External Evaluation Report on the Peanut Collaborative Research Support Program:

A Report Submitted to the Bureau of Food Security, USAID

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February 29, 2012

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List of Acronyms

AF-aflatoxins
AOTR-Agreement Officer's Technical Representative
BOD-Board of Directors
CA-Cooperative agreement
CGIAR-Consultative Group on International Agricultural Research
CRP-Consortium Research Program
DIVA-Diffusion of Improved Varieties in Africa
EIAR –Ethiopian Institute of Agricultural Research
FFS-Farmer Field School
FTE-Full-time equivalent
FtF-Feed the Future
GP3MT-Georgia Peanut Production, Processing and Marketing Team
HCC-Host County Collaborator
HCI-Host County Institution
ICRISAT-International Crops Research Institute for the Semi-Arid Tropics
IFPRI-International Food Policy Research Institute
LAC-Latin American and the Caribbean
NARO-National Agricultural Research Organization (Uganda)
NASLGUC-National Association of Land Grant Universities and Colleges
NaSARI- National Semi-Arid Resources Research Institute (Uganda)
NIH-National Institutes of Health
NS-NovaSil
PI-Project Investigator
POP-Publish or Perish
RUTF- Ready to use therapeutic foods
SMOG-Sorghum, Millet and Other Grains
SPS-Sanitary and Phytosanitary
SSA-Sub-Saharan Africa
UGA-University of Georgia
UPSN-Uniform particle size
VCS-Value chain segment

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Executive Summary

The Peanut CRSP (PCRSP) is an integrated set of twenty-one projects organized along a value chain. Research is conducted in traditional production areas such as plant breeding, agronomy, farm economics and also in post-harvest management, processing, consumer demand and product development. Aflatoxins, fungal toxins, often infest peanuts and destroy value so a cross-cutting theme addresses this issue. The extent and magnitude of the antinutritive properties of aflatoxins is being researched from a human health perspective and integrated with management strategies across the value chain. Gender issues are prominent in the PCRSP because women are very often the producers of peanuts and the gatekeeper to household food preparation and nutrition. Collaborative research activities are conducted in Ghana, Senegal, Burkina Faso, Kenya, Uganda in Africa and Haiti, Bolivia, Guyana and Brazil in Latin American and the Caribbean.

Overall the PCRSP program is highly aligned with Feed the Future research themes and countries including the "deep dive" nation of Ghana and several other FtF countries including Uganda, Kenya, Senegal, Mali and Haiti. The production segment is contributing to "Advancing the Productivity Frontier" through new groundnut varieties and "Transforming Key Production Systems" through agronomic and social science research. Recent publications credit the PCRSP with contributing to profound positive welfare impacts (increases in farm income and a reduction in poverty, using the headcount measure) in Uganda. Productivity-enhancing technologies developed through collaborative activities in Uganda spill over into neighboring countries. Similarly, activities in West Africa are strategically positioned to contribute to confronting climate change. Crop improvement activities are also conducted in Haiti, Guyana and other Latin American nations, some of which are FtF countries or are relevant because of their location in centers of peanut genetic diversity.

The processing and post-harvest management segment is contributing to "enhancing food safety and nutrition" through its focus on a key grain legume and its investment in research to reduce and eliminate aflatoxins. Aflatoxins are antinutritive contaminants that can be minimized throughout the value chain. Cutting edge human health research conducted by PCRSP has demonstrated the extent and magnitude of this problem and has helped to eliminate aflatoxins from the food chain. Integrating human health research into the PCRSP is novel and highly constructive to meeting FtF objectives. Furthermore, proper management of harvested groundnuts can reduce aflatoxin contamination yet PCRSP studies reveal that there is very weak awareness and understanding of the human health impacts from aflatoxins among farmers, traders and small scale food processors.

The markets and products segment is engaging the private sector to develop new products from peanuts or to reengineer existing products using locally available peanuts. Products range from shelf-stable spreads, used in school feeding snacks, to ready to use therapeutic foods for emergency relief and acute malnutrition. In both cases, the private sector plays a key role to scaling up research conducted in this area. Many of the strategies used to develop these products are horizontally scalable to other nations. Furthermore, new strategies to reduce or eliminate the impact of mycotoxins (both aflatoxins and mycotoxins) are being developed in this segment. These technologies have been tested and found effective. They are poised to alter the landscape of food safety and enhance the value of peanuts and other mycotoxin-infested grains, such as maize, in low income nations.

Research activities are highly successful due in part to a lean, and mostly effective, administrative structure. Small impediments rest with navigating the administrative bureaucracy of the University of

Georgia but these are under review by senior university administration. The PCRSP manages 55 subcontracts with host country institutions and the management entity does it well despite shifting from a "performance-based" accounting system to a "receipt-based" structure under the current agreement. The shift from a grant to a cooperative agreement with USAID has also created administrative challenges especially since there has been poor continuity of AOTRs. The PCRSP has had four AOTRS during this phase. Communication between USAID and the PCRSP can be described as "unsettled" but can be easily remedied with stability on the part of USAID. If this commitment cannot be met by USAID, then the program should revert back to a grant with greater managerial autonomy granted to PCRSP and its board of directors. If none of these modifications can be made, then a continued strained relationship will remain which is unfortunate and counterproductive, given the strong contribution PCSRP is making to agricultural and human development.

The Management Entity provides strong intellectual leadership of the program. The recent addition of an assistant director will contribute to navigating day-to-day management necessities and broaden the scope of intellectual skills into monitoring, assessment and environmental impacts. These skills should help to diffuse tensions described above.

Moving forward, the PCRSP will benefit from a strategic reassessment of its project portfolio. Some projects do not contribute to the core mission and others may have reached the end of their 'life-cycle.' Pruning some projects and tightening up activities in others could liberate up to $1.5 million for reallocation to other activities. It may also provide opportunities for new research directions currently underserved in the program. An externally-led strategic planning retreat should take place before charging into another phase. Based upon a clearly articulated strategic research investment plan, with input from a broad range of stakeholders, PCRSP can be justified into the future. Doing so would provide PCRSP and USAID a stronger footing from which to allocate funding amounts.

USAID should fund another phase of the PCRSP. Furthermore, a clear commitment needs to be made so that rational allocations of funding to projects can be made. PCRSP's budget ceiling jumped from an initial amount of $8.2 million to $13.9 million and this amount of discontinuity is difficult to adjust to, given that it requires a complete revision of the project proposal. CRSP activities, in general, are long-term research-for-development activities and cannot respond as nimbly as targeted project interventions. Stable commitments by USAID, where possible, will improve the functioning of all CRSPs and maintain the flow of investment required to produce research and development impact. PCRSP's clear strategic alignment with FtF, its past research and development achievements, and the potential benefits in its pipeline of knowledge and new technologies justifies renewal.

Recommendations

Science and research

The PCRSP has an excellent portfolio of projects that are contributing to substantive developmental goals along the peanut value chain and also beyond it. There are a few projects that do not seem to bring much benefit to the overall strategic orientation of the CRSP. It is recommended that the PCRSP conduct a facilitated strategic planning session with individuals that are not in a conflict of interest to rationalize the portfolio.

The crop breeding activities have contributed to the release of several varieties that have generated significant human welfare benefits. These activities should continue and collaborations with ICRISAT, other advanced research centers such as CIRAD for West Africa, and/or the private sector, through the National Peanut Board and state organizations for example. Linkages with the CGIAR consortium research program on grain legumes (CRP 3.5) should be developed. Not being a part of this proposal was a large missed opportunity to leverage additional resources.

The aflatoxin sector of the research portfolio is highly productive and should be maintained. However, it is also recommended that the ME seek connections and leverage funding via NIH and other health-related donors to ease some of the burden of trying to conduct health research on too small of a funding base. Interaction with the Nutrition CRSP could be fruitful.

Extend value chain research to examine how constraints in the seed sector are affecting varietal adoption.

Obtain unambiguous direction on how much investment must be made to directly serve U.S. constituencies and communicate this to all PIs so that they may allocate resources to stated aims.

The Role of USAID

The review team concluded that there is need for a change in the way USAID manages the PCRSP. The grave frustration expressed by the PIs, ME and the board underscores this need. The AOTR changed four times during this phase. Different emphasis from each new AOTR posed challenges in keeping up with the guidance. Substantive input by USAID could be constructive, but if it is not available, the program should revert to a grant rather than cooperative agreement format.

Unambiguous direction, i.e. endorsement and clear specification of future funding allocation, must be provided by USAID so that the program can achieve its full potential rather than respond to frequent unanticipated adjustments. Conducting projects in developing countries is already a challenging process. Unanticipated adjustments affects PIs' plans, complicates the ME's duties, affects relationships with Host Country collaborators and decreases program effectiveness.

The relationship between CRSPs and country missions should be facilitated by USAID so that both parties can collaborate to maximize benefits to target populations.

Interaction between USAID and host-country collaborators and institutions and between individual PIs should be enhanced for the benefit of both parties.

USAID should examine the construct of the CRSP boards (this goes beyond PCRSP) to bring true unbiased advice and oversight of the ME.

Management entity

There are excellent aspects of the ME, with a number of staff dedicated to managing the financial flow of funds. There was a lot of discussion about going back to the model where the Universities manage the sub-contracts, however this team recommends that the sub-contract management stay with the ME.

If UGA administration does not continue to reform and improve financial services required for sub-contract administration, alternative arrangements should be investigated including relocating the ME. While this may seem extreme, smooth administration of subcontracts is essential for program performance. To reiterate, this bottleneck is with UGA central administration not with the ME.

The ME director is universally respected for intellectual input into the PCRSP and is seen by all to be fully invested in the life of this program. The ME director would do well to manage the stresses that come from working on soft moneys rather than engaging in speculation that fuels anxieties among project participants.

To improve the day-to-day functioning of the CRSP and its public appearance, greater attention to the details of program administration should be delegated. Two options include specific management training for Dr. Carolyn Fonseca or the hiring of a business manager to oversee day-to-day operations.

The Advisory Board does have significant conflict of interest in that the membership is comprised of representatives from the universities that traditionally receive grant funds. It is recommended that the Advisory Board become more interactive in oversight of the CRSP.

Priority Setting for the Future

The integrated value chain platform should be maintained as it is a strong construct for applied research. Evidence indicates it is having positive impact on target populations in numerous FtF countries.

Opportunities for integrating state-of-the art advances in plant genomics should be investigated and capacity built among host-country researchers to take advantage of these scientific tools. Many stressors facing peanuts (leaf spot, drought for example) are complex traits and aflatoxin resistance may only be introduced through wild accessions. These breeding objectives will be facilitated by using

markers and other genetic tools. We note the recent return of a Ph.D. graduate in plant breeding to Ghana as a promising opportunity, interest by Burkinabe collaborators and regional strength in Senegal

The project portfolio should be reevaluated and rationalized. PUR 151 and UGA 124 should be eliminated. Underperforming projects in the production segment should be scrutinized for opportunities to turn them around and if it is not possible, eliminate them. Potentially, over $1.5 million in funding allocated during the previous phase is at stake. Specific project suggestions are discussed in the following sections along with our perspective of their weaknesses.

Opportunities to collaborate with the Consultative Group for International Agriculture Research (CGIAR) Research Program on Grain Legumes (CRP 3.5) should be encouraged. We note that the Dry Grain Pulse CRSP is listed as a partner in CRP 3.5 but the Peanut CRSP is not.[1]

PCRSP funding should be extended to another five-year phase. The funding ceiling should not be altered until strategic planning is complete and a rational argument developed one way or the other.

[1] The revised proposal for CRP 3.5 was presented to the CGIAR consortium board on August 15, 2011. It is available http://www.cgiarfund.org/cgiarfund/sites/cgiarfund.org/files/Documents/PDF/crp_3.5_grain_legumes_proposal_aug_2011.pdf

Scientific and Technical Assessment Overview

This report is divided into three sections. The first section provides an overview of the scientific approach to the Peanut CRSP (PCRSP) and key overview findings. The second section presents greater details on the project portfolio organized around value chain segments. The third section presents the management review. Following the bibliography, several appendices are provided with additional information.

Organizational Structure: The Value Chain Concept and the Peanut CRSP

The PCRSP contains twenty-one projects covering topics in production agriculture (plant breeding, agronomy, cropping systems), storage, processing, product development, consumer demand and human health. The project portfolio is organized around a "value chain" concept in order to develop a programmatic coherence from project activities. At the Strategic Research Conference in Malta, Tim Williams pointed out that through years of experience, the PCRSP learned that if they increased yields, they in turn flood the markets, driving prices down and subsequently inducing farmers to produce fewer peanuts. They concluded that higher peanuts yields can only be sustained if there are markets for the commodity, and they subsequently arrived at the value chain concept. Appendix 1 provides a listing of all PCRSP projects along with descriptive information including five year budget allocations.

The evaluation team organized the projects along the value chain into segments (Figure 1). An alternative depiction showing tighter relationships between all projects and with complete feedback loops is given in Appendix 2. In the Figure 1, the first segment in the value chain focuses on increasing groundnut production and improving the productivity of smallholder farmers through new varieties, crop and resource management and farm economics. The second segment begins after harvesting the product and transporting it to the farm household. The third segment transforms stored commodity into new and/or manufactured products. The final segment is augmented with research on consumer preferences for processed products and contributes additional value through identification of market demand.

In addition to projects fitting into one of these segments, some fit into several segments of the value chain. Our organization of the value chain segments (VCS) differs slightly from that provided by the ME. Their organization paradigm is presented in Appendix 3. It is organized around a "production" segment, a "processing/markets" segment and a "consumer" segment that mixes both supply and demand. The integrated production and consumption organizational structure creates a programmatic coherence that contributes to overall success of the PCRSP. Each of these segments and cross-cutting activities is described in detail in the second section of the report.

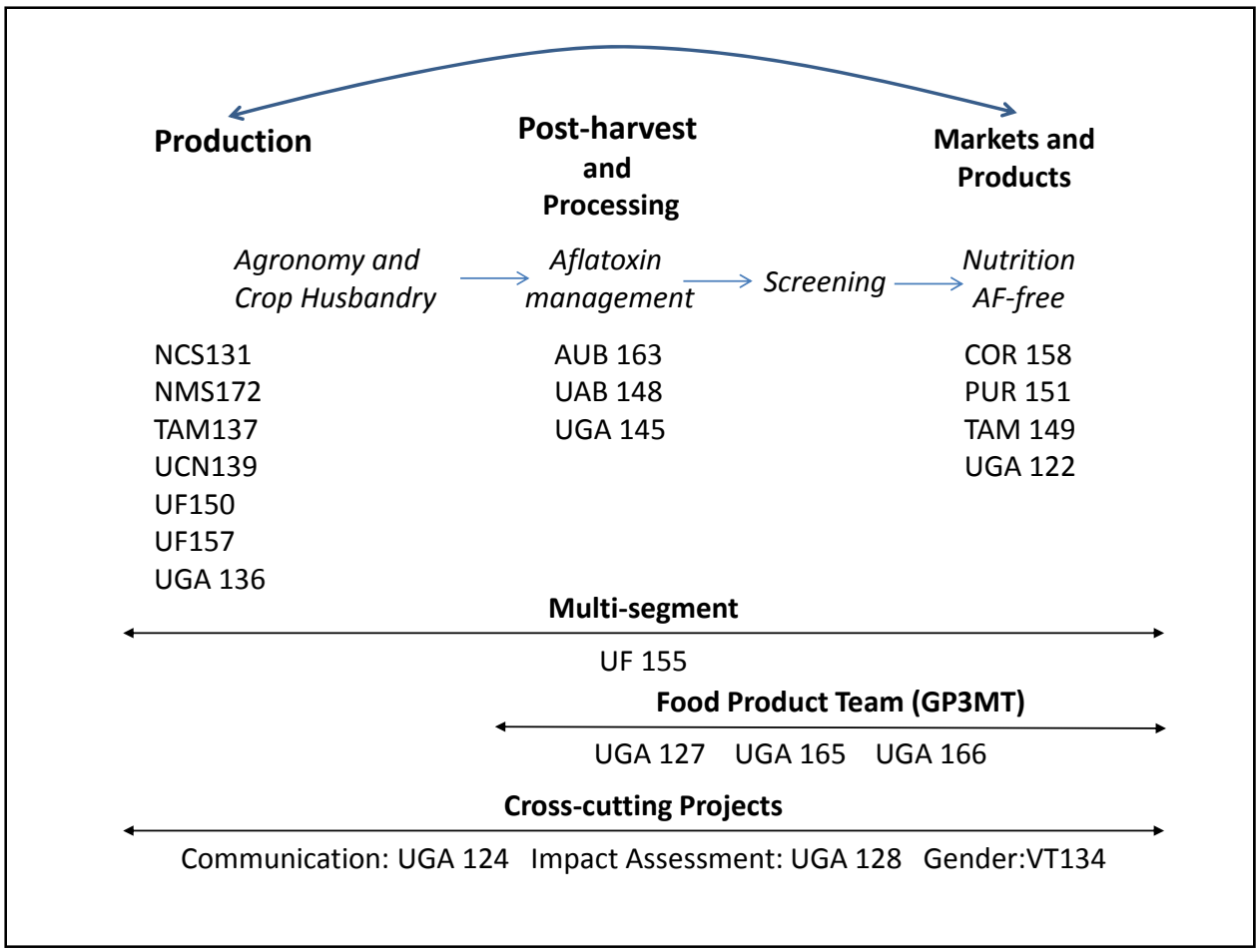

Figure 1. Product-oriented value chain concept with project themes

Where does Research on Aflatoxins Fit?

Key to the functioning of the peanut value chain is research on the management of aflatoxin contamination and mitigation. Aflatoxins (AF) can be conceptualized as contributing "negative value" to peanuts through antinutritive health effects. In many low income countries, food safety regulations may not be strong enough to prevent consumption hence the negative value might be viewed through chronic and acute illness or disease. PCRSP demonstrates that the health impacts of consuming aflatoxins are not well understood by consumers. In Figure 1, the aflatoxin theme is represented across the value chain since activities in all segments can contribute to a reduction of the aflatoxin burden. Aflatoxins may impact farmers when self-produced nuts are consumed. Aflatoxins can accumulate in storage and be transferred to others when traded. Processed products can also be sources of aflatoxins.

When aflatoxin tainted groundnuts enter the food chain, they cause human health damage when consumed in quantity. Identifying the extent and value of the economic and human health penalty contributed by aflatoxins, and strategies to minimize and eliminate this penalty, has been a consistent theme ranging across production, post-harvest and markets and products in PCRSP. At the Malta Conference the PIs pointed out that the adverse effects of aflatoxins are known and include causing

death, stunting, anemia, immune suppression, and low birth weight. Because the topic of aflatoxins is at the heart of their cliental (low income peanut farmers and consumers), it comes as no surprise that the PCRSP has responded to this topic. Furthermore, it can be argued that this research theme has created significant global public goods that have impact beyond groundnuts and spill over into other important cereal crops such as maize. The medical research produced by PCRSP's team of PIs is significantly adding to critical global data, and the ME must be mindful of assiduous administration of funds for medical studies because of the sensitive and unique nature of this type of research. Combatting the antinutritive effects of aflatoxins (or more generally mycotoxins) when fighting undernutrition is essential to realize the full impact of increased agricultural productivity and market development.

Aflatoxin research is critically important to peanuts and the PCRSP yet it might be viewed as competitive for funding that could be invested into research conducted in other areas. The amount of money invested in human health is considered "small" (about $3 million during this phase) relative to the amounts invested in medical research by NIH and other donors. The human health research activities have been conducted on a "shoestring" budget and yet the benefits are large. But there also have been extremely large payoffs to crop improvement in Uganda (Kassie, Shiferaw and Muricho, 2011). And the number of FTEs in peanut research in Africa are very limited (Alene et al, 2011). While this tension is acknowledged, it should not be viewed as an either/or proposition but as one the needs to be managed rationally. Given the breadth of activities conducted by PCSRP, it merits strategic planning to determine the optimal scope and mix of research activities, given limited budget resources.

Cross-cutting Activities

In addition to aflatoxin research, several individual projects cut across multiple segments of the value chain. The role of gender along the value chain has been a consistent focus, and while one project has taken leadership in this area (VT134), it is reasonable to say that several segment-specific projects have integrated gender-specific research into their design

Long-term continuity of research investment in Guyana (UF155) has allowed the project to sequentially address increasing production and improving productivity, managing harvested stocks, and creating demand for a value-added school snack through policy advocacy. As this nutritional intervention was scaled up, renewed interest in the production of groundnuts (varieties and husbandry) was stimulated. This specific case is an example of the feedback loop that reinforces the linkages between segments of the value chain and more specifically, the derived demand for peanuts and improved quality. Other cross-cutting projects work across themes in order to understand the value addition process. The Global Peanut Product, Processing and Marketing team (GP3MT) works in the two right-hand side segments of the value chain to stimulate product development.

Management Entity Leadership

The ME's contribution to setting in motion the VCS paradigm, and continued emphasis on the interaction between human health and agriculture, are key indicators of intellectual leadership. In addition, the ME has coauthored several publications with project PIs illustrating a strong level of interaction. Dr. Carolyn Foneseca, while new to the program, is also contributing to project assessment

and gender analysis and aspires to continue these activities in a the subsequent phase. Thus while there is some separation between the ME and projects, there is also much interaction, especially in research and, as of recently, monitoring and evaluation.

Furthermore, the PCRSP has earned an international reputation that has led to several invitations to participate in global conferences on human health and development. Finally, there is strong loyalty among the PIs and the host country participants, the Board of Directors and University of Georgia administrators to the Director. There is not universal praise however, and even some very disgruntled PIs, but these are among a minority.

Innovation and Contribution to Feed the Future

The program is contributing to all focus areas under in the FtF research plan (USAID, 2011). This is due in part to the commodity under focus, partly due to the CRSP platform and particularly due to their activity in the 'deep dive' country of Ghana. PCRSP is active in other FtF countries including Haiti, Senegal and Kenya. Technologies developed in Kenya and Uganda are horizontally scalable to Tanzania and Malawi while the Ghanaian research pole and Senegal activities provide a platform for extension into Mali. In these locations, women receive focused attention and benefit through the program's efforts to improve production, marketing and nutritional status.

Overall, program activities are highly consistent with FtF research themes and cross-cutting activities (USAID, 2011). Research activities contribute to "Advancing the Productivity Frontier" and "Transforming Key Production Systems" not only through traditional supply-side production science research but also through demand-driven product development to avoid price disincentives often accompanying technological change-induced supply shifts. The value chain approach is a particularly resilient paradigm to avoid price disincentives associated with productivity growth and essential to sustained agricultural growth. The CRSP contributes to "Enhancing Nutrition and Food Safety" through its focus on a grain legume and its investment in research to reduce and eliminate mycotoxins. Peanuts are a key legume to improve nutrition whether consumed at the farmgate or processed into shelf-stable products or ready to use therapeutic foods (RUTFs).

One strategy to reduce aflatoxin contamination centers on better post-harvest management of the product, an additional focus area of the FtF strategic plan. The "Markets and Products" segment is engaging private sector participants into product development and stimulating demand for raw products. Gender issues are integrated in all segments of the value chain and there is targeted research providing new insight into how to scale up information flow on aflatoxin management to women. Furthermore, the design of the CRSP model centers on collaborative research and capacity building. From the perspective of the evaluation team, the alignment of the PCRSP to the FtF is obvious and compelling. Further discussion is limited on this topic for this reason. The ME has contributed to the discussion from their perspective. Their alignment briefing is presented in Appendix 4.

Key Messages from the Technical Analysis

Section two, evaluates the technical content of the project portfolio under the Peanut CRSP, but there are three primary findings of this review. First, the strategic organization of projects along the value chain is extremely constructive and a productive concept to move agricultural and health science to food security impacts. Overall, scientific and technical organization of the projects is innovative and can be improved only marginally.

Secondly, most projects are highly complementary. The complementary nature of the projects can be seen in geographic clusters (not presented in the figure above), in thematic work around aflatoxins, in product development and in testing the VCS paradigm in focus countries. The complementary nature of the projects maximizes the returns to research investment and research collaboration between project investigators (PIs) and host-country collaborators. This collaboration is essential because peanut science is composed of a relatively small number of researchers and centers of excellence. In ten Sub-Saharan African (SSA) nations producing over 61% of the region's groundnuts, there are only 20.1 full-time equivalent (FTE) scientists conducting research on groundnuts (Alene et al., 2011). A simple extrapolation from 60.1% to 100% of groundnut production suggests that a total of 33 FTEs contribute to groundnut science across SSA. To place this in perspective, this is similar to the number of FTEs in the Department of Agricultural Economics at Kansas State University, a medium-sized academic department serving a state with a population of 2.9 million, not a sub-continent of over 800 million.

Research clusters exist not only geographically and in segments of the value chain, but also on aflatoxin management, mitigation and understanding its impact on human health. The PCRSP is highly innovative, and exemplary, in its integration and linkage of agricultural development with human health. Aflatoxin research conducted in the PCRSP is state of the art, groundbreaking and influential. This is a third important observation of the evaluation. It is extremely relevant for other FtF crops, notably, maize. Gaps in funding that can result in loss of critical and highly specialized medical technicians must be avoided at all costs. Failing to maintain the emphasis on reducing the antinutritive effects of mycotoxins will reduce future impact of the program.

Value Chain Segments and Cross-Cutting Activities

The following section presents the technical content of the research program. Groups of projects are discussed according to which segment of the chain they fall under with cross-cutting themes integrated in where appropriate. Key information contained in annual reports, scientific publications, outreach publications and additional information obtained from project PIs through interviews is summarized. Approximate project funding amounts are provided in Appendix 1.

It should be pointed out that not everybody agrees with the idea of the value chain approach. Some PIs at the Malta Conference felt the value chain approach resulted in spreading the limited resources thinly. Some felt that if the PCRSP consolidated and focused on a few key areas, its impact could be focused in the most needy areas. A facilitated strategic planning retreat is highly recommended to address both perspectives.

Production Segment

The production segment of the value chain covers a broad range of a research ranging from agronomic studies on groundnut intensification, plant breeding for yield, maturity, host plant resistance and other traits, screening of plant material for geographical adaptation, social science studies on production, correlates of productivity, and gender dimensions surrounding crop production. Ten PCRSP projects (nearly ½ the portfolio) have activities in the production segment.

During the Malta Conference, the PIs pointed out the importance of agronomy. Tim Williams argued that current yields obtained by farmers are only 10-25% of potential. Indeed with just the current varieties, he believes that the PCRSP could double yields with improved crop and resource management. While the observation is likely correct, the economics of doing so is another question.

PCRSP has directed their breeding efforts towards a wide range of attributes including disease and drought tolerance, and desirable consumption characteristics, such as seed color and size. Breeders have mostly used traditional breeding techniques, screened elite germplasm collections, and have also used microarray experiments to identify genes associated with drought tolerance and disease resistance(TAM137). Plant breeding and screening efforts in Uganda, supported by PCRSP projects, have contributed to the release of improved groundnut varieties in the SERENUT series (Deom et al., 2006). Subsequent impact studies have found that farmers adopting these varieties have higher income per hectare for groundnuts (approximately form $US134-254/ha) and 7-9% lower poverty rates, as measured by the headcount index, than nonadopters (Kassie, M., B. Shiferaw and G. Muricho, 2011). This is definitive evidence of the impact of the production segment in Uganda that needs validation in other regions. Additional evidence on the impact of groundnut improvement will be available through the Bill and Melinda Gates Foundation supported Diffusion of Improved Varieties in Africa project (DIVA) in the near future (Alene et al., 2011).

In Uganda, three production projects (NMS 172, UCN, 139 and UGA 136) work together in an integrated manner to build capacity at the National Semi-Arid Resources Research Institute (NaSARI) of the National Agricultural Research Organization (NARO). Considerable investments in human capital, physical capital and scientific collaboration have led to an expanded capacity to conduct research for development purposes. The investments contributed to developing the station as a center of excellence in groundnut research serving Rwanda, the Democratic Republic of Congo, Sudan, Southern Sudan, Kenya, Tanzania and Burundi. In Uganda, two varieties, Serenut 5R and Serenut 6T were released in 2010 and seed is being bulked. The Ethiopian Institute for Agricultural Research (EIAR) has requested several lines for evaluation including Serenut 2, Serenut 3R, and Serenut 4T. Southern Sudan has requested seed from Dr. Okello, NaSARI geneticists and collaborator. Evidence indicates that there is strong geographical spillover to neighboring countries from the investment in Uganda. Given that the investment in supporting NaSARI might impact several additional FtF countries, a critical review of funding is suggested to equate investment with potential impact. Additionally opportunities to increase the usage of state-of-the-art breeding techniques and genomics should be extended to host country collaborators (HCCs) through visits, exchanges or sabbaticals to centers of excellence, such as the University of Georgia center for Plant Genomics.

Furthermore, studies on the economics of peanut production have identified sources of technical and economic inefficiency (UCN 139). This project has studied technology adoption and farm productivity in Uganda and Kenya. Studies have been conducted with host-country collaborators that examine system intensification through seed adoption, fertilizers and packages of biochemical inputs. Dr. Bravo-Ureta works collaboratively with Drs. Deom (UGA 136) and Pupalla (NMS 172). Dr. Bravo-Ureta has participated in research meetings with the Kenya Agricultural Research Institute to showcase student research conducted under the project. An additional contribution of the project has been research on the impact of climate change on groundnut productivity. This research theme is being developed with an eye on continuation into the next phase of the project. It is an example of an additional contribution of the program to FtF goals.

TAM 137 draws comparisons between the dry conditions in Texas and West Africa and breeds for early maturity and other characteristics contributing to drought tolerance. TAM 137 contributes expertise in genomics and molecular markers to the program. Leveraging funds from other sources, the PI has contributed to the development satellite markers for molecular characterization of the U.S. peanut mini core collection (Kottapalli et al, 2007). The U.S. minicore of peanut germplasm has been screened for drought tolerance and progress has been made to identify the QTL for field response with selected materials sent to West Africa for performance evaluation. Collaborative activities have taken place with EMBRAPA in Brazil.

In Ghana, additional characteristics include breeding for desirable consumer quality traits and ease of harvest. They also breed for enhanced oleic:linoelic ratios to improve shelf life and reduce the incidence of coronary artery disease. The PIs raise concerns about early and late leafspot and note that this is a complex trait. A second application introduced leaf spot resistance into Texas and West African cultivars through identification of “true” hybrids (Gomez et al. 2008). Field analysis is required to evaluate the resistance. Both applications build upon a review of peanut genomics published prior to the inception of the current phase of the program (Burrow et al, 2008). Additional research is searching for aflatoxin resistance from wild species but this research is still in a discovery stage. Other researchers argues that there is very little variation in aflatoxin resistance in existing cultivars and varieties so this line of research may yield limited benefits. Overall, this project has benefited from support from the National Peanut Board and the Texas Peanut Producers Board that has funded much of the U.S. based research that has spillovers into West Africa.

This project addresses training on seed production and explores collaboration with NGOs to improve seed distribution to farmers, especially in Senegal where this has been identified as a limiting constraint. In addition, collaborators from Burkina Faso have expressed an interest in training in genomic in a subsequent phase. A Spanish cultivar with resistance to leaf spot will be released soon in Burkina Faso. The Senegal activities will release two Spanish cultivars in Year 5. The Senegal program provides an opportunity to develop a regional center for molecular breeding is support can be marshaled. Finally, one of the PIs recently defended his PhD at Texas Tech University and is now the peanut breeder at the Savanna Agricultural Research Institute, Tamale, Ghana with expertise in pathology.

One contribution of UF 155 is in peanut breeding in Haiti to try to minimize the impact of rust disease and other production stresses, and reduce aflatoxin contamination, in conjunction with project COR 158. Rust resistant varieties have been brought in from ICRISAT for local selection and end use acceptance. COR 158 focuses on ready to use therapeutic food (RUTF) Medika Mamba, which is being produced for school feeding programs (Filbert and Brown, 2010). COR158 wishes to purchase locally produced peanuts with the lowest levels of aflatoxin as possible. In addition to being the focus groups for new, disease resistant varieties, growers who provide peanuts to the RUTF program are trained in post-harvest management of their peanuts to lower aflatoxin contamination. This is a program that bridges research from production, through post-harvest management and processing, right to end-users. Regulations on RUTFs state very low aflatoxin limits, therefore up to 30% of harvested groundnuts must be discarded during the clean-up process. This puts additional emphasis on increasing production.

Not only have breeders succeeded in releasing new germplasm in target countries, the PIs indicated that the CRSP program has tremendously benefited US peanut production. The PCRSP provides U.S. plant breeders an opportunity to collect new germplasm (UF150). The breeders indicated that they have benefitted from PCRSP relationships to collect germplasm in areas where it would have been impossible without the CRSP interface. According to the breeders, the germplasm collected through this project has benefitted the US by identifying new sources that can enhance host-plant resistance to disease and other desirable characteristics. In fact the USDA-ARS Plant Genetic Resource Conservation Unit in Griffin GA houses a large collection of cultivated and wild *arachis* accessions and also collects their germplasm in collaboration with the PCRSP. In addition, this area of production research is one that benefits from interaction with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Clear international collaboration linkages exist.

Areas of Concern

The review process noted a few cases where projects were not meeting stated objectives, for example, UF157 “Systems Approaches to Enhance Peanut Production under Resource Limitation” and NCS 131 “Improved West African peanut production for enhanced health and socioeconomic status through the delivery of research-based production systems in Ghana.” Tim Williams acknowledged the problems and indicated that they are working with the researchers to resolve the issues. Overall, agronomic and cropping systems research appeared weaker than research in plant breeding. Projects on cropping systems should be reviewed to determine whether they have completed their life cycle. If so, casting a wide net for new participants in this area might be invigorating and an opportunity for new research.

The PCRSP currently does not breed for aflatoxins resistance peanuts. The difficulty of breeding for aflatoxins mainly results from lack of genetic variability for *Aspergillus* resistance between peanut varieties. The CRSP advises growers on an integrated approach to reduce aflatoxin infestation. It does not appear that investigators are evaluating field treatments of aflatoxin biocontrol agents to mitigate infestation (products similar to Afla-guard). Several explanations for the limited potential of biocontrol have been proposed, but it may be a strategic future intervention that merits “proof of concept” in target countries (Williams, J.H., 2011).

The value chain does not examine seed input provision despite considerable discussion surrounding the impediments in getting improved seed to farmers. Determining the impact of seed bottlenecks is important to facilitate future adoption, especially given the lack of private sector attention to non-hybrid seeds in most countries.

Post-Harvest and Processing

Six projects contribute to the post-harvest and processing link. The post-harvest and processing segment is the first point at which consumers may enter the value chain so we include the research on human health impacts into this segment (UAB 148 and UGA 145) plus the wide-ranging studies on human perceptions on aflatoxin contamination (AUB 163). A literature review of human and animal health consequences of high levels of aflatoxin in foods indicates the very serious nature of having any kind of chronic exposure (Williams et al, 2004; Khlangwiset, Shepard and Wu, 2011). As peanuts are very susceptible to aflatoxin, it is very important that growers know how to manage the crop from the time it is planted through storage and home consumption or through sale and into value-added products. Globally, large populations are chronically exposed to levels of aflatoxin that are cumulative (Khlangwiset, Shepard and Wu, 2011).

Additional cross-cutting projects contribute to this segment including the Guyana project (UF 155) which is developing applied interventions to ensure that stored peanuts do not enter snacks for school age children, the GP3MT team, and specifically UGA 127. Interventions developed by the GP3MT team assist in screening AF tainted peanuts so they are more easily identified and sorted before they move through the chain into new products. Gender-specific constraints are addressed through VT 134 and substantial evidence of how these interventions have affected small holder farmers and their families demonstrated.

AUB 163 is contributing information on aflatoxin management and mitigation from the perspective of producers, traders and consumers. Several types of studies have been conducted including baseline information on the awareness of aflatoxin contamination and strategies to reduce it. Key findings indicate that aflatoxin can occur at all levels of the value chain but awareness of contamination was not strong. Through focus group discussions and other instruments, correlates of AF awareness were identified. The level of education was consistently significant and positively related to awareness. Dr. C. Jolly's studies on awareness and perceptions are well regarded scientifically and the survey instrument and methods were adopted directly, or modified for use, in eight other countries/projects unaffiliated with PCRSP. The method is presently being used to study the awareness of AF contaminated maize in Kenya.

Effort has been invested to determine awareness and efficacy of AF mitigation strategies in addition to general knowledge of AF. Sorting can help reduce the risks associated with aflatoxin contaminated groundnuts if the groundnuts are dried to less than 12 percent moisture before storage under sanitary conditions. Sorting can pose an additional financial burden on groundnut market participants if the groundnuts are not thoroughly dried before storage. Farmers will improve their storage if they are aware of the health effects of consuming aflatoxin contaminated groundnuts, but, as described above,

knowledge is weak. Poverty was associated with high AF contaminated groundnuts. Poor households are less likely to adopt practices to reduce aflatoxin levels. Given these findings, developing strategies to reduce AF in groundnuts, or AF awareness, would benefit the poorest segment of target populations.

According to ex-ante economic surplus modeling, the adoption of international standards to reduce aflatoxin risks in Ghana will result in major welfare losses to groundnut producers, consumers and society. To counter this loss, the development of a research and extension agenda showed that respondents placed emphasis on harvesting, field drying, household drying, early planting, and cleaning/improved storage over curative measures for reducing aflatoxin contamination.

Agricultural researchers who work to reduce aflatoxins in susceptible food crops have long known that top down regulatory controls are not enforceable in most developing countries. It is rare that market pressures are forceful enough to drive adoption of improved and more labor-intensive aflatoxin management. Hence the problem is weakly addressed. The Peanut CRSP is at the forefront of quantifying the public health implications of chronic exposure of aflatoxins in humans. The project team represented by UAB148 has conducted groundbreaking research on the impacts of aflatoxin on humans and published powerful papers on their findings in prestigious peer reviewed medical journals.

Partnered with the University of Science and Technology and St Markus Hospital in Kumasi, Ghana, this team had made discovery after discovery about the ways in which aflatoxin is associated with health status of humans. They have shown much more deleterious effects than ever understood before. Using consenting index cases and doing epidemiological analyses with appropriate Institutional Review Board and Ghanaian Ministry of Health approvals, they have studied the associative impacts of aflatoxin on pregnant women and newborns, people with TB, those infected with HIV/AIDS and finding significant associations with bad outcomes. They have postulated that the rapid development of HIV into fatal AIDS in Africa is due (perhaps to a large extent) to the chronic immune suppressive background of aflatoxin exposure. AIDS patients with TB are significantly more likely to have severe symptoms if they have a high titer of aflatoxin in their bodies. Infants born to women with high aflatoxin exposure have lower birth weights. These are just a few of the total products of this PCRSP project that have global benefits.

The quality and quantity of research conducted by this team is of global value and makes PCRSP stand out as an innovative. It can be claimed that this research, funded by USAID, is a global public good of deep importance to human welfare. The burden of aflatoxin as a public health issue is only now being fully understood and the global health communities are beginning to take note. This research is scalable to any country in the world where aflatoxin is unregulated and prevalent in the food supply. The project has completed over a dozen scientific papers on PCRSP topics during this period.

Critical to progress in UAB 148, as well as to mycotoxin researchers around the world, are activities in UGA 145. UGA is led by Dr. Wang, one of the foremost biochemists who developed biomarkers for aflatoxin, and more recently for fumonisins. These markers have made it possible to conduct the epidemiological work that looks at blood levels of aflatoxin (and/or fumonisins) and associate the toxins

with health outcomes. They are used by TAM 149, UGA 122 and will become the true metric to test aflatoxin mitigation technologies. Researchers can now measure changes in blood-mycotoxin levels before and after technological packages have been introduced. The true metrics of aflatoxin control will be in improved human health outcomes. Thus, the advent of production and post-harvest agricultural technologies to manage aflatoxins can use the biomarkers developed by this PCRSP to measure success. This research contributes to understanding progress towards mitigating the antinutritive value of mycotoxins and the FtF goal of improving food safety.

The link between aflatoxins and health research conducted by the PCRSP team of PIs is pioneering and significantly added critical understanding to the field. The PCRSP has published several articles in first class peer reviewed medical journals including the *American Journal of Clinical Nutrition*. One of their scholarly review articles, "Human aflatoxicosis in developing countries: a review of toxicology, exposure, potential health consequences, and interventions" is heavily cited (328 citations). While this paper was published prior to this phase, it provided key continuity and justification to move forward with this line of research

Other project interventions have also reduced aflatoxin exposure. VT 134 under Dr. Christie has conducted consumer studies in four regions of Uganda and found that consumers are at a high risk of aflatoxin poisoning. As a result of these findings, several trainings took place to reduce exposure to AF contamination. These findings were reported to the Ugandan National Bureau of Standards to develop guidelines to reduce contamination of peanut-based products. Simple post-harvest management interventions were extended to peanut farmers to reduce AF contamination. This project is well documented and has produced a range of publications from outreach posters on aflatoxin mitigation to peer-reviewed publications. Considerable effort to reach policymakers was successful.

UGA 127 has developed a simple intervention to help screen aflatoxin tainted peanuts before they enter the food chain. The process is a simple blanching process that intensifies the color of aflatoxins making them easier to identify and sort. This tool also helps to improve food safety.

Areas of Concern

Understanding the relationship between groundnuts and aflatoxins is perhaps one of the most important topics in the PCRSP since there is a well-established negative human health impact of aflatoxins fighting against the positive human health impacts of a protein legume. The PCRSP's involvement in aflatoxins comes with controversy, as some consider aflatoxins a medical topic, not specifically agricultural. Financial requirements of human health research can be large so there is need to ensure that commitments are sufficient to conduct the research at the required level of rigor. The team overwhelmingly supports the integration of human health issues into a commodity-based CRSP. Potential interactions with the Nutrition CRSP may be useful to further reinforce the linkage between the two domains. The demonstrated negative human health impact of AF combined with poor human perception and understanding of AF by producers, consumers and traders points to the need for a public health information campaigns of broad scope, building from the insights found in VT154 and AUB163.

Markets and Product

This segment is creating a "demand-pull" to reinforce the "supply push" of technological change. Furthermore, this demand pull is intentionally focused on creating safe food products that meet *Codex Alimentarius* guidelines for aflatoxins. Ensuring that vulnerable populations have access to aflatoxin free foods is an essential element of fighting undernutrition. It is also an essential element in the development of good health and cognitive abilities that are a key to human capital development.

The potential market for peanuts and peanut-based products is vast. But the human health penalty of aflatoxin consumption must be managed alongside the value gained (financial and human health) in new product development. Furthermore, there is an important role for aflatoxin-free peanuts in RUTFs. To this aim, projects build upon the low cost raw peanut screening tool developed in UGA 127 and use it in new food products (UGA 166) demanded by consumers (as identified in UGA 165). A second approach has been to mitigate the human health impact of AF tainted peanuts through enterosorbents. The PCRSP has taken leadership in the field by developing clay based treatments of aflatoxins. At the Malta conference, the PIs argued that if we can protect with iodized salt, we should be able to protect with clay. The idea to ameliorate aflatoxins using additives is not new, several aflatoxin binding technologies are on the market, however not all work effectively. The major concern raised was how safe the clay is for humans and whether such research on humans was a potential liability to USAID. The PIs' published research in first class peer-reviewed journals indicates that Novasil, the clay being used, is safe for human consumption.

TAM 149 forms a close corollary to UAB 148 and UGA 145. This team of investigators is active in evaluating health impacts of aflatoxin exposure and potential health improvements using clay enterosorbents for therapeutic management of aflatoxin-prone foods (Phillips et al, 2005; Phillips et al, 2008b). The research is conducted primarily on humans in hospitals and clinical trials in Ghana, with appropriate IRB and Ghanaian test subject ethical approvals. Animal subject research is conducted at Texas A&M to safeguard testing protocols and supplement clinical data on impacts of using enterosorbents.

Enterosorbents are latticed clays that trap aflatoxin (and possibly fumonisins) in the gut of mammals that have ingested foods with these mycotoxins, rendering the foods safe and preventing the deleterious effects of the toxins. The enterosorbent is montmorillinitic clay, named Novasil (NS) that has been screened for unwanted trace elements and proven to be safe in animal and human trials. NS has been extensively tested to assure that it does not interfere with uptake of important nutrients, including vitamins A and E and Fe and Zn. In the past 5 years, further refinement of the NS clay has been undertaken to ensure uniform particle size (UPSN) and ensure that inter-batch UPSN can be reliably replicated and consistently uniform. This is the step required to prepare for regulatory acceptance and commercialization. Refined UPSN is being compared to parent NS for safety in rats, examining biometric, biochemical and nutritional outcomes in dose response. In addition to continuing to develop commercial quality assurance/quality control, this project needs to test the products in human children. It will also be necessary to prove that enterosorbents do no exacerbate protein energy malnutrition and

also that exposure to enterosorbents in every meal does not produce unwanted, unexpected side effects.

The ultimate analysis of impact of NS and/or UPSN is in aflatoxin-albumin adduct quantities in blood (UGA 145) and health outcome indicators (UAB 148) in human clinical trials over 1-year in a blind experimental design. Biomarkers of immune status will be used as proxy for human health comparing between subjects using a clay supplement with diet *vs.* those who are given a placebo. Blood nutrient status and biochemistry is followed, as well as body weight and health (incidents of diarrhea, infections, and cancers). The hypothesis is that long term clay supplements in aflatoxin prone zones will result in improved health of individuals using it.

This research is as innovative as it is novel. Regulatory acceptance is being sought by the PI. It is being seen as a front line solution to mitigate aflatoxin infestation in peanuts for RUTFs, particularly in the absence of effective production or postharvest management strategies (Wang et al., 2008).

COR 158 has been researching locally-produced, peanut-based ready to use therapeutic foods to establish their effectiveness in reversing childhood malnutrition in Haiti and for their use to support HIV-infected individuals as well. Unfortunately, local peanuts often contain harmful amounts of aflatoxins. In developing countries the profound antinutritive effects of aflatoxins including childhood stunting, immunosuppression and acute liver damage are immediate and important concerns (Williams et al, 2004; Khlangwiset, Shepard and Wu, 2011). Dr. Brown's laboratory, established in Haiti, has created stringent procedures that prevent the inclusion of aflatoxins in one RUTF in Haiti: Medika Mamba. However, the vast majority of Haitians of all ages and HIV status eat peanuts that are not screened for aflatoxins. In Haiti, their laboratory has not yet found any peanut samples from public markets, farms or even upscale hotel bars that did not have aflatoxin concentrations of an order of magnitude greater than that allowed for dairy cow feed. They intend to assess the extent of aflatoxicosis in two high HIV incidence populations and evaluate procedures to reduce the barrier to the nutritional support and recovery of infected individuals and malnourished children.

UGA 122 continues this thematic area. The PIs of UGA 122 take pride in a truly collaborative project, with two U.S. PIs and two host country PIs who interactively develop project protocols and objectives. This project is closely linked with COR158, and a natural extension to the end of the value chain where peanut products are created and used. The approach is to create RUTF's that are comprised of local materials, using a computer program to maximize nutritional value while minimizing cost. The RUTFs produced by this approach are not always going to be the same, as component foods may undergo price shifts. However, peanut is the basic component with the most protein density available. The addition of mycotoxin-binding clay and pro-biotics is the most recent thinking on how to eliminate aflatoxins and reduce causes of diarrhea. The team is attempting to render the RUTF into an easy to store product to which water can be added to produce a drinkable supplement. The thinking is that those who are the sickest and most malnourished will be more able to swallow a liquid. The project is testing the product in Ghana with women of child bearing age to determine palatability (sensory qualities) and efficacy. Animal testing for protein quality is taking place in Uganda.

This is a highly productive set of research and development activities, with U.S. researchers from Cornell, to UGA, to Florida working in concert with host country counterparts on extremely meaningful interventions contributing to FtF nutritional objectives. It is being done in a Haiti, an important FtF country in addition to other FtF countries. COR158 primarily focuses on women and children. However Linkages to the production sector via UF 155 also has the potential to improve producer's incomes and management skills.

Mitigation efforts described above (both Novasil and the blanching process in GP3MT) are as important to everyday products as RUTFs. The Global Peanut Product, Processing and Marketing Team (UGA-GP3MT) consists of three complementary projects that move peanuts from the procurement phase through processing and into products to meet consumer demand. The team approach can be regarded as innovative, strategic and as a model for other CRSP programs to follow if interested in moving beyond improved commodity production into value-added products. UGA 127 has been mentioned above but UGA 165 "Enhancing the Peanut Value Chain, from Processing to Marketing of Peanuts and Peanut Products" and UGA 166 "Enhancing the Peanut Value Chain, from Processing to Marketing of Peanuts and Peanut Products – Product Development" have not. Their approach has been successfully implemented in Asia during the previous phase and is now being implemented in Ghana and in Uganda. The approach appears broadly applicable and scalable horizontally (to other countries and commodities).

The GP3MT's approach starts with securing aflatoxin free peanuts. Considerable attention has focused on simple methods to identify AF tainted peanuts through blanching and then sorting to remove those identified as contaminated. This technology has been developed in the Philippines and Thailand in the previous phase. In January 2012, a workshop (Processing for Aflatoxin Elimination in Peanut Products: Reduction below Regulatory Thresholds) was held in Ghana to extend this approach to Ghanaian industry collaborators with a second day concentrating on peanut product development. A USAID/USDA advisor on SPS issues attended the workshop and provided comments that were generally favorable and also offered to publicize their workshops in the future (Bacon, Connie L., pers. correspondence January 29, 2012). She stressed greater attention to the costs of this activity to insure that it is economically relevant.

This activity is followed by engaging industry and microprocessor partners to develop new products for local consumers (UGA 166). In the Ghanaian case, this could be new food products or it could be the redevelopment of existing products relying upon imported, AF-free peanuts. Product development strategies are proactive and rely upon a competitive proposal process where organizations vie for small grants to develop new products. These organizations must show industry support through in-kind access to processing facilities or other contributions. The idea is to not only to develop a product but to develop a product that can be taken to market with minimal delay. Furthermore, MOU's are developed among partners and signed to solidify commitments to the final commercialization of developed peanut products.

The third component of this project is market surveys to better understand consumer preferences for alternative peanut products (UGA 165). These studies are conducted at the onset of activities to ensure that products are consistent with consumer demand.

All elements of this team have leveraged considerable additional resources. UGA 165 is contributing to understanding the entire peanut value chain in Ghana with support from IFPRI. Recent workshops in Ghana and Uganda have been supported by the International Union of Food Science and Technology and attended by USAID country and regional representatives.

Finally, UF 155 is also active in this segment. With UGA 145 and COR 158, these projects exemplify a complete system, with end users demanding higher production and higher quality, producers adopting necessary technology to comply and respond, and processors monitoring quality throughout the food preparation system. This occurred in Haiti. In Guyana the project focused on improving production in the previous phase, evolved to focus on value-added activities through the development of the school feeding snack, and now has returned to production issues as food product demand has stimulated need for new production technologies to meet these consumer needs. It is an example of a nimble project that has adapted to local needs over time.

Areas of Concern

The PCRSP can be credited for reducing aflatoxin exposure through agriculture by focusing on its occurrence throughout the value chain. While addressing health effects from an agricultural standpoint is arguably a strength, the ME faces an investment dilemma and must be mindful of assiduous administration of funds for medical studies because of the sensitive and unique nature of medical research.

Another concern about this area of study is that the ME tends to overstate inference in summary documents and in some publications, e.g. Williams et al., 2010. On the basis of a 'desk study' correlating disparate data sets on cropping patterns and various diseases, the PI overstates inference concerning the 'maize factor'; going so far as to state that he is warning governments. The evidence illustrates that there is a correlation between maize consumption and diseases in Africa. It does not establish causality between the two[2],[3]. Whether the inference is correct or not; the strength of the scientific method is not such that governments should be warned about one of the continent's staple food crops.

[2] The Team Leader is concerned that the relationship might be one of spurious correlation of data that can only be verified through a panel analysis of times series and cross sectional data. He hypotheses that a time series analysis would show an increase in HIV infection and deaths over time but a constant level of maize consumption, especially in eastern and southern Africa. If this is the case, then the relationship, over time may not be significant but would highlight the geographical intensity of the pandemic. The only manner to establish this relationship is to rigorously test for it using Granger and other econometric tests for causality.

PUR 151 is a departure from the research and development activities of the rest of the PCRSP portfolio. The focus of this project is specifically about obesity. The research is designed to seek evidence documenting that peanuts do not promote weight gain. On the surface, and with the materials provided to the reviewers, this project almost seems to contradict everything that the PCRSP is working towards in developing countries. There was some debate in Malta as to whether this project fitted the FtF program. The PIs defended the project on the basis that obesity is a major issue in Brazil and the US. Obesity is just as bad as malnutrition from a health stand point, so there was a need to use peanuts to address obesity. The PI further reminded that the CRSPs are supposed to be mutual relationships between the developing countries and US, however research is being conducted in Brazil, a non-FtF country. While the objectives of the research may be scientifically relevant, they are inconsistent with immediate needs on mitigation of undernutrition. Overall, the review team, like most people in Malta, felt that this project did not fit the FtF program.

Cross-cutting Projects

Beyond the value-chain specific projects are several that cut across several segments. Where possible, the contribution of these cross-cutting projects to the segments has been highlighted. The purpose of this section is to discuss how these cross cutting projects have added value to the overall Peanut CRSP.

Gender Analysis

VT134 "Improving the health and livelihood of people of East Africa by addressing aflatoxin and gender-related constraints in peanut production, processing and marketing" led by Marie Elise Christie has conducted a number of activities in Uganda and Kenya. Activities in Uganda have been far reaching and include developing institutional linkages with universities, not-for-profit organizations, extension and other projects. The project worked successfully with a Ugandan NGO: NAWOU, National Association of Women Organizations in Uganda. According to Dr. Christie, this organization was an extremely productive partner that extended project activities to a broader set of beneficiaries than those targeted by PCRSP. The project has been successful in mainstreaming gender research in Uganda and has helped to "reach the unreachable". A parallel set of activities is in development in Kenya.

In addition to the consumer studies, the project attempted to develop a true gender research program, rather than one that only provides service to other research activities. It certainly contributed to segment-specific objectives but it also empowered women with new knowledge to better control their health status and the management of their financial resources. Training on these issues took place. Additionally, a simple calendar was used to transmit practical messages on how to manage aflatoxins

[3] A contrasting opinion, Dr Katsvairo, points out that the Williams et al., 2010 is an excellent contributory paper, pioneering uncharted waters. The probable causality given is logical – "features of aflatoxicosis that could promote HIV infection include immune suppression, reduced mucosal IgA and results from animal studies, (Am J Clin Nutr 2004; 80:1106-22; Clin Dev Immunol 2008;2008:790309". The process of elimination of other possible causalities given is convincing. Lastly, as the first to establish such a relationship, the article clearly makes a disclaimer that these are preliminary findings, leaving the field open for other investigators.

and these calendars, distributed in 2008, still continue to adorn the same walls and disseminate aflatoxin management information today, according to Dr. Christie. The project conducted training on qualitative and participative methodologies for data collection for Ugandan graduate students. Ethnographic studies were conducted to better understand the entry points for aflatoxin management with direct feedback presented to participants.

This project is very well documented and has produced a range of publications from outreach posters on aflatoxin mitigation, a book and to six peer-reviewed publications. It has leveraged additional resources from non-affiliated departments at Virginia Tech.

Multiple Segments of the Value Chain

UF 155 "Development of the Peanut Sector for Guyana and Selected Caribbean Countries" has worked in all segments of the value chain. It was initiated as a production project (in a previous phase) but then adapted to conditions in Guyana by shifting to the development of a school feeding snack. This product was developed as a substitute for one trucked from the coast and has provided employment for numerous women from the target localities.

Product development activities are well documented and this is a useful case study of how the agricultural development process was stimulated not through an increase in production, but through product demand. In order to get this product to school-age consumers, several aspects of the upstream value chain needed development. This new demand has stimulated a renewed interest in improving productivity, thus linking the markets and products back to production themes of varieties and agronomy. GP3MT is another example of multi-segment activities. The primary difference with UF 155 is that they focus on post-harvest management, processing and the development of new products. It is combined consumer demand studies to help define products with a high commercial potential.

Impact Assessment Case Studies

UGA 128 is a recent addition to the PCRSP project portfolio and initiated in year 4 of the program. Most activities are in an early- to mid- state of project cycle and will be completed as this phase winds down. Dr. Kostandini, Dr. Zahirovic-Herbert and Dr. Tanellari are currently investigating the impact of peanut technology adoption and cropping practices on intra-household distribution of labor and revenue sharing in Uganda and Ghana. A household survey was designed to collect information on all family members that grow peanuts and how they manage their individual plots. The research focuses on identifying management and technology adoption differences between male and female farmers with the specific aim on quantifying gender differences.

In addition, Dr. Kostandini and Dr. Tanellari are using the Uganda National Household Survey (2005/06) data to document the PCRSP contributions to poverty alleviation based on revenue and expenditure impacts on poor households. It will identify the impact of PCRSP activities on reducing the incidence, depth, and severity of poverty in peanut producing regions in Uganda. In addition, they are investigating PCRSP benefits in terms of risk-reduction for representative poor, medium and rich farms by estimating

producer and consumer benefits from reductions in yield variation. They are also examining country-level benefits from the adoption of new peanut varieties in Bolivia.

A second research topic will evaluate the impact of the FFS program developed by a PCRSP project in Ghana through a survey administered to Farmer Field School (FFS) villages and non-FFS villages. The sample consisted of 6 FFS villages and 6 non-FFS villages where 30 households were randomly selected from each village. Additional information is being collected through an expert opinion that will help document benefits of PCRSP technology development and integrated crop management research.

In the future, UGA 128 would like to focus on the impact of new technologies on gender relations in Ghana and Uganda, as well as risk and poverty impacts in other countries where PCRSP projects have been in place. Baseline surveys with other teams will be very important for this analysis. Some information from this project will be available by the end of the current phase, notably in the form of student theses and dissertations.

Information Transfer and Communication

UGA 124 argues that constraints to production, post-harvest handling and processing of peanuts can be similar between regions. In addition, there exists a huge volume of peanut data and information that is not published in standard journals. The project addresses these issues by creating a website that is to improve the sharing of this information between PIs, growers, and industry. The project proposes to develop a train-the-trainer initiative.

The project idea is creative but the reviewers have a few concerns. The website is not easy to find. Surprisingly the website was not even linked to the PCRSP webpage until the reviewers pointed this out. The website is poorly designed. Because it was built on a template of the University of Georgia website, it nearly looks like a page on the University of Georgia website, with the University of Georgia logos. The main headers and links point to the University of Georgia activities and simply drive the traffic away from their website towards the University of Georgia site. While the PI pointed out that the University of Georgia provided free hosting, it is noted that hosting of website is not expensive. Overall the website could be better designed and made to carry information relevant to clients and constituents it is meant to serve: smallholder farmers, PIs and other relevant stakeholders. Financial investment in this project appears disproportionately high relative to activities and outcomes. This activity could be subsumed under the ME, as common in other CRSPs.

Long-term Training and Outreach: Part of the Technical Contribution

One element of the research and technical review is the allocation of financial, time and other resources in long-term training activities. Eighty six students are supported by PCRSP through assistantships or stipends at the bachelors, masters and doctoral level. Forty-nine percent of the students receive full support for their studies and the remainder partial support.

Table 1 presents several statistics describing long-term training under PCRSP. Sixty-five percent of the trainees are women and trainees are concentrated in advanced degree categories with over ninety percent at the masters or doctoral level. Half of the students focus on human health related fields of

nutrition, public health, epidemiology and toxicology, 28% in production-related fields and 23% in the social sciences and education. By the end of this phase of the program, 68% of the students will have earned their degrees leaving 27 still enrolled.

Table 1. Student distribution by gender, degree and field of study

	Gender		Degree			
	Female	Male	BS	MA/MS	PhD	Total
Agricultural Extension Education	1	0	0	1	0	1
Agronomy	2	3	0	2	3	5
Applied Economics or Sociology	9	6	0	9	6	15
Biological Systems Engineering	1	0	0	0	1	1
Crop Science	4	1	0	3	2	5
Education	1	0	0	0	1	1
Entomology	0	1	0	1	0	1
Epidemiology	0	1	0	0	1	1
Food Science and Nutrition	17	10	3	14	10	26
Food Security	1	0	0	0	1	1
Genetics	1	0	0	1	0	1
Horticulture	0	1	0	0	1	1
Microbiology	1	0	0	1	0	1
Plant Breeding	3	3	0	4	2	6
Public Health	1	1	0	0	2	2
Toxicology	10	3	0	1	12	13
Virology	1	0	0	1	0	1
Women and Gender Studies	3	0	0	3	0	3
Total	56	30	3	41	42	86

Source: Data provided by PCRSP ME, "Student_byProjects.xls"

Research Investment in Value-Chain and Cross-Cutting Activities

Investment into research activities has been relatively constant across this phase of this program with the exception of a large increase in the ceiling amount occurring in year 3. The program was originally

funded at $8.2 million and then increase to $13.9 million and this affected project allocations and the breadth of the portfolio. As described above, the GP3MT project was initiated in year 3 and the impact assessment studies (UGA 128) in year 4. Figure 2 describes the evolution of funding from year to year with financial information provided by the ME aggregated by VCS (data provided by PCRSP ME, "PROJECT AWARD STATUS thru yr5xls.xls"). Project-specific totals are found in Appendix 1.

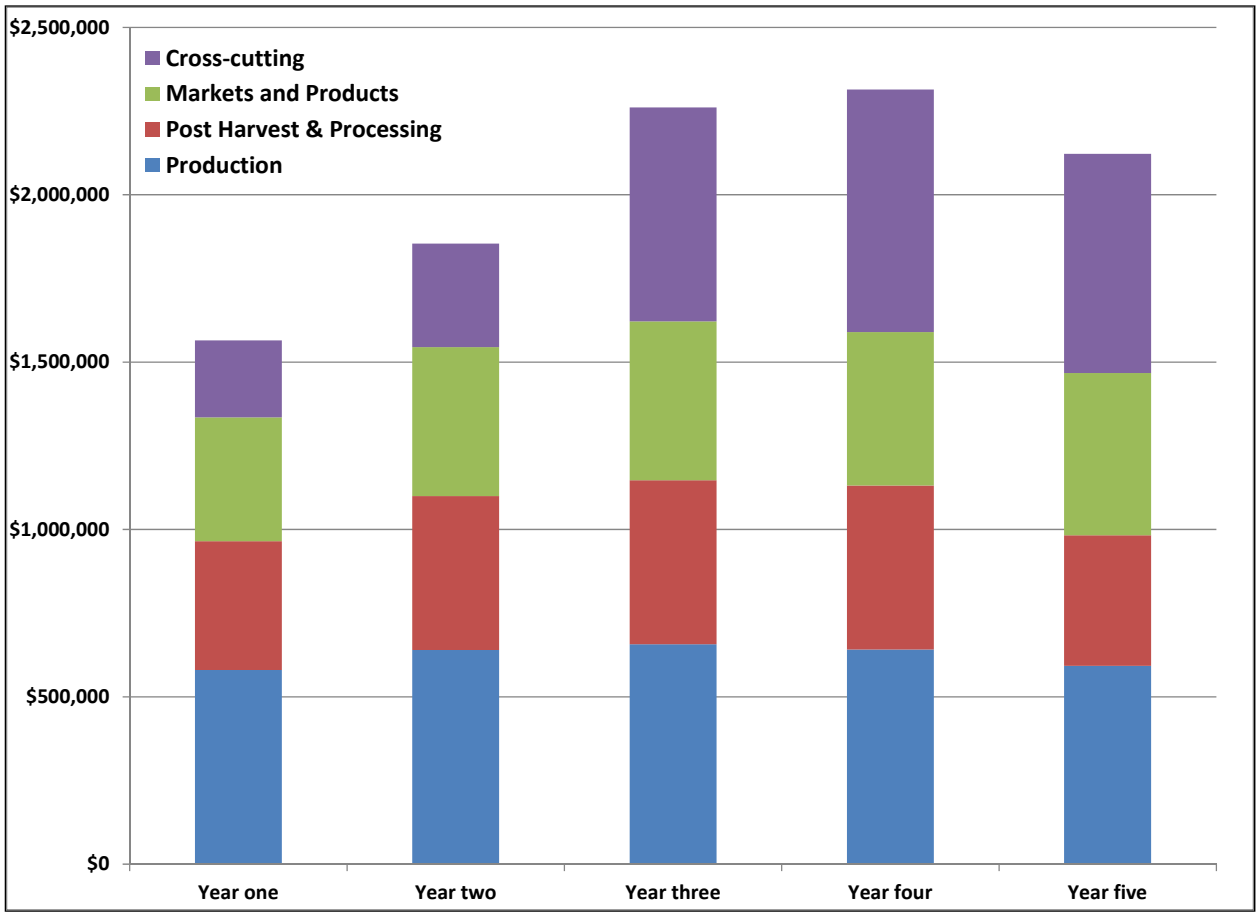

Figure 2. Annual funding allocation by VCS and cross-cutting segments (US$)

There are few remarkable findings associated with this graph except for the large increase in funding in year 3 that results in small increases among the value segments but a large increase in cross-cutting activities through the addition of new projects. On average, research projects accounted for 78% of total expenditures of the program but this varied from year to year from a low of 73% in year 1 to a high of 82% in year 2. Overall the shares by segment appear stable. According to financial information provided by the ME, approximately 16% of the total budget remains which is disproportionately high relative to the six months remaining in this phase (10% of the program's 5 years).

Project investigators have leveraged additional funding sources to support their activities. These additional grants are likely the source of financial support for students only partially funded by PCRSP and research activities complementary to PCRSP studies. While the relationship between PCRSP funding

and these other sources of support is not entirely clear, insofar as what percentage of which grant covers which activity, it does indicate additional "buy-in" or leverage of funding.

Project investigators listed 54 additional research grants leveraged through PCRSP activities totaling $9.8 million (Data provided by PCSP ME "LeverageGrants_byProject.xls). Data provided by the ME did not specify the time frame so it is unclear whether these amounts are over just one year or the program phase. The largest share of additional grants leveraged by the project was in the production segment with nearly $8.0 million. This segment includes a large biofuels grant worth $6.8 million that focuses specific investigation on oil content. The remaining three segments leveraged about $600,000 each.

There is little consensus about how much more in grant funding an investment should leverage. If the biofuels grant is held apart as an outlier (since biofuels is not an activity of the PCRSP research portfolio) then project PIs from the U.S. obtained $3.0 million in additional funding. This is only 22% of the total program budget. PCRSP was not a part of the CGIAR consortium research proposal on legumes (CRP 3.5) which has a budget of $138.6 million from 2011-2013 while the pulse CRSP was. This was a missed opportunity to be part of global efforts to improve legume productivity. Entering into a new phase, the ME and the Board of Directors should develop a strategy and set an explicit goal for leveraging additional funding and be held accountable for successes or underperformance. A goal of a 1:1 ratio of USAID:outside funding is a reasonable target[4]. Additional information from other CRSPs will help to establish the relative performance of the PCRSP in leveraging funding.

Research Productivity

One metric of the benefit created by PCSP is research productivity as measured through publications. It is often argued that research publications are an important input into the stock of knowledge that is required to develop new technologies, processes or to improve the efficiency of production. Thus they are often viewed as an intermediate input to technological change or total factor productivity growth. Furthermore, it is difficult to value a publication using a dollar metric to compare against investment.

The PCRSP ME provided a list of 244 publications produced by scientists affiliated with the program (Pubs_byProject.xlsx). Using this list as a base, the publications were systematically reviewed for citations using the citation indexing software Publish or Perish (Harzig, 2007). Citations can be used to identify research publications with impact. Publish or Perish (POP) uses Google Scholar to identify citations of specific papers or authors. Google Scholar is regarded as more reliable source of citations than ISI *Web of Science* in the Social Sciences, Humanities and Arts but similar to ISI in the Natural and Health Sciences. Google Scholar does not capture publications written in languages other than English better than ISI (Harzig, 2007).

Several publications were deleted from the original list. Repeated publications were deleted thereby reducing the total by 44. Twenty-one publications were dated before the current phase and were not

[4] This is the team leader's opinion and not based upon any objective norm.

included in the analysis. Seventeen of the listed publications were still under review and not included in the analysis. Sixty-one manuscripts were not found by POP and this was often due to the type of publication. Publications in conference proceedings (abstracts or papers), recent theses or dissertations and non-western journals were commonly not located. A total of 139 papers (or about 28 per year) were located and their citations tabulated.

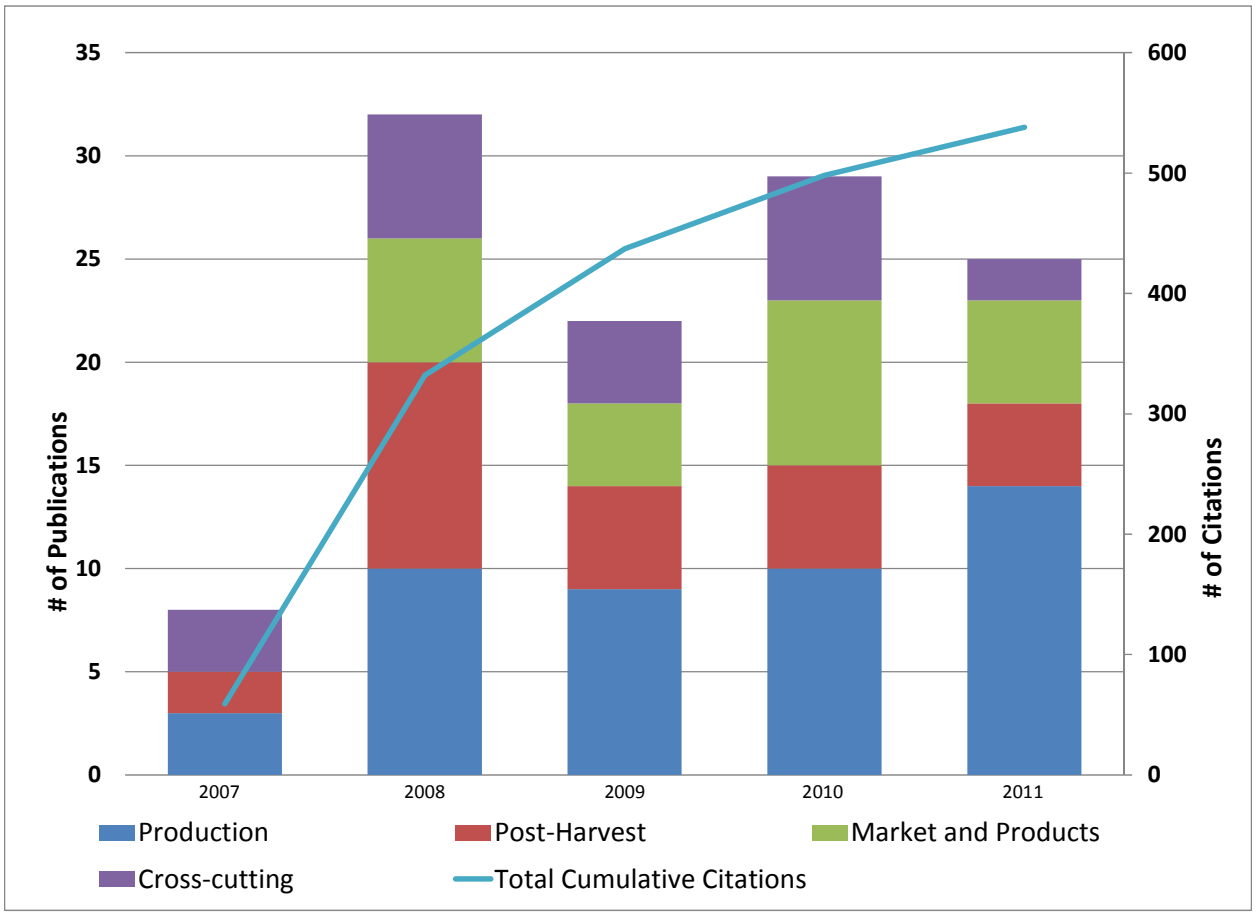

Figure 3. Publications by VCS and cumulative citations from 2007 to 2011

Figure 3 describes the trend in publications by VCS and the cumulative number of citations of these papers. What is noticeable is the highly varying nature of publication rates by year. For example, 2007 is noted as a year with few publications while in 2008 four times as many are published. This could be a result of the time lag associated with the review process and also an artifact of the research process where research is first presented at conferences where many abstracts and publications are not indexed by Google Scholar, then into a more formal, indexed publication. On average, the 139 papers have been cited more than five times each. Several publications received more than ten citations and these were often in the area of nutrition, health and toxicology. The trend in cumulative publications also reflects the "young" age of recent publications that have not been in press long enough to accumulate citations.

For example, a large bump in citations occurred from publications in 2007 and 2008. Publications from these two years have been cited nine and seven times on average, respectively while those from 2010 and 2011 only twice. Nonetheless, citation analysis indicates a stream of publications with growing influence produced under PCRSP and affiliated research activities. Future analysis of publications should include only those tagged with an acknowledgement of the USAID funding assistance.

Input from Host-Country Collaborators

Insight from host-country collaborators was elicited at the Malta 2011 Strategic Research Conference and through an online survey. Both sources provide insight into the importance of the program on peanut research activities in partner countries.

Meeting with the African PIs at the Malta Conference

In Malta one of the African participants requested a meeting of the African PIs that Dr. Katsvairo coordinated. The PIs were interested in sharing the challenges they were facing. Among the issues raised was the need to collaborate more and learn from each other. The PIs exchanged lots of stories, some successful and where things went wrong. The most discussed topic was how the PIs have dealt with governments and policy makers in their respective countries. The group discussed the need for regional workshops to facilitate more communication. The need to form multidisciplinary teams to strengthen grant applications to leverage and support CRSP grants was discussed. It was suggested that impact indicators be given to PIs ahead of time and that the group be active in translating the success stories in ways evaluators understand.

Based on this meeting with African PIs, it is recommended that USAID engage professionals trained in policy communication to assist PIs. It was clear that more could have been done or done better by PIs as they approached government officials for approvals. It should be borne in mind that discussing with policy makers can require skill sets different from scientific training.

Host country PIs voiced several concerns about their interaction with USAID. They saw USAID shifting direction twice during this phase and implementation strategies were inconsistent. This has contributed to researcher anxiety and concern about the continuity of funding. The high rate of turnover in USAID staff (AOTRs) has limited direct interaction with host country researchers. Furthermore, the receipt based accounting systems is onerous and should be reviewed to determine whether the administrative burden is worth its cost.

Consequences of Cutting the CRSPs as Provided by the PIs at the Malta Conference

At the heart of the Malta Conference was the concern and consequences of cutting the PCRSP. The PIs pointed out several consequences of cutting the PCRSP project as follows:

- CRSPs are the only program which incorporates research, development, health and gender issues. This makes CRSPs unique and invaluable. To most attendees, it is

inconceivable to even think of cutting the CRSPs in view of the benefits. CRSP have advanced several issues and to cut them, simply rolls back all the effort.

- USAID claim to champion gender issues and cutting CRSPs which is the only organization which link gender to a key crop (Peanuts) in terms of food and income is inconsistent with USAID stance on gender.

- CRSPs have far wider reaching effects. CRSPs create relations with foreign countries. These relations and intangible benefits of networking are good for the US government policies. In fact killing the CRSP will damage US perception.

- CRSPs have access and interact and link the top US universities with PIs in the developing world. CRSP also have access to several agencies and labs.

- It has taken years of work to build the relations the CRSP has, none of this happened overnight. Credit should be given to the hard work of the CRSP. Cutting the CRSP program discards all this effort.

- Peanut is not only a key food crop, from an ecological standpoint; it is good for nitrogen fixation, increasing the yield of subsequent crops. It provides N where it's most needed.

- Peanut is such an important crop in the developing world, how could the CRSP want to cut it?

Online Survey

An online survey consisting of closed-ended and open-ended responses was sent to 54 non-U.S. based host country collaborators (HCCs) from a list compiled by the ME (HCCollaborators_byProject.xls). A copy of this survey and the results is found in Appendix 5. The survey was administered from January 27 to February 3, 2012. An initial email was sent to all collaborators with follow-up reminders every second day. Only eighteen host country collaborators (33%) responded to the survey so representation of their responses must be viewed with caution. Rather than presenting this material statistically, it is described qualitatively due to limited responses.

Most questions asked for responses on an ordered Likert scale where the first class indicated "not important" while the fifth class indicated "very important." When possible, classes were used to designate ordered quintiles. The questionnaire was organized to identify geographical and scientific background, the relative importance of peanut in their countries and then shift to questions on scientific collaboration. The distribution of responses is presented in the Appendix 5.

Half of the responses came from West African collaborators. Forty-two percent of the respondents were from production fields with approximately 25% of the respondents from human health and food

science backgrounds respectively. Sixty-five percent of the respondents indicated that they allocate more than 60% of the professional time to peanut or human health research.

In terms of scientific interaction, the responses suggest that HCCs play a very important role in setting research priorities, scientific methods and in taking leadership for developing written outputs including reports and scientific publications. Open-ended responses indicated that the relationships are very valuable but could be reinforced through reciprocal visits to the U.S., through greater regional interaction among scientists and continued investment in research equipment and infrastructure.

Financially, the importance of PCRSP funding was quite dispersed with some respondents indicating that it covered very little of their expenses while others indicating that the funding covered all of their research costs. Only one individual indicating that PCRSP contributed very little to their research budget and many others cited it as "very important", indicating it covered 81-100% of their research activities. More than 80% of all responses indicated that PCRSP funding was of "average" or "very important" significance to their research program. Forty-one percent of the respondents indicated that they could not conduct research on these topics without PCSRP funding and an additional 34% indicated that PCSRP covered more than 50% of their research costs. It appears that complying with financial reporting requirements and administrative requirements is roughly equal to other projects the respondents work with. Again, the numbers of respondent are too few to make any general statements. Review of the comments in Appendix 5 may assist in gaining an appreciation of HCCs' concerns and accolades.

Management Assessment

Challenges facing the ME

There have been several challenges for the Management Entity during this phase of the program. First and foremost is the change in the funding mechanism from a grant to a cooperative agreement (CA). This shift has altered the working relationship between all parties. The ME and University of Georgia (UGA) grants and contracts office no longer takes unilateral management decisions, reducing flexibility to respond to unforeseen issues with regard to procedural operations. UGA and the ME believe that nearly all procedural and scientific issues must be vetted with USAID and the AOTR before policy can be put into operation. This additional transaction cost is significant in terms of time and the opportunity cost of inaction.

The second important management shift was the consolidation of all sub-awards in the ME rather than being administered by each project. Each HCC project is associated with a subaward even though several projects may be administered by the same host country institution. Currently, the ME manages 55 subcontracts. This consolidation has been viewed as helpful by some researchers (notably those with weak administrative support) but as an impediment to those researchers working in institutions with strong support. In addition to the move to a CA and sub-award consolidation, a receipt-based accounting system was enacted, shifting away from a "performance-based" approach. As a result, the ME must process every transaction conducted under the program. While it appears that this is well

managed at the ME, there are bottlenecks to timely reimbursement that occur at UGA central administration that have often delayed payment. The ME responded by overseeing wire transfers actively with notifications sent to PIs and host country institutional grants representatives to alert them of the transfer of funds. This hopefully reduces the delay in getting funds for recipients' banks. Real-time monitoring of the movement between ME and Host Country Institutions (HCI) is not facilitated by UGA financial management information systems, requiring frequent follow up by the ME by telephone to Athens.

There has been a veritable "revolving door" of AOTRs on this program over the program phase. The most recent AOTR , J. "Vern" Long, just came on board in late 2010. She was preceded by J. Oweis from August 2007 to May 2008, C. Jackson from May 2008 to February 2010 and J. Turk from February 2010 until November 2010. *Only one AOTR has been present at a board meeting in the past four years.* The combination of a cooperative agreement and the lack of a consistent AOTR is a recipe for frustration among all parties, a drain on time, talent and other resources and a handicap to conducting the research and development activities prescribed under Title VII.

The relationship with USAID is unsettled. UGA was the only institution to bid for hosting the ME. Since they were the only institution to submit an application, USAID decided to put the award back out to bid. Due to the delay in the award, UGA provided bridge funding to the ME to carry the program until the decision was made. The program award was originally made for a ceiling of $8.2 million but increased to $13.9 million after the second year. Funding uncertainties and changes mid-stream made strategic planning difficult. Since the change in ceiling was so large, the program was required to resubmit their application. Resubmission was laborious requiring repeated explanations to numerous USAID employees. At the onset of the program, the ME decided to eliminate projects in Southern Africa and also held off on market development projects. When funding increased, the GP3MT and impact assessment projects were initiated.

USAID impact indicator reporting requirements were extremely time-consuming. Preparation of a response to USAID consumed four months of time by the ME. After submission, the indicators were audited by USAID for accuracy. This request for information was unanticipated at the program outset. During a general discussion with PIs, they indicated that many of the indicators were not relevant to their activities and complying with requests impossible. While it is not the opinion of the reviewers that the impact indicators are superfluous, but in fact constructive to monitoring and evaluation, the process set in motion by USAID was disjointed with revolving requests and little consultation.

Finally, a number of significant life events have befallen ME staff. While the review team does not want to dwell on this point, we do wish to emphasize that these events would affect anyone in any professional capacity, and were beyond the control of the ME.

Advisory Boards and Linkages to USAID

The evaluation team met with several layers of administration including the Board of Directors (BOD), UGA Deans and the Vice President for Research and Administration. Present at the meeting convening

the Board of Directors were representatives from Purdue (K.G. Ragu by telephone), the University of Florida (Walter Bowen), Industry (Darlene Coward), North Carolina State University (J. Harper), the University of Georgia (Ed Kanamasu), Auburn University (Joe Molnar) and UGA-Griffin campus Dean Jerry Arkin.

Board of Directors

The Board of Directors (BOD) plays a very proactive role in the PCRSP and yet the shift to a CA has weakened their legitimacy, according to their interpretation. The Board feels that it would be useful if USAID would supply a terms of reference for their role in overseeing the ME and this would be very useful to other CRSPs as well. However, in light of constantly changing AOTRs, USAID in effect did not replace operational function of the board. In light of constantly evolving policy in USAID, the board believes that it is more important than ever for the AOTR to be actively involved. By-laws that had been established by the over-arching CRSP council, including guiding principles for membership became irrelevant in the CA model. Otherwise said, these by-laws are more suggestions or guidelines (as perceived by the board members).

Board members stated that projects now must be vetted through the country missions thereby creating another layer of administrative approval. They also believe that country missions are not really interested in CRSP activities since they are not responsible for their administration. This is a general issue for all CRSP and not specific to PCRSP.

The BOD viewed their role as a "stand-by equipment" to solve problems, to help the ME as "sounding board" and also to provide cross-CRSP perspective as some board members sit on more than one CRSP advisory council. PCRSP has protocols in place for when the ME contacts the board as well as regular annual meetings. If the ME does not agree with BOD, the director must submit an explanation why he has not followed their advice in writing. The Board has to approve the budget. They indicated that they adamantly requested hiring an associate director. The BOD unanimously supported UGA as the ME (and we note that all universities were identified in the proposal as part of the consortium).

There was consensus that ME communicates regularly with the BOD and they are never surprised when issues are brought forth for discussion. In general the BOD feels that the ME is doing an excellent job especially in providing 'intellectual leadership', fiscal responsibility, and reporting responsiveness. As an example of fiscal responsibility, the ME director presented different project finance scenarios and sought Board input on project choices and financing levels. In some cases, the Board was brought to a vote over disagreements.

The industry representative voiced strong support for PCRSP and listed several benefits to the domestic industry. She indicated that "PCRSP is an important leg on the research stool." In particular she cited benefits from new knowledge on yield benefits from plant breeding across the world, especially with respect to drought tolerance in the face of climate change (particularly for Texas), and seeing pest and disease problems before they arrive in the U.S. She argued that PCRSP provides a key linkage to the rest

of the world on international relief and humanitarian aid efforts, elements in the corporate responsibility ethos of industry.

Board and University of Georgia representatives indicated that they had benefited by being members of the PCRSP consortium by leveraging activities in the PCRSP research portfolio into new areas of nutrition, animal sciences, and food sciences at their respective universities. A slight concern voiced by the board is that the Director is so passionate that his frankness can be counterproductive. For example, when he was chair of CRSP Council his outspokenness caused him (and his board) to feel as though there was a punitive backlash from USAID towards the PCRSP.

University of Georgia Administration

In addition to our meeting with the BOD, the review team met with Dean of the College of Agriculture and Environmental Sciences, J., Scott Angle and the VP for Research of UGA, David Lee (by videoconference from Athens). We learned there is a strong level of support for the PCRSP from UGA due in part to the relevance to Georgia and to the peanut industry. There is considerable investment by UGA in the PCRSP and they feel it is their role to make sure the PCRSP is healthy and operating well. They contribute to the salary for Tim Williams and Carolyn Fonseca in addition to providing physical infrastructure.

The PCRSP approach is consistent to the applied and problem solving orientation of UGA. They commented that many industries are very negative about doing research on their crop overseas but PCRSP has full backing of the powerful peanut industry of Georgia. They also averred that the peanut industry will not let UGA walk away from this commitment. Dean Angle indicated that there is strong complementarity between the new Plant Breeding Institute and PCRSP germplasm exploration.

The VP acknowledged the challenges concerning moving funds through the UGA financial system to host country partners overseas. This problem is not unique to PCRSP but is a systemic issue for the university in all international partnerships. He relayed that a special committee has been formed to look at procedures and specific points of contact have been assigned to respond to problems of moving money overseas. He also stated that there is a new Provost of International Education to oversee these developments. Based upon several meetings with administration and faculty engaged in international activities, several remediating steps have been taken that have culminated in the development of a centralized website (http://www.busfin.uga.edu/ipc/). Overall, UGA administration provided a positive impression that they were working on reducing administrative impediments for effective international collaborations.

On the issue of Sinecure – a lively discussion on the potential of an 'old boys network'

The BOD acknowledge that many projects are long term and continuations, but there is justification in that the CRSPs are institutions, with relationships, personnel, careers and also there are long term projects such as plant breeding that need continuation. They agreed that sometimes pruning is needed, new players and institutions need to be brought in, and unproductive projects discontinued. They suggested that one strategy to bring new blood into the program might be to expand the objectives of

the RFP, and also to circulate the RFP more widely. As an example, the progress in understanding the human health implication of aflatoxin with the interface to agriculture was a novel step and puts the PCRSP at the forefront of innovation.

The Sub-award process follows best practices for selection. The procedures are included on the RFA and have been passed before USAID for their approval. The RFA was posted by USAID, sent to previously collaborating institutions, industry (board members), and NASLGUC. The objectives of the selection process were to balance the activities across the value chain and in each region. Regional focus was primarily East and West Africa, plus Latin America and the Caribbean (LAC). At the onset of this phase, proposals were electronically submitted to the ME using on-line forms, but the software interface has been discontinued. The proposals are backed up and stored, according to the ME. Proposals submitted for new funding in year three were submitted directly to the ME without using the electronic submission interface.

The review panel expertise consisted of an economist, gender consultant, USDA regulatory official, genomicist, mycotoxicologist, and a representative of the peanut industry. The panel was vetted and approved by USAID. In Year 1 (Aug 2007-July 2008) – 17 awards were made out of 47 applications; 14 were continuations, 2 old projects from previous phase were dropped and 2 new university partners came in. $2.78 million were awarded ($2.78 million was approximately 2/3rds of total requested amount). Unfunded proposals included several focused on Asia, which had been dropped from the geographic emphasis for the PCRSP and market development and genomics were left unfunded during this cycle of selection. One of the market development projects was funded at a later date.

Year 2 (Aug 2008-July 2009) – one of the awardees from the 2007 competition dropped out and the funds were redistributed among the 16 remaining projects. $2.11 million were available for distribution to the 16 projects. Year 3 (Aug 2009-July 2010) – funding was increased to $3 million and a new RFA (process and selection took place in early 2008) for market development, food processing and post-harvest brought in three new projects. The review panel expertise was restricted to food science expertise and all awardees were from UGA Griffin. Year 4 (Aug 2010-July 2011) – funding again was $3 million. An impact evaluation grant was included in the PCRSP package with limited interest due to the size of the grant ($300,000). Year 5 (Aug 2011-July 2012) funding was $2.55 million. PCRSP's $100k contribution to the USAID CRSP Synthesis activity was initiated.

Award Processing and Administration

A clear procedure is in place once a project is selected for funding. After notification of an award, the PI is required to submit a five-year budget though an online interface. The first year budget is binding but subsequent years are estimations. Accountants then review the budgets and work with the PI in case there are any errors. At the same time, a workplan must be submitted with a detailed budget description. Once both the budget and workplan are completed, the ME sends copies to the Business Office, who reviews and then forwards these documents to Grants & Contracts. Grants & Contracts prepares the legal documents of the award and forwards it to the awardee for acceptance. The ME

receives notification from Grants & Contracts informing them of the award. Once the award has been finalized, UGA Athens finally informs the ME that the funds are now available for that contract.

After the award has been finalized, up to 25% of the annual budget can be advanced to the subrecipient. The subrecipient must then invoice the ME for these costs and submit receipts for 90% of the advanced amount in order to receive the next tranche of funding. Subcontracting arrangements indicate that a HCI cannot charge more than 10% overhead on the projects and this is only if the institution can provide proof that the institution has a policy regarding charging overhead. According to discussions with an ME accountant, only Makerere University in Uganda has such a policy. In the online survey, one HCC remarked that this was unfair.

The policy of receipts-based invoicing has not been viewed favorably by investigators. It appears that expectations may be different from both sides. The ME is frustrated with processing requests made with little time for reimbursement through the administrative channels required by UGA, and PIs are frustrated with the minutiae of accounting for every expense. HCIs have been hampered with managing several projects and accounts rather than one account for all the institution's PCRSP activities (as done in SMOG). PCRSP has attempted to make the process more transparent by providing sample invoices and templates for institutions, and requesting confirmation receipts for wire transfers and forwarding them to all parties including PIs and HCI administrators. In some instances, the ME has traveled to HCIs with the specific goal of assisting them to meet the financial exigencies required by UGA and USAID.

Web Presence and Communication

The PCRSP website has undergone a major renovation and there is a full time web administrator on staff. Nonetheless, the evaluators were nonplussed by the website and found instances of "legacy" information no longer relevant to the current phase of the program. We found the site frustrating our search for background information and counterproductive during our initial step to create a working paradigm for the evaluation. Evaluators were provided a 613 page document used by the External Evaluation Team commissioned by the ME as background. This document was a concatenation of annual reports. It was illegible in parts and redundant making it extremely difficult to arrive at any sense of the program's strengths or weakness. We requested a synthetic overview and were provided one. However, none of the assertions in the document were referenced making it impossible for the reader to investigate the source of the assertions.

The external face of the project is very poorly managed, yet the ME argues that it is a source of strength. Content on the website is weak, and review documents poorly prepared. The ME claims that there is a dynamic interface between information entered on the website and its appearance on the web pages. This may be so but there still are a number of duplications in some of the project webpages which may be due to input problems or programming errors. External constituents looking to the PCRSP website for information, if they are like us, have difficulty finding it.

The ME provided four site usage reports from July 19-25, 2011, November 1-7, 2010, June 13-19, 2011 and November 2011 to January 2012 (Appendix 6). During the first period, 121 visits were made to the

site and each visit lasted 1:23. During the second period, 70 visits were made to the site and each visit lasted 1:40. During the June 2011 period, 2 visits were made to the site and each visit lasted 0:01. During the final period, traffic increased substantially as did the amount of time spent on the site. 942 unique visitors viewed the site with an approximate time of 6:36 per visit. It is not clear what is driving the change in usage but it does coincide with the period of the Malta conference and when then evaluation team was collecting information from the website. While this information is not conclusive it certainly suggests that the website is not communicating information effectively. Project PIs have also indicated that the web interface to submit trip reports and other information does not, or had not, worked in the past, and this was a source of frustration with the ME. It is unclear whether this problem has been resolved and these comments date to a prior period. Given that the information content of UGA 124 is similarly weak, PCRSP is failing at communications, especially to lay audiences outside of technical and scientific circles.

Key Considerations for the ME

Project investigators and the BOD repeatedly cited Tim Williams for dedication to the project, intellectual leadership and his insistence for investing as much money as possible into research and field activities and not administration. Only recently has he added an assistant director to the staff. This is a positive development and an opportunity to diffuse any lingering questions on the ME. Specifically, this addition can contribute to managing the mundane tasks associated with running a multi-million dollar project financed by the U.S. government. This is no trivial task. Investing in management training for Dr. Fonseca is worth considering to ensure that the PCRSP functions with aplomb in the rapidly evolving environment of FtF. Opportunities for networking with, and mentoring by other female senior administrators (inside and outside the CRSPs) should be encouraged for long-term professional development.

A strategic review and planning session is critical to move the program forward. Projects need to be reviewed for their continuity and contribution to the program. Exploration of opportunities to intensify activities in key FtF countries is suggested. Until this is completed it is impossible to comment on the total level of funding. While the program is highly consistent with FtF, a critical review will only heighten its position and place it in a stronger position to advocate for the financial allocation to implement its activities. We note that sessions on strategic priority setting were listed on the Malta conference program agenda so the groundwork has been established.

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Appendix 1. PCRSP Project Portfolio

Project Number	Project Title	Principal Investigator	Total Budget*
AUB163	Aflatoxin financial and health risks along the peanut marketing chain in Ghana	Curtis Jolly	270,000
COR158	Innovative Procedures to Protect Therapeutic Foods from Aflatoxins in Developing Nations	Dan Brown	352,902
NCS131	Improved West African peanut production for enhanced health and socioeconomic status through the delivery of research-based production systems in Ghana	Rick Brandenburg	554,756
NMS172	Global Valencia Peanut Niche Market Development Program	Naveen Puppala	375,000
PUR151	Peanut consumption and human weight management	Richard Mattes	438,000
TAM137	Overcoming Abiotic and Biotic Constraints to Yield, and Production of High-Quality Peanuts in West Africa and Texas.	Mark Burow	528,925
TAM149	Enterosorbent intervention therapiesfor populations at risk for Aflatoxin related diseases	Tim Phillips	907,000
UAB148	Association of Aflatoxin Biomarker Levels with Health Status and HIV Disease	Pauline Jolly	975,000
UCN139	Improving livelihoods of farm households in peanut based farming systems in East Africa	Boris Bravo-Ureta	494,631
UF150	Breeding Peanut for Disease Resistance Valuable to Latin America, the Caribbean, and the United States	Barry Tillman	425,109
UF155	The Development of the Peanut Sector for Guyana and Selected Caribbean Countries	Greg McDonald	515,074
UF157	Systems Approaches to Enhance Peanut Production under Resource Limitation	Ken Boote	302,111
UGA122	Aflatoxin free Peanut-based Recovery and Functional Food	Dick Phillips	535,000
UGA124	A Peanut Information Network and Train-the-Trainer Program	Y.C. Hung	221,750
UGA127	Enhancing the Peanut Value Chain, from Processing to Marketing of Peanuts and Peanut Products - Processing	Manjeet Chinnan	303,000
UGA128	Economic Impact Assessment for the Peanut Collaborative Research Support Program	Genti Kostandini	277,032
UGA136	Strategies for Controling Groundnut Rosette Disease in SubSaharan Africa	Mike Deom	429,960
UGA145	Development of Methods for Establishing a Global Network for Aflatoxin Exposure	J-S Wang	970,000
UGA 165	Enhancing the Peanut Value Chain, from Processing to Marketing of Peanuts and Peanut Products	Wojciech	335,898
UGA166	Enhancing the Peanut Value Chain, from Processing to Marketing of Peanuts and Peanut Products - Product Development	Anna Resurreccion	292,254
VT134	Improving the health and livelihood of people of East Africa by addressing aflatoxin and gender-related constraints in peanut production, processing and marketing	Marie Elise Christie	613,000

*Source: Author's calculation of total budget for this phase from "PROJECT AWARD STATUS thru yr 5xls.xls"

Appendix 2. Alternative model of project interaction

The following graph extends the Figure 1 by showing the explicit interactions between the value chain segments. It also extends provides insight to where multi-segment projects are participating.

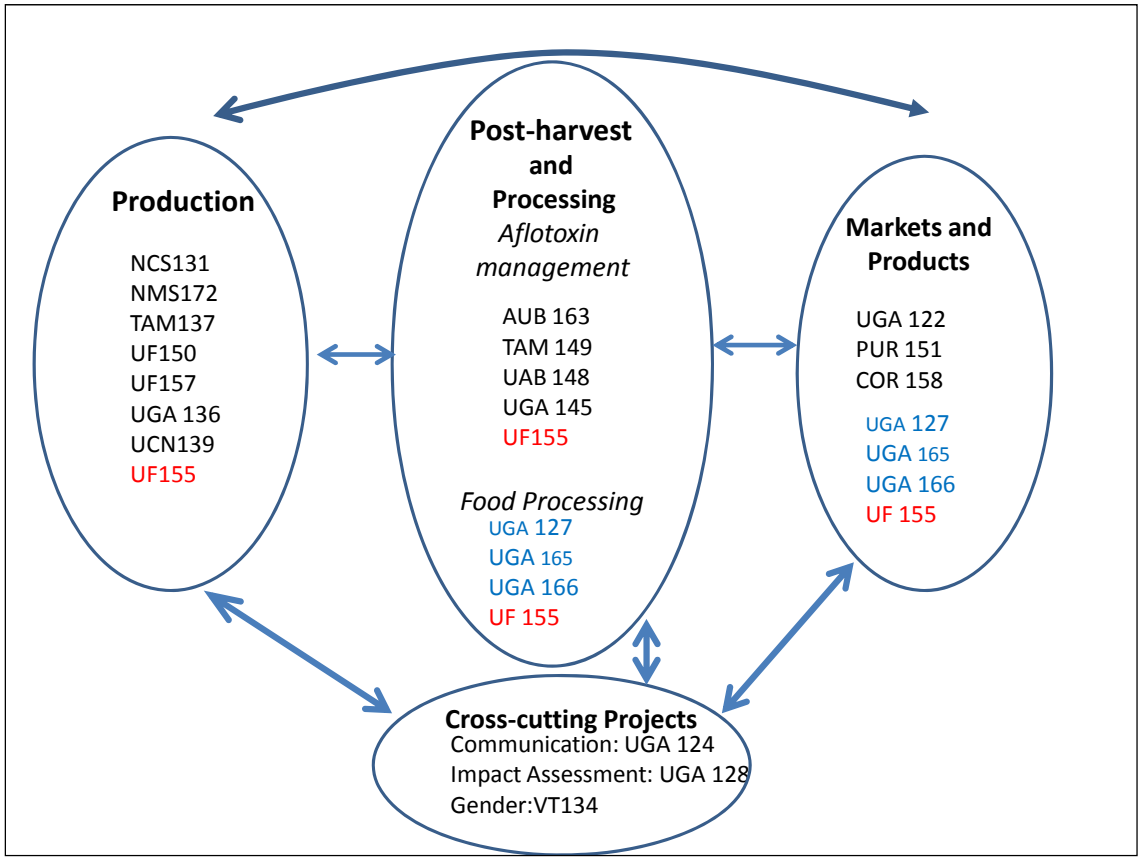


Figure 4. Value chain relationships between the PCRSP Projects

Appendix 3. PCRSP Value Chain Paradigm provided by the ME

- UGA128 is assessing impact is doing measurements in all areas
- UGA124 is working creating an information system
- Some projects are in more than one area in the value chain
- Project cluster (inter-project collaboration)
    - Example: NMS172 + UGA136 + UCN139 *East Africa Production*
    - Example: UF157 + TAM137 + NCS131 *West Africa Production*
    - Example: AUB163 + UAB148 + TAM149 + UGA145 *Global Aflatoxin*
    - Example: UGA165 + UGA166 + UGA127 *Processing/Market Development*

Production	Processing/Markets	Consumers
• NCS131	• UF155	• UF155
• NMS172	• UGA122	• UGA122
• TAM137	• UGA127	• UGA165
• UF150	• UGA165	• VT134
• UF155	• UGA166	• UGA145
• UF157	• VT134	• UCN139
• UGA136	• COR158	• UAB148
• UCN139		• TAM149
• VT134		• COR158
		• AUB163
		• PUR151

*Note: Red text denotes multi-sector projects

Appendix 4. FtF alignment document provided by the PCRSP ME

The following information is directly reprinted from "technical and Programmatic Alignment with FtF.docx" provided by the ME.

Technical and Programmatic Alignment with FtF

The Peanut CRSP responses strongly to the FtF goals:

1. Inclusive Agricultural Growth. The program is achieving inclusive Agricultural Sector Growth, particularly in the 'deep dive' countries of Ghana and Uganda. Other FtF countries where activities are located include Haiti, Senegal and Kenya. In these location women are receiving attention and benefiting through the programs efforts to improve production, marketing and nutritional status.

In Uganda rapid agricultural progress is happening as the release of improved varieties with resistance to the important disease (Groundnut Rosette Virus) finds willing partners in NGOs who extend these varieties. Independent impact analysis shows that these varieties add between $150- 250/ ha to farmers incomes, and surveys indicate that adoption has reached about 60%, providing a return of about $40 million to the PCRSP investment of $120,000 annually (the cost of other contributions to achieve this impact is not known).

IN Ghana the scaling up of technologies that provide farmers with 2-3 fold yield increases developed in the earlier phase have been slow to happen because of the difficulties associated with money transfers and the

Associated with this FtF objective are the important advances in knowledge about the connections of aflatoxin and fumonisin that are helping to shape the agricultural research programs of many African nations under the CAADP initiative. By demonstrating the importance of aflatoxin to public health the research and outreach by the PCRSP contributed to that development.

2. Improved Nutrition. PCRSP has both direct and indirect contributions to the nutrition goals of FtF and sees these contributions also increasing to the efforts to expand market demand for peanuts through documenting and promoting the nutritional value of safe peanuts. Just as important are the efforts that are demonstrating the consequences of neglecting aflatoxin as a contaminant in the diet of developing country people. Specific projects have worked to improve the safety of ready to use therapeutic foods (RUTFs) are work to produce more affordable products for improved nutrition of special interest groups (pregnant women, people living with HIV/AIDS, school children). In the development arena the program has taken to scale the use of peanut butter in school feeding, this has been achieved through the development of women's cooperatives that buy, process and market to the Min. of Education the school snacks.

The program has a major relevance to child nutrition because of the focus on aflatoxin, which has anti-nutritional significance, particularly for children. At this point the program has contributed to the knowledge that aflatoxin is important to vitamin, mineral and protein nutrition. Data from the PCRSP has demonstrated association of maternal exposure to aflatoxin with anemia and adverse pregnancy outcome.

The research on adsorption to recover the safety and nutritional value of contaminated commodities is progressing well in Ghana with human clinical trials proving that the approach is as effective in humans as it is in animals; trials have proven that the additive is safe and effective for adults.

On a world scale the intervention of using food additives to bind aflatoxin in animal feeds is increasing animal source proteins, this being an impact of earlier phases of the PCRSP.

Although not a goal of PCRSP the discovery that Novasil is a binding agent for fumonisin could also have significant implications to childhood nutrition in maize dominated diets since this maize-based toxin is now also implicated in the poor growth and nutritional status of children in Africa.

3. Private Sector Engagement. Peanut CRSP has significant private sector engagement, particularly through the collaborations established to extend technologies. Peanut CRSP has partnered well with NGO's that multiply and distribute seed, provide mechanization and educate consumers of PCRSP technologies. For example the PCRSP has partnered with CTI and the Fully-belly Project (FBP). CTI manufactures peanut butter grinders, while FBP has build its operation about the provision of a peanut sheller that was designed jointly with the Peanut CRSP. Coordinated activities have occurred in Guyana, Haiti, Ghana, and Uganda.

The deployment of the Peanut Industry Incubator in Africa was delayed in this program but it has already started to greatly increase the linkage of the HC scientists and their institutions to local private sector players in the peanut sector.

4. Research and Capacity Building. Over the past 4 years PCRSP has been effective in developing research and capacity for the participating institutions with benefits also apparent in increasing the capacity and interest of US students to engage in development work.

Institutional

PCRSP projects supported institutional capacity by either providing equipment (U Ghana and Makerere) and transportation (***Serere*** Agricultural and Animal Research Institute (SAARI)in Uganda;, Crop Research Institute in Kumasi and Savanna Research Institute at Tamale , Ghana) and/or by renovating laboratories and glasshouses (SAARI, U Ouagadougou, FDA(Guyana). In Haiti the first capacity to analyze aflatoxin was established in a factory laboratory in Cap Haitien, Haiti. An advanced HPLC unit for aflatoxin and fumonisin biomarkers was provided to, and in stalled at U Ghana (Noguchi Memorial Institute) and a research level FTIR unit was purchased for Makerere University to develop a new method of analyzing for aflatoxin without reagents in foods and feed.

Human

Over the period of this program 86 advanced degree training units have been achieved with CRSP support. This was either fully or partially supported by the CRSP and is describe in depth under the student training analysis.

5. Gender Integration. Peanut is a highly gender significant crop and the importance of peanuts to the empowerment of women in Africa and in many other locations is unquestionable. In Africa many of the producers are women. Commonly they are also engaged in value adding activities and the program works to exploit this to where opportunity presents. All programs do have an expectation of gender responsiveness, and the peanut CRSP has a very favorable gender ration in capacity development. To do a better job of promoting gender awareness Peanut CRSP selected a Associate Director with training in gender and socio-economic evaluations.

Alignment with FtF Geography

The PCRSP aligns well to FtF geography; only the efforts in Bolivia, Brazil, Burkina Faso and Guyana are outside the FtF focus countries. Reasons for the location of these projects are as follows:

a. Bolivia is the center of biodiversity for peanut. This project exploits germplasm from this location for both the host country and the global benefit, with particular relevance to the Caribbean.

b. The project in Brazil has global nutritional relevance and accesses a cooperating partner with skills that this type of research demands. The HC expertize in this case is not know to exist in FtF countries.

c. The Burkina Faso project is located there for the region, being also anchored in Senegal (a FtF country)

d. The Guyana location also involves Haiti.

Summary on alignment with FtF

Significant contributions to the goals of FtF are happening as a result of the programs projects to improve production through breeding, systems research and the emerging programs that are focused on developing the value chain, and addressing

We find that the Peanut CRSP aligns well with the expressed development objectives of the U.S. and USAID Feed the Future (FtF) program initiative. The results being gleaned from the Peanut CRSP projects provide contributions to the realization of the short-term FtF program initiative goals. Support for outreach activities and future plans that address ending hunger and improving health among underfed/malnourished populations is well justified. The outcomes being obtained or likely to result from the Peanut CRSP include developing and extending technologies to small and large farmers, commodity handlers, food manufacturers and marketers to process and market quality, safe, and nutritious foods responding to consumer preferences. Policy recommendations relating to the problem of aflatoxicosis have been realized, BUT much still has to be achieved to fully capture the benefits of

these investments. In this area a disruption of the program would be particularly harmful to momentum that has been established.

Appendix 5. Host Country Collaborator Survey Responses (click to enter response file)

AXIO SURVEY

SURVEY REPORT

Summary

Survey Name:
Peanut CRSP Collaboration

Offering Name:
Initial offering

Offering Date:
1/27/12 to 2/3/12

Statistics
Started: **17** out of **54**
Opted out before starting: **1**
Completed: **13**
Drop outs after starting: **4**

Drop outs by page number:

- Page 1: **2**
- Page 2: **0**
- Page 3: **0**
- Page 4: **1**
- Page 5: **3**

Average completion times:

- Average Time To Complete Survey: **4 hours 33 minutes 7 seconds.**
- Average Time Spent Before Quitting: **7 minutes 29 seconds.**

Page 1

Question 1

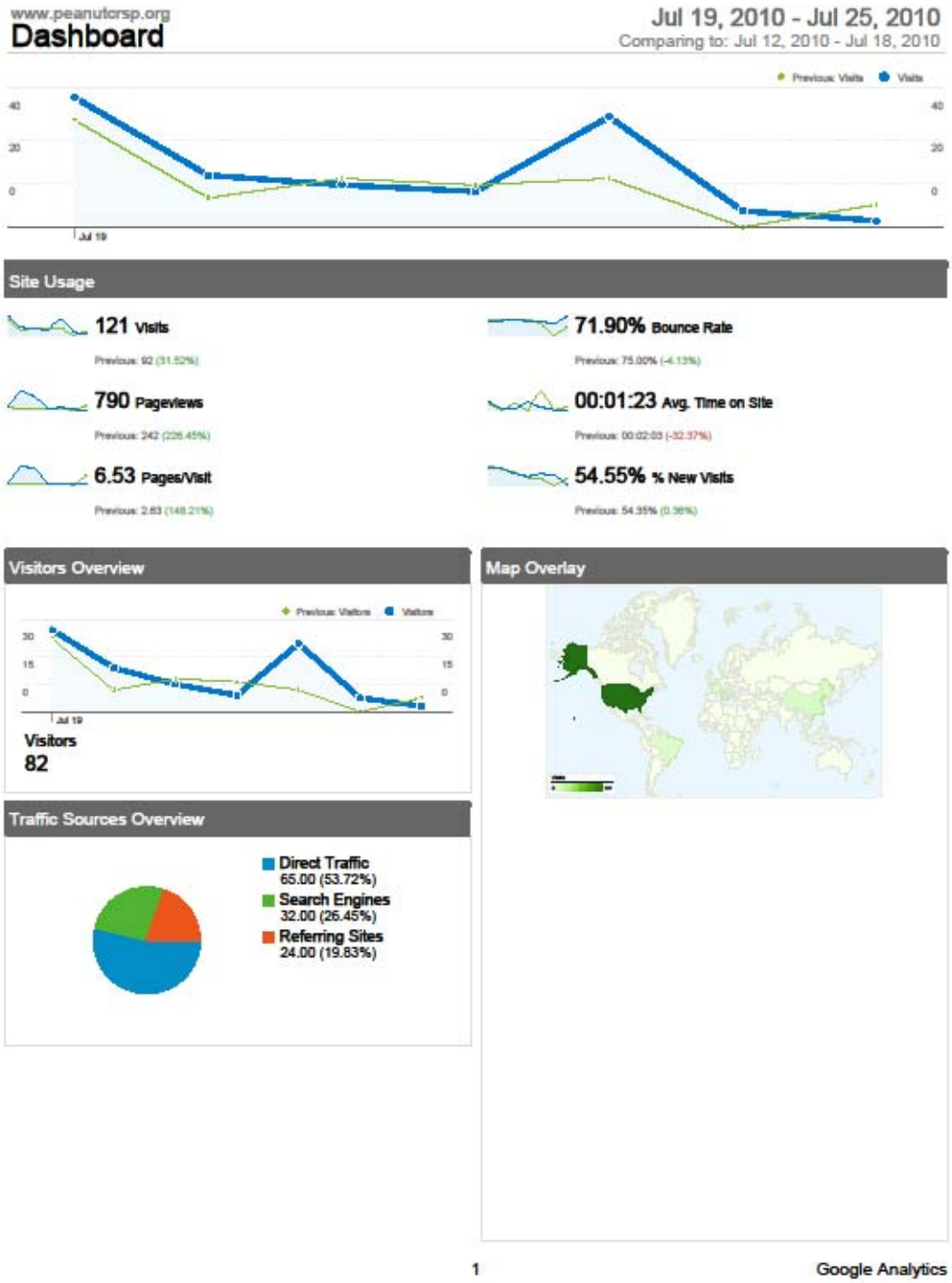
Have you engaged in a collaborative research/development activity with a Peanut CRSP collaborator during the current phase of the project (between 2007 to the present)? If no, you will directed to the closing page of the survey.

Yes	17 (100%)
No	0 (0%)
N/R	0 (0%)

Page 2

Question 2

Appendix 6. Four PCRSP Website Usage Reports (click to enter the first three files)



www.peanutcrsp.org
Dashboard

Jul 19, 2010 - Jul 25, 2010
Comparing to: Jul 12, 2010 - Jul 18, 2010

Previous Visits Visits

40
20
0
Jul 19

Site Usage

121 Visits
Previous: 92 (31.52%)

71.90% Bounce Rate
Previous: 75.00% (-4.13%)

790 Pageviews
Previous: 242 (226.45%)

00:01:23 Avg. Time on Site
Previous: 00:02:03 (-32.37%)

6.53 Pages/Visit
Previous: 2.83 (148.21%)

54.55% % New Visits
Previous: 54.35% (0.39%)

Visitors Overview

Previous Visitors Visitors

30
15
0
Jul 19

Visitors
82

Map Overlay

Traffic Sources Overview

Direct Traffic
65.00 (53.72%)
Search Engines
32.00 (26.45%)
Referring Sites
24.00 (19.83%)

1

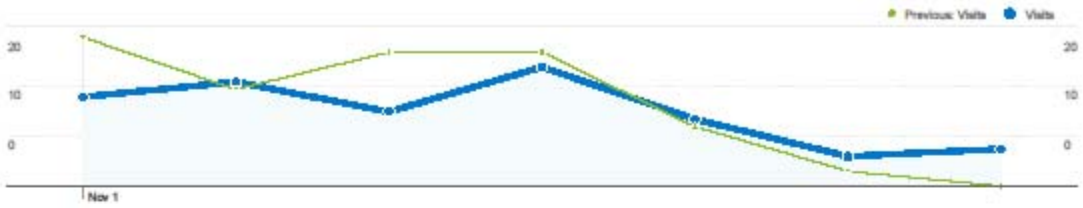
Google Analytics

www.peanutcrsp.org

Dashboard

Nov 1, 2010 - Nov 7, 2010

Comparing to: Oct 25, 2010 - Oct 31, 2010



Site Usage

70 Visits

Previous: 79 (-11.39%)

82.86% Bounce Rate

Previous: 73.42% (12.86%)

94 Pageviews

Previous: 123 (-23.58%)

00:01:40 Avg. Time on Site

Previous: 00:01:39 (0.85%)

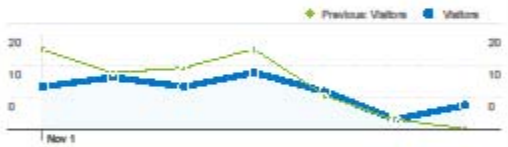
1.34 Pages/Visit

Previous: 1.56 (-13.75%)

45.71% % New Visits

Previous: 48.10% (-4.96%)

Visitors Overview



Visitors
50

Map Overlay

Traffic Sources Overview

Direct Traffic
43.00 (61.43%)

Search Engines
18.00 (25.71%)

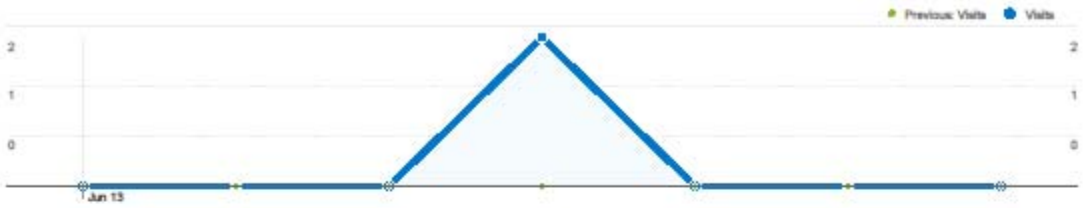
Referring Sites
9.00 (12.86%)

www.peanutcrsp.org

Dashboard

Jun 13, 2011 - Jun 19, 2011

Comparing to: Jun 6, 2011 - Jun 12, 2011



Site Usage

2 Visits
Previous: 0 (0.00%)

50.00% Bounce Rate
Previous: 0.00% (0.00%)

4 Pageviews
Previous: 0 (0.00%)

00:00:01 Avg. Time on Site
Previous: 00:00:00 (0.00%)

2.00 Pages/Visit
Previous: 0.00 (0.00%)

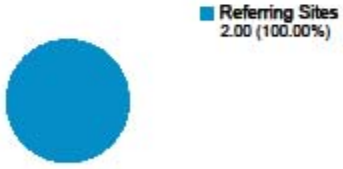
0.00% % New Visits
Previous: 0.00% (0.00%)

Visitors Overview

Visitors
2

Map Overlay

Traffic Sources Overview



Content Overview

Pages	Pageviews	% Pageviews
/		
Jun 13, 2011 - Jun 19, 2011	4	100.00%
Jun 6, 2011 - Jun 12, 2011	0	0.00%
% Change	100.00%	100.00%

This recent view is from a screen shot provided by the ME. It indicates considerable more traffic.