years**	
		From	To

(4)	**Type of B/C CRSP funding:** (Please check all that apply)			
	☐ Research assistantship for all semesters	☐ Research assistantship for at least one semester		
	☐ Full funding for dissertation research	☐ Partial funding for dissertation research		
	☐ No funding	☐ Don't know		
(5)	**Did you receive other sources of funding?**	☐ No	☐ Yes	☐ Don't know
(6)	If YES, **what were your other sources of funding?** (Please check all that apply)			
	☐ Teaching assistantship	☐ Research assistantship on a non-CRSP project		
	☐ University fellowship	☐ Fulbright	☐ Other: (specify)	

(7)	**Major Professor** (name):		
(8)	**CRSP Supervisor** (name): (if applicable)		
(9)	**Thesis/Dissertation:** (title)		
(10)	**Did you publish an article/book chapter based on your dissertation research?**	☐ No	☐ Yes
(11)	**Did you present the results of this research at a professional conference/seminar?** (as paper/poster presentation)	☐ No	☐ Yes

MS Program Information

(12) **University** (Name and Location)	(13) **Department**	(14) **Years**	
		From	To

(15)	**Type of B/C CRSP funding:** (Please check all that apply)			
	☐ Research assistantship for all semesters	☐ Research assistantship for at least one semester		
	☐ Full funding for thesis research	☐ Partial funding for thesis research		
	☐ No funding	☐ Don't know		
(16)	**Did you receive other sources of funding?**	☐ No	☐ Yes	☐ Don't know
(17)	If YES, **what were your other sources of funding?** (Please check all that apply)			
	☐ Teaching assistantship	☐ Research assistantship on a non-CRSP project		
	☐ University fellowship	☐ Fulbright	☐ Other: (specify)	

(18)	**Major Professor** (name):		
(19)	**CRSP Supervisor** (name): (if applicable)		
(20)	**Thesis:** (title)		
(21)	**Did you publish an article/book chapter based on your thesis research?**	☐ No	☐ Yes
(22)	**Did you present the results of this research at a professional conference/seminar?** (as paper/poster presentation)	☐ No	☐ Yes

II. CURRENT EMPLOYMENT

(23)	**Are you currently employed?**	☐ No ☐ Yes; Full time ☐ Yes; Part-time
(24)	If NO, **what is the main reason you are not currently employed?**	
	☐ Studying ☐ Retired ☐Health Reasons ☐ Other: (specify)	

Please describe details of your current job or your most recent job, if NOT currently employed.

(25) **Name of Employer and Country of Location**	(26) **Year**		(27) **Job Title/Position**
Employer: Country:	From	To	
(28) **Type of Employer:**			
☐ University ☐ Private: local ☐ Private: multi-national ☐ International organization ☐ Government agency ☐ NGO ☐ Other: (specify)			
(29) **Job Responsibility:** (Please check all that apply)			
☐ Research ☐ Teaching ☐ Planning/policy-making ☐ Outreach/extension ☐ Administration/management ☐ Marketing/sales ☐ Other: (specify)			
(30) **What was the minimum degree level required for this job?**			
☐ B.S./B.A. ☐ M.S. ☐ Ph.D. ☐ Don't know			
(31) **Does this job entail work related to beans/cowpeas?**		☐ No ☐ Yes	
(32) If YES, **please describe nature of your work in relation to beans/cowpeas.**			
(33) **Please approximate the annual salary (in US$) you receive(d) from this job.**		**Starting: $** **Final: $**	
(34) **In addition to this job, do (did) you supplement your income through outside consulting?**		☐ No ☐ Yes	

III. EMPLOYMENT AFTER RECEIVING HIGHEST DEGREE

Please describe the job that you held immediately after receiving your highest degree.
If your job after receiving your highest degree is the same as your current job, SKIP this section. GO to Section IV.

(35) **Name of Employer and Country of Location**	(36) **Year**		(37) **Job Title/Position**
Employer: Country:	From	To	
(38) **Type of Employer:**			
☐ University ☐ Private: local ☐ Private: multi-national ☐ International organization ☐ Government agency ☐ NGO ☐ Other: (specify)			
(39) **Job Responsibility:** (Please check all that apply)			
☐ Research ☐ Teaching ☐ Planning/policy-making ☐ Outreach/extension ☐ Administration/management ☐ Marketing/sales ☐ Other: (specify)			
(40) **What was the minimum degree level required for this job?**			
☐ B.S./B.A. ☐ M.S. ☐ Ph.D. ☐ Don't know			
(41) **Did this job entail work related to beans/cowpeas?**		☐ No ☐ Yes	
(42) If YES, **please describe nature of your work in relation to beans/cowpeas.**			
(43) **Please approximate the annual salary (in $US) you received from this job.**		**Starting: $** **Final: $**	
(44) **In addition to this job, did you supplement your income through outside consulting?**		☐ No ☐ Yes	

IV. EMPLOYMENT BEFORE BEGINNING GRADUATE PROGRAM

(45)	**What was your employment status before beginning your graduate program?**	☐ Employed; Full-time ☐ Not employed ☐ Employed; Part-time ☐ I was a student

If you were not employed or were a student, SKIP the following questions. Go to Section V.
If you were employed full/part-time, please describe the job that you held immediately before beginning your graduate program.

(46) **Name of Employer and Country of Location**		(47) **Year**		(48) **Job Title/Position**
Employer Country:		From	To	
(49)	**Type of Employer:**			
	☐ University ☐ Private: local ☐ Private: multi-national ☐ International organization ☐ Government agency ☐ NGO ☐ Other: (specify)			
(50)	**Job Responsibility:** (Please check all that apply)			
	☐ Research ☐ Teaching ☐ Planning/policy-making ☐ Outreach/extension ☐ Administration/management ☐ Marketing/sales ☐ Other: (specify)			
(51)	**What was the <u>minimum</u> degree level required for this job?**			
	☐ B.S./B.A. ☐ M.S. ☐ Ph.D. ☐ Don't know			
(52)	**Did this job entail work related to beans/cowpeas?**		☐ No ☐ Yes	
(53)	If YES, **please describe nature of your work in relation to beans/cowpeas.**			
(54)	**Please approximate the <u>annual salary</u> (in US$) you received from this job.**		**Starting:** $ **Final:** $	
(55)	**In addition to this job, did you supplement your income through <u>outside consulting</u>?**		☐ No ☐ Yes	

V. CRSP-FUNDED GRADUATE DEGREE

(56)	**What was the highest degree you completed with B/C CRSP funding?**	☐ MS ☐ PhD

For this CRSP-funded graduate degree, please answer the following questions.

(57)	**Were you married?**	☐ No ☐ Yes
(58)	If YES, **was your spouse living with you?**	☐ No ☐ Yes
(59)	**Did you have any children?**	☐ No ☐ Yes
(60)	If YES, **how many did you have?**	
(61)	If you had children, **did any of them live with you?**	☐ No ☐ Yes

(62)	**How important was each of the following in your decision to pursue this CRSP-funded graduate degree in the U.S.?** (Please rate each item below on a scale of 1-Very Important to 4-Not Important)	Very Important 1	2	3	Not Important 4
	Desire to collaborate with specific scientists	☐	☐	☐	☐
	Opportunity to study at a specific university	☐	☐	☐	☐
	Encouraged by employer	☐	☐	☐	☐
	Encouraged by CRSP scientists	☐	☐	☐	☐
	Desire to gain an international perspective	☐	☐	☐	☐
	Opportunity to travel abroad	☐	☐	☐	☐
	Felt necessary for professional development	☐	☐	☐	☐
	Desire to earn higher income in the future	☐	☐	☐	☐
	Desire to secure a job in the future with an international organization	☐	☐	☐	☐

(63)	**Please indicate if you agree or disagree with each of the statements about your personal experiences during this CRSP-funded graduate degree.** (Please rate each item below on a scale of 1-Highly Agree to 4-Highly Disagree)	Highly Agree			Highly Disagree
	Academic Program	1	2	3	4
	My department provided an intellectually stimulating atmosphere.	☐	☐	☐	☐
	Communication with faculty regarding my needs and concerns was satisfactory	☐	☐	☐	☐
	The advice I received from my major professor was satisfactory.	☐	☐	☐	☐
	My major professor spent sufficient time to advise me on academic matters.	☐	☐	☐	☐
	The requirements and work of my graduate program were challenging but reasonable.	☐	☐	☐	☐
	My graduate program allowed me to pursue my specific academic interests.	☐	☐	☐	☐
	My graduate program provided me with excellent preparation for my future professional work.	☐	☐	☐	☐
	My graduate program was relevant to my current work/job responsibility.	☐	☐	☐	☐
	B/C CRSP Research				
	My CRSP research provided me an opportunity to gain valuable professional expertise and experience.	☐	☐	☐	☐
	I received sufficient professional guidance from CRSP staff/scientists.	☐	☐	☐	☐
	My CRSP research was interesting and intellectually challenging.	☐	☐	☐	☐
	The work requirements and expectations of my CRSP research were reasonable.	☐	☐	☐	☐
	My CRSP research provided me with excellent preparation for my future professional work.	☐	☐	☐	☐
	My CRSP research was relevant to my current work/job responsibility.	☐	☐	☐	☐

(64)	**During this CRSP-funded graduate degree, did you encounter any <u>academic-related</u> problems?** (e.g., failed exams, disagreement with faculty)	☐ No	☐ Yes
(65)	If YES, **please describe the problem(s) and suggest ways how the B/C CRSP can help students cope with such problem(s) in the future.**		
	Problem(s)	Suggestion(s)	

(66)	**During this CRSP-funded graduate degree, did you encounter any <u>non-academic-related</u> problems?** (e.g., family, financial matters)	☐ No	☐ Yes
(67)	If YES, **please describe the problem(s) and suggest ways how the B/C CRSP can help students cope with such problem(s) in the future.**		
	Problem(s)	Suggestion(s)	

(68)	**What significant changes/impacts in your personal and/or professional life can you attribute to your CRSP-funded graduate degree?** (Please provide us some concrete examples)
	a) Changes/impacts on personal life
	b) Changes/impacts on professional life

VI. PROFESSIONAL ACTIVITIES AFTER COMPLETING HIGHEST DEGREE

(69)	**What was the highest degree you completed?** (regardless of funding source)	☐ MS ☐ PhD

For this degree program, please answer the following questions.

(70)	**What are the 3 most important types of knowledge, skills, and attitudes (KSAs) that you acquired from this degree program?** (e.g., designing/conducting/analyzing scientific research, scientific methods/tools, attitude towards work, computer skills, critical thinking, time management, language fluency, communication skills)
	1.
	2.
	3.

(71)	**Did you encounter any problems in applying these KSAs in the job that you help immediately after receiving your highest degree program?**	☐ No ☐ Yes
(72)	If YES, **please describe any problem(s) you encountered in applying these KSAs.**	

(73)	**How have you shared your knowledge, skills, and attitudes with others?** (Please check all that apply)
	☐ through seminar/conference ☐ through workshop/training course ☐ as university instructor ☐ through publication ☐ through research supervision of students ☐ through outside consulting ☐ Other: (specify)

(74)	**Since completing this graduate program, have you collaborated on a research project with your B/C CRSP supervisor?**	☐ No ☐ Yes
(75)	If YES, **please describe the time and nature of your most recent collaboration.**	
	Nature of Collaboration	Years

(76)	**Are you currently involved in any bean/cowpea related organizations?** (e.g., professional societies, associations, networks)	☐ No ☐ Yes
(77)	If YES, **please list the name(s) of the bean/cowpea related organization(s).**	

(78)	**Please describe your most important professional accomplishments (related to beans/cowpeas) after completing your highest degree.** (e.g., varieties released, patents registered, awards received)

(79)	**Please feel free to share any additional comments.**

If you were a U.S. citizen during your B/C CRSP-funded graduate program, do not answer the following questions. You have completed the survey. Please GO to "Final Instructions" on how to submit your survey.

If you were a non-U.S. citizen during your B/C CRSP-funded graduate program, please continue to Section VII.

VII. HOST-COUNTRY SCHOLARS

(80)	**In your home country, what do you think are the most important constraints to building institutional capacity?**

(81)	**In your home country, how could the B/C CRSP better achieve its goal of building institutional capacity?**

(82)	**What was your visa status during your CRSP-funded graduate program?**	☐ F-1 ☐ J-1 ☐ Other

	After completing your highest degree....	
(83)	**Were you required to return to your home country?** (e.g., visa restrictions, contract agreements)	☐ No ☐ Yes
(84)	**Were you guaranteed of a job upon returning to your home country?**	☐ No ☐ Yes
(85)	**Did you return immediately to your home country?**	☐ No ☐ Yes
(86)	If YES, **did you return to the same institution at which you were employed before beginning your graduate program?**	
	☐ No ☐ Yes ☐ Not applicable (I was not previously employed)	
(87)	If NO, **where did you go and why?** (Please choose one and briefly explain why)	
	☐ Stayed in the U.S. Reason:	
	☐ Joined another institution in my home country Reason:	
	☐ Went to a third country Reason:	
	☐ Other: (specify) Reason:	
(88)	If you are currently in the U.S. or a third country, **do you intend to return permanently to your home country?**	
	☐ Within a year ☐ In 1-2 years ☐ In 3-5 years ☐ No/never ☐ Don't know	

(89)	**Could you have done the same graduate degree and specialization at a university in your home country?** (referring to your highest degree program)	☐ No ☐ Yes ☐ Don't know
(90)	If YES, **would you receive the same salary if you had earned your highest degree from a university in your home country?**	☐ No ☐ Yes ☐ Don't know

(91)	**Could you have done the same graduate degree and specialization at a university in your geographical region?** (referring to your highest degree program)	☐ No ☐ Yes ☐ Don't know
(92)	If YES, **please tell us the name of the university.**	

(93)	**In your field, please approximate the current entry-level annual salary** (in US$) **of a host-country national who:**			
	Earned his/her degree at a local university		Earned his/her degree at a U.S. university	
	BS:	US$	**BS:**	US$
	Masters:	US$	**Masters:**	US$
	PhD:	US$	**PhD:**	US$

You have completed the survey.
Please GO to "Final Instructions" on how to submit your survey.

Appendix 5.

US-PI Survey Questionnaire[31]

[31] This survey was approved by the Social Science/Behavioral/Education Institutional Review Board (SIRB) at Michigan State University. Approved 3/31/06 – valid through 3/30/07. IRB # 06-142.

DIRECTIONS: Please type your answer in the shaded areas of the questionnaire. For questions with pre-coded responses, click on the box to mark your answer. You can use TAB (or your mouse) to go to the next question or space. Press ENTER if you want to add another row or need more space for your answer.

I. CURRENT WORK INFORMATION

Please tell us details of your current job or your most recent job, if NOT currently employed.

(1) **Name of Employer/Institution**	(2) **Years** (From-To)	(3) **Job Title/Position**
	-	

(4)	**Type of Employer:**	☐ University ☐ Other: (specify)
(5)	**Job Responsibility:** (Please select all that apply) ☐Research ☐Teaching ☐Outreach/Extension ☐Administration ☐Other: (specify)	

II. B/C CRSP

(6)	**Are you involved in the current B/C CRSP grant?**	☐ No ☐ Yes
(7)	If YES, **please tell us the year when you first became involved with the B/C CRSP.**	
(8)	If NO, **please tell us the years of your most recent involvement with the B/C CRSP.**	From: To:

(9) **What is/was the nature of your involvement with the B/C CRSP?** (Please consider your current and past involvement)	**Current Grant**	**Past Grant(s)**
a) Receive(d) and manage(d) B/C CRSP funds as **PI/Co-PI**	☐	☐
b) Receive(d) and manage(d) B/C CRSP funds as a **collaborator**	☐	☐
c) Serve(d) as a **collaborator** on a B/C CRSP project, **but** do (did) **not** receive or manage B/C CRSP funds	☐	☐

(10) **On which commodity do/did your CRSP activities focused?**
☐ Beans ☐ Cowpeas ☐ Both beans & cowpeas

(11) **With which institutions/countries have you collaborated with support from the B/C CRSP?** (Please list the name of institution, country of location, and years of collaboration)		
Institution	Country	Years
1.		-

(12) **In the 3 countries where you have worked most intensively on a B/C CRSP project, what do you consider is/are the biggest constraint(s) to building institutional capacity?**	
Country	Constraints
1.	1.
2.	2.
3.	3.

(13) **In the 3 countries where you have worked most intensively on a B/C CRSP project, how do you think B/C CRSP can better achieve its goal of building institutional capacity?**	
Country	Recommendations/Suggestions
1.	1.
2.	2.
3.	3.

III. B/C CRSP GRADUATE DEGREE TRAINING PROGRAM

Please consider involvement in graduate degree training only (MS or Ph.D.).

(14)	**How have you been involved in the B/C CRSP graduate degree training program?** (Please select all that apply)	
	☐ I have not played any role in the B/C CRSP graduate degree training program*	
	☐ Served as major professor for a B/C CRSP trainee enrolled in my university	☐ Served as major professor for a B/C CRSP trainee enrolled at another university
	☐ Served as thesis/dissertation adviser for a B/C CRSP trainee enrolled in my university	☐ Served as thesis/dissertation adviser for a B/C CRSP trainee enrolled at another university
	☐ Served as member of thesis/dissertation committee for a B/C CRSP trainee enrolled in my university	☐ Served as member of thesis/dissertation committee for a B/C CRSP trainee enrolled at another university
	☐ Other: (specify)	

*If you have NOT played any role in the B/C CRSP graduate degree training program, do not answer the following questions. You have completed the survey. Please GO to "Final Instructions" on how to submit your survey.

(15)	**Have you encountered any problems in funding graduate students through the B/C CRSP?**	☐ No ☐ Yes
(16)	If YES, **please describe the most significant problem(s) and suggest ways how the B/C CRSP can help with such problem(s) in the future.**	
	Problem(s) (up to 3)	Suggestion(s):
	1.	1.

(17)	**What do you think are the major strengths of the B/C CRSP graduate degree training program?**
	1.

(18)	**What do you think are the major weaknesses of the B/C CRSP graduate degree training program?**
	1.

The next section asks you about student/trainee-specific information.

IV. STUDENT ASSESSMENT

DIRECTIONS: Our records indicate that you have supported the following students with B/C CRSP funds. Please answer the corresponding questions for each student.

(1)	Last Name	Given Name	Citizenship	Start Yr	End Yr	Degree	Department

(19)	**In what capacity did you supervise this student?** (Please select all that apply)	
	☐ I did not supervise this student*	☐ I do not remember*
	☐ Major professor	☐ Thesis/dissertation adviser
	☐ Member of thesis/dissertation committee	☐ Other: (specify)
	*SKIP the following questions if you did NOT supervise the student or if you do NOT remember having supervised the student. GO to NEXT student.	
(20)	**Did you play a role in selecting and recruiting this student?**	☐ No ☐ Yes ☐ Do not remember

(21) If YES, **why did you select/recruit this student?**

- ☐ Student was employed at a collaborating host-country institution and with which I have had prior working relationship
- ☐ Student was employed at a collaborating host-country institution but with which I have not had prior working relationship
- ☐ Student was from a collaborating host-country and was already enrolled in my department
- ☐ Student was from a non-host country and was already enrolled in my department
- ☐ Student was from a collaborating host-country and was recommended by a host-country collaborator
- ☐ Student was from a country where I had plans to expand B/C CRSP research
- ☐ Do not remember
- ☐ Other: (specify)

(22) **Was this student fully or partially funded by B/C CRSP?**

- ☐ Fully funded (funded tuition, stipend, and research costs for the student's whole degree program)
- ☐ Partially funded (funded part of the costs of the student's degree program and/or funded only student's thesis/dissertation costs)
- ☐ Don't know (I did not play a role in funding decisions/I do not remember)

If fully funded, go to Q# 23. If partially funded, go to Q# 24.

(23) **If fully funded, what factor(s) played a role in your decision to fully-fund this student?**
(Please select all that apply)

- ☐ Trainee was from a collaborating host country institution
- ☐ Trainee could not attend graduate school without full-funding
- ☐ Certainty of B/C CRSP funds to support the trainee's whole degree program
- ☐ Adequacy of B/C CRSP funds to support the trainee's whole degree program
- ☐ Do not remember ☐ Other: (specify)

(24) **If partially funded, what factor(s) played a role in your decision to partially-fund this student?**
(Please select all that apply)

- ☐ Trainee was from a non-host country
- ☐ Availability of funds from my department to partially support the trainee
- ☐ Availability of funds from external sources to partially support the trainee
- ☐ Inadequate B/C CRSP funds to fully-support the trainee
- ☐ Uncertainty of timing of B/C CRSP funds
- ☐ Do not remember ☐ Other: (specify)

(25) **Did you play a major role in the selection and approval of the student's research/thesis/dissertation topic?** ☐ No ☐ Yes ☐ Do not remember

(26) If YES, **how was the research/thesis/dissertation topic selected?**

- ☐ I proposed the topic to the student
- ☐ The student proposed the topic himself
- ☐ Do not remember
- ☐ Other: (specify)

(27) **Are you currently collaborating with this student?** ☐ No ☐ Yes

(28) If YES, **please describe the nature of your collaboration.**

(29) If NO, **please describe the time and nature of your most recent collaboration.**
(SKIP this question if you did not collaborate with this student since he/she completed graduate study)

(30) **Do you know of any outstanding achievements/contributions that this student has made/accomplished since completing his/her graduate program?**
(Please consider both CRSP and non-CRSP related achievements/ contributions) ☐ No ☐ Yes

(31) If YES, **please describe his/her most important achievements/contributions.**

(32) **Please provide this student's last known e-mail address.**

You have completed the survey.
Please GO to "Final Instructions" on how to submit your survey.

Appendix 6. US-PI and HC Collaboration

US Institution	Number of PI	HC: HC Institution
Colorado State University	1	Costa Rica: University of Costa Rica
Michigan State University	7	Costa Rica: University of Costa Rica; Ecuador: Insituto Nacional Autónomo de Investigaciones Agropecuarias; Guatemala: Institut de Ciència i Tecnologia Ambientals; Honduras: Escuela Agrícola Panamericana; Jamaica: University of West Indies; Malawi: Bunda College of Agriculture; Mexico: National Institute for Forest, Agriculture and Livestock Research; Nicaragua: Instituto Nicaraguense de Tecnología Agropecuaria; U.S. Virgin Islands: Agricultural Experiment Station; Tanzania: Sokoine University of Agriculture, University of Morogoro
Purdue University	3	Burkina Faso: Institut de l'Environnement et de Recherches Agricoles; Cameroon: Institut de Recherche Agricole pour le Developpement; Costa Rica: University of Costa Rica; Ghana: Savannah Agricultural Research Institute, Cooperative Resources International; Malawi: Bunda College, University of Malawi, Institut d'Economie Rurale du MALI; Mozambique: Instituto de Investigação Agrícola de Moçambique; Niger: Institut National de la Recherche Agronomique du Niger; Nigeria: Institute of Agricultural Research, Abubakar Tafawa Balewa University; Senegal: Institut Senegalais de Recherches Agricoles; South Africa: University of the Free State; Tanzania: Sokoine University of Agriculture
Seminis Vegetable Seeds	1	Brazil: Agricultural Research Corporation; Tanzania
University of California-Davis	1	Malawi: Bunda College
University of California-Riverside	2	Ghana: SRI Nyankpala; Kenya: University of Nairobi; Senegal: ISRA; Sudan: Agricultural Research Council
University of Georgia	3	Benin: National Institute of Agricultural Research of Benin; Ghana: Univ. of Ghana at Legon, Accra; Nigeria: University of Nigeria, Nsukka
University of Minnesota	1	Ecuador: Instituto Nacional de Investigaciones Agropecuarias; Tanzania: Sokoine University of Agriculture
University of Nebraska	1	Dominican Republic: Secretary of Agriculture, Centro para el Desarrollo Agropecuario y Forestal, Inc.; Honduras: Escuela Agrícola Panamericana; Tanzania: Sokoine University of Agriculture
University of Puerto Rico	1	Dominican Republic: Ministry of Agriculture, Instituto Dominicano de Investigación Agroflorestales; Haiti: Ministry of Agriculture; Honduras: Escuela Agrícola Panamericana
University of Illinois	1	Tanzania: Sokoine University of Agriculture; Malawi
Washington State University	1	Guatemala: Instituto de Nutrición de Centro América y Panamá
USDA-ARS	2	Costa Rica: University of Costa Rica; Guatemala: Instituto de Nutrición de Centro América y Panamá; Tanzania: Sokoine University of Agriculture
TOTAL	**25**	

Appendix 7. List of B/C CRSP Trainees from Tanzania

	Trained at U.S. institutions						
	Last Name	**Given Name**	**Gender**	**End Year**	**University**[a\]	**Degree**	**Department**
1	Elia	Frank	M	1995	MSU	Ph.D.	Crop Science
2	Mabagala	Robert	M	1991	MSU	Ph.D.	Plant Pathology
3	Magayane	Flavianus	M	1994	U of Illinois	Ph.D.	Ag Extension
4	Mmbaga	Emil	M	1989	MSU	Ph.D.	Crop and Soil Sciences
5	Mollel	Naftali	M	1989	U of Illinois	Ph.D.	Ag Extension
6	Mosha	Theobald	M	2004	MSU	Ph.D.	Nutrition/Food Science
7	Msolla	Susan Nchimbi	F	1988	UWI	Ph.D.	Horticulture
8	Njau	Paul	M	1995	WSU	MS	Virology
9	Quentin	Martha	F	1991	MSU	Ph.D.	Entomology
10	Rugambisa	Jeremiah	M	1985	U of Illinois	Ph.D.	Ag Economics
11	Rweyemamu	Cornel	M	1995	MSU	Ph.D.	Crop and Soil Sciences
	Trained at Sokoine University of Agriculture, Tanzania						
	Last Name	**Given Name**	**Gender**	**End Year**	**University**	**Degree**	**Department**
12	Gondwe	Betty James	F	1996	SUA	Ph.D.	Bacteriology
13	Ijani	Afihini	M	1996	SUA	Ph.D.	Plant Pathology
14	Kweka	Sosthenes	M	2005	SUA	MS	Plant Breeding
15	Misangu	Robert	M	1996	SUA	Ph.D.	Crop Science
16	Mkenda	Vera	F	1996	SUA	MS	Crop Science
17	Mohamed	Rose-Anne	F	1989	SUA	MS	Crop Science
18	Mtenga	Kibiby	F	1999	SUA	MS	Ag Extension
19	Silomba	Luseshelo	M	1999	SUA	MS	Ag Economics
20	Zubeda	Mduruma	F	1994	SUA	Ph.D.	Crop Science

a\ MSU=Michigan State University, U of Illinois=University of Illinois, UWI=University of Wisconsin, WSU=Washington State University, SUA=Sokoine University of Agriculture

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