Research Proposal: Haiti Peanut Value Chain Interventions

Description

Production to Consumption – Technologies to Improve Peanut Production, Processing, and Utilization in Haiti

Project Investigator

Greg MacDonald
Professor and Weed Scientist/Agronomist
Agronomy Department
P.O. Box 110500
3015 McCarty Hall
University of Florida
Gainesville, FL 32611-0500
Phone: 352-294-1584
Fax: 352-392-1840
Email: pineacre@ufl.edu

Co-Project Investigator(s)

Timothy Brenneman
Professor
Department of Plant Pathology
Plant Science Building
2360 Rainwater Rd.
University of Georgia
Tifton Campus
Tifton, GA 31794
Phone: 229-386-3121
Email: arachis@uga.edu

Robert Kemerait
Professor
Plant Pathology
Department of Plant Pathology
Horticulture Building
2360 Rainwater Rd.
University of Georgia
Tifton Campus
Tifton, GA 31794
Phone: 229-386-3355
Email: kemerait@uga.edu

Genti Kostandini
Assistant Professor
Department of Agricultural and Applied Economics
The University of Georgia
Griffin Campus
1109 Experiment St.
Griffin, GA 30223
Phone: 770-228-7231 x 121
Email: gentik@uga.edu

Dan Brown
Associate Professor and International Professor of Animal Science
320 Morrison Hall
Cornell University
Ithaca, NY 14850
Phone: 607-255-4407
Email: dlb20@cornell.edu

Partner Scientist(s) and In-Country Collaborator(s)

Barry Tillman
Associate Professor
Peanut Breeding
North Florida Research & Education Center
University of Florida
3925 Highway 71
Marianna, FL 32446-7906
Phone: 850-394-9124
Fax: 850-482-9917
Email: btillman@ufl.edu

Noelle Barkley
Geneticist and Peanut Curator
USDA-ARS
1109 Experiment St.
Griffin, GA
Phone: 770-412-4035
Email: Elle.Barkley@ars.usda.gov

David Jordan
Professor and Extension Specialist
North Carolina State University
Box 7620
4207 Williams Hall

Raleigh, NC 27695
Phone: 919-515-4068
Fax: 919-515-7799
Email: david_jordan@ncsu.edu

Rick Brandenburg
Professor and Extension Specialist
North Carolina State University
Box 7613
Raleigh, NC 27695
Phone: 919-515-8876
Fax: 919-515-7799
Email: rick_brandenburg@ncsu.edu

Rajapopalbabu Srinivasan
Assistant Professor
Department of Entomology
2360 Rainwater Road
Tifton, GA 31794-5766
Phone: 229-386-3199
Fax: 229-386-3086
Email: babusri@uga.edu

Patricia Wolff
Executive Director
Meds & Food for Kids
4488 Forest Park, Ste. 230
St. Louis, MO 63108
Phone: 314-420 1634
Email: pwolff@mfkhaiti.org

Francois B. Laroche
Executive Officer
Creole Incorporated
3708 Cypress Lake Drive
Lake Worth, FL 33467
Phone: 561-310-9102
Email: francoisbrave@yahoo.com

Robert Johnson
Executive Officer
TechnoServe/Partners in Health
Port-au-Prince, Haiti

Jamie Rhoads
Technical Advisor
Meds & Food for Kids
Cap Haitien, Haiti
Phone: 509 3 640-6675
Email: jrhoads@mfkhaiti.org

Frank Nolin
Design Engineer
Frank's Designs for Peanuts, LLC
P.O. Box 13902
Mexico Beach, FL 32410
Phone: 229-567-7348
Email: f_nolin@live.com

Geographical Locations

Haiti

Project Duration

September 1, 2013 – August 31, 2017

Executive Summary

Haiti is among the world's poorest nations, with significant severe and chronic malnutrition and rampant poverty. Peanuts have been and continue to be an important part of Haitian diet and culture. In addition, peanuts provide an important source of cash income. To combat malnutrition in the country, certain NGO's have developed facilities to produce peanut-based 'Ready-to-Use Therapeutic Foods – RUTF's'. To date, however, there has been limited utilization of locally grown peanut due to issues with productivity, quality and aflatoxin contamination. In 2007, Peanut CRSP (under project UFL 155) worked with Meds & Food for Kids (NGO based in Cap Haitien) to help improve peanut production. Our project quickly realized peanut production in Haiti could immediately benefit from a wider choice of technologies, which were just recently becoming available through the work of the Peanut CRSP and their Haitian partners. While our project provided some initial gains, peanut diseases such as rust, variety performance as it relates to yield and quality, harvest efficiency, storage, aflatoxin and marketing remain as critical factors limiting productivity and utilization of peanut in Haiti. Aflatoxin contamination remains a barrier to export markets and a threat to the health of local consumers and producers and diverting contaminated peanuts to non-food uses is critical to the health of local populations who might otherwise eat rejected peanuts. Assessments of how value-added markets have influenced the local and regional economy, especially as it relates to women, have not

been thoroughly studied.

We propose to develop a comprehensive production, processing and utilization strategy for peanuts in Haiti. We will begin with establishing a research farm with a local landowner, providing infrastructure improvements to modernize production facilities. Demonstration will be a key component of the farm, and the development of a cooperative is one of the major goals of the landowner. All phases of peanut production will be evaluated, including varieties specific to the region and market influences. We will institute a seed-increase program and develop facilities to maintain genetic resources through a curation of important peanut germplasm. Capacity building through the introduction of labor saving devices and harvesting equipment and procedures will be accomplished, along with infrastructure to improve peanut handling, drying and long-term storage. Once these improvements have been evaluated, we will take these best management practices and strategies to the grower level at several villages/communities in the region. We will provide training and infrastructure support to realize these improvements and ensure long-term capacity building. Aflatoxin and the role of women in the peanut value chain will be measure/surveyed throughout the duration and in all phases of the project. We will re-establish aflatoxin testing facilities and re-train Haitians in how to measure and the importance of avoiding aflatoxin in their diet. Another important capacity building measure will be the creation of alternative products/markets for high aflatoxin contaminated peanuts.

Project Description

Goal

The overall goal of this project is to address and mitigate key constraints to peanut production and utilization in Haiti. Within this goal, technological, social and economic barriers will be investigated, documented and ameliorated, if possible and deemed necessary, to fulfill the overall project objectives.

Relevance and Justification

Haiti continues to be one of the world's poorest nations, with widespread poverty and malnutrition. Local agricultural production remains as a key component of many Haitian livelihoods, where it provides income and sustenance for many families. However, access to technical support, infrastructure such as modern technologies, and markets remains limited, despite a wealth of foreign aid to this struggling nation.

Peanuts continue to be one of the most widely cultivated crops throughout many areas in Haiti, especially in the north and central plateau regions.

Production is small scale, with most land-holdings <0.5 hectares. Nearly all production is accomplished using hand-labor for tillage, planting, weed control and harvesting which limits productivity and results in reduced yields, quality and aflatoxin contamination due to labor constraints at key points. Moreover, knowledge of improved production practices is limited, with little to no formal training. As such, yields are extremely poor (< 1000 kg/ha) and quality concerns are not addressed nor regulated, especially with respect to aflatoxin. Several key aspects to production are not known, including varieties utilized, growing season as a function of region, rainfall patterns and irrigation potential, disease assessment and impacts, soil fertility and testing, planting patterns, harvest procedures (maturity evaluations) and overall plant growth and development. While recent surveys indicate other crops grown by peanut farmers include cassava, rice, sugar cane, corn, black beans and banana, little is known about how these crops are utilized in a rotational cropping system. In addition, little is known about the role of peanut by-products as feedstuff for livestock production.

The introduction of in-country 'Ready- to- Use Therapeutic and Supplementary Foods' (RUTF and RUSF's) factories, has been widely accepted and provides an ideal market for peanuts. However, these facilities require high quality, low aflatoxin peanuts at competitive prices, which has been difficult for local growers to achieve. The projected demand for the two existing facilities is estimated to be >300 MT/year of farmer stock with a strong potential for growth, but this volume of high quality peanuts is not available for purchase at any price. The local market demand for peanuts and peanut products greatly exceeds the supply, even at existing market prices. The estimated average price of farmer stock peanuts is $1.50/kg ($1363/US ton) and with average yields between 500-800kg/ha, the potential for profitable increases in yields is exceptional.

There continues to be major problems with manufacturing and marketing of high quality peanut products, centered on aflatoxin contamination. While visual sorting provides a suitable technique for reducing high aflatoxin, a grave concern is the fate of these sorted, high aflatoxin level peanuts. Often times these bad peanuts return to the human consumption supply, partly due to the inability to garner profit from rejected peanuts. Alternatives to utilize these peanuts in a profitable manner while minimizing human and animal health risks are greatly needed.

Research Plan

Our project seeks to build upon our existing work in Haiti and develop a comprehensive production and utilization strategy for peanuts in Haiti. We

envision strong linkages with the breeding and mycotoxin projects, as well as an economic and social (gender) evaluation throughout the project timeframe. Our value-added project in Guyana was originally based upon improving production through technology transfer, but quickly transitioned to include post-harvest storage, sanitation, business management, food quality, food processing, and aflatoxin detection/mitigation/management. We propose to use the model adapted and currently functioning in Guyana to develop a strategy for Haiti. With this in mind, we have the following objectives:

Objectives

1. Assess and quantify limitations to peanut production and utilization in the north and central growing regions of Haiti that could provide peanuts to existing Ready-to-Use Food facilities and both large and small peanut processing enterprises in Haiti. This assessment will provide the framework for final development and implementation of production based objectives and also establishes baseline data for the socio-economic and aflatoxin analysis. We will utilize preliminary data gathered by Schwartzbord and Brown (2012) as a baseline to initiate research studies and outreach programs and modify as data becomes available. We will also utilize current and relevant assessment data from local NGO's on peanut production.

   Initially we will document the intra-household distribution and utilization of peanut production, technology use and post-harvest practices. This will be accomplished through a thorough review of past studies and also by conducting a survey with peanut producing households. The surveys will be implemented in at least two villages, one treatment and one control, and subjects will be randomly chosen to participate in these randomized control trials. Based on existing survey instruments and past experience in Ghana and Uganda we will survey each adult family member that is involved in peanut production/sale/processing/handling and ask a series of questions on their decision making power in each of the stage of the peanut value chain. Particular attention will be paid to access to fertilizer, seed, labor and credit.

   We will also document the impact of the Ready-to-Use Food facilities on producers and consumers. Similarly, subjects will be selected randomly in the treatment and control village/s and the impacts of RUFT on producers and consumers will be examined through two surveys capturing pre and post interventions. Interventions will be designed on the households interviewed in one of the villages, and a second round survey will capture the effects of the interventions on the treated by comparing them to controls. We will also interview the non- participants in the treatment villages and compare them with the control group to

assess the impact of any potential spillover effects. Attempts will be made to keep the interventions separated in different treatment villages in order to be able to capture the independent effects of each, as this is a major determinant of the success of the analysis.

2. We will address issues surrounding variety utilization across the region and evaluate potential variability from farm to farm or within farmer planted peanuts, what market types are being used, and whether farmers are buying seed or saving seed. Seed will be collected from around the region and grown at Creole, Inc. facilities using standard U.S. production practices. Once evaluated, we will develop procedures to establish variety purity (uniformity), establish a central foundation for seed, and work with the breeding PMIL (Drs. Tillman and Barkley) to assist in instituting procedures and infrastructure for curating germplasm to be used in future breeding efforts. Initially the focus of the collection could be disease resistance, drought tolerance and aflatoxin reduction. In conjunction with this effort, we will evaluate introduced/improved peanut varieties for use in Haiti. Yield, quality (including aflatoxin) and disease resistance will be the primary parameters measured and evaluated.

3. As a continuation of our earlier work in Haiti (Peanut CRSP # UFL 155) we will revisit traditional practices to provide a platform for establishing research and extension activities for optimum peanut production. Such practices could include row spacing, seed spacing, fertility, rotation and pest management (weed, insect and disease control). From this information we will conduct field trials to evaluate production practices and variety performance (in conjunction with objective 1). Main research trials will be conducted at the Laroche farm in conjunction with Creole, Inc. Inputs will include fertilizer, herbicides, insecticides and fungicides, as well as improved varieties that provide increased disease resistance and yield. Once a best management plan(s) has been developed we will conduct smaller, more demonstration-oriented trials at various villages and communities. As a result, growers will be exposed and trained in the best management practices that include appropriate inputs to maximize yield and quality. We will prepare and distribute a peanut production guide for the various regions in Haiti, translated into Creole for local growers. In addition, we will train local growers/agronomists in proper evaluation of production practices and link the production guide and training to produce training modules.

   **Potential adverse consequences of chemical inputs (fertilizers,

pesticides) on the natural environment will be considered prior to use. The Management Entity will review the proposed plan for approval by USAID and pesticides will not be procured or used until USAID approval has been granted. When pesticides are used a stewardship program related to human health and environmental protection will be discussed and implemented at the grower level.

4. We will conduct research on harvest maturity of local and introduced varieties. This aspect of peanut production is often overlooked, but remains as a critical component to maximizing yield and maintaining quality, including low aflatoxin. Harvest maturity evaluations will be conducted on the Laroche farm to establish approximate days to maturity using the hull scrape method. Subsequent harvest clinics will be held in conjunction with field trials. Growers will be extensively trained in harvest techniques, including proper maturity determination, digging, threshing, and drying to proper moisture.

5. We will introduce, evaluate and demonstrate labor saving devices at the farm field production level. These could include, but not limited to, tillage equipment, planters, irrigation equipment (pumps, piping, etc.), hand-held pesticide application equipment (sprayers), and peanut harvesting machinery. We will evaluate existing techniques and equipment and work with Frank's Designs for Peanuts to develop these devices. We will also collaborate with local fabricators to provide training in manufacture (if possible) and maintenance.

6. Assess current techniques for peanut handling (including harvesting in conjunction with objective 4), drying and both short and long-term storage. Short term storage would be at the local farm level prior to transport to market, while long-term storage would be more community based. Proper drying and maintaining peanuts at the proper humidity during long- term storage will be a priority to reduce insect infestation and aflatoxin contamination. We will work with Frank's Designs for Peanuts to develop facilities that provide increased storage capacity and longevity while maintaining quality. This type of facility will also be utilized in the storage of peanuts for seed, as outlined in objective 1. We will also provide a tech-pack that details aspects of post-harvest handling and storage of peanuts, addressing factors that affect quality and marketability.

7. Monitor and develop strategies to detect, mitigate and manage aflatoxin through the production, storage and processing chain for peanuts as a function of variety, region, and final product utilization. This objective will be imbedded within the first 5 objectives, whereby aflatoxin levels will be measured in peanuts from traditional/current techniques and compared to levels in peanuts from improved techniques. For example, we will measure aflatoxin in peanuts harvested from the field by local growers without input from the PMIL team and compare aflatoxin to peanuts harvested at the proper maturity and growth under best management practices developed by PMIL research. By comparing levels as the peanuts move from the field through harvesting, drying and throughout storage, we can determine where aflatoxin contamination is most likely. Through this approach, we can best implement mitigation and management strategies. Aflatoxin awareness posters and demonstrations will be distributed and delivered at key areas of production and marketing.

   Aflatoxin detection will be accomplished through various techniques and will utilize facilities established during the previous CRSP project (Brown – COR-158). An aflatoxin testing lab was established at the RUTF facilities operated by Meds and Foods for Kids in Cap Haitien, and has the capability to detect aflatoxin in raw peanuts, peanut butter and other food crops. In addition to the facilities in Cap Haitien, we work with the Agricultural Ministry laboratory for food and feed safety to re-establish a testing lab in Port-au-Prince. This will include educating staff in sampling and analytical techniques and getting their equipment upgraded and functional. A tech-pack that details procedures for aflatoxin testing and detection will be developed for each testing facility.

8. Develop methods to utilize aflatoxin contaminated peanuts to ensure these harmful peanuts are not re-introduced into the food supply. Initially we will conduct a small survey to better assess the knowledge, needs and problems that Haitians face with respect to peanut sorting (this could be in conjunction with survey work in objective 1). Previous work by Brown (COR-158) demonstrated a good ability to visually sort high aflatoxin peanuts, but in many cases these peanuts are used for food. For example, some farmers sort peanuts prior to sale, and retain the 'bad' peanuts for family consumption. To mitigate this harmful practice, we propose to create safe animal feeds based on locally processed and tested rejects and refine earlier work on manufacturing fuel patties. We will design materials to educate and train local Haitians in sorting and manufacturing techniques and envision a creation of model enterprises in which groups of Haitians convert rejects into proven products and sell them in local markets for profit. Our goal is to

create an aflatoxin dependent market chain whereby peanuts are bought and sold as three products: certified low-aflatoxin peanuts, fuel cakes and livestock feed. Within this objective we will also monitor aflatoxin levels in food and feedstuffs at the same location as alternative products are produced.

Throughout each objective, specific training modules will be developed for in-country personnel, and training meetings for local growers will be held routinely throughout the project. Experience has taught us that it is imperative to include agricultural specialists from within the country in the programming and to also further develop aptitude through carefully planned training. We will also provide technical expertise and support through other organizations and efforts in Haiti. Such linkages through our in-country partners that are likely with our project include "Farmer Field School" FAO project in the Northeast region and a large Feed the Future "strategic value chain" project through DAI in Northern Haiti. Both groups have expressed interest in our involvement through our Peanut PMIL project.

Role of Each Scientist/Partner

Greg MacDonald

will coordinate the project between The University of Georgia, Cornell University and Meds and Foods for Kids in Haiti. He will also provide linkages between other potential NGO partners in Haiti, such as Partners in Health, Techno-Serve, FAO and DAI. Greg MacDonald will assist in the production-based objectives and work with Drs. Tillman and Barkley of the breeding/Germplasm project to introduce varieties and develop a seed production procedure and germplasm bank within Haiti. He will also be responsible for all reporting and publication outputs, including training manuals, presentations and other print/electronic media.

Tim Brenneman and Robert Kemerait

will provide assistance in production aspects and evaluation of peanut varieties for agronomic characteristics and disease resistance. They will also provide leadership in training activities with local farmers and in-country agronomists. Robert Kemerait will serve as major advisor for a production-based graduate student, Abraham Fullmer. Mr. Fullmer will be conducting a portion of his PhD dissertation research in Haiti.

Genti Kostandini

will provide leadership in the development, implementation and analysis of surveys to be taken as outlined in the objectives. He will also serve as the lead Co-PI for the University of Georgia subcontract. He will work with local

officials, graduates students and MFK personnel to conduct surveys. He will also supervise a graduate student whose PhD dissertation work will be largely based on research in Haiti.

Dan Brown
will provide leadership in all aspects of aflatoxin detection, training, and development of mitigation strategies. He will also work with local ministries and RTUF facilities to develop and/or re-establish aflatoxin testing programs in Cap Haitien and Port-au-Prince. In addition, he will direct programs to utilize high aflatoxin peanuts as outlined in objective 8. Dr. Brown will also supervise a graduate student, Jeremy Schwartzbord, who will continue his PhD research in Haiti, as a continuation of his work under a previous CRSP project (COR-158).

Barry Tillman and Noelle Barkley
in conjunction with the breeding/germplasm PMIL project, will provide germplasm and technical expertise in seed production. They will work with local officials and the overall project team to help develop varieties suitable for Haiti conditions that provide increased yield, quality, and disease resistance. Dr. Barkley will also help develop a curation procedure and facility for maintaining germplasm for future in-country variety development.

David Jordan, Rick Brandenburg and Rajapopalbabu Srinivasan
will provide technical expertise in agronomic production, pest management and post-harvest handling and storage. As PI's of the value-chain projects in Ghana and the southeast Africa, respectively, Drs. Jordan and Brandenburg will provide valuable programmatic linkages with our project in Haiti.

Frank Nolin
of Frank's Designs for Peanuts will provide support in equipment development and fabrication for peanut production, storage and processing. He will also provide technical expertise in the equipment operation of the RUTF facilities and also provide training to local persons in the use, repair, and manufacture of equipment developed.

Patricia Wolfe
will serve as the lead contact and financial officer for our in-country partner, Meds & Food for Kids (MFK). This organization will serve as the subcontracting agency for Haiti but work with other organizations involved in peanut production and utilization in the country.

Jamie Rhoads
will serve as a technical advisor for MFK and other in-country organizations. He will also work as a liaison between local growers, co-operatives and villages

to facilitate training and on-farm research. Robert Johnson of Techno-Serve will also provide leadership in this role.

Francois Laroche

will help coordinate field research facilities at Creole Incorporated. This will be used for the development of an in-country research and demonstration facility that will also be used for trainings, field days, etc.

Annual Work Plan, Milestones and Timeline:

General Project Outline for Haiti PMIL Team

September 2013 – March 2014

Identify and survey villages in northern and central plateau regions of Haiti relative to production, drying and storage, and processing practices. Collect local germplasm and secure germplasm seed from breeding/germplasm PMIL project. Bring aflatoxin testing facilities up to working capacity; begin training of local individuals on proper procedures for testing.

December 2013 – April 2014

Assess production and processing survey data from villages to determine appropriate interventions in time for the planting season in spring of 2014. Continue household surveys to establish baseline data in several villages. Establish field trials at Laroche farm, and begin comparisons to traditional/local planting practices. Assist graduate students in developing research plans. If available, begin seed increase of previously evaluated favorable cultivars.

March 2014 - September 2014

Conduct cultivar evaluations and production-based research objectives, integrating labor devices if possible as outlined in objective 4. Establish rapport with villages and begin training seminars on all aspects the peanut value chain where appropriate. During the growing season (75 to 100 days after planting), hold at least one field day at Laroche farm to demonstrate research studies to local officials, stakeholders and farmers.

September 2014 - December 2014

Harvest maturity, drying and storage objectives will be conducted as the peanut season ends. Training in this aspect will be simultaneous during the entire harvesting process. Analyze and interpret data from field experiments.

Aflatoxin assessment will begin at this time and continue throughout the timeframe of the project.

December 2014 - February 2015

Adjust procedures as needed for 2015 field research including addition of new cultivars. Begin work on utilization of high aflatoxin peanuts as outlined in objective 8.

March 2015 - September 2015

Continue field based cultivar evaluations and production-based research objectives at Laroche farm, integrating labor devices if possible as outlined in objective 4. Establish demonstration field research plots at villages, implanting best management practices gleaned from 2014 studies. Perform training seminars in conjunction with demonstration field plots at villages.

September 2015 - December 2015

Harvest maturity, drying and storage objectives will be conducted as the peanut season ends. Training in this aspect will be simultaneous during the entire harvesting process. Analyze and interpret data from field experiments. Complete first draft of production, storage, processing, and aflatoxin manuals as described in objectives.

December 2015 - February 2016

Adjust procedures if needed for 2016 research such as adding new cultivars. Continue work on aflatoxin training, testing and utilization of high-level aflatoxin peanuts. Define specific training modules for local agronomists.

March 2016 - September 2016

Continue field based cultivar evaluations and production-based research objectives at Laroche farm, integrating labor devices if possible as outlined in objective 4. Continue demonstration field research plots at villages, implanting best management practices gleaned from 2015 studies. Perform training seminars in conjunction with demonstration field plots at villages and distribute technical manuals.

September 2016 - December 2016

Harvest maturity, drying and storage objectives will be conducted as the peanut season ends. Training in this aspect will be simultaneous during the entire harvesting process. Analyze and interpret data from field experiments. Initiate follow-up surveys to determine impact and changes in all aspects of the peanut value chain as influenced by the PMIL project.

January 2017 - December 2017

Continue field based cultivar evaluations and production- based research objectives at Laroche farm, integrating labor devices if possible as outlined in objective 4. Continue demonstration field research plots at villages, implanting best management practices gleaned from 2016 studies. Perform

training seminars in conjunction with demonstration field plots at villages. Continue work on aflatoxin training, testing and utilization of high-level aflatoxin peanuts. Prepare and publish manuscripts, technical reports and other documents pertinent to the project. This will include the complete social and economic analyses.

Gender Considerations

Gender will be a primary focus of all surveys taken throughout the project timeline. All surveys will be conducted in accordance with University guidelines, with proper documentation to ensure compliance and accuracy of results. We will address those issues listed in the PMIL proposal guidelines, which include: 1) land tenure and property rights; 2) cultural norms as to the type of work men and women do; 3) access to and use of agricultural inputs or access to credit necessary to obtain these inputs; and 4) distribution of income, food and other benefits derived from peanut production and from changes in traditional practices.

We will also assess the impact of our previous efforts in Haiti (CRSP projects UFL 155 and COR 158) for both men and women. Such efforts included exposure to new techniques and technologies, limited access to improved peanut varieties and aflatoxin training and awareness. We will also determine the role of women in the 'Ready-to-Use Therapeutic Foods – RUTF's' facilities – as current and former workers, sellers (either as farmers or intermediary buyers) of raw peanuts for the facilities, or consumers.

All field-based production research will engage equal numbers of male and female farmers. Women farmers that are heads of households will be selected for at least half of the demonstration farms across the villages, and given equal access to improved varieties, improved technologies such as mechanical inputs to reduce labor or increase yield and quality. They will also have equal access to other inputs such as fertilizers and pesticides. Storage facilities manufactured as part of the project will also target women farmers or buyers of raw peanuts. We anticipate the role of women as it relates to the high-quality peanuts grown for the RUTF facilities to increase. As such, accounting, personnel management and other small business training will be conducted for women in the peanut value chain.

Aflatoxin awareness, detection, and mitigation studies will preferentially target women. Women are often the end users of peanuts for family consumption and therefore will be the target audience for conveying the dangers and medical consequences of consuming high aflatoxin peanuts. Women will also be the target audience for training for visual detection and physical separation

of bad peanuts. During the development of aflatoxin testing labs, we will work with Haitian officials to encourage women staff and training. In objective 8 we propose to develop uses and potentially model enterprises for 'sorted-out' high-aflatoxin peanuts and women will receive equal exposure and opportunity for these ventures.

As mentioned previously, we will make every attempt to ensure equality among Haitian men and women throughout all phases and objectives of our project. We also will conduct our surveys and other measurements of project impact in a manner that allows separation of impact by gender. If we determine our impacts on women are minimal (and significantly less than their male counterparts), and can be improved during the timeframe of the project, we will make changes to improve exposure to, and impacts on, women.

Outcomes and Impacts

The following data will be recorded (separated by gender):

1. Number of farmers adopting new released cultivars. This will be in conjunction with the breeding/germplasm PMIL project and will include number of new cultivars developed and released.
2. Number of farmers utilizing seed from seed increase programs.
3. Number of farmers utilizing labor saving devices for field preparation and in-season cultivation.
4. Number of farmers adopting new production practices (agronomic techniques, use of pesticides, fertilizers, or improved spray equipment). Safety will be included in this impact assessment.
5. Number of farmers adopting new harvesting techniques and drying methods. This will include community/village evaluation of a peanut dryer.
6. Number of farmers adopting new seed storage methods than allow for increased quality and minimizing aflatoxin. This will include community/village evaluation of common storage facilities.
7. Development and impact of a research and demonstration farm in conjunction with a local landowner (Francois Laroche), and will include utilization of infrastructure improvements to the facility.
8. Development, impact and success of businesses and enterprises to utilize high aflatoxin peanuts.
9. Three to four PhD graduate students will be trained, with manuscripts generated from their and other research associated with the project.
10. A comprehensive production guide will be developed and translated in Creole, utilization and adoption of this guide will also be measured in conjunction with outcome #4 listed above.

11. Number of farmers, buyers, processors and consumers adopting specific practices to minimize aflatoxin.
12. Utilization and impact of aflatoxin testing facilities and quantitative changes in aflatoxin levels throughout the value chain of peanuts as a result of our project.