AN EVALUATION OF THE IMPACT OF TRAINING: A CASE STUDY OF THE MALAWIAN AND TANZANIAN BEAN/COWPEA COLLABORATIVE RESEARCH SUPPORT PROGRAMS

By

Teresa Jean Howes

A PLAN B PAPER

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Agricultural Economics

1992

ABSTRACT

THE BEAN/COWPEA CRSP:
AN EVALUATION OF THE IMPACT OF TRAINING
IN MALAWI AND TANZANIA

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Teresa Jean Howes

PURPOSE: The Bean/Cowpea collaborative research support program (CRSP) was established to address the problems of hunger and malnutrition in Africa and Latin America by increasing smallholder production of beans and cowpeas, major subsistence crops. This was to be accomplished by developing and testing improved technologies and enhancing the abilities of developing country scientists to solve problems related to bean and cowpea production and use. A major accomplishment of the CRSP has been to increase agricultural scientific research and training capacity. The purpose of this paper is to evaluate the training component of the Malawi and Tanzania Bean/Cowpea CRSPs. The evaluation examines the impacts of training on the individual research scientists, on building scientific capacity, on upgrading the bean research programs, and on strengthening institutional linkages, with emphasis on the last two issues.

METHODOLOGY: Data used in this study were collected from CRSP records and reports, the training institutions in the U.S. and a survey of past and present training participants and host-country principle investigators.

RESULTS: Training has increased scientific capacity for bean research in Malawi and Tanzania by increasing the number of national researchers with advanced degrees and upgrading the level of associated professional skills. Although training has resulted in an

increase in non-monetary benefits to individual research scientists, the impact on real salaries is unclear. CRSP training has strengthened the linkages between farmers and researchers, researchers and policymakers, and among researchers. Non-degree training opportunities provided by the CRSP, such as workshops, seminars and conferences, keep scientists up-to-date on new technological developments and encourage collaboration by providing a forum for intellectual exchange.

CONCLUSIONS: CRSP training has already contributed greatly to building scientific bean research capacity in both Malawi and Tanzania by increasing the number of teachers and research scientists and upgrading their skills. Despite the fact that the CRSP currently spends 50% of its budget overseas, it still cannot provide research project funding at desired levels. Coupled with low salaries for host-country scientists, this may jeopardize program efficiency and productivity by reducing research morale or inducing turnover. Host-country scientists represent savings of up to 43%, or $145,000 per year, relative to the employment of expatriates.

Research and training take time, and require a long planning horizon. In order to make the most of prior investments in training and the development of host-country scientific capacity, projections of long-term human resource needs must be incorporated into the planning and budgeting process. Research system performance will be enhanced by adding staff in subject areas not covered adequately by current staff, including the addition of administrative specialists so that skilled scientists currently performing these tasks can return to their roles as researchers. Continued training of host-country scientists is essential to the long-term health of bean programs in Tanzania and Malawi.

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LIST OF ACRONYMS

AID	Agency for International Development
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CRSP	Collaborative Research Support Program
FY	Fiscal Year
GDP	Gross Domestic Product
IARC	International Agricultural Research Center
IBRD	International Bank for Reconstruction and Development (The World Bank)
IMF	International Monetary Fund
ISNAR	International Service for National Agricultural Research
MSTAT	Micro-Computer Statistical and Data Management Package
MSU	Michigan State University
NARS	National Agricultural Research System
PI	Principle Investigator
SADCC	South African Development Coordinating Committee
SUA	Sokoine University of Agriculture
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WSU	Washington State University

Chapter 1 INTRODUCTION

Over the course of the past three decades, it has become increasingly apparent that Africa is falling behind in economic development. The optimism generated in the late 50s and early 60s when many countries gained independence has been dampened by slow economic growth and increasingly frequent food deficits. Although agriculture employs the majority of the population as small-scale, subsistence farmers and plays a dominant role in many countries as a generator of foreign exchange, food production in Africa has not kept pace with the rate of population growth, increasing only half as fast (Eicher 1988). For these reasons, increasing agricultural production through research and development is considered key to "getting Africa moving." Unfortunately, Africa is far behind in this arena as well, with only one-fifth the number of research and development scientists and engineers per million people as Asia. In addition, expatriates hold nearly one-fourth of the positions in national agricultural research systems (NARS) and faculties of agriculture, as agricultural researchers and academic staff (Eicher 1988).

Building indigenous agricultural scientific research and training capacity as well as strengthening research, development and extension institutions are prerequisites to increasing agricultural production. Recognizing this, the Bean/Cowpea collaborative research support program (CRSP) has focused many of its resources during the past decade on training. The overall goal of the CRSP is to increase production of beans and cowpeas in those countries where they are major food crops by developing and testing improved technologies and by enhancing the abilities of developing country scientists to solve problems related to bean and cowpea production and use. The first purpose of the CRSP program was to mount a major, multi-institutional U.S.-LDC collaborative research effort which could provide the knowledge base necessary to achieve significant advances in alleviating the principle constraints to

improved bean and cowpea production, marketing, and utilization. The second purpose is to generate, adapt and apply improved technologies to local conditions. Training, as an integral part of this coordinated research effort, has been a means of reaching the more general CRSP goal of addressing hunger and malnutrition in Africa and Latin America. Major emphasis has been placed on "collaborative research between scientists from different countries and different disciplines," with each project focusing on a particular aspect of production or utilization of beans and cowpeas according to a global plan (USAID 1980; Bean/Cowpea CRSP 1988, 1). Because the CRSP is a global effort with research as its mandate, individual CRSP projects are centered around particular research problems. Decisions on the allocation of resources for graduate research assistantships are based primarily on research project needs, with an effort to match recipients' abilities and interests with a particular research problem. For this reason, each CRSP project funds trainees from various countries, including the United States.

Statement of Purpose

One of the major objectives of the Bean/Cowpea CRSP has been to increase scientific capacity and encourage institution building by providing funding for training. The purpose of this paper is to evaluate the training component of the Bean/Cowpea CRSP in Malawi and Tanzania. The evaluation will examine the impacts of training on the individual research scientists, on building scientific capacity, and on strengthening institutional linkages, with emphasis on the last two issues.

Chapter 2 DATA COLLECTION AND METHODOLOGY

Data used in this study were collected from CRSP records and reports at the host training institutions in the U.S. and a survey of past and present trainees. The host-country principle investigators provided additional information concerning the bean programs in their respective countries, and also served to verify the information obtained from other sources.

Survey Methodology

Human resource development literature was reviewed to determine appropriate indicators of training impacts. A questionnaire (Appendix A) was then designed to elicit information concerning: a) both the monetary and nonmonetary impacts of training on the individual research scientists; b) the impact of training on the development of institutional linkages; and c) the personal assessments of the scientists concerning the appropriateness and management of research and training. A draft questionnaire was pretested on four current CRSP trainees from four different African countries, and their comments and suggestions incorporated into the final version. The target population for the survey included all Bean/Cowpea CRSP degree training participants from Malawi and Tanzania who had received partial of full funding through the CRSP, or who had received funding from other sources to work on CRSP projects during training. The target population included both those currently in advanced degree training programs in the United States and Tanzania, and those who had already completed their training and were back in country. In order to track their progress, the questionnaire was also sent to individuals who were not citizens of Malawi and Tanzania, but who received partial or total funding for their education from the Malawi and Tanzania CRSP project funds. A breakdown of the training participants (by project, highest degree-level of training, and gender) is presented in Table 1.

Method of Analysis

Results obtained from the survey were examined to determine the level and direction of training impact, and compared to findings of other training evaluations and human resource development literature.

Table 1 CRSP Supported Trainees[a]

Highest Degree Attained	Tanzania		Malawi	
	Female	Male	Female	Male
PhD	2 (1)	3[b] (2)	1 (2)	2
MS	1 (1)	1 (2)		2 (1)
BS[c]		7		
Total	3 (2)	11 (4)	1 (2)	4 (1)

SOURCE: CRSP Management Office

a) Numbers preceding parentheses indicate host-country nationals. Numbers in parentheses indicate non-host-country nationals.
b) Two additional Tanzanians currently working on their doctorates are not included table since they have not yet completed their degrees.
c) BS students only received support for their senior thesis and were therefore not included in the survey.

Chapter 3 BACKGROUND

Malawi

From 1978 to 1989, Malawi's population grew from 5.68 million to 8.03 million, which represents an average annual increase of 3.76%, one of the highest population growth rates in Africa (Table 2). Agricultural production lagged behind, however, with per capita food production in 1988 only 85% of its 1980 level. Increased pressure on arable land, in tandem with a host of macroeconomic factors, has resulted in food insecurity for many Malawians. Malnutrition is a chronic problem and Malawi's infant mortality is among the highest in the world, at just under 151 per thousand (USAID 1989; World Bank 1990).

Due to the structural adjustment policies pursued by the Government of Malawi, the kwacha (Malawi's currency) has depreciated to only 30% of its 1978 value. Foreign exchange earnings have fallen, due in part to falling world prices for export commodities. This has reduced the amount of intermediate and capital inputs that can be obtained, since most must be imported and purchased with scarce foreign exchange. Real per capita GDP has fallen 38.6% since 1978, from $266.92 to $163.72 in 1989.[1]

Since independence, agriculture has been the largest source of GDP, contributing between 32.3 and 36.8 percent of annual product since 1978. In 1988, agriculture employed 85% of the labor force and accounted for nearly 90% of the foreign exchange earnings. Smallholders dominate agriculture, producing 76% of the agricultural GDP in 1989. However a lack of arable land, low productivity due to the lack of high-yielding varieties, pricing and marketing distortions and low incomes, are making it increasingly difficult for smallholders to survive. The land available for cultivation was only 0.41 hectares per capita

[1]All figures quoted in constant U.S. dollars where 1982-84 = $1.

Table 2 Social and Economic Indicators of Development

Indicator	Malawi	Tanzania
Population (millions)		
1978	5.68	17.44
1989	8.03	24.7
Average Annual Population Growth Rate	3.76%	3.78%
Percent of Total Population Living in Rural Areas (1988)	86	70
Agriculture as a Percent of GDP (1988)	37	66
Average Index of Food Production per Capita in 1988-88 (1979-81 = 100)	85	89
Average Real per Capita GDP (in US 1982-84 dollars)		
1978	$266.92	$381.10
1989	$163.72	$87.84
Exchange Rate[a]		
1978	0.8091	7.415
1981	0.9074	8.322
1984	1.5649	18.105
1987	2.0538	83.717
1990	2.6795	192.300
Average Annual Rate of Inflation (1980-1988)	12.6%	25.7%
Terms of Trade[b] (1980 = 100)		
1978	69	90
1989	72	94
Life Expectancy at Birth	47	53
Infant Mortality Rate (per 1000 live births)	151	104

SOURCES: IBRD/ The World Bank, World Development Report 1990.
IMF, International Financial Statistics.

a) Malawi: Malawian kwachas per US dollar.
Tanzania: Tanzanian schillings per US dollar.

b) Net barter terms of trade: calculated as the ratio of the country's average import price index to its average export price index.in 1987, and is expected to shrink to 0.3 hectares per capita by 2002. As a consequence, rural to urban migration has accelerated, increasing the need for affordable food in urban centers (USAID 1989; Mkamanga 1988).

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A formal national research program on phaseolus beans was begun in 1979, when the Ministry of Agriculture gave the mandate for bean research to Bunda College of Agriculture (Bunda College) in Lilongwe. This program was built on extensive earlier work of individual professionals at the college. In 1982, the Michigan State University-Malawi Bean/Cowpea CRSP project was established at Bunda College and was given the primary responsibility for research on genetic diversity (Billing 1984). Research objectives for the current funding period[2] are two-fold: 1) to understand the genetic and sociocultural factors underlying the diversity present in Malawian beans by quantifying and describing the variability found within major preferred seed classes through germplasm collection and sorting; and 2) to screen for disease resistant genotypes of preferred bean types (CRSP 1988).

Tanzania

Like Malawi, Tanzania has also been experiencing rapid population growth. From 1978 to 1989 the population increased from 17.44 million to 24.7 million representing an average annual growth rate of 3.78%. In contrast to Malawi, Tanzania is land rich; in 1983, only 9% of the total arable land was under cultivation. Here too, however, per capita food production had fallen by 1988 to only 89% of its 1980 level for many of the same reasons.

[2]Fiscal years 1989-91, which cover the period from October 1, 1989 to September 30, 1991.

With a per capita GDP of $88 in 1988, Tanzania is one of the poorest countries in the world, although it ranks relatively high in terms of human development.[3] With 80% of the population in the rural sector, agriculture plays the dominant role in the Tanzanian economy, contributing 66% of the GDP in 1988 (World Bank 1990). Over 85% of the working population are in smallholder production (Bennell 1989, 8).

Bean research in Tanzania prior to the 1980s was limited to some research efforts directed towards improving canning characteristics. The National Phaseolus Bean Research Program was begun in 1979, but did not acquire a breeder, agronomist and plant protectionist until 1981. In 1981 the Washington State University - Tanzania Bean/Cowpea CRSP project was established at what is now Sokoine University of Agriculture (SUA), located at Morogoro. Current research objectives include: 1) the development of disease and insect resistant cultivars for smallholder families; and 2) estimation of the economic viability of the new cultivars and their impact on women's roles in the production, consumption and marketing process" (Bean/Cowpea CRSP 1988).

Relevance of Bean Research and CRSP Objectives

In both Malawi and Tanzania smallholders produce nearly 100% of the beans. Only 25% of total production is marketed, which indicates that beans are grown primarily for subsistence. They are high in protein, providing an inexpensive alternative source of nutrients for those unable to afford animal protein. They also provide nutrients, in the form of green pod, during the "hungry season" before the first harvest. Beans are frequently intercropped

[3]According to a new Human Development Indicator (HDI) developed by the UNDP, Tanzania ranks 118th out of 130 countries in terms of per capita GDP, but in terms of human development, it ranks 35th (HDI = 0.413 on a scale of 0 to 1, where 1 indicates high human development). Malawi ranks 116th in terms of per capita GDP and has an HDI of only 0.250 (UNDP, 1990).

with maize and other crops, in part due to their ability to fix nitrogen. This alleviates some need for purchased fertilizer, which is often unavailable due to distribution bottlenecks, lack of cash, or foreign exchange scarcity (Shao et al. 1988; Bennell 1989; Malima et al. 1985; Manda et al. 1985). Hence, the CRSP has focused on increasing smallholder productivity by pursuing research to develop high-yielding, drought-, pest- and disease-resistant varieties.

Building indigenous scientific capacity in these two countries has been difficult yet critical, given the colonial legacy left behind in the wake of the independence celebrations that swept Africa: a fragile research system made up almost entirely of teams of expatriate research scientists who concentrated their efforts on large-scale commercial farms and commodities for export to the North. A similar situation characterized the training institutions. In 1974 only two Malawians on the teaching faculty of Bunda College, the main training institution for agricultural sciences, held an M.S. degree and only one held a Ph.D. By 1985, the faculty consisted almost entirely of Malawians; 17 held M.S. degrees and 14 held Ph.D.s (Delane et al. 1987).[4]

Although Malawi and Tanzania have made significant progress in building indigenous scientific capacity, as Table 3 and 5 illustrate, there is still a dearth of trained professionals. In 1984, 58, or 20% of the authorized professional agricultural research and training posts in Malawi were vacant, while 185, or 25% of the authorized posts were vacant in Tanzania. Such vacancies are due not only to budgetary constraints but also to a lack of competent and experienced personnel.

Prior to the CRSP, the bean research programs in both countries were very small and poorly funded. To address this constraint, the CRSP focused on strengthening bean research programs by training and upgrading human resources. This concentration of effort is crucial

[4]Comparable data were unavailable for Tanzania.

to the success of the program; without a critical mass of scientific personnel, effective and efficient agricultural research is nearly impossible (ISNAR 1984).

Chapter 4 RESULTS

Of the 30 questionnaires distributed, 12, or 40%, were returned. The questionnaire was designed specifically for Malawian and Tanzanians who received funding for advanced degree-level training. Of the 14 students who fit this category, 9 (6 Tanzanians and 3 Malawians), or 64% returned completed questionnaires. These numbers include two students who did not fill out the actual questionnaire, but who did fill out the pretest, which was similar. Two of the Malawian participants refused to participate in the survey on the grounds that they did not receive direct funding from the CRSP. However, the MSU-Malawi CRSP was responsible for arranging the training positions and funding for these students, as well as for providing staff support, equipment, and supplies. Completed questionnaires returned by expatriates trained with CRSP funds were not included in the results, but were used to track the progress of these CRSP funding recipients as well.

Impact of Training on Individual Research Scientists

Two potential types of benefits to individual research scientists exist: 1) monetary benefits, such as salary increases and outside contracting opportunities; and 2) nonmonetary benefits.

Monetary Benefits

Monetary benefits are probably the easiest to quantify and compare. Unfortunately only 6 people provided useable information concerning their pre- and post-training salaries. As expected, post-training salaries were higher in nominal terms, with 5 out of 6 rising (one remained the same). Real salaries, however, declined, with 4 falling 37 to 88 percent, one indeterminate and one rising by 38%.

Nonmonetary Benefits

All respondents noted a general increase in nonmonetary benefits since training. These included increased prestige, intellectual satisfaction, opportunities for travel, communication with other researchers, and availability of an increased number of support staff. Some respondents also noted an improvement in housing, per diem and access to vehicles.

Ongoing career development is a benefit CRSP participants also enjoy, both during degree training in the United States and after, when they are already in place. The CRSP arranges various short term training opportunities such as specially designed technical courses, off-the-shelf technical courses, on-the-job-training, symposia, conferences, and visits to research centers. All CRSP trainees have participated in numerous short term, non-degree training courses.

Not all personal impacts were positive. Four out of six respondents experienced a decrease in leisure time as a result of their current positions. Although three respondents noted an improvement in their family's diets, two stated that their families' diets had worsened, offering the explanation that their real salaries had declined a great deal. Given the low number of returns, however, it was impossible to determine whether diet and real income were correlated.

Although it is difficult to establish causality in the relationship between training and benefits, evaluation of the adequacy of personal benefits has important implications for research planning and management in terms of researcher productivity and retention (Wesson 1988). Inadequate benefits can lead to high turnover rates, disrupting continuity and necessitating increased expenditure on projects or training. It is generally accepted that

continuity and a long planning horizon are critical for agricultural research and development.[5] In contrast to other national agricultural research systems (NARS), Malawi and Tanzania have not had a problem with attrition of CRSP trained researchers, due to contracts, relatively high salary and benefit packages, and the lack of available positions in other organizations[6]. However, survey results indicate that turnover may soon become a problem. All respondents were aware of more lucrative job opportunities in international agricultural research centers, nongovernment organizations, foreign universities and the private sector. Two respondents indicated that they were considering other positions due to the declining real salaries they received in their current jobs.

Benefits can also take the form of improvements in the work environment, especially in those organizations with inflexible official pay scales which prohibit merit-based salary increases. A poor work environment can decrease job satisfaction and induce or accelerate turnover. Survey results and interviews with trainees indicate that a lack of financial resources for research is evident in both the Malawi and Tanzania CRSPs. Major constraints respondents face in conducting their research are lack of supplies, administrative hold-ups, insufficient funds, and inadequate staff. Some participants felt they weren't able to dedicate sufficient time to research due to heavy teaching loads and frequent school activities. These individuals indicated they were only able to conduct research on weekends and holidays, which may explain the decrease in leisure time associated with training. Participants

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[5]It took 10 years of work led by one individual to make a significant break through in tea research in Kenya and 30 years of maize research, again by the same individual, to develop the hybrid variety that resulted in the "green revolution" in Zimbabwe (Eicher 1989).

[6]USAID regulations stipulate that degree training recipients funded by USAID return to their country and sponsoring institution for a minimum of two years upon completion of training. In some cases participants are required to commit themselves to their sponsoring agency for longer periods.

interviewed said they found it very disappointing not to be able to utilize directly the research skills they had acquired during training.

Despite these drawbacks, 5 of the 9 respondents attributed increased job satisfaction directly to their CRSP training, as well as increased opportunities to plan and manage their research program and increased access to written resources.

Table 3 Number of Research and Training Professionals[a] in Malawi in 1984

	Research	Training
Authorized posts[b]	184	107
Vacancies	37	21
Malawians in posts	147	76
Expatriates in authorized positions	15	7
Expatriates in unauthorized positions	15	11
Female (percent of total number of professionals)	10%	10%
Expatriate (percent of total number of professionals)	20%	25%

SOURCE: Manda, et al. Agricultural Research Assessment in the SADCC Countries - Vol. II. Country Report: Malawi.

a) Professionals = bachelors degree or above.
b) Staff in training are not included in this table, thus the number of vacancies and filled posts do not add up to the number of authorized posts.

Impact on Scientific Capacity

Given the weak state of bean research prior to 1980, CRSP training has made a significant contribution to the bean and cowpea research programs in Malawi and Tanzania in the past decade by increasing the quantity and improving the quality of indigenous scientific capacity. Tables 3 through 6 provide a summary of research and training professionals in Malawi and Tanzania in 1984.

Table 4 Gender Distribution of Research and Training Professionals in Malawi in 1984[a]

	Research		Training	
Degree	Female	Male	Female	Male
BS	9 (2)	75 (3)	4 (0)	23 (0)
MS	5 (3)	40 (5)	3 (2)	2 (2)
PhD	2 (0)	23 (23)	1 (0)	12 (8)
Total	16 (5)	138 (31)	8 (2)	37 (10)

SOURCE: Manda, et al. Agricultural Research Assessment in the SADCC Countries - Vol. II. Country Report: Malawi.

a) Numbers in parentheses indicate non-host country nationals.

Quantity

Malawian research on pulses was limited prior to the CRSP. In 1980 there was only one bean researcher working part time at Bunda College although a second had previously invested considerable attention to bean research. In 1984 there were 10 professionals working on bean research: six Malawians (4 with bachelors and 2 with doctorates) and 4 expatriates (all with doctorates). This represented only 1.5 full time equivalents, however, since researchers had other responsibilities such as teaching. As of fiscal year 1991, the Malawi Bean/Cowpea CRSP supported the training of three Malawian, one Lebanese, and two American students (Table 1). In addition, the CRSP arranged research assistantships for two Malawian students to work on research related to, but not funded by, the CRSP. Three of the six trainees supported by CRSP were women, but only one of these was Malawian. All five

of the Malawian participants have returned to Bunda College to teach and to conduct bean research.

Table 5 Number of Research and Training Professionals[a] in Tanzania in 1984

	Research	Training
Authorized posts[b]	376	374
Vacancies	58	127
Tanzanians in posts	276	192
Expatriates in authorized positions	4	40
Expatriates in unauthorized positions	73	24
Total number of professionals	353	256
Total number of female professionals	64	26
Female (percent of total number of professionals)	18%	10%
Expatriate (percent of total number of professionals)	20%	25%

SOURCE: Malima, et al. Agricultural Research Resource Assessment in the SADCC Countries - Vol. II. Country Report: Tanzania.

a) Professionals = bachelors degree or above.
b) Staff in training are not included in this table, thus the number of vacancies and filled posts do not add up to the number of authorized posts.

The Bean/Cowpea CRSP at Sokoine University of Agriculture (SUA) in Tanzania has strengthened national bean research capacity considerably. Since 1980, the CRSP has supported advanced degree training for 15 people: nine Tanzanians, four Americans, one Ugandan and one Taiwanese citizen (Table 1). Of the Tanzanians, two are still working on their doctorates. Two completed master's degrees and five have completed their doctorates and are now back in place teaching and/or conducting research. Three of the Tanzanian participants were women, two of whom were doctoral students. When compared to the

number of female research and training professionals in 1984 (Table 6), this represents a significant increase in female PhDs. In addition, seven undergraduates received funding for work on their senior theses.

Table 6 Gender Distribution of Research and Training Professionals in Tanzania in 1984

	Research		Training	
Degree	Female	Male	Female	Male
BS	48	127	11	112
MS	16	131	12	74
PhD	0	31	3	44
Total	64	289	26	230

SOURCE: Malima, et al. Agricultural Research Resource Assessment in the SADCC Countries - Vol. II. Country Report: Tanzania.

The impact of the CRSP in arranging non-CRSP funded assistantships and providing administrative support for trainees from Malawi and Tanzania should not be overlooked. In some cases, faculty members at U.S. universities involved in the CRSP and U.S. principle investigators have actively sought and arranged alternative funding sources for Tanzanian and Malawian students to enable them to pursue research on beans, thereby complementing the CRSP training and research activities. It is unlikely such arrangements would have been made in the absence of the CRSP. It seems clear that the bean research programs have benefitted from CRSP collaboration and contacts. The two Malawian researchers referred to above, for example, whose assistantships were arranged by the U.S. CRSP principal investigator, both continue to carry out research on beans at Bunda College.

Given the relatively small size of the total annual budgets of the Malawian and Tanzanian CRSP, the projects have facilitated the training of a large number of individuals. USAID budgets $200,000 per year for each expatriate it supports overseas. By contrast, the total 1990 fiscal year budgets for the Malawi and Tanzania Bean/Cowpea CRSPs were $181,672 and $199,750, respectively.

Quality

The impact of advanced degree training on both the research and training systems cannot be reflected in the number of degree recipients alone. Those queried felt that the quantity and quality of their research and writing had improved as a direct result of training. While a limited number of CRSP participants hold research positions, most of those who received training have returned to universities where they are responsible for both teaching and research. Those who work at Bunda College tend to spend a greater proportion of their time (60-70%) teaching than do those who are in place in Tanzania. Upgrading the skills of these people has far-reaching effects since it improves the quantity and quality of the skills and information they are able transfer, as teachers as well as researchers.

Participants felt they could benefit from additional training. This is consistent with Bennell's assertion that "if agricultural research personnel are to maintain up-to-date knowledge and skills in their area of specialization and, thereby, be able to continue to undertake high-quality research throughout their careers, training must be received on a periodic basis" (Bennell and Zuidema 1988, 12). Continued education also serves to sustain motivation and productivity. Both the Tanzanian and Malawian Bean/Cowpea CRSP projects have recognized the importance of continued training and provide a variety of non-degree training opportunities such as short courses, workshops, conferences and seminars for bean

researchers and staff at all levels. In addition, project funds are used to send researchers to relevant workshops at international agricultural research centers. These events also provide opportunities for scientists to interact and to collaborate.

Impact on NARS of Training Host-Country Nationals

In countries such as Malawi and Tanzania, where salaries consume in excess of 70% of the R&D budgets, training of indigenous scientists can represent a significant savings to NARS. As noted above in tables 3 through 6, expatriates still represent a large portion of the professional research and development personnel in both Malawi and Tanzania, and are expensive budget items. The current annual salary and benefits package in Malawi and Tanzania for an expatriate and his family is estimated at $100,000, a large portion of which must be paid in scarce hard currency.[7] Salaries and benefits for CRSP trained indigenous bean research personnel are much lower. According to information provided by survey respondents, the current annual salary for host-country bean research scientists in Malawi is between $2,874 and $3,360, while the current annual salary in Tanzania ranges from $499 to $1,040. Regardless of the source of funding, employing indigenous scientists instead of expatriates represents a tremendous savings. Where budgets are a constraint on research, hiring host-country nationals can free resources for use elsewhere (eg. for equipment, recurrent costs, further training, or in the case of donor agencies, for completely different programs).

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[7]From personal communications with the host country principal investigators. It should be noted that this figure is at the low end of the range. Representatives of several donor agencies stated that they budget between $100,000 and $200,000 annually for each expatriate they support overseas, but also indicated that $100,000 was extremely low. It should also be noted that expatriate salaries are often paid by donor agencies and do not necessarily come out of national coffers.

The financial trade-offs between training indigenous scientists and employing expatriates can best be illustrated by way of example. Suppose a research organization, currently employing expatriate staff but still faced with a high number of vacant posts due to a lack of trained research personnel, such as is common in African NARS, is trying to determine the best use of its limited funds. Two options are being considered: 1) the organization could continue present staffing patterns; or 2) it could forgo employment of one expatriate scientist for one year and use the $100,000 salary and benefit savings for the MS/PhD education of one host-country national. Under option 2, the $100,000 would be placed in a savings program paying 10% interest; education expenses would be deducted annually. Table 7 illustrates this example, using actual costs to the CRSP for supporting the training of one Malawian participant. The Malawi CRSP trainees receive funding in the form of research assistantships. A half-time assistantship is considered "full-funding" by the CRSP. The first year $6,624 would be used for training and the balance of $93,376 would be placed in the savings program. After one year, $9,337.60 would have accumulated, pushing the balance up to $102,713.60. Training costs of $11,142 for the second year would be deducted from this new balance, leaving $91,571.60. After five years $87,693 would remain in the account. The research organization could use the interest on the remaining $87,000 to pay the trained scientist's annual salary and benefits, and provide a reasonable level of operating budget (Table 7).

It should be noted that the CRSP is very conservative in terms of its training expenditures per student, paying what is minimally required to support a student in the United States. Reworking the above exercise using a more realistic estimate of training costs of $20,000 annually yields a balance of $26,739 after five years. In addition, 5 years is an exceptionally short time-frame in which to obtain a combined MS/PhD, especially if language

Table 7 Example of Savings from Training a Host-Country National Using Resources Otherwise Used to Employ One Expatriate for One Year

Year	Beginning Balance (as of Jan. 1)	Cost of Education[a]	Ending Balance (as of Dec. 31)	Interest
1985	100,000.00	6,624	93,376.00	9,337.60
1986	102,713.60	11,142	91,571.60	9,157.16
1987	100,728.76	11,796	88,932.76	8,893.28
1988	97,826.04	13,824	84,002.04	8,400.20
1989	92,402.24	12,681	79,721.24	7,972.12
1990	87,693.36			
Total		56,067		

a) Tuition and expenses, exclusive of airfare and health insurance, for one trainee to obtain both an M.S. and Ph.D.

training required prior to beginning a graduate program. However, researchers trained with Malawi and Tanzania CRSP project funds generally took 4-6 years to finish a combined MS/PhD and 2-3 years to finish a PhD (see Appendixes B and C).

The preceding exercise looks only at two alternative uses of research funds; it does not imply anything about the value of expatriate scientists compared to indigenous scientists. Indeed, many research "successes" in Africa are the product of expatriate researchers as well as collaborative research efforts, thus the CRSP's focus on collaborative research.

There are still many instances where NARS employ expatriates simply because of a lack of trained indigenous scientists. Training indigenous scientists to fill posts while continuing to employ expatriates in the interim can still represent a significant long term savings to NARS. Suppose a NARS, currently employing 8 expatriates to fill vacant positions, was offered funding to support the PhD training of 8 host country nationals, with the understanding that

they would eventually replace the expatriates. Replacing the expatriates should not represent a problem, since most are on short term contracts of 2 years. $20,000 per year for five years would be budgeted to cover the training costs of each host country national, and $100,000 per year would be budgeted for each expatriate's salary and benefits. Expenses during the first five years would total $972,000 per year ($160,000 in training costs for the eight host country nationals, $800,000 in salaries for the eight expatriates, and $12,000 in operating budget[8]). Once they have completed training, the new scientists could be employed at an annual salary of $3,000 and an annual operating budget of $1,500 per scientist. This would reduce the cost to the NARS of filling the same eight positions to only $36,000 annually. It is reasonable to assume that these scientists, once trained, could provide at least 20 years of service. Over the course of the 25 years, including the initial training period, this would constitute a 43% savings to the NARS.[9]

Another less obvious benefit of building permanent indigenous scientific capacity is this capacity's stabilization of the research system and programs. Host-country nationals usually stay with the organization for long periods, contributing to the continuity of the program and to institutional memory. Expatriate scientists tend to remain in place for relatively short periods, with their departure often disrupting the program. Expatriate staff at Bunda College, for example, have usually served two year terms. This high turnover in expatriate staff has "produced considerable discontinuity in staffing and course offerings" (Welsch et al. 1987).

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[8]$1,500 is used as an estimate of the minimal operating budget necessary for each scientist. This is derived by taking 50% of the standard host country salary and benefits allocated for each research position. If a higher operating budget were allocated for expatriate scientists, the savings to NARS would be even greater.

[9]Using a discount rate of 12 percent. Again, it should be noted that the figure used in this example to represent the cost of supporting each expatriate is very conservative, but was chosen based on the host country PI's estimate. Using higher, more "realistic" figures would yield even greater savings.

Impact on Institutional Linkages

To improve the effectiveness and efficiency of agricultural research, attention must be given to strengthening both formal and informal linkages among policymakers, researchers, extensionists, and farmers. Effective linkages facilitate information flows, ensuring that research is in line both with national policy goals and individual farmer's needs (Stoop 1988). Strong linkages also provide opportunities for collaboration, thereby reducing the likelihood of costly duplication of research efforts.

All respondents felt that training had increased their opportunity to interact with other researchers, both domestically and internationally. In addition, 5 out of 6 felt that training increased their ability to influence farmers, extensionists and policymakers. Six out of nine participants commented, either during interviews or in the space provided for additional comments in the questionnaire, that the linkages among researchers, extensionists and farmers need to be strengthened to ensure that research is addressing farmers' needs. Objectives outlined in the Sokoine University of Agriculture and Washington State University Bean CRSP Participatory Research Program address this concern by focusing on: 1) producing a product that farmers will accept; 2) increasing farmer - researcher dialogue; and 3) identifying appropriate smallholder production practices (Michael-Butler et al. 1990).

Survey respondents and CRSP trainees and researchers interviewed[10] were unanimous in their assessment that the CRSP has been successful in encouraging collaboration among scientists. This corroborates external evaluation panel findings. In addition to the formal education it provided, advanced degree level training at universities in the United States enabled participants to establish contact with domestic and international researchers working

[10]5 CRSP participants in training at U.S. institutions during the survey period (August - December, 1990) and 2 host-country principal investigators.

in their field. CRSP workshops also serve to bring researchers together. According to one respondent, "CRSP has been very useful in bringing researchers closer together [both] basic and applied researchers, local and [foreign]. It was through some of these CRSP workshops that some of us got to know scientists working in our areas of interest and [we] established contacts..." Since the bean CRSP was introduced in Malawi and Tanzania, the CRSP has organized and funded many non-degree workshops and short courses, such as the Annual Bean Workshops in Tanzania and MSTAT workshops at MSU. Project funds have also been used to send bean researchers to workshops held at various universities in the United States as well as to workshops held at international agricultural research centers. The CRSP bean research project at SUA and the CIAT bean project in Arusha have participated in joint workshops for researchers, with efforts presently being made to strengthen collaboration between the two programs. Scientist to scientist communication is crucial in research and development, where it is important to keep in touch with the latest development (Bitanyi in Shao 1988, 78). Respondents noted that this is especially important for those researchers based in remote areas. In regards to this issue, respondents expressed concern that CRSP continue to function as a clearing-house for journal articles, papers and other information produced by bean researchers. Some respondents complained that they had not received CRSP newsletters as they had been promised.

Planning and Management of Training

The development and extension of new agricultural technologies take time. For example, it can take years, even decades from the time research is undertaken to develop a new variety until the impact on production can be seen. For this reason, a long time horizon for the planning and evaluation of agricultural research must be used. Eicher (1989)

recommends a 20 year minimum. Since training of research scientists is an integral part of any research program, it must be integrated into the planning and management processes. CRSP training programs are country specific, with the number and field of trainees tailored to meet each country's particular needs. At present, the MSU-Malawi CRSP project has phased down training, while the WSU-Tanzania CRSP just sent a new participant in 1990 for training. However, it does not appear that long term human resource planning is taking place in either CRSP, since there is no indication of such in either programs' annual research plans. An external evaluation panel for fiscal year 1989 concluded that there was "not a general understanding of the need for project training plans in the CRSP," and that it was "not exactly clear that the CRSP as a whole, or the management office, has internalized the need for project, regional and/or CRSP-wide training plans." (Bean/Cowpea CRSP 1990, 7).

In terms of participants' views of short- and long- term supply and demand for trained scientific research personnel, all but one felt that the number of scientists being trained was inadequate to fill projected needs for the next five years. This is not a short-coming of the CRSP; CRSP project resources are limited. In addition, the CRSP was never meant to replace national research programs, but was created, instead, to supplement them.

Previously training appeared not to have been a separate consideration in budgetary planning at the project level, since records prior to 1987 were not broken out into training and research categories but were kept only on a research project basis. This was in part due to the fact that the primary mandate of the CRSP was, and continues to be, research. However, training was also an integral part of the original CRSP goal and not merely an unexpected by-product. Data on training expenditures for the period under consideration were unavailable for the Tanzanian-WSU CRSP, while records on training expenditures for the Malawi-MSU CRSP were kept only at an aggregate level. Training records should include detailed

information on training expenditures for each individual student and on an aggregate, per project basis. It is nearly impossible to plan future training expenditures or evaluate past training expenditures, without precise information on how past resources were used. New record-keeping techniques have been implemented to solve this problem.

Appropriateness of Training

As mentioned previously, 4 participants felt that CRSP-related training had increased their opportunity to plan and to manage the research program. In addition, all respondents but one were responsible for some planning and management activities, such as budgeting, organizing field trips and managing staff. One former trainee, Alexander Mkandawire, is now the principal investigator for the Malawi Bean/Cowpea CRSP. Despite the fact that research scientists frequently acquire some degree of management responsibility once they are in place, management training is not incorporated into their programs of study. Research administrators and managers are often selected from the top research scientists. This lack of attention to management training can have two unfortunate consequences: the NARS, already suffering from a lack of trained researchers, loses an excellent scientist while gaining a poor research manager.

centers. Such a comparison would facilitate evaluation by the CRSP of the job market for agricultural scientific personal and enable the CRSP to predict and perhaps prevent personnel turnover induced by low salaries and benefits.

Although the information would be useful to the CRSP for decision-making purposes, it is very difficult to objectively measure, or even define, "scientist productivity," "critical mass," "quality of work," "research products," etc. However, obtaining even subjective information from the survey respondents and principle investigators was not a wasted effort in that it provides the CRSP with rough guides for determining future training needs and optimal academic curricula. Anecdotal information obtained through the survey and through interviews is also useful. Given the small sample population, it would be feasible in the future to interview past and current CRSP trainees in Malawi and Tanzania on a regular basis. This could be done on site by the CRSP management office during a seminar, workshop, or short course with little additional expense.

The survey elicited initial baseline data for the CRSP and should probably be repeated periodically in all countries that participate in the Bean/Cowpea CRSP to monitor on-going training and evaluate future training needs. The management office should ensure that detailed financial records and training plans for all Bean/Cowpea CRSP projects are kept in the same format.

Chapter 6 CONCLUSIONS

Despite the low number of responses, it is still possible to draw general conclusions. First, research and training take time, and require a long planning horizon. Although 10 years have elapsed since CRSP projects were established in Malawi and Tanzania, most of the training recipients have only been in place for a relatively short period, or are still in training. It may still be too early to observe the long term impacts of training. Still, it is possible to discern both some of the positive impacts of CRSP training and some of the aspects of CRSP training that need improvement.

First, CRSP training has already contributed significantly to building scientific bean research capacity in both Malawi and Tanzania by increasing the number of teachers and research scientists and upgrading their skills. In general, the Bean/Cowpea CRSP has been a relatively inexpensive means of building scientific capacity for the donor and can, over the long term, represent a significant savings to NARS.

Second, building permanent indigenous scientific capacity contributes to the stability of research programs by reducing turnover. Thus far it seems that benefits to individual scientists, combined with the lack of have been adequate to prevent attrition, but that this situation will not last indefinitely. Although nonmonetary benefits may previously have been sufficient to offset the rapid decline in real salaries, some CRSP scientists have begun to consider other, more lucrative work alternatives. The current incentive structure may soon be inadequate, jeopardizing program efficiency and productivity by reducing researcher morale or inducing turnover. Both CRSP projects have recognized the importance of continued training as a means of maintaining and enhancing researchers' professional skills, facilitating collaboration between scientists, and increasing scientists' personal satisfaction. In Malawi

and Tanzania, these career development opportunities are perceived to be a benefit by researchers, and may in fact reduce personnel turnover.

Third, CRSP training has strengthened linkages, most notably between researchers. Training overseas allows scientists to establish contacts with researchers at foreign universities. In-country and regional workshops and seminars provide excellent opportunities for establishing contacts, collaboration and additional training, all of which can contribute to scientist satisfaction and program success. Once trained scientists return to their countries to carry out research, it is important for them to keep abreast of what is happening in their area of expertise and in bean research in general. In addition to providing researchers with occasional opportunities to meet and receive additional training, the CRSP acts as a clearinghouse for information produced by, and/or relevant to, researchers. As the Bean/Cowpea CRSP evolves, perhaps more resources can be shifted to performing this service.

One area on which the Malawian and Tanzanian CRSPs should focus attention is the planning and management of training. Human resource management must be integrated into the planning process, both in terms of dollars spent and the number of people trained. Both the Malawi and Tanzania CRSP projects appear weak in this area. Changes in record-keeping have been implemented at the Management Office which will ensure that training becomes a separate budgetary consideration, however, the development of long-range training plans at the project level should also be required.

A second issue that should be addressed is the lack of management training for CRSP trainees. At present, training does not include courses designed specifically to improve participants' management skills, despite the fact that most scientists have administrative and management responsibilities once they are in place. CRSP scientists perceive this lack of

management training as a shortcoming and have requested that it be incorporated into their overseas training. However, one must consider the opportunity cost of adding one or two more courses to students' curricula. Requiring additional courses might necessitate longer stays in the United States, adding to the cost of training each student. Given a fixed budget, this implies forgoing some other alternative. Perhaps management training could be arranged by the CRSP once scientists have completed training and returned to their jobs. Short courses and workshops, offered in country or in the region, would be less costly in terms of financial cost and scientists' time. In addition, management training may be more practical at a point in the scientists' career when they are able to immediately utilize the skills they acquire.

Finally, given the CRSP's budget constraints, the trade-offs between expenditures on additional training and on the research program itself must continually be reassessed, to determine the optimal allocation of resources. The work environment also influences researcher performance; inadequate physical resources and poor research management reduce productivity and decrease job satisfaction (Wesson 1988). Special consideration must be given to equipment, supplies, vehicles and support staff, since these were listed as the biggest constraints to research productivity.

Chapter 7 IMPLICATIONS

To protect prior investments in research and training, and to ensure the stability and continuity of the research program, it may be necessary to modify the current incentive structure, to the extent possible. In those cases where civil service policy makes it impossible to reward scientists for their performance and productivity with salary increases, other forms of compensation, such as the provision of career training alternatives discussed above, or equipment and supplies, may be necessary.[11] Further analysis of the evaluation and compensation procedures system will be necessary to determine what changes can and should be made.

Despite the fact that CRSP consistently spends 50% of its budget overseas, it still cannot provide research project funding at desired levels. While it should be recognized that the CRSP was intended to supplement, and not substitute for, national funding of research programs, the CRSP can assist host-country governments in solving funding problems. Possible solutions include direct donor support, or donor assistance in arranging other sources of funds for investment in the equipment, supplies and operating budgets necessary for efficient agricultural research.

In order to make the most of prior investments in training, projections of long-range human resource needs must be incorporated into the planning and budgeting process. Although the CRSP may be using up all of its training resources, this does not mean that the number of scientists currently being trained is sufficient to meet future needs. Each respondent listed several areas and disciplines they felt would experience shortages. In northern Tanzania, for example, there is currently no pathologist. While it may not be cost-

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[11]For a comprehensive discussion of compensation possibilities, see P. Bennell and L. Zuidema, "Human Resource management for Agricultural Research: Overview and Issues", ISNAR working paper no. 15, 1988.

effective to have a pathologist in northern Tanzania, the important point is that current human resources and training plans for the national agricultural research system as a whole need to be considered when developing training plans for the future.

Given the fact that those scientists already in place in Malawi and Tanzania feel they are unable to devote sufficient time to their research due to teaching and managerial responsibilities, continued training is warranted. Since most research scientists' responsibilities include managerial activities, training in research management should also be provided. This can be achieved by stipulating that the curricula of trainees include courses in research management.[12] Alternatively, opportunities for participation in special research management workshops can be arranged, such as the training workshop for agricultural research managers held in Malawi earlier this year.[13]

As the cadre of trained research personnel grows, the CRSP may need to consider shifting resources away from degree training in the U.S. toward degree training and increase short term, non-degree training in the region (Malawi and Tanzania) as a means of nurturing the national bean research programs in Malawi and Tanzania. However, it would be necessary to carry out an extensive review of past and current training plans, the program budget, and program objectives before future plans could be made. The CRSP should continue its efforts to encourage collaboration between research scientists, by providing opportunities for scientists to meet and exchange ideas through workshops and seminars, and by collecting and distributing bean scientists' publications and papers.

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[12]Such courses are sometimes offered in management or administration departments.

[13]In May, 1990, the Malawian Department of Agricultural Research (DAR) and ISNAR/SADDC cosponsored a conference to assist DAR managers in research priority-setting, program budgeting, and managing human resource information.

While this study provides a short overview of the impacts of CRSP training, it has many weaknesses and should be considered preliminary. First, because the CRSP trainees have only recently begun to complete training programs and return to their jobs, the number surveyed was too small to allow any statistical analysis. Surveying a larger population, all Bean/Cowpea CRSP trainees, for example, would give more meaningful and reliable results. As the number of trainees who have completed training grows, obtaining a sufficiently large sample size should become easier. Second, criteria need to be developed, where possible, to facilitate evaluation of many training impacts, such as "researcher productivity," "critical mass," etc. In future evaluations, the CRSP should enlist the assistance of social scientists who specialize in the evaluation of training. In summary, this evaluation should be considered a learning experience by the CRSP and will provide a basis and benchmarks for future evaluations.

APPENDIX A Bean/Cowpea Training Survey

1. Name:_____

2. Current mailing address:_____

_____

_____

3. Permanent mailing address:_____

_____

_____

4. What is the title of your current job?_____

5. What is the nature of your current job?_____

6. What changes in benefits and quality of life did you experience as a result of your most recent CRSP training?

	improved or increased	stayed the same	worsened or decreased
housing	____	____	____
educational opportunities for your children	____	____	____
access to health care for you and your family	____	____	____
travel	____	____	____
per diem	____	____	____
staff working under your supervision	____	____	____
prestige	____	____	____
access to a vehicle	____	____	____
diet for you and your family	____	____	____
leisure time	____	____	____
intellectual satisfaction	____	____	____

other (please specify)_____

_____

7. Do better-paying positions for which you are qualified exist:

   nationally? ____yes ____no

   internationally ____yes ____no

8. If such jobs exist, why do you not take them?

   _____

   _____

9. Do better positions for which you are qualified exist in terms of the following benefits? (Check the appropriate blanks to indicate yes.)

	international	domestic
increased opportunity to earn additional income from seminars, demonstrations, etc.	____	____
more frequent travel	____	____
more staff	____	____
improved educational opportunities for your children	____	____
improved access to health for your family	____	____
more access to vehicles	____	____
other (please describe below)	____	____

   _____

   _____

10. If such jobs exist, are they with:

   ____International Agriculture Research Centers
   ____National Agriculture Research Centers
   ____Nongovernment Organizations
   ____foreign universities
   ____private companies

   ____other (describe)_____

11. If such jobs exist, why do you not take them?

_____

_____

12. In addition to your current job, what type of outside work have you taken on? (Specify employer by checking the appropriate blank. IARC=International Agriculture Research Center & NGO=Nongovernmental Organization.)

work	self	private firm	other ministry	IARC	NGO
own farm	____	____	____	____	____
own business	____	____	____	____	____
consulting	____	____	____	____	____
research	____	____	____	____	____
other	____	____	____	____	____
other	____	____	____	____	____

13. What is your current regular annual salary? (Specify currency used.)

_____

14. What was your regular annual salary prior to your CRSP training? (Specify currency used.)

_____

15. What portion of your cash income is derived from your regular salary?

____less than 40%
____40% - 49%
____50% - 59%
____60% - 69%
____70% - 79%
____80% - 89%
____90% - 100%

16. In what ways has your CRSP-related training increased your professional and personal opportunities? (Check all that apply.)

____increased salary
____increased travel
____increased job satisfaction
____increased contact with other researchers in your field
____increased access to written resources
____learned a new language (or: improved English)
____increased opportunity to plan & manage research program

____other (describe)_____

17. What equipment or materials did you acquire during training which you were able to take home with you? (Check all that apply.)

____typewriter
____computer
____textbooks
____reference books
____journals
____other (including personal effects)_____

_____

18. What percent of the total benefits of training were nonmonetary?

____less than 10%
____10% - 25%
____50% - 75%
____75% - 100%

19. In what research projects have you participated since your CRSP training? Please indicate whether the project has been a joint research project and, if so with whom?

IARC=International Agriculture Research Center
NARC=National Agriculture Research Center
PD=private donor
FU=foreign university
Min=other government ministries

Name of project	dates	joint? (yes/no)	with whom?
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

20. Is your involvement in these projects due to your CRSP training?

____entirely
____somewhat
____not at all

21. What have been the major products of your research since training? (Check all that apply.)

____new varieties produced
____new varieties adapted
____germplasm collection
____germplasm multiplication
____seminars
____papers

____other_____

____other_____

22. How do these products differ from the products of your research prior to CRSP training?

____increase in quality
____increase in quantity
____no change
____did not do research prior to training

Additional comments:_____

_____

_____

23. What are the major constraints you face in conducting your research? (Check all that apply.)

____lack of funds
____lack of staff
____lack of own time
____lack of supplies
____administrative hold-ups
____communication problems

____other_____

____other_____

24. Describe below any teaching you have done since completion of your CRSP training.

course (subject matter)	duration & frequency	location	number of students per class	level (BS, MS, PhD, other)

25. Other than teaching, how many students have you worked directly with since your CRSP training, and in what capacity? Please indicate the number of students for whom you have served as:

_____major professor

_____thesis advisor

_____other (describe)_____

_____other_____

26. What percent of your time do you spend at the following activities?

Prior to CRSP training	After CRSP training	
_____	_____	research
_____	_____	teaching
_____	_____	extension
_____	_____	administrative and managerial tasks
_____	_____	other (describe)_____
100%	100%	TOTAL

27. Does your work involve any of the following managerial activities? (Check all that apply.)

____managing staff
____organizing field trips
____raising funds
____budgeting

____other (describe)_____

28. List any seminars, workshops, demonstrations, etc. which you have given since your CRSP training.

description	topic	audience	year
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

29. List any meetings and conferences in which you have participated both during and after your CRSP training.

Meeting	Location	Year

30. List any technical papers, journal articles, research reports, bulletins, etc. which you have written or co-authored since CRSP training.

Title	Author(s)	Year

31. How has the quantity of your writing changed as a result of your CRSP training?

____more
____same
____less

32. Has the quality of your publications improved as a result of CRSP training?

____improved
____not improved

33. Do you undergo formal job evaluations?

____yes
____no

34. How is your job performance evaluated? By whom?

_____

_____

_____

_____

_____

35. What factors are taken into consideration in assessing the quality of your research? (Specify importance by writing: VI=very important, SI=somewhat important & NI=not important.)

	very important	moderately important	not important
number of publications	____	____	____
number of new varieties released	____	____	____
trials conducted	____	____	____

other (specify) _____

other (specify) _____

36. What benefits, if any, are based on job performance?

____salary increase
____bonuses
____additional staff
____promotions
____additional travel
____other (describe)_____

_____

37. Describe any other titles or joint appointments you may have in other research centers, indicating the nature of your responsibilities.

_____

_____

_____

_____

38. What was the nature and frequency of your contact with the following people or institutions prior to CRSP training? Indicate frequency by writing D, W, M, or N in the appropriate blanks.

D=daily
W=weekly
M=monthly
N=Never

	conferences	seminars/ workshops	social events	field visits	lab work
extensionists	____	____	____	____	____
farmers	____	____	____	____	____
policy makers	____	____	____	____	____
other researchers	____	____	____	____	____
foreign universities	____	____	____	____	____

39. What was the nature and frequency of your contact with the following people or institutions after CRSP training? Indicate frequency by writing D, W, M, N in the appropriate blanks.

D=daily
W=weekly
M=monthly
N=Never

	conferences	seminars/ workshops	social events	field visits	lab work
extensionists	____	____	____	____	____
farmers	____	____	____	____	____
policy makers	____	____	____	____	____
other researchers	____	____	____	____	____
foreign universities	____	____	____	____	____

40. Has your ability to influence the following groups of people changed since CRSP training? (Indicate level of influence by writing strong, some, little or no in the appropriate blanks.)

	Prior to training	After training
farmers	____	____
extensionists	____	____
policy makers	____	____
other researchers	____	____

41. Who determines your research agenda?

_____

_____

42. What do you feel are the three biggest constraints to increasing bean production in your country?

a._____

b._____

c._____

43. What three major problems do you feel bean research in your country should address in the future?

a._____

b._____

c._____

44. How many scientists are there currently working on bean and cowpea research in your country?_____

45. Do you feel that an adequate number of scientists are being trained to fill projected needs for the next 5 years?

_____yes _____no

46. If not, what fields will experience a shortage?

_____

_____

47. Do you feel additional training would help you in your research program?

_____yes _____no

48. Additional comments:_____

APPENDIX B List of Tanzanian Trainees

Trainee's Name	Citizenship	Sex	CRSP Support	Begin Date	End Date	Degree	Field
Elia, F.	Tanzania	M	partial	1/88	n/a	PhD	Crop Science
Mabagala, R.	Tanzania	M	total	1/85	6/87	MS	Plant Pathology
Mabagala, R.	Tanzania	M	total	9/87	n/a	PhD	Plant Pathology
Magayane, F.	Tanzania	M	partial	8/87	8/89	MS	Ag. Extension
Minja, G.	Tanzania	M	total	6/83	9/84	MS	Failed
Mmbaga, E.	Tanzania	M	total	11/87	7/89	PhD	Crop Science
Mohamed, R.	Tanzania	F	partial	1/87	7/89	MS	Crop Science
Mollel, N.	Tanzania	M	total	6/84	5/86	MS	Ag. Extension
Mollel, N.	Tanzania	M	total	5/86	7/89	PhD	Ag Extension
Nchimbi, S.	Tanzania	F	total	8/82	6/85	MS	Plant Breeding
Nchimbi, S.	Tanzania	F	total	6/85	4/88	PhD	Plant Breeding
Rugambisa, J.	Tanzania	M	total	8/81	6/85	PhD	Ag. Economics
Quentin, M.	Tanzania	F	total	9/84	3/91	PhD	Entomology
Kashaliza, A.	Tanzania	M	partial	1/88	n/a	BS	n/a
Kasuga, L.	Tanzania	M	partial	1/88	n/a	BS	Crop Science
Kikoka, L.	Tanzania	M	partial	1/88	n/a	BS	Crop Science
Mdoe, N.	Tanzania	M	partial	1/88	n/a	BS	n/a
Njau, P.	Tanzania	M	partial	1/88	n/a	BS	Crop Science
Rashidi, Z.	Tanzania	M	partial	n/a	n/a	BS	n/a
Urio, A.	Tanzania	M	partial	1/88	n/a	BS	Crop Science
Gillard-Byers, T.	USA	M	partial	8/80	5/84	PhD	Ag. Economics
Miller, P.	USA	F	partial	1/83	5/86	MS	Ag. Economics
Rocke, T.	USA	M	total	8/83	5/86	MS	Ag. Economics
White, M.	USA	F	partial	9/81	5/86	PhD	Ag. Economics
Oree, A.	Uganda	M	partial	1/87	n/a	MS	Crop Science
Wang, W.	Taiwan	M	total	6/81	6/83	MS	Plant Pathology
Wang, W.	Taiwan	M	total	7/83	8/85	PhD	Plant Pathology

APPENDIX C List of Malawian Trainees

Trainee's Name	Citizenship	Sex	CRSP Support	Begin Date	End Date	Degree	Field
Bokosi, J.	Malawi	M	none	9/83	7/86	MS	Crop & Soil Science
Mafuleka, M.	Malawi	F	total	9/85	12/90	PhD	Food Science & Human Nutrition
Mkandawire, A.	Malawi	M	partial	4/84	7/87	PhD	Crop & Soil Science
Mloza-Banda, H.	Malawi	M	partial	9/83	12/85	MS	Crop & Soil Science
Msuku, W.	Malawi	M	none	6/81	8/84	PhD	Botany & Plant Pathology
Martin, G.	USA	M	partial	9/81	8/84	MS	Crop & Soil Science
Sprecher, S.	USA	F	partial	9/83	6/87	PhD	Crop & Soil Science
Khairallah, M.	Lebanon	F	partial	1/84	n/a	PhD	Crop & Soil Science

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