Research in Sustainable Intensification in the sub-humid maize-based cropping systems of Babati

Africa RISING East and Southern Africa

Research Proposal 2012/2013
Tanzania- Babati

Lead Institution
International Institute of Tropical Agriculture (IITA)

Principal Investigator
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Implementing Partners
CIAT
CIMMYT
ILRI
Selian ARI

Research Team 3

Research in Sustainable Intensification in the sub-humid maize-based cropping systems of Babati

Description of the intended workplan
Team Leader: IITA – Mateete Bekunda

Sub-Contractors: CIAT, CIMMYT, ILRI, Selian ARI

Summary

This research proposal is a component of the East and Southern Africa Research Project of the Africa RISING Program. The unique feature of the research is that it is being conducted in a district specifically chosen to offer comparisons following an agrocological gradient offered at one research site, but also with no direct influence from a USAID supported development partner. Other project components are designed to operate consistent upon the guiding principles and purpose of the Africa RISING Program. The project mainly proposes to introduce basic system improvement technologies based on related production constraints identified by stakeholders at the ESA review and planning meeting in Arusha during October 2012. Concurrent with this will be participation in situation analysis studies that will generate information necessary to ensure better-targeted integrated systems interventions building upon the prioritized outcomes of the improvement technologies being introduced during this project phase. The studies in this proposal seek to identify (i) maize, beans and forage varieties that are adaptable to agroecologies of Babati, (ii) technologies for efficient utilization of local nutrient sources, (iii) appropriate situations for controlling aflatoxin and fumonisin, and (iv) improved post-technologies for major food crops in the district. Research activities will be participatory and interdisciplinary, and farmer capacity will be increased through training, engagement in implementation of field activities and through targeted awareness campaigns.

Background

Babati is one of the five districts in Manyara region covering 6069 sq km with ecological zones influenced by a landscape that ranges from 900 to well above 2000 m above sea level (Hillbur, 1998[1]). The district receives bi-modal rainfall; short rains occur between October and January while the long rainy season lasts between February and May. The long-term (1970–95) average precipitation for the district is 790 mm/year but is highest in the semi-humid

[1] Hillbur, P. 1998. The knowledge arena: Approaching agroforestry and competing knowledge systems – a challenge for agricultural extension. Lund University Press, Lund, Sweden. 198pp.

uplands (e.g. Babati Ward) and humid highlands (e.g. Bashnet Ward), ranging between 900-1200 mm year^{-1} (Table 1) The predominant soils are red and black where crops such as maize, wheat, rice, beans and pigeon peas are grown. The main economic activity in the district is peasant agriculture and pastoralism, and whose growth is particularly important for reducing poverty levels and raising food security.

Key constraints to achieving increased agricultural productivity in Tanzania's FtF investment target area, in which Babati lies, are common and were identified during the ESA Project Review and Planning Meeting (Arusha, 1-5 October, 2012) as being poor soil fertility, limited access to improved seeds, climate (rainfall) variability, pest infestations, weak linkages between research/extension/farmers, inadequate agro-processing/mechanization, insufficient knowledge about nutrition; and for livestock, unavailability of improved breeds, overstocking, pests and diseases, conflicts between livestock keepers and farmers; generally weak market linkages and poor transformation. Studies have identified the role of economic profitability of the technologies, the role of socioeconomic constraints and gender as additional constraints, especially to technology adoption (Shiferaw, et.al., 2005[2]). It is these problems that Africa RISING will address through a stepwise integration of sustainable intensification innovations sourced from and implemented by a wide range of research and development institutions.

Table1. Biophysical and socio-economic characteristics of Babati district

	Administrative divisions			
	Bashnet	Gorowa	Babati	Mbugwe
Altitude (m)	1800 - 2200	1200 - 1500	1500 - 1800	900 – 1200
Agroecological zone	Humid highlands (2)	Sub-humid midlands (4)	Sub-humid uplands (3)	Semi-arid lowlands (5)
Annual total rainfall (mm)	1100 - 1200	750 - 900	900 - 1100	500 – 700
Soils	Sandy loams (medium fertility)	Sandy loams with black clays	Volcanic soils	Sandy soils
Livestock systems			Semi-intensive (dairy and non-dairy)	Pastoral
Market access in terms of road network	Medium - poor	Good	Good	Medium – poor
Relative wealth status classes of households	Medium	Better-off	Better-off	Poor

Source: Based on the assessment of the adoption and impact of improved pigeonpea varieties in Tanzania by Shiferaw et al. (2007).

[2] Shifferaw, B., Silim, S., Muricho, G., Audi, P., Mligo, J., Lyimo, S., Liangzhi You, L. and Christiansen, J.L.. 2005. Assessment of the adoption and impact of improved pigeonpea varieties in Tanzania. Working Paper Series no. 21. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 36 pp.

Overall research objectives

Addressing the constraints noted above provides the opportunity to increase agricultural production and food security, improve nutrition and environmental sustainability and increase resilience through alternative income generating activities and stronger market orientation. Addressing these constraints during the 2012-13 year, will be guided by three main objectives: (i) to identify demand-driven system intensification scenarios with potential for sustainably enhancing productivity over the current farming practices, and approaches that will promote their uptake; (ii) to evaluate and recommend the basic productivity components of food and feed crop varieties and selected soil and crop management technologies, contributing to the baseline stage of a stepwise progress towards sustainable intensification; and (iii) to facilitate formation and operationilisation of research team and R4D partners .

Theoretical framework

Current food, nutrition and environmental security in Babati will be determined by crop and livestock diversity and yields as well as household perceptions of adequacy using IFPRI- and Research Team-developed and tested questionnaires. These baseline conditions are characterized in 2012-13 and opportunities for improvement identified. The opportunities, consisting of integrated candidate crop, livestock and soil management practices, nutrition and marketing are tested through participatory research approaches in 2013-14. Management packages are developed and tested through household and on-farm evaluation in 2014-15. 2015-16 is largely devoted to refining extension recommendations and developing information material and campaigns that synthesize project gains, for scaling. Extension recommendations will be holistic, with better nutrition, increased crop and livestock production, and more effective land management considered as complementary activities. During 2012-13, however, ground-truthing field activities will be conducted concurrently with the situation analysis studies, but these are based on problem identification by district agricultural officials and a limited interaction with farmers from the action villages. Project impacts will be assessed by establishing a baseline of the key constraints to better food security and monitor change through a suite of practical indicators based upon landscape, physical, chemical, biological and land management criteria applicable to small-scale farms but also at the program-wide scale through RCTs (Lynam and Twomlow[3]).

Project-level Research questions for 2012-13

Relating to Research Output 1:

1. What are the key biophysical and socio-economic constraints to crops and livestock production at farm and landscape levels? (all work packages)
2. Which opportunities exist for enhancing productivity and resource use efficiencies for different farm typologies? (all work packages)
3. How extensive is mycotoxin contamination in on-farm food and feed products and along value chains to warrant aflasafe-type control interventions? (work package 5)

[3] Lynam, J.K. and Twomlow, S. A 21st Century Balancing Act: Smallholder heterogeneity and cost-effective research. AFAD Smallholder Technology Draft Paper.

Relating to Research Output 2

4. Which recently released improved varieties of maize, grain legumes and fodder crops can be best incorporated into smallholder systems of Babati at both farm/typologies and landscape levels? (work packages 2 and 3)
5. Which accompanying best-bet technologies complement adoption of the new crops (work package 4)
6. What potential does integrating postharvest nutrition technologies into the maize-based farming systems have on increased agricultural productivity (work package 6)

Intended results during 2012-13

System analysis outputs (including farming system characteristics, soil fertility status, household typology definitions) will enable the Research Team and the R4D Platform to identify and plan execution of integrated system intensification approaches that will result in increased productivity of the farming systems and enhanced opportunities to address food and poverty challenges. Being part of the stepwise approach, ground-truthing field activities will contribute first step technologies (suitable food and feed crop varieties, basic soil nutrient requirements, food safety needs and post-harvest losses reduction approaches) that will be entry points for introducing other improved practices. Smallholders' knowledge about sustainable farming, food safety and meeting postharvest needs will be improved through training and observations. Research teamwork approach will be strengthened. Specific deliverables are described within each Work package later.

Implementation strategy

The questions above and consequent deliverables are more refined under the different work packages (WP; described later), a model that the research team opted to use as an implementation strategy. Integration between and within the WPs is assured through Research Team and R4D Platform planning and implementation of activities on same action sites (Figure 1) and where possible, at same time. Most of the activities addressing RO1 will be conducted in collaboration with the M&E Team 5 and the initial activity will be the convening of a meeting of partners at District level, to develop the R4D Platform, its tools and methods of operation. The partners will utilize this opportunity to strengthen a unified survey protocol to generate data for characterizing the action sites, as well as developing appropriate M&E tools and procedures.

Activities related to RO2 will be conducted in close cooperation with participating farmers and through their grassroots organizations. Prior to the cropping season, research team members will organize a meeting to discuss which of their WP technologies will be best integrated to constitute management options that offer promise in cropping/livestock systems improvement and how they may be incorporated within an otherwise standardized experimental design (e.g. farmer practice, cross-site practice, current best practice and others of interest). Some of the field experiments will be conducted on the same farms and fields so

that the effects of treatment integration (in sequence and space) may be determined, and residual benefits quantified.

A project planning meeting that will include farmers, local administrators and extension supervisors at Action Site level will be convened to discuss implementation schedules. Local farmers will assist in site selection, and all on-farm work will be farmer-installed and managed. For 2012-13, mother-baby and field demonstration approaches will be utilized in the truthing studies as these also allow for implementation of technology dissemination through participating farmers and farmers' groups.

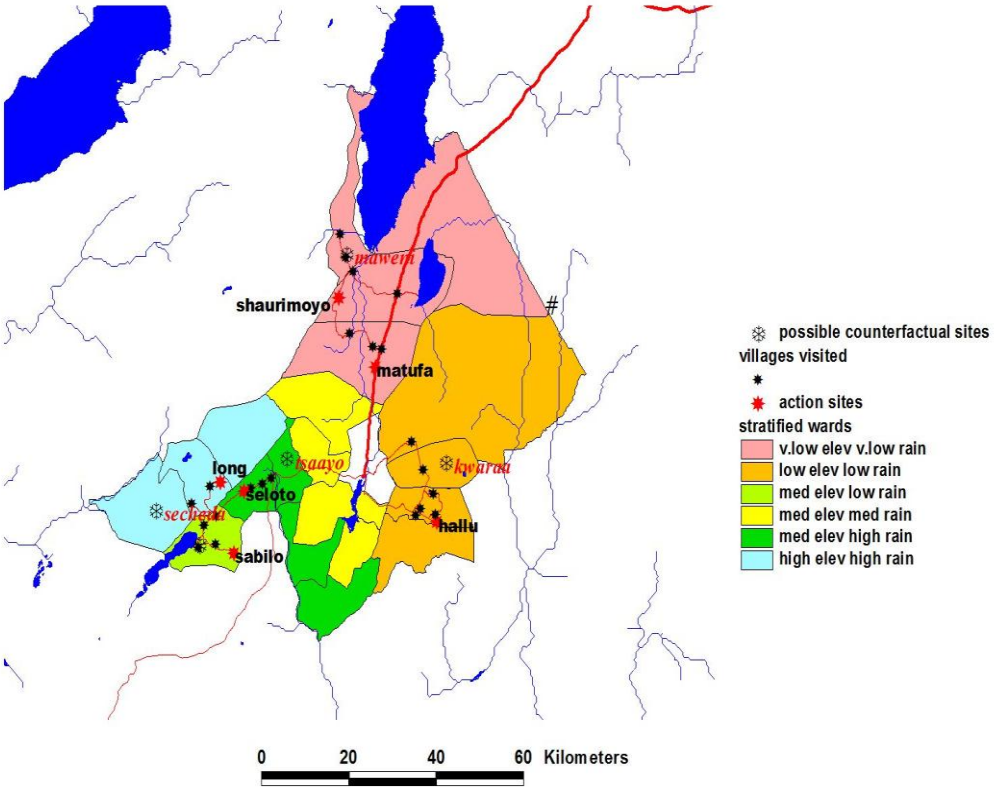

Figure 1. Map of Babati showing selected Project Action Sites (Villages). Integrated research activities are scheduled to start in Long, Sabilo, Seloto villages in Bashnet division during 2012-13, and expand to other villages during subsequent years. The villages represent different agro-ecologies (Figure1).

Data Analysis

Situation Analysis. Univariate statistics will be used for data handling (frequencies, means, standard deviations), while Chi-Square test, Student's *t*-test and ANOVA will be used to compare differences. Pairwise ranking will be used to determine farmer preferences of new technologies. Functional typologies of farm will be developed. Households will be categorised considering resource endowment and criteria representing orientation of production activities (market-vs. consumption), main type of constraints to agricultural production and main

sources of income to those households. Principal component analysis (PCA) will be used to identify non-correlated socio-economic indicators for use as proxies for the household categorization. Households will be grouped into homogeneous classes of "farm types" using cluster analysis (CA) after Tittonell et al., 2005[4].

Crop productivity. Data analysis on field trials will be performed using mixed model ANOVA. Farms will serve as replicates and be further stratified by resource endowment (typology) based upon the baseline survey. Since farmers will be permitted a choice in technologies (babies) they evaluate and chances of experimental failure are recognized, appropriate statistical considerations will be applied to overcome unequal replication within locations and over time. Relationships between variables that are significant using correlation and simple regression analysis will be used to predict outcomes of interest. Mother trials will be randomized control plot in design and analysis.

The Research Team

One of the objectives of Africa RISING is that integrated innovations increase production and / or improve productivity in a sustainable manner. Integrated innovations are an outcome of teams comprising multidisciplinary institutions, working to address the multi-faceted challenges at household level, and their composition may change as new challenges require inputs from alternative disciplines. The initial composition of the Research Team for the sub-humid action area is given in Table 2 below, but more disciplinary membership appears within the WPs.

Table 2. Sub-Humid Research Team Composition

Institution	**Scientist**	**Discipline**
IITA	Mateete Bekunda	Agronomy
IITA	Fen Beed	Plant Pathology
IITA	Adebayo Abass	Post-harvest technology
CIAT	Jean Claude Rubyogo	Bean Breeding
CIAT	Job Kihara	Soil Science
CIMMYT	Dan Makumbi	Maize Breeding
ILRI	Ben Lukuyu	Livestock Feeds
Selian ARI	Stephen Lyimo	Agronomy

Table 3. Consolidated budget (USD). Details are given under each WP.

Main budget category	WP0 IITA	WP1 CIAT	WP2 CIMMYT	WP3 ILRI	WP4 SELIAN	WP5 IITA	WP6 IITA
Project Chief Scientist	80,000						
Research Associate	18,000[1]						
Personnel		51,000	19,500	33,855	25,300	26,000	25,000
Research		33,900	69,600	43,282	30,970	22,600	40,000
Training		10,000			2,500	6,000	5,000

[4] Tittonell P, Vanlauwe B, Leffelaar P, Rowe E, Giller K (2005) Exploring diversity in soil fertility management of smallholder farms of western Kenya I. Heterogeneity at region and farm scales. Agriculture, Ecosystems and Environment 110:149–165

Other					4,500		
Institutional overheads		22,776	27,441	11,956	45,80		-
Total	98,000	117,676	116,541	89,093	73,850	54,600	70,000

[1]Includes salary (∼ $1200) and operational funds. Based in Babati; supervise all field activities

Description of the work packages (WP)

WP1
Identification of the key biophysical production constraints to crops and livestock at farm and landscape levels

Action period	November 2012 to October 2013
Activity Type	Action research and capacity building
Target areas Villages	Long Sabilo Seloto
WP leader	CIAT
Partners	Selian ARI DALDOs IFPRI?
WP Total Budget	117,676.00

RO 1: Situation Analysis (Biophysical characterization)
Key intervention areas:
Apply novel approaches to characterize the biophysical production constraints and identify priority areas for targeted interventions

Description of work

Task 1.1. Community mobilization for the action. The aim of this activity is to sensitize the communities in the two districts on the study purposes and activities and to prepare local experts (DALDOs and Selian ARI) to participate in the characterization activities.

Task 1.2. Soil survey to characterize 2 sentinel sites. The aim is to conduct an integrated assessment of soil and ecosystem health at 100 sq. km sentinel sites, which will cover the three action villages. The Land Degradation Surveillance Framework (LDSF) used by AfSIS will be employed to conduct a systematic biophysical assessment of various ecological and soil health metrics. The LDSF is based on a hierarchical spatially stratified, random sampling approach consisting of 100 km^2 sentinel landscapes, which are statistically representative of the variability in climate, topography and vegetation of the study area under consideration. The sampling approach replicates soil and other biophysical (e.g., land cover) measurements at different spatial scales, linking consistent, geo-referenced ground observations to laboratory measurements and remote sensing data. In order to be able to predict soil properties for areas where samples have not been collected, relatively large number of samples from representative locations will be needed. To overcome the huge cost of analyzing large soil samples using conventional laboratory

techniques, near and mid-infrared spectroscopy approaches will be used. These technologies are available and CIAT is operating a near-infrared spectrometer at Selian in Tanzania. Data will be used for prediction of basic soil properties and map the spatial variability of land condition and soil health constraints and areas that require priority land management interventions.

Task 1.3. Agronomic survey to estimate actual yield obtained by farmers in their own practices and relation with management strategies. Agronomic survey, involving physical determination of crop yields, will be conducted in at least 200 farmer fields (50 per each of the 4 agro-ecozones) to determine production levels. Two key crops in Babati, namely maize and pigeonpea, will be the targets for this agronomic survey. This survey will assist to estimate the effect of improved management on reducing yield gap between farmer observed and attainable/potential yield, and complement the socio-economic survey. Estimation of yields of the two crops will be undertaken on two representative sections of a field on plots 10 m by 10 m. The selected farmers will be informed of the project intent and harvest areas will be marked out one month prior to harvest. This is to ensure that farmers do not harvest the marked areas before measurements are taken. Data taken on each of the plots will include agronomic practices undertaken including plant spacing, pest and disease control, organic/inorganic fertilizer applications and field history according to a protocol implemented in AfSIS. Each field will be georeferenced and the production survey information will be linked with biophysical production constraints mapped in Task 1.2.

Information derived from the identification of biophysical and socio-economic constraints to crop production and from variety evaluations conducted in the second year of Africa Rising will be used to design, test and demonstrate best-bet production options within the action sites. Thus soil scientists and agronomists will design socially and economically feasible yet integrated management options that address soil, water and crop management constraints identified. The choice of land management options such as use of conservation agriculture will derive from the matching of constraints to their possible solutions, thus allowing also for new technologies performing well elsewhere to be introduced.

Deliverables

There are three deliverables under this work package i.e.

1. A map showing key biophysical constraints to crop production in Babati.
2. A map of key degradation hotspots within Babati and possible interventions.
3. Agronomic practices limiting production in Babati identified

Task 1.4. Educate farmers through village-level field days (4 days/villages) to identify limiting nutrients through a translated "maize doctor". The aim of this activity is to enhance farmer knowledge for diagnosis of production constraints such as limiting nutrients important in the intensification of crop production. Maize doctor tool developed by IPNI for such diagnosis will be introduced to extension staff and to farmers through organized field days for practical experience. Also farmers will be provided with a translated version of this tool.

Deliverable
We expect to train at least 400 farmers (100 in each village) during the 2013 cropping season. This activity will be conducted within Long action site for this season.

Budget estimates

Description	**Total Budget**
A. Staff time	
Scientists –Characterization and surveys	**30,000**
Field Technicians	**12,000**
Field allowances	**9,000**
Sub total	***51,000***
C. Other Direct Costs	
Motor vehicle use / hire	**16,000**
Soil processing & shipping	**3,800**
Soil analysis	**10,600**
Supplies+communication	**3,500**
Maize Doctor training	**10,000**
Sub-total	***43,900***
C. Total Direct Costs	***94,900***
D. Indirect Costs (24%)	**22,776**
E. Total Direct and Indirect Costs (H + I)	**117,676**

Timeline for the activities

	2012		2013									
Activity	N	D	J	F	M	A	M	J	J	A	S	O
Identify field technicians												
Conduct LDSF survey												
Process soil samples												

Run NIRS												
Run MIRs												
Conduct Agronomic survey												
Translate Maize doctor												
Train farmers on use of maize doctor												
Data analysis and reporting												

WP2

Introducing improved food and feed crop varieties in the maize-based farming of Babati,

Action period	November 2012 to October 2013				
Activity Type	Action research and capacity building				
Target villages (maize, beans)	Long	Sabilo	Seloto		
WP leader	CIMMYT				
Partners	CIAT	ILRI	Selian ARI	DALDOs	SUBA-AGRO & MERU-AGRO (Seed Companies), Farmer Organizations
WP Total Budget	**116,541**				

RO 2: Integrated systems improvement

Key intervention areas:
Introduce and evaluate improved varieties of food and feed crops to farm households in a manner that complements their on-going farm enterprises

Description of work

Task 1.1. Community mobilization for the action
The aim of this activity is to prepare the communities in the districts of Babati, to engage in the project. Farmers willing to provide land for trials will selected with help of village leadership, DALDOs and Selian ARI following general sensitization in target villages.

Task 1.2. Description of experiments - Cereals
Subtask 1.2.1. To introduce potentially highly yielding and marketable and food and feed crops from neighboring countries or other regions
A working collection of about 25 maize and 18 bean varieties and genotypes will be constituted from national and/or regional trials. Multidisciplinary research team members at national research institutions and international will select materials of specific adapted to the target biophysical conditions and market needs. Data will be collected based on crop evaluation protocols. Soil and weather data to quantify levels of weather related conditions will be collected.

1.2.1.1. Maize
New stress tolerant (disease resistant, drought and low nitrogen tolerant, and insect resistant) maize varieties are continually developed by CIMMYT and tested by various partners in East Africa in regional trials. In order to speed the process of identification of new maize varieties that are adapted to the target sites, it is important to continually evaluate new maize varieties from CIMMYT and the national maize program. A trial consisting of 25 stress tolerant maize hybrids will be planted at three locations (Selian, Babati) to identify adapted maize varieties that will be used in intercropping trials and for release in subsequent years. The experimental design to be

used will be a randomized complete block design with three replications. Data to be collected will include plant stand count, plant height, days to 50% anthesis and silking, days to physiological maturity, leaf angle, leaf area index and number of leaves per plant, ears per plant, grain yield and yield components. Yield components will include harvest index, cob length, kernel-rows per cob, kernels per cob-row, and 100 seed weight. Adapted varieties that will be identified under this activity will be used in mother and baby trials the following year. Farmer evaluation of the varieties in mother and baby trials will be used to decide the varieties to be promoted through Africa RISING partners like NAFAKA.

1.2.1.2. Beans

Under the activity, CIAT will support the national bean programme at Selian Agricultural Research Institute (SARI) to introduce released and promising highly marketable and /or micro-nutrient rich mid altitude climbing beans and also drought tolerant lines /varieties from neighboring countries (Rwanda, Kenya and Uganda). For the first crop season, these genotypes will be evaluated in SARI research farm for phenotypes characterizations. For the second crop season, promising genotypes will concurrently evaluated on station and on farm in Africa Rising sites (depending on their genotypes agro-ecological adaption). It is envisaged that using release data from the countries of origin, there will be possibility of release after two crop seasons depending on weather conditions. The phenotypic data particularly genotypic characterization will be recorded during the growing period and after harvesting.

Subtask 1.2.2. Evaluate the performance of recommended and promising food and fodder crops under farmer management practices

The overall objective is to conduct participatory selection of the promising crop varieties across agro-ecological zones (AEZs) and identify high yielding stress tolerant market preferred crop (food/feed) varieties under farmer management practices

1.2.2.1. Maize

Maize breeders have developed maize varieties (high yielding hybrids and open pollinated varieties) for sole crop systems. In view of the potential of intercrop systems in intensifying farm productivity, it is important to select maize varieties that are compatible with intercrop systems commonly practiced by farmers in the target region. This study will evaluate new stress tolerant maize varieties and farmer-preferred maize varieties for agronomic performance under both under sole and intercrop system in maize-pigeon pea growing regions of Babati district. Field experiments on maize-pigeon pea intercrop systems will be conducted during the long rains of 2012/2013 at 15 locations. The trial will have 10 maize varieties including five recently released stress tolerant varieties, four new drought tolerant hybrids, and a local farmer-preferred check. A preferred pigeon pea variety (Mali) will be used for intercropping. The experimental design to be used will be a randomized complete block design with three replications. Plot size will be four rows of maize. Data to be collected will include plant stand count, plant height, days to 50% anthesis and silking, days to physiological maturity, leaf angle, leaf area index and number of leaves per plant, ears per plant, grain yield and yield components. Yield components will include harvest index, cob length, kernel-rows per cob, kernels per cob-row, and 100 seed weight.

Farmer evaluation will be carried out at harvest to understand farmer preferences and also to guide breeders during selection. Based on farmer preference and performance, seed of the selected hybrids will be produced by the respective seed companies and sold to farmers. Demonstration plots of the selected new varieties will be established the following year in collaboration with NAFAKA.

1.2.2.2. Beans

New released /promising bean varieties (climbing and bush) will be tested on farm across different agro-ecological zones and with randomly selected farmers. The randomly selected farmers will be opportunity to give chance to each farmer to participate in the bean varieties evaluation. There will be 10 sites for PVS sites in each agro-ecological zones (30 sites in total) and each site will comprise of 10 new improved and two farmers' bean varieties (local check). One farm site constitutes a replication. The variety evaluation will mainly consist of farmers (men and women separately and collectively) assessment and their selection criteria will be recorded. In addition to phenotypic characterization/data (disease, pest and yield), varieties will also be evaluated based their post-harvest characteristics. These include organoleptic qualities (cooking time, taste and post cooking quality and post-harvest management) a will also be recorded. Traders will be engaged in the evaluation as much as they will be available to facilitate market linkages.

Subtask 1.2.3. Evaluate the performance of nutritionally-enhanced crop varieties under farmer management practices

Quality protein maize (QPM) is a range of maize cultivars with twice the content of limiting amino acids (lysine and tryptophan) compared to conventional maize. QPM has been developed to reduce human malnutrition in areas where protein deficiency is prevalent and maize is the major source of protein in the diet. Breeding efforts have led to the development of QPM varieties that have been released in a few countries in sub-Saharan Africa including Tanzania. However no information is available on the performance of these varieties under intercropping. In this study, quality protein maize (QPM) varieties will be evaluated under intercropping. The trial will have eight QPM hybrids including four released QPM hybrids (three released in Tanzania and one released in Kenya), three experimental QPM hybrids, and a local farmer-preferred check. A preferred pigeon pea variety (Maali) will be used for intercropping. The experimental design to be used will be a randomized complete block design with three replications. Plot size will be 4 rows of maize. The trial will be planted at 4 locations in Babati district. Data to be collected and farmer evaluation of the QPM varieties will be carried out as described in 1.2.2. Information from these trials will be used to identify QPM varieties adapted to the target area and suitable for intercropping. Farmer evaluation of QPM varieties will be used to select varieties for promotion through Africa RISING partners like NAFAKA.

Deliverables

There are four deliverables under this work package i.e.
At least two adapted varieties of maize identified for target areas
At 30 farmers and their neighbors (500) are engaged in bean participatory variety selection
At least three adapted and preferred bean varieties identified for each site
At least one adapted QPM variety identified
At least 2000 farmers are aware of new bean varieties through field days
At least 1000 farmers are aware of new maize varieties through on-farm farmer assessment

Budget Estimates (maize and bean variety evaluation on station and farm)

Line item	**CIMMYT**	**CIAT**	**Comments**
Personnel			
Scientist	7,500	12,000	Staff time
Research Costs			
Field trial set up and management	25,850	30,000	Seed preparation, field preparation, planting, trial management, data collection & analysis
Local and International travel	2,000	4,000	For staff to travel to various locations for trial monitoring and meetings
Vehicle costs	2,250	4,000	Hire vehicle or vehicle maintenance for in-country travel during field operations
Office equipment and supplies	500	1000	Computer, printer consumables, stationery
Sub-total (Direct costs)	38,100	51,000	
Institutional costs: CIAT (24%)		12,240	
Sub-total			**101,340**
Institutional costs: CIMMYT (15%)	15,201		
Total Grant Request	**53,301**	**63,240**	**116,541**

Project Timeline (Maize and Beans)

	2012		2013									
Activity	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**
Proposal development												
Land preparation and planting												
Community engagement												
PVS establishment												
Monitoring												
Evaluation with farmers and other users (pre harvest)												
Harvesting												
PVS evaluation – post harvest												
Data analysis and report												

WP3

Introducing improved fodder species in the maize-based systems of Babati as a land management strategy.

Target Villages: Long, Seloto and Sabilo
WP leader: ILRI
Partners: CIAT (Brigitte Maass, Fred Wassena); Selian Agricultural Research Institute (Jean Claude Rubyogo); Tanzania Livestock Research Institute (TALIRI), Tanga (Julius Bwire) Ministry of Livestock (District staff - Mr. Lyimo); Sokoine University of Agriculture (Germana Laswai)

Action Period: December 2012 to September 2013

WP Total Budget: 89,093.00
Target Output: RO 2, Integrated Systems Improvement

Key intervention areas:

1. Introduce and evaluate potential forages for suitability in different agroclimates and farming systems in Babati
2. Introduce and test the potential for the use of pulveriser to minimize wastage

Description of Work.

Task 1. **Sourcing for planting materials**: - We shall identify and source suitable forage varieties (seed and planting materials) form ILRI Addis Ababa and CIAT Columbia. Emphasis will be placed on high yielding leafy and smut resistant Napier grass also known as Elephant grass (*Pennisetum purpureum*) accessions and varieties of Signal grass (Bracharia spp.) and other potential grass species.

Task 2. **On station bulking of planting material and seed**: - We shall introduce evaluate and bulk planting vegetative material and seed of improved forage varieties on station at Selian Agricultural Research Institute (SARI) for subsequent distribution to participating farmers.

Task 3. **Evaluate agro-ecological suitability of forages**: - Introduce and evaluate improved forage varieties to farm households in a manner that complements their on-going farm enterprises. The aim is to 'ground truth' highly promising forage varieties (in terms of yield and drought tolerance), especially those that withstand long drought periods common the research areas. Evaluations will include comparisons with local checks on-farm. Data will be collected and used to inform adoption strategies.

Task 4. **Evaluate forages for their land management potential**. This will be done concurrently with Task 3. The mechanism for introducing these forages will be to maximize land utilization as well as conserve it from degradation. The different forage species will be planted as boundary crops, especially along contour lines, around gardens and their impact on minimizing soil loss will be determined using erosion reconnaissance methods. The impact may very much be affected by the harvesting method, which will also be assessed.

Task 5. **Feed processing,** Introduce and test the potential for the use of pulveriser to minimize wastage and to ensure that livestock have access to sufficient quantities of high quality feed all

year round. The aim is to assess the potential for the use, operations and support of the small scale feed processing services in Babati district.

Deliverables

The main deliverable under this work package will be:

1. At least two 'best bet' species suitable for both forage and erosion control in each agro ecology identified
2. The potential for the use, operations and support of the small scale feed processing services in Babati district assessed

Detailed budget

Category	Description	Unit	Unit No.	Unit Cost USD	Total USD
Personnel					
	International Staff				
	Ben Lukuyu (30%)	day	66	467.73	30,870.00
	Peter Thorne (2%)	day	4	746.36	2,985.44
	Sub-total personnel				**33,855.44**
Travels					
	International travel				5,000.00
	Sub-total Travels				**5,000.00**
Workshops/ Office supplies/ Communication					
	Workshops/trainings /meetings	lump sum			5,000.00
	Sub-total				**5,000.00**
Services Charge ILRI					
	ICT service charge	per annum	35%	3,500.00	1,225.00
	Space charge	per annum	35%	2,715.00	950.25
	Research and coordination charge [15% of int'l staff]	per annum	15%	39,080.00	5,862.00
	Sub-total Services				**8,037.25**
Sub-grants					
	Partners – National Program	lump sum			15,244.56
	Partner-CIAT	lump sum			10,000.00
Total Sub-grant					**25,244.56**
Total Direct Cost					**77,137.25**
Overheads [15.5%]					11,956.27
Total Project Cost					**89,093.52**

Activity calendar

Activity	Dec 2012	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec 2013
Task 1													
Task 2													
Task 3													
Task 4													
Task 5													
Annual Report													

WP4

Promoting sustainable intensification through efficient application of a local source of phosphorus (Minjingu PR).

Action Period	November 2012 to October 2013					
Activity Type	Action research and capacity building					
Target Villages	Long	Seloto	Sabilo			
WP leader	Selian ARI Arusha Tanzania.					
Partners	IITA	ICRISAT	Minjingu Fertilizer Company	DALDOs	Farmers organizations, NGOs	PANNAR and SUBA-AGRO Seed Companies
WP Total Budget			73,850.00			

RO 2: Integrated systems improvement
Key intervention areas:
Evaluate modified forms of Minjingu phosphate rock for P micro-dosing in the maize-pigeonpeas cropping to improve soil fertility and crop productivity.

Description of work

Task 1.1. **Project planning.** Researchers, DALDOs, village extensionists and local leaders will meet to discuss the justification of conducting the study in the district and solicit their interest and commitment in participating in, and implementing it. Next will be a meeting with farmers of the three villages through local membership arrangements to plan the "learn-by-doing" implementation of the project. A total of fifteen (15) sites/farmers will be selected from Long, Seloto and Sabilo villages. Farmer selection will be participatory, but among farmers who must be willing to provide land and are also committed to implement the trials. At least 5-6 of the selected farmers should be women.

Task 1.2. Description of experiments

Subtask 1.2.1. Maize and pigeonpeas intercropping. Maize is the most important staple crop grown in Babati at an estimated acreage of 41,600 ha. Farmers in the district intercrop maize with pigeonpeas and it has been suggested that the adoption of this system has a positive and significant impact on income and consumption expenditure among sample households across Tanzania (Amare et al, 2011[5]). Normally they intercrop one row of maize followed by a row of pigeonpeas at a spacing of 100-120cms x 60-80cms, with two plants per hill. This technology has been implemented irrespective of the indiscriminate growing of different crop varieties; improved maize hybrids or Open Pollinated Varieties (OPVs) from

[5] Amare, M., Asfaw, S. and Shiferaw, B. 2012. Welfare impacts of maize–pigeonpea intensification in Tanzania. Agricultural Economics 43: 27–43

different seed companies, or recycled seed. Likewise, a mixture of pigeonpea varieties is grown.

This project will test different spatial maize/pigeonpea arrangements in the field with already recommended varieties that are differentiated by maturity periods (which affect canopy interactions). Preferential economic returns could determine the crop yield targets, thus directly affecting space arrangement agronomic tradeoffs. The maize varieties include PAN 691, a long maturing maize variety, Mkombozi, an early to medium maturity high yielding maize variety, and SC 627, an early maturing variety. These will be intercropped with pigeonpea variety Mali from ICRISAT, a long maturing and high yielding variety that is considered new in the study sites.

Sub-task 1.2.2: Micro-dosing with different sources of P fertilizer to enhance BNF and environmental quality. Pigeonpea is a legume that can add as much as 200 kg N $ha^{-1}$to the soil, and this can be beneficial to a companion crop like maize. To achieve this, however, the soil conditions must be conducive, including readily available phosphorus (P). Using some little amounts of P (micro-dosing) during planting enables the pigeonpea to fix more N. Studies conducted in the Northern and Central Zones of Tanzania, using 20 kg P ha^{-1} have indicated that the yields and net benefits from the maize and pigeonpea could more than double.

MicroFertiliser P treatments will be imposed on selected treatments from sub-task 1.2.1. The project will demonstrate the effects of P sourced from local Minjingu Phosphate Rock, Minjingu Mazao and Di-Ammonium Phosphate (DAP) on the maize-pigeonpeas intercropping. There will be a total of four treatment plots per site/farmer (see Table below). Each site/farmer will be considered as a replicate. The size for each plot will be 10mx 10m, with 1 meter separation. Each plot will be planted to maize/pigeonpea intercropped at a spacing of 100cm x 50cm.

Talble 1: Maize/pigeonpea intercrop treatments

Control Treatment 1	Treatment 2	Treatment 3	Treatment 4
Maize/pigeonpea intercropped without fertilizer	20 kg P ha^{-1} as Minjingu PR (13% P) 18 kg N ha^{-1} (as urea) applied at planting; 42 kg at knee high	20 kg P ha^{-1} as Minjingu Mazao (10% N, 9% P) 38 kg N ha^{-1} (as urea) applied at knee high	20 kg P ha^{-1} as DAP (18% N, 20% P) 42 kg N ha^{-1} (as urea) at knee high

Agronomic and socio economic data will be collected from each treatment. Farmers will assess the treatments using participatory tools like matrix and pair wise ranking in order to solicit their preferred treatment. Two mini field days will be conducted to expose farmers and other stakeholders to the technology in order to create awareness and promote up-scaling in subsequent years.

Deliverables

There are five deliverables under this work package i.e.

1) Farmers and other stakeholders exposed to improved maize and pigeonpea varieties. Participating farmers and extensionists trained on use of fertilizers
2) Farmers' and other stakeholders' most preferred P- fertilizer micro-dosing source identified
3) At least 1,500 farmers and stakeholders become aware of the technology through the farmers' assessment sessions, field days, and news media coverage
4) Maize and pigeonpeas yields, and net benefits increased by at least two-fold through the combined intercropping and use of fertiliser
5) Strategies for scaling the technology identified for next season

Work plan

Activity	2012		2013									
	N	D	J	F	M	A	M	J	J	A	S	O
Work Package development												
Farmers selection												
Training of extentionists, farmers, leaders												
Soil sampling												
Seeding/planting of trials												
Data collection												
Field Days												
Harvesting maize												
Harvesting pigeon peas												
Data compilation & analysis												
Report write up and presentation												

Budget Estimates

Line item	Units cost (USD	Total cost (USD)	Comment
Personnel			
IITA at Arusha: Field support Staff	1000USD/month x6	6,000	Other WP support to complete yr, + operational funds needed
International (ICRISAT)	400USD/day(10 days)	4,000	staff time & during field visit
PI (SARI-Arusha)	200USD/day (30 days)	6,000	leader and staff time
Other researchers	65USD/day (90 days)	5,850	3 researchers
Driver	45USD/day (90 days)	4,050	
Extensionists	15USD/day (160 days)	2,400	2 district + 5 vill ext
Support staff	3 months	3,000	accounts/casuals
International travel		2,000	ICRISAT staff
Field Activities			ext/farmers/leaders
Training of farmers & extensionists		2,500	
Field materials - fertilizer		3,000	15 sites demo/trials
- Soil analysis	20USD/30 samples	600	laboratory costs
- others		371	sisal twines, bags, maize etc
Farmers assessment		2,000	
Field Days		8,000	
Vehicle costs/maintanance/fuel		16,000	in country travel
Office equipment, supplies and communication		2,500	stationery, printer cosumables, comm.
Data compilation, report write up and presentation		1,000	
Indirect costs 7 %		4,579	
Total Grant Request		**73,850**	

WP5

Evaluation of mycotoxin contamination along value chains

Action Period	November 2012 to October 2013			
Activity Type	Action research and capacity building			
Target Villages	Long	Sabilo	Seloto	
WP leader	IITA			
Partners	MAFC – Naliendele	NM-AIST	DALDOs and local extension	Commercial partners; SUBA-AGRO & MERU-AGRO (Seed Companies), exporters (Virtus Global Ltd)
WP Total Budget	54,600.00			

RO 1: Situation Analysis

Key intervention area

Evaluate of mycotoxin contamination in maize and groundnut based food and feed on farm and along value chains and recommend control interventions

Description of work

In Tanzania, several indicators allude to high mycotoxin exposure levels among maize and groundnut growing rural households, such as (1) erratic rainfall, high temperature and humidity levels in crop production areas (2) presence of predominantly small farm holdings (85% of maize in Tanzania is grown on less than 1 ha) that produce for informal, local markets and that escape regulation mechanisms and (3) a general lack of awareness about mycotoxins and their effects. Quantification of mycotoxin contamination is a critical first step to address the problem. Management options to mitigate mycotoxins during growth, storage, processing and distribution of maize and groundnut will be publicised in those villages and points along the value chain identified as being the worst affected, thereby ensuring that the staples consumed locally become safer for consumption by humans and animals and also eligible for regulated trade opportunities.

Task 1.1. Community mobilization for the action. The aim of this activity is to prepare the communities in the targeted sites and to identify or develop farmers' organizations to engage in the project. Awareness of mycotoxins and the risks they pose to the health of humans, livestock and to trade will be facilitated through the distribution of information factsheets in English and Swahili and through consultation with village leaders, DALDOs, local extension officers and value chain actors. Partners leading the other WPs and CGIAR partners (CIAT, CIMMYT, ICRISAT, ILRI) will be similarly informed to ensure that assessments for mycotoxin contamination are integrated with their activities and to enable combined planning and reporting.

Task 1.2. Description of study

1.2.1. To develop a sampling strategy for maize and groundnut. Farmers and value chain actors will be selected to provide samples for mycotoxin analyses that are representative of those consumed on farm as food and feed and at critical points along existing value chains. Collection sites along existing value chains will be selected based on information provided by village leaders, farmer organizations, DALDOs, local extension, other WP leaders and through consultation with the private sector. Maize and groundnut samples will be targeted as these commodities are known to be the most vulnerable to contamination by mycotoxins, and in particular aflatoxin. One hundred (100) samples will be collected from each of the 3 villages

targeted for each commodity so producing a total of 300 samples for maize and 300 samples for groundnut. A sampling protocol will be developed and distributed to ensure all partners are aware of the designed sampling strategy and have sufficient information to implement it.

1.2.2. Sample collection. A questionnaire will be developed and used to collect data on each 1 kg sample collected that will include; GPS coordinates basic demographic details of supplier, crop variety, production, processing and storage methods, intended use and knowledge of mycotoxins. This information will be catalogued in a database that can be interrogated to correlate analysed mycotoxin levels with production, processing and storage practices. Procedures for sample collection will be detailed in the sampling protocol to ensure all partners adopt the same methods.

1.2.3. Sample analysis. Clearly labeled samples will be dried (to not exceed 13% moisture), milled into flour and sub sampled in order to produce a blended sub-sample that is representative of the whole sample. Tests will be performed to determine degree of variance of results produced from 10 different sub- samples from each stock sample. Should variance of mycotoxin levels exceed 10% between sub-samples then efforts will be made to extract total mycotoxins from the 1kg sample which when analysed will produce average mycotoxin values per sample. Storage pests will be recorded and removed through sieving and samples will be checked regularly to ensure that pests do not arise from undetected eggs. Samples will be stored in a dry environment that is free from insects and rodents in order to prevent subsequent infestation by mycotoxin producing fungi. The mycotoxins to be quantified will include aflatoxin (produced by *Aspergillus* spp. fungi) and fumonisin (produced by *Fusarium* spp. fungi) as these are the most common, most damaging to human and livestock health and subject to regulation along value chains. Aflatoxin will be analysed using a novel serological method relying on lateral flow for automated serological diagnostics with a detection sensitivity of 0.1 ppm and fumonisin will be measured using serological diagnostics in 96 well test plates with a detection sensitivity of 0.2 ppm. Each sub-sample will be analysed twice and if the results vary by more than 10% then each sub-samples will be analysed 3 times and mean aflatoxin and fumonisin will be recorded.

1.2.4. Analyse and report results and recommend control interventions

The aim of this activity is to identify control interventions to mitigate mycotoxin contamination and to identify mycotoxin hotspots and justify where to deploy control interventions along the value chain. This will be done by determining the fate; type, incidence and quantity of mycotoxins, with focus on aflatoxin and fumonisin, along maize and groundnut based food and feed intended for on farm consumption and to supply commercial value chains. In detail;

- Trace the movement of mycotoxins (type, incidence and quantity) in maize and groundnut from field to fork and field to feed
- Identify factors (using data recorded in questionnaires that accompany each sample) leading to mycotoxin contamination; crop type, crop variety, agronomic practices for cultivation and harvesting, threshing and drying methods, storage structures and time of storage, processing and transport methods, etc..
- Based on factors responsible for contamination intervene with targeted management interventions in areas identified as mycotoxin hotspots and target awareness raising and training campaigns to mitigate practices that lead directly to mycotoxin contamination. Methods to mitigate mycotoxin contamination include deployment of varieties resistant to fungal diseases that produce mycotoxins and with resistance to insect attack and abiotic stresses such as drought that increase mycotoxin contamination, use of harvesting and transport methods that do not cause physical damage which facilitates infection by mycotoxin producing fungi, use of storage techniques that allow for free air flow and dry conditions

- Increase awareness of problems caused by mycotoxin contamination and methods to regulate their fate along the value chain to stakeholders at action site villages
- When food and feed is found to be contaminated with mycotoxins encourage sorting of damaged grains and promote consumption and commercialization of these while damaged, contaminated grain is destroyed

1.2.5. Develop plans for subsequent years' activities

Based on results from year 1 activities plans will be made in conjunction with other WP leaders, stakeholders and CG centres to expand activities to other sites and to include the following:

- Increase awareness of problems caused by mycotoxin contamination to stakeholders at action sites villages plus national regulatory organizations including TFDA, TPRI, TBS, Ministry of Agriculture and Ministry of Health
- Increase awareness of methods to mitigate and measure mycotoxin contamination to value chain actors for maize and groundnut based foods and feed at action sites villages plus national regulatory organizations including TFDA, TPRI, TBS, Ministry of Agriculture and Ministry of Health
- Select fields, based on those identified with high aflatoxin contamination in year 1, for applications of Aflasafe (biological control agent) through linkages with PACA project (Program for aflatoxin control in Africa) and commercial sector
- Develop evaluation mechanism for efficacy of Aflasafe applications and other recommended technologies to mitigate aflatoxin contamination along the chains to produce food and feed for home consumption and for commercial purposes. Evaluations will be based on quantified measures of reductions in aflatoxin levels in food and feed plus a cost to benefit ratio of interventions
- Select fields and points along value chain, based on those identified with high fumonisin contamination in year 1, for training and awareness campaigns to mitigate fumonisin contamination
- Develop evaluation mechanism for efficacy of fumonisin mitigation strategies in maize and groundnut based food and including a cost to benefit ratio

Deliverables

- 300 c analyses for aflatoxin contamination in maize and groundnut based food and feed products on farm and along value chains
- 300 analyses for fumonisin contamination in maize and groundnut based food and feed products on farm and along value chains
- Fate (type, incidence and quantity) of mycotoxins, with focus on aflatoxin and fumonisin, identified for targeted action sites and value chains
- At least 2 factors identified that increase aflatoxin contamination in maize and groundnut food and feed production systems and along value chains
- At least 2 factors identified that increase fumonisin contamination in maize and groundnut food and feed production systems and along value chains
- Awareness campaign initiated to inform 600 growers and actors along value chain of risks to health and trade resulting from mycotoxin contamination
- Awareness and training campaign initiated to inform 100 growers and actors along value chain of methods to mitigate mycotoxin contamination
- 10 sites identified with high aflatoxin contamination targeted for application of Aflasafe for

bioloigcal control of aflatoxin producing fungi in year 2

- For year 2; 10 sites evaluated for efficacy of Aflasafe applications on aflatoxin contamination along the maize and groundnut value chains to distribute food and feed
- Year 2 Awareness campaign initiated to inform 1000 growers and actors along value chain of methods to mitigate mycotoxin contamination for each of 4 crops used to produce food and feed

Budget Estimates

Line item	Unit cost [USD]	Units	Total cost [USD]	Comments
Personnel				
IITA Scientist	20,000	1	20,000	Staff time
IITA Technical staff	12,000	0.5	6,000	Staff time
NM-AIST	6,000	1	6,000	MSc student
Research Costs				
Community mobilization, meetings, factsheet and sampling protocol distribution, training and awareness campaigns	1,000	1	1,000	Increase awareness and engage stakeholders
Local travel	4,000	1	4,000	Staff and driver to travel to action sites for sample collection and meetings
Vehicle costs	4,000	1	4,000	Hire vehicle or vehicle maintenance for in-country travel during field operations
Office equipment, supplies, electricity, lab space and communication	2,000	1	2,000	Computer, printer consumables, stationery, internet, telephone
Aflatoxin equipment (quantitative Lateral Flow Device for automated serological diagnostics)	5,000	1	5,000	To be procured from USA and is a the latest type of equipment and offers precise and cost effective analyses not previously possible
Analysis of samples for aflatoxin	12	300	3,600	For reagents and sample LFDs
Analysis of samples for fumonisin	10	300	3,000	Equipment already purchased but reagents and extraction solvents needed
Total Grant Request			**54,600**	

Project Timeline

	2012		2013									
Activity	N	D	J	F	M	A	M	J	J	A	S	O
Proposal development												
Community engagement												
Awareness raising												
Sampling protocol developed												
Sample collection and completion of questionnaires												
Procure, test analysis equipment and develop protocols												
Sample preparation (grinding and sub-sampling)												
Sample analysis												
Training campaign												
Data analysis and report, plans for subsequent years												

WP6

Integrating postharvest nutrition technologies into the maize-based farming systems of Babati District, Tanzania.

Action Period	November 2012 to October 2013				
Activity Type	Action research and capacity building				
Target Villages	Long	Soloto	Sabilo		
WP leader	IITA				
Partners	SUA	DALDOs	Selian ARI Arusha	NM-AIST	Farmers organizations, NGOs
WP Total Budget	70,000.00				

RO 2: Integrated systems improvement (Postharvest management)
Key intervention areas:

- Evaluation of the factors contributing to high postharvest losses, the effect on productivity gain, income and food security of farm households.
- Develop and test, with farmers, new strategies to reduce postharvest losses and increase food processing in ways that increase market opportunities for the farmers.
- Human capacity building at graduate degree level in collaboration with SUA and NM-AIST

Introduction

Increasing farm level profitability requires the use of appropriate postharvest interventions that enhance farmers' willingness and ability to adopt high yielding crop varieties, reduce food losses, increase the shelf life and market value of farm produce. A single-minded pursuit of production increases is counterproductive as it often lowers prices and penalizes producers (IITA strategy, 2012-2020). Studies in postharvest systems and value-addition are required to design more effective interventions for sustainable production systems that lead to better income for farmers. Important postharvest handling factors that increase opportunities for local processing or adding value to agricultural products and reducing the tiresome and non-ergonomic labor practices, particular drudgery traditionally assigned to women, need to be investigated. The labor saving technologies also provide greater opportunity for agro-industry development, product development, import substitution and higher incomes to all the rural value chain actors.

Description of work

Task 1: Sensitize farmers and build stakeholder platform for postharvest research and postharvest improvement interventions.

Sub task 1.1. Sites and Farmer selection: Partners (IITA, SUA, DALDOs, NM-AIST) have been selected based on their experiences and capacity in postharvest project implementation. These partners will work with village extension agents to sensitize local village leaders and

select farmers /farmers' organization/ CBOs who will participate in the postharvest research.

Task 2: Evaluate the factors contributing to high postharvest losses, the effect on productivity gain, income and food security of farm households.

Postharvest loss assessment study will be done in Long, Seloto, Sabiro and 3 other counterfactual villages (to be identified) to establish the factors that contribute to high postharvest losses: The study will be done through focus group discussions and household interviews. At least 150 individuals will be interviewed during the focus group discussions and a minimum of 350 households will be interviewed using a structured questionnaire. Assessments of the household processing and storage infrastructure/capacity will be evaluated during the surveys. Data from the survey will analyzed to understand the major constraints and to develop new postharvest management strategies.

Task 3: Develop and test, with farmers, new strategies to reduce postharvest losses and increase food processing in ways that increase market opportunities.

Subtask 3.1: Complete data collection from the storage experiments that have been started with farmers: monitoring storage indices (moisture, residual O_2 inside the storage devices, grain moisture, weevil infestation, and extent of grain damage). A total of 41.8 MT of maize and pigeonpea are currently in the storage experiments in two Jumpstart villages.

Subtask 3.2: Complete the evaluation of value chain performance for maize and sorghum in the two intervention villages where mechanised threshing and shelling technologies were introduced compared to the counterfactual villages where traditional methods are used (if found appropriate: sechada, tsaayo & kwaraa could be adopted as counterfactual villages).

NOTE: For Subtasks 3.1 & 3.2, only collection of experimental data will be completed. Additional investments for setting-up new experiments are not required.

Subtask 3.3: ***On-farm demonstration of improved postharvest handling technologies through experimentation with farmers****:* In the intervention villages, at least three improved postharvest technologies: 1. Mechanized shelling; 2. Improved storage technologies - hermetic storage; and 3. improved crop drying of grains; will be introduced through on-farm demonstration to crop growing farmers/farming households. Choice of technology will depend on predominant crops and extent of postharvest losses (Task 2 will provide this information). Framers will use manual shelling and drying practices and traditional storage facilities as control.

Method: Pilot processing activities for the most important crops of postharvest loss significance will be initiated in the intervention villages. Farmers' groups will use the processing machines (e.g for threshing of maize and sorghum). Both the intervention and counterfactual households or/and villages will be evaluated for the extent to which improved the mechanized postharvest processing technologies (a) reduce postharvest losses; (b) reduce labour inputs and improve health of women farmers; (c) reduce processing time; and (d) increase willingness of men and women farmers to increase on-farm production (intensify) in

the intervention villages compared to counterfactual villages. Storage experiments to compare traditional crib storage systems (control) with improved storage techniques (hermetic storage) will be established to reduce storage loss. Each village will be treated as a block. Households and farmers' cooperatives that have traditional storage facility (cribs) and large quantity of maize in each village will be selected as experimental farmers.

Deliverables

There are three deliverables under this work package i.e.

- Factors contributing to high postharvest losses, the effect on productivity gain, income and food security of farm households will be identified.
- New strategies will be developed and tested for reducing postharvest losses and increasing food processing in ways that increase market opportunities for the farmers.
- Human capacity building at farmers' level and at graduate degree level in collaboration with SUA and NM-AIST

Work plan 2012/203

Activity	**2012**		**2013**									
	N	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**
Working Package development												
Task 1: Site selection/farmers selection and sensitization												
Subtask 2.1. Postharvest loss assessment study												
Subtask 3.1: Complete data collection from the storage experiments												
Subtask 3.2: Complete the evaluation of value chain performance												
Subtask 3.3: On-farm experimentation of improved postharvest handling technologies with farmers												
Data compilation and analysis												
Report write up and presentation												

BUDGET ESTIMATES

Line item	**Total cost [USD]**	**Comments**
Personnel		
Coordination	25,000	Staff time (IRS - 1 month; RA - 6 month equivalent)
Operations		
Sensitization workshop and partners' meetings	5,000	Accommodation, meeting venues, DSA for partners
Food processing and training sites	3,000	Pilot processing and training sites' establishment
Technology demonstration	20,000	Processing equipment, Instruments and training
Farmers selection, site selection	3,000	Partner- DALDOs, SUA, etc.
Training, Data collection,	5,000	Partner-NGOs and SUA
Office supplies, stationery for meetings	2,000	Stationeries
Communication	2,000	IT, phones, media contacts
Travel		
National travel	5,000	For local partners
Total	**70,000**	