Mali and ICRISAT

Partners in improving food security and resilience for smallholder farmers

Introduction

The partnership between Mali, through the Institut d’Economie Rurale (IER), and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) aims at improving the productivity and resilience of smallholder agriculture along the country’s climate-risky Sahelian and Sudanian zones. This agricultural research for development (AR4D) partnership has achieved significant successes in the development and large-scale dissemination of improved varieties of pearl millet, sorghum and groundnut, which in turn has played an important role in overcoming poverty, hunger and environmental degradation in the country.
The Mali-ICRISAT partnership has evolved over the past 36 years to become a model for collaboration between national and international AR4D organizations. In 2011, the ICRISAT West and Central Africa (WCA) regional office was relocated to Mali because of the dynamism of national partners led by IER, and to strengthen resource mobilization efforts in the region. The move seeks to take advantage of the aggregation of development partners and donors in Mali, and the opportunities to raise resources for the region to benefit AR4D initiatives including those undertaken in other WCA countries like Niger, Nigeria and Senegal.

**Partnership for food security and resilience**

In a meeting with the ICRISAT management in 2014, Dr Bocary Téréta, Malian Minister of Rural Development, recognized “ICRISAT’s commitment to strengthen its research partnership with national institutes in critical areas of research such as resilience, up-scaling of improved technologies, processing and soil health.”

“I am delighted that ICRISAT interventions in Mali focus on the improvement of millet and sorghum which are staple crops and form the base of the country’s national food security stock of 35,000 tons per year. Increasing millet and sorghum production and yield would mean reaching food security and raising this national cereals stock to prevent food issues. Therefore, we have great interest in whatever technologies are available for resilient farming,” said Minister Téréta.

The Minister also thanked ICRISAT for the ongoing research on climate change adaptation for millet and sorghum: “As we improve technologies for smallholder farmers to cope with climate change, we should take into account a value-chain approach, providing capacity building where needed for processing and access to markets to enable farmers to increase their revenues and improve their livelihoods.”

The Mali and ICRISAT partnership is premised on all stakeholders coming together and working towards a positive transformation of the country’s agriculture sector. Public-private partnerships are a vital component for an inclusive, market-oriented development in the country, especially in up-scaling technology interventions and science-based solutions for millions of smallholder farmers.

**The evolution of the partnership**

The collaboration between IER and ICRISAT began in 1979 with the establishment of the ICRISAT-Mali Bilateral Program for research on sorghum and millet, with support from the United States Agency for International Development (USAID). From the 1990s onwards the collaboration between IER and...
ICRISAT has grown to include research areas on better soil fertility management, productive and nutritive crop-tree farming systems, safer and inclusive crop value chain options, as well as approaches to improve family nutrition and women's status in agriculture.

Since 1998, natural resource management (NRM) and decision-support tools, in particular, became important areas of joint work. Working groups have been formed to ensure coordination and complementarity for joint review and research planning.

In 2000, a Geographical Information Systems (GIS) remote sensing and modeling unit was jointly established by Mali and ICRISAT hosted by IER. Through a Memorandum of Agreement in February 2001, the initiative was welcomed by sub-regional bodies such as the Institut du Sahel and the West and Central African Council for Agricultural Research and Development (WECARD) as an innovative model to strengthen networking among national institutions, share information, enhance agricultural NRM research, and provide capacity building and training. This development, which raised strong interest from several partners including major advanced research institutes and other CGIAR centers, now lays the foundation for a regional facility on biospatial research.

The ICRISAT WCA regional office hosted by Mali-IER is now at the forefront of implementing a regional research for development strategy to address constraints of low productivity of sorghum- and millet-based cropping systems, and that of groundnut; improve soil, water and fertility management; link farmers to the markets; as well as improve crop diversification.

A major focus of this strategy is to boost AR4D activities in WCA through strengthened resource mobilization initiatives and capacity building for the NARS in terms of both human resources and infrastructure.
Areas of strategic intervention

- Developing improved varieties of groundnut, sorghum and pearl millet with increased productivity, resistance to diseases, and improved nutritional value.
- Strengthening seed systems to ensure farmers’ access to new diversity by developing platforms for sustainable breeder and foundation seed, enhancing information systems for assessing demand and creating awareness of new varieties, and skills for establishing commercially viable enterprises.
- Developing methods for enhancing effectiveness of agricultural research by strengthening researcher-farmer-development personnel linkages through participatory research, regional collaboration and exchange, and use of advanced biotechnology and geospatial technology.
- Improving crop management techniques through field and post-harvest practices that reduce aflatoxin contamination and *Striga* control.
- Understanding and exploiting key traits for adaptation such as photoperiod sensitivity in sorghum and millets, and early maturing groundnuts that maximize productivity, and reduce risk of loss.
- Improving integrated genetic and natural resource management through soil fertility enhancement, soil and water conservation, and diversification of cropping systems, leading to less land degradation, reduction of biological diversity loss and sedimentation, and enhanced carbon sequestration.
- Making dryland agriculture in Mali more productive, robust, and resilient to climate change, by building more diversified livelihoods and improving fodder production for pastoralists.
- Linking smallholder farmers to markets through efficient, safer and inclusive value chains.

Joint research for development activities through special projects

**Increasing Groundnut Productivity of Smallholder Farmers in Ghana, Mali and Nigeria (USAID, 2015-2018)**
The project goal is increasing groundnut productivity and production of smallholder farmers in partner countries thereby improving their income, nutrition and health. The project will focus on three important areas: diffusion of improved varieties with Integrated Crop Management (ICM), improved seed systems, and capacity building. ICRISAT will work with partners to implement the project activities, with IER as the main stakeholder of the project in Mali.

IER and ICRISAT collaborated in the identification of molecular markers for resistance of sorghum to *Striga hermonthica*, working together in transferring resistance genes into farmer-preferred sorghum cultivars.

**West African Groundnut Germplasm Project [Common Fund for Commodities (CFC), 1996-2002]**
Through this project the national groundnut collection has been characterized and conserved in the regional Gene Bank at Niamey. New collections have been made from desert-threatened areas in northern Mali. Four groundnut varieties (ICG 7878), ICG (FDRS) 4, ICG (FDRS) 10, and ICG (E) 34 were registered in the official variety catalog of Mali.

**West and Central Africa Sorghum Research Network (USAID, 1993-2006)**
IER has developed capacity in market-oriented research resulting in the development of new sorghum products, such as biscuits, flour, etc. that are being tested with local bakeries. This helped enhance the unrecognized benefits of growing sorghum.

**Guinea-race sorghum hybrid development (The Rockefeller Foundation, 2000-2008)**
IER and ICRISAT worked to develop diverse hybrid parents, used in producing the first Guinea-race hybrids for national and regional testing and for establishing methods for hybrid sorghum seed production.

**ICRISAT-WCA-NARS Project on farmer participatory millet-sorghum production in the Sahel [International Fund for Agricultural Development (IFAD), 2001-2003]**
Mali has benefited from this project in the area of participatory seed production systems and farmer training.

**Fertilizer microdosing (USAID, 2002-2004)**
IER and ICRISAT promoted the fertilizer microdosing technology in targeted regions in Mali. Encouraging results showed that yields of sorghum and millet increased by up to 120%; the income of farmers using this technology also increased. Efforts to scale up and out these technologies are underway.
West African Groundnut Seed Project (CFC, 2003-2007)
Groundnut farmers of Mali’s major groundnut production basins (Dioila, Kolokani, Kita, Kayes) have been empowered to select new groundnut varieties. Individual farmers and farmers’ associations have begun to multiply seeds of the new varieties.

Access to seed (BMZ, 2003-2007)
The goal was to have better access to new sorghum varieties and strengthen farmer-researcher collaboration in variety testing and dissemination. The methodologies developed served as a model for similar efforts throughout the region.

The Desert Margins Program [Global Environmental Fund (GEF), 2003-2008]
IER was one of the main partners in the Desert Margins Program (DMP) which focused on arresting land degradation in desert margins of sub-Saharan Africa and issues of global environmental importance, in particular the loss of biological diversity, and reduced sequestration of carbon.

ICRISAT, IER and partners worked to estimate environmental risk associated with crop-to-weed gene flow, helped build regulatory decision making, and support national partners to handle the introduction of genetically engineered food crops in a sustainable and environmental manner.

An aflatoxin risk early warning system to improve nutrition, health and income in West African smallholder farms (Canadian International Development Agency, 2006-2009)
ICRISAT and IER sought to improve nutrition, health and income of poor households through the development of an aflatoxin risk prediction and mapping system.

Mobilizing regional diversity for creating new potential for pearl millet and sorghum farmers in West and Central Africa (BMZ/GTZ, 2006-2009)
ICRISAT and IER sought to enhance long-term household food security in Mali through more efficient and sustainable use of pearl millet and sorghum genetic resources.

Intensification of sorghum and millet systems using local biodiversity and market opportunities in semi-arid West Africa (IFAD, 2006-2010)
This regional project aimed at: (a) strengthening participatory processes for variety development, scaling-up and out the methodologies developed jointly by IER and ICRISAT; (b) enhancing local seed systems; (c) strengthening farmers’ knowledge and decision making capacity regarding soil-fertility, crop-, weed-, insect- and striga-management; and (d) increasing market options.

An Bè Jigi: Enhancing nutrition in sorghum/pearl millet consuming communities (McKnight Foundation, 2006-2010)
There is a high incidence of anemia in both women of reproductive age (63%) and children 6-59 months old (88%) in Mali. This project addressed micronutrient deficiency problems using affordable, locally available sources.

Farmer-participatory improvement of sorghum and pearl millet genetic resources (McKnight Foundation, 2006-2010)
Together, IER and ICRISAT worked towards increasing food security by increasing farmer access to genetically diverse varieties of pearl millet and sorghum that are better adapted to specific local constraints.

Sustainable seed supply: Farmer-managed seed marketing initiatives (McKnight Foundation, 2006-2010)
This project aimed to build the capacity of local farmer groups to develop sustainable local seed systems for the dissemination of increased quantities of seed of improved sorghum and pearl millet varieties.

ALIVE (A Legume Intensification and Variety Enhancement) and nutritious cropping systems: A legume intensification and variety enhancement participatory approach (McKnight Foundation, 2006-2010)
The goal was to increase legume intensification and use in sorghum- and millet-based cropping systems in three regions of Mali – Dioila, Mande, and Cinzana. This will eventually lead to improved soil fertility and family nutrition.

Enhancing grain legumes’ productivity and production, and the income of poor farmers in drought-prone areas of Sub-Saharan Africa and South Asia (Tropical Legumes-II) (Bill & Melinda Gates Foundation, 2007-2011)
Tropical Legumes-II is a joint initiative of three international agricultural research centers, viz. ICRISAT (chickpea, groundnut and pigeonpea), IITA (cowpea & soybean), and CIAT (common bean)

Improved drying practices for groundnut pods in Foh, Sikasso in Mali.
that aims to increase productivity and production of legumes and the income of poor farmers in Africa and South Asia by 15%, with improved varieties occupying 30% of the total area planted by some 57 million poor farmers in the coming 10 years.

**West Africa Seed Alliance (WASA) (USAID, 2007-2011)**
The WASA project supports critical agricultural and trade measures aimed at increasing the production and marketing of food staples along key trade and transport corridors. It aims to modernize the agricultural input and output distribution systems, facilitating smallholder producer access to improved seed varieties, complementary inputs, production technologies and strengthened links to cash markets.

Community management of crop diversity to enhance resilience, yield stability and income generation in changing West African climates (BMZ/GIZ, 2008-2011)
The goal of this research-action project was to enhance farm community resilience, production stability and income generation in West Africa under variable and changing climates by enriching agro-biodiversity management across a climatic gradient.

Backstopping and coordinating the fertilizer microdosing and inventory credit system project in Burkina Faso, Mali and Niger [Alliance for a Green Revolution in Africa (AGRA), 2009-2012]
This project sought to provide technical backstopping and to coordinate country level activities in order to promote mutual exchange of information, experiences and expertise among the three countries on the fertilizer microdosing technique.

Food facility program (IFAD, 2010-2011)
The main objective of IER-ICRISAT’s work was to support the production of high and stable yields of millet and sorghum for smallholder farms.

Harnessing Opportunities for Productivity Enhancement (HOPE) of sorghum and millets in Sub-Saharan Africa and South Asia (Bill & Melinda Gates Foundation, 2009-2013)
This project seeks to take an integrated value-chain approach that harnesses market pull linked to increased production potential from technologies to stimulate production of sorghum and millets.

Establishing a molecular breeding program based on the aluminum tolerance genes, AltSB, and the P efficiency QTL, Pup-1, for increasing sorghum production in sub-Saharan Africa – (Sorghum MB) [Generation Challenge Program (GCP)/CIMMYT, 2010-2014]
The project implements a molecular breeding program targeting Mali, Niger and Kenya using random mating ms3 populations (RMPs) for the eventual development of improved varieties and breeding materials with Al tolerance and improved performance under low P stress.

Tackling abiotic production constraints in pearl millet and sorghum-based agricultural systems of the West African Sahel (BMZ/GIZ, 2010-2013)

Using an integrated genetic and natural resource management (IGNRM) approach, this project aims at enhancing adaptation of pearl millet and sorghum to low-phosphorus (P) soils and water stress in the Sahelian zone of West Africa (WA).

**Sustaining farmer-managed seed initiatives for sorghum and pearl millet in Mali, Niger, and Burkina Faso (McKnight Foundation, 2019-2014)**
The project seeks to strengthen the dynamics of local social seed networks so as to improve local seed availability and thus increase the adoption of new sorghum and pearl millet varieties for improved food security and income.

An Be Jigi II Project: Enhancing bioavailability of Iron and Zinc in varieties of sorghum and pearl millet consumed in Mali (McKnight Foundation, 2010-2014)
The main goals of the project are to enhance micronutrient nutrition through improved sorghum and pearl millet varieties and cultivation practices, and develop grain processing and food preparation methods/recipes for enhanced micronutrient nutrition.

Unlocking the opportunities to enhance sustainable seed systems of staple crops (sorghum, pearl millet, maize, cowpea and groundnut) to improve food security and agricultural production in West and Central Africa (CORAF-Senegal and IER-Mali, 2011-2014)
This project focuses on ways and means of establishing efficient, sustainable seed systems for major staple crops – sorghum, millet, maize, cowpea and groundnut – to provide farmers with a reliable supply and a range of choices of quality seed that are well-adapted to local conditions.

An integrated cereal-livestock-tree system for sustainable land use and improved livelihoods of smallholder farmers in the Sahel (CerLiveTreeS) (CORAF-Senegal, 2011-2014)
The project aims at improving integrated cereal-livestock-tree systems and livelihoods of smallholder farmers through sustainable land use management in the Sahel in the context of agricultural land degradation and climate change.

Improving the livelihoods of smallholder farmers in drought-prone areas of sub-Saharan Africa and South Asia through enhanced grain legume production and productivity (TLII Phase 2) (Bill & Melinda Gates Foundation, 2011-2014)
The overall goal of TLII is to enhance productivity by at least 20% for six legume crops covered by this project (chickpea, common bean, cowpea, groundnut, pigeonpea and soybean) in drought-prone areas, through the availability and adoption of improved crop varieties and associated crop management practices.

Capacity building for soil and plant analysis laboratories for the improvement of soil health in West Africa (AGRA, 2012-2013)
The goal was to improve the capacity of soil laboratories in West Africa to provide accurate and timely service to target clients.
Mali and ICRISAT
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Africa RISING program: Large-scale diffusion of technologies for sorghum and millet systems in Mali (NARS, USAID, 2014-2017)
This involves the large-scale diffusion of technologies for sorghum and millet systems in Mali (DT_SMS) to increase the incomes of producers in targeted Feed the Future intervention areas by raising the productivity and profitability of these principal cereals.

Easy molecular breeding tools for accelerating sorghum improvement in West Africa (NARS, BMZ, 2014-2016)
The project’s purpose is to enable NARS and ICRISAT sorghum breeders in West Africa to use a molecular breeding platform in the development of farmer-preferred sorghum cultivars with excellent local adaptation and grain nutrient contents.

Bringing the benefits of heterosis to smallholder sorghum and pearl millet farmers in West Africa (NARS, BMZ, 2014-2017)
This project seeks to enhance sorghum and pearl millet productivity in WCA through cultivation of nutritious hybrids, contributing to food security, income generation, and improved nutrition through sustainable hybrid development and efficient hybrid breeding strategies based on quantitative-genetic parameters and molecular-breeding tools.

Implementation phase of the Universities, Business and Research in Agricultural Innovation (UniBRAIN) project (Forum for Agricultural Research in Africa (FARA)-Ghana, 2012-2015)
The main goal is to establish six pilot agribusiness incubators in Ghana, Kenya, Mali, Uganda and Zambia, with ABI-ICRISAT providing support to the incubators on leadership in business planning, incubator management, governance and training.

Climate change impacts on West African agriculture: a regional assessment (CIWARA) (Columbia University-USA, 2012-1014)
The project proposes to standardize an open access database, compare and improve crop model performance, improve spatial coverage of agro-meteorological advisories for smallholder farmers, update selected policy instruments at the national and regional levels, and build research capacity for integrated climate change impacts assessments.

Assessing and refining the concept of dynamic gene pool management and simultaneous farmer-participatory population improvement in pearl millet and sorghum (McKnight Foundation, 2012-2014)
This project aims to contribute to diversification of farmer-grown cultivars and yield stability in variable climates; and in ensuring that new, specifically adapted and farmer-preferred cultivars enter formal and informal seed systems and are cultivated by the farming communities, thereby contributing to food security.

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Women’s group in Mali at a microdosing training.
Harnessing new, dynamic partnerships

Mali and ICRISAT are both committed to strengthen and stimulate AR4D partnerships in WCA. ICRISAT is leading two global, strategic research partnerships – the CGIAR Research Programs on Grain Legumes and on Dryland Cereals – to help boost food and nutrition and improve livelihoods particularly of the dryland poor. Under these programs, national and regional organizations like IER, CORAF/WECARD, AGRA, and FARA play significant roles in ensuring that research results benefit the smallholder farmers. ICRISAT-Mali is also hosting the Program Leader of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), and the Gender Specialists of both CCAFS and Dryland Cereals. It also hosts the offices of the World Vegetable Center (AVRDC), the World Agroforestry Centre (ICRAF) and the International Livestock Research Institute.

In the spirit of inclusiveness and making farmers at the center of AR4D undertakings, ICRISAT-Mali works with local and international civic and farmers’ organizations like the Association Malienne d’Eveil au Développement Durable (AMEDD), Association Malienne pour la Sécurité et la Souveraineté Alimentaires (AMASSA), Faso Kaba, World Vision, Catholic Relief Services (CRS).

The way forward

Partnership is the key to overcoming poverty and food insecurity which remain as serious challenges in the dryland tropics of the world, affecting about 700 million people living on less than $2 a day. The potential of partnership in advancing food security and poverty reduction is increasingly evident especially with new ways of AR4D collaborations as evident in the partnership between Mali and ICRISAT.

Linking smallholder farmers to markets through efficient, safer and inclusive value chains is now the way forward for the partnership. Conditions are being set up for an inclusive market-oriented development that enable smallholder farming families to go beyond subsistence farming to produce surpluses that can be stored and sold to markets.

Gender and nutrition through the promotion of Smart Foods such as sorghum and millets, which provide 69% of total energy intake of children and 75% of the total energy intake of mothers in Mali, are now cutting across most AR4D initiatives in the country.