

# Innovative Agricultural Research Initiative (iAGRI) Final Report



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**Cover Page Photo Captions:** (Clockwise from top left) – 1). Tractor-training event at Sokoine University of Agriculture (SUA) through the Innovational Portfolio; 2). Participants during hydrological modeling workshop at SUA in November 2016; 3). iAGRI student, Stanslaus Materu, discusses his field research on water management in rice production; 4). Glory Mhalu, iAGRI student during Cohort II, who researched the effect of orange fleshed sweet potatoes on Vitamin A status in children.

# List of Acronyms

AWARD	African Women in Agricultural Research and Development
CARI	Chollima Agricultural Research Institute
CICT	Center for Information Communication and Technology
CSU	Classroom Services Unit
DAECD	Department of Agricultural Extension and Community Development
ELRC	English Learning Resource Center
FtF	Feed the Future
GoT	Government of Tanzania
GRE	Graduate Record Exam
GTA	Graduate Teaching Assistant
HDF	Horticulture Demonstration Facility
HICD	Human and Institutional Capacity Development
iAGRI	Innovative Agricultural Research Initiative
ICD	Institutional Capacity Development
IGU	Income Generating Unit
IP	Innovation Portfolio
IRR	Internal Rate of Return
LGU	Land Grant University
LIBHUB	Library Management Software System LOP
MALF	Ministry of Agriculture, Livestock and Fisheries <sup>1</sup>
MATI	Ministry of Agriculture Training Institute
M&E	Monitoring and Evaluation
MLND	Maize Lethal Necrosis Disease
MoU	Memorandum of Understanding
NAIVS	National Agricultural Input Voucher System
NBS	National Bureau of Statistics
NGO	Non-Governmental Organization
NMB	National Microfinance Bank
NORAD	Norwegian Agricultural Development Agency
OIES	Organizational Experiment Indicator Scale
OSUC	Ohio State University Consortium
PAU	Punjab Agricultural University
PMP	Performance Management Plan
PMU	Program Management Unit (of iAGRI in Tanzania)
PPP	Public-Private Partnership
QAPB	Quality Assurance Promotion Bureau
ROI	Return on investment
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SERA	Enabling Policy Environment for Agricultural Sector Growth Project
SME	Small Medium Enterprise
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for the Social Sciences
SUA	Sokoine University of Agriculture
SUALISA	Sokoine University of Agriculture Laboratory for Interdisciplinary Statistical Analysis
SUGECO	Sokoine University Graduate Entrepreneurs Cooperative
TAHA	Tanzania Horticulture Association
TAPP	Tanzania Agricultural Productivity Program
TOEFL	Test of English as a Foreign Language
UN/FAO	United Nations/Food & Agricultural Organization

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<sup>1</sup> Formerly, Ministry of Agriculture, Food Security and Cooperatives (MAFC).

# 1. INTRODUCTION

This is the final report of the Innovative Agricultural Research Initiative (iAGRI), a six-year project in Tanzania funded by USAID under its Feed the Future Initiative.

## 1.1 Program Description

The Innovative Agricultural Research Initiative (iAGRI) was a six-year investment in human and institutional capacity development (HICD) to improve food security in Tanzania. From 2011 to 2017, iAGRI provided graduate-degree training to 135 Tanzanians to prepare them to be agricultural scientists, teachers, farmers, entrepreneurs, and agribusiness managers. The project sponsored agricultural and nutrition research carried out by teams of Tanzanian and American scientists. iAGRI also helped transform agricultural and nutrition teaching, research, and outreach programs of Tanzania's major agricultural university, Sokoine University of Agriculture, to better address the present and emerging needs of Tanzanian's employers, farmers, agribusinesses, and consumers. The plans and activities of iAGRI were based on dynamic organizational-learning theory implemented through sustained conversation, creation of shared understanding, experimentation with incremental change, and ultimately, transformation of individual mindsets and organizational strategies, structures, and systems.

The primary counterpart organizations in Tanzania were Sokoine University of Agriculture (SUA) and the Ministry of Agriculture, Livestock and Fisheries (MALF). Staff members from both SUA and MALF participated in the training and research activities of iAGRI. The project also engaged other government ministries, local government authorities, NGOs, and companies.

The iAGRI project was part of USAID's Feed the Future (FtF) initiative in Tanzania. The prime contractor was The Ohio State University. It assembled a consortium that included five other U.S. land-grant universities to provide graduate training programs, academic advisors, and technical assistance personnel for iAGRI.

**Table 1: iAGRI Program Profile**

<b>Program Name:</b>	Innovative Agricultural Research Initiative (iAGRI)
<b>Activity Start and End Dates:</b>	March 1, 2011 – August 27, 2017
<b>Prime Implementing Partner:</b>	Ohio State University (OSU), Office of International Programs in Agriculture
<b>Ohio State University Consortium Universities:</b>	Ohio State University, Michigan State University, Virginia Tech, Tuskegee University, University of Florida, Iowa State University
<b>Agreement Number:</b>	621-A-00-11-000090-00
<b>Agreement Type:</b>	Cooperative agreement
<b>Counterpart Organizations in Tanzania:</b>	Sokoine University of Agriculture (SUA) Ministry of Agriculture, Livestock and Fisheries (MALF)
<b>Geographic Coverage:</b>	Tanzania
<b>Amount Awarded and Spent:</b>	\$25.5 million





Degree Training



Collaborative Research



Institutional Capacity Building



Global Linkages

## 1.2 Project Objectives

The goal of iAGRI was to improve food security. To this end, USAID designated four objectives in a Request for Application (RFA) issued in December 2010 and further developed in a proposal submitted by The Ohio State University in January 2011. The RFA and the project proposal identified four primary objectives:

- **Degree training** - provide graduate degree training in agriculture and nutrition for Tanzanian scholars;
- **Collaborative research** - establish a program of collaborative research on agriculture and nutrition to be conducted by teams of Tanzanian and U.S. scientists;
- **Institutional capacity building** - strengthen the teaching, research, and outreach capacity of Sokoine University of Agriculture (SUA); and
- **Global linkages** - promote cooperation between SUA, U.S. universities, and Global South universities.

## 1.3 Balancing Intermediate and Long-term Results

The full effect of iAGRI on Tanzania's food security is the sum of the intermediate and the long-term results, though only the intermediate results can be measured precisely today. Generating intermediate results was given high priority by the iAGRI team as was investing in transformative strategies, structures, and systems intended to endure beyond the life of the project. The iAGRI team sought to balance intermediate results with long-term results. Out of the inevitable tension between intermediate and long-run imperatives, the team developed a distinctive "iAGRI model", informed both by the realities of contemporary African agricultural systems and by theories and practices of transformative organizational change borrowed from global academic and business communities.

## 1.4 Overview of Activities

The activities of iAGRI follow from the aforementioned project objectives. This section presents a brief overview. Details on the nature, scope, and modalities of iAGRI's activities are provided in subsequent sections of this report.

**Training** – iAGRI undertook two types of training: long-term degree training and short-term training. Both were intended to address gaps in agricultural and nutrition knowledge and skills but they differed in length and venue of the training.

- Degree training – the degree training activities of iAGRI were intended to increase the number of agricultural and nutrition scientists, teachers, managers, and entrepreneurs in Tanzania. iAGRI implemented a degree training program involving recruitment, application and placements at universities, pre-departure orientation, classroom studies, research proposal writing, field research,

data analysis, thesis/dissertation preparation, final examination, and graduation. Training applicants were recruited from SUA, MALF, local governments, government institutes, NGO, and companies. The selected trainees pursued Masters and PhD degrees in twelve subject matter areas related to agriculture and nutrition. Approximately half the trainees studied at Ohio State University Consortium (OSUC) member institutions in the U.S. while the other half studied at universities in Africa and India. For details on degree training activities, see Section 3.1.1.

- **Short-term training** – short courses sponsored by iAGRI targeted specific knowledge and skill gaps in agriculture and nutrition. Relevant topics were identified through needs assessment surveys. The training courses were taught by subject matter specialists from the U.S., Tanzania, and other African countries. Some courses were aimed at academic staff members and graduate students at SUA while others were aimed at farmers and agribusinesses. For details on short-term training see Section 3.1.2.

**Collaborative Research** –research activities sponsored by iAGRI addressed knowledge and technology gaps identified through a rigorous scan of past research and assessment of current needs in agriculture and nutrition in Tanzania. Eight broad areas of need for research were identified. A total of eleven research proposals were funded in two rounds of proposal elicitation. The research was carried out by teams of Tanzanian scientists from SUA and MALF and U.S. researchers from the OSUC member universities. The research results targeted producers, processors, consumers, and other actors engaged in efforts to improve food security. For details on collaborative research, see Section 3.2.1.



**Institutional Capacity Development** – the Request for Application (RFA) issued by USAID in 2010 called for “strengthening the institutional capacity of SUA to provide world class degree training in agriculture.” The RFA also called for “introducing institutional innovations”. At the beginning of iAGRI, SUA had weak leadership at all levels, weak planning and implementation of strategies for growth and quality improvement, outdated organizational structures and systems, few active linkages with external stakeholders (especially the private sector), and widespread internal pessimism about the ability of the institution to change. To strengthen SUA as an institution, iAGRI undertook four types of activities.

- **Organizational experiments** – as an initial step in institutional capacity development, iAGRI assisted persons through SUA to launch a series of organizational experiments each focused on a particular organizational problem to be tackled by ad-hoc groups of interested SUA employees, primarily faculty members, in search of a solution that could be implemented initially at a small scale. In addition to serving as laboratories for organizational learning and problem solving, these exploratory and experimental activities were a vehicle for iAGRI to identify and mentor change agents at various administrative levels within SUA. The experiments were also intended to create “early wins” within the project life of iAGRI and to alter mindsets of members of the SUA community about the benefits of investing time and effort in institutional improvement. The iAGRI team developed a multi-part indicator for guiding the organizational experiments to maximize the potential for making lasting changes. For details on the organizational experiments, see Section 3.3.1.

- **Study tours** – the small-scale organizational experiments revealed various structural and systemic gaps at SUA that required a higher-level vision before they could be tackled. iAGRI sought to impart the needed vision and to create a desire for large-scale transformation by sponsoring study tours to several Kenya universities that had successfully undertaken major organizational transformation initiatives in recent years. Study tours were also undertaken to universities in Ghana, South Africa, and Uganda. The purpose of the study tours was to enable SUA’s leaders to see first-hand how other university leaders in the region were overcoming institutional challenges and constraints similar to the ones in Tanzania. Details on the study tours are provided in Sections 3.3.1 and 3.3.2.
- **Innovation Portfolio** – to create impetus for internal change in research and teaching at SUA, iAGRI set out to help the University increase and strengthen its interactions with external actors in the private and public sectors through the nurturing of marketable agricultural and nutrition innovations. Student and faculty innovators were identified and supported to go beyond the conventional end-product of academic research to design and test technological solutions for which companies, agencies, and NGOs would be willing to pay. In addition to supporting innovators as individuals or groups, iAGRI helped SUA transform its technology transfer office, which previously focused mainly on patents, to a more comprehensive directorate aimed at building external linkages and commercializing intellectual property. For details on the Innovation Portfolio, see Section 3.3.4.
- **Transformation of strategies, structures, and systems** – it was the intention of iAGRI that the organizational experiments, study tours, and Innovation Portfolio would foster an organizational environment at SUA in which an internal push for larger and deeper institutional transformation would emerge. This anticipated outcome began to occur in the fourth and fifth years of the project when a previously stalled effort by SUA to create a more modern and efficient organizational structure moved forward with iAGRI’s assistance. Nurtured by the project, SUA developed and approved a decentralized organizational structure aimed at reducing bureaucratic bottlenecks at the top. With the counsel of iAGRI, SUA leaders decided to scrap their existing 10-year strategic plan, which had never been implemented, and created a new strategic plan that, for the first time, was demand-driven and realistic in its targets. For details on transformation of strategies, structures, and systems, see Section 3.3.2 and 3.3.3.

**Global Linkages** – activities were implemented to strengthen the institutional capacity of SUA by promoting and expanding cooperation between SUA, U.S. universities and Global South universities. These activities included the placement of Tanzanian graduate students at universities in the U.S., eastern and southern Africa, and India; sponsoring student participation in regional conferences; hosting international conferences at SUA; and supporting SUA administrative visits to other universities in the region.



*During Year 1, iAGRI conducted a needs assessment to identify activities to be undertaken to meet project objectives. Private firms, farmer groups, SUA officials, MALF officials, other government agencies, and NGOs were consulted. Here the Needs Assessment Team meets with MALF officials in Dar es Salaam to discuss the training and research priorities of the Ministry.*



## 1.5 Monitoring and Evaluation

The aim of iAGRI's monitoring and evaluation (M&E) unit was to set targets for intermediate results, to collect information to track progress, to compare what was achieved with what was planned, and to assess the project impact. The unit provided feedback for management of the project's activities to ensure that objectives and targets were met. Operationally, the M&E function consisted of the following processes: (i) preparation of a Performance Management Plan (PMP), (ii) preparation of data collection forms, (iii) collection and storage of relevant data that met data quality standards, and (iv) data analysis and reporting.

**Performance Management Plan (PMP)** – Ohio State University and Virginia Tech prepared a PMP for the period FY2011 to FY2016 presenting the results framework through which iAGRI would strive to achieve its objectives. The results framework showed the indicators as well as the nature, type and frequency of collection, and baseline data that would need to be collected to gauge project performance. For each indicator, life-of-project (LOP) targets and annual targets were indicated. Each indicator was described and defined to identify the relevant data for the indicator. Definitions of the various iAGRI indicators were based on the Feed the Future Indicator Handbook Definition Sheets of October 3, 2011 and subsequently updated in April 2012, September 2013, October 2014 and June 2016.

**Data collection instruments** - data collection instruments were designed to collect valid and reliable indicator data from primary sources. The instruments included training registers for degree training, participant registers for short term training, field visit forms used to verify results, documents to list MoUs, and quarterly performance forms for each indicator. PMU staff reported on performance of the program activities they supervised.

**Data collection and storage** - data were collected by the M&E Specialist and associated staff members. The M&E Specialist held data collection planning sessions with all other staff members who were responsible for data collection. At these sessions, the M&E Specialist explained the data collection process and discussed the purpose and content of the forms with staff members. These discussions were designed to ensure that data quality standards would be met. Data provided by staff were handed over to the M&E Specialist for review and correction if needed. Hard copies were filed and subsequently used to prepare quarterly, yearly, and LOP reports. Performance data for indicators that USAID monitors globally were entered into the online Feed the Future Monitoring System. Quarterly performance data for other indicators were entered into the Implementing Partners Monitoring System until discontinued by USAID in 2013.

**Data analysis and reporting** – performance data were presented in quarterly and annual reports. When quarterly targets were not met, projected targets for subsequent quarters were increased accordingly. Thus, LOP targets were maintained. In a few cases, LOP targets were adjusted based on the internal deliberation of the iAGRI team as it gained a better understanding of the context in which the project operated.



## 2. PROJECT OUTCOMES MEASURED BY FORMAL INDICATORS OF INTERMEDIATE RESULTS

### 2.1 Categories of Indicators

Throughout the life of the project, iAGRI's intermediate results were measured using indicators of two types: Feed the Future indicators developed by USAID and custom indicators developed by iAGRI.

#### 2.1.1 Feed the Future Indicators

Intermediate results of iAGRI's activities were measured by five indicators selected from the Feed the Future Indicator Handbook, according to the Performance Management Plan prepared by iAGRI in Project Year 1 and amended in subsequent years. These indicators are in the categories of Improved Agricultural Productivity (IR 1) and Investment in Agriculture and Nutrition (IR 3) in the Intermediate Result (IR) framework of Feed the Future. As shown in the table below, **iAGRI met or exceeded its targets for all FtF indicators** by the end of the project (FY 2017 PMP Indicator Progress: see Annex I).

**Table 2: Feed the Future Intermediate Results Indicators**

Indicator	Base-line	LOP Target	Achieved	Achieved as % of Target
<b>IR 1 – Improved Agricultural Productivity</b>				
Sub IR 1.1 - Human Capacity Development				
Number of individuals who have received USG-supported degree-granting agricultural sector productivity or food security training	0	135	139	103%
Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training	0	450	917	204%
Sub IR 1.2 - Research and Technology Transfer				
Number of technologies or management practices under research, under field testing, or made available for transfer as a result of USG assistance	0	42	107	255%
Phase I: under research as a result of USG assistance	0	23	92	400%
Phase II: under field testing as a result of USG assistance	0	17	13	76%
Phase III: made available for transfer as a result of USG assistance	0	2	2	100%
<b>IR 3 – Investment in Agriculture and Nutrition</b>				
Sub IR 3.1 – Private Sector Linkages				
Number of public-private partnerships formed as a result of USG assistance	0	8	12	150%
Value of new private sector capital investment in the agriculture sector or food chain leveraged by Feed the Future implementation	0	\$80,000	\$83,250	104%

## 2.1.2 Custom Indicators

USAID Tanzania encouraged its Implementing Partners to supplement the FtF indicators with custom indicators to measure results of project-specific activities. Intermediate results for nine custom indicators developed by iAGRI are presented in the table below. The custom indicators are in the categories of Improved Agricultural Productivity (IR 1), Investment in Agriculture and Nutrition (IR 3), and Enabling Policy Environment (IR 8). In addition, custom indicators were developed to measure performance of Cross-Cutting activities (gender and climate change). Scrutiny of the table below reveals that **iAGRI met or exceeded targets for all but one of its custom indicators** (See Section 3.3, Institutional Capacity Building Activities, pages 22-40; and Section 4, Project Impacts and Sustainability, pages 40-45, for more detail on these activities).

**Table 3: Custom Intermediate Results Indicators**

Indicator	Base-line	LOP Target	Achieved	Achieved as % of Target
<b>IR 1 – Improved Agricultural Productivity</b>				
Number of researchers trained on Randomized Controlled Trials (RCTs)	0	35	44	126%
<b>IR 3 – Investment in Agriculture and Nutrition</b>				
Sub IR 3.3 – Knowledge and External Ideas				
Number of organizational experiments developed and carried out as a result of USG assistance	0	10	15	160%
Number of people participating in study tours as a result of USG assistance	0	18	72	400%
<b>IR 8 – Enabling Policy Environment</b>				
Sub IR 8.1 – Policy research and Analysis				
Number of policy issues in agriculture, natural resources and environment, climate change and nutrition researched and analyzed as a result of USG assistance	0	12	12	100%
Sub IR 8.2 – Policy Dialogue				
Number of USG-supported policy dialogue events held that are related to improving the enabling environment for agriculture and nutrition	0	15	5	33%
<b>Cross-Cutting Issues</b>				
Gender				
Number of USG-sponsored research projects which focus specifically on gender	0	9	9	100%
Number of high school girls provided with career guidance through USG assistance	0	4150	5295	128%
Number of actions supportive of gender mainstreaming at Sokoine University of Agriculture as a result of USG assistance	0	20	23	115%
Climate Change				
Number of USG-supported research projects that address issues of climate change	0	14	17	121%

## 2.2 Improved Agricultural Productivity (IR 1)

The FtF and custom indicators under IR 1 are divided into two categories. The first deals with human and institutional capacity building while the second deals with research and technology transfer.

## 2.2.1 Human and Institutional Capacity Building (Sub IR 1.1)

**FtF Indicator:** *Number of individuals who have received USG-supported degree-granting agricultural sector productivity or food security training.* In the original cooperative agreement, the degree training target was 120 students. In June 2014, Modification 4 to the original cooperative agreement increased funding partially for an additional 15 students to receive degree training. This increased the LOP target for degree training to 135 students. In total, 139 degree trainees were achieved resulting in 103% of the LOP target.

**FtF Indicator:** *Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training.* iAGRI provided short-term training events for 917 individuals, achieving 204% of the goal of training 450 individuals. The training was provided through 25 short courses and workshops.

**iAGRI Custom Indicator:** A target was set to train 35 researchers in the methodology of randomized controlled trials, a rigorous approach used worldwide to evaluate project and program outcomes. Forty-four researchers were trained, which is 126% of the target.

## 2.2.2 Research and Technology Transfer (Sub IR 1.2)

**FtF Indicator:** *Number of technologies or management practices under research, under field testing, or made available for transfer as a result of USG assistance.* For this indicator, iAGRI set a target of developing 42 new technologies or management practices but achieved 107, which is 255% of the target. Faculty and student researchers developed the technologies and management practices through degree training, collaborative research, and Innovation Portfolio activities. Of this number 92 were under research, exceeding the target of 23 for this phase by 400%. The target for field testing technologies or management practices was set at 17 and 13 were achieved (76%). Major impediments were lack of funding and interest on the part of the researchers in moving the research into this phase. Two technologies/management practices were made available for transfer by the end of the project, representing an achievement of 100% for this phase.

## 2.3 Investment in Agriculture and Nutrition (IR 3)

iAGRI generated investments in agriculture and nutrition through the nurturing of linkages with the private sector, through organizational experiments, and through study tours that resulted in the acquisition of human capital in the form of knowledge and ideas.

### 2.3.1 Private Sector Linkages (Sub IR 3.1)

**FtF Indicator:** *Number of public-private partnerships formed as a result of USG assistance.* The project set a target of eight public-private partnerships but actually achieved 10 partnerships with international companies, Tanzanian companies, international NGOs, and Tanzanian NGOs. The partnerships were undertaken in an effort to link SUA to the private sector and became the basis for activities related to research, training, and extension. The list below shows the organizations with which Memoranda of Understanding (MOUs) were created through the initiative of iAGRI (See pages 38-40 for details):

- John Deere Limited and Lonagro Limited (international companies)
- MORAGG Co. Limited and Afrivet Business Management PVT Limited (international companies)
- Banana Investment Limited (Tanzanian company)
- SUGECO (Tanzanian cooperative)



- Tanzanian Horticultural Association (Tanzanian NGO)
- COUNSENUH (Tanzanian NGO)
- Catholic Relief Services (international NGO)
- World Vision (international NGO)
- MEDA (international NGO)
- Farmer-to-Farmer East Africa (international development project)

### 2.3.2 Knowledge and Ideas Generated through Organizational Experiments

**iAGRI Custom Indicator:** *Number of organizational experiments developed and carried out as a result of USG assistance.* iAGRI set a target of 10 organizational experiments to be carried out by SUA to ensure that institutional capacity building activities were well adapted to local needs and circumstances. The actual number achieved was 16 organizational experiments (See Table 7, page 25).

### 2.3.3 Knowledge and Ideas Acquired through Study Tours (Sub IR 3.3)

**iAGRI Custom Indicator:** *Number of people participating in study tours as a result of USG assistance.* A target was set early in the project for 18 persons to participate in study tours. However, the first several study tours were so effective in changing mindsets of the tour participants that the project ultimately sponsored 72 persons to participate in tours.

## 2.4 Enabling Policy Environment (IR 8)

To facilitate an improved policy environment for agriculture nutrition in Tanzania, iAGRI sponsored research on applied topics and sponsored policy dialogue with organizations, groups, and individuals in the public and private sectors.

### 2.4.1 Capacity to Conduct Research and Analysis (Sub IR 8.1)

**iAGRI Custom Indicator:** *Number of policy issues in agriculture, natural resources and environment, climate change and nutrition research and analyzed as a result of USG assistance.*

A target was set for research and analysis on 12 issues on these topics. The actual number of issues analyzed was 12, so that 100% of the target was achieved (See page 21 for more detail).

### 2.4.2 Public/Private Sector Dialogue on Policy (Sub IR 8.2)

**iAGRI Custom Indicator:** *Number of USG-supported policy dialogue events held that are related to improving the enabling environment for agriculture and nutrition.* Fifteen policy dialogue events were targeted. Of these, five were actually held, most of them taking place on the SUA campus and involving stakeholders from the Ministry of Agriculture Livestock and Fisheries, local government authorities, NGOs, and the private sector. The primary reason for underperforming on this indicator was the weakness of government ministries and other policy-making agencies in Tanzania, leading to difficulty in getting them involved in policy events.

## 2.5 Cross-cutting Issues

Two issues cut across many of iAGRI's activities: gender and climate change. These two issues were addressed through training, research, and institutional capacity building.

### 2.5.1 Gender

***iAGRI Custom Indicator: Number of USG-sponsored research projects which focus specifically on gender.*** The project set a target of sponsoring nine research projects focused specifically on gender. The project achieved 100% of this target.



*A female scientist uses a microscope to inspect a diseased leaf at an iAGRI-supported workshop on Plant Disease Diagnostics at Sokoine University of Agriculture.*



*A Cohort IV student at workshop to prepare iAGRI cohorts for the GRE and TOEFL exams.*

***iAGRI Custom Indicator: Number of high school girls provided with career guidance through USG assistance.*** The number of girls targeted was 4150 while the actual number reached was 5295, which is 128% of the target.

***iAGRI Custom Indicator: Number of actions supportive of gender mainstreaming at Sokoine University of Agriculture as a result of USG assistance.*** The project targeted 20 actions supportive of gender mainstreaming to be undertaken at SUA. The actual number of actions achieved was 23, 115% of the target.

### 2.5.2 Climate Change

***iAGRI Custom Indicator: Number of USG-supported research projects that address issues of climate change.*** The project set a target of sponsoring 14 research projects focused on climate change issues. The actual achievement was 17 research projects, which is 121% of the target.

## 3. MAJOR PROJECT ACTIVITIES

This section describes the degree training, short-term training, collaborative research, institutional capacity building, and external linkage activities through which the intermediate results reported in the previous section were achieved. In addition, important outcomes not captured by the formal indicators are reported here.

## 3.1 Training Activities

iAGRI engaged in two types of training: degree training and short-term training. The degree training targeted employees of SUA and MALF, as well as employees of local governments, NGOs, and private firms. The short-term training targeted students and faculty at SUA, employees of MALF and local governments, and farmers.

### 3.1.1 Degree Training

iAGRI recruited, selected, and placed degree trainees in five annual cycles over the life of the project. At the request of USAID, preference was given to employees of SUA and MALF for advanced degree training to strengthen them as key partner institutions. Potential candidates were sought through newspaper advertisements, distribution of flyers at public events, website postings, email messages, and personal contact. A Training Committee, consisting of persons from SUA, MALF, and iAGRI, conducted face-to-face interviews with the most qualified applicants. Candidates bound for the U.S. undertook training for the Test of English as a Foreign Language (TOEFL) and Graduate Record Examination (GRE), which are standard application requirements in American universities.



*Dr. Peg Redinbaugh (left), molecular geneticist at Ohio State University, discusses a maize disease with her iAGRI advisee, Victoria Bulegeya (right) during a field visit by Redinbaugh to Tanzania.*



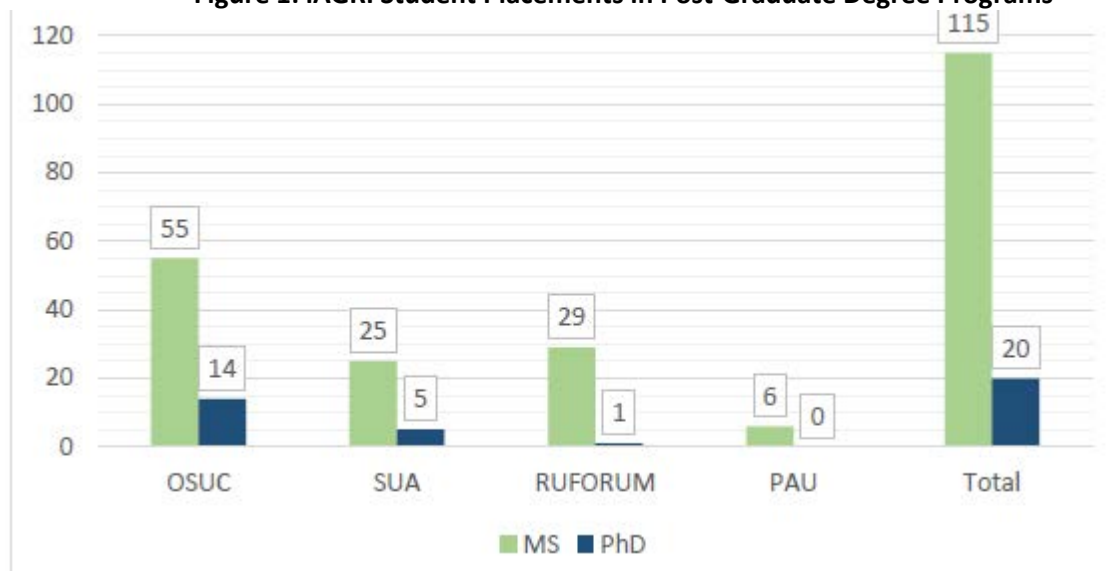
*Boniface Massawe, iAGRI-sponsored PhD student studying at Ohio State University works in soils laboratory at Sokoine University of Agriculture during his return to Tanzania for data gathering.*

The initial training target was completion of post-graduate degree training by 120 Tanzanian scholars, 100 at the Masters level and 20 at the Ph.D. level. In 2013, USAID increased the targeted number of Masters students to 115, making the total target 135. In actuality, some selected candidates failed to show up and enroll in their programs while several dropped out after beginning studies. Given the inevitable uncertainty of the number who would complete iAGRI selected more than 135 candidates. By the end of the project 135 students had completed or were on track to complete their programs soon (See Annex I).

Based on guidance from USAID Tanzania, iAGRI placed half of the students in US universities and the other half in universities in Africa and India. Fifty-three Masters students and 16 Ph.D. students were placed at member institutions of the OSU Consortium; however, two of the Ph.D. candidates switched to Masters programs because of failure to satisfy doctoral requirements. Thirty students were placed at SUA, including 5 Ph.D. students while another 30 students were placed at RUFORUM member institutions. Six students were placed at Punjab Agricultural University in India.

At the beginning of the project, USAID requested that at least 50% of the candidates placed for training be women to address the gender imbalance among professionals working in the agricultural sector. This gender-based target was ultimately achieved by iAGRI despite the fact that the pool of applicants for trainee slots consisted of 70% males and 30% females.

**Figure 1: iAGRI Student Placements in Post-Graduate Degree Programs**



A training needs assessment was conducted during the first six months of the project. The needs assessment identified priority topics based on macro trends in the Tanzanian agricultural and food sector, existing and projected shortages of professionals working in various subject matter areas, and knowledge gaps found in the literature on Tanzanian agriculture. The needs assessment provided guidance to the Training Committee for recruitment of students interested in pursuing studies in particular disciplines. As illustrated in the graph below, the largest topical area of placement was Economics/Agribusiness due to the relative shortage of Tanzanian personnel in value chain analysis, marketing, farm management, and agribusiness development.



Boniface Massawe (right), an iAGRI-supported PhD graduate of Ohio State University, works in a lab at SUA with Lab Technician, Mrs. Paskalina Mtanke (left). Dr. Massawe is in the Department of Soil and Geological Sciences at SUA.

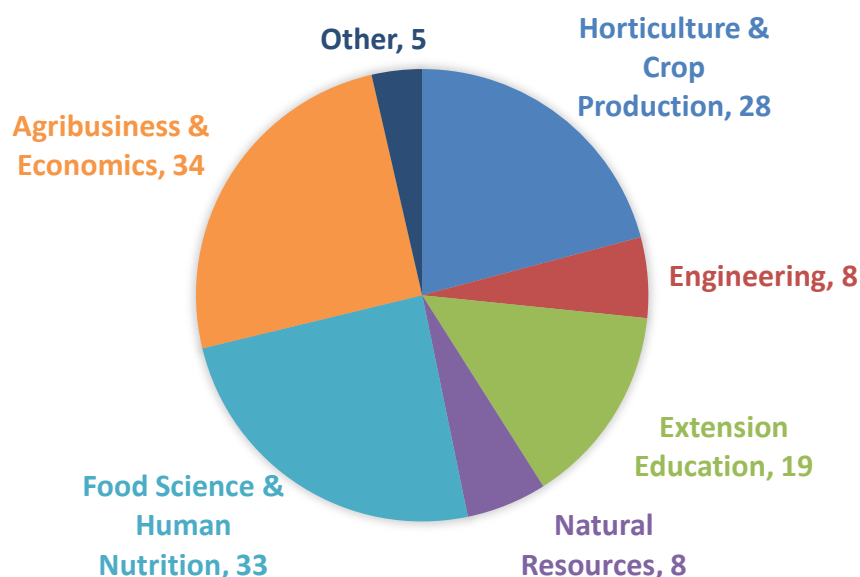


iAGRI student, Stanslaus Materu (center), discusses his field research on water management in rice production with his University of Florida advisor, Dr. Sanjay Shukla (left), and his local supervisor, Prof. Andrew Tarimo (right) of SUA.



Food Science and Nutrition was the second-highest area of concentration of degree studies sponsored by iAGRI. Nutrition was prioritized based on current country needs and USAID programming directions. The third highest ranked area of study was Horticulture and Crop Production, consistent with the focus of USAID Tanzania on horticultural crops, maize, and rice. The fourth highest area was Agricultural Extension/Education, the fifth highest was Agricultural Engineering, and the sixth highest was Natural Resource Management. A handful of students undertook studies in other areas of agriculture consistent with the findings of the needs assessment.

**Figure 2: iAGRI Graduate Degree Programs by Fields of Study**



iAGRI-sponsored students were expected to conduct their research in Tanzania on issues of relevance to the national or local agricultural systems. Funds were provided to each student for field research - \$5000 for Masters students and \$15,000 for Ph.D. students. Those enrolled in U.S. or other African universities were assigned a local advisor to supplement the guidance provided by the advisor at the university where they were enrolled to aid in tailoring the research to Tanzanian conditions. Visits by their advisors to Tanzania allowed them to observe and assist in the students' data collection and analysis in Tanzania.

Publication of research results is an important measure of research productivity. The table below indicates that at least 95 articles based on student research have been published in scientific journals and that at least 143 presentations, based on this research, were made at conferences.

**Table 4. Summary of Scientific Outputs by IAGRI-Supported Students**

Degree Received	Publications		Conference Presentations		Total	
	Number	Percent	Number	Percent	Number	Percent
M.S.	41	43	102	71	143	60
Ph.D.	54	57	41	29	95	40
Total	95	100	143	100	238	100

Note: See Annexes III and IV for listings of publications and conference presentation.

The number of publications is expected to increase after the end of the project, given the lag between submission of manuscripts and final publication by journals. The data in the table above indicate that Ph.D. dissertation research has been disseminated in these outlets to a greater extent than M.S. thesis research, an outcome that is not surprising since Ph.D. students generally have greater expertise and are enrolled for longer periods of time. Much of this research productivity represents joint collaboration between the students and their supervisors and co-supervisors.



*Neema Shosho, an iAGRI-sponsored Master's scholar studied Food and Nutritional Sciences at Tuskegee University. Here she explains complementary feeding practices to mothers in Peapea, Tanzania. Today, she works as a nutrition advisor for World Food Program in Dar es Salaam.*



*iAGRI student, Martin John, conducted his field research in Tanzania on insect control in tomato production following completion of his coursework at Tuskegee University. Tanzania has a shortage of entomologists, such as Mr. John.*

### 3.1.2 Short-term Training

Over the life of the project, iAGRI sponsored 25 short-term training workshops to enable students, professors, government officials, and the private sector to better understand and manage food security in Tanzania. The workshops addressed skill and knowledge gaps among iAGRI's key stakeholders. A Short-Term Training Committee, consisting of persons at SUA and iAGRI, identified and selected the topics of the workshops. Topics included plant disease diagnostics, social science research methods, introduction to evaluation research, randomized controlled trials, scientific data management, social network analysis, participatory research methods, gender and agriculture, writing of agricultural policy briefs, qualitative research methods in agricultural extension education, weather data management, research and project proposal writing, how to conduct technology field tests, how to develop a business plan, broiler production, introduction to the Statistical Package for Social Sciences (SPSS) software, and introduction to the R statistical software. High-priority and popular workshops were repeated two or three times. These workshops generated most of the intermediate results reported for short-term training in Section 2. In addition, iAGRI engaged in other short-term training that did not meet the stringent requirements of USAID's short-term training indicator. This training was a byproduct of visits to Tanzania by the Ohio State University Consortium (OSUC) advisors of iAGRI students. In most cases, the advisor was asked to prepare and deliver a seminar, generally held in the SUA department most closely aligned with the research of the student. Consequently, iAGRI sponsored 73 seminars, which were attended by over 1,118 faculty and graduate students. These seminars helped in restoring the practice of collegial sharing of research in seminars, an important element of academic culture which had eroded at SUA.

## 3.2 Research Activities

iAGRI had two categories of research: collaborative research and policy research.

### 3.2.1 Collaborative Research

The aim of iAGRI's collaborative research was to generate knowledge about food security in Tanzania while enhancing the research skills and capacity of Tanzanian researchers. Eight research background papers on priority food security topics were produced by multi-institutional teams involving SUA, MALF and OSUC representatives during the first phase of iAGRI. The objective of the papers was to identify knowledge gaps and researchable areas to guide iAGRI's collaborative research program as well to guide the graduate student researchers funded by the project. The themes of the eight research background papers were Crop Improvement, Value Chain Management, Climate Change, Gender/Agricultural Productivity, Water Resource Management, Agricultural Policy Analysis, Extension Systems, and Nutrition and Food Science.

iAGRI sponsored two rounds of collaborative research. The first was initiated in 2012 and the second in 2014. The first round began with a competitive call for proposals, which were reviewed and ranked by a team of outside experts. Eight team proposals were funded during the first round. A different process was used for the second round of proposals. iAGRI staff identified priority FtF research gaps and invited teams of researchers known to be experts on these topics to submit proposals to address them.

#### **AGRI-Funded Collaborative Research Projects**

Each of the eleven research teams participating in the collaborative research program prepared a final report. Nine of them focused on technology development and transfer and two on socio-economic and institutional arrangements. Outputs included new technologies, improved management practices, field and storage skills acquired by farmers, and the number of farmers trained on specific practices. Most of the research teams included at least one representative from SUA, MALF and OSUC institutions. Technologies and improved practices were transferred to communities and farmers in various ways, such as field days, farmer demonstrations, and community meetings.

The research teams produced at least 27 research papers, 22 popular publications, 22 conference papers, and 25 popular presentations. Nine iAGRI-funded graduate students participated in these research projects and produced M.S. theses using data from them. Researchers reported that more than 2,200 farmers, extension workers, and others received training on pathogen identification, grafting, drip irrigation systems, soil reclamation and other agricultural topics. The research teams were brought together to report on the status of their research at three research workshops for which proceedings were produced. Representatives from SUA, MALF and other interested regional and national organizations also attended these workshops (See Annex II).

iAGRI aimed to strengthen the participation of women scientists in the collaborative research program. This is reflected in the fact that 5 of the 11 research projects were headed by women. Women represented more than 40% of the total number of scientists participating in the program (24/55), and many of the graduate students participating the program were women.

**Table 5: Collaborative Research Project and Teams**

Project Title	Research Team Leaders*
<b>Phase I</b>	
Improving Agricultural Productivity and Crop Nutritive Quality through a Gender Sensitive Approach	Nyambilila Amuri (SUA), Cathy Rakowski (OSU)
Improvement of Tomato Productivity and Quality in Tanzania	Carlene Chase (UF), Theo Msogoya (SUA)
Integrated Salt-Affected Soil Management Options for Sustainable Rice Productivity in Irrigation Schemes of Tanzania	Sophia Kashenge-Killenga (MALF), Brian Boman (UF), Warren Dick (OSU)
Agricultural Innovation for Smallholder Farmers through Locally Adapted Conservation Agriculture for Improved Food Security in the Context of Climate Change	Didas Kimaro (SUA), Rattan Lal (OSU)
From Soil Elements to Food Nutrients: The Nutrient Content of Foods for Human Consumption	Joyce Kinabo (SUA), Norma Dawkins (TU)
Improved Soil Health and Germplasm to Advance Tomato Production in Tanzania	Sally Miller (OSU), Delfina Mamiro (SUA)
Low-Cost Drip Irrigation Technology	Andrew Tarimo (SUA), Brian Boman (UF)
Assessment of Extension Service Delivery for Maize in Tanzania Using an Agricultural Innovation Systems Approach	Raphael Wambura (SUA), Prosper Doamekpor (TU), Dorothy Masinde (ISU)
<b>Phase II</b>	
Impacts of Drought-Insured Loans on Farmer Group Sustainability and Technology Adoption	Mario Miranda (OSU), Flavanius Magayane (SUA)
Improving Maize Productivity by Drought, Striga, and Maize Lethal Necrosis Disease Management in Tanzania	Joseph Ndunguru (MALF), Thomas Lubberstadt (ISU), Walter Suza (ISU)
Land Use and Climate Change Impacts on Sustainable Intensification in the Upper Ruvu River Basin	Conrad Heathole (VT), Henry Mahoo (SUA)

\* ISU-Iowa State University; MALF-Ministry of Agriculture, Livestock, and Fisheries; OSU-Ohio State University; SUA-Sokoine University of Agriculture; TU-Tuskegee University; UF-University of Florida; VT-Virginia Tech.



*Prof. Didas Kimaro of SUA presents findings of his research on conservation agriculture methods for coping with climate change at a Collaborative Research Workshop in 2014.*



*At the same workshop, Dr. Sophia Kashenge-Killenga of CARL discusses her research on reclamation of salt-affected soils in rice growing areas.*



### 3.2.2 Policy Research

Six analytical policy studies were carried out by teams of iAGRI researchers and researchers from SUA, SERA, MALF, MSU, NBS and OSUC. Some of the projects were part of the collaborative research program, which were funded entirely by iAGRI, while others were carried out outside the framework of the collaborative research program with funding by other organizations. In addition to those listed below, six policy issues were addressed at international conferences or other national meetings hosted by iAGRI. They were: Agricultural Risk Insurance Policy, the Role of Women in Agriculture, Watershed Management Policy, Climate Change Policy, Sustainable Agriculture Policy and Agriculture Training Institute Policy.

**Cashew Industry Policy:** An institutional analysis of the raw cashew product market was conducted to identify challenges that interfere with proper functioning of the warehouse receipt system. This research was based on the premise that the key roles of institutions are to facilitate coordinated exchange (bringing willing buyers and sellers together), facilitating low cost exchange and providing incentives for exchange.

**Agricultural Input Policy:** The purpose of this study was to analyze Tanzanian agricultural input service delivery from an institutional perspective. The National Agricultural Input Voucher System (NAIVS) was used as a case study to do so. The analysis critically assessed the process of institutional design, the institutional framework adopted for implementation of NAIVS, contract enforcement under an input services delivery scheme, and related policy environment and incentive structure.

**Child Nutrition Policy:** This study was undertaken to assess the feasibility of the 1000-day focus health strategy for improving child nutrition and health in Tanzania. The overall objective was to assess the existing policy environment in Tanzania and its contributions to achieving intended positive outcomes associated with a 1,000-day window to reduce child undernutrition.

**Rice Import Policy:** The study formed part of an iAGRI-funded collaborative research project which focused on the consumer side of the Tanzania rice market. It was designed to estimate price elasticities of imported and domestically produced rice. Previous studies of the rice market in Tanzania concluded that the sale of domestic rice is protected by a consumer preference for its perceived better quality. However, Tanzanian rice producers argue that rice importation adversely impacts the price they obtain for their rice. The study concluded that Tanzanian consumers prefer to consume domestic rice varieties and that there is a weak substitutability between domestic and imported rice varieties.

**Land Policy:** A land policy study is currently underway. It is focused on the short, medium and long term impacts of land acquisitions of 10 hectares and above in the rural districts by urban elites. Many potentially negative and positive short, medium and long-term societal impacts can result from this trend toward consolidation of village lands into medium to large farms. Policy implications will be drawn from the study findings.

**Maize Commercialization:** The major objective of the study was to determine the degree of commercialization of maize production and how it is related to farm household food security in the Rukwa region. A major conclusion was that most smallholder farmers in the region do not commercialize their maize production. Market factors, such as costs of transport and price variability, were found to be important factors governing household commercialization decisions. No significant

difference in the commercialization of maize production between female-headed households and male-headed households was found.

### 3.3 Institutional Capacity Building Activities

iAGRI assisted SUA in four major types of institutional capacity building: (1) organizational experiments, (2) organizational restructuring, (3) strategic planning, and (4) innovation.

#### 3.3.1 Organizational Experiments and Study Tours to Change Mindsets

When iAGRI began, SUA was in its fourth year of attempting to create a new organizational structure that would decentralize administration and finance to lower administrative levels, especially colleges, in an attempt to relieve administrative bottlenecks in central administration. Two successive task forces had failed to reach agreement on the nature and extent of the restructuring. This failure led SUA's top administrators to ask iAGRI in 2013 to assist in "changing mindsets" within the University community so as to create an environment in which SUA faculty and staff would embrace restructuring. Aware that restructuring cannot occur effectively without broad internal support, iAGRI management set out to help alter the University's organizational culture in a sustainable way that would lead to transformative changes at SUA so it can make a larger contribution to food security in Tanzania.

With the help of a consultant, iAGRI management proposed to SUA's top administrators the use of participatory organizational experimentation as a vehicle for both altering mindsets and for finding tangible solutions to administrative and academic problems of the University.<sup>2</sup> iAGRI management drew inspiration for this approach to institutional capacity building from institutional transformation at US land grant universities and from recent literature on organizational change. The organizational experimentation approach is hands-on, problem-focused, adaptive, and iterative. It stands in contrast to traditional management, which is based on sequential stages from planning to implementation and heavy reliance on codified, formal knowledge and experts as agents of change. The organizational experimentation approach assumes that management capacity is built through a process of "learning-by-doing" within the particular context of the institution where change is intended to be brought about. The learning and doing must be done by local people and the aim is for them to become agents of endogenous organization change as they work on solving problems important to them. The thinking of the iAGRI management team on institutional capacity building was, itself, a learning process inspired by the local context of SUA and by literature on complex adaptive systems, double-loop learning, emergent behavior, problem-driven iterative adaptation, learning organizations, learning-by-doing, and knowledge management.

Creativity and experimentation were needed at SUA to overcome lengthy chains of administrative decision-making, rigidity in policies, social hierarchies, outdated administrative and financial systems, and pessimism. These obstacles thwart transformative change. Though SUA's leaders had asked for help in changing mindsets, iAGRI staff members were aware that even when an organization's leaders acknowledge the need for internal change and seek outside help in achieving it, they are often fearful of allowing change to occur because it may threaten their power and position.

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<sup>2</sup> The iAGRI staff and top SUA leaders were initially exposed to organizational experiments as a tool for institutional change by Steve Bosserman, a US-based consultant. Bosserman had worked previously as a change management consultant advising agricultural implement manufacturers and land-grant universities. His work with LGUs was carried out in the 1990s under the Food Systems Professions Education Initiative supported by the W.K. Kellogg Foundation.

Based on an understanding of resistance to organizational change, iAGRI sought to establish an “authorizing environment” for organizational experimentation at SUA. This was done through a series of conversations that focused on the value and use of “informal systems”, which can be planted, cultivated, and nurtured within the “formal systems” of an organization to create freedom and facilitation for experimentation. Informal systems created by small groups of motivated individuals become venues for “positive deviance” that is understood, appreciated, and nudged in productive directions by change agents, such as iAGRI, and by the leaders of the formal system. To build trust and create confidence in this approach, iAGRI promised to keep SUA top administration fully informed of the experimental activities. Over a period of approximately 18 months, iAGRI then engaged in conversations with members of the SUA community at various administrative levels in an effort to find SUA faculty and staff members who demonstrated interest and were motivated to identify particular problems and work at solving them.

The iAGRI staff developed a three-stage process for launching, implementing, and monitoring organizational experiments (see Table 6). In the first stage, mobilization, an informal group identifies a problem and agrees to devise a solution. In the second stage, the group develops and implements an experimental solution and implements it parallel to the formal system of the organization. In the third stage, the group extracts lessons learned from the experiment and refines the solution. The revised solution is then scaled up and implemented within the organization’s formal system, which puts in place structures, processes, and resources to sustain and continue to adapt the solution to fit the evolving needs of the organization.

iAGRI and SUA jointly planned and implemented a total of 16 organizational experiments aimed at solving specific problems in the areas of teaching, research, private sector linkages, revenue enhancement, leadership, and administration (Table 7).<sup>3</sup> For 13 of the experiments, a revised version of the solution was scaled up and implemented by SUA’s formal system. Ten of the scaled-up solutions met iAGRI’s standards for organizational sustainability, and 8 of them met the standards for financial sustainability.

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<sup>3</sup> More than 16 activities were launched initially as organizational experiments. However, after iAGRI staff members developed the organizational experiment stages and steps shown in Table 6, some of these activities did not meet the criteria of an experiment, even though they were valid institutional capacity building activities. For example, several one-shot training activities, which were not intended to be repeated, were removed from the organizational experiment list.

**Table 6: iAGRI's Stages, Steps, and Indicators for Organizational Experiments**

Stages	Steps	Indicators
Stage 1- Mobilization	Step 1 - Problem identification	A problem has been identified by a group of persons willing to try to solve it
	Step 2 - Agreement to act	The group has agreed to conduct an organizational experiment to solve the problem
	Step 3 - Goal setting	The group has identified objectives for the experiment
	Step 4 - Learning process review	The group has agreed on a process of experimentation, evidence-based learning, and revision of the solution
Stage 2 - Experimentation	Step 5 - Solution design	A tentative solution has been identified and documented
	Step 6 - Cost and benefit analysis	An analysis of benefits, costs, and challenges of implementing the solution has been conducted
	Step 7 – Task assignment	Steps to be carried have been identified and persons in the group have agreed to carry out particular tasks
	Step 8 - Implementation of solution	The experiment has been implemented
Stage 3 - Sustainability	Step 9 - Revision and scaling up	Lessons have been extracted from the experiment and a refined version of the solution has been translated into changes in policies and/or procedures in the formal system
	Step 10 - Management and budget	The formal system has adopted the solution and has specified reporting relationships, assigned responsibilities, and prepared budgets (if funding is required)
	Step 11 - Organizational sustainability	The formal system has set performance standards against which it monitors progress regularly and adapts the solution continually to correct shortfalls and weaknesses
	Step 12 - Financial sustainability	The scaled-up solution is adequately resourced with staff and funds for long-term continuation

**Table 7: Sustainability Status of Organizational Experiments at Sokoine University of Agriculture**

Category	Experiment	Stage 1				Stage 2				Stage 3			
		Step											
		1	2	3	4	5	6	7	8	9	10	11	12
Teaching	Strengthening Capacity to Manage Classroom Facilities	X	X	X	X	X	X	X	X	X	X	X	X
	Strengthening Capacity of Remedial English Language Program	X	X	X	X	X	X	X	X	X	X	X	X
	Strengthening Capacity to Utilize Teaching Assistants	X	X	X	X	X	X	X	X				
Research	Strengthening Capacity for Digital Librarianship	X	X	X	X	X	X	X	X	X	X	X	X
	Strengthening Capacity for Provision of Statistical Advisory Services	X	X	X	X	X	X	X	X	X	X	X	
External Linkages	Strengthening Capacity for Entrepreneurship Programming	X	X	X	X	X	X	X	X	X	X	X	X
	Strengthening Capacity for Horticultural Teaching and Outreach	X	X	X	X	X	X	X	X	X	X	X	X
	Strengthening Capacity to Provide Commercial Soil Laboratory Services	X	X	X	X	X	X	X	X	X	X		
	Strengthening Capacity for Poultry Industry Outreach	X	X	X	X	X	X	X	X	X	X	X	
	Strengthening Capacity for Farm Mechanization Outreach	X	X	X	X	X	X	X	X				
	Enhancing Capacity to Strengthen National AET System with Focus on MATIs	X	X	X	X	X	X	X	X	X	X	X	X
Revenue Enhancement	Strengthening Capacity to Generate Income	X	X	X	X	X	X	X	X	X	X	X	X
	Strengthening Capacity for Alumni Outreach	X	X	X	X	X	X	X	X	X	X	X	X
Leadership	Strengthening Capacity for Mentorship	X	X	X	X	X	X	X	X	X	X	X	
	Strengthening Capacity for Leadership Development	X	X	X	X	X	X	X	X	X			
Administration	Strengthening Capacity for Electronic Document Handling	X	X	X	X	X	X	X	X	X	X	X	X
Column Totals		16	16	16	16	16	16	16	16	14	13	12	8

For each of the 16 organizational experiments, the section below describes the problem addressed by the experiment, the solution adopted, the rationale for selection of the experiment, the contribution of iAGRI to the experiment, the implementing entity at SUA, the outcomes measured using an Organizational Experiment Indicator Scale (OEIS) developed by iAGRI, and the degree of sustainability of the solution.



### **Strengthening Capacity to Manage Classroom Facilities**

**Problem addressed:** maintenance, repair, and security of classrooms were not coordinated centrally and classrooms were often in poor condition.

**Solution description:** design and implementation of a Classroom Services Unit (CSU) to maintain the physical condition of classrooms, including electronic projection equipment. The CSU classroom technicians conduct a regular inventory of classroom conditions, provide maintenance and make repairs, and are on call to provide assistance to professors.

**Selection rationale:** classrooms with good electricity, lighting, projection equipment, and seating are essential for adequate teaching and learning of agriculture and nutrition.

**iAGRI's contribution:** nurturing and nudging during problem analysis, assistance in design of the CSU, preparation of operational procedures, preparation of job descriptions, allocation of LCD projectors, and design of a classroom facility monitoring and inventory system. iAGRI provided funds for purchase of projectors, repair of classrooms, and hiring of a CSU coordinator.

**Implementing entity:** Quality Assurance and Promotion Bureau (QAPB).

**Outcome:** Professors report a significant improvement in availability of projectors, electricity, lighting, seating, and security of classrooms.

**OEIS Score:** 12 (on 1-12 scale). Factors contributing to the success of this experiment include it having addressed a problem of great concern to faculty members and about which administrators felt and expressed embarrassment. In addition, the classroom technicians selected for this work were highly motivated.

**Sustainability:** Strong support for the QAPB program by the SUA Office of Academic Affairs and by the SUA teaching staff will ensure that the program is maintained over time.



*Broken classroom door before repair.*



*The door now repaired and protected by a metal security gate.*



*Metal ceiling cage in which projectors are now locked.*

### **Strengthening Capacity of Remedial English Language Program**

**Problem addressed:** many incoming students at SUA have poor command of the English language, due in large part to inadequate training at the secondary school level. Poor English language fluency limits their ability to acquire technical knowledge and skills.

**Solution description:** revamping of the curriculum of SUA's remedial English language program to include up-to-date language instruction methods of teaching. Also, an English Language Resource Center (ELRC) was created with electronically-equipped stations for classroom teaching and self-study of English.

**Selection rationale:** improved teaching and learning of English were important to iAGRI because the English fluency of many of SUA's incoming students is inadequate for the study of agricultural and nutrition sciences due to the poor quality of Tanzania's public schools.

**iAGRI's contribution:** assistance in problem analysis and in a search for curricular best practices. iAGRI sponsored a study tour for several members of the Department of Language Studies to visit remedial English language programs at five other universities in South Africa and Ghana to get ideas for curriculum revision. iAGRI also sponsored two visits to SUA by an English language expert from Virginia Tech and it purchased equipment for the ELRC.

**Implementing entity:** Department of Language Studies at SUA.

**Outcome:** OEIS score is 12. Students' English language scores on an assessment test administered before and after they took the University's two English language courses showed a significant improvement in command of English.

**OEIS Score:** 12 (on 1-12 scale): a contributing factor in the success of this experiment was that the curriculum revision and the ELRC were implemented by a group of highly motivated SUA faculty members who took full ownership of the changes.

**Sustainability:** this program will continue to thrive in large measure due to the highly motivated staff of the English Language Program and the ELRC.



*SUA staff members attend an English language training session offered by staff from Virginia Tech's Language and Culture Institute.*

### ***Strengthening Capacity to Utilize Teaching Assistants***

**Problem addressed:** teaching staff at SUA have a heavy teaching load, often teaching three or more courses per academic term. Grading of exams is a major undertaking which often requires as much time as preparation for classroom presentations. This limits professors' ability to conduct research and to provide outreach services to stakeholders.

**Solution description:** create a program to select and train Graduate Teaching Assistant (GTA)s to aid faculty members in undergraduate teaching, recitations, and exam grading. The program was also intended to prepare graduate students to eventually become professors themselves. The SUA Faculty Senate had passed a measure in 2009 prior to the beginning of iAGRI to permit use of GTAs but the University had not implemented it. This solution was chosen on the assumption that lack of procedures to choose and prepare GTAs was the reason the program had not been implemented.

**Selection rationale:** high quality teaching is essential for passing on knowledge about food security and other topics. This was an opportunity to train the emerging generation of teachers. Also, it would free professors to spend more time on lecture development and meeting with students and less time on exam grading.

**iAGRI's contribution:** assistance in designing procedures to select and train graduate students, funds to renovate a room in each participating department for graduate students to use as an office where they could hold office hours to meet with undergraduates.

**Implementing entity:** Office of Deputy Vice Chancellor-Academic.

**Outcome:** Two academic departments signed up to participate in this experiment. At pilot scale, the experiment went well but efforts to interest other departments failed.

**OEIS Score:** 8 (on 1-12 scale). Lack of interest by most academic departments was probably due to the hierarchical relationship between most professors and graduate students, a social norm that makes professors uncomfortable treating graduate students as near-equals.

**Sustainability:** This experiment was deemed by iAGRI to be unsustainable given the lack of departmental interest in it.

### ***Strengthening Capacity for Digital Librarianship***

**Problem addressed:** researchers at SUA lacked access to scientific publications, which hampered their capacity to find solutions to problems and to contribute to the body of scientific literature on agriculture and nutrition. The SUA library had very limited ability to assist them to access this literature because of the small and outdated collection of hardcopy library materials and because of limited connectivity to global databases of digitized scientific papers and books.

**Solution description:** implementation of a library management software system, LIBHUB, to give SUA library users an electronic gateway through which to easily access repositories of scientific journals from around the world. Library staff members were trained in digital librarianship, and the library developed a program to train students and faculty on an ongoing basis to conduct literature searches and download literature electronically.

**Selection rationale:** access to up-to-date scientific publications is essential for teaching and research on food security.

**iAGRI's contribution:** assistance in problem diagnosis, solution design, library software planning and development, and staff training. iAGRI provided funding for the library to adapt and implement a web portal that gives users access to proprietary and public digital literature services from around the world.

**Implementing entity:** Sokoine National Agricultural Library.

**Outcome:** Students and researchers at SUA now have access to far more scientific literature than they did before this organizational experiment began. Many students have now been trained on how to conduct online literature searches. The downloading of scientific articles and other documents has increased greatly. This experiment also provided off-campus access to the library through the Internet to users for the first time at SUA.

**OEIS Score:** 12 (on 1-12 scale). This organizational experiment is successful because several highly motivated SUA librarians took ownership of it from the beginning and did an excellent job of organizing and implementing.

**Sustainability:** The program is being run by library personnel who are permanent staff at SUA. They are strong champions for it and will ensure that it continues to provide the services needed by SUA faculty and graduate students. The only recurring cost is an annual renewal fee for LIBHUB but this cost is small (around \$1,000) and well within the budget of the library.



*A library staff member explains the use of LibHub, an online platform for searching and accessing scientific literature, at Sokoine National Agricultural Library (SNAL) on SUA's campus.*

**Problem addressed:** research staff and graduate students at SUA require assistance in developing appropriate experimental designs as well as in identifying appropriate statistical analyses for data collected. This affects the quality of their research and utility of research outputs.

**Selection rationale:** SUALISA expands human capacity in Tanzania for generating and analyzing scientific data on biological, economic, and social aspects of food security.

Implementing entity: Department of Biometrics and Statistics.

OEIS Score: 11 (on 1-12 scale). The organizational experiment was successful because a small group of highly motivated faculty members took ownership of it from the beginning.

### ***Strengthening Capacity for Entrepreneurship Programming***

**Solution description:** professionalize the management functions of Sokoine University Graduate Entrepreneurs Cooperative Organization (SUGECO), an NGO previously operated on a part-time basis by SUA faculty members to train SUA students in entrepreneurship. iAGRI assisted SUGECO develop a strategic frame, hire its first full-time Executive Director, prepare annual budgets, and train its advisory board.

iAGRI's contribution: assistance in developing strategic plan, performance targets, and budgets. iAGRI provided funds for the salary of the Executive Director for one year.



**Implementing entity:** SUGECO, which is registered with the Government of Tanzania as a cooperative whose founding members are mainly faculty members at SUA.

**Outcome:** The objective of helping SUGECO professionalize its management was accomplished. This organizational experiment was successful because a well-qualified and highly motivated Executive Director has brought professional management principles to the organization and because of the unflagging efforts of SUA professor, Dr. Anna Temu, to keep SUGECO going.

**OEIS Score:** 12 (on 1-12 scale).

**Sustainability:** the management improvements supported by iAGRI have helped SUGECO to establish better planning and implementation capability, which bodes well for organizational stability. SUGECO recently received a multi-year grant from the Mastercard Foundation. Dr. Temu is a true champion for change and is effective in securing resources for its operation.



*A cooperative-society expert is shown discussing board member responsibilities with SUGECO board members.*



*Workers in test kitchen in the SUGECO business incubator on the SUA campus.*

### ***Strengthening Capacity for Horticultural Teaching and Outreach***

**Problem addressed:** SUA lacked a modern field training laboratory for horticultural crop production to train students and stakeholders. The Department of Crop Science and Horticulture lacked opportunities to generate revenue for its programs.

**Solution description:** creation of a 7-acre self-sustaining commercial horticultural farm for demonstration of best practices to students and farmers.

**Selection rationale:** horticulture is one of the three crop groups on which Feed the Future in Tanzania has focused. Also, the availability of crops is important for improving nutritional intake of households and horticultural production is a good source of income for households.

**iAGRI's contribution:** provided technical advice on horticulture jointly with USAID's TAPP project and TAHA. iAGRI also provided management mentoring with the aim of professionalizing the management of the unit and provided funds for Project Leader and Farm manager salaries (during first year only until internally-generated revenues grew), farmer field day, construction of a horticultural sales shop on campus, and expansion of cultivated area from 4 to 7 acres.

**Implementing entity:** Department of Crop Science and Horticulture.

**Outcome:** more than 600 SUA students and 400 farmers have been taught horticultural techniques and the facility has generated enough revenue to sustain farming operations and demonstrations.

**OEIS Score:** 12 (on 1-12 scale).

**Sustainability:** from an organizational standpoint, this experiment is very stable, given the strong support and involvement of the Department of Crop Science and Horticulture and the high degree of motivation of the two managers of the Horticulture Demonstration Facility. The Facility now generates sufficient revenue from the sale of horticultural produce to cover its costs and it has support from TAHA and other non-university partners.





*Dr. Hosea Mtui from the Department of Crop Science and Production lecturing at the Horticulture Demonstration Facility located within the SUA Horticulture Unit.*

### **Strengthening Capacity to Provide Commercial Soil Laboratory Services**

**Problem addressed:** Tanzania lacks commercial soil laboratories capable of providing timely soil testing services for farmers and agribusinesses. Existing labs primarily serve researchers and are plagued by inefficiencies that lead to long delays in obtaining results.

**Solution description:** design and establishment of a client-oriented, commercial soil testing laboratory to generate fee income for services provided to farmers and agribusinesses.

**Selection rationale:** this was viewed as an opportunity for SUA to build stakeholder relationships by providing an important service to visible and influential external client groups (horticulture producers) and other clients.

**iAGRI's contribution:** assisted in problem identification and analysis; sponsored study tour to Kenya for SUA faculty and staff to visit public and private soils labs in order to learn about services provided and lab equipment options; assisted in selection of type of analytical lab technology to be used; and provided funds for equipment, supplies, and lab renovation. iAGRI also helped the SUA department overseeing the lab to connect with the Farmer-to-Farmer program which is providing short-term experts to establish proper analytical procedures and management systems.

**Implementing entity:** The Department of Soil and Geological Sciences.

**Outcome:** The lab began processing soil samples through the new lab facilities in February 2017.

**OEIS Score:** 10 (on 1-12 scale). A weak administrative structure for lab management and lack of a strong champion for the lab within the implementing department resulted in poor follow-through on plans.

**Sustainability:** organizationally, the future of this experiment is tenuous because it lacks a faculty champion willing and able to ensure that efficient operation is prioritized. The lab has potential to be financially self-sustaining from the revenue stream generated from provision of services to fee-paying clients if the organizational issues are resolved.

### **Strengthening Capacity for Poultry Industry Outreach**

**Problem addressed:** training in improved methods of poultry rearing is not widely available for smallholder farmers in Tanzania.

**Solution description:** development of teaching materials on basic techniques of smallholder poultry production, preparation of SUA staff to become trainers, and establishment of relationships with NGOs for provision of poultry production training for smallholder farmers.

**Selection rationale:** a private company visited SUA looking for poultry experts to conduct trials and provide training which sparked a strong, positive response from the Department of Animal, Aquaculture and Range Sciences. If it succeeded in this stakeholder-oriented activity, the department would set a good example for other departments. The Department Head was very supportive and enthusiastic from the beginning, and this experiment was viewed as an opportunity to enlist him as a “champion of

change” for higher-level transformation initiatives. The leader of the experiment was a female professor and supporting her was consistent with iAGRI’s aim of helping to develop female leadership at SUA.

iAGRI’s contribution: sponsored a training-of-trainers workshop on poultry production, provided funds for preparing and printing a training manual, brokered an arrangement for a private company to sponsor the testing of an innovative smallholder poultry house, and connected SUA with an NGO seeking poultry production training.

Implementing entity: Department of Animal, Aquaculture and Range Sciences.

Outcome: a poultry training manual was prepared and printed for distribution and the implementing department submitted a proposal to World Vision to provide training for its clients.

OEIS Score: 11 (on 1-12 scale). The high priority placed on stakeholder services by the department and attention paid to it by the Department Head were major factors in the success of this organizational experiment.

Sustainability: Organizationally, this experiment has strong support from the department and is likely to continue. Financially, plans have been laid but not yet actualized for training to be provided for a fee to be paid by either NGOs or independent farmers. The department has submitted a proposal to World Vision that would generate revenue to provide poultry training to its clients.



*SUA students examine portable poultry houses designed for urban areas where permanent structures are not feasible.*

### ***Strengthening Capacity for Farm Mechanization Outreach***

Problem addressed: trained and experienced tractor operators are in short supply in Tanzania.

Solution description: develop and implement a tractor-training program for tractor operators and tractor-hire businesses.

Selection rationale: A private company, the John Deere Company, donated a tractor to SUA which represented much-needed equipment for teaching and research. This activity was an opportunity to change mindsets within SUA and in the agribusiness community about the University’s ability to develop and maintain a symbiotic, mutually beneficial relationship with the private sector.

iAGRI’s contribution: recruited John Deere as a private sector partner, assisted in the design and initial implementation of the training program, and assisted in the planning and funding of a launch event for the program.

Implementing entity: Department of Engineering Sciences and Technology.

Outcome: the tractor was delivered to SUA and the training program has offered two rounds of training to a total of 170 trainees from within and outside of SUA.

OEIS Score: 8 (on 1-12 scale). This was one of the last organizational experiments begun by iAGRI, explaining why it had not advanced further on the scale by the end of the project but its future is bright.

Sustainability: The likelihood of this experiment achieving organizational and financial sustainability is high given the strong demand for tractor training in Tanzania and the strong commitment of the implementing department to it.



*Trainees in the field at the Tractor Training Boot Camp on SUA Campus.*



*John Deere officials hand over new tractor to SUA Vice Chancellor, Prof. Gerald Monela.*

### **Strengthening Capacity to Generate Income**

**Problem addressed:** the Tanzania government has sharply reduced its funding of universities in recent years, posing a threat to vital programs and services at SUA. Universities in Tanzania and other African countries are now seeking to generate their own revenues.

**Solution description:** create and operate an Income Generating Unit (IGU) to reform University policies that excessively tax and regulate income-generating activities, establish a private university-owned company to operate the University farm and other enterprises, cultivate relationships with the private sector, and provide seed money for initiation of income-generating activities.

**Selection rationale:** the decline in government revenue is one of the most serious issues facing SUA. Top administration at the University requested assistance to increase income generation.

**iAGRI's contribution:** sponsored a study tour to Kenya in search of ideas on how to identify, launch, and nurture income-generating activities, brought three consultants to campus to make recommendations on how to create an enabling environment for income generation, assisted in planning for the IGU, provided funding for one year for the IGU director, and provided advice on the recruitment of an Executive Director for SUA's private company.

**Implementing entity:** Income Generation Unit under Office of the Deputy Vice Chancellor-Administration and Finance.

**Outcome:** the IGU was established and an Advisory Board was formed to support it. Proposals have been prepared by the IGU for reforming University policies that include reducing taxation of projects and regulation of income-generating activities.

**OEIS Score:** 12 (on 1-12 scale). This experiment succeeded because of support from both top and middle administrators who perceive it as a solution to a threat to the institution's survival. Another factor was the appointment of a senior professor who proved to be a competent and enthusiastic Director of the IGU.

**Sustainability:** Organizationally, the IGU is now well established within the formal structure of the University. Financially, its future looks bright since its primary aim is to generate income, a small portion of which will go to operation of the unit.

### **Strengthening Capacity for Alumni Outreach**

**Problem addressed:** SUA had long received little financial and political support from its alumni. Though an alumni association existed, it had no paid staff, no office on campus, convened infrequently, and its leaders were unaware of models of vibrant university alumni associations.

**Solution description:** revitalize SUA's alumni association by exposing its officers to modern alumni relationship-building techniques, creation of a strategic plan, hiring of a paid administrative support person, establishment of a physical office, and regular communication with members and chapters.

**Selection rationale:** alumni of any university are potentially its largest single group of financial and political supporters. The American tradition of strong alumni offices that maintain regular contact with alumni is absent in Africa, and this experiment appeared to be a way of transforming mindsets inside and outside SUA about the University's capacity to develop stakeholder relationships that help sustain the institution.

**iAGRI's contribution:** sponsored a visit by a top official, the Deputy Vice Chancellor-Academic, to Ohio State University where he visited and was impressed by its alumni association, sponsored an official of Ohio State University Alumni Association to visit SUA to teach principles of alumni relationship building, assisted in development of the association's strategic plan, provided funds for renovation of an alumni office and for the salary (first year only) of an administrative support person, and assisted in planning and implementing a Homecoming Week.

**Implementing entity:** Executive Committee of Convocation and the Office of the Deputy Vice Chancellor-Academic.

**Outcome:** a strategic plan was prepared (a first) and released, a physical office was established on campus, an administrative officer was appointed, and a Homecoming Week was held (also a first) in 2015.

**OEIS Score:** 12 (on 1-12 scale). This experiment attained a measure of success because it was requested by and strongly supported by the Deputy Vice Chancellor-Academic, who is also the Secretary of the alumni association.

**Sustainability:** This experiment was quickly formalized within the structure and procedures of the University though without senior paid staff who can devote full-time efforts to it. The alumni association remains weak and a number of its new goals have not been met. Financially, the association generates enough revenue from member contributions to continue to sustain its current operations and the University pays for the salary of the administrative officer.



*Andy Gurd, Chief Operating Officer of the Ohio State University Alumni Association, makes a presentation during a week of training and consulting at SUA to help the University strengthen its alumni relations.*

## **Strengthening Capacity for Mentorship**

**Problem addressed:** junior faculty members at SUA, especially women, reported difficulty in developing supportive social and professional networks, a reality exacerbated by the fact that 80% of SUA faculty members are male.

**Solution description:** a program to recruit, train, and nurture senior and junior faculty members who meet regularly as mentor-mentees pairs to provide career development for the mentees.

**Selection rationale:** this program was defined as an opportunity to increase the retention rate of young females on the SUA faculty and to help them become role models for future women scientists.

**iAGRI's contribution:** assisted in the design of the program, sponsored the Mentoring Coordinator to participate in mentorship training by AWARD, sponsored AWARD personnel to conduct a training session at SUA for mentors and mentees, and provided funds for mentor-mentee workshops.



Implementing entity: Office of the Deputy Vice Chancellor-Academic.

Outcome: two cohorts of mentors and mentees were sponsored, each for a year. Most participants rated the program highly.

OEIS Score: 11 (on 1-12 scale). The program attained organizational maturity within the SUA system primarily because it was supported by the Deputy Vice Chancellor-Academic and because the Mentoring Coordinator was very committed to the effort.

Sustainability: Organizationally, the program is now part of the formal system at SUA, which bodes well for its continuation. Financially, however, the program will be challenged to find resources to hire trainers and hire venues for mentor-mentee events since it generates no revenue of its own.



*Prof. Joyce Kinabo meeting with a junior faculty member at SUA to discuss the latter's professional development plans.*



*Prof. Nchimbi-Msola explains to her mentee, Luseko Chilagane, an Assistant Lecturer at SUA, steps she took to develop a bean line now being replicated by Tanzania's Agricultural Seed Agency.*

### ***Strengthening Capacity for Leadership Development***

Problem addressed: deans and department heads expressed frustration over the lack of opportunity which the formal system of the University provided for open discussion among administrators at various levels as well as campus-wide resistance to change.

Solution description: a Monthly Leadership Forum (MLF) at which department heads, deans, and top administrators could learn about new and improved approaches to management and where they could share their aspirations and frustrations in an open and supportive environment.

Selection rationale: this organizational experiment was viewed as an opportunity for SUA's leaders to develop a higher level of trust among themselves so as to have the courage for tackling tough problems such as restructuring, creating a more sharply defined strategy for the future, and income generation.

iAGRI's contribution: assisted in the design and operation of the forum, sponsored outside speakers, provided funding for leadership books and a subscription to a website for learning new management techniques.

Implementing entity: iAGRI

Outcome: conversation emerging out of the forum and the resulting mindset changes paved the wave for subsequent, larger organizational changes.

OEIS Score: 10 (on 1-12 scale). This organizational experiment was effective largely because the faculty member who led it was highly committed and was trusted by persons at all levels of administration.

Sustainability: By design, this organizational experiment sought to encourage open dialogue in the informal system of the University. Attempting to bring it within the current formal system prematurely would have defeated its purpose. However, the forum had loyal and highly committed members who



appreciated its transformative power. They are likely to continue to engage in open and constructive discussion of crucial issues and to promote change.



*At a meeting of the Monthly Leadership Forum, iAGRI Project Director, Prof. David Kraybill, makes a presentation on how organizational experiments in the informal system can be used to bring about changes in the formal system of SUA.*

### **Strengthening Capacity for Electronic Document Handling**

**Problem addressed:** SUA managed its administrative documents using an antiquated paper filing system no longer appropriate for an institution of SUA's size. New correspondence was filed in boxes containing all previous documents from the sender and these boxes had to be transferred from office to office for the recipient to read the latest addition to the file. File boxes were piled in the office of top administrators on a daily basis, creating a physically untenable situation. File boxes were frequently moved without proper updating of the registry and often could not be located when needed.

**Solution description:** design and install an electronic document management system that would minimize the physical movement of files and that would allow administrators to view and sign documents from any location.

**Selection rationale:** this organizational experiment was an opportunity to change mindsets throughout the SUA community. Staff have long been frustrated by the inefficiency of the University's internal communication system and the slow pace of change.

**iAGRI's contribution:** assisted in diagnosis of the problem, devising a solution and providing funding for development and implementation of the new electronic management system.

**Implementing entity:** Center for Information and Communication Technology (CICT).

**Outcome:** development of the new system was completed and the system was installed and now being used.

**OEIS Score:** 12 (on 1-12 scale). This organizational experiment was successful because the Head of CICT was highly committed to it and because it was backed by the Deputy Vice Chancellor for Administration and Finance.

**Sustainability:** Organizationally, this experiment is now fully integrated into the formal system of the University. Once operational, the system requires very little additional maintenance funding.

### **Enhancing Capacity to Strengthen National AET System with Focus on MATIs**

**Problem addressed:** the curricula and teaching methods of the Ministry of Agriculture Training Institutes (MATIs) are outdated and poorly suited to address the changing needs of the Tanzanian food and agriculture system and the needs of employers.

**Solution description:** assist MATI-Ilonga to identify the skills needed by employers and revamp curricula and teaching methods to better address those needs with the aim of eventually scaling up this effort to reach all the MATIs.

**Selection rationale:** this was viewed as an opportunity for SUA to expand its leadership in Tanzania's agricultural education training (AET) system and to demonstrate that its own transformation has reached a point where it can now help other institutions to transform.

*iAGRI's contribution:* assisted in analyzing the problem and designing a curriculum assessment process that was external stakeholder driven. iAGRI also provided funding for training workshops at the MATIs. Ohio State University provided additional funding of its own for several OSU agricultural education, extension and agribusiness faculty to serve as resource persons for the workshops and to collaborate with SUA counterparts on research designed to assess stakeholder recommendations for curriculum change.

*Implementing entity:* Department of Agricultural Extension and Community Development (DAECD).

*Outcome:* Curriculum review process designed, implemented and validated in workshops with stakeholders; workshops delivered to MATI tutors on teaching methods and training modules on Farming as a Business: Agribusiness Management, Value Chains and Entrepreneurship.

*OEIS Score:* OEIS Score: 12 (on 1-12 scale).

*Sustainability:* the SUA Department of Agricultural Extension and Community Development (DAECD) is reestablished as leader and convener on national technical agricultural education. MALF is interested in making curriculum adjustments and hopes to build on these experiences at other MATIs. DAECD is committed to continue this interface with the MATIs through MALF.



*Staff members from SUA and OSU visiting with MATI-Ilunga staff members that their vocational training station.*

### 3.3.2 Administrative Restructuring for the 21<sup>st</sup> Century University

The momentum created by the organizational experiments brightened spirits and created confidence at SUA for renewing its efforts at organizational restructuring, an effort at which the University had failed in a series of two task forces created for this purpose over the period 2007-2014. The institutional structure of SUA was outdated, having been designed for an earlier era when student enrollment and staff numbers were much smaller. SUA leaders acknowledged that the structure was inefficient and unsuitable for the present and future. Given the current size of the institution, it recognized the need to decentralize and devolve responsibility for program and budgetary matters to colleges and schools within the University. iAGRI focused its restructuring assistance on the College of Agriculture, facilitating internal planning sessions and meetings with external stakeholders under the guidance of an experienced management consultant. The University Council reviewed the restructuring plan for the College of Agriculture in 2016. It approved the plan as submitted. The college model for restructuring, which was refined with iAGRI's assistance, was adopted by other colleges and units within SUA, and the University Council has now approved restructuring plans for most of the other parts of the University.

With iAGRI's help, SUA also took a major step towards becoming more financially self-sufficient by establishing and staffing a unit on campus to coordinate and support income generation activities.

Creation of this unit was a direct result of an iAGRI-supported study tour by SUA officials to Kenyan universities and an iAGRI-supported visit to SUA by income generation experts from Kenya and Tanzania. The experts advised on practical steps to enhance SUA's capacity to generate additional revenue. Subsequently, SUA created an Income Generation Unit (IGU) and appointed an Income Generation Coordinator and Income Generation Advisory Committee. The IGU is responsible for developing revenue-enhancing policies and providing financial support to various departments to engage in income generation activities related to teaching, research, and outreach.

### 3.3.3 Building Capacity for Strategic Planning and Implementation

In 2011, in the early months of iAGRI, SUA released its third strategic plan, which was a long list of projects and activities with no cost projections. The plan was ineffective due to its unrealistic nature and to the absence of an administrative link between it and the annual budget cycle of the University. Furthermore, there was a missing link between the strategic plan and the University's personnel evaluation system. Consequently, there were no internal champions and the oversight committee that, in theory was designed to guide implementation of the plan, was never appointed. By 2015, it was clear to iAGRI management that SUA lacked an effective process to set and implement strategy. However, the organizational experiments implemented with iAGRI's assistance had created a mood of optimism at multiple levels within the University, opening the door for deeper and more fundamental institutional transformation.

In an effort to build strategy setting and implementation capacity at SUA, iAGRI sponsored a study tour to three Kenyan universities that had recent records of impressive expansion and quality improvement.<sup>4</sup> They were guided by strategic plans that were integrated with annual budget processes and annual employee evaluation processes. The study tour participants included the SUA Vice Chancellor and two Deputy Vice Chancellors, the Chair and Deputy Chair of the University Council, the Dean of the Faculty of Agriculture, the Bursar, and the Chief Planning Officer. Before the study tour had ended, SUA Council leaders and management decided to abandon their existing five-year strategic plan and to create a more realistic plan that would be integrated with annual budgetary and personnel evaluation processes.

iAGRI provided technical assistance during 2016 to the College of Agriculture to hold a stakeholder workshop, to analyze stakeholder input, and to use this information to develop a strategic plan that responds to stakeholder needs. An important outcome of the iAGRI-sponsored strategic planning process was the "spread effect" it had throughout the University. Three other colleges and the library adopted a similar process of convening stakeholders to develop their strategic plans based on their input. Later in 2016, the University Council approved a new comprehensive strategic plan for the University.

### 3.3.4 Building Capacity for Technological Innovation

iAGRI created an Innovation Portfolio in 2014 to help SUA forge public-private partnerships (PPPs) to translate research into marketable products and services to address technological and technical needs of the farming community and to attract external funding for SUA. The Innovation Portfolio was designed to enhance linkages between the private sector and the University, to promote utilization of higher education research outputs by the private sector, to promote consultative engagement in curriculum and research development and implementation, and to jointly organize dialogue forums and

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<sup>4</sup> The three Kenya universities visited were Jomo Kenyatta University of Agriculture and Technology, Kenyatta University, and Egerton University.

exhibitions to redress recurrent problems. The Innovation Portfolio acted as an intermediary to bring together actors on the demand side and the supply side of the market for hard and soft technologies. Previously, many technology users in Tanzania's agricultural and food system were unaware of the services SUA could provide. On the supply side, SUA researchers and technical experts were unaware of how to connect with potential technology users to refine their research products for end use. The Innovation Portfolio worked with intermediary organizations that support agricultural production and small and medium enterprises (SMEs) in the agricultural input and food processing supply chain.

Through a PPP established by iAGRI with World Vision, the Innovation Portfolio facilitated field testing of two drip irrigation technologies and making it available for transfer. The first system was for irrigation of bananas and the second for irrigation of vegetables. Researchers developed these systems at SUA under iAGRI's Collaborative Research Program using a screw-type emitter made from materials available in local hardware stores in Tanzania. The emitter is less prone to clogging and is less costly than commercial emitters. If farmers need to make repairs, the materials are readily available in local stores. Field testing of the new irrigation systems was carried out jointly by World Vision and SUA researchers.

A PPP established by iAGRI with Banana Investments Ltd., a Tanzanian company located in Arusha, targeted the market for non-alcoholic beverages. The company previously manufactured its beverages using bananas that are available in large supply during only some parts of the year. Through the Innovation Portfolio, SUA helped the company develop a clear malt beverage from sorghum and millet, which can be stored and, therefore, are available year round. The innovation helped the company achieve its goals of diversifying its products and its raw material sources, of increasing company income, and of increasing farmer incomes. The new sorghum-millet beverage has valuable nutritional properties, and the innovation contributes towards the company's goal of promoting improved nutrition. The innovative manufacturing protocol developed by SUA also shortens production time so that the product can get to the market quicker, thus reducing delays on return on investment (ROI).

The Innovation Portfolio brokered a PPP between SUA and the John Deere Company to develop a tractor training and research program to increase the number of skilled tractor drivers and mechanics, which are in short supply in the Tanzanian labor market. Under the PPP, John Deere donated a 75-horsepower tractor to SUA and provided trainers to build SUA's capacity to train students, farmers, and entrepreneurs. The training program has three modules: 1) tractor operations, 2) tractor mechanics, and 3) tractor-hire business management. The program is expected to aid youth in school-to-work transition, particularly in rural and semi-rural areas. Availability of a modern tractor on campus will also provide opportunities for SUA faculty members and graduate students to conduct research on agricultural mechanization. A total of 120 persons participated in the first tractor training workshop for SUA students, farmers, and MALF staff members. SUA offered a second tractor training workshop in February 2017, which attracted more than 400 applicants. Two banks (NMB and CRDB), an equipment lease-loan company (EFTA), and John Deere provided workshop participants with information on the financing services they provide for tractor owners. Some of the participants immediately applied for loans for purchase of tractors. The Eastern Africa Grain Council (EAGC) provided information on grain marketing services for farmers.



*iAGRI graduate Kadegehe Fue, a Tech Talent participant, explains the computer-controlled drip irrigation flow control system he developed for his Master's thesis.*



*A Tech Talent student innovator demonstrates a simple milk processing machine he developed.*

The Innovation Portfolio also brokered a PPP between SUA and several private companies to test broiler production technologies and techniques. The companies involved in this agreement were MORAGG (American), TanFeeds (Tanzanian), and AgriVet (South African), which worked with the Department of Animal Sciences to test an innovative portable broiler house marketed by AgriVet. The partnership provided SUA with chick housing, feed, essential minerals, vitamins, drugs, and vaccines for testing. Findings from the adaptive research trial informed the development of a training-of-trainers workshop, held at SUA. To provide materials for future training, SUA animal scientists developed a broiler production training manual. The training program will expose participants to innovative broiler production methods. With the help of the Innovation Portfolio, SUA developed and submitted to World Vision a proposal to expand its training program in poultry production.

A Tech Talent Initiative sponsored by iAGRI paired student innovators at SUA with experienced innovators and agribusinesses. The aim was to provide young innovators with tools, resources and mentors to help them develop prototypes, business models and technologies for local markets. Eight mentors in Tanzania and abroad were selected to guide student innovators, volunteering their time and expertise to develop innovative concepts, create product prototypes, and prepare business plans. Sixteen innovators currently studying at SUA or recently graduated were paired with the experienced innovators. Student innovators each prepared written descriptions of their innovations, the problems they addressed, and the proposed solutions to them. Innovations were presented at an innovation fair organized by iAGRI and SUA.

## 4. PROJECT IMPACTS AND SUSTAINABILITY

Impacts of training, research, and institutional capacity building are difficult to measure in the short-term given that many of them are likely to occur over multiple decades after the project's completion. One rapid, measurable impact that occurred during the life of the project is that SUA's ranking among universities in Sub-Saharan Africa improved from 40<sup>th</sup> in 2014 to 31<sup>st</sup> in 2017 and from 80<sup>th</sup> to 53<sup>rd</sup> for the entire African continent during the same period.<sup>5</sup> This improvement was at least in part a result of investments made by USAID at SUA through iAGRI.

<sup>5</sup> See <http://webometrics.info/en>.



The remainder of this section focuses on the long-term impact of the training, collaborative research, institutional capacity building, and global linkage building activities of iAGRI. Training impacts are the easiest to measure because the training-related increase in earnings is a proxy for impact. Accordingly, we present a quantitative estimate of the impacts of degree training.

In contrast, the long-term impact of iAGRI's other activities is much harder to measure because there is no readily observable proxy equivalent to wages arising from research, institutional capacity building, and external linkage building. Impacts of these investments tend to be spread among many individuals, households, firms, and other organizations. Consequently, we provide a qualitative description of the anticipated "impact pathway" of collaborative research, institutional capacity building, and global linkage building.

## 4.1 Training

**Impacts** – estimates of the future impact of training assume that the training-induced increase in earnings of the trainees is an approximation of the impact of the training on the economy. The approximation is rough because earnings may not be fully accurate reflections of pre-and post-study trainee productivity. Furthermore, a trained individual tends to make others more productive and this impact may be under-represented by the trainee's earnings. Though changes in earnings are an imperfect measure of impact, they are generally the best available measure available at the project level and therefore are widely used to evaluate training.

To calculate the net benefits of training, we subtract costs from benefits. All costs are incurred by the end of the project. The benefits (increased earnings), however, are spread over the working life of the trainees. It is standard practice in project analysis to discount future financial flows since a dollar earned in the future is not worth as much as a dollar earned today. We use the current annual yield rate of 3% on 30-year U.S. Treasury bonds as the discount rate to express future earning in terms of present value. Estimates of earnings before and after Masters and PhD degrees are based on data from the Tanzania Government Scheme of Service. For information on expected years of work life after the degree and expected consulting income, we relied on a panel of informed Tanzanian experts.<sup>6,7</sup>

For Masters graduates, the estimated undiscounted increase in lifetime earnings per graduate is \$338,714 which, after training costs are subtracted, gives a net lifetime benefit of \$287,294. In present value terms, the discounted increase in lifetime earnings is \$215,756 and the net lifetime benefit is \$164,335. Summed across all 119 Master trainees, the aggregate net earnings gain is \$33,900,672 undiscounted and \$19,391,560 discounted.

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<sup>6</sup> According to the Scheme of Service of the Government of Tanzania, government employees have the following average annual salaries: 16,800,000 shillings for Bachelor degree holders, 36,000,000 shillings for Masters degree holders, and 54,000,000 for PhD holders. We assume that the average age at graduation is 28 years for Masters trainees and 35 for PhD trainees, and that the average age of retirement is 60 years for Masters graduates and 62 years for PhD graduates. Though 60 is the government-mandated age of retirement, PhD holders are often hired back on contract for up to four years and they typically have opportunities for consulting. We estimated that the average annual consulting income of Masters graduates is \$1,000/year while that of PhD graduates is \$4,800/year.

<sup>7</sup> We have used conservative assumptions regarding income, which lowers our estimates of impact. First, some iAGRI graduates are employed by NGOs or private sector organizations where they are likely to have salaries higher than government employees, yet we use the government salary for all trainees. Second, graduates with degrees in economics or agribusiness have more opportunities for consulting than those with degrees in most other fields of agriculture, yet we use the lower (average) consulting income estimate for all disciplines.

For PhD graduates, the estimated undiscounted increase in lifetime earnings per graduate is \$384,000, giving a net lifetime benefit of \$208,486 when costs are subtracted. The discounted increase in lifetime earnings is \$259,783 and the net lifetime benefit is \$84,269. Summed across all 20 PhD trainees, the aggregate net earnings gain is \$4,378,203 (undiscounted) and \$1,769,648 (discounted).

The iAGRI degree training program is estimated to result in an undiscounted increase in lifetime earnings of \$38,278,875. After training costs are subtracted, the aggregate net lifetime benefit is estimated to be \$28,525,465. The discounted aggregate increase in lifetime earnings is estimated to be \$21,161,209 and the net lifetime benefit is \$11,407,798. These figures are proxies for the long-term impact of the degree training program, assuming that wages are a reasonably accurate reflection of productivity.

In the calculations above, benefits of degree training were measured in U.S. dollars. Another way of evaluating training investments is to focus on rates of return. For Masters trainees, the lifetime rate of return on investment is 559% undiscounted and 320% discounted. For PhD trainees, the lifetime rate of return on investment is 119% undiscounted and 48% discounted. Expressed on an annual basis, the internal rate of return (IRR) is 19.7% for Masters-level training and 7.0% for PhD-level training.<sup>8</sup> For both Masters and PhD training, the IRR is far above the average return of 4.9% to 10-year U.S. Treasury bills over the period 1928-2016.<sup>9</sup> For Masters training, the IRR is more than twice the average U.S. stock market return, based on the Standard & Poors 500 index, over the same time period.

The returns to training reported above are private returns accruing to the trainees through an increase in earnings and do not include social externalities, which are long-term benefits to society over and above what is reflected in the increased salary of the trainee. Our quantitative estimate of impact of degree training would be considerably higher if social externalities were included. Economists have estimated social externalities using national econometric models that attempt to relate changes in education to the growth of gross domestic product (GDP) using annual data over long periods of time. Unfortunately, at the project level, there are no available methods or data for estimating social externalities. Therefore, in the next paragraph, we give a descriptive narrative of the social externalities from the iAGRI training program.

iAGRI graduates now work as classroom teachers (at SUA, other universities, and the MATIs), extension workers (with local governments and private firms), researchers (with SUA and MALF), analysts, managers (at private firms, NGOs, and government agencies), and entrepreneurs (self-employed). Nearly all of the degree trainees conducted research and wrote a thesis or dissertation to fulfill their degree requirements, and the findings of the research and the expert knowledge acquired by the training graduates both in the classroom and in their research makes them better informed as experts. As a result of their training, it is reasonable to expect that iAGRI graduates are more capable and effective in passing on skills, methods, techniques, and technologies to students, farmers, agribusinesses, and consumers. The number of indirect beneficiaries benefitting from these social externalities is likely far greater in number than the number of iAGRI trainees and therefore the total indirect benefit of USAID's investment in graduate training is expected to be high.

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<sup>8</sup> The internal rate of return is the discount rate that equates total costs to total benefits.

<sup>9</sup> Aswath Damodaran, "Annual Returns on Stock, T.Bonds and T.Bills: 1928 – Current," New York University: [http://pages.stern.nyu.edu/~adamodar/New\\_Home\\_Page/datafile/histretSP.html](http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histretSP.html).

**Sustainability** - the impacts from degree training implemented by iAGRI will continue for many years into the future because it was, in essence, a “training of trainers” (TOT). Many of the program graduates are now teachers at SUA, other Tanzanian universities, and the MATIs where they are using the improved teaching materials and methods that they acquired through this USAID investment in human capital.

## 4.2 Research

**Impacts** - The 11 collaborative research projects funded by iAGRI produced outputs (reports and workshops) that were translated into outcomes in the form of technologies, processes, practices or services for intended beneficiaries or the natural environment. These outcomes lead to Impacts, which are positive changes at the individual, farm or environmental level. Several examples of research outcomes and impacts are presented below.

Rice Research - research on paddy soil salinity and sodic soils has produced many positive outcomes including the reclamation of farm lands that were abandoned due to salinity and sodicity. They currently produce above average yields. The introduction of salt resistant varieties of rice has increased yields. Use of the SARRO5 rice variety has increased yields to 3.1 tons/ha and use of the SATO1 variety has increased yields to 4.0 tons/ha on farmers’ paddy fields. Proper soil management practices introduced to farmers have greatly increased their yields as well. These practices include the application of farm manure and gypsum to reduce soil salinity. Initially introduced at experiment stations, these practices have spread to surrounding regions. A secondary research effect increased demand for naturally occurring gypsum in the Mkomazi area which has resulted in increased incomes for farmers in the area.

Maize Research - iAGRI funded a major research project on maize lethal necrosis (MLND) and other maize production constraints. This disease is relatively new to East Africa, including Tanzania. The research project mapped the prevalence of the disease in Tanzania, indicating where productivity is most likely to be reduced by it. iAGRI-funded research at Iowa State University produced new disease-resistant maize genes (SCMV1 and SCMV2) using four inbred lines from Tanzania. These new genes will be important future parent materials for maize breeding in the East Africa region.

Horticultural Research - two collaborative research projects focused on tomato production. Training and coaching of farmers by the research teams had many positive impacts including (a) reduced pesticide use; (b) increased numbers of farmers carrying out scouting before fungicide/pesticide application; (c) more farmers testing the soil health of their tomato fields before fertilizer application; (d) increased awareness by small-scale producers of pest problems, including the presence of invasive species; (e) a greater variety of tomatoes being used by farmers; (f) improved researcher and laboratory technologist capacity to identify insect pests and vegetable diseases; (g) increased tomato yields; (h) increased profit margins arising from reduced pesticide use; (i) increased farmer incomes; (j) improved quality of tomatoes found in markets; and (k) increased awareness of benefits resulting from tomato grafting. At least four types of impact are anticipated due to these outcomes including (a) healthier farmers because of their reduced exposure to pesticides; (b) healthier tomato consumers due to their reduced exposure to pesticide residues; (c) less environmental pollution and more potable water resulting from reduced use of pesticides and fertilizers, and (d) healthier soils resulting from reduced fertilizer and pesticide applications.

Irrigation Research - a project on low-cost drip irrigation for Maasai communities brought men and women together near Arusha for training on drip irrigation. This project significantly enabled mutual learning by the communities, helping to facilitate important agricultural and cultural changes. The irrigation system introduced by the project resulted in sustained production of vegetables for farm-level consumption and for sale. As a result, diets of the participating households have improved. World Vision is considering further dissemination of this technology as part of its program in Arusha Region.

**Sustainability** – the results of this research will be long lasting. Farmers and other rural residents have adopted recommendations resulting from research outcomes with positive impacts on productivity and livelihoods. Tanzanians will continue to use the technologies developed as a result of the research. Popular and scientific publication of the results will help assure their further dissemination. Both student and staff researchers benefitting from the support will continue to pursue the solution of problems represented by the research. Because of the collaboration between Tanzanian researchers and the OSUC research faculty, the former gained knowledge, skills and values related to research. Furthermore, several Tanzanians in the research teams have formed partnerships US researchers and these will continue beyond iAGRI.

### 4.3 Institutional Capacity Building

**Impacts** – the organizational experiments are generating impacts in the quantity and quality of programs and services at SUA and these impacts are likely to continue for many years into the future. For example, in SUA's classrooms, the physical quality of 80% of SUA teaching venues has improved through new maintenance capacity brought about by establishment of a new administrative unit with a network of iAGRI-trained technicians to monitor and repair classrooms on an ongoing basis. In the library, students and faculty members now access and download many more scientific articles than before from online databases of global scientific publications. This is a result of training received by library staff members in digital librarianship and the installation of new equipment. In the horticulture program for students and farmers, SUA now has greater impact on the rate of adoption of new technologies in Tanzania through the establishment of a financially self-sustaining horticulture farm used for demonstration.

**Sustainability** - the outcomes of most organizational experiments at SUA will persist well beyond the end of iAGRI. As measured by iAGRI's twelve-step sustainability indicator in Section 3.3.1 of this report, twelve of the 16 experiments have matured organizationally to the extent that they are now part of SUA's formal system and are currently well managed by the University. However, good management alone does not ensure sustainability; financial resources are also required. Given the cutbacks in higher education allocations by the Government of Tanzania and the meagre budget of the University, non-conventional sources of funding are needed to sustain some of the new activities started through the organizational experiments.

Eight of the 16 organizational experiments and their scaled-up version were judged by iAGRI to be financially sustainable at project end. For example, the Horticulture Demonstration Facility generates its own income from the sale of crops. SUGECO, the entrepreneurship training cooperative run by SUA faculty members, has obtained new funding through multi-year grants. The remedial English Language Program and the Statistical Consulting Lab (SUALISA) have low recurring costs. Furthermore, they are managed by faculty members for whom salaries are paid by the government. These programs will require additional funding and both have prepared plans for generating income internally from services provided to fee-paying clients. Other organizational experiments do not require additional funding. For

example, existing staff provide the new digital library services. The four experiments that have reached organizational maturity (step 11), but not financial maturity (step 12), have good potential for either generating income internally or obtaining central funding from the University. Thus, the sustainability prognosis is relatively bright for at least 12 of the 16 organizational experiments.



*Evidence of the transformative impact of iAGRI: SUA staff attending an agricultural stakeholder's fair planned and implemented by SUA in early 2017. It was an outcome of a stakeholder listening process initiated with iAGRI's assistance as part of the College of Agriculture's development of a new strategic plan in 2016.*



*The 2017 SUA stakeholder fair attracted more than 200 persons from private companies, NGOs, government agencies, and the University. During the fair, SUA and stakeholders agreed upon several new public-private partnerships for training, applied research, and outreach. Based on its success, SUA is planning a follow up fair for 2018.*

#### 4.4 Impact of Global Linkages

**Impacts** – The food security research and graduate degree training funded under iAGRI extended the reach of Tanzanian agricultural teachers and scientists to the broader global community, thus increasing their access to cutting edge academic and research programs and the latest discoveries and methodologies related to specific topics addressed by them. Graduate degree training at RUFORUM member institutions, at the Punjab Agricultural University, and at OSUC member institutions increased the capacity of academic trainers to access and use up-to-date teaching methods and communication technology tools in the classroom. The training also provided the participants with opportunities to link with international agricultural research centers of excellence, including IITA, ICRISAT, IRRI, CIMMYT, and the Africa Rice Research Center. These linkages, in turn, have permitted the participants to bring cutting-edge research solutions to Tanzania to address related food security constraints.

iAGRI students placed at RUFORUM and at OSUC member institutions served as bridges to bring together Tanzanian scientists with international scientists to share knowledge being applied to the solution of problems addressed through thesis and dissertation research. While in Tanzania, many of the international student advisors shared cutting-edge knowledge and practices with researchers and academics at SUA through seminars with SUA staff and students.

SUA convened two international conferences on climate change in Sub-Saharan Africa. The conferences were sponsored by iAGRI and other international partners including NORAD and UN/FAO. The conferences produced two major edited volumes on food security published by Springer. They provided an opportunity for SUA and MALF scientists to share the results of their research with other scientists in



the region, Europe and the U.S. Papers in the volumes have been frequently cited by researchers addressing similar topics in the region.

**Sustainability** – Global linkages between SUA and Global South partners nurtured by iAGRI will persist into the future. They all have solid funding sources that will provide continuity in support for the research scientists and scholars involved. Relationships forged through iAGRI-supported graduate education and research will be supported through the development of continued research and academic collaboration, including joint solicitation of funding for collaboration, resulting collaborative research and joint publication of research results. RUFORUM will continue to play an important bridging role between SUA and RUFORUM member universities.

## 5. LESSONS LEARNED AND RECOMMENDATIONS

### 5.1 Human Capacity Development

**Training needs assessment:** Conducting a training needs assessment in the first year of the project provided vital information that helped the iAGRI staff prioritize subject-matter areas for which degree trainees were to be recruited. The needs assessment also helped the iAGRI staff to identify food-security knowledge gaps that could be addressed through problem-focused thesis and dissertation research and led to the commissioning of eight papers spelling out potential research topics for student research as well as collaborative research. The background papers provided useful guidance to the students and their advisors as they narrowed down the topic of the students' research.

**Two factors that contributed to the success of the degree training program are:** (1) selection of students who have a high probability of succeeding and (2) selection of advisors who have a strong interest in seeing that the student succeeds and a strong interest in the student's area of research.

- **Trainee recruitment:** the iAGRI staff sought to reach potential graduate degree training candidates through announcements in websites, newspapers, and email but discovered that these media alone were not adequate. A valuable recruitment mechanism was discovered in the third year of the project when iAGRI distributed a flyer featuring a call for applications at its booth at the Nane Nane Agricultural Fair. A large number of persons came to the booth seeking the flyer and, in that year, the number of applicants, especially female applicants, soared making it possible for the project to achieve its goal of a 50:50 ratio of female-to-male trainees.
- **Trainee selection process:** iAGRI developed a merit-based trainee selection process. A respected and experienced Training Specialist from Tanzania developed a transparent selection process for the project. The Training Specialist worked with a Training Committee composed of iAGRI staff members, faculty members from SUA, and a representative from MALF. Given the high ultimate graduation rate of the trainees, it can be concluded that the selection process worked well.

A "short list" was created by culling applicants whose previous cumulative Grade Point Average fell below a cut-off set by the Training Committee. The short list identified the candidates most likely to succeed in post-graduate studies. The Training Committee then conducted personal interviews with all short-listed applicants and ranked them on the basis of their responses to a series of identical questions posed to each individual. The questions assessed the candidates' knowledge of agriculture and nutrition, their ability to identify topics worthy of research,

whether they have the habit of reading, their awareness of current events in Tanzania, and their commitment to undertake the sacrifice required for post-graduate studies.

- **Advisor selection:** ensuring that students are matched with effective advisors requires a campus contact person who knows faculty interests at the host university and who will invest the time required to contact and select motivated advisors. Advisor selection was carried out by the iAGRI training team, which included local staff in the PMU at SUA and the Management Entity Training Coordinator at OSU.
- **Dual advisor model:** assigning graduate students an advisor at their host university as well as one in Tanzania from SUA or MALF proved to be beneficial by providing a practical platform for Tanzania and host-country advisors to collaborate and to ensure that the students' research addressed priority agricultural and nutrition challenges in Tanzania.

**Importance of Information Technology:** Early in the project, iAGRI developed enhanced IT capacity at the PMU headquarters on the SUA campus. This allowed iAGRI students to use videoconferencing for "virtual advising" with their U.S. advisors after they returned to Tanzania to conduct their field research. It also allowed returned students to take their final oral examination (thesis or dissertation defense) in Tanzania by videoconferencing. This avoided the cost of a return trip to the U.S. merely for the examination. The use of IT also made it possible to offer leadership webinars to the students while they were studying at their host universities in the U.S., Africa, and India or while they were conducting their field research in Tanzania.

**Leadership training for graduates:** Two leadership webinars based on well-known leadership books developed trainees' personal and professional leadership skills through instructional webinars with Ohio State faculty and the staff of the PMU. This program complemented the technical training they received through their degree program and strengthened leadership and communication skills necessary for assuming a leadership role in the graduates' home institutions.

**Gender:** iAGRI designed its training program so that at least 50% of the selected trainees were female. Providing training options at SUA, in the East Africa region and in the US allowed women to make choices that best suited their own personal circumstances. This resulted in the training of approximately 71 women who will contribute significantly to improving Tanzania's food and agricultural systems at SUA, MALF, and in the private sector, as well as facilitating the acceptance of women in positions of leadership in agriculture-related institutions in Tanzania.

**Collaboration with African universities:**

- In many African universities, it is difficult or impossible for Masters degree students to complete their studies in two year. This is because of weak supervision by the universities of the examination process, resulting in delays beyond the control of the student and the sponsor.
- Regular communication with top administrators of African universities where trainees were placed was found to be important so that students had access to labs/facilities, to address conflicts arising between students and their instructors and advisors, and to minimize delays in the thesis examination process.

## Recommendations:

1. ***Continue to build human capacity through degree training:*** A major contribution of iAGRI was the training of the next generation of leadership for the Tanzanian agricultural sector. Degree training will need to be continued for both SUA and MALF due to retirements and the need for replacements so that the human resource pipeline remains filled. Human Capacity Development needs to be a continuous sustained process to maintain a balance among new, mid-career and experienced staff. SUA and MALF should develop and continuously update staff training plans based on assessments of the Tanzanian food system, emergent research themes and labor force needs.
2. ***Continue to build human capacity through short-term training:*** Continued attention will need to be given to human capacity development through staff development activities including sabbatical leaves, short-term professional training, participation in professional meetings and leadership training.
3. ***Support training at diverse institutions:*** Degree training needs to be supported at diverse institutions in Sub-Saharan Africa as well as at U.S. land grant universities (LGU) and other similar institutions on other continents. Because of the diversity of host universities, it was possible to match student interest with advisor interest and to make a wide range of research and teaching foci available to students. This will prevent in-breeding and expose students and faculty to international knowledge generation systems, including how they interact with the private sector and other clientele to address existing problems.
  - ***Support training at U.S. land grant universities.*** Training at U.S. LGU should be continued because the quality of training is excellent and provides additional long-term diplomatic benefits. Although training in the U.S. is relatively more expensive, these costs can be reduced by restricting training in the U.S. to only PhD programs or by using various sandwich degree training models.

## 5.2 Institutional Capacity Development

***Human Capacity Development (HCD) is a necessary but not sufficient condition for Institutional Capacity Development (ICD).*** Many African scientists, teachers, and managers work in organizations which are not change-oriented; are unable to harness the talents, skills, and creative energies of current and newly trained staff members; and are not demand-driven because of limited linkages with the external environment. Newly trained scientists return to universities or other home-country organizations where bureaucratic inefficiencies frustrate their attempts to “make a difference.” Improvements in the structure and performance of agricultural higher education institutions are required for them to harness the creative, professional/scientific talents and energies of their well-trained staff. Strengthened institutional capacity raises the return on investments made in HCD and greatly expands the effectiveness of HCD to improve food security.

Agricultural higher education partnerships need to be long-term because it takes time to build capacity and commitment on the part of all partners. ICD is a long-term process and partnerships take time to evolve because they are fundamentally based on trust, which itself takes time to develop. iAGRI built

trust with partners at SUA by the prime contractor (OSU) having its own faculty stationed at Sokoine University of Agriculture on a resident basis. Also, trust with SUA was strengthened by the fact that the prime contractor was a university and handled both the academic and management aspects of the project.

***Formal administrative systems tend to resist innovation and engagement with external stakeholders.***

Formal systems are, by their nature, intended to create standardization and stability but often stand in the way of needed change. The organizational experiments co-sponsored by SUA and iAGRI operated, by design, in the “informal system” of the University, meaning that they did not depend on the existing hierarchy, reporting arrangements, or resource base. In the informal system, as long as the organizational experiments are blessed by top administration, members of a university community have more freedom to experiment with activities and processes that are not “business as usual.” This inspires innovation and harnesses the energies of champions of change within a university.

***Organizational experiments must lead to improvements in the formal system in order for them to have a lasting impact.*** Learning and revising must be an integral part of the design of an organizational experiment or it will not create sustainable change. This requires time and takes resources, but it ultimately pays large dividends in local understanding and ownership of the change.

***Planting many small changes at multiple levels and identifying champions of change at each level creates a climate that facilitates bigger changes,*** such as changes in the strategy and structure of the institution. Mindset change is essential but generally does not happen effectively (or even at all) through top-down directives. Rather, it happens through individuals and groups observing and becoming part of the change and experiencing the benefits of change. These experiences result in greater trust in the system and greater motivation to perform well.

## Recommendations:

1. ***Retain focus on comprehensive Institutional Capacity Development (ICD):*** Comprehensive ICD implies the integration of training, research and outreach activities with a focus on promoting institutional change and development. Human Capacity Development (HCD) and collaborative research are important, but undertaken alone are insufficient in making strong contributions to ICD. In sum, ICD needs to be the overall goal.
2. ***Focus on providing quality programming:*** In response to the increased demand for higher education in Tanzania and the region, the number of public and private higher education institutions has increased, as have enrollments. For SUA to excel in this increasingly competitive higher education environment, it will need to emphasize and incentivize the provision of quality training, research and outreach programs. Training that leads to self, public or private sector employment will be an increasingly important measure of quality programming.
3. ***Develop alternative sources of revenue:*** Government of Tanzania funding to SUA is declining as governmental support is divided and distributed to additional public universities. Other sources of revenue must be generated in order for SUA to attract and retain high quality staff and to maintain high quality teaching, research, and outreach programs. SUA has the potential to substantially increase revenue from grants, contracts, and the sale of agricultural and intellectual products and

services. To realize this potential, the University must strengthen its ability to seek outside funding, to manage projects, and to administer project finances. iAGRI helped to develop several mechanisms at SUA in this regard, including an Income Generation Unit, a Directorate of Intellectual Property and Linkages, an Innovation Portfolio, and a SUA affiliated company to manage its farm and other large income-generating assets. Continued support for these mechanisms will be very important to strengthen revenue generation at SUA.

4. ***Strengthen research capacity:*** Continuous assessments of farmer and other client needs should be undertaken to identify and prioritize an applied problem-solving research agenda. Identified research themes can best be addressed using trans-disciplinary teams of scientists that include graduate students to foster human capacity development. Simultaneously, SUA will need to continue strengthening its capacity to conduct basic science research so that students are exposed to advanced, cutting-edge research techniques and methodologies.
5. ***Strengthen programmatic linkages with the private sector:*** SUA will need to continue to strengthen its linkages with the private sector. As Tanzania has liberalized its economy, private sector agribusinesses have become major contributors to agricultural growth and important employers of agricultural graduates. Market forces are driving the transition to more commercial and productive agriculture. For SUA to contribute to this important transformation of Tanzania's agricultural and food systems, the University must reorient curriculum, research, and outreach programs, and build its institutional capacity to provide training and technologies in demand by agricultural businesses.
6. ***Improve University outreach programming:*** SUA will need to continue to develop and strengthen its outreach programming to support the emerging agriculture sector transition of the country. To do so, it will need to develop appropriate incentives and enabling organizational structures. A vibrant outreach strategy will make SUA relevant and responsive to changing needs and interests and stakeholders will come to value the university as a key resource. SUA cannot achieve this alone but needs collaborations with and support from governmental, non-governmental, donor, and private-sector organizations.
7. ***Build the capacity of Tanzanian public-sector organization:*** SUA and MALF will need to continue to build their capacity to create and sustain public-private partnerships. iAGRI emphasized the development of these partnerships by emphasizing relevant individual training, promoting success-models of private-sector linkage creation, and helping organizations put structures and processes in place to build vibrant public-private partnerships. The goal is for public-sector organizations (i.e., universities, research organizations, and government ministries) to become more attuned to the needs of commercial agriculture, especially small and medium-sized farms.
8. ***Strengthen linkages with Agricultural Knowledge Systems (AKS):*** SUA will need to be better integrated with national and regional agricultural knowledge systems, to facilitate the transformation of the Tanzanian agricultural sector. It should seek to serve as a leader and convener of the national agricultural knowledge system so that complex and trans-disciplinary challenges like food security and climate change can be better addressed.



# ANNEX I: FY 2017 PMP INDICATOR PROGRESS

Indicator Data / Disaggregation	Units	Baseline Value	FY2017						Life of Project (LOP) Target	Cumulative Achievement by End of Q4FY2017
			Target	Q1	Q2	Q3	Q4	Achieved to Date		
A: FTF INDICATORS										
IR 1: Improved agricultural productivity / Sub IR 1.1: Enhanced human and institutional capacity development for increased sustainable agriculture sector productivity										
EG3.2-2: Number of individuals who have received USG supported degree granting agricultural sector productivity or food security training	Number	0	0						135	139
Sex		0								
Male										
Female		0								
Duration										
New										
Continuing										
EG3.2-1: Number of individuals who have received USG supported short-term agricultural sector productivity or food security training	Number	0		33				33	450	917
Type of individual										
Producers										
People in government										
People in private sector firms										
People in civil society		0		33				33	450	917
Sex		0		33				33	450	917
Male		0		27				27	225	560
Female		0		6				6	225	357
IR 1: Improved agricultural productivity / Sub IR 1.2: Enhanced technology development, dissemination, management and innovation										
EG 3.2-7: Number of technologies or management practices in one of the following phases of development:	Number	0							42	107
Phase I: under research as a result of USG assistance	Number	0							23	92
Phase II: under field testing as a result of USG assistance	Number	0							17	13
Phase III: made available for transfer as a result of USG assistance	Number	0							2	2
IR 3: Increased investment in agriculture and nutrition related activities/ Sub IR 3.1: Increased participation of the private sector in the delivery of services										
EG 3.2-5: Number of public-private partnerships formed as a result of FTF assistance	Number	0	5						8	12
Agricultural production	Number	0								2
Agricultural post harvest transformation	Number	0								4
Nutrition	Number	0								
Other	Number	0								3

Multi-focus	Number									2
Indicator Data/Disaggregation	Units	Baseline Value	FY2017						Life of Project (LOP) Target	Cumulative Achievement by End of Q4FY2017
			Target	Q1	Q2	Q3	Q4	Achieved to Date		
EG 3.2-22 Value of new private private/public/NGOs investments in agricultural/food chain leveraged	US \$	0	4,120	7,370				7,370	80,000	83,250
<b>B: iAGRI CUSTOM INDICATORS</b>										
<b>IR 1: Improved Agricultural Productivity / Sub IR 1.1: Enhanced human and institutional capacity development for increased sustainable agriculture sector productivity</b>										
OSU 1.1-5 Number of research projects conducted which specifically focus on gender	Number	0							9	9
OSU 1.1-9 Number of researchers trained on Randomized Control Trials (RCT's)										44
Sex										44
Male										33
Female										11
<b>IR 1: Improved Agricultural Productivity / Sub IR 1.2: Enhanced technology development, dissemination, management and innovation</b>										
OSU 1.2.1 Number of research projects that address issues of climate change	Number	0							14	17
<b>IR 3: Increased investment in agriculture and nutrition related activities / Sub IR 3.2: Increased capacity of women to participate in agriculture and nutrition</b>										
OSU 3.2.2. Number of high school girls provided with career guidance and counseling program	Number	0							4,150	5,295
OSU 3.2.4. Number of actions supportive of gender mainstreaming at Sokoine University of Agriculture	Number	0							20	23
<b>IR 3: Increased investment in agriculture and nutrition related activities / Sub IR 3.3: Enhanced knowledge and external ideas through study tours</b>										
OSU 3.3.1. Number of people participating in study tours as a result of FfF assistance	Number	0							18	72
Male	Number	0							9	48
Female	Number	0							9	24
<b>IR 8: Improved enabling policy environment for both agriculture and nutrition / Sub IR 8.1: Improved capacity to conduct policy research and analysis</b>										
OSU 8.1.1. Number of policy issues in agriculture, natural resources and environment, climate change and nutrition researched and analyzed as a result of FfF assistance	Number	0							12	12
<b>IR 8: Improved enabling policy environment for both agriculture and nutrition / Sub IR 8.2: Public/private sector dialogue on policy increased</b>										
OSU 8.2.1. Number of USG-supported policy dialogue events held that are related to improving the enabling environment for agriculture and nutrition	Number	0							15	5

## ANNEX II: IAGRI-SPONSORED STUDENT LIST

<u>Name</u>	<u>University</u>	<u>Student Discipline</u>	<u>Degree</u>	<u>Status</u>	<u>Graduate Study Research Focus</u>
<b>COHORT I</b>					
<b><u>OSU Consortium</u></b>					
Respikius Gabagambi	Ohio State	Rural Sociology	M.S.	Completed	Contract Farming and Smallholder Farmers in a Global Economy: Mtibwa Cane Growers in Mvomero Tanzania
Frida Nyamete	Michigan State	Food Science	M.S.	Completed	Potential of Lactic Acid Fermentation in Reducing Aflatoxin B <sub>1</sub> and Fumonisin B <sub>1</sub> in Tanzanian Maize-Based Complementary Gruel
John Martin	Tuskegee	Agronomy	M.S.	Completed	Diversity and population dynamics of insects in Corn ( <i>Zeamays</i> )-Beans ( <i>Phaseolus vulgaris</i> ) Intercrop Systems
Lilian Mpinga	Florida	Horticulture	M.S.	Completed	Tomato Grafting for Low-Resource Open-Field Tomato Production in Tanzania
Stanslaus Terengia	Florida	Agricultural Engineering	M.S.	Completed	Yield/Water Use of Alternative Production Systems in Hai and Kilosa Districts, Tanzania: Field Experiment Modeling
Asma Gharib	Florida	Agribusiness	M.S.	Completed	Village Savings and Loan Associations and Rural Women Development: A Case of Zanzibar Rural Women
<b>COHORT II</b>					
<b><u>OSU Consortium</u></b>					
Elizabeth Isaya	Ohio State	Agr Extension Education	M.S.	Completed	Sources of Agricultural Information for Women Farmers in Hai and Kilosa Districts, Tanzania
Edith Lazaro	Ohio State	Agricultural Economics	M.S.	Completed	An Empirical Analysis of Rice Demand in Tanzania
Nafeti Mheni	Ohio State	Plant Breeding	M.S.	Completed	Association Analysis and Genome-wide Selectin for Early Maturity in Wheat

Alunas Mwamakimbule	Iowa State	Agr Extension Education	M.S.	Completed	Assessment of the Factors Impacting Extension Training Programs in Tanzania: A Descriptive Study
Kabura Philip	Iowa State	Agr Extension Education	M.S.	Completed	Extension Program Needs of Farmers in Tanzania: A Descriptive Study
Glory Mhalu	Michigan State	Food Science & Nutrition	M.S.	Completed	Effect of Feeding First Food Enriched with Orange Fleshed Sweet Potatoes on Vitamin A Status in 6-12 Month Children in Morogoro Region, Tanzania
Fabian Mhafu	Tuskegee	Food Science	M.S.	Completed	Optimizing Traditional Processing Technologies to Increase Nutrient Bioavailability of Complementary Foods in Rural Tanzania
Ibrahim Shabani	Tuskegee	Food Science	M.S.	Completed	Mycological Evaluation of Maize ( <i>Zea mays</i> ) Flour Use in Complementary Feeding in Handeni District5, Tanzania
Neema Shosho	Tuskegee	Human Nutrition	M.S.	Completed	Impact of Maternal Education on Complementary Feeding Practices of Infants and Young Children in Peapea Village, Kilosa, Tanzania
Kadeghe Fue	Florida	Agricultural Engineering	M.S.	Completed	Development of a Precision Irrigation Control System for Horticultural Food Crops in Tanzania
Mariam Marianda	Florida	Human Nutrition	M.S.	Completed	An Educational Intervention to Increase Frequency of Consumption of Iron and Folate from Supplements and Dietary Source among Women of Childbearing Age from Mvomero District of Morogoro, Tanzania
Bertha Nguku	Florida	Agronomy	M.S.	Completed	A Systems Approach to Improving Abiotic Stress Tolerance in Peanuts
Emmanuel Msemo	Virginia Tech	Statistics	M.S.	Completed	Statistical Support for Agronomic and Rural Social Science Research
Boniface Massawe	Ohio State	Soil Science	Ph.D.	Completed	Digital Soil Mapping and GIS-based Land Evaluation for Rice uitability in Kilombero Valley, Tanzania
Emmanuel Mgonja	Ohio State	Plant Breeding	Ph.D.	Completed	Molecular Analysis of Host Resistance and Pathogenicity of Rice Blast in East Africa

Rita Mirondo	Ohio State	Food Science	Ph.D.	Completed	Contribution of Enzymes and Other Components in Food in the Formation and Destruction of Volatile Compounds
Rashid Suleiman	Iowa State	Agricultural Engineering	Ph.D.	Completed	Accessing and Controlling Bio-Deterioration of Maize in Tanzania
Theresia Jumbe	Michigan State	Food Science & Nutrition	Ph.D.	Completed	Association of Fatty Acids with Growth and Cognition of Tanzanian Children
Eva Kassara	Michigan State	Agricultural Extension	M.S.	Completed	Gender Differences and Agricultural Extension in Sub-Saharan Africa: Research Issues
Juma Mmongoyo	Michigan State	Food Science & Nutrition	Ph.D.	Completed	Aflatoxin Levels in Sunflower Seeds, Cakes, and Crude Oil Sediments Locally Produced in Tanzania and Potential Phytochemicals for Aflatoxin Management
Mawazo Shitindi	Tuskegee	Soil & Plant Science	Ph.D.	Completed	Integrative Soil Fertility Management for Improved Nitrogen and Phosphorus Utilization by Maize in the Northern Zone of Tanzania
Newton Kilasi	Florida	Plant Pathology	Ph.D.	Completed	Identification of Quantitative Trait Loci and Candidate Genes for Vegetative State Heat Stress Tolerance in Rice ( <i>Oryza sativa</i> L)
Ramadhani Majubwa	Florida	Horticulture	Ph.D.	Completed	Studies in Mandarin ( <i>Citrus reticulata</i> Blanco.) Fruit Quality: Response of Cold-Hardy, Seedless Cultivars to Rootstock and De-greening Temperatures in Florida: Current and Potential Harvest and Handling Practices to Reduce Postharvest Losses Along the Value Chain in Tanzania
Mpoki Shimwela	Florida	Plant Pathology	Ph.D.	Completed	Spatio-Temporal Analysis and Modeling of the Spread of Banana Xanthomonas Wilt (BXW) and Citrus Huanglogbing (HLB): Implications for Disease Control
William Warsanga	Florida	Agricultural Economics	Ph.D.	Completed	Farm Efficiency, Value Chain Participation, and Food Accessibility for Wheat Growers of Tanzania
Kuruthumu Mwamende	Virginia Tech	Natural Resources	Ph.D.	Defense	Impacts of Habitat Fragmentation on Foraging by Primates of Udzungwa, Maize Raiding and Possible Parasite and Disease Transmission between Primates and Humans (to be completed by VT).



Winfred Mbungu	Virginia Tech	Agricultural Engineering	Ph.D.	Completed	Impacts of Land Use, Cover Changes, and Climate Variability on Hydrology and Soil Erosion in Upper Ruvu Watershed
<b><u>Sokoine University</u></b>					
Secilia Mrosso	Sokoine	Agr Extension Education	M.S.	Completed	The Role of Agricultural Extension in Improving Vegetable Production for the New Market in Meru District, Tanzania
Miriam Chanzi	Sokoine	Agricultural Economics	M.S.	Completed	Economics of Small Scale Paddy and Sugar Cane Production in Kilombero District, Tanzania
Werenfrid Michael	Sokoine	Land Use Plan & Manage	M.S.	Completed	Community Considerations of Underlying Valuation of Agricultural Land: A Case Study of Lushoto District
Consesa Richard	Sokoine	Rural Development	M.S.	Completed	Exploring Agricultural Extension Staff Knowledge and Practice of Value Chain Approach in Extension: A Case Study of Maize in Kongwa District, Tanzania
Christopher Msongore	Sokoine	Agribusiness	M.S.	Completed	Profitability Analysis of Maize Storage Technologies in Tanzania: A Babati District Case Study
Musa Abdallah	Sokoine	Entomology	M.S.	Completed	Abundance and Dispersal of the African Black Beetle ( <i>Heteronychus Arator F.</i> ) ( <i>Coleopetera: Scarabaeidae</i> ) in Njombe Region
Mtirankiza Misibo	Sokoine	Agricultural Economics	M.S.	Completed	Productivity and Post-Harvest Determinant Losses among Smallholder Maize Farmers in Kilosa District, Morogoro Region
Chacha Nyangi	Sokoine	Food Science	M.S.	Completed	Aflatoxin and Fumonisin Contamination of Maize and Beans Along the Food and Feed Value Chain in Babati District
Haji Omar	Sokoine	Agricultural Economics	Ph.D.	Examiner	Determinants of Competitiveness and Comparative and Comparative Advantage for Rice Production in Zanzibar
Judith Hubert	Sokoine	Crop Science	Ph.D.	Completed	Pathogenic Variation, Diagnosis and Reaction of Elite Rice Genotypes to Rice Yellow Mottle Virus in Tanzania
Gosbert Shausi	Sokoine	Agricultural Education	Ph.D.	Research	Willingness of Crop Farmers to Pay for Agricultural Extension Services in Mpwapwa and Mvomero Districts, Tanzania (to be completed by SUA)

**RUFORUM**

Zaharan Hussein	Stellenbosch	Food Science	M.S.	Completed	Bruise Damage Susceptibility of Pomegranate Fruit and Impacts on Quality
Charles Levi	Makerere	Agricultural Extension	M.S.	Completed	Effectiveness of Information Communication Technologies in Dissemination of Agricultural Information to Smallholder Farmers in Kilosa District, Tanzania
Mohammed Ramadhani	Makerere	Agricultural Extension	M.S.	Completed	Assessment of Quality of Collaboration In Rice Innovation System In Kilombero District, Morogoro Tanzania
Marco Mwende	Makerere	Crop Science	M.S.	Completed	Inheritance of Resistance to Brown Spot Disease in Upland Rice in Uganda
Althuman Mahinda	Nairobi	Soil Science	M.S.	Completed	Effect of Drip Irrigation on Production and Economic Returns of Sorghum ( <i>Sorghum Bicolor</i> ) in Semi-Arid Tanzania
Mwajija Almasi	Nairobi	Agronomy	M.S.	Completed	Effect of Organic and Inorganic Nitrogen Sources on Growth, Yield and Oil Content of Sunflowers Grown in Highly Weathered Soils of Morogoro
Eliafie Mwanga	Nairobi	Agricultural Engineering	M.S.	Completed	Stabilization of Silt Clay Soil Using Molasses for Small Dam Embankment Construction as Inner Zone
Nyamonge Kenya	LUANAR	Rural Development	M.S.	Completed	The Role of Farmer Field Schools in Adoption and Adaptation ecommended Rice Production Practices in Mvomero District in Tanzania

**COHORT III****OSU Consortium**

Elias Balimponya	Ohio State	Crop Science	M.S.	Completed	Application of Genomic Selection and Association Mapping in Breeding for Resistance to Rice Blast and Bacterial Blight of Rice ( <i>Oryza Sativa L.</i> ) in East Africa
Prisca Kimaro	Ohio State	Agribusiness	M.S.	Completed	Sorghum Production in Tanzania: Niche Market Opportunities for Smallholder Farmers
Upendo Kimati	Iowa State	Agricultural Extension	M.S.	Completed	An Assessment of the Factors that Impact the Level of Success of Farmer Field School training in Tanzania: A Descriptive Study

Furaha Guivaha	Iowa State	Agricultural Extension	M.S.	Completed	Factors Impacting Agricultural Extension Training Programs Smallholder Women Farmers in Njombe District, Tanzania
Johnson Mtama	Iowa State	Agronomy	M.S.	Completed	Pedology of Corn Productivity Indices for Selected Parts of the Southern Highland Zone of Tanzania
Emmanuel Msanya	Michigan State	Agricultural Economics	M.S.	Completed	Farmers' Perceptions of the Purposes and Challenges of Microfinance Credit: A Case Study of the Pride RFW Credit Program for Rice Production in Mvomero District, Tanzania
Papias Binagwa	Tuskegee	Plant Protection	M.S.	Completed	Evaluation of Common Beans ( <i>Phaseolus Vulgaris</i> ) Germplasm for Resistance to <i>Pythium</i> Root Rot Disease
Innocent Ritte	Tuskegee	Plant Biotechnology	M.S.	Completed	Identification and characterization of Markers Linked to Resistance Mofifs against Maize Chlorotic Mottle Virus Infection in Tanzanian Maize Germplasm through Amplified Fragment Length Polymorphism Analysis
Aldegunda Matunda	Michigan State	Horticulture	M.S.	Completed	Use of Pineapple Vinegar on Shelf Life of Carrot and Mango in Tanzania
Denis Kiobia	Michigan State	Agricultural Engineering	M.S.	Completed	Design and Development of a Low-cost Acoustic Device to Detect Pest Infestation
<b><u>Sokoine University</u></b>					
Mkali Mlanzi	Sokoine	Agricultural Economics	M.S.	Completed	Small Scale Rice Farmer Productivity and Market Access in Kilosa District
Rajabu Kangile	Sokoine	Agricultural Economics	M.S.	Completed	Efficiency in Production by Smallholder Rice Farmers under Cooperative Irrigation Schemes in Pwani and Morogoro Regions, Tanzania
Theresia Nsumba	Sokoine	Agricultural Economics	M.S.	Completed	Analysis of Rice Profitability and Marketing Chain: A Case Study of Kilombero District
Tumiani Masue	Sokoine	Agribusiness	M.S.	Completed	The Relationship of Small Scale Farmer Access to Use of Financial Services om Hai District, Kilimanjaro Tanzania

**RUFORUM**

Happiness Nnko	Makerere	Plant Protection	M.S.	Completed	Species Diversity, Distribution and Associated Parasitoids of Maize Stem Borer in Iringa district Tanzania
Allan Mariki	Makerere	Plant Protection	M.S.	Completed	Distribution of Maize Lethal Necrosis Disease: Viruses and Alternative Hosts in Manyara and Dodoma Regions
Buzo Honi	Makerere	Food Science	M.S.	Completed	Development of Orange Fleshed Sweet Potato and Bambara Groundnut-Based Snacks for School Children in Tanzania
Mbwando Dimjosso	Zambia	Crop Science	M.S.	Completed	Inheritance of Resistance to <i>Alectra Vogellii</i> in Wpeas ( <i>Vigna unguiculata</i> [L] Walp.)
Sebastian Mosha	LUANAR	Aquaculture	M.S.	Completed	Effect of Organic and Inorganic Fertilizers on Natural Food Composition and Performance of African Catfish ( <i>Clarias Gariepinus</i> ) Fry Produced under Artificial Propagation
Christerbel Micanuru	Jomo Kenyatta	Food Science	M.S.	Completed	Effect of Sun Drying on Nutrient Content and Microbiological Safety of Orange Fleshed Sweet Potato Tubers and Cowpea Leaves Used in Maswa District Tanzania
Venance Saimon	Egerton	Agricultural Economics	M.S.	Completed	Factors Influencing Legume Production Profitability under Current Policy Regime: Implications for Post-Harvest Innovations: A Case of Small-Scale Bean Farmers in Babati District, Tanzania
Semeni Ngozi	Egerton	Agricultural Economics	M.S.	Completed	Efficiency and Effectiveness of Participatory Research Approaches among Smallholder Farmers in Babati District

**Punjab Agr University**

Hilali Saleh Hilali	Punjab Agricultural University	Crop Breeding	M.S.	Completed	Physiological Studies on Rice ( <i>Oryza sativa</i> L.) under High Temperature Stress
Emmanuel Lulandala	Punjab Agricultural University	Agribusiness	M.S.	Completed	A Study of Advertising Avoidance in Social Networking Environment

#### COHORT IV

##### OSU Consortium

Boniphace Nkombe	Ohio State	Soil Science	M.S.	Completed	Investigation of the Potential of Forage Species at Enhancing the Sustainability of Rangeland and Cropland Soils
Christopher Lameck	Ohio State	Agricultural Education	M.S.	Completed	Impact of Agricultural Subsidies to Smallholder Maize Farmers of Mbeya District Council in Tanzania
Joan Msuya	Ohio State	Human Nutrition	M.S.	Completed	Food Safety of Home Made Complimentary Foods in Tanzania
Joyce Mwakatoga	Ohio State	Agricultural Education	M.S.	Completed	Improving Food Production and Security through Youth Programs in Agriculture
Kassim Msuya	Ohio State	Agricultural Economics	M.S.	Completed	The Applicability of Drip Irrigation to the Smaller Holder Farmers: A Case Study of Horticultural Industry in Tanzania
Pascal Mlindi	Ohio State	Agricultural Engineering	M.S.	Completed	Techno-Economic Evaluation of Current Maize Harvesting, Handling, Transportation and Storage Practices of Small Rural Farm Operators
Peter Ngimbwa	Ohio State	Agricultural Engineering	M.S.	Completed	Irrigation Decision Support Tool for Smallholder Farmer
Privata Chiwindo	Ohio State	Agribusiness	M.S.	Completed	Economics of Agroforestry and Monocrop Systems in Tanzania
Victoria Bulegeya	Ohio State	Plant Breeding	M.S.	Completed	The Effect of Potyvirus Resistance on Maize Lethal Necrosis (MLN) Disease
Victoria Nkuba	Ohio State	Agribusiness	M.S.	Completed	Assessment of Marketing Efficiency for Tomato Producers
Saidah Bakar	Michigan State	Human Nutrition	M.S.	Completed	Determinants of Nutrition Inadequacies among Adolescent Girls of Rural Tanzania
Emmanuel Domonko	Florida	Agribusiness	M.S.	Completed	Consumer Risk Perception of Vitamin A Deficiency and Acceptance of Biofortified Rice in Tanzania
Gloria Kuhumba	Florida	Food Science	M.S.	Completed	Evaluation of Aflatoxins in Peanut-Enriched Complementary Flours from Selected Markets in Tanzania



Roman Fortunatus	Florida	Food Science	M.S.	Completed	The Fight Against Vitamin A Deficiency: Development and Assessment of Fortified Maize Flour Product
Wilfred Makombe	Florida	Agricultural Economics	M.S.	Completed	Tanzanian Export Ban Policy Effects on Maize Farmer Production Decisions
Adelina Rwabilimbo	Tuskegee	Agricultural Economics	M.S.	Completed	Analyzing Marketing Performance for Smallholder Farmers in Kilombero, Tanzania
Devotha Mwazembe	Tuskegee	Agronomy	M.S.	Completed	Climate Change Projection and Impact On Maize Production in Kiteto and Kongwa Districts
Gertrude Kanyairita	Tuskegee	Plant Breeding	M.S.	Completed	Agronomic and Molecular Screening, Characterization and Identification of Tanzania Maize Germplasms for Drought Tolerance
Godebertha Rugazia	Tuskegee	Agricultural Economics	M.S.	Completed	Water Management and Agricultural Production; The case of Buigiri Dam, Chamwino District, Dodoma, Tanzania
Jamila Mweta	Tuskegee	Biotechnology	M.S.	Completed	Characterization of Viruses Affecting Tomato Production in Rufiji and Ruaha River Basin on Tanzania
Japhet Laizer	Tuskegee	Agribusiness	M.S.	Completed	Determinants of Consumer's Preferences for Local and Imported Rice in Kilimanjaro Region, Tanzania
Asha Shayo	Virginia Tech	Agr Education	M.S.	Completed	Socio-Cultural Practices that Impact Women Farmer Land Ownership: A Case of Sukuma Women in Tanzania
Richard Ngaya	Virginia Tech	Statistics	M.S.	Completed	Statistical Support for Agronomy and Social Science Research
<b><u>Sokoine University</u></b>					
Mwanaidi Japhary	Sokoine	Crop Science	M.S.	Completed	Reaction of Selected Rice Breeding Lines to Bacterial Blight Caused by <i>Xanthomonas Oryzae Pv. Oryzae</i>
Selina Nombo	Sokoine	Agricultural Economics	M.S.	Completed	Vegetable Nursery Technology Profitability in Arumeru and Mvomero
Tabu Katengesya	Sokoine	Human nutrition	M.S.	Completed	Aflatoxin and Fumonisin Contamination in Commercial Locally Processed Cereal Based Complementary Foods in Morogoro Municipality, Tanzania

Stella Andrea	Sokoine	Agricultural Extension Education	M.S.	Completed	Effectiveness of Farmer Field Schools in Improving Agricultural Productivity: A Case Study of Smallholder Maize Farmers in Hai District, Kilimanjaro Region
Hanney Mbwambo	Sokoine	Agricultural Economics	M.S.	Completed	Assessment of Postharvest Losses along Rice Supply Chain
Rose Ngwala	Sokoine	Rural Development	M.S.	Completed	Effectiveness of Agricultural Credit on Rice Productivity among Smallholder Farmers in Kilombero District
Zena Mchomvu	Sokoine	Agricultural Economics	M.S.	Completed	Economic Competitiveness of Farm Power Technologies for Major Farm Operations in Selected Farming Crops in Southern Tanzania
Julius Medardus	Sokoine	Veterinary Medicine	Ph.D.	Completed	Genotypic Diversity and Antimicrobial Resistance in Salmonella Isolates from Food Animals and Animal Products
Isaac Kashoma	Sokoine	Veterinary Medicine	Ph.D.	Completed	Molecular Typing and Antimicrobial Resistance of Campylobacter Isolates from Food Animals and Animal Products
<b><u>RUFORUM</u></b>					
Doris Sendewa	Makerere	Agribusiness	M.S.	Examiner	Consumer Preferences and Willingness to Pay for Organic Vegetables in Dar es Salaam
Pendo Nghambi	Makerere	Human Nutrition	M.S.	Completed	Effect of Germinated Maize Flour on Nutrient Density and Acceptability of Porridge as Complementary Food for Children 6-24 Months in Morogoro-Tanzania
Mary Marcel	Makerere	Human Nutrition	M.S.	Completed	Development of a Complementary Porridge from Orange Fleshed Sweet Potato, Pumpkin Seeds, Soy Bean and Amaranth Grains
Beata Ktabazi	Makerere	Human Nutrition	M.S.	Completed	Aflatoxin Exposure and Nutritional Status of Children Age 6-36 Months
Nicholas Nchembi	LUANAR	Agricultural Extension Education	M.S.	Completed	Assessment of Factors Influencing Continued Use of Improved Maize Seed Technology in Kilosa District in Tanzania
Angela Aluko	Jomo Kenyatta	Food Science	M.S.	Completed	Probiotic Viability and Storage Stability of Yoghurt Enriched with Baobab Pulp ( <i>Adansonia digitata</i> )

Julieth Balilemwa	Kenyatta	Natural Resource Management	M.S.	Completed	Assessment of Soil Moisture, Maize Performance under Rainwater Harvesting and Practices Used to Cope with Water Scarcity in Morogoro, Tanzania
Aika Okting'ati	Egerton	Agricultural Economics	M.S.	Completed	The Role of Market Information Systems in Improving Income Earning Opportunities of Smallholder Vegetable Farmers: A Case Study of Self Help Groups in Babati District, Tanzania
Maria Mtui	Egerton	Agricultural Economics	M.S.	Completed	Economic Cost Quantification of Post-harvest Losses of Vegetables in Babati District of Manyara
Neema Mboye	Zimbabwe	Dairy Technology	M.S.	Completed	Microbial and Compositional Quality of Raw Milk from Selected Small Scale Dairy Farmers at Hai District
<b><u>Punjab Agricultural University</u></b>					
Meshack Tegeye	Punjab Agricultural University	Food Science	M.S.	Completed	Development of Nutritious Convenience Foods Using Crops: Sorghum, Maize and Sweet Potato
Amina Makbel	Punjab Agricultural University	Food Science	M.S.	Completed	Assessment of Quality Characteristics of Paneer as Influenced by Fruit Acidulants
Ashura Dulazi	Punjab Agricultural University	Soil Science	M.S.	Completed	Soil Aggregation and Organic Carbon Fractions in Different Land Uses In Sub-Montane Punjab
Nengilang'et Kivuyo	Punjab Agricultural University	Human Nutrition	M.S.	Completed	Dietary Acculturation and Food Related Issues: A Study of African Emigrant Students
<b>COHORT V</b>					
<b><u>OSU Consortium</u></b>					
Deogratias Massawe	Ohio State	Plant Breeding	Ph.D.	Research	Identification and Characterization of maize-infecting viruses in the United Republic of Tanzania (to be completed by OSU)
Elizabeth Ndaba	Michigan State	Human Nutrition	M.S.	Defense	Effectiveness of Universal Salt Iodation (USI) in Preventing Iodine Deficiency Disorders in Tanzania (MSU will complete)

Winfred Tamba	Ohio State	Agricultural Education	M.S.	Completed	Exploring the Effects of Farmer-Extension-Research Linkages on Farmer Adoption of Farming Practices at Regional and District Levels: A Case of Mtwara Region
<b><u>Sokoine</u></b>					
Anna Tesha	Sokoine	Human Nutrition	M.S.	Completed	Improving Nutrient Contents of Frequently Used Complementary Foods for Children Aged 6-23 Months in Rombo District
Fahmia Selemani	Sokoine	Human Nutrition	M.S.	Completed	Levels of Fumonisin in Cereal-Legume Based Complementary Flours
Mbano Nuru	Sokoine	Agribusiness	M.S.	Drafting	Determinants of Profitability in Food Small and Medium Food Enterprises (SME's) in Morogoro Municipal, Tanzania
Elizabeth Medard	Sokoine	Agricultural Economics	M.S.	Drafting	Factors Underlying Common Beans Consumption Decisions in Dar-es-Salaam, Tanzania
Sarah Luzangi	Sokoine	Human Nutrition	M.S.	Completed	Effect of Behavior Change Intervention to Improve Child Nutrition: A Case Study of Mwanzo Bora Nutrition Program in Morogoro Region
Hope Masanja	Sokoine	Human Nutrition	M.S.	Completed	Contribution Of Fish In Improving Micronutrients Content in Complementary Foods for Children Aged 6 to 23 Months at Lindi Rural
<b><u>RUFORUM</u></b>					
Mercy Mmari	Jomo Kenyatta	Food Science	M.S.	Completed	Nutrient Composition and Consumer Acceptability of Soybean-Sweet Potato Based Complementary Food Fortified with Senene - Longhorn Grasshopper ( <i>Ruspolia differens</i> )
Scholastica Mwema	LUANAR	Agricultural Economics	M.S.	Completed	Effectiveness of Extension Dissemination Methods in Raising Awareness, Increasing Knowledge and Stimulating Uptake of Improved Inputs: A Case Study of Common Beans in the Southern Highlands of Tanzania
Zaharan Hussein	Stellenbosch	Food Science	Ph.D.	Drafting	Perforation – Mediated Modified Atmosphere Packaging (PM – MAP) and Shelf Life of Pomegranate Fruit (to be completed by Stellenbosch)

## ANNEX III: COLLABORATIVE RESEARCH OUTPUTS, OUTCOMES, AND IMPACTS

Titles, outputs, outcomes, and impacts of the collaborative research projects are presented in the table below. Impacts of this research are likely to increase over time as alternative practices and newly introduced technologies are disseminated further among farmers and entities working with them.

Name of PI	Title of Research Project	Most Notable Research Outputs, Outcomes, and Impacts	Training Completed
Amuri, SUA	Improving Agricultural Productivity and Crop Nutritive Quality through a Gender Sensitive Approach	Knowledge on macro and micronutrient status of soils in the surveyed areas made available for further research use and for use by extension advisory services. Nutritional status of staple food crops in the surveyed areas established. To date one paper published, one seminar paper presented, and a flyer disseminated	2 MSc students; 20 farmers, 1 ward executive, 3 undergraduates, and 15 farmers (8 female and 7 male) trained in fertilizer use for improved yields and crop quality.
Chase, U. of Florida	Improvement of Tomato Productivity and Quality in Tanzania	At least 100 farmers were introduced to grafting technology, learned how to do it, and adopted it. Grafting provides protection for tomato plants from diseases and leads to higher yields. Five articles prepared for publication in peer reviewed journals.	138 farmers trained in various aspects of tomato production (about 50% female). Three extension agents trained on grafting.
Kashenge - Kilenga, MALF	Integrated Salt-Affected Soil Management Options for Sustainable Rice Productivity in Irrigation Schemes of Tanzania	Fields abandoned for almost 20 years are now being rehabilitated through effective salinity management. Rice yields have increased from 0 to 4 tons/ha. Creates a local market for gypsum. A book chapter, journal papers, posters and brochures have been published and a farmer field day for 70 farmers undertaken.	163 female/257 male extension officers trained in soil salinity mitigation practices; 149 female/139 male farmers trained in soil salinity mitigation; 197 female/192 male farmers involved in field visits.
Kimaro, SUA	Agricultural Innovation for Smallholder Farmers through locally Adapted Conservation Agriculture (CA)	Two hundred farmers in the study area adopted SRI; yields increased from 1.7 to 3.6 tons/ha; one paper published; 6 conference papers presented; 2 farmer training materials sets and 2 policy briefs prepared; 2 M.Sc. and 1 Ph.D. students supported and completed programs.	200 farmers trained in SRI; 6 ag extension staff trained on efficient rice production; 72 students at Kilimanjaro MATI trained on use of SRI.
Kinabo, SUA	From Soil Elements to Food Nutrients	Awareness of importance of soil nutrients was heightened through feedback sessions with community members where studies were conducted. Community members became aware of nutrient content of their foods and dietary intake. Three papers presented at conferences; four journal drafts	50 community members trained on cooking techniques designed to preserve various food nutrients followed by testing of improved recipes.

Miller, Ohio State U.	Improved Soil Health and Germplasm to Advance Tomato Production in Tanzania	Farmers' yields improved by 150%; individual incomes for adopters estimated to increase by 50% in three years—from Shs 5 million to 7 million; 6 journal papers published; 3 papers presented at conferences; and 4 webinar series conducted on tomato production.	13 technical staff persons trained in soil testing and advanced tomato germplasm usage; 201 farmers trained in various soil health and soil testing kit usage.
Tarimo, SUA	Low-Cost Drip Irrigation Technology	Increased consumption of vegetables from one meal to four meals per week; increased sales of vegetables in village from 375 to 625 bunches per week; water productivity increased from 2.6 kg/m <sup>3</sup> to 5.5kg/m <sup>3</sup> ; 2	Community members trained on all aspects of efficient drip irrigation.
Wambur a, SUA	Enhancing Exten- sion Service Deli- very by Using Ag- ricultural Innova- tion Systems: The Case of Maize	71 ag extension stakeholders involved in identification of options for improving maize extension system. Report will be an input to several high level forums for improving maize extension system.	10 extension agents trained on GIS and research ethics.
Miranda, Ohio State;	Investigating the Impacts of Drought-Insured Loans on Farmer Group Sustainability and Technology Adoption	i) Developed a research design for predicting the impact of index insurance coupled loans on farmer risk taking decisions under individual and joint liability lending. ii) Conducted Framed Field Experiment with 405 farmers from 40 farmer groups in 8 villages in the Dodoma region of Tanzania; iii) workshop held with crop insurance firms, banks, and agricultural	i) 3-day training on introduction to Matlab for the 4 team members; ii) 3-day seminar for the 4 project team members on behavioral experimental economics.
Lubber- stedt, Iowa State U.	Abiotic and Biotic Maize Productivity Constraints	Field surveys conducted in three northern- zone regions to assess hot spots for Maize Lethal Necrosis Disease (MLND) incidence and symptom severity; striga incidence mapped in main maize growing regions of Tanzania; participation in Nairobi regional workshop to share information on MLND.	Three iAGRI sponsored students trained by Joseph Ndunguru in his lab on MLND lab material handling; students advised on MLND research.
Heatwole, Virginia Tech	Agricultural Resource Water Management in the Ruvu Basin	Stakeholders' workshop involving the Ruvu Basin staff, local community representatives, Ministry of Water and SUA was held to collect key project information and perceptions on challenges facing the basin and alternative pathways of circumventing the problems.	A SUA-based staff person (Mbungu) completed his PhD at VT under iAGRI. He provided much of the leadership for the project.  9 Ministry of Water staff and 6 SUA graduate students trained on development and interpretation of hydrological models to address erosion problems in the Ruvu catchment area.



## ANNEX IV: PEER-REVIEWED PUBLICATIONS BY IAGRI STUDENTS

**Abdallah, M.**, Mwatawala, M.W., Kudra, A. B.

- 2016 Abundance and dispersal of *Heteronychus arator* (Coleoptera: Scarabaeidae) in maize fields under different fertiliser treatments. SpringerPlus, 5(1), 1-9.

**Aluko, A. E.**, Kinyuru, J., Chove, L. M., Kahenya, P. and Owino, W.

- 2016 Nutritional Quality and Functional Properties of Baobab (*Adansonia digitata*) Pulp from Tanzania. Journal of Food Research, 5(5), 23.

**Binagwa, P.H.**, Bonsi, C.K., Msolla, S.N.

- 2015 Evaluation of Common Beans (*Phaseolus vulgaris*) Genotypes for Resistance to Root Rot Disease caused by *Pythium aphanidermatum* and *Pythium splendens* under Screen house Conditions. Journal of Natural Science Research. (6): 36 – 43.

- 2016 “Morphological and Molecular Identification of *Pythium* spp. Isolated from Common Beans (*Phaseolus Vulgaris*) infected with Root Rot Disease. African Journal of Plant Science, 10(1):109.

**Domonko, Emmanuel S.**, Brandon R. McFadden and Conner Mullally.

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## ANNEX V: CONFERENCE PRESENTATIONS BY IAGRI STUDENTS

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- 2015 “Nutritional and Functional Significance of Baobab Grown in Tanzania.” Poster presented at the 11<sup>th</sup> International Food Data Conference, Hyderabad, India, November 3-5.
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- 2016 “Breeding for Rice Blast Resistance in Rice (*Oryza sativa* L) Using an Approach of Genomic Selection (GS) or Genomic Prediction (GP).” Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

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- 2015 “Enrichment of Functional Properties of Ice Cream with Non-Conventional Ingredients.” Paper Presented at the National Conference on Innovative Techniques in Food Product and Processing Technologies, Punjab, India, October 9-10, p. 91.

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- 2016 “Capacity Building of Farmer Groups for Good Quality Seed Production to Accelerate Adoption of Improved Bean Varieties in Northern Zone of Tanzania: A Case Study of Kilindi District, Tanga.” Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.



2016 “Evaluation of Common Bean (*Phaseolus vulgaris*) Genotypes for Resistance to Root Rot Disease Caused by *Pythium aphanidermatum* and *Pythium splendens* under Screen House Condition.” Paper Presented at the Pan Africa Grain Legumes and World Cowpeas Conference, Livingstone, Zambia, February 28 – March 5.

2016 “Capacity Building of Farmer Groups for Good Quality Seed Production to Accelerate Adoption of Improved Bean Varieties in Northern Zone of Tanzania: A Case Study of Kilindi District, Tanga.” Paper Presented at the Pan Africa Grain Legumes and World Cowpeas Conference, Livingstone, Zambia, 28th February – 5th March.

**Binagwa, P.H.,** Bonsi, C.K., Msolla, N.S. and Ritte, I.P.

2015 “Morphological and Molecular Identification of *Pythium* spp. Isolated from Common Beans (*Phaseolus Vulgaris*) Infected with Root Rot Disease.” Paper Presented at the Common Bean Disease Workshop on Angular Leaf Spot and Root Rots, Skukuza, South Africa.

**Buzo, H.,** Mongi, R.J., & Mukisa, I. M.

2016 “Development and Assessment of Nutritional Quality and Sensory Properties of Orange Fleshed Sweet Potato and Bambara Groundnut-Based Snacks for School Children.” Paper Presented at the Fifth RUFORUM Biennial Regional Conference, 17-21 October, Cape Town South Africa.

**Chiwindo, Privata.**

2016 “Economics of Agroforestry and Mono Crop Systems in Tanzania.” Poster presented at the 2016 OARDC Annual Research Conference, Wooster Ohio, USA, April 21.

**Consesa, Richard.**

2016 “Exploring Agricultural Extension Staff Knowledge and Practice of Value Chain Approach in Extension: The Case of Maize in Kongwa District, Tanzania.” Paper Presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Dimosso, Mbwando.**

2016 “Inheritance of Resistance to *Alectra Vogelii* in Cowpea (*Vigna Unguiculata*).” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Domonko, Emmanuel.**

2016 “Tanzanian Willingness to Pay for Biofortified Rice to Decrease the Risk of Several Visual Impairment.” Paper Presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Fortunatus, Roman.**

2016 “The Fight Against Vitamin A Deficiency: Development and Assessment of Fortified Maize Flour Product.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Fue, Kadeghe.**

- 2016 “Self Adjusting Wireless Irrigation Controller Using Plant Water Requirement LogRhythms.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Gabagambi, Respikius, Sharp, J and Mwaseba, D.**

- 2014 “Contract Farming and Smallholder Farmers in a Global Economy: The Case of Mtibwa Cane Growers in Mvomero Tanzania.” Paper Presented at International Conference on Contract Farming in Africa. 2-3 October at White Sands Hotel, Dar es Salaam, Tanzania
- 2014 “Contract Farming and Smallholder Farmers in a Global Economy: The Case of Mtibwa Cane Growers in Mvomero Tanzania. Paper Presented at the International Conference on Bridging the Gap between Science, Society and Industry: Building a new Generation of African Soil Scientist and Agronomists. Decembe5 1-5, Kenyatta University, Nairobi, Kenya.
- 2016 “Farmer Perceptions of Contract Farming in Tanzania: A Case Study of the Mtibwa Out-Grower Sugar Cane Scheme in Morogoro Region.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Goraya, R. K., Bajwa, U. and Ahmed, A.**

- 2015 “Bioactive Potential of Spices: Advantage Health and Disease (Abstract).” Paper Presented at the National Conference on Innovative Techniques in Food Product and Processing Technologies, Punjab, India, October 9-10.

**Hilali Saleh Hilali.**

- 2016 “Physiological Studies of Rice (*Oryza sativa* L.) under High Temperature Stress.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Honi, Buzo.**

- 2016 “Development and Assessment of Nutritional Quality and Sensory Properties of Orange Fleshed Sweet Potato and Bambara Groundnut-Based Snacks for School Children.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Hussein, Zaharan, Oluwafemi J. Caleb, Pramod V. Mahajan, Marena Manleya, Umezuruike, Linus Opara.**

- 2014 “Effect of Perforation and Storage Temperature on the Water Vapour Transmissoin Rate of Selected Biodegradable and Polymeric Films.” Poster Presented at the 4<sup>th</sup> RUFORUM Biennial Scientific Conference, Maputo, Mozambique, July.

**Hussein, Z., Fawole O. A. and Opara, U. L.**

- 2016 “Reducing Susceptibility of Fresh Produce to Physical Damage during Post Harvest Handling: The Case of Pomegranate Fruit.” Paper Presented at the Fifth RUFORUM Biennial Regional Conference, 17-21 October, Cape Town South Africa.

**Irika, M. A.,** Kinama, J., Cheminin'wa, G. and Nyambilila, A.

- 2014 "Effect of Organic and Inorganic Nitrogen Sources on Growth, Yield and Oil Content of Sunflower Grown in Highly Weathered Soils of Morogoro." Paper Presented at the Fourth RUFORUM Biennial Regional Conference, 25 July, Maputo Mozambique.

**Jumbe Theresia.**

- 2016 "Evaluation of Fatty Acids and Mineral Contents of Local Seeds and Oils in Tanzania." Paper Presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Jumbe Theresia,** Sarah S. Comstock, William S. Harris, Joyce Kinabo, Matthew B. Pontifex and Jenifer I. Fenton.

- 2015 "Association between Fatty Acid Status and Executive Function in Tanzanian Children Aged 2-6." Paper Presented at the 3<sup>rd</sup> Congress of Federation of African Nutrition Societies, Arusha, Tanzania.

**Kangile, Rajabu.**

- 2016 "Price Competitiveness of Smallholder Rice Farmers under Cooperative Irrigation Schemes in the Coastal and Morogoro Regions, Tanzania." Paper Presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

- 2016 "Rice Marketing and Consumer Preference. Paper Presented at the CARI National Workshop, Dar es Salaam, Tanzania, September 30.

**Kangile, Rajabu.**

- 2016 "Rice Seed Value Chain in Tanzania. Paper presented at the ARI Chollima Internal Program Review," Morogoro, Tanzania, August 16.

**Kashoma, Isaac.**

- 2016 "Prevalence and Antibiotic Resistance of Campylobacter Isolated from Dressed Cattle Carcasses and Raw Milk in Tanzania." Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Kimaro, Prisca.**

- 2016 "Niche Market Opportunities for Sorghum Smallholder Farmers in Tanzania." Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Kiobia, Denis.**

- 2016 "Sitophilus Zeamais (Coleoptera: Curculionidae) in Stored Maize Show a Daily Feeding Rhythm." Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Kilasi, N. and B. Rathinasabapathi.**

2015 “Wide Adaptation of N22 Rice Variety to Temperature Extremes: A Potential Resource to Develop Climate Change Resilient Varieties,” Poster Presented to the Florida Genetics Symposium, Gainesville, FL., November 18-19.

Krishnamurthy A., **Kilasi, N.** and B. Rathinasabapathi.

2013 “Improving Heat Tolerance in Rice through Early Heat Shock Treatment.” Poster Presented at the Florida Genetics Symposium, Gainesville, FL., (October 9-10.

**Laizer, Japhet,** Ashi, A., Joakin, M., Baharanyi, N., and Robert, Z.

2015 “An Analysis of Consumer Preferences in International Calls.” Paper Presented to the 125<sup>th</sup> Southern Association of Agricultural Scientists Meeting, Atlanta, GA.

**Lazaro, Edith.**

2016 “An Empirical Analysis of Rice Demand in Tanzania.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Levi, Charles.**

2016 “Effectiveness of ICTs in Dissemination of Agricultural Information to Smallholder Farmers.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

2014 “Effectiveness of ICT in Dissemination of Agricultural Information to Smallholder Farmers in Kilosa District, Tanzania.” Poster Presented at the 4<sup>th</sup> RUFORUM Biennial Scientific Conference, Maputo, Mozambique, July.

**Mahinda, A.**

2016 “Effect of Watering Regimes on the Performance, Yield and Water Use Efficiency of Sorghum in Semi-Arid areas of Tanzania.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

2014 “Effect of Drip Irrigation on the Performance and Economic Returns of Sorghum (Sorghum Bicolor) in Semi-Arid Areas of Tanzania,” Poster Presented at the 4<sup>th</sup> RUFORUM Biennial Scientific Conference, Maputo, Mozambique, July.

**Massawe, D. P.,** Stewart, L. R., Kusolwa, P. M., Francis, D., Feng, Q., and Paul, P.

2016 “Poliovirus Identified in East African Country Maize Samples” Poster Presented at the 2016 OARDC Annual Research Conference, Wooster Ohio, USA, April 21.

**Matunda, A.,** O’Keefe, F. S., Malikarjunan, K., Duncan, S., Stewart, A., Mongi, R.

2015 “Pineapple Vinegar to enhance shelf life of Carrot and Mango in Tanzania.” Paper Presented at Virginia Tech, June 3.

**Makombe, Wilfred.**

- 2016 “The Effects of Export Bans on Tanzanian Maize Farmer Welfare and Food Security.” Paper presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Marcel, Mary.**

- 2016 “Development of a Nutrient Dense Porridge Flour for Children from 6-24 months of Age Based on Locally Available Foods in Tanzania.” Paper presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Marianda, Mariam.**

- 2016 “Folate and Iron Consumption in Tanzanian Women of Childbearing Age: A Case Study of Mvomero District.” Paper presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Mariki, Allan.**

- 2016 “Distribution of Maize Lethal Necrosis Disease: Its Viruses and Alternative Hosts in Arusha, Manyara and Dodoma Regions.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

Manion, W., Munz, S., Wetzel, E., **Shayo, A.** and Tyhust, M.

- 2015 Communicating Science: A Qualitative Analysis.” Poster Presented at the Conference on Higher Education Pedagogy, CIDER, Blacksburg, VA., February 10-11.

**Massawe, Boniface.**

- 2016 “Involving Farmers in the Agricultural Land Use Planning Process Using Analytic Hierarchy Process: A Case of Kilombero Valley Rice Farmers, Tanzania. “Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

- 2013 “Digital Soil Mapping and GIS-Based Land Evaluation for Rice Production in Kilombero Valley, Tanzania.” Paper Presented at ICIPE Campus, Nairobi, Kenya CGIAR Scientists Meeting, June 12.

**Massawe, Boniface H.J.,** Brian K. Slater, Sakhti K. Subburayalu, Abel K. Kaaya, Leigh Winowiecki.

- 2015 “Mapping Numerically Classified Soil Clusters of Kilombero Valley Using Machine Learning.” Paper Presented at the Pedometrics Conference, Cordoba, Spain, September 14-18.

**Massawe, Boniface** and Brian Slater

- 2015 “Digital Soil Mapping for Rice Production in Kilombero Valley, Tanzania,” Paper Presented at the Symposium on International Scholarships Organized by The Office of International Affairs, The Ohio State University, February 27, 2015.

- 2015 “Quantitative and Fuzzy Classification of Alluvial Soils of Kilombero Valley, Tanzania.” Paper Presented at the 28<sup>th</sup> Bi-Annual Conference of the Soil Science Society of East Africa, Morogoro, Tanzania, November 23-27.

**Massawe, Boniface H.J.**, Brian K. Slater, Abel K. Kaaya, Leigh Winowiecki.

- 2015 “Multi-Criteria Land Evaluation Analysis for Rice Production Suitability Using GIS and Analytic Hierarchy Process (AHP)) in Kilombero Valley, Tanzania,” Paper Presented at the 28<sup>th</sup> Bi-Annual Conference of the Soil Science Society of East Africa, Morogoro, Tanzania, November 23-27.

**Boniface Massawe**, Brian K. Slater, Sakthi K. Subburayalu, Abel K. Kaaya, and Leigh Winowiecki

- 2015 “Updating Legacy Soil Maps for Climate Resilient Agriculture: A Case of Kilombero Valley, Tanzania,” International Conference on Climate Change and Multi-Dimensional Sustainability in African Agriculture.” Morogoro, Tanzania, June 3-5.

Mahay, F.H, **W.B. Mbungu**, P.M. Ndomba, A. Griensven

- 2013 “Ecohydrology Assessment of Kirumi Wetland Using Hydroinformatics Tools.” Paper Presented at the 14th Waternet/WARFSA/GWP-SA Symposium, IWRM: Building Partnerships and Strengthening Cooperation for Integrated Water Resources Management in Eastern and Southern Africa, 30 October – 1 November, Dar es Salaam | Tanzania.

**Winfred Mbungu and Conrad Heatwole**

- 2016 “Modeling Effect of Changes in Land Use and Land Cover in the Upper Ruvu Watershed, Tanzania Using SWAT-VSA.” Paper Presented at the 21st Century Watershed Technology Conference and Workshop. Quito, Ecuador. December 3 – 9.

**Winfred Mbungu** and Conrad Heatwole

- 2016 “Spatial Extent of Land Use/Cover (LULC) Changes and Estimation of Associated Impacts on Soil Erosion Hazards/Risks in the Upper Ruvu Watershed, Tanzania.” Paper Presented at the Graduate Students Association Research Symposium and Expo, March, 23, 2016. Blacksburg, VA.

**Winfred Mbungu and Conrad Heatwole**

- 2013 “Evaluation of DEMs Derived from SRTM and ASTER for Hydrologic Applications in the Ruvu Watershed in Tanzania.” Paper Presented at the OGIS Symposium, Blacksburg, VA, March.

Heatwole, C.D. and **W. Mbungu**.

- 2015 “Hydrologic Monitoring of Headwater Catchments for Climate Change Adaptation Studies.” Paper Presented at the International Conference on Climate Change and Multi-Dimensional Sustainability in African Agriculture, Morogoro, Tanzania, June 3-5.



**Medardus, J. J.,** Kashoma, I. P., Nana, I. G., Johnson, R. P., Kazwala, R. R., Gebreyes, W. A.

2015 "Multidrug Resistant Salmonella Isolates from Food Animals and Animal Products in Pastoral Zones of Tanzania: Prevalence and Molecular Characterization." Poster Presented at the 3rd International Congress on Pathogens at the Human- Animal Interface (ICOPHAI), August 6-8, Chiang Mai, Thailand.

**Medardus, J. J.,** Molla, B. Z., Nicol, M., Morrow, W. E., Rajala-Schultz, P., Kazwala, R. R., Gebreyes, W. A.

2013 "The Use of Heavy Metals in Swine Feed and Its Association with the Occurrence of Copper and Zinc Tolerant and Multi-Drug Resistant Salmonella." Paper Presented at the 2nd International Congress on Pathogens at the Human- Animal Interface (ICOPHAI), held on 14-17 August 2013, Porto de Galinhas, Brazil.

**Medardus, J. J.,** Kashoma, I. P., Kessy, B. M., Kazwala, R. R., Gebreyes, W. A., Rajashekara, G.

2014 "Prevalence, Antimicrobial Resistance of Campylobacter: Pastoral Zones of Tanzania." Paper Presented at the 1st IGAD International Scientific Conference on Health, December 3-6, Addis Ababa, Ethiopia.

**Emmanuel Mgonja.**

2015 "Molecular Analysis of Host Resistance and Pathogenicity of Rice Blast in East Africa." Poster Presented at the American Phytopathological Society Annual Meeting, Pasadena, Cal., August.

2016 "Genome-Wide Association Mapping of Rice Resistance Genes Against *Magnaporthe oryzae* Isolates from Four African Countries." Poster Presented at the 2016 OARDC Annual Research Conference, Wooster Ohio, USA, April 21st.

**Mhafu, Fabian.**

2016 "Optimizing Traditional Processing Technologies to Increase Nutrient Bioavailability of Complementary Foods in Rural Tanzania." Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Mhalu, Glory.**

2016 "Effect of Nutrition Information on Feeding First Food Enriched with Orange Fleshed Sweet Potatoes on Vitamin A Status of 6-12 Month Children in Morogoro Region, Tanzania." Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Milindi, Paschal.**

2016 "An Improved Hermetic Grain Storage System for Smallholder Farmers in Tanzania" Poster presented at the 2016 OARDC Annual Research Conference, Wooster Ohio, USA, April 21st.

**Mirondo, R.** and S. Barringer.

2014 "Effect of Peels on Quality Attributes of Hot and Cold Break Tomato Juice and Sauce." Ohio Agricultural Research and Development Center Annual Symposium, Wooster, Ohio.

- 2014 "Effect of Peels on Quality Attributes of Hot and Cold Break Tomato Juice and Sauce." Poster Presented at the OVIFT Annual Symposium, Columbus, Ohio, March 17.
- 2014 Effect of Peels on Volatile Levels of Hot and Cold Break Tomato Juice and Sauce." Syft User's Meeting, Columbus, Ohio.
- 2014 "Effect of Peels on Quality Attributes of Mango Puree with Different Holding times." Syft User's Meeting, Columbus, Ohio.
- 2014 "Assessing the Quality Attributes of Peeled and Unpeeled Tomato Juice Using Hot and Cold Break Processing and Different Thermal Pasteurization Treatments." International Food Technologists Annual Meeting, Chicago, Ill.
- 2015 "Effect of peel on quality attributes of mango puree with different holding times." Paper Presented at International Food Technology Annual Meeting.

**Mirondo R, S Barringer.**

2015. Effect of peels on quality attributes of mango puree held at different times. 2015 Paper Presented at Syft User's Meeting.

**Mercy Mmari**

- 2016 "Application of edible insects in enriching complementary foods made from common plant sources. A Case study of *Ruspolia differens*" paper presented at fifth African higher education week and RUFORUM biennial conference, Cape Town, South Africa on 19th October.

**Mercy Mmari**

- 2016 "Can Edible Insects spare 43,000 lives and save 280M USD annually in Tz?" Poster presented at the fifth African higher education week and RUFORUM biennial conference, Cape Town, South Africa on 17th-21st October.

**Mmongoyo, J, A.,** Wu, F., Linz, J. E., Nair, M. G., Mugula, J. K., Strasburg, G. M.

- 2016 "Aflatoxin Levels in Sunflower Seeds, and Cakes Collected from Micro- and Small-Scale Sunflower Oil Processors in Tanzania," Poster Presentation at International Food Technology Conference in Chicago. Illinois, July 16-19.

**Mosha, Sebastian.**

- 2016 Effect of Organic and Inorganic Fertilizers on Natural Food Composition and Performance of African Catfish (*Clarias Gariepinus*) Fry Produced under Artificial Propagation." Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Mpinga, Lillian.**

- 2016 "Tomato Grafting for Improved Yield and Quality in Open-Field Production in Tanzania." Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Mpinga, L., Msogoya, T.J., and Chase, A.C.**

- 2014 “Tomato Grafting for Improved Yield and Quality in Open-Field Production in Tanzania,” Paper presented at the International Conference on Youth and Agriculture, Kenyatta University, Nairobi, Kenya, December.

**Msemo, Emmanuel.**

- 2016 “Impacting Agricultural Productivity in Tanzania through the Wheels of Statistics.” Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.
- 2014 “Impacting Agricultural Productivity in Tanzania through the Wheels of Statistics,” Paper Presented at the Joint Statistical Meetings, Boston, MA, August.

**Msuya, Joan.**

- 2016 “Food Safety Knowledge, Practices and Behaviors of Mothers and Caregivers in Tanzania.” Poster presented at the 2016 OARDC Annual Research Conference, Wooster Ohio, April 21.
- 2016 “Food Safety of Homemade Complementary Foods in Tanzania.” Paper presented at the iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.
- 2016 “Food Safety Knowledge, Practises and Behaviors of Mothers and Caregivers in Morogoro, Tanzania.” Poster presented at Agriculture, Nutrition and Health Academy Week, Addis Ababa Ethiopia, June 20-24

**Mtama, Johnson.**

- 2016 “Pedology of Corn Productivity Indices for Selected Parts of the Southern Highland Zone of Tanzania.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

Mwahija, Almasi, **Irika, M.A.**, Kinama, J., Chemining’w, G. Amuri, P.

- 2014 “Effect of Organic and Inorganic Sources of Nitrogen on Growth, Seed Yield and Oil Content of SunFlower in Highly Weathered Soils in Morogoro, Tanzania,” Poster Presented at the 4<sup>th</sup> RUFORUM Biennial Scientific Conference, Maputo, Mozambique, July.

**Mwanga, E. F.**, Gitau, A. N., Christianne, T. and Earnest, M.

- 2015 “Stabilization of Silt Clay Soil Using Molasses for Small Dam Embankment Construction as Inner Zone.” Paper Presented at Fourth RUFORUM Biennial Regional Conference, July 2014, Maputo, Mozambique.

**Mwendo, M.M.**

- 2016 “Inheritance of Resistance to Brown Spot Disease of Upland Rice in Uganda.” Paper presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Mwendo, Marco M.,** M. Ochwo-Ssemakula, J. Lamo

2014 “Inheritance of Resistance to Brown Spot Disease in Upland Rice in Uganda,” Poster Presented at the 4<sup>th</sup> RUFORUM Biennial Scientific Conference, Maputo, Mozambique, July.

**Nicanuru, C.**

2016. “Effect of Pre-treatments and Drying on Nutrient Content of Orange Fleshed Sweet Potato Tubers and Cowpea leaves used in Maswa District, Tanzania.” Paper Presented at the Fifth RUFORUM Biennial Regional Conference, 17-21 October, Cape Town South Africa.

**Ngozi, Semeni.**

2016 “Efficiency of Participatory Research Approaches among Smallholder Farmers in Babati District, Tanzania.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

2016 “Efficiency of Participatory Research Approaches among Smallholder farmers of Agricultural Integrated Innovations in Babati District, Tanzania.” Poster Presented at the Student Week, Ibadan, Nigeria

2016 “Farmer Research Groups: An Efficient and Effective Model for the Uptake of Agricultural Innovations among Smallholder Farmers in the Babati District, Tanzania.” Poster Presented at the 5th RUFORUM Biennial Scientific Conference and African Higher Education Week, Cape Town, South Africa, October.

**Ngozi, S.,** Mshenga, P., Hillbur, P., & Kukuhenzire,

2014 “Efficiency of Participatory Research Approaches among Small Holder Farmers.” Paper Presented at the Fourth RUFORUM Biennial Regional Conference, July 25, Maputo Mozambique.

**Nicanuru, Christerbel.**

2016 “Effect of Drying and Storage on Beta Carotene Content of Orange Fleshed Sweet Potatoes.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Nkombe, B.M.** and Barker, D. J.

2015 “The Potential of Forage Species to Enhance the Sustainability of Grassland Soils.” Poster Presented at Graduate Research Competition, The Ohio State University, Columbus OH (Outstanding Poster Award).

**Nkombe, Boniphace.**

2016 “Investigation of the Potential of Forage Species to Enhance the Sustainability of Grassland Soils.” Poster Presented at the 2016 OARDC Annual Research Conference, Wooster Ohio, USA, April 21

**Nyamete, F.,** Bennink, M., and J. Mugula.

- 2015 “Potential of Lactic Acid Fermentation to Reduce Aflatoxin B1 in Tanzania Maize-Based Gruel.” Paper Presented at the International Food Research and Development Conference, Izmir, Turkey, June 1-5.

**Nyangi, Chacha.**

- 2016 “Assessment of Pre-Harvest Aflatoxin and Fumonisin Contamination of Maize in Babati District, Tanzania.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Majubwa, Ramadhani.**

- 2016 “Quality of Collaborations among Actors in the Rice Value Chain of Kilombero District.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.
- 2014 “Assessment of Quality of Collaboration in Rice Value Chain in Kilombero District, Morogoro, Tanzania, Poster Presented at the 4<sup>th</sup> RUFORUM Biennial Scientific Conference, Maputo, Mozambique, July.
- 2016 “Alternative Methods for Harvesting and Field-Packing Mandarin (*Citrus reticulata* Blanco) Fruits in Tanzania.” Paper Presented at the American Society for Horticultural Sciences Conference, Atlanta, Georgia, USA, August 8-11.

**Majubwa, Ramadhani.**

- 2016 “Sensory and Physiochemical Fruit Quality of Three Seedless Mandarin (*Citrus reticulata* Blanco) Cultivars Grown on Three Rootstocks.” Paper Presented at the Florida State Horticultural Society Conference, Stuart Island, Florida, USA, June 12-14.

**Nchembi Nicholas,**

- 2016 “Farmer Evaluation Criteria for the Continued Use of Improved Maize Varieties in Kilosa District Tanzania,” Poster Presented at the 5th RUFORUM Biennial Scientific Conference, Capetown, South Africa, October.

**Ritte, Innocent.**

- 2016 “Identification and Characterization of Markers Linked to Resistance Motifs against Maize Chlorotic Mottle Virus Infection in Maize Germplasms through Amplified Fragment Length Polymorphism Analysis.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Inocent Ritte,** M. Egnin, P. Kusolwa, G. He and S. Samuels.

- 2016 “Characterization of Markers Linked to Resistance Motifs Against Maize Lethal Necrosis Disease in Tanzanian Maize Germplasm.” Paper Presented at In Vitro Cellular and Developmental Biology-Plant Conference, Dar es Salaam, May.

**Ritte, I.,** M. Egnin, C. Bonsi, S. Samuels, G. Bernard, G. He, D. Mortley, P. Kusolwa A. Lorenz and T. Hoegemeyer.

2014 “SSR Based Bulk Segregant Analysis for Tagging Maize Chlootic Mottle Virus Resistant Genes on a Smaller Scale in Corn.” Paper Presented at the Society of In Vitro Biology. Savannah, Georgia, May 31–June 4.

Steven Samuels, M. Egnin, T. Nashar, J. Jaynes and **I. Ritte.**

2014 “Engineering Sweet Potato [*Ipomoea Batatas* (L.) Lam] Expressing Synthetic Lytic Peptide for the Potential Inhibition of Human Immunodeficiency Virus Replication.” Paper Presented at In Vitro Cellular and Developmental Biology–Animal Conference, Dar es Salaam, May.

**Rugazia, Godebertha.**

2016 “Economic Assessment of Irrigation Schemes and Agricultural Production: A Case of Chamwino District, Dodoma,” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Saimon, Venance.**

2016 “Factors Influencing Legume Profitability: A Case of Smallholder Bean Farmers in Babati District” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Saimon, V. K.,** Mshenga, P. and Birachi, E.

2015 “Factors Influencing On-Farm Common Bean Productivity in Manyara Region in Tanzania.” Paper Presented at the Fifth RUFORUM Biennial Regional Conference, October 17-21, Cape Town South Africa.

**Sanka, M. B.,** Diiro, G.M., & Hiilbur, P.

2016 “Adoption and Welfare Effects of Integrated Soil Fertility Management Technologies among Small Holder Maize and Pigeon Pea Farmers,” Paper Presented at the Fifth RUFORUM Biennial Regional Conference, October 17-21, Cape Town South Africa.

**Sendewa, Doris.**

2016 “Consumer Preferences and Willingness to Pay for Organic Vegetables in Tanzania.” Paper Presented at iAGRI Graduate Researcher Workshop, Morogoro, Tanzania, May 5-6.

**Sendewa, D. D.,** Elepu, G. and Temu, A.

2016 “Consumer Knowledge and Preferences for Organic Vegetables in Tanzania.” Paper Presented at the Fifth RUFORUM Biennial Regional Conference, October 17-21, Cape Town South Africa.

**Shausi, G.** and Agunga, R.

2014 “Implementing the Pluralistic and Demand-Driven Extension Approach in Tanzania: Implications for Agricultural Communication.” Paper Presented at the Agriculture Extension and Food Security Conference, Columbus, Ohio.

Niewolny, K., Landis, B., Mason, G., D'Adamo-Damery, D., Bass, R., Hogg, D., McGee, A., Mitra, S., Omosa, O., Sebit, M., **Shayo, A.**, Sorensen, E., Travis, E., Yan, L.

- 2015 "Learning through Story: Using Narrative Inquiry in a Graduate-Level Food Security Course." Poster Presented at North American Colleges and Teachers of Agriculture (NACTA) Conference. University of Georgia, Athens, GA., June 16-20.

**Shimwela, Mpoki.**, M. M., Roberts, P.M., Lee, W., and van Bruggen, A.H.C.

- 2013 "Spatial and Temporal Spread of Citrus Huanglongbing (HLB) Disease in South Florida Using Spatial and Spatio-Temporal Analyses," Paper Presented at the Florida Phytopathological Society Meeting, May.

- 2013 "Spatial Analysis of Citrus Huanglongbing (HLB) Spread in South Florida," Paper Presented at the Emerging Pathogens Institute Research Day, University of Florida, Gainesville, FL, February.

**Shimwela, M.M.**, Beed, F., Lee, W.S. and VanBruggen, H.C. A.

- 2014 "Spatiotemporal Pattern Analysis of the Spread of Banana Xanthomonas Wilt (BXW) in Kagera Region, Tanzania," Paper Presented at the Emerging Pathogens Institute Research Day, University of Florida, Gainesville, FL, February.

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**Shausi, Gosbert** and Agunga, R.

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**Shitindi, Mawazo.**

- 2013 "Effect of Cover Crop Rhizosphere Soil on Phosphorus Solubilization from Phosphate Rocks," Paper Presented at 17<sup>th</sup> Biennial Research Symposium – Association of 1890 Research Directors, Jacksonville, FL, April.
- 2014 "Effect of Organic Amendments on Activity of Selected Soil Enzymes," Paper Presented at the Soil Science Society of America Annual Meeting, Long Beach, Cal., November.
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- 2014 “Techno-Economic Analysis (TEA) and Life Cycle Assessment (LCA) of Maize Storage in Developing Countries,” Paper Presented at the American Society of Agricultural and Biological Engineering and Canadian Society of Biological Engineering Annual International Meeting, Montreal Canada.
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- 2016 “The Synergistic Interaction between Sitophilus Zeamais, the Maize Weevil and Prostephanus Truncatus, Larger Grain Borer on Storage of Maize in Hermetic and Non-Hermetic Conditions,” Paper Presented at the ASABE Annual International Meeting, Orlando, Florida.

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- 2016 “Optimization of Ready to Eat Extrudates from Sweet Potato-Sorghum-Maize Blend,” Abstract Presented at 25th Indian Convention of Food Scientists and Technologists – Food Processing for Sustainable Agriculture and Industry at Guru Nanak Dev University, Amritsar, Punjab, Nov 10-12.

**Makombe Wilfred** and Kropp Jaclyn,

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**Warsanga, W.B.** and Bee, F.K.

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**Warsanga, W.B.**

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**Yaredi, P. N.**

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