

# Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification



## Semi-Annual Performance Report FY 2016

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## Acronyms

Africa RISING – Africa Research in Sustainable Intensification for the Next Generation  
 AGRA – Alliance for a Green Revolution in Africa  
 ANCAR – Agence Nationale de Conseil Agricole et Rural  
 ASMC – Appropriate Scale Mechanization Consortium  
 CIAT – International Center for Tropical Agriculture  
 CIRAD - French Agricultural Research Centre for International Development  
 CNRA – Centre National de Recherches Agronomiques de Bambey  
 IITA – International Institute of Tropical Agriculture  
 ITA – Institut de Technologie Alimentaire  
 ITC – International Institute for Geo-Information Science and Earth Observation  
 IFPRI – International Food Policy Research Institute  
 ILRI – International Livestock Research Institute  
 ILSSI – Innovation Lab for Small Scale Irrigation  
 INERA - Institut de l'Environnement et Recherches Agricoles  
 IRRI – International Rice Research Institute  
 ISRA – Institut Senegalais de Recherches Agricoles  
 IWMI – International Water Management Institute  
 NGO – non-governmental organization  
 OMT – organic matter technologies  
 QED – Quantitative Engineering Design  
 RESOPP - Réseau des Organisations Paysannes et Pastorales du Senegal  
 SI – sustainable intensification  
 SIIL – Sustainable Intensification Innovation Lab  
 SIPS-NO - Sustainably Intensified Production Systems and Nutritional Outcomes  
 SOC – soil organic carbon  
 WAgN – Women in Agriculture Network

## I. Feed the Future Sustainable Intensification Innovation Lab

The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) is housed at Kansas State University in Manhattan, KS. The management entity was established in September 2014, and two staff additions were made in the first six months of FY 2016. Dr. Shahida Sarker Parul was named the new SIIL coordinator in Asia, with responsibilities in Bangladesh and Cambodia. Dr. Aliou Faye was also designated the Senegal country coordinator for the SIIL during FY 2016. A second search for the SIIL Associate Director began in February 2016, with final candidate interviews planned for April 2016. Additional activities pursued by the SIIL management entity in the first six months of FY 2016 included: 1) engagement with the USAID Mission in Cambodia regarding potential establishment of a Center of Excellence for Sustainable Agriculture and Nutrition; 2) conducting the first annual meeting for the SIIL, and 3) establishment of a nutritional framework for the SIIL program. These activities and several others will be described in detail in the SIIL FY 2016 Annual Report.

## II. Research Progress Summary

### A. Research progress made during the reporting period

During this reporting period, the SIIL management entity and its Geospatial and Farming Systems Research Consortium selected new research subawards to fund, which directly support the Innovation Lab's four objectives. The SIIL management entity awarded the Appropriate Scale Mechanization Consortium in October 2015 as well as six focus country subawards in December 2015. The research progress during this period was largely confined to planning meetings for each project and completion of subaward contracts at both the management entity and subaward institution level. Thus, much of this report describes the scope of recently selected subawards.

#### I. Objective 1: Use geospatial tools to identify SI needs, opportunities for intervention, scaling, and to assess impact.

During the first six months of FY 2016, the SIIL's Geospatial and Farming Systems Research Consortium initiated subaward contracts for research projects that support the first SIIL objective. Project titles include:

- Spatial Targeting Agricultural Sustainable Intensification Investments: Linking Household Surveys with Spatial Data in Africa (An Notenbaert, CIAT)
- Geospatial Data and Analysis Support to the SIIL Geospatial and Farming Systems Research Consortium (Jawoo Koo, IFPRI)
- Generating land cover land use database to support Geospatial and Farming Systems Research Consortium research activity in Bangladesh and Cambodia (William Wu, QED)
- Using micro-satellites to estimate maize yield in Tanzania (David Lobell, Stanford University)
- Towards standardization of farm household surveys: protocols and tools for data collection, analyses and visualization (Andy Nelson, ITC Geo-Informatie Wetenschappen en Aardobservatie, Netherlands)
- Generating cropland extent of Ethiopia by capturing field boundaries from high resolution imagery: Assessing crowdsourced approaches for accuracy, cost effectiveness and scalability (Tim Pagella and Mark van Wijk, ILRI)

#### 2. Objective 2: Improve nutrition using integrated and environmentally sustainable technologies (nutrition-sensitive agriculture).

In October 2015, the SIIL awarded the Appropriate Scale Mechanization Consortium to the University of Illinois at Urbana-Champaign, a \$4.7 million award over a four-year period (FY 2016 – FY 2019):

- i. Countries: Burkina Faso, Cambodia, Bangladesh, Ethiopia
- ii. PI: Alan Hansen, University of Illinois at Urbana-Champaign

- iii. Collaborating Institutions: Michigan State University, Kansas State University, North Carolina A&T State University, Bangladesh Agricultural University, Feed the Future Innovation Lab for the Reduction of Postharvest Loss, CIRAD, Horticulture Innovation Lab, Conservation Agriculture Service Center, Tillers International, Bahir Dar University (Ethiopia), Royal University of Agriculture in Cambodia, Bobo-Dioulasso Polytechnic University (Burkina Faso), and Innovation Lab for Small Scale Irrigation.
- iv. Project Summary: The Appropriate Scale Mechanization Consortium will introduce multifunctional and modular mechanized technologies that are technically, environmentally, and economically appropriate for use by smallholder farmers. The ASMC includes members with substantial institutional capacity and expertise, as well as active collaborations with institutions and entry point organizations in the project's four designated countries. To address the barriers to adoption, the ASMC will facilitate the creation of unique Appropriate-Scale Mechanization Innovation Hubs in each country that will identify specific needs, leverage ASMC resources, and implement innovative solutions to address current challenges for mechanization. Innovation Hubs will create an ecosystem of innovation by engaging various stakeholders in identifying needs, seeking solutions and resources, promoting/adopting/scaling technology and business development. To ensure long-term impacts, the Innovation Hubs will focus on capacity building efforts that span mechanization-specific training/educational programs and curricula development to extension activities targeting smallholder farmers and especially women farmers. The work in South Asia will focus on rice and vegetable value chains and the development of technologies and tools that can be used especially by women to sustainably intensify land preparation and water management, transplanting, cultivation and weeding, crop harvesting, handling and on-farm processing. The work in Ethiopia and Burkina Faso will develop and refine sustainable mechanization practices with draft animals and small 2-WD tractors with an emphasis on zone tillage, seeding, weeding, and shelling technologies for maize that will be readily transferrable to other cropping systems.

In December 2015, the SILL awarded six focus country research subawards, each valued at approximately \$1 million over a four-year period (FY 2016 – FY 2019). While focus country research subawards address multiple SILL objectives, they are included in this report under the most relevant objective.

- a. Evaluation of the Relationship Between Sustainably Intensified Production Systems and Nutritional Outcomes (SIPS-NO) *(also contributes to SILL Objective 3)*
  - i. Country: Ethiopia
  - ii. PJ: Neville Clarke, Texas A&M University
  - iii. Collaborating institutions: North Carolina A&T State University, Feed the Future Innovation Lab for Collaborative Research on Nutrition in Africa, Feed the Future Innovation Lab for Small Scale Irrigation, Bahir Dar University, International Water Management Institute (IWMI), International Food Policy Research Institute (IFPRI)
  - iv. Project summary: The project will evaluate the implications of sustainable intensification of crop and livestock production systems (SIPS) on human nutrition in northern Ethiopia. The existing infrastructure and ongoing research and development of the Innovation Lab for Small Scale Irrigation (ILSSI) in the Lake Tana basin of Northern Ethiopia will be used as a platform to efficiently conduct research to evaluate SIPS for crop and livestock production and their environmental, economic and nutritional consequences.

- b. Adoption of sustainable intensification in dual-purpose millet – leguminous crop – livestock systems to improve food and nutritional security and natural resources management for rural small holder farmers in Senegal (*also contributes to SILL Objectives 3 and 4*)
- i. Country: Senegal
  - ii. PI: Doohong Min, Kansas State University
  - iii. Collaborating institutions: Institut Senegalais de Recherches Agricoles (ISRA) – Centre National de Recherches Agronomiques de Bambey (CNRA/Bambey), University of Thies, Institut de Technologie Alimentaire (ITA), Agence Nationale de Conseil Agricole et Rural (ANCAR), and Réseau des Organisations Paysannes et Pastorales du Senegal (RESOPP)
  - iv. Project summary: The main objective of this project is to ensure food and nutritional security, establish resilient farming systems (via a holistic approach for rural small holder farmers, particularly women), and improve nutritional and socio-economic status in particular for women and children in Senegal. This will be achieved by using sustainably intensified production and management practices of dual-purpose millet and leguminous crops (cowpea and groundnut) with small ruminant livestock (i.e., goats, and sheep) integration. In Senegal, millet is primarily produced at the subsistence level, and hand-processed by women and girls. Cowpea and groundnuts are very important nitrogen fixing leguminous crops that can provide nitrogen to millets. These leguminous crops can also be used as fodder for livestock in Senegal. Thus, intercropping dual-purpose millets as grain and fodder into dual-purpose cowpea or groundnuts, as well as integrating these dual-purpose crops with livestock, will help improve: food security, human nutrition, crop diversity, livestock performance, soil quality (carbon sequestration) via nutrient recycling from animal manure/crop residue, biodiversity, small holder farmers' income (especially women), and further women's engagement in farming.
- c. Sustainable intensification through better integration of crop and livestock production systems for improved food security and environmental benefits in Sahelian zone of Burkina Faso (*also contributes to SILL Objectives 3 and 4*)
- i. Country: Burkina Faso
  - ii. PI: Augustine Ayantunde, International Livestock Research Institute (ILRI)
  - iii. Collaborating institutions: University of Wisconsin, Madison, ILRI-Kenya, International Union for Conservation of Nature, and Institut de l'Environnement et Recherches Agricoles (INERA)
  - iv. Project summary: The overall goal of this project is to improve household food production and nutrition and enhance ecosystem services through better integration of crop and livestock production systems in the Sahelian zone of Burkina Faso. The specific objectives are: 1. To increase crop and livestock integration in these mixed systems, through improved crop production (dual purpose sorghum and cowpea varieties), soil fertility (application of manure and inorganic fertilizer), water harvesting (zai and stone-bunding with vegetation strips) and livestock feed enhancing interventions (forage sorghum, dual purpose cowpea, efficient feeding systems). 2. To assess the economic, social, nutritional and environmental benefits and tradeoffs of the productivity enhancing interventions, and their potential for cost-efficient outscaling. 3. To build capacity of smallholder farmers and researchers on sustainable intensification and improved nutrition through multi-stakeholders' platforms and to provide platforms for co-learning. The main underlying hypothesis is that there is a great potential for the smallholder currently in crop-livestock systems to produce more per a given land area thereby improving productivity, food security and nutrition while preserving ecosystem services.
- d. Unlocking the production potential of "polder communities" in coastal Bangladesh through improved resource use efficiency and diversified cropping systems (*also contributes to SILL Objective 3*)
- i. Country: Bangladesh
  - ii. PI: Krishna Jagadish, Kansas State University

- iii. Collaborating institutions: International Rice Research Institute (IRRI) – Bangladesh, BRAC, and Khulna University
- iv. Project summary: The coastal region of Southern Bangladesh is home to some of the world's poorest, most food insecure, malnourished and socio-economically challenged people. Despite significant investment in development of the region, extremely low farm productivity is a persistent obstacle for improving the food and nutrition security and livelihoods of about one million farming families. The goal of this project is to increase farm income and nutrition security by intensifying polder farming systems through implementation of sustainable and economically viable practices. The main challenges encountered by polder communities for intensification of production systems are ineffective water management and inadequate drainage infrastructure. This has invariably resulted in the use of low yielding traditional rice varieties and minimal rabi (dry season) crop production. The proposed project aims to work with the farming community in a pilot sub-polder (~600 ha) to develop and adapt cropping system options for sustainable intensification, together with improved drainage management. The project will build on past achievements and proactively work with ongoing programs. Specifically, the project will advocate improved high yielding and stress tolerant rice varieties (including rice with high grain Zn), improve productivity of rice + fish cultivation and introduce high value rabi crops to significantly increase farm income and improve household nutrition. Further, new opportunities for income generation for farm women will arise by introducing new management technologies and rabi crops.

### 3. Objective 3: Identify enabling conditions and social networks to support and enhance SI.

- a. Raising crop response: bidirectional learning to catalyze sustainable intensification at multiple scales
  - i. Country: Tanzania
  - ii. PI: Sieg Snapp, Michigan State University
  - iii. Collaborating institutions: Sokoine University of Agriculture, CIAT, IITA, Wageningen University, and the Nelson Mandela African Institution of Science and Technology
  - iv. Project summary: The team is fully engaged with Africa RISING, CIAT, and AGRA efforts in Tanzania and ready to address five 'unknowns' that impede broad scaling-up of SI. First, the team is uncertain of what constitutes 'best practices' for organic matter technologies (OMT) such as push-pull, pigeonpea rotations, doubled up legumes, and manure over the range of micro-environments within which smallholder farmers operate. The proposed work will overcome these knowledge gaps. Second, this project proposes to measure on-farm nitrogen fixation of OMTs and test 'threshold levels' of soil organic carbon (SOC) and other aspects of soil quality below which crops respond poorly to inorganic fertilizer. Thirdly, knowledge is needed concerning effectiveness of novel approaches to outreach. Bidirectional learning supports an iterative process by which information providers (e.g., agrodealers, extension services and NGOs) and farmers fine-tune recommendations on OMT, seeds and fertilizers. The project will test if this bidirectional learning (linked to mini-packs of inputs) is an effective means to support limited-resource farmers, and particularly women, to adapt and adopt these technologies. Fourth, little is known about the effects of OMT/SI take-up on nutritional outcomes of children and women – effects that will be estimated in this project. Fifth, the project proposes to quantify system-wide barriers to OMT/SI and engage with the Tanzanian government to guide the design of policies and programs for supporting and scaling-up SI in maize and bean based systems of Tanzania.
- b. Women in Agriculture Network (WAgN) Cambodia: Gender- and Ecologically-Sensitive Agriculture (*also contributes to SILL Objectives 2 and 4*)
  - i. Country: Cambodia
  - ii. PI: Ricky Bates, Penn State University



- iii. Collaborating institutions: University of Tennessee Institute of Agriculture, Agricultural Development Denmark Asia, World Vegetable Center, ECHO Asia, Kasetsart University, Royal University of Agriculture, Conservation Agriculture Service Center, and University of Battambang
- iv. Project summary: The project will empower women and improve nutrition by promoting women's participation in the value chains for horticultural crops and rice produced via sustainable intensification (SI) practices. The overarching goal of the project is to provide a scientifically rigorous and comprehensive understanding of the nexus of gender and SI. The project aspires to improve the socio-economic and nutritional status of women and their families as well as identify, develop and strengthen existing and potential SI technologies, practices and policies that promote production of nutritious and marketable food while protecting agro-ecological resources. The project will pursue three major objectives. First, to identify and promote adoption of gender-sensitive SI technologies and practices in rice and horticulture value chains, targeted to improve ecological resilience as well as the nutritional status and income for poor households. Second, to identify and foster enabling conditions and social networks for women to fully participate in the local, regional and international value chains for horticultural and rice-based foods produced via SI. And finally, to build capacity in local agricultural institutions, NGOs, and international universities and research institutes, and to scale up and out innovations in gender and ecologically sensitive SI.

#### 4. **Objective 4: Develop platforms for communication, knowledge sharing, and capacity-building.**

As shown above, several of the SILL subawards contribute to the fourth SILL objective. Apart from the recently awarded projects, one of the existing SILL subawards to Michigan State University and Columbia University, 'Developing Indicators for Sustainable Intensification', has made progress in its development of the sustainable intensification indicator framework. The framework development was accomplished by visiting key SI research locations, interviewing researchers, and collecting protocols for data collection in Mali, Ethiopia, and Rwanda. The project leaders presented the drafted framework at the SILL annual meeting and at the Tanzania subaward launch meeting, and these recent SILL subawards are beginning to utilize the indicators as the framework is in the last stages of being finalized.

The SILL management entity also aims to directly contribute to Objective 4. During this reporting period, the management entity initiated contact with the ILRI's communications and knowledge management team to explore potential alignment or overlap with Africa RISING's communication and knowledge management strategy. The SILL will continue to explore such collaborations that expand the influence of the Innovation Lab and the SI community as a whole. A communications and knowledge sharing and management strategy will be finalized in FY 2016.

#### **B. Issues or concerns encountered during the reporting period**

There were no serious concerns during the reporting period. There was a slight (3 month) delay in the initiation of the research subawards due to overwhelming response for our call which took longer time to review concept notes and full proposals. This delay can potentially impact our budget pipeline, corrective measures are currently being taken with discussion with our AOR from USAID.

### **III. Human and Institutional Capacity Development**

#### **A. Long-term training**

Under the Senegal research subaward, led by Doohong Min at Kansas State University, one long-term trainee began her PhD program in the first six months of FY 2016. Awa Faye is studying at Cheikh Anta Diop University and the Institut de Recherche pour le Développement (IRD).