

Research Proposal: Improving livelihoods of farm households in peanut based farming systems in East Africa

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Focus

Domain - Production Values Region - E and C Africa

Background

Agriculture remains the engine of growth for most economies in the Sub-Saharan region and this is certainly the case for the countries of interest in this project. The sector's contribution to GDP is 26% for Kenya and 40% for both Uganda and Ghana. Contribution to employment in the respective countries is roughly 80% for Kenya and Uganda, and 50% for Ghana (Kilambya, 2004; McKay & Aryeetey, 2004; UHDR, 2007). In the countries of interest, agriculture is the main source of food supplies for the large non-agricultural population and a source of raw materials to agro-based industries (Muigai, 2005; Nyanteng & Seini, 2000; UHDR, 2007). Although women dominate the agricultural labor force in Africa, development agencies have

devoted limited resources to conduct research on technologies and activities that could positively impact the welfare of women farmers and their families (Lo, 2007; Kaaya, 2007)

Despite the prominent role of agriculture in Africa, poverty levels are particularly high among farmers and other rural dwellers, and resource deprivation for women remains a serious problem (IFAD, 2007). Some of the factors that lead to widespread poverty in Africa include low farm productivity, land degradation, high population growth rates, lack of employment opportunities, poor functioning markets and infrastructure, lack of information, low endowment of human capital, lack of access to development assets, high incidence of diseases particularly malaria, tuberculosis and HIV/AIDs, and inappropriate economic policies (World Bank, 1996; Mwabu & Thorbecke, 2001; Ekbom, 2002). There is also a heavy concentration of poor people in particular geographical locations within a country. For example, in Uganda the northern region has the highest poverty rate, estimated at 70%, while in Kenya the Coast and Nyanza regions have an estimated rate of 60%. In Ghana, the northern and central regions exhibit the highest poverty levels (GoK, 2000; Okurut, 2002; IFAD, 2007).

Commonly grown in semi-arid areas, peanuts/groundnuts serve as a source of both food and cash in regions of West and East Africa and are produced along with other major crops, such as maize, sorghum, yams and millet. Research studies from Kenya, Ghana and Uganda reveal that farm yields for peanuts as well as for other major crops are considerably below achievable levels. The poor performance in peanut farming is attributed to lack of improved seeds, foliar diseases (peanut rosette and leaf spot), and poor pre- and post-harvest handling techniques that result in loss of value due to aflatoxin (Okoko, et al., 1998; Naab et al., 2005; Kaaya, 2007). Another factor contributing to low yields is poor soil fertility, which is a severe problem in many African countries. Use of inorganic fertilizers is recommended for cash and major cereal crops but adoption rates have remained low over the years. The few farmers who use inorganic fertilizers apply quantities far below the recommended rates. This low level of use stems from high costs associated with inorganic fertilizers coupled with low household incomes, low liquidity and lack of credit (Oluoch-Kosura, 1999; Makhoha et al., 2001).

Technical Review

Peanut (*Arachis hypogaea* L) is a major oilseed and a crop of global importance. It is the world's fourth most important source of edible oil and third most important source of vegetable protein. Furthermore, peanut is considered a women's crop in Africa, as it was originally grown by women to supplement their families' diet with protein. Peanut is a source of high energy and protein, oil for cooking, and high quality feed for cattle. With its high quality edible oil and easily digestible protein and carbohydrates, peanut is a valuable crop for growers with small holdings. As a cash crop, it gives relatively high returns for a limited land area, and is well adapted to the hot semi-arid conditions characterizing many of the regions where it is grown.

Productivity growth in peanut production has experienced major challenges both in West and East Africa especially due to the prevalence of foliar diseases (e.g., peanut rosette) that affect peanut yields in most producing areas. Symptoms of the disease vary across regions with chlorotic rosette being more prevalent in East Africa while green rosette is more common in West Africa (Olorunju et al., 2001). In Ghana, the disease was estimated to cause 80% leaf defoliation by harvest time resulting in poor pod formation (Tsigbey et al., 2007). Another study by Wangai et al., (2001) on the distribution and molecular characteristics of the peanut rosette disease in Kenya shows that the occurrence of the disease was approximately 20% and 40% for the 1997 and 1998 crops in Western Kenya, while the frequency in the Rift Valley was 30%. In Uganda, Bonabana-Wabbi et al., (2006) noted that groundnut rosette and *Cercospora* leafspot could lead to complete crop failure. Farmers have limited access to improved seed varieties (e.g. Serenut2 in Uganda) and also lack enough operating capital to purchase chemicals. In Kenya, although farm trials have led to identification of suitable and acceptable varieties (ICGVSM 12991, 12988, 9991, and CG7), adoption remains low in South Nyanza (Okoko, et al., 1998).

Moreover, a study carried out in Uganda shows that groundnut yield under the Teso farming system is roughly 800kg/ha of dry pod which is significantly lower than the potential of 3000kg/ha achieved by ICRISAT (Obuo et al., 2004). A more recent study by Kipkoech, et al. (2007) reveals that given the existing technology and production practices, peanut producers in Western Kenya could increase output from 31% to 44% through improved managerial performance (technical efficiency). Analyzing the potential for improved performance and related policy alternatives will be an important focus of this project.

It is important to make clear that although this project will not deal directly with the technical constraints to production, an important thrust will be to collaborate with other PCRSP projects to identify key technical issues and then, in a collaborative effort, collect and analyze relevant data in order to perform pertinent economic analyses, particularly in Uganda and Kenya and to a lesser degree in Ghana. The major projects we expect to collaborate closely with are: UGA136 (Dr. M. Deon); NMS172 (Dr. N. Pupalla); VT134 (Dr. M. E. Christie); UF157 (Dr. K. Boote); and UGA124 (Dr. Hung).

Problem Statement

Kenyan farmers have extended crop production to arid and semi-arid lands (ASAL), notably Nyanza & Coast provinces, but land degradation through grazing, continuous farming and drought conditions have lowered farm yields. Peanut farming could offer significant economic improvement for smallholder farmers in the ASAL because of the potential high returns per unit area, as well as its ability to improve soil fertility. Peanut farming also offers women an alternative source of income, thereby increasing their agency and empowerment.

The Kenyan Ministry of Agriculture research and extension activities have not adequately addressed the economics of peanut farming in the ASAL. The limited empirical evidence available shows that farmers achieve about 60% of their potential output compared to 77% for all studies reported. This suggests potential to improve farm performance and profitability using only existing technology.

Challenges facing the Kenya peanut industry include; incorporating better farming practices to conserve soil fertility, promoting technologies to increase yields, value addition and market expansion to improve quality and raise peanut output, and greater participation by women in agricultural programs.

The global importance of peanuts requires development of varieties with high nutritional and agronomic qualities. By undertaking the proposed project, the UConn and Kenyan partners will generate and disseminate knowledge that can improve the economics of peanut farmers in Kenya and neighboring countries.

Vision and Approach

Goals

The overall purpose of the UConn-PCRSP effort is to improve understanding of the farm level economics of peanut production and marketing in Uganda and Kenya, and to a lesser degree in Ghana. We will focus on the analysis of the socio-economic benefits of peanut farming, on strengthening human capital resources and on disseminating relevant information to key stakeholders in selected peanut producing regions in each of the three countries mentioned.

The major goals of the UConn PCRSP effort are:

1. Develop quality farm level data sets that would be available in a web site for agronomic and socioeconomic analysis of peanut production
2. Increase understanding of the connection between rural household income and alternative farming systems that incorporate sustainable practices for peanut production and value addition
3. Examine opportunities for women to participate actively in the household's economy through peanut production and marketing
4. Formulate policy recommendations to increase production efficiency and facilitate the adoption of environmentally sound technologies in peanut farming in the selected regions
5. Increase soil fertility and land productivity through proper management of peanut crop residues
6. Increase access to information on pre- and post-harvest handling techniques to improve peanut quality so as to enhance the value of peanuts to producers, processors and consumers
7. Improve individual and institutional capabilities to sustain development of the peanut value chain

8. Develop a sustainable linkage among the researchers from the US and African institutions focusing on peanut farming systems in Africa

Objectives

1. Improve farm level data collection protocols and introduce standardized procedures for data collection and documentation
2. Analyze the potential to increase household income through productivity growth in peanut farming systems
3. Examine the impact of alternative peanut farming systems, including value-added activities, on resource use and income generation
4. Evaluate the determinants of technology adoption (fertilizer, improved seed varieties and selected farming practices) among peanut producers, including gender effects
5. Work with Host Country collaborators to develop training materials and workshops on production economics and farm management, with special attention to women farmers
6. Provide partial support to train several professionals in agricultural economics and other relevant fields, both at the Ph. D. and M.S. levels, mainly in country

Research Approach

Objective 1

To develop research linkages with farmers, the Host Country teams will identify and establish farmer research groups in the peanut producing areas. Women will be targeted for inclusion in the groups and/or in separate groups, depending on their preferences. Farm trials on different peanut varieties will be carried out by KARI and NaSSARI, with farmers' practices as a control. Host Country researchers will conduct regular follow-up, from planting to the utilization stage. Our participatory approach will ensure that farmers take ownership of technology development for their region. Since group networking through information sharing provides a strong foundation for sustainable development programs, we will work closely with various PCRSP projects to collect data and provide information to researchers and extensionists, who will use this resource in their work with farmers.

Farm level data are key to understanding agricultural production systems and resource use. We will compile existing farm level data compatible with the objectives of this project. Comprehensive surveys will be applied to random samples of farmers located in the study sites in year 2 and again in year 4 to collect socio-economic and farm production data. More limited surveys focusing on variety trials will be applied in Years 2 and 3. All farm level data will be collected in conjunction with the work on variety trials performed by the Soroti Station in Uganda. The data collection effort will be done in collaboration with UGA136, NMS172 and VT134. Similar arrangements will be explored in Kenya in conjunction with work in the Kisii Station.

Objective 2

Very few efficiency studies have been published for African countries (Bravo-Ureta et al. 2007). Two exceptions are the work by Kipkoech et al. (2007) for Kenya and Thiam and Bravo-Ureta (IAN, 2003) for Senegal, and both studies show considerable inefficiency in peanut production. To identify ways to improve managerial performance, we will measure technical efficiency at the farm level and examine its determinants utilizing stochastic production frontier methodology. This work will utilize data collected in years 2 and 4 as described under objective 1. Models will be formulated that incorporate relevant exogenous variables with emphasis on human capital (Solis, Bravo-Ureta and Quiroga, 2007). The recently developed meta frontier approach will then be used to analyze technological and efficiency disparities among peanut farmers across regions and countries (Moreira and Bravo-Ureta, 2007).

Objective 3

To understand the effectiveness of resource use in the peanut production value chain, a set of "typical farms" will be constructed for the major agro-ecological areas included in the project in the target countries. Whole farm models (Cisse et al.2003, and Solis and Bravo- Ureta 2004) will then be formulated to examine the role and income generating capacity of peanut production in such systems. Value added activities will be explicitly incorporated to examine their impact on resource use, farm income, poverty alleviation and on women's time and income.

These models will pay explicit attention to emerging technologies and farm practices conducive to environmental sustainability. Development of an environmentally sustainable farming system that incorporates an economically viable value chain system will require integration of farmers' knowledge and judgment to complement the formal analytical process.

Joint work with Dr. Professor Ken Boote (UF157) will be explored in Ghana where the purpose will be to simulate the impact of herbicide resistant peanut seeds on women's time allocation and farm income. In addition, efforts will be made to incorporate economic considerations in the bio- physical models that Dr. Boote has developed for Ghana. This work might also be extended to Uganda and Kenya, depending on relevance, interests and resources.

We also plan to coordinate closely with PCRSP VT134 in order to collect and analyze issues concerning aflatoxin awareness and possible means to mitigate this problem at the household level. Collaboration is also expected with VT134 in gender related research and training under this objective as well as objective 4.

Objective 4

The practices we will investigate to formulate and implement policies to reach the goal of sustained farm productivity and the adoption of value added activities at the household level include: adoption of improved varieties, use of fertilizer and other methods to improve soil fertility, and use of crop rotation and inter-planting to enhance soil fertility and to control the spread

and buildup of parasitic plants, pests and disease. Econometric models (Thuo et al. 2007) will be estimated to quantify the effect of socioeconomic variables on the adoption of various technologies.

Training & Capacity Development Approach

Objective 5

In this project we intend to devote considerable effort to preparing materials, based on research results that can be readily used by extensionists in their work with various stakeholders. These materials will be disseminated in publications (print and online) and a limited number of workshops designed to train researchers and extensionists on various topics dealing with production economics and farm management. The project website will contain all data and materials developed within this project as well as relevant materials gathered from a variety of sources in the Host Countries. A major effort will be made to incorporate topics in the workshops of particular relevance to women in order to induce their participation and to contribute information that is sensitive to women.

In order to avoid duplication, close collaboration is expected with PCRSP UGA124 in matters related to information archival and dissemination. It is hoped that such collaboration might avoid the need to have a separate web site for UCN139, but rather have a comprehensive website for training and research materials for all PCRSP projects under UGA124.

Objective 6

To sustain the accomplishments of the project, it is important to incorporate formal degree training opportunities to increase individual and institutional capacity to support the peanut sector. To this end, the project will support two students (1 Ph.D. and 1 M.S.) to pursue graduate degrees at UConn in fields relevant to the project and of interest in the host countries. Both of the students funded by this project to pursue degrees at UConn will be women.

Funding will also be provided to partially support research for students pursuing their Ph. D. degrees in Host Country institutions in each of the three countries in years 2 to 5 of the project. This support will be for up to two years and is intended to cover expenditures associated with the latter part of the degree program during the research phase. Preference will be given to agricultural economists but funding will also be possible for related agricultural sciences. It is expected that all of the students funded under this project will undertake research on topics directly related to objectives 1 through 4 discussed above and will participate in the training activities discussed under objective 5. The plan calls for supporting a total of six students (two per country) under this modality, and at least three will be women.

Intended Benefits & Impact Responsiveness

Development Benefits

This project will strengthen the capacity of Host Country institutions to design programs, including programs for women, focusing on the promotion of productivity and income growth in the agricultural sector. Host Country personnel will acquire methodological skills necessary for future research and collaboration. Partnerships with farmers will enhance the collaborating institutions ability to work with farmer groups to develop promising alternatives that provide rapid feedback and implementation.

The findings of this project, disseminated through publications and workshops, will give agricultural policy makers a better understanding of agricultural processes, how to encourage productivity, output and income growth, gender issues in agricultural development and changes in resource use over time within the study area. Benefits will also stem from the training of extensionists and researchers and the increased availability of training/teaching materials that can be used to reach farmers to promote sustainable growth in the peanut industry. Training of men and women extensionists will enable these professionals to be gender sensitive as they undertake future work with farmers.

The number of agricultural researchers will be increased through the formal training of graduate students. Full appreciation of the value of this training requires acknowledgement of the multiplier effect at work, as the students trained in this project will continue to teach other students and farmers. Moreover, at least five of the eight students to receive support in their degree training will be women, increasing the likelihood that gender sensitivity will factor into future agricultural projects undertaken by these professionals.

US Benefits

Collaboration with the various African institutions will deepen the knowledge and skills of UConn researchers, enabling them to work more effectively with Kenyan colleagues and others to strengthen the peanut industry. This project will also expand the capabilities and experience at UConn to do Women in Development work. Greater understanding of African agriculture will allow UConn to integrate new material into courses, thus enhancing the quality of instruction in agricultural and resource economics, and development studies. A larger benefit will accrue to agricultural researchers in general. Datasets developed through this project will be placed on the projects website and scientific articles beneficial to understanding agricultural development will be made available to a broad community of researchers.

The partnership with the African collaborators will expand UConn's global connections especially with developing countries in East and West Africa, thus enhancing the opportunities for future work by faculty and students.

Potential Impacts

At the end of the formal project, several impacts can be expected:

1. Well documented and readily available data sets that can be utilized for different analyses related to peanut value chain research and the economics of alternative farming systems
2. Increased adoption of environmentally sound technologies that also contribute to higher productivity and incomes
3. Improved farm performance manifested in higher average farm productivity
4. Increased production and use of peanut products through improved farming techniques and marketing
5. Improved understanding of the role women play in value added activities related to peanuts at the farm level
6. An understanding of policies that can support agricultural growth, particularly in the peanut sector, with particular attention given to the role of gender
7. Several women and male extensionists will be trained
8. An informed community of producers and consumers who are aware of the nutrition and health related issues associated with aflatoxin, and of post-harvest options to minimize this problem
9. Individual and institutional capacity development to support the peanut sector and other crops grown in association with peanuts
10. Eight graduate students will be supported, including at least five women

Equipment

Project resources will be used in the first year to purchase equipment for data recording, processing and information dissemination. Computers, printers and related equipment for the two collaborating Research Centers in Kenya will be purchased. A total of \$6,000 to \$8,000 is expected to be spent for these items.

Project Timeline

Year 1

UConn-KARI team meeting in Kenya; Thuo begins PhD in Ag Econ at UConn; Purchase & install computers & related equipment in 2 Kenyan regional research centers; KARI will identify & integrate available data into a comprehensive data bank; Recruitment and meetings with field staff and farm leaders to plan project activities; Workshop in Kenya to develop farm level data survey instrument; Finalize selection & financial arrangement for 2 Kenyan PhD students; 1st round data collection

Year 2

Team meetings in Kenya; Launch project website; Analyze 1st round data; 2 students begin PhD study in Kenya; Formulation of research agenda with supervisors; Reports on preliminary results of 1st round data; Training in business management, aflatoxin reducing practices, gender issues

Year 3

Team meetings in Kenya; Formulation & analysis of whole farm models by PhD students; Submission of research papers on 1st round data; Meetings

with supervisory committees to discuss progress; 1 female student recruited for MS degree in Ag Econ at UConn; Thuo completes PhD program, returns to Kenya to perpetuate agricultural programs; Training workshops for farmers and field staff

Year 4

Team meetings in Kenya; 2 students complete research PhDs in Kenya; Training workshops on priority topics; 2nd round farm level data collection

Year 5

Team meetings in Kenya; Analyze 2nd round farm level data; preparation of publications; Publications finalized & submitted; Kenyan student completes MS in Ag Econ at UConn; Preparation of final report; Meetings with policy makers in provinces and Nairobi

USAID Mandate Responsiveness

MDGs

Poverty/Hunger: Improved Health: Raised Rural Incomes: Sustainable Development

Foreign Assistance Framework

Governance: Human Capacity: Economic Structure: Persistent Dire Poverty: Global Issues (HIV and Infectious Diseases, climate change, biodiversity)

IEHA

Science and Tech Applications: Increased demand for peanuts: Market Access: Increased Trade

USAID Focal Areas

Greater incomes: Greater value and market demand: Public Health: Food Security: Sustainable Value Chain: Improved Human Capacity