Dry Grain Pulses Collaborative Research Support Program

Enhancing productivity, dietary quality and sustainability of pulse/grain legume value-chains for improved human welfare
WHAT IS A CRSP?
Collaborative Research Support Programs (CRSPs), mandated under Title XII, partner U.S. universities with the United States Agency for International Development (USAID) to achieve poverty alleviation and food and nutritional security goals in strategic developing countries. The CRSPs empower host country institutions to address priority needs and constraints through the creation of new technologies and knowledge while concurrently developing human resource capacity and competencies in strategic areas of agriculture, socio-economics, nutrition and natural resource sciences, thus leading to institutional self-reliance and sustainability. CRSP funding is provided by USAID’s Bureau of Food Security through the Office of Agriculture Research and Technology. CRSP technologies and expertise are available to USAID Regional and Country Missions, NGOs, IARCs and private sector groups to achieve development objectives consistent with USAID’s Feed the Future Initiative (www.feedthefuture.gov).

WHAT ARE DRY GRAIN PULSES?
Dry grain pulses represent a diverse group of edible grain legumes including common bean (Phaseolus vulgaris), cowpea (Vigna unguiculata), Lima beans (Phaseolus lunatus), pigeon pea (Cajanus cajan), chick peas (Cicer arietinum), and lentils (Lens culinaris). These crops have the unique potential to provide solutions to the health, income creation and agriculture sustainability needs of developing countries in Sub-Saharan Africa, Latin America and Asia. As traditional staple foods, they constitute an important source of affordable protein, complex carbohydrates, essential micro-nutrients, dietary fiber, vitamin B and anti-oxidants in the nutritionally challenged diets of both rural and urban poor. Due to their adaptability to marginal production agro-ecologies and high market value, pulses are extensively cultivated by resource-poor small-holder farmers for both household food and nutritional security and as cash crops. Moreover, pulse crops are valued by farmers for their ability to biologically fix nitrogen and thus contribute to soil fertility and health, and their compatibility with cereal and root crops in farming systems.

THE DRY GRAIN PULSES CRSP
The Dry Grain Pulses CRSP, which supports collaborative multi-disciplinary research between U.S. universities and institutions in Africa and Latin America, focuses on edible grain legumes (primarily common bean, cowpeas, lima bean and pigeon pea).
GLOBAL PROGRAM VISION
The Dry Grain Pulse CRSP seeks to contribute to:

- Economic growth and food and nutritional security through knowledge and technology generation.
- Sustainable growth and competitiveness of pulse value chains utilizing socially and environmentally compatible approaches.
- Empowerment and strengthened capacity of agriculture research institutions in USAID priority countries.
- USAID’s Feed the Future and Global Food Security Research Strategy, and
- Achievement of Title XII legislative goals for CRSPs, including the generation of dual benefits to developing country and U.S. agriculture.

TECHNICAL THEMES
The Pulse CRSP achieves its vision by focusing on four technical themes that seek to:

- Reduce production costs and risks for enhanced profitability and competitiveness of bean, cowpea and other grain legumes.
- Increase the utilization of bean and cowpea grain and food products so as to expand market opportunities and improve community health and nutrition.
- Improve the performance and sustainability of bean and cowpea value chains, especially for the benefit of women, and
- Increase the capacity, effectiveness and sustainability of agriculture research institutions which serve the pulse sectors and developing country agriculture in Sub-Saharan Africa and Latin America.

INSTITUTIONAL CAPACITY BUILDING
The Pulse CRSP strengthens institutions by:

- Providing degree and short-term training to address strategic needs and priorities of host country institutions,
- Facilitating regional and international networking with scientists and public and private sector organizations,
- Supporting equipment purchases and training to enhance institutional research and extension program effectiveness, and
- Leveraging resources to assist in strengthening research programs and institutional capacity building objectives.

PROGRAM STRUCTURE
USAID awarded a Leader with Associate-Cooperative Agreement to Michigan State University to serve as the management entity for a five-year program (2007-2012) with the possibility of a five-year extension. Requests for proposals for core projects are announced to address technical themes of the global program. All proposals are peer reviewed by scientists and development professionals external to the CRSP. USAID is involved in the selection of projects to be awarded. Two- to three-year projects (Phases I, II and III) are contracted for collaborative research, extension and institutional capacity building activities in Africa and Latin America. A Technical Management Advisory Committee assesses technical performance of projects and advises the management office and USAID on technical matters, strategic planning and operational guidelines.

PROJECTS AND OUTPUTS
Theme: Increasing Pulse Productivity through Genetic Improvement
- Improved varieties of bean and cowpea with high yield potential, resistances to economically important diseases and insect pests, and grain quality attributes demanded by markets.
- Improved varieties of bean and cowpea with adaptation to drought, high temperatures and low soil fertility, factors associated with climate change.

Combining Conventional, Molecular and Farmer Participatory Breeding Approaches to Improve Andean Beans for Resistance to Biotic and Abiotic Stresses. PIs: James Kelly and Sieglinde Snapp, Michigan State University; George Abawi, Cornell University; Eduardo Peralta, Instituto Nacional de Investigacion Agropecuaria (INAP), Ecuador; and Louis Butaire, Instituto des Sciences Agronomiques du Rwanda (ISAR), Rwanda.

Development, Testing and Dissemination of Genetically Improved Bean Cultivars for Central America, the Caribbean and Angola. PIs: James Beaver and Consuelo Estevez, University of Puerto Rico; Timothy Porch, USDA-ARS Tropical Agriculture Research Station-Mayaguez, Puerto Rico; Juan Carlos Rosas, Escuela Agricultura Paramecuaria-Zamorano (EAP), Honduras; Emmanuel Prophete, National Seed Program, Ministry of Agriculture, Haiti; and Antonio Chicapa Dovala, Instituto de Investigacion Agronomica (IA), Angola.

Modern Cowpea Breeding to Overcome Critical Production Constraints in Africa and the U.S. PIs: Philip Roberts and Jeff Ehlers, University of California-Riverside; Ndiaga Cisse, Centre National Recherches Agronomie-Bambey, Institut Senegalais de Recherches Agricoles (ISRA), Senegal; Issa Drabo, Institut de l’Environnement et des Recherches Agricole (INERA), Burkina Faso; and Antonio Chicapa Dovala, Instituto Investigacao Agromonica (IA), Angola.
**Theme: Increasing Pulse Productivity through Integrated Crop Management (ICM)**

- Biological controls for affordable integrated management of insect pests in cowpea
- Improved Rhizobium inoculants and bean varieties with high biological nitrogen-fixing capacity
- Bean genotypes with root architectures more efficient in P uptake and adapted to drought
- ICM technologies to enhance productivity and sustainability of pulse-based cropping systems

**Using Improved Pulse Crop Productivity to Reinvigorate Smallholder Mixed Farming Systems in Western Kenya, PIs: Julie Lauren, Cornell University and John Ojiambo, Kenyan Agriculture Research Institute (KARI), Kenya.**

**Improving Bean Production in Drought-Prone, Low Fertility Soils of Africa and Latin America – An Integrated Approach. PIs: Jonathan Lynch and Jill Finden, Pennsylvania State University; Magalhaes Miguel, Celestina Jochua, and Soares Xinrinda, Instituto de Investigación Agraria Moçambique (IIAM), Mozambique; and Juan Carlos Rosas, Escuela Agricola Panamericana-Zamorano (EAP), Honduras.**

**Enhancing Biological Nitrogen Fixation of Leguminous Crops Grown on Degraded Soil in Uganda, Rwanda, and Tanzania. PIs: Mark Westgate, Iowa State University; Maitete Bekunda, Makerere University, Uganda; Susan Mchimbiri-Musila and Hamisi Tindwa, Sokoine University of Agriculture, Tanzania; Augustine Musoni, Institut des Sciences Agronomiques du Rwanda, Rwanda; Michael Ujen, National Crops Research Institute, Uganda; Henry Kizito Museke, Volunteer Efforts for Developmental Concerns (VEDCO), Uganda; Lynne Carpenter-Boggs, Washington State University; Karen Cichy, USDA-ARS, Michigan State University; and Eda Reinot, Becker Underwood, Inc., Iowa.**

**Biological Foundations for Management of Field Insect Pests of Cowpeas in Africa, PIs: Barry Pittendrigh, University of Illinois at Urbana-Champaign; Clementine Dalière, Institut de l’Environnement et des Recherches Agricoles (INERA), Burkina Faso; Ibrahim Baxa, l’Institut National de la Recherche Agronomique du Niger (INRAN), Niger; and Mohammad Ishiyaku, Institute for Agricultural Research (IAR), Nigeria; and Mamadiou N’Diaye, Institute d’Économie du Développement et de la Recherche Agricole (INDERA), Senegal.**

**Although pulses are recognized by dieticians as having a nutritionally dense food important for dietary quality, a growing domain of knowledge is emerging on their health promoting attributes. Dr. Maurice Bennink focuses his CRSP research on understanding the nutritional and health benefits of cowpea.**

**Value added beans through appropriate management of insect pests, grain handling and processing**

**Assessment of bean and cowpea market structures and identification of leverage points in domestic and regional value chains**

**Strengthening Pulse Value Chains:**

- Expansion of pulse supply and demand in Africa and Latin America: Identifying Constraints and New Strategies. PIs: Richard Bernsten and Cynthia Donovan, Michigan State University; David Klaa, Universidade Agostinho Neto, Angola; Feliciano Mauze, Instituto de Investigação Agrária Moçambique (IIAM), Mozambique; and Juan Carlos Rosas, Escuela Agricola Panamericana-Zamorano (EAP), Honduras.

**Improving Nutritional Status and CD4 Counts in HIV-Infected Children through Nutritional Support. PIs: Maurice Bennink, Michigan State University; Theobald Moshia and Henry Laswai, Sokoine University of Agriculture (SUA), Tanzania; and Elizabeth Ryan, Colorado State University.**

**Increasing Utilization of Cowpeas to Promote Health and Food Security in Africa. PIs: Joseph Awika, Susan Talcott, Lloyd Moore, and Brillah Nadal, Texas A&M University; Chitundo Kasase, John Shindano, and Kalakula Lungwa Munyinda, University of Zambia (UnZa); Kennedy Muiruri, Zambia Agriculture Research Institute (ZARI), Zambia; Abdul Faraj, Priscia Tuitoek, Egerton University, Kenya; Amanda Minnaar, Gysie Duodu and Andre Oelofse, University of Pretoria, South Africa.**

**Improving Nutritional Status and Health**

- Pulse CRSP scientists are using modern molecular-genetic tools to assist in breeding cowpea cultivars resistant to diverse Striga species (a parasitic weed that attacks cowpea) found in Africa.

**Expanding Pulse Supply and Demand in Africa and Latin America—A Global Perspective. PIs: Richard Bernsten and Cynthia Donovan, Michigan State University; David Klaa, Universidade Agostinho Neto, Angola; Feliciano Mauze, Instituto de Investigação Agrária Moçambique (IIAM), Mozambique; and Juan Carlos Rosas, Escuela Agricola Panamericana-Zamorano (EAP), Honduras.**

**Pulse Value Chain Initiative—Zambia. PIs: Vincent Arnaror-Boadu, Tim Dalton, Allen Featherstone and Mahmud Yesuf, Kansas State University; Gelson Tembo, Mukvitwila Mwilingi, Rebecca Lutinda, Hamuwaka Priscilla, University of Zambia (UnZa); Zambia.**
Technology Dissemination Projects

Dissemination of Seed of Improved Black Bean Varieties in Haiti and Guatemala. PIs: James Beaver, University of Puerto Rico; James Beaver, University of Puerto Rico; Juan Carlos Rosas, Escuela Agrícola Panamericana-Zamorano (EAP), Honduras; Emmanuel Prophete, National Seed Program, Ministry of Agriculture, Haiti; Julio Cesar Villatoro, ICTA, Ministry of Agriculture, Guatemala.

Dissemination of Seed of Improved Cowpea Varieties in West Africa. PIs: Phil Roberts, University of California-Riverside; Noliaga Cisse, ISRA, Senegal; and Issa Drabo, INERA, Burkina Faso.

Implementation of a Comprehensive Bio-Control Program for the Management of Economically Important Insect Pests on Cowpea in West Africa. PIs: Barry Pitterdriigh, University of Illinois at Urbana-Champaign; Manu Tam, International Centre for Tropical Agriculture (CIAT), Benín; Clementine Dabin, Institut de l’Environnement et des Recherches Agricoles (INERA), Burkina Faso; and Ibrahim Baoua, l’Institut National de la Recherche Agronomique du Niger (INRAN), Niger.

Theme: Impact Assessment

- Ex-post impact assessment of Bean/Cowpea and Dry Grain Pulses CRSP investments in research, institutional capacity building and technology dissemination in Africa, Latin America and the U.S.
- Baseline data collection and impact evaluation integrated into Pulse CRSP projects


New technologies developed through the Dry Grain Pulse CRSP (such as improved varieties of bean and cowpea) must be disseminated to the appropriate stakeholders in order to achieve developmental impact. In Burkina Faso, with support from the Pulse CRSP, associations of small-holder farmers are producing and marketing “quality declared” seed of improved varieties of cowpea with the assistance of the Institut de l’Environnement et des Recherches Agricoles (INERA) in Burkina Faso.

Technology Dissemination Associate Award

Strategic Investment in Rapid Technology Dissemination: Commencer-ization of Disease Resistant Bean Varieties in Guatemala, Nicaragua and Haiti. Participating Institutions: Escuela Agrícola Panamericana-Zamorano, Honduras; Instituto de Ciencia y Tecnología Agrícolas (ICTA), and Agencia de Extensión, Guatemala; Instituto Nicaragüense de Tecnología Agropecuaria (INTA), Nicaragua; Instituto Interameri-"cano de Cooperación para la Agricultura (IICA) and the National Seed Service, Ministry of Agriculture, Haiti; Universidad de Puerto Rico-Mayagüez, Puerto Rico, Michigan State University, Michigan. Project life- October 1, 2010 – September 28, 2013.

Outcome goals

- Disseminate a technology package that includes quality seed of improved bean varieties and Rhizobium inoculants to 120,000 resource-poor farmers in food insecure areas of the four countries
- Increase the availability of highly nutritious bean grain in domestic markets at affordable prices so as to improve the nutritional value of the diets of both rural and urban poor
- Implement sustainable bean seed multiplication systems with local farmer/community involvement so as to ensure long-term availability of quality seed of improved varieties at affordable prices to resource-poor farmers beyond the termination of this three-year project

Feed the Future (FfF)
The Dry Grain Pulses CRSP (Pulse CRSP) contributes to USAID Feed the Future (FfF) priority goals of advancing the productivity frontier and enhancing the nutritional value of diets in USAID focal countries. New technologies, management practices and knowledge generated by CRSP-supported collaborative research has the potential to be of great benefit to stakeholders of pulse value chains in developing countries, especially women entrepreneurs and resource-poor farmers. The Pulse CRSP’s management entity, Michigan State University, and its U.S. and host country partner institutions are committed to supporting USAID regional and country mission FfF strategies and are willing to mobilize their capacities to disseminate productivity and value-enhancing technologies and management practices to target beneficiaries in strategic food-insecure countries and regions.

The use of biological controls as part of integrated management strategies shows great promise for the sustainable and effective management of insect pests on cowpeas in West Africa. In this photo, scientists at the Institut de l’Environnement et des Recherches Agricoles (INERA) investigate strategies to control/bruchid (cowpea weevil) in cowpea grain.

Dry Grain Pulse CRSP Alignment with FfF Research Strategy for Global Food Security:

- Enhancing biological nitrogen fixation in beans and other grain legume crop systems
- Increasing productivity of beans and other grain legumes
- Expand the productivity and adoption of climbing beans in Africa
- Manage insect pests in cowpea in West Africa
- Improve drought and heat tolerance in beans and other grain legumes

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The Dry Grain Pulses CRSP (Pulse CRSP) is a global program which collaborates projects in a total of 18 countries in developing countries, 13 of which are USAID Feed the Future focal countries. Administrative Officer, Ben Hassankhani, presents Pulse CRSP caps to participants in a 2010 global PI conference in Ecuador.

A Technical Management Advisory Committee (TMAC) advised the Management Office on technical and administrative matters regarding the Dry Grain Pulses CRSP. The TMAC is comprised of three elected PIs in the CRSP, two representatives from the IARCs, an external peer scientist, a representative from private industry and the USAID AOTR for the Dry Grain Pulses CRSP.

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Participant Countries in the Dry Grain Pulses CRSP

West Africa—Benin, Burkina Faso, Mali, Niger, Nigeria, Senegal
East and Central Africa—Kenya, Rwanda, Uganda, Tanzania
Southern Africa—Angola, Mozambique, South Africa, Zambia
Latin America—Ecuador, Guatemala, Haiti, Honduras, Nicaragua

Participating U.S. Universities
Cornell University
Iowa State University
Kansas State University
Michigan State University
Pennsylvania State University
Texas A&M University
University of California-Riverside
University of Illinois at Urbana-Champaign
University of Puerto Rico-Mayaguez
Washington State University
Colorado State University

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Cowpea is a strategic pulse crop for food and nutritional security in Africa. The advantage of cowpea is that the leaves, immature pods, fresh peas and dry grain are highly nutritious and are harvested for household consumption or sale in local markets.

Common bean originated and was domesticated in the Americas but was introduced and has become a staple crop and staple food in many countries of Africa. The woman in this photo is selling beans in a local market in Rwanda, which is the country with the highest per capita consumption of beans in the world.

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