INTSORMIL Collaborative Research Support Program (CRSP)

What is INTSORMIL?

Management Entity
Sorghum, Millet and Other Grains Collaborative Research Support Program (INTSORMIL CRSP)
Leader with Associates Award: EPP-A-00-06-00016-00

Introduction

INTSORMIL (Sorghum, Millet and other Grains CRSP (Collaborative Research Support Program) is a non-profit international agricultural development organization of the United States Agency for International Development (USAID) based at the University of Nebraska, Lincoln.

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Food quality grain sorghum (left) developed by the Central America Regional Project breeding program

What is INTSORMIL?

The Sorghum, Millet and Other Grains CRSP (INTSORMIL) is funded by the United States Agency for International Development (USAID) and collaborating organizations in the U.S. and in host countries. The INSORMIL CRSP is a research organization focused on education, mentoring and collaboration with host country scientists in developing new technologies to improve sorghum, pearl millet and other grains (teff, fonio, finger millet) production and utilization worldwide. INTSORMIL has projects in 20 developing countries of Africa, Central America and the Caribbean and in the United States. The Global INTSORMIL program currently involves 15 U.S. scientists at six universities and 26 host country national research programs. The INTSORMIL mission is to conduct collaborative research to improve farm income and human and animal nutrition by overcoming constraints to sorghum, millet and other grains production and utilization for the mutual benefit of agriculture in the U.S. and developing countries. INTSORMIL agronomists, animal nutritionists, biotechnologists, plant breeders, cereal chemists, economists, entomologists, food scientists, plant pathologists and weed scientists, from the Land Grant universities of Kansas State University, University of Nebraska, Ohio State University, Purdue University, Texas A&M University and West Texas A&M University collaborate with national research programs in East Africa, West Africa, Southern Africa and Central America. INTSORMIL works in 13 countries in Africa, six countries in Central America and in Haiti. The focus is on increasing food security and promoting market development of sorghum and millet through targeted basic and applied research, education, short-term training and technology transfer to promote adoption and economic impact. The approach involves regional, interdisciplinary and multi-organizational teams.

History

In 1975, the United States Congress passed an amendment to the Foreign Assistance Act of 1961 known as "Title XII – Famine Prevention and Freedom from Hunger." The Title XII mandate is to "… improve the participation of the agriculturally related universities in the United States' governmental efforts internationally to increase world food production and provide support to the application of science to solving developing countries' food and nutrition problems." The Collaborative Research Support Program (CRSP) concept was created by USAID and the BIFAD (Board for International Food and Agricultural Development - a presidential appointed advisory board to the USAID administrator) as a long-term mechanism to focus capabilities of U.S. Land Grant

Universities to carry out the international food and agricultural research mandate of the U.S. Government.

The initial development of INTSORMIL was carried out by University of Missouri scientists under contract to USAID. As a result of their planning, 12 universities were recommended for participation in the new program and the University of Nebraska was selected as the Management Entity (ME). Global experts in sorghum and pearl millet met and 15 research areas were established. A request for proposals (RFP) from INTSORMIL resulted in 44 proposals being accepted for funding out of 75 submitted from 19 U.S. universities. The name INTSORMIL, representing International Sorghum and Millet CRSP, identified the new organization. The sorghum/millet CRSP was established in 1979 with an expiration date of June 30, 1984. The grant was later extended to June 30, 1985. At the time INTSORMIL was established there were ongoing international sorghum/millet projects, funded in part by USAID, at four of the participating universities: millet breeding (Kansas State University); sorghum stress physiology breeding (University of Nebraska); sorghum breeding for quality and nutrition (Purdue University) and sorghum breeding for insect and disease resistance (Texas A&M University). These projects were folded into the new INTSORMIL program and had a major impact on the initial project composition of the new program. INTSORMIL continued at the University of Nebraska through 10-year contracts 1985-1995 and 1996-2006. In 2006, USAID issued an RFP for the Management Entity of a new CRSP called the Sorghum, Millet and Other Grains CRSP. The University of Nebraska submitted the winning proposal for this new program. To form a new program the INTSORMIL Management Entity issued RFPs (Requests for Proposals) for 15 projects in 4 general subject areas: Sustainable Plant Protection Systems, Sustainable Production Systems, Germplasm Enhancement and Conservation and Crop Utilization and Marketing. Concurrently, regional planning meetings for West Africa, East Africa, Southern Africa and Central America were held and host country enhancement projects developed for these four regions. The Sorghum, Millet and Other Grains CRSP Management Entity elected to continue use of the 'INTSORMIL' name due to world-wide recognition and acceptance of the original program. The current cooperative agreement runs until September 29, 2012.

Objectives

- Improve the food and nutritional quality of sorghum and pearl millet and develop new food products to enhance marketability and consumer health
- Facilitate the development of markets for high quality processed sorghum and pearl millet grain products as a human food and as a livestock and poultry feed

- Increase the stability and yield of sorghum and pearl millet through crop, soil and water management while maintaining or improving the natural resources of soil and water
- Develop and disseminate information on the management of biotic stresses in an integrated system to increase grain yield and quality in the field and in storage
- Enhance the stability and yield of sorghum and pearl millet through the use of genetic technologies
- Enhance global sorghum and pearl millet genetic resources and the conservation of biodiversity
- Develop effective partnerships with national and international agencies engaged in the improvement of sorghum and pearl millet production and the betterment of people dependent on these crops for their livelihoods

Management

The Sorghum, Millet and Other Grains CRSP is administered as a Leader with Associates Cooperative Agreement from USAID to the University of Nebraska, Lincoln, which as the Management Entity, administers sub grants to participating U.S. institutions and host country programs and maintains fiscal responsibility. The Program Director is responsible for development of the program and coordinating activities across and within regions and projects. The Technical Advisory Committee provides input on program planning and program review to the Program Director. The Board of Directors advises, sets policy and procedures, reviews progress and sets annual budgets.

Current Awards

- *The Sorghum, Millet and Other Grains CRSP (INTSORMIL)* is funded by the U.S. Agency for International Development under Leader with Associate Cooperative Agreement No. EPP-A-00-06-00016-00.

- USAID/EGAT/AG/ATGO/Mali Cooperative Agreement # 688-A-00-007-00043-00: *Transfer of Sorghum, Millet Production, Processing and Marketing Technologies in Mali.*

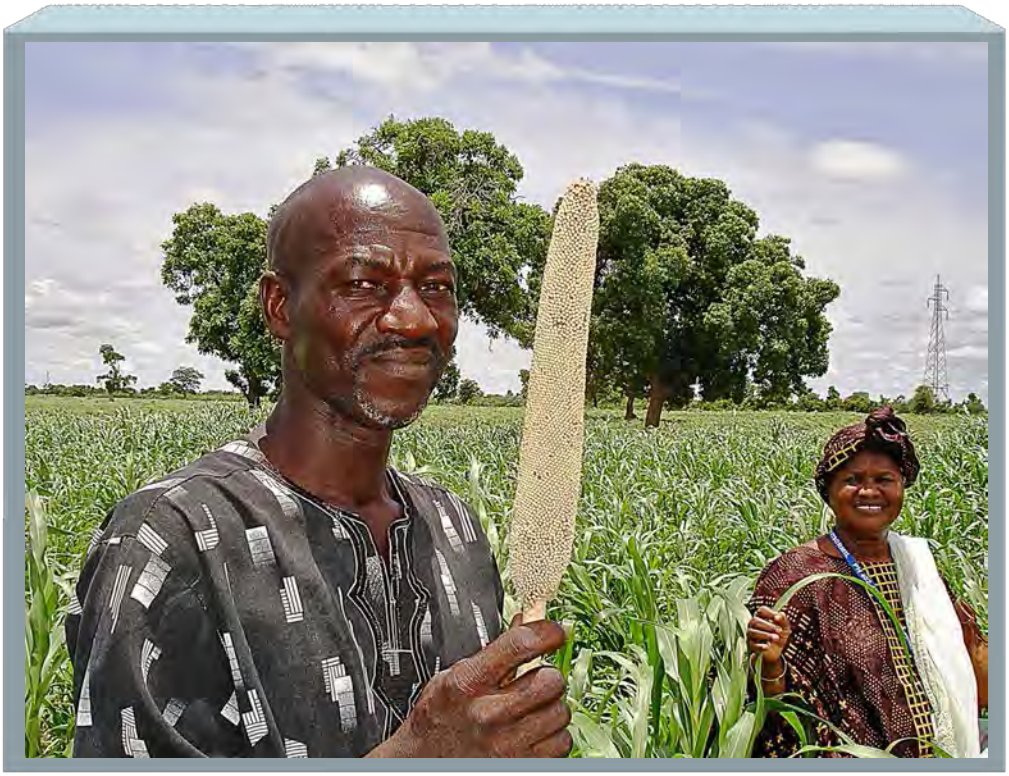
- Associate Award Cooperative Agreement No. AID-O-LA-10-00009: *Identification and Release of Brown Midrib (bmr) sorghum Varieties to Producers in Central America and Haiti.*

Current Global Activities

INTSORMIL collaborates with national programs and universities in 20 countries in West Africa, East Africa, Southern Africa, Central America and Haiti.

West Africa

- Burkina Faso (INERA: Institut d'Environnement et de Recherche Agricoles; IRSAT: Institut de Recherche en Sciences Appliqées et Technologiques)
- Ghana (SARI: Savannah Agricultural Research Institute)
- Mali (IER: Institut d'Economie Rurale)
- Niger (INRAN: Institut National de Recherches Agronomiques du Niger)
- Nigeria (Lake Chad Research Institute, University of Maiduguri)
- Senegal (ISRA: Institut Sénégalais de Recherches Agricoles; ITA: Institut Sénégalais de Recherches Agricoles)



Millet farmer of the Cooperative Yereta-Ton, Tingoni, Mali and a Malian food processor who purchases clean, high quality food grain millet from the Cooperative. INTSORMIL works with the Cooperative to produce high yields of clean food quality grain for the food processors and works with the processors to develop nutritious millet- and sorghum-based food products.

East Africa

- Ethiopia (Axum University, EIAR: Ethiopian Institute for Agricultural Research
- Tanzania (Sokoine University, Ministry of Agriculture)
- Uganda (NARO: National Agricultural Research Organization)

Field of a high yielding INTSORMIL developed sorghum variety in East Africa

Southern Africa

- Botswana (Botswana College of Agriculture),
- Mozambique (IIM: Instituto de Investigação Agrária de Moçambique),
- Republic of South Africa (ARC: Agricultural Research Council; MRC: Medical Research Council; University of the Free State; University of Pretoria)
- Zambia (ZARI: Zambia Agriculture Research Institute; University of Zambia)

Field of a high yielding INTSORMIL developed sorghum variety in Southern Africa

Central America and Haiti

- Costa Rica (INTA: Instituto de Tecnología Agropecuaria)
- El Salvador (CENTA: Centro Nacional de Tecnología Agropecuaria y Forestal)
- Guatemala (ICTA: Instituto de Ciencia y Tecnología Agrícolas)
- Haiti (Chibas Bionergy)
- Honduras (DICTA: Direcion de Ciencia y Tecnología Agropecuaría)
- Nicaragua (INTA: Instituto Nicaragüense de Tecnologia Agropecuaria).
- Panama (IDIAP: Instituto de Investigación Agropecuaria de Panamá)

El Salvador farmers' association (ADISA) members in a seed production field of sorghum variety "SOBERANO" which produces high yields and grain quality suitable for human consumption. SOBERANO was developed by the INTSORMIL Central America Breeding Program.

Global Projects- Core Program

The Sorghum, Millet and Other Grains CRSP (INTSORMIL) is funded by the U.S. Agency for International Development under Leader with Associate Cooperative Agreement No. EPP-A-00-06-00016-00.

- Breeding Sorghum for Improved Grain, Forage Quality and Yield for Central America (W. Rooney, Texas A&M University): Central America
- Breeding Sorghum for Improved Resistance to Striga and Drought in Africa (G. Ejeta, Purdue University): East, West and Southern Africa
- Breeding Sorghum for Improved Resistance to Abiotic and Biotic Stresses and Enhanced End-Use Characteristics for Southern Africa (G. Peterson, Texas A&M University): Southern Africa
- Developing Sorghum with Improved Grain Quality, Agronomic Performance and Resistance to Biotic and Abiotic Stresses (M. Tuinstra, Purdue University): West Africa
- Crop, Soil and Water Management to Optimize Grain Yield and Quality for Value-added Markets in East and Southern Africa (C. Wortmann, University of Nebraska): East and Southern Africa
- Integrated Soil, Water, Nutrient and Crop Management Strategies for Improving Productivity in Sorghum and Millet Based Cropping Systems (P.V. Vara Prasad and Scott Staggenborg, Kansas State): West Africa
- Ecologically-Based Management of Sorghum and Pearl Millet Insect Pests in Africa and the United States (B. Pendleton, West Texas A&M University): Southern and West Africa
- Grain Molds, Mycotoxins and Stalk Rots of Sorghum and Millet (J. Leslie, Kansas State University): Southern Africa
- Enhancing the Utilization and Marketability of Sorghum and Pearl Millet through Improvements in Grain Quality, Processing Procedures and Technology Transfer to the Poultry Industry (J. Hancock, Kansas State University): West Africa and Central America
- Product and Market Development for Sorghum and Pearl Millet in West Africa (B. Hamaker, Purdue): West Africa
- Market Development in Support of Sorghum and Millet Farmers in Tanzania and Zambia (M. Erbaugh and D. Larson, Ohio State University): East and Southern Africa
- Development of the Input and Product Markets in West Africa for Sorghum and Pearl Millet (J. Sanders, Purdue University): West Africa

- Product and Market Development for Sorghum in Southern Africa and Central America (L. Rooney, Texas A&M): Southern Africa and Central America

- Building a Sustainable Infrastructure for Product Development and Food Entrepreneur/Industry Technical Support: A Strategy to Promote Increased Use of Sorghum and Millet in East Africa (D. Jackson, University of Nebraska): East Africa

- Global Impact Assessment of Three INSTSORMIL Activities: 1) Assessing the Impact of Capacity Building, 2) Assessing the Impact of Germplasm Development and 3) Estimating the Returns to R & D from New Uses (value added) of Sorghum (Tim Dalton and Yacob Zereyesus, Kansas State University).

- Impact Assessment of the INTSORMIL Program in Mali and Niger (John Sanders, Purdue University)

- Evaluation of the Impacts of New Technology in Central America of the INTSORMIL Program: Returns to the Introduction of New Sorghum Cultivars into the Dairy Industry of El Salvador (John Sanders, Purdue University)

- West Africa Regional Technology Transfer Project (Bruce Hamaker, Purdue University and Bonnie Pendleton, West Texas A&M University)

- East Africa Regional TechnololgyTransfer Project (Chales Wortmann, University of Nebraska)

- Southern Africa Regional Technology Transfer Project (Gary Peterson, Texas A&M University)

- Central America Regional Technology Transfer Project (W. L. Rooney, Texas A&M University)

Global Projects- USAID/Mali Associate Award

USAID/EGAT/AG/ATGO/Mali Cooperative Agreement # 688-A-00-007-00043-00: Transfer of Sorghum, Millet Production, Processing and Marketing Technologies in Mali

- Production and Marketing (John Sanders, Purdue University)

- Food Processing (Bruce Hamaker, Purdue University)

- Decrue Sorghum (Vara Prasad and Scott Staggenborg, Kansas State Uiniversity)

- Training (Jess Lowenberg-DeBoer, Purdue University)

Global Projects- USAID/W bmr Sorghum

Associate Award Cooperative Agreement No. AID-O-LA-10-00009: *Identification and Release of Brown Midrib (bmr) sorghum Varieties to Producers in Central America and Haiti*

- Costa Rica (INTA: Instituto de Tecnología Agropecuaria)
- El Salvador (CENTA: Centro Nacional de Tecnología Agropecuaria y Forestal)
- Guatemala (ICTA: Instituto de Ciencia y Tecnología Agrícolas)
- Haiti (Chibas Bionergy)
- Honduras (DICTA: Direcion de Ciencia y Tecnología Agropecuaría)
- Nicaragua (INTA: Instituto Nicaragüense de Tecnologia Agropecuaria).
- Panama (IDIAP: Instituto de Investigación Agropecuaria de Panamá)

Training, Education and Human Capital Development

The underlying premise for forming CRSPs was to empower the development of well-trained scientific human capital in developing nations. This is achieved by providing formal programs and assistance that help to build highly capable agricultural research and development (R & D) infrastructure and a strong cadre of well-trained scientists in targeted nations. INTSORMIL training is conducted at multiple levels, including formal academic degree training and short-term training initiatives in specific subject areas. In addition, informal training such as workshops, training sessions, field days etc. has included thousands of trainees. Between 1979 and 2011 a total of 948 scientists have received degree training through INTSORMIL support and 243 have received short-term training (non-degree) in 12 disciplines. The 948 degree trainees include 266 women and 682 men with 350 from Africa, 105 Asia and the Near East, 106 Central America, 55 South America, 306 U.S., 12 Europe and Eurasia and 14 others. Almost 100% of the INTSORMIL supported trainees returned to employment with their respective national programs. The CRSP model provides for continued mentorship for returning students and most continue to collaborate with their U.S. mentor through the support provided by the INTSORMIL Program. This mentorship has stimulated scientific productivity as indicated by the 8,7000 articles and academic materials published by 766 international and U.S. scientists and has resulted in in the development of strong national research and technology transfer programs in African and Central American countries including the Feed the Future (FtF) countries; Ethiopia, Mali, Mozambique, Nicaragua, Tanzania, Uganda and Zambia.

Agbiosciences Discipline	Degree (B.Sc., M.Sc. PhD) Trainees	Non-degree Trainees	Total Number of Trainees (1979-2011)
Breeding	225	75	300
Food Science	226	60	286
Agronomy	164	13	177
Plant Pathology	100	55	155
Entomology	102	13	115
Economics	47	13	60
Physiology	28	4	32
Sociology	26		26
Soil Science	8	7	15
Animal Nutrition	6	1	7`
Molecular Biology	8	2	10
Others	8	0	8
Total	**948**	**243**	**1191**

INTSORMIL sponsored mentors from left to right: Dr. Brhane (VA Tech, Ethiopia), Dr. Gebisa Ejeta, Purdue University, Dr. Mitch Tuinstra, Purdue University, Dr. Tesfaye Tesso, Kansas State University and Taye Tadesse, Ethiopia.

IMPACTS

Key Accomplishments of the INTSORMIL Collaborative Research Support Program (CRSP) Managed by the University of Nebraska-Lincoln

- **Networking:**
  - Engaged 17 U.S. scientists at 6 U.S. universities and the USDA/ARS and 140 partners in Africa (14 countries), Central America (6 countries) and Haiti.

- **Institutional capacity building:**
  - Supported degree training of 948 students (46 for B.S., 458 for M.S. and 444 for Ph.D. and 28 % were women) in the USA and developing countries. 100% of INTSORMIL supported students returned to employment with national programs.
  - CRSP model provides for continued mentorship for returning students and most continue to collaborate with their U.S. mentor through the INTSORMIL program. This approach has resulted in the development of strong national research and technology transfer programs in African and Central American countries including the Feed the Future (FtF) countries; Ethiopia, Mali, Mozambique, Nicaragua, Tanzania, Uganda and Zambia.

- **Scientific productivity:**
  - 8,700 articles and academic materials published by 766 international and US scientists in five geographical regions (Africa=2,922; Asia and Near East=1,447; US= 2,700; Central and South America= 1,427 and Europe= 204). These documents were cited 68,015 times in the literature.

- **Technology development:**
  - > 2,200 sorghum and 350 pearl millet breeding lines released for use as donors in breeding programs.
  - > 80 sorghum varieties released for commercial production in 20 countries.
  - Estimated that 50% sorghum grown in the U.S. contains germplasm from INTSORMIL-affiliated university research programs with a value of $357 million of U.S. grain production annually.
  - Since INTSORMIL began operations in 1979 sorghum yields have increased by 10.2 % annually which is an annual $71.5 million.
  - In Sudan approximately $784 million in annual benefits from the sorghum improvement program with several varieties produced through collaboration with INTSORMIL.
  - Malian collaborating farmers increased sorghum yields by 8.8 tons or 61% on poor land.

- Nigerien farmers achieved a two-fold increase in sorghum yields using the INTSORMIL inputs
- Breeding for abiotic and biotic stress resistance has paid huge dividends: (1) Greenbug resistance is estimated at a net welfare gain to U.S. of $389 million, (2) Sorghum midge resistance a $9.90 yield gain per $1 spent on R &D, (3) Drought resistant hybrids produce 4,060 kg/ha under drought stress vs. 2,289 kg/ha for non-drought tolerant varieties and (4) In Niger, soil nutrient management practices increase pearl millet production by more than 500 kg/ha in both normal and dry years.

➢ **Economic and social impact:**

- A study on the importance of value-added products made from sorghum conducted in El Salvador and Nicaragua indicated that the biggest payout for research resources currently (2012) is in the development of markets for using *bmr* sorghum as livestock feed (forage and grain for dairy cows and poultry) and for food sorghum as a partial replacement for wheat in the baking industry. Both are INTSORMIL activities.
- A study on the returns to the introduction of new dual purpose (forage and grain) sorghum cultivars into the El Salvadoran dairy industry indicated that the cultivars were widely adopted by both large scale and small scale dairy farmers and the return to research investment in developing the cultivars was 37% with increased returns to both the producers and the consumers.
- Through the *bmr* associate award "Identification and Release of Brown Midrib (*bmr*) Sorghum Varieties to Producers in Central America (CA) and Haiti" 140 new technologies or management practices (*bmr* varieties and agronomic practices) were field tested in 2011. FY 2013 target is for 36,000 additional hectares under these technologies in CA and Haiti with a total of 7,500 rural households benefiting from these interventions.
- Through the Mali USAID Mission associate award in 2011: (1) 4,100 farmers applied new technologies on 3,700 ha, (2) 4,100 farmers received short term agricultural sector productivity training, (3) 3,900 rural households and 19 women's food processing organizations benefited.
- Through INTSORMIL core funding, globally in 2011 (1) 10,000 ha under improved technologies, (2) 3,500 rural households, 400 agricultural related firms and 465 women's organizations benefited and (3) 65 public-private partnerships formed.

Further Information:

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