



Africa Research in Sustainable Intensification for the Next Generation

Sustainable intensification of cereal-based farming systems in the
Guinea-Sudano-Savanna of West Africa

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Contact Person:
Dr. Irmgard Hoeschle-Zeledon, Project Coordinator
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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. <http://africa-rising.net/>



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Partners

AMASSA	Afrique Verte, Mali
AMEDD	Association Malienne d'Eveil et de Développement Durable, Mali
ARI	Animal Research Institute, Ghana
AVRDC	The World Vegetable Center
CAAD	Centre d'Appui a l' Autopromotion pour le Development, Mali
CBOs	Community-based Organizations, Ghana
CIAT	International Center for Tropical Agriculture
CMDT	Compagnie Malienne de Développement des Textiles, Mali
CRI	Crops Research Institute, Ghana
FRI	Food Research Institute, Ghana
GLDB	Grains and Legumes Development Board, Ghana
GRAADECOM	Groupe de Recherches d'Actions et d'Assistance pour le Développement Communautaire, Mali
GUIFFA	Guinea Fowl Farmers Association, Ghana
HI	Heifer International
ICRAF	World Agroforestry Center
ICRISAT	International Crops Research Institute for the Semi-arid Tropics
IER	Institut d'Economie Rurale, Mali
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INSTI	Institute for Scientific and Technological Information, Ghana
IWMI	International Water Management Institute
KNUST	Kwame Nkrumah University of Science and Technology, Ghana
MOBIOM	Mouvement Biologique du Mali, Mali
MoFA	Ministry of Food and Agriculture, Ghana
MoH	Ministry of Health, Ghana
NORGFA	Northern Region Guinea Fowl Farmers Association, Ghana
SARI	Savanna Agricultural Research Institute, Ghana
SEEDPAG	Seed Producers Association of Ghana
SRI	Soil Research Institute, Ghana
UDS	University for Development Studies, Ghana
UG	University of Ghana, Ghana
WIENCO	Wienco Seed Company, Ghana
WU	Wageningen University, The Netherlands
WIAD	Women in Agriculture Development, Ghana
WRI	Water Resources Institute, Ghana

Summary

Implemented work and achievements for the period April to September 2014 for the Africa RISING project in Ghana and Mali are reported. Establishment of research-for-development platforms were initiated in both countries. Surveys on feed markets and livestock value chains were complete. Several on-farm agronomic trials were established to test, demonstrate and disseminate improved technologies to intensify the small holder integrated crop-livestock-vegetable production systems. Group and individual training were conducted to strengthen the capacity of farmers and researchers and development partners. Project outputs were disseminated through the farmers' field days, and farmer field schools, exchange visits and video shows.

1 Introduction

1.1 Africa RISING Program

As part of the Feed the Future Initiative, the United States Agency for International Development (USAID) is supporting an innovative multi-stakeholder agricultural research program, the Africa Research in Sustainable Intensification for the Next Generation (Africa RISING). The program's main objective is to identify and validate scalable options for sustainable intensification of key African farming systems to increase food production and improve livelihoods of smallholder farmers and at the same time conserve or improve the natural resource base.

The three projects are:

- Sustainable intensification of crop-livestock mixed farming systems in the Guinea-Sudan-Savanna Zone of West Africa – led by the International Institute of Tropical Agriculture (IITA),
- Sustainable intensification of crop-livestock integrated farming systems in the Ethiopian highlands – led by the International Livestock Research Institute (ILRI), and
- Sustainable intensification of cereal-legume-livestock integrated farming systems in East and Southern Africa – led by IITA.

The International Food Policy Research Institute (IFPRI) is responsible for monitoring, evaluation, and impact assessment across all three projects.

The program is organized around four research outputs that are logically linked in time and space, namely:

1. Situation Analysis and Program-wide Synthesis
2. Integrated Systems Improvement
3. Scaling and Delivery of Integrated Innovation
4. Integrated Monitoring and Evaluation

1.2 Africa RISING in West Africa

Africa RISING is being implemented in 25 intervention communities in the three northern regions of Ghana (Fig. 1), and 10 villages in the Bougouni-Yanfolila and Koutiala districts of the Sikasso Region in southern Mali (Fig. 2). It is intended to result in spillover effects to other similar agro-ecological zones.

The farming systems in the region are dominated by small-scale, resource-poor farmers whose livelihoods depend on rain-fed crop, livestock, and crop–livestock farming systems. Main staple crops are cereals (maize, rice, sorghum, pearl millet), legumes (groundnut, cowpea, soybean, Bambara nut, pigeon pea), and vegetables (roselle, okra, pepper, onion, garden egg, tomato, amaranths, pumpkin). The cereals are either grown in pure stands or intercropped/rotated with the legumes and a variety of vegetables. Crop yields on farmers' fields are generally poor due to low and variable rainfall, drought, low and declining soil fertility, use of low yielding varieties, lack of quality seed of improved crop varieties and land preparation equipment, high cost of inputs and postharvest losses, labour constraints that lead to poor growing conditions (late sowing, sub-optimal plant populations, inadequate control of weeds, *Striga*, pests and diseases), and low use of organic or mineral fertilizers.

Cattle, sheep, goats, pigs, chicken, guinea fowl, turkeys, and ducks are reared for meat, milk, egg, land preparation, transport, manure, and cash. The animals are mostly managed under extensive and semi-intensive systems with limited feed, shelter, health care, and breeding management. Productivity of the animals is low due to inappropriate husbandry (feeding, health care, housing, and breeding) practices that result in high mortality rates. Farmers have limited access to veterinary services, and improved livestock breeds. In general, the crop and livestock enterprises are weakly integrated.

Diets of most rural poor farm-families are often dominated by the intake of basic staple foods (e.g., maize, rice, millet, and sorghum) which are usually deficient in micro nutrients such as vitamin A, iron, and zinc needed to prevent malnutrition. The nutritional status of most farm households, especially pregnant women, breast feeding mothers, and children below 24 months of age, is therefore poor. Chronic malnutrition is common and linked to low income, unsuitable food processing and feeding practices, and iron deficiency.

Farmers have limited access to input and output markets. Enabling institutions and policies are also lacking. Due to inadequacies of traditional promotional and scaling-up/out pathways, there is a large, unmet demand for information and technology, especially by women. This has led to low adoption of improved technologies and best practices by farmers to reduce food insecurity, poverty, and natural resource degradation.

The activities presented in this work plan were selected to address the above challenges in the smallholder 'integrated cereal-legume-vegetable-livestock' farming systems in northern Ghana and southern Mali outlined above. The activities also address the expected outputs of the Africa RISING program, namely: increase productivity (WP-2, 3, 4, 5, 6, 7), conserve the natural resource base (WP-7, 8, 9), improve household nutrition (WP 10) and link farmers to markets (WP-1). Activities are linked within and across work-packages to ensure integration.

1.2.1 Implementation strategy

For participatory identification and implementation of activities to address the bio-physical and socio-economic constraints of the farming systems, community-based research-for-development (R4D) platforms which are merged to form district level platforms are promoted. The R4D Platforms consist of multi-disciplinary and multi-institutional research teams and development partners, male and women farmers, community-based organizations (CBOs), processors, service providers, traders, agro-input dealers, seed producers, public and private organizations and policy makers. Such approach facilitates farmer experimentation and evaluation, and ensures ownership by stakeholders, sustainability, and effective scaling-out and scaling-up of introduced technologies. Strategic partnerships are built with existing initiatives and farmer associations, non-governmental organizations (NGOs) and international organizations working on food security, poverty, household nutrition and environmental issues.

The activities are implemented mostly on-farm and on-station. The on-farm activities are managed by researchers, researchers and farmers, and farmers only. In addition to comparing intensified practices with farmers' practices, the on-farm activities are used to demonstrate new technologies and/or a combination of technologies through farmers' field days, farmers' field schools and exchange visits. They are also used to train farmers, extension and research assistants. The on-station activities are mostly used by graduate students as part of their dissertation research to test and/or develop new technologies. In Ghana, the activities are implemented by multi-disciplinary research teams from ARI, AVRDC, FRI, IITA, ILRI, KNUST, MoFA, MoH, SARI, and UDS. Similarly in Mali, activities are implemented by multi-disciplinary and multi-institutional partners such as AMASSA, AMEDD, AVRDC, CMDT, ICRAF, ICRISAT, MOBIOM, L'ONG-CAAD and L'ONG-GRAADECOM. Strengthening human capacity at all levels from farmers and their associations' officers, development workers, field and laboratory technicians, scientists and policy makers is a key component of the project. Academic training at the MSc and PhD level focuses on research to address important knowledge gaps, and to develop 'second generation' technologies that may be suited specifically to particular recommendation domains.

Gender awareness and gender equity, youth and under-privileged groups within society are considered in all project activities. Barriers-to-participation are reduced by offering gender sensitive interventions. Women interest groups (WIGs) are promoted to ensure effective participation of women.

1.2.2 Scale of operation

The scale of implementation varies with activity in each country. It ranges from the plot to farm/field scale or from household to the community level. Most of the activities are implemented at the plot or field levels. Nevertheless, results and outputs from the activities can be extrapolated to larger scales and bigger recommendation domains using modeling, Geographical Information Systems (GIS) and Remote Sensing techniques. For example, our preliminary GIS analysis showed that results from plot activities implemented at the Natodori intervention community in the Upper West Region of Ghana can be applied to other West African countries with similar agro-ecology and socio-economic environment.

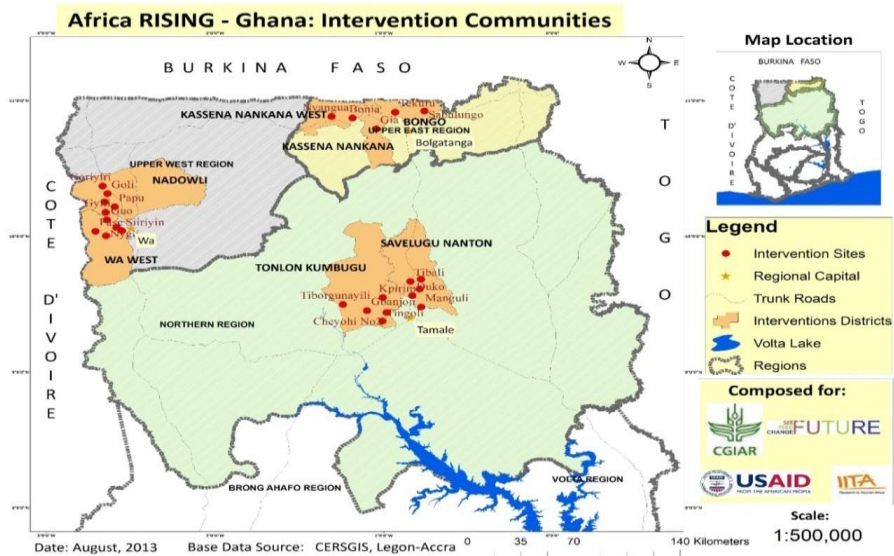


Figure 1. Africa RISING intervention communities in Ghana

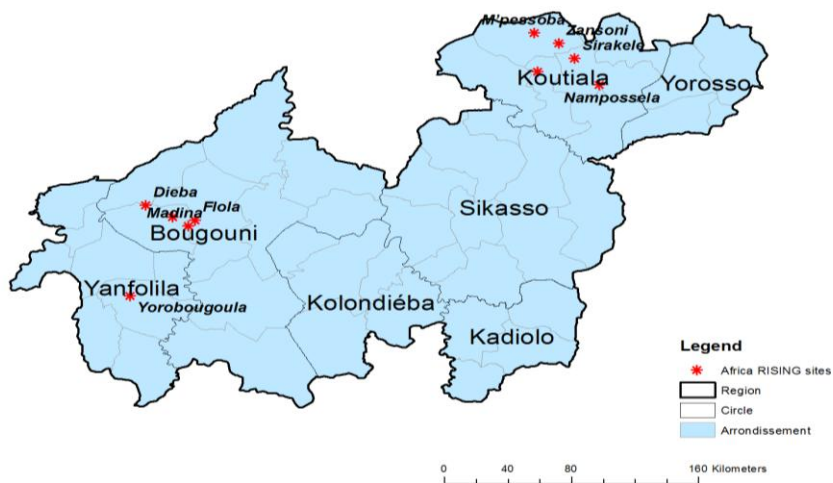


Figure 2. Africa RISING intervention villages in Mali

2 Implemented work and achievements

2.1 Situation Analysis (Research Output 1)

2.1.1 Socio-economic studies on sustainable intensification in northern Ghana and southern Mali

2.1.1 Mobilize communities and establish R4D platforms in Ghana

The Upper West Region was the focus of most of the activities on R4D platform establishment during the reporting period. A stakeholder workshop was organized on 18th June, 2014 at Wa to identify potential actors and their roles in district- and community-level platforms. The meeting was attended by 41 representatives from: MoFA, ARI, IITA, policy makers or assembly men, women's group, Ghana Health Services (GHS), Ghana Education Service (GES) and farmer-based organizations (FBOs). Key actors and their roles at the district- and community-levels R4D platforms were identified (Table 1).

The Nadowli/Kaleo district R4D platform was inaugurated on 16th of September, 2014 at the World Vision Conference Hall, Nadowli. The meeting was attended by 60 participants representing MoFA, ARI, IITA, assemblymen, women's group, Ghana Health Services (GHS), Ghana Education Service (GES), FBOs, farmers, Chiefs and Tindanba or land-owners and Makazie or Women's leader. The institutions present nominated a representative each to constitute the district R4D platform committee. Thereafter, members of the committee then elected the R4D platform executives, namely: David K. Waawula (Chairperson), John Mwininye (Vice-Chairperson), Celistina Dakubo (Treasurer) and Noah Mwinine (Organizer). Both the R4D platform committee and executive members were commissioned into office by Mr. Kennedy Toranyi who represented the District Chief Executive at the meeting.

The R4D platform for the Wa West district was inaugurated on September 18, 2014 at Wechiau. Stakeholders present were similar to those listed above for Wa West. Each agency nominated a representative to serve on the R4D platform committee. The R4D platform executives nominated by the committee members were: Dominic Maalu (Chairperson), Isaac Yendan (Vice-Chairperson), Mary Asante (Secretary), Alimata Razak (Treasurer) and Amyueta Roga (Organizer). The members of the committee and executives were sworn into office by Mr. Adenyo Jaspard (Deputy Coordinating Director) who represented the Wa West District Chief Executive.

2.1.1.2 Establish and characterize R4D platforms in Mali

Planned activities for the establishment and characterization of R4D platforms in Mali included: characterization of platform sites in Bougouni and Koutiala districts, quick assessment of relevant stakeholders, stakeholder analysis and mapping, multi-stakeholder workshops for feedback on results and establishment of platforms. Data were collected in Koutiala and Bougouni districts for biophysical and social characterization of the platform site, stakeholder inventory, analyzing stakeholder interest and influence on the critical issues, and mapping stakeholder characteristics and interactions. In both districts, data for the characterization of the platform sites were collected by visiting the departments of agriculture, health, social

development, water and forest and meteorology to compile information on rainfall, temperature, population and farming systems.

In Koutiala district, information on inventory of stakeholders were collected from AMASSA and the Agricultural Chambers where the farmers' organizations were registered. Interviews were held with three NGOs and farmers' groups to analyze stakeholders' interest and influences on critical issues. The NGOs included: AMEDD, AMASSA and COPAM (Centre commercial des produits agricoles du Mali). The farmers' cooperatives were: UFROAT (Union des femmes rurales ouest africaines et du Tchad), UCPTC (Union des coopératives des producteurs et des transformateurs de céréales), ULPP (Union locale des pépiniéristes et planteurs), ULCFBV (Union locale des coopératives de la filière bétail et viande) and ULCMK (Union locale des coopératives maraichères de Koutiala).

At Bougouni, information on potential stakeholders and actors were collected in collaboration with the following partners: MOBIOM, BACIR (Bureau d'appui conseil aux initiatives rurales), CORIMA (Coopérative des riziculteurs et maraîchers), CJR (Coopérative des jeunes ruraux), CSE (Coopérative des syndicats des éleveurs), Dalabani (Coopérative semencière nationale), Balimaya (Coopérative agricole) and COFROSOTRANS (Coopérative féminine pour la promotion du soja et la transformation des produits agro-alimentaires locaux). The information collected is being analyzed.

2.1.1.3 Survey of feed markets and analysis of livestock value chains in Ghana

Data collection on prices of livestock feeds in markets in Northern, Upper East and Upper West Regions was completed in June 2014. Feed samples are being processed for laboratory analysis to determine concentrations of nitrogen, neutral and acid detergent fibre content and organic matter digestibility. A paper on 'Feed markets in Ghana' was presented by Solomon Konlan (PhD student) at the Ghana Animal Science Association (GASA) Biennial Conference in August at Tamale.

Data collection, entry into computer and analysis on characterization of livestock value chains in northern Ghana was completed. Two out of the three MSc students working on the activity defended their dissertation research at the University of Ghana, Legon.



Photo 1: Participants at the stakeholder meeting on research-for-development platforms, 18 June 2014, Wa, Ghana

2.1.2 Baseline surveys

Baseline surveys by IFPRI have been completed in both countries. Data are being cleaned and analyzed. Data of specific modules are available to scientists upon request.

Table 1: Proposed stakeholders and their roles in research-for-development platforms in the Upper West Region, Ghana

Actor	Roles
Ministry of Food and Agriculture	<ul style="list-style-type: none"> • Backstopping at the district level • Coordinating agricultural activities • Providing extension services • Compiling reports • Planning
Council for Scientific and Industrial Research	<ul style="list-style-type: none"> • Research on new technologies • Supervision/coordinating district level research • Monitoring and evaluation
Rural banks (Sunzele or Nandom)	<ul style="list-style-type: none"> • Provide agricultural financing schemes • Fund nutritional plans for the district
Service providers	<ul style="list-style-type: none"> • Supply inputs to farmers • Provide services (ploughing and harrowing) • Aggregate agricultural inputs
Department of Cooperatives	<ul style="list-style-type: none"> • Facilitate development of farmer-based organizations • Build capacity of farmer-based organizations
Chiefs or opinion leaders	Endorse, communicate and facilitate community entry
Makazie or Queen	Leadership of women and women's group
Tindana or land-owners	Makes land available through the chiefs
Assembly men	Community mobilization
Ghana Education Services	Information dissemination through school children to parents
Ghana Health Services	Train mothers and farmers on nutrition and food processing, ante-natal clinics
Agricultural Extension Agents	Extension services to farmers, technical back-stopping, link farmers to input dealers
Livestock Officers	Disease surveillance, animal health care

Local radio stations and media	Information, education on agricultural activities to farmers
Community-based organizations	Build farmer capacity, link farmers to input dealers, disseminate information to farmers
Farmers' interest groups	Mobilize farmers, farmer-to-farmer dissemination of technologies, represent farmers

2.2 Integrated systems improvement (Research Output 2)

2.2.1 Raising and sustaining productivity in cereal-legume cropping systems in northern Ghana

2.2.1.1 Data analysis and publication of results from completed experiments

A data base of completed experiments was developed. Two-year data from SARI-led agronomic trials were analyzed. Papers are being drafted for publication in peer reviewed journals. Data from two IITA-led trials were analyzed.

In Ghana, maize is the major staple especially in the northern part where it is even replacing sorghum and millet which were the major staples some years ago. Application of blanket fertilizer recommendation together with improved varieties of maize has not given maximum yield. There is need for farmer participatory on-farm trials to refine fertilizer recommendation for improved maize varieties. In the first trial, grain yield of extra-early (80-85 days), early (85-100 days) and medium (100-110 days) maturing maize types were compared in a multi-location trial replicated in 10 communities in the UWR and NR and in five communities in the UER. A split-plot design with two fertilizer rates (government recommended and higher fertilizer rates) as main-plots and six maize varieties listed in Table 2 as sub-plots were used. The fertilizer rates were: 1) recommended fertilizer rate: NPK (15-15-15) compound fertilizer at 250kg/ha + top dressing sulphate of ammonia at 125kg/ha (64-38-38kg/ha); and 2) higher fertilizer rate: NPK (15-15-15) compound fertilizer at 250kg/ha + top dressing sulphate of ammonia at 250kg/ha (91-38-38kg/ha).

The fertilizer rate x variety interaction was not significant in all regions (Table 2). The main effect of fertilizer was significant in the NR and UER, whilst variety affected grain yield only in the NR. Averaged across varieties, the higher fertilizer rate increased grain yield by 6, 19 and 150 percent in the UWR, NR and UER respectively.

Cowpea grain yield on farmers' field is below 500kg/ha due to lack of improved cultivars, high incidence of diseases and pests, and inappropriate agronomic practices. Applying insecticides can control pests and increase grain and fodder yields. However, few farmers use insecticides because it is costly and excessive use can harm the environment. Quantitative data on the effects of insecticide spraying regime on grain yield of improved cowpea varieties from the 2012 cropping season is limited.

The second trial compared the effect of spraying regime on grain yield of newly released cowpea varieties in the NR, UER and UWR. A split-plot design was used with two spraying regimes as main-plots and six cowpea varieties as sub-plots (Table 3). Cymetox Super (a systemic and contact insecticide) with the formulation 30g of Cypermethrin and 250g of Dimethoate of active ingredient per litre was applied at the rate of 1.5l/ha. Cymetox was replaced with Lambda Super 2.5E.C (25g of Lambda-Cyhalothrin) during the third spray in the three spraying regimes to prevent insect getting immune to the first chemical.

The spraying regime rate x cowpea variety interaction was not significant in all regions (Table 3). The main effect of insecticide spraying significantly increased grain yield in the NR and UWR. Variety did not affect grain yield in all regions.

Table 2: Grain yield (kg/ha) of maize extra-early, early and medium maize varieties under recommended and higher nitrogen fertilizer rates in northern Ghana

Variety	Northern			Upper East			Upper West		
	¹ Rec.	² High	Mean	Rec.	High	Mean	Rec.	High	Mean
³ Abontem	2972	2906	2939	835	2881	1858	2037	2923	2480
³ TZEE W STR QPM CO	3106	3891	3499	918.5	3048	1983	2789	3006	2898
⁴ Abrohema	2516	3240	2878	1127	2756	1942	2789	2472	2631
⁴ Omankwa	2488	3056	2772	1169	2630	1900	3072	3073	3073
⁵ Obatanpa	2806	3524	3165	1336	2672	2004	2238	2822	2530
⁵ DT SR W CO F2	3456	4088	3772	1461	3131	2296	3056	2722	2889
Mean	2891	3451		1141	2853		2663	2836	
S.E	372.7			319.1			301.1		
<u>Probability of F-value</u>									
Fertilization (F)	*			**			ns		
Variety (V)	*			ns			ns		
F x V	Ns			ns			ns		

¹Government recommended fertilizer rate: 64-38-38kg/ha as N, P₂O₅ and K₂O.

²High fertilizer rate: 91-38-38kg/ha as N, P₂O₅ and K₂O.

³Extra-early maturing variety (80-85 days).

⁴Early maturing variety (85-100 days).

⁵Medium maturing variety (100-110 days).

ns=not significant; significant:*P<0.05, **P<0.01.

Table 3: Grain yield (kg/ha) of cowpea varieties under different spraying regimes in the northern Ghana

Variety	Northern Region			Upper East			Upper West		
	1-Spray ⁷	3-Sprays ⁸	Mean	1-Spray	3-Spray	Mean	1-Spray	3-Spray	Mean
Songotra ^{1,4}	874	1040	957	475	796	636	457	833	645
Apagbala ^{1,4}	736	949	843	1496	888	1192	425	580	503
Padituya ^{2,5}	751	1173	962	875	671	773	401	701	551
IT 99K 573-1-1 ^{2,5}	673	1170	922	650	1279	965	404	764	584
Zaayura ^{2,4}	943	1097	1020	800	625	713	531	984	758
Local Check ^{3,6}	660	1029	845	788	942	865	443	683	563
Mean	773	1076		847	867		443	758	
S.E	170.8			266.4			91.7		

Probability of F-value

Spraying(S)	*	ns	ns
Variety (V)	ns	ns	ns
S x V	ns	ns	ns

Maturity type: ¹Early maturing, ²Medium maturing and ³Late maturing

Growth habit: ⁴Erect, ⁵Semi-erect and ⁶Prostrate

⁷One insecticide spray at 50% flowering .

⁸Three insecticide sprays at 50% flowering, flower bud initiation and early podding .

ns=not significant; significant:*P<0.05.

2.2.1.2 Testing and disseminating improved cropping practices

IITA and partners used a 'Community-based Technology Park' (CTP) approach to address the key constraints to increased crop production on farmers' fields. A CTP is a community-based experimental station consisting of a series of replicated and un-replicated experiments ('Mother' trials) established and managed by researchers and farmers' groups in the community. The CTPs are used to: evaluate and demonstrate new technologies, provide hands-on training for farmers, facilitate knowledge flow among farmers, train undergraduate and graduate students, and to determine farmer preferences for technologies. About 150 experiments were established in CTPs in the three regions (Tables 4 and 5).

2.2.1.3 Biological control of aflatoxins in maize and groundnut with Aflasafe Ghanaian product GH01

Stakeholder workshops were held in three regions to raise awareness about the dangers of aflatoxin exposure and to sensitize and train farmers and extension officials on aflatoxin mitigation. Presentations were made on the basics of aflatoxin, its prevalence and the efforts to minimize aflatoxin contamination using aflasafe - a novel biocontrol technology for reducing aflatoxin contamination in the field, and on other good management practices that improve crop quality. A total of 129 farmers and extension agents were trained.

A total of 1.08t of aflasafe Ghana was produced for field application. It was composed of 360kg of three products: A (GHM174-1, GHG331-8, GHGo79-4 GHM109); B (GHM173-6, GHG083-4, GHM287-10 GHG183-7); and C (GHM017-6, GHM552-3, GHG321-2 GHM001-5). The products were evaluated for their ability to reduce aflatoxin in maize and groundnut.

Five maize and 5 groundnut fields ranging between 0.3-2.5 ha were selected from each of the two districts in the three regions for aflasafe application. A portion of the field was left untreated to serve as control. A total of 60 fields comprising 30 maize and 30 groundnut fields were treated with aflasafe.

2.2.2 Improving farm and field profitability in Mali

2.2.2.1 Farmers' feedback on 2013 trials

Feedback sessions were conducted with local stakeholders in five villages in Bougouni/Yanfolila area. The sessions focused on identifying sources of variability in yields in the different trials, and also served as the first step for planning trials in 2014, with farmers identifying priorities and topics they wished to investigate.

In Koutiala, feedback sessions including economic analysis were carried out at Ngolonianasso and M'pessoba villages where mechanized microdosing trials were conducted in 2013. The sessions included discussion on labor requirements for different technology options as well as economic cost/benefit analysis. The farmers appreciated the low additional labor and capital requirements of the micro-dosing treatments, and noted improved emergence and early plant vigor in treatments where mechanized micro-dosing was practiced.

Farmers were interested in continuing the trials begun in 2013, with some minor changes, particularly in sorghum variety. They request for early-maturing groundnut varieties and good agronomic practices for maize production, especially integrated soil fertility management options.

Feedback sessions were conducted with local stakeholders in five villages in Bougouni/Yanfolila area. The sessions focused on identifying sources of variability in yields in the different trials, and also served as the first step for planning trials in 2014, with farmers identifying priorities and topics they wished to investigate.

Table 4: List of trials in ‘Community-based Technology Parks’ in Africa RISING intervention communities in the Northern and Upper West Regions, Ghana, 2014 cropping season

		Savelugu district					Tolon and Kumbungu districts				
Region	Trial	Tibali	Duko	Botingli	Jana	Kpallung	Gbanjong	Tibogunayili	Tingoli	Kprim	
Northern	Maize-type response to nitrogen	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Insecticide spraying on cowpea	✓	✓		✓	✓					
	Soybean soil fertility	✓	✓	✓			✓	✓			
	Maize-eggplant intercrops	✓									
	Maize-roselle intercrops					✓				✓	
	Phosphorus effects on groundnut						✓	✓	✓		
	Maize-legume strip cropping		✓		✓			✓	✓		
	Maize-sesame intercrops		✓								
	Early soybean adaptation			✓							
	Medium soybean adaptation		✓								
	Ridge-type on cereals		✓				✓		✓		
	Maize-cowpea, soybean rotation			✓							
	Cowpea medium-adaptation					✓			✓		
	Maize-okra/pepper/tomato intercrop					✓	✓	✓		✓	
	Upper West		Nadowli district					Wa West			
		Gyilli	Papu	NatoD	Goli	Goriyiri	Siriyiri	Zanko	Guo	Nyali	Passe
Maize-type response to nitrogen		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Insecticide spraying on cowpea		✓	✓	✓	✓	✓			✓	✓	
Integrated soil fertility management-Soy						✓		✓			✓

Maize-eggplant intercrops									
Maize-roselle intercrops		✓						✓	
Phosphorus effects on groundnut	✓					✓	✓		✓
Maize-legume strip cropping			✓	✓		✓			✓
Maize-sesame intercrops		✓	✓			✓			
Early soybean adaptation							✓		
Medium soybean adaptation									✓
Ridge-type on cereals									
Maize-cowpea, soybean rotation				✓					✓
Cowpea medium-adaptation				✓				✓	
Maize-okra intercrop		✓				✓		✓	
Maize-pepper intercrop									
Maize-tomato intercrop									
Pigeon pea adaptation	✓		✓				✓		
Sesame- N and planting date effects		✓		✓				✓	✓

Table 5: Trials in ‘Community-based Technology Parks’ in Africa RISING intervention communities in the Upper East Region, Ghana, 2014 cropping season

Trial	Kassena-Nankana district				Bongo district
	Bonia	Nyangua	Gia	Tekuru	Samboligo
Maize-type response to nitrogen	✓	✓	✓	✓	✓
Insecticide spraying on cowpea	✓	✓			✓
Integrated soil fertility management-Soy	✓	✓			✓
Maize-eggplant intercrops	✓	✓			✓
Maize-roselle intercrops	✓	✓			✓
Phosphorus effects on groundnut	✓	✓			✓
Maize-legume strip cropping	✓		✓	✓	✓
Maize-sesame intercrops	✓	✓			✓
Early soybean adaptation					
Medium soybean adaptation	✓				
Ridge-type on cereals		✓	✓		✓
Maize-cowpea, soybean rotation	✓		✓	✓	✓
Cowpea medium-adaptation	✓				✓
Maize-okra intercrop	✓		✓		✓
Maize-pepper intercrop	✓	✓			✓
Maize-tomato intercrop					
Pigeon pea adaptation	✓				
Sesame- N and planting date effects	✓	✓			✓
Modeling maize production	✓				
Starter nitrogen and spraying on cowpea	✓	✓			
Zia and fertilizer micro-dosing on cereals	✓	✓	✓		✓
Okra variety adaptation	✓				
Roselle variety adaptation	✓				
Sheep-soil-crop interaction		✓	✓		✓

2.2.2.2 Intensifying productivity of cereal-legume based crop and crop-livestock systems

Several trials were established to sustain and intensify the cereal legume production systems in Mali during the reporting period. Table 6 presents trials established at Dieba, Flola, Madina, and Sibirila villages in Bougouni district. Table 7 summarizes activities on groundnut implemented in villages in Koutiala (M’Pèrèso, Banian, Try I, Finkolo and Sanakorobougou) and Sikasso (Dougoumousso, Zerelani, Natoumana, Tinzanadougou and Foh) in collaboration with two NGOs – CAAD and GRAADECOM.

2.2.2.3 Estimating efficiency of whole-farm systems and components

Calibration of the crop and soil model 'Field-scale Interactions, Use Efficiencies and Long-Term Soil Fertility Development (FIELD)' for Malian crop and soil conditions is ongoing. Livestock model 'LivSim' has been calibrated for the Koutiala area, and a paper on this calibration has been submitted for publication in the journal *Animal* (de Ridder et al.). Required data for modeling and for analysis of farm efficiency, profitability, and trade-offs was collected in the WUR-led farm characterization in 2013, and analysis of the data is in process.

A seminar was organized for Africa RISING partners and others at Samanko on September 2nd 2014. The half day seminar focused on farming systems analysis in Africa RISING program. Sixteen scientists from ICRISAT, WUR, and ILRI participated in the seminar. The following presentations were made:

- Farming systems analysis and few examples from Africa RISING Malawi by Katrien Descheemaeker
- Natural resources management by Birhanu Zemadim
- Farm characterization in Bougouni by Mary Ollenburger
- Participatory research on legume-cereal intercropping by Gatien Falconnier
- Integrating crop production and nutrition by Eva Weltzien

Table 6: Trials on cereal-legumes systems established at Dieba, Flola, Madina, and Sibirila, Bougouni district, Mali

Trial type	Design and treatments	Participating farmers		
		Female	Male	Total
Groundnut (Mother trial)	Randomized block design using five improved groundnut varieties with a farmers' variety as control.	2	2	4
Groundnut (Baby trial)	Randomized block design with two improved varieties with a farmers' variety as control.	19	2	21
Cowpea with neem-based insecticide	A 3 (cowpea varieties: Dunanfana, Wulibali and a farmers' variety as control) x 2 (spraying of neem-based pesticide and no-spraying) factorial treatment arrangement in a split-plot design. A neem-based insecticide was applied every seven days from floral initiation to harvest.	10	13	23
Sorghum/cowpea intercropping	Two cowpea varieties (local and fodder variety Dunanfana) intercropped with sorghum variety Soumalembe using two intercropping methods: an additive and a substitutive design.	2	9	11
Maize responses to chemical and organic fertilizer	Grain yield of maize variety Sotubaka was compared in a 3 (mineral fertilizer levels: 0, 50 and 100% of the recommended dose) x 2 (organic manure level: 0 and 6 t/ha) factorial treatment arrangements using a randomized block design.	2	19	21
Soya responses to inoculation and fertilizer	Grain yield of soybean variety Houla was compared under four treatments: farmer practice (no mineral fertilizer and rhizobium inoculum), inoculum, manure at 4 t/ha and inoculum and fertilizer.	6	7	13

Total	41	52	93
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Table 7: On-farm groundnut trials in Sikasso and Koutiala, Mali

Activity	Sikasso	Koutiala	Total
Participatory variety selection	20	5	25
Baby trials	120	25	145
Demonstrations	-	3	3
Seed multiplication	-	1	1
Farmer training	100	57	157

2.2.2.4 Testing options to improve cereal/legume-vegetable cropping systems in Mali

From 4-14 June 2014, AVRDC held planning workshops with farmers at five villages each in Bougouni/Yanfolila and Koutiala Districts. Ten farmers (households) from each of the 10 villages (making a total of 100 farmers) were selected to participate in the testing and diffusion of vegetable crops planted in association with either cereals or legumes. Two series of intercropping trials were carried out in the target villages. The first series tested maize in associations with okra, pepper and tomato using the following treatments: 1) 100% maize (M), 2) 100% vegetable (V), 3) 75% M + 25% V, 4) 50% M + 50% V, and 5) 25% M + 75% V, on plot area basis. Treatments for the second series of trials were: 100% groundnut (G), 2) 100% Sorrel (S), 3) 75% G + 25% S, 4) 50% G + 50% S, and 5) 25% G + 75% S, on plot area basis. A total of 105 trials were established in Bougouni/Yanfolila (54) and Koutiala (51) districts.

Twenty eight trials were established in Bougouni and 60 in Koutiala districts to compare two improved varieties each of okra, sorrel, tomato and pepper crops against a local check under two densities (recommended vs farmers' practices).

2.2.2.5 Develop agroforestry options for intensive fruit, vegetable and livestock fodder production in Mali

Activities consisted of monitoring fruit tree trials established in 2013 for intensive fruit production from four species (*Adansonia digitata*, *Tamarindus indica*, *Vitellaria paradoxa* and *Ziziphus mauritiana*), the establishment of garden plots for intensive leafy vegetable production from *Adansonia digitata* (baobab) and *Moringa oleifera* and the implementation of trial for improving soil fertility using fodder and fertilizer tree species.

Growth and fruit production of fruit tree species planted in 2013 in five villages (M'pessoba, Sirakele, Zanzoni, Sibirila and Yorobougoula) in Koutiala and Bougouni circles were monitored. About 25,000 plants were produced in the nursery, and a study on the effect of irrigation (irrigated, non-irrigated) and grafting (grafted, non-grafted) on the growth and fruit production of the four indigenous tree species initiated in Sibirila. The effect of three spacing (0.3m x 0.3m, 0.5m x 0.5m and 1m x 1m) on leafy vegetable production from *Adansonia digitata* and *Moringa oleifera* was started.

2.2.2.6 Intensifying livestock and poultry production in Ghana and Mali

In Ghana, data collection on performance and manure production of experimental animals on a long-term trial to study the effect of health and feed intervention on performance of rural sheep and goats continued in six intervention communities in Northern, Upper East and Upper West

Regions. Feed and fecal samples are being analyzed for nitrogen and phosphorus. On-farm studies were initiated to compare feed, health and management options to intensify pig and poultry production.

In Mali, an on-farm sheep fattening trial in Yorobougoula, Sibrila and Dieba villages was completed. Data is being processed.

2.2.2.7 Managing natural resources to increase productivity and reduce degradation in Ghana and Mali

Land, soil and water management strategies to intensify cereal-legume farming systems in Ghana: Ground truth data to complement land health assessments for the Northern, Upper East and Upper West Region were collected. In addition, data on farming systems such as distribution of food crops and land management practices which is helpful in linking land cover change to agricultural system productivity was collected.

Village-level biomass and pasture assessment and mapping of grazing itineraries in Mali: Herbaceous biomass in 24 sampling boxes in two villages was measured at five bimonthly time periods. Data on trees and shrubs (diameter at breast height, tree height, crown height and two crown diameters, as well as observations on foliage density and ground cover under the tree) were collected for all trees and shrubs within the same 24 sampling boxes. Herds for monitoring were selected using information collected from the detailed farm characterization. Five herds in Dieba and 5 in Sibrila will be monitored over a one-year period to record herd dynamics and movement. GPS collars were purchased for tracking of cattle.

Documentation and validation of existing local conventions and participatory conflict management in Mali: A draft report on the strength and weakness of the existing local conventions in six communities (Sirakele, Nampossela and Zanzoni) in Koutiala District; three communities (Dieba, Sibrila and Yorobougoula) in Bougouni/Yanfolila Districts was prepared. Chronogram of activities for the practical application of the results from the study on existing local conventions was developed in a planning meeting with AMEDD in Koutiala on 25 and 26 August, 2014. A survey on participatory conflict analysis in six villages was completed.

2.2.2.8 Improving household nutrition through agricultural and behavioral change in Ghana and Mali

Publish results of the nutrition baseline survey in Ghana: Data from the nutrition baseline survey was re-analyzed. Two papers were drafted for publication in international peer review journals. The 82-page report of the baseline household nutrition survey conducted in November 2013, was synthesized into a 37-page booklet which is under review.

Key findings from the re-analyzed data include the following:

- Of the 778 children aged 6-23 months, 57.3% met the minimum meal frequency, 61.8% received the minimum dietary diversity (≥ 4 food groups), and only 44.1% had received minimum acceptable diet.
- Multi variable logistic regression adjusted for cluster sampling showed that older children (12-23 months) were 13.9 times more likely [(AOR = 13.93, 95% CI (8.51-22.80), $p < 0.001$] to meet minimum dietary diversity compared to younger children (6-8 months).

- Children of older mothers (>35 years) were 5.1 times more likely to be fed on acceptable diversified meals [AOR 5.07; 95% CI (1.21-21.35), p<0.001] than their counterparts whose mothers were younger (under 18 years).
- Children from households that keep chickens, ducks, or other birds for the meat/sale were 2.1 times more likely [AOR 2.09; 95% CI (1.36-3.23), p<0.001] to meet minimum dietary diversity, compared to children from households that did not keep such birds.
- Children resident in the Upper East Region were 2.6 times more likely [AOR 2.64; 95% CI (1.63-4.26)], of being fed on more diversified diet, compared to children in the Northern Region.
- Children from households of higher socio-economic status were more likely [AOR 1.07; 95% CI (1.01-1.13)], to have been provided with the recommended dietary diversity, compared to children from lower socio-economic status.
- Of the 1,168 children aged 6-36 months, 67.9 % (CI: 64.5-71.1) were classified as positive deviant (PD). Multivariable logistic regression adjusted for cluster sampling showed that positive deviant children (that is, neither wasted nor stunted) were 1.9 times more likely to be female children [AOR 1.88; 95% CI (1.32-2.67)].
- Younger children (6-8 months) were 13.7 times more likely of being positive deviant children [AOR 13.66; 95% CI (5.51-33.90)], compared to children aged 24-36 months.
- Children who had no diarrhoea in the past two weeks prior to the study were 1.9 times more likely of being positive deviant [AOR 1.93; 95% CI (1.34 - 2.76)] compared to children who had diarrhoea in the last two weeks prior to study
- Children who were not breastfeeding were more likely to be positive nutritional deviants as compared to their counterparts who were breastfeeding [AOR 2.80; 95% CI (1.62-4.82)].
- Breast feeding children were at greater risk of being fed on sub-optimal complementary feeding regime and they were also less likely of being positive deviants.
- Provision of diversified diets to children 6-23 months was inadequate in Northern Ghana and children aged 6-8 months are at increased risk of poor infant feeding practices.
- Improving economic status of households, supporting households to keep chickens, ducks, or other birds for the meat/sale are important to improve diversity of diets.

Improve nutritional knowledge of women in Africa RISING intervention areas in Ghana:

Community level training to improve nutritional knowledge of women in Ghana was carried out in the Savelugu and Nadowli Districts. Forty community and health workers (CHWs), including members of women's groups in the intervention communities were trained in Infant and Young Child Feeding (IYCF) practices which included individual counseling and growth monitoring skills.

Review and document nutrition activities in Mali: ICRISAT with AMASSA and AMEDD organized feedback discussions with participants in the nutrition field schools during 2013, to evaluate procedures and topics chosen for discussion. The first set of discussions with village level trainers and participants in the respective clusters was held from 19-21 April. The results indicated that the recipes for improved children's porridge and new options for sauces with green leafy vegetables were being used regularly by participants. The discussions also revealed that beyond the planned feedback sessions in the individual clusters, the trainers as well as cluster participants conducted second tier feedback and training sessions with members of their households. This information suggests that households of the participants, instead of individual members of a household are being reached.

The second set of discussions involving health center staff as well as village representatives were held 29-30 May 2014. The discussions confirmed the interest of the stakeholders to continue the development and refinement of the curriculum and organizational options for implementing effective 'nutrition field schools'. In both villages, the teams agreed to focus on adapting the curriculum, such that during the rainy season the field school activities will focus on improving productivity of women's priority crops. The nutrition training will primarily be conducted during the dry season. This will ensure that the discussions will focus on issues and recipes that are important for the dry season, when different crops and fruits are available. This will ensure that the diversity of recipes used for the training will cover a wide range of situations.

The farmer field school (FFS) facilitator, hired by AMASSA, was trained in key elements for FFS activities focusing on groundnut and cowpea production. Each FFS session on crop cultivation was associated with a set of key nutrition messages, based on last years' topics, and on discussions and questions raised by participants.

2.3 Scaling and Delivery (Research Output 3)

2.3.1 Scaling-up sustainable cropping systems in Ghana

Farmers in all the three regions in Ghana established and managed a series of 'Baby' trials to compare component technologies from the 'Mother' trials in the CTP (Tables 4 and 5) with their practices under the leadership of Agricultural Extension Officers (AEAs) from MOFA in each district. In addition, farmer-managed large demonstration plots were established to scaling-up proven cereal-legume technologies, including cereal-legume rotation, cereal-legume strip cropping and cereal-legume inter-cropping. A total of 817 and 559 farmers established 'Baby' and 'Scaling-up' trials respectively during the cropping season (Table 8).

Table 8: Baby trials and demonstration plots established to scale-up technologies in the 2014 growing season in Ghana

Trials	Region			Total
	Northern	Upper East	Upper West	
Baby trials (15 x 15 m plots)	326	307	187	817
Demonstration plots	170	200	189	559
Total	496	507	376	1376

2.3.2 Africa RISING Large-Scale Diffusion of Technologies for Sorghum and Millet Systems in Mali (ARDT_SMS)

The ICRISAT-led ARDT_SMS project which focuses on diffusion of technologies of proven efficacy for enhancing sorghum and pearl millet production systems under the realities of Malian farmers' conditions (environmental, economical and social) was started in Mopti and Sikasso regions. This project complements and creates synergies through linkage with other projects that focus on sorghum and millet grain marketing and value chains, the strengthening sorghum and pearl millet seed producers organizations (FarmSEM), and the enhancement of farmer-learning and experimentation on systems levels (e.g. the research of the Africa RISING program).

The objectives of the project are to:

- Enhance male and female farmers' knowledge of new sorghum and millet production technologies in selected Feed the Future (FtF) communities of Mopti and Sikasso regions, Mali; and
- Facilitate male and female farmers' access to sorghum and pearl millet production technologies in order to strengthen the sorghum and millet value chains in the FTF target areas.

This Project builds on existing institutional capacities, bringing together many different partners to pursue technology diffusion through multiple, contrasting approaches to meet the needs and opportunities of men and women farmers who rely on production of sorghum, pearl millet, and associated crops for their livelihoods.

3. Capacity building and knowledge exchange

Individual and group trainings were integral part of the project activities during the reporting period. Seventeen graduate students jointly supervised by staff of Africa RISING and national or international universities were attached to the project for their dissertation research during the reporting period (Table 9).

Table 9: Graduate students attached to Africa RISING West Africa during the reporting period

Student	Sex	Country	University	Degree
Mary Awuni	Female	Ghana	University for Development Studies	MSc
Martha Agyri	Female	Ghana	Kwame Nkrumah University of Science and Technology	MSc
Shaibu Mellon	Male	Ghana	University for Development Studies	MSc
Daniel Apalibe	Male	Ghana	University for Development Studies	MSc
Joseph Clottey	Male	Ghana	University of Ghana	MSc
Emmanuel Gyakah	Male	Ghana	University of Ghana	MSc
Mohammed Shaibu	Male	Ghana	University of Ghana	MSc
Haruna Abdulai	Male	Ghana	Kwame Nkrumah University of Science and Technology	MSc
Richard Amponsah	Male	Ghana	Kwame Nkrumah University of Science and Technology	MSc
Raphael Azayiga	Male	Ghana	Kwame Nkrumah University of Science and Technology	PhD
Abdul R Nurudeen	Male	Ghana	Kwame Nkrumah University of Science and Technology	PhD
Sarfo K Goodman	Male	Ghana	Kwame Nkrumah University of Science and Technology	PhD
Solomon Konlan	Male	Ghana	University for Development Studies	PhD
Clarisse Umutoni	Female	Mali	Cheik Anta Diop University, Dakar, Senegal	PhD
Peter Agbetiamah	Male	Ghana	Kwame Nkrumah University of Science and Technology	PhD
Mary Ollenburger	Female	Mali	Wageningen University	PhD
Katja Kuivanen	Female	Ghana	Wageningen University	MSc

A short-term course on ‘Integrated Crop-Livestock Systems’ was organized for early career research scientists from Ghana during 21-25 July 2014 at Bolgatanga, Upper East Region, Ghana. The aim of the course was to introduce participants to the principles of integrated farming systems research and different types of integrated crop-livestock systems in the developing world. There were 15 participants (3 female and 12 male) from MoFA, Biotechnology and Nuclear Agriculture Research Institute (BNARI), University for Development Studies (UDS), Biodiversity Research Institute (BRI), KNUST, SARI and the IITA-Africa RISING project.

A second short-course on ‘Statistics and Statistical Computing Using SAS Software’ run by the IITA Biometric Unit was organized for early career scientists from Ghana and Mali from 4-8 August, 2014 at the in Ghana. The course aimed at teaching the participants how to use SAS statistical software to manage data management and to perform various statistics (e.g., data management, transformation, regression, ANOV, Multi-variate analysis, etc. Seventeen

scientists (8 female and 9 male) from 10 agencies in Ghana participated - Water Research Institutes (WRI), Soil Research Institute (SRI), MoFA, SARI, Animal Research Institute (ARI), KNUST, Valley View University (V VW), University for Education (UEW), Oil Palm Research Institute (OPRI), IITA-Africa RISING project. Two research assistants attached to the Africa RISING project in Mali lead by the International Crops Research Institute for the Semi-arid Tropics (ICRISAT) attended.



Photo 2: Participants at the short-course on '*Statistics and Statistical Computing Using SAS Software*' 4-8 August, 2014 at the Little Acre Hotel, Aburi, Ghana

4 Project implementation issues

The agricultural economist has come on board in May 2014. He is based in at the project office in Tamale, Ghana. He is spending 50% of his time on assignment in West Africa and 50% in East/Southern Africa.

The recruitment of a gender specialist is in progress. The staff is expected resume work in March 2015. The position will also be split between the two regional Africa RISING projects.

The expired Memorandum of Understanding with the ACDI/VOCA ADVANCE project has not yet been renewed.

Staff continuity in some partner organizations continues to be of concern. The new IWMI staff involved in Africa RISING resigned is leaving again after less than one year. There have also been changes in the lead scientist of AVRDC for Ghana and the nutritionist of ICRAF in Mali. The activities of the latter staff have now been commissioned to AVRDC. After the resignation of the IFPRI Regional M&E Officer in January 2014 a new staff was recruited in April but also left after a few weeks. The position is vacant since then.

Staff time allocation of several partner scientists to Africa RISING is insufficient because they are also involved in other projects of their institutions. In addition the amount of money disbursed to partner institution for example in Mali couldn't enable institutes to hire full time staff for the project, however efforts are going on to have shared time allocation with other bilateral and CRP programs.

Researchers of national institutions complain about delays in release of funds from their institutions despite IITA having disbursed the funds. We are working with institutions not individual scientists for sustainability and continuity. Therefore agreements cannot be signed with individuals and no funds can be disbursed directly to scientists. The partner institutions need to improve their internal procedures and transparency.

In some cases drop outs of farmers have been experienced which affected the set-up and/or completion of field trials.

In September, an IITA commissioned external review of the Africa RISING West Africa Project has started. The team of 3 reviewers interviewed in person or virtually relevant project implementers, partners, and stakeholders. Their report with the findings and recommendations is expected by mid of November 2014.

5 Africa RISING Large-Scale Diffusion of Technologies for Sorghum and Millet Systems in Mali (ARDT_SMS)

5.1 Status of Achieving Goals, Objectives and Benchmarks

5.1.1 Objective 1: Enhance male and female farmers' knowledge of new sorghum and millet production technologies in selected Feed the Future (FtF) communities of Mopti region, Mali

PLANNED ACTIVITIES	STATUS OF BENCHMARKS	Partner
Enhance farmers' knowledge and understanding for the appropriate use of new technologies through farmer field schools (with and without facilitated video viewing and field activities)	<p>This activity is detailed into:</p> <ul style="list-style-type: none"> - Training of farmer trainers (ToT) on the new technologies of millet and sorghum production and productivity - Restitution of training received to larger communities <p>This activity has started as scheduled from June and will continue through December 2014. Five (5) communes have been targeted in the circle of Djénne including the communes of Fakala, Madiama, Dandougou-Fakala, Nemabadenyakafo, Femaye. While the information is being disseminated about the integrated soil fertility management and the biological control of pests through the FFS, sites have been identified around the ToT plots to test the performance of non-hybrids and hybrid millet seeds "Toroniou" and "Synthetic 006". Trials are about intercropping improved varieties of millet and cowpea, planted using the techniques of micro-dose and the application of Apron Star 42ws which is a chemical seed treatment fungicide/insecticide for controlling downy mildew, damping-off diseases as well as for protection of seeds and seedlings against soil pests and early season pests in beans, sorghum and pearl millet. Farmers' associations in the localities of Fakala, Sio and Madiama have received training on the use of these techniques and technological package on 5 July 2014.</p>	Aga Khan Foundation
	<ul style="list-style-type: none"> - 18 demonstration plots installed in the 18 communes interventions with one (1) demonstration plot commune (100% of realization rate). - For the implementation of the project, five (5) communes by district have been chosen in the 	CRS in Mopti Region

PLANNED ACTIVITIES	STATUS OF BENCHMARKS	Partner
	<p>districts of Bankass, Koro, and Mopti.</p> <ul style="list-style-type: none"> - The district of Bandiagara circle has registered 3 communes because there are only 3 eligible. To be eligible, all target communes must be identified as FtF priority areas. - 152/180 diffusion/dissemination plots have been installed by the producer trainers for an 84% completion rate. - 1000 completed trainings of producer trainers targeted, including 30% female participation 	
	<ul style="list-style-type: none"> - 10 demonstration plots installed in the 10 communes interventions with one (1) demonstration plot commune (100% completion rate). - For the implementation of the project, five communes by circle have been chosen in the circles of Sikasso and Koutiala - 94/100 diffusion/dissemination plots have been installed by the producer trainers for a rate of 94% - 500 completed trainings of targeted producer trainers, including 30%female participation 	CRS in Sikasso region
Train extension workers on value of new technologies and enhance their capacity to advise farmers	<p>400 farmer trainers who will act as extension workers from the communes of Fakala, Sio, Madiama, Dandougou-Fakala, Nemabadeyakafo, Femaye have been identified to receive training on conducting the trials using Apron Star 42ws, micro-dose fertilization techniques, and the intercropping of pearl millet with cowpea. Since the planting season is right here, there is no more time left for a large-scale distribution of the Apron Star this year. However in order to prepare future growing seasons, AKF has agreed with ICRISAT to conduct pilot tests on demonstration plots in the selected communes within the circle of Djenné.</p> <p>Each demonstration strip measures 125 sqm (replications of 6 lines of 80 x 50). Trials are the selected seeds of hybrid /non-hybrid millet mixed to Apron Star and planted using the micro-dose fertilization techniques, and with cowpea intercropped. These strips receiving the technological package will be compared with the farmer's practice strip of similar size (check plots).</p> <p>The purpose of the demonstration of the non-hybrids (Toroniou and Synthetic 006) is for dissemination of these proven high-yield varieties. That explains why FFS are being extended to agro-dealers as well. For the hybrids (Toroniou and Synthetic 03-03), the objective is to test their performance in comparison with local standard varieties.</p>	Aga Khan Foundation

PLANNED ACTIVITIES	STATUS OF BENCHMARKS	Partner
Enhance farmers' knowledge of agricultural practices for integrated <i>Striga</i> and soil fertility management (ISSFM) and postharvest management	The Integrated Striga and Soil Fertility Management (ISSFM) have been introduced during the first gathering of the TOT of the FFS this June. The purpose was to introduce the cluster of farmers, the ICRISAT innovative modeling and participatory on-farm strategy of controlling striga weeds while enhancing soil fertility by combining agricultural and agro-forestry practices on millet and sorghum fields. The cluster-based FFS approach provides a platform for farmers, facilitators and scientists to exchange knowledge and develop practical ISSFM strategies, observe the efficacy of <i>Striga</i> control associated with agro-forestry practices such as alley-cropping and live fencing nitrogen-fixing tree species, and to evaluate the ISSFM strategy in agronomic and economic terms for small-scale farmers. The effective demonstration activities and the striga control hands-on training will take place late in the course of the cropping season.	Aga Khan Foundation
Training of agro dealers and farmers on technics for packaging, storage and marketing of seeds	<p>Preliminary meeting with Agro dealers and seeds producers</p> <p>MALIMARK organized from 11 to 14 June 2014 an assessment on the production and distribution of seeds millet/sorghum in the region of Sikasso. This assessment was prior to commencement of activities to be undertaken within the framework of the implementation of the project. The assessment was for agro-dealers and seed producers from following communes; Bougouni Zantiebougou, Sikasso, Farakala, Koutiala and Kapala.</p> <p>Before the mission, calls from different people helped to explain briefly what Malimark wanted to do as part of the project and the appointments were made to meet with representatives of agro dealers and seed producers. Leaders of the six municipalities covering agriculture sectors were also informed of the activities to be undertaken.</p> <p>In each commune, preliminary visits were made to the heads of agricultural sectors in order to inform them in detail of the project's activities and to inquire their support for the success of the activities to be performed. A total of 77 agro dealers and seed producers including 11 women were recorded in the various meetings.</p> <p>During the assessment, general findings were highlighted. Among them, the most relevant are the following;</p> <ol style="list-style-type: none"> 1. Several agro dealers do not have authorization issued by the National Department of Agriculture 	MALIMARK

PLANNED ACTIVITIES	STATUS OF BENCHMARKS	Partner
	<p>(NDA). In response, MALIMARK decided to liaise with the National Union of Agricultural Inputs dealers so they can dispose of approval annually at a cost of 5,000FCFA instead of 10,000FCFA under the cover of MALIMARK with the NDA.</p> <ol style="list-style-type: none"> There are very low trade relationship between the agro dealers and seed producers. For this reason, producers should be trained in packaging, storage and marketing of millet and sorghum seeds. This training will be delivered by MALIMARK. Most agro dealers and farmer cooperatives of millet and sorghum seed producers do not have access to the funding. To solve this issue, MALIMARK intends to put agro dealers and seeds producers of millet and sorghum in connection with a microfinance institution on one hand and with input suppliers on the other hand, mainly with the company that distributes the chemicals (apron star). Participants expressed the wish to receive training, especially in business management (and marketing) in the use of chemicals (Apron Star) on the fields and on seed. This training will be provided by MALIMARK. The seed producers of millet and sorghum raised the challenges to access to the basic seeds. Solutions will be discussed with ICRISAT in order to provide basic seeds to the producers. <p>Training course on the technics for using the APRON STAR From 8 to 10 July 2014, the agro dealers and seed producers of five communes in the region of Sikasso (Bougouni Zantiébougou Farakala, Sikasso and Koutiala) have been trained on the recognition and use of the product apron star. The training brought together 174 participants in total, including 42 women.</p>	
Organization of agri-shows with focus on inputs (fertilizers, plant protection and seed)	<p>Organization of agri-shows Organization of agri-shows has been organized in Koutiala on 3 July 2014. This show had the dual objectives of bringing agricultural input to the farmers in the area of Koutiala and to establish business relationships between suppliers and agro dealers.</p>	MALIMARK
Establishment of Farmer Field Schools	<p>Preparation and implementation of the fields by farmers The month of July was characterized by the establishment of Farmer Field Schools in 5 communes in the region of Sikasso namely, Bougouni, Zantiébougou, Farakala, Sikasso and Koutiala.</p>	

5.1.2 Staff recruitment

ICRISAT recruited the following staff for this project:

- Project Manager
- Project administrative assistant
- Two drivers
- Three research technicians (agronomy, entomology and pathology)

The following recruitments are in progress:

- Communication officer
- Senior Scientist in agronomy
- Senior Scientist in socio economics.