Africa RISING Baseline Evaluation Survey (ARBES) report for Tanzania

Ainsley Charles, Carlo Azzarri, Beliyou Haile, Maria Comanescu, Cleo Roberts, and Sara Signorelli

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

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

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Currency Unit = Tanzanian Shilling; US$1 = 1,650 TZS (April 2014)

ACRONYMS AND ABBREVIATIONS

Africa RISING / AR	Africa Research in Sustainable Intensification for the Next Generation
BMI	Body mass index
EDI	Economic Development Initiatives Ltd
ESA	East and Southern Africa
FRG	Farmer research group
IFPRI	International Food Policy Research Institute
kg	Kilograms
kg/a	Kilograms per acre
kg/m^2	Kilograms (weight) per square meter (height)
NBS	National Bureau of Statistics
p-value	Probability value (statistic) used for hypothesis testing
SACCO	Savings and Credit Cooperative
TARBES	Tanzania Africa RISING Baseline Evaluation Survey
TZS	Tanzania shillings
US$	United States dollars
z-score	Standardized anthropometric score based on individual and comparable reference population (median and standard deviation) values

1 Executive summary

This report presents overall summaries and cross-tabulations, and empirical means-difference tests across household type, location, wealth, and gender of head, for data that cover 810 households in Africa RISING areas in northern and north-central Tanzania in three districts (Babati, Kiteto and Kongwa) and twenty-five villages in which Africa RISING was either operational or pre-operational at the date of the survey (February-April 2014). Following a description of the report and of the survey from which its data are drawn, its main findings are presented in two parts, providing description and analysis of household- and community-level data, and these also include a series of tables and graphs to further illustrate the descriptive results. Each part contains six sections. For household-level data, these include household demographics, health and nutrition, dwelling characteristics and asset ownership, agriculture, household consumption, and shocks and vulnerability. And for community-level data, these cover community demographics, access to services, extension advice and farmer groups, land and major crops, shocks, and food prices.

The report's main goal is to present a snapshot of agricultural and socio-economic conditions in the survey areas. By doing so, it will provide a baseline assessment to characterize the main production systems and socio-economic challenges within these communities, and to inform the array of research interventions currently underway. At the same time, these data, when complemented by appropriately scheduled follow-up surveys, may also be used for evaluative purposes in the future.

To foreshadow its results, we briefly discuss some of its main findings and highlight three key themes that emerge from these investigations. The first relates to the extent to which gender and wealth play a role in determining specific outcomes within the survey areas. The second theme focuses on an apparent dissonance between community-level and household-level assessments of traditional and new interventions aimed at promoting agricultural innovation and development. And the third focuses on key differences among districts that may have implications for the platform of research being undertaken within Africa RISING. Throughout, we attempt to draw some policy conclusions based on these findings and thematic implications.

Overall, the areas being targeted by Africa RISING are maize-, beans-, and pigeon pea-based agricultural communities (along with groundnut, sorghum, and sunflower) in which a majority of household heads, spouses, and other working age adults practice farming as their prime economic activity – and a non-zero fraction of school-age children too, at times. As rural communities, they fit within the national picture in terms of socioeconomic outcomes as well as overall provisioning of infrastructure and services. For example, at the lower levels of education, the fraction of household heads either with no education or with some (but not more than) primary school education is 24 percent and 70 percent, respectively, compared with 19.1 percent and 64.6 percent of women and 9.5 percent and 67.6 percent of men nationally (NBS and ICF Macro 2011).

A majority of communities have access to key services such as schools, health facilities, markets, communal water facilities, and mobile money points, all within quick reach, while livestock markets, post and police offices, and administrative centers are farther removed. For them, adverse weather and market events (droughts, floods, crop input and output price fluctuations) interact with challenging agro-ecology in ways that can pose both immediate and longer-term risks to household welfare. Rates of stunting among children under five and overweight and obesity among reproductive-age women are comparable to national averages, while risk of food insecurity is non-trivial. In the sum, these data suggest that Africa RISING is well targeted to these areas.

On the extent to which gender and wealth play a role in determining specific outcomes, the first theme of the report, the data show that the survey areas in Tanzania comprise a set of individual, household, and community arrangements that overwhelmingly reflect traditional gender roles. On almost every dimension for which data have been captured, female-headed households appear to lag behind their male counterparts. Compared to men, female heads of households have less human capital, with double the rates of illiteracy and of lack of formal education. They live in more modestly provisioned homes, built using cheaper, more traditional materials, and possess less modern furniture and equipment.

On-farm, female-headed households also face a series of well-documented deficits, including lower access to extension advice and less ownership of key farm implements. Presumably because of the uneven burden associated with home duties, or because they are more likely to be single-parent homes, female household heads are unable to spend equal amounts of time in cultivation, working up to 13 days less on maize and beans. They also have fewer resources, possessing, for example, less livestock which can often be used to boost consumption in lean times. Even in the face of common shocks, their households appear to be more vulnerable: they were twice as likely as male-headed households to have experienced food insecurity, which also remains a risk at higher wealth levels than for men. And finally, at the (local) policy level, they lack adequate representation to advocate for and affect change: in twenty-five communities surveyed, only one (Chitego, in Kongwa District) had a female chairperson.

However, the data also reveal a few areas of possibility for changing this narrative in the future. For example, while participation in farmer training centers and other institutions of knowledge diffusion is low overall, female membership in cooperative organizations is high which, if exploited, may present alternative channels for new agricultural technologies to be disseminated. Increasing the representation of women among the pool of model farmers may also be critical, as farmers are seen to interact more heavily with friends and neighbors and with these lead farmers, rather than with extension agents, whose visits are typically sporadic. Third, female-headed households appear to farm an equal size of land and to own this land to the same degree as male-headed ones and, as confirmed by community-level informants, can inherit land left by a spouse when widowed in more places than men who face the same situation.

In terms of wealth, the evidence presented here reveals both the adverse knock-on effects of being poor and the counterposed, positive outcomes associated with being relatively richer. Ranking households in quintiles along a wealth continuum (generated as a function of reported asset ownership) results in a distribution which is predictive, at its lower end, of negative health, food security, and agricultural outcomes. First, residents of poorer households, who are surely no less likely to suffer from illness, are found to engage less with the system of available health care, by visiting providers less frequently. Second, reproductive-age women living in poor households are more likely to be underweight than their richer-households peers, an outcome that is shared with children in these households. Children from poor households are also likely to suffer elevated levels of malnutrition, evidenced by higher rates of stunting, compared with the richer-household peers.

In contrast, the consumption bonus attached to being richer shows up in additional (and excess) weight, as opposed to improved nutrition: richer-household reproductive-age women unambiguously have a higher likelihood of being overweight and obese than peers from each of the poorer quintiles. Second, these outcomes are mirrored by the contrasting exposure to food insecurity of poor and relatively richer households revealed by the data. Regardless of the period of recall, poor-household residents faced risks of having to worry about near-term food insufficiency and of undergoing an actual episode of food shortage at *eight times the rate* of richer households. And finally, it emerges that richer farmers, even when located within the same area of operation and therefore subject to similar agro-ecological and infrastructural conditions as poor farmers, are able to extract higher yields of the major crops, including maize (the dominant crop) and pigeon pea.

From a policy perspective, it is important to consider the implications of these findings. First, if equity is being considered, programming for development in these areas must try to reach the poorest households, to relieve the immediate dangers to consumption and health faced by their members. Children who lack proper nutrition are also more likely to be poor learners which, together with other deficits, could reinforce (but would certainly not weaken) the transmission of poverty over future generations. Second, if efficiency is the motivation, programmatic interventions such as Africa RISING should equally attempt to move beyond the so-called model farmers, who are typically already well-resourced and therefore capable of tolerating higher risk than poor farmers. For an equal measure of adoption of new techniques, and with the appropriate level of support and input provisioning, poor farmers should exhibit larger gains in key agricultural outcomes.

The second theme is the apparent dissonance between community-level and household-level assessments of traditional and new interventions aimed at promoting agricultural innovation and development. While commonly accepted as performing a critical role in knowledge diffusion, the effectiveness of extension systems within the survey areas appears in question. Community leaders appear unreserved in their praise of extension advice but, at the household level, the evidence is that contact with agents is sparse. In fact, as mentioned above, farmers get advice from their neighbors more often. Also, while community leaders would undoubtedly have interacted with agents of Africa RISING, farmers themselves report little knowledge of the program. So it remains unclear both if

ground-level challenges (say, in uneven access to services or lack of advice on new methods and techniques) are being efficiently fed up to community-level representatives and if higher-level interventions and programming are being filtered down effectively.

The third and final theme revealed by the statistical analysis is the significant level of heterogeneity among the survey districts along key agricultural, social, infrastructural, and economic dimensions. Among the three survey districts, Kongwa District stands out for having the largest communities, by population size. More household heads report agriculture as a primary work activity, and it is also where the highest proportion of food-insecure households live, by a factor three times as high as in Babati District. Kongwa District in addition has the lowest consumption expenditure, on both food and non-food items (and, unsurprisingly, the highest share of total expenditure devoted to food purchases). Congruent with higher levels of food-insecurity and lower consumption expenditure, this district has the highest incidence of severe child malnutrition, by all indicators (severely wasted, severely stunted, or severely underweight). Stunting, usually taken as a signal of chronic malnutrition, is particularly serious, with over half of all children below five short for their age, and twenty-five percent severely so. At the same time, this district has the lowest fraction of reproductive-age women in any of the unfavorable weight categories (overweight or obese, but also underweight).

Babati District, the smallest by average community size but the highest in elevation, is also the best educated (for household heads) and generates the highest agricultural yields. Total consumption expenditure and non-food expenditure, measured from purchases, is highest in Kiteto District, while food expenditure is highest in Babati District. While the severe forms of child malnutrition are most prevalent in Kongwa, and despite relatively higher yields and relatively lower food insecurity, children in Babati and Kiteto are still affected by child malnutrition, in particular by stunting (roughly two in five children). In Babati, women of reproductive age have the highest levels of both underweight and overweight, while Kiteto has the highest fraction of obese women. In the sum, this high number of dimensions over which these communities differ – perhaps a feature of the program's design – presents both an opportunity for agricultural researchers to design equally variegated research interventions and a challenge to social scientists interested in program evaluation.

On the issue of sample group comparability for future project and policy evaluation, we confirm that randomization of a set of Babati District households into an input-provision experimental group was successful: input recipients and non-recipients are similar along all key dimensions. However, while this assures the experiment's internal validity, we found no evidence to support extrapolating any future findings of input-provision effects from this experiment to the broader group of Africa RISING beneficiaries. We also find no evidence to support using non-beneficiaries of Africa RISING as a comparison group to determine Africa RISING program effects.

In summary, it bears remarking that these communities all represent rural, heavily agricultural areas facing similar risks and challenges. A majority of farmers typically rely on traditional methods for agricultural cultivation and livestock management, while a few strive to be innovators. In these areas also, research and development programs more and more aim to provide these innovations and to

understand challenges posed to adoption by extant conditions. Dealing with gender and wealth disparities, appreciating community leader-level versus ground-level discordance in assessment of challenges, and understanding area heterogeneity are certainly prerequisites to effective program implementation in the near term and to program evaluation in the future. The statistical evidence provided by this report should assist in both these efforts.

2 Introduction

The program Africa Research in Sustainable Intensification for the Next Generation (Africa RISING or AR) was created to investigate pathways out of hunger and food insecurity in sub-Saharan Africa. Begun in 2012, it represents a major effort by the United States Agency for International Development – through its Feed the Future Initiative – to use a research-for-development model to support smallholder farming across six African countries. Working with a comprehensive slate of African research scientists, agricultural ministries, departments and other agencies, and various external partners, its aim is to promote sustainably intensified farming systems that can positively impact key outcomes such as food and income insecurity, under-nutrition and resource degradation. Research activities within Africa RISING comprise three central projects, one in Ethiopia, another in the west African countries of Ghana and Mali, and a third in the east and southern African (ESA) countries of Malawi, Tanzania and Zambia. As a separate but related project, monitoring and evaluation of the program is the responsibility of the Washington, DC-based International Food Policy Research Institute (IFPRI).

As part of these duties, IFPRI has commissioned several baseline surveys across the regions of the program. These surveys are expected to complement other available data streams to permit characterization of targeted farming systems and provide a necessary baseline assessment of socioeconomic conditions, challenges, and key welfare indicators in research areas. Second, they will serve alongside other data sources – administrative, programmatic and otherwise – to populate the program's information system base and allow more effective mapping and monitoring of project activities. And third, in combination with periodic follow-up surveys, these datasets are also anticipated to provide dynamic assessments of the effectiveness and impacts of Africa RISING research on these communities.

The main purpose of this study is to present the results and findings of a series of empirical investigations of one of these new African data sets, the 2014 Tanzania Africa RISING Baseline Evaluation Survey (TARBES 2014). These investigations include data summaries and cross-tabulations, along with means-difference tests of key indicators drawn from over 1,300 variables developed from the raw dataset. These statistical tests provide the likelihood that observed differences arise by chance; low likelihoods (commonly, less than 10 percent) permit the characterization of the difference as "statistically significant." Tests of difference in mean values are conducted within four key categorical blocks: district-level location, household type, household-head gender, and household wealth. Empirical results are tabled – and in some cases complemented with graphical illustrations – and are used analytically to uncover associations and patterns that describe both socioeconomic conditions and challenges facing survey households and the consumption and production choices they make in response. Where relevant, contextual knowledge and data arising from administrative reports, extensive site visits to Babati, Kiteto, and Kongwa districts, research progress reports and non-program sources were also utilized.

The report is laid out as follows. The following section presents detailed information on the survey, its planning and implementation, and the process by which its target and ultimate sizes were determined. It also summarizes the content of the survey questionnaires. Sections 4 and 5 set forth the main analytical results of the report presenting, in turn, a series of analyses of the household- and community-level datasets. Section 6 concludes.

3 The Survey

3.1 Introduction

As part of IFPRI's ESA monitoring and evaluation duties, TARBES 2014 was agreed in late 2013 and put in the field in February 2014. Data collection therefore occurred roughly midway of the program's five-year term. The survey was administered by Economic Development Initiatives (EDI), a data collection firm based in Bukoba, Tanzania, with the technical assistance of IFPRI. In the preparation phase, this assistance extended to development and adaptation of household and community questionnaires and training manuals – including local language (*Kiswahili*) translations; piloting of the questionnaires; preparation of village, sub-village and household lists; listing of district and village contacts; and determination of a sampling strategy, intended sample size, and sample allocation. Later on, in the field phase, IFPRI would collaborate on enumerator training and pre-testing both survey instruments (household and community level), observe and monitor field enumerations, and maintain supervisory oversight of the five weeks of data collection.[1]

3.2 Coverage

The United Republic of Tanzania comprises thirty regions (twenty-five in mainland Tanganyika and five in the island of Zanzibar). Each region is divided into districts which are themselves further sub-divided into wards (*shehia*), villages, and sub-villages (*kitongoji*). The survey was designed to cover twenty-five rural communities (villages) in the three districts of Babati, Kiteto and Kongwa, which are spread between the neighboring regions of Dodoma and Manyara in the country's north and central zones.[2]

3.3 Sample design

A projected sample size of 917 households was preliminarily agreed, motivated by a desire to capture as much information as possible about AR participant farmers but also to have a basis for comparison with non-participant farmers to whom the program could yet be expanded. To achieve these twin objectives, households from all seven intervention villages already hosting AR activities would be included alongside households from eighteen control villages that up to that point held no AR activities but that could serve as direct comparators (see Table 1). These latter villages were purposely selected on a 'distant-but-comparable' criterion, essentially a requirement that they exhibit similar agro-ecological conditions as existing program areas within the same district but be geographically

[1] Copies of the questionnaires, datasets and EDI's Basic Information Document may be requested from the IFPRI M&E team by contacting Carlo Azzarri (c.azzarri@cgiar.org).

[2] Of the country's thirty regions, Dodoma and Manyara are the eighth- and sixteenth-largest by population, respectively (NBS 2013).

apart, thereby ruling out the possibility of contamination.[3] Lists of candidate comparator villages were established in concert with local-area extensionists and then verified with district-level agricultural officials.

Table 1. Tanzania Africa RISING Baseline Evaluation Survey (TARBES) coverage

Region (n=2)	District (n=3)	Intervention villages (n=7)	Control villages (n=18)
Dodoma	Kongwa	Chitego, Mlali-Iyegu, Moleti	Laikala, Leganga, Makawa, Mautiya, Ngutoto, Njoge, Vihingo
Manyara	Babati	Long, Sabilo, Seloto	Dudie, Gidas, Gidewari, Gidngwar, Hallu, Haysum, Matufa, Mer, Shaurimoyo
	Kiteto	Njoro	Dosidos, Makame

Note: n - number.
Source: Author's compilation based on TARBES 2014.

The majority of households from the first group of communities, the seven intervention villages already hosting AR activities, would be chosen on the basis of their active participation in AR activities, either from involvement in one or more of the work packages dating from program onset or from membership in an input-provision experiment conducted by IFPRI in mid-2013.[4] In this experiment, farmers in Babati District attending field demonstrations were invited to participate in an experiment surrounding the use of modern seed varieties and non-traditional local fertilizer that resulted in their assignment (via randomization) into two sub-groups: coupon (and, a few months later, input) recipients and non-recipients.

To facilitate their identification, an initial listing of program participants in the seven intervention villages was sourced over several site visits and from ongoing dialogue with research team leaders. This was then matched with lists of participants from the experimental group in the three Babati District villages. These lists were later field-verified by EDI during the survey preparation phase. Ultimately, after accounting for duplicate households, households from non-intervention villages, and non-existent households, this portion of the sample was whittled down to 435 households (from 542 originally), comprising 328 households who took part in the abovementioned input-provision experiment and 107 who fell outside of it. In this report, these households are referred to as 'members of the experimental group' and as 'AR beneficiaries', respectively.

In addition, it was decided to include a randomly sampled subset of 15 non-participants from each of the seven intervention villages, to meet the question whether – within Africa RISING communities – anticipated program benefits could filter to non-participating farming households via indirect

[3] Contamination could arise if, for example, partnered villages were served by the same markets.
[4] Work package activities included soil sampling; maize, beans and pigeon pea production and post-harvest handling; yield and pest surveys; and mycotoxin assessments, among others.

learning, neighborhood interactions and networking (so-called 'spillover effects'). These 105 households are referred to in the report as 'indirect beneficiaries'.

Finally, households from the second group of communities, the comparator villages, were selected by two-stage sampling methods in which, first, one sub-village was randomly chosen from within each control village and, second, 20 households were randomly chosen from the list of all households within that sub-village. Fifteen households so chosen would enter the final sample for enumeration and five would serve as reserve units in the event of non-response or other anomaly. Thus 270 households (and 90 reserves) were chosen in this way to serve as comparators to households actively participating in the program; they are referred to in the report as 'control' households.[5]

Thus, the final sample design for TARBES 2014 included purposeful selection of 435 AR and experimental households (from intervention villages only) and sampling of 25 sub-villages (from control and intervention villages) followed by 15 households in each sampled sub-village. In combination, this produced the ultimate sample size of 810 households.[6]

3.4 Questionnaires and indicators

In terms of coverage, the TARBES comprised both household- and community-level surveys. The household-level roster included modules on household demographics, labor, health and women's and children's anthropometry, agricultural land, crop inputs, production, sales, storage, livestock ownership and feed, agriculture-related problems and strategies, interaction with extension agents, credit and other income, dwelling characteristics and housing assets, subjective welfare, food security, and welfare shocks, and food and non-food consumption expenditure. The household survey included on recall periods that varied from one day (for certain health and nutrition questions), seven days (for labor, food and non-food consumption questions), one month (health questions), one year or the last agricultural season (for labor, health, food security, non-food consumption and most agricultural questions), and five years (for questions on shocks to welfare).

From the raw data an expansive set of new indicators were created. These included adult (including head of household) demographics, such as age, sex, marital status, education, literacy, employment status and religion, and anthropometric measurements of height and weight of infants, young children and working-age women. At the household level these included household size, dependency ratio, vulnerability status, and use of and expenditure on local health care facilities. Other indicators covered ownership of assets, both in-house (such as appliances and furniture) and on-farm (including farming implements and livestock), and identified dwelling conditions, such as floor, roof and wall materials, and types of water sources, lighting and fuel. And a final set covered both agricultural operations, including those related to availability and use of inputs, technology, and past-season

[5] Twenty-one households in total were replaced.

[6] One household did not complete the full survey but was not replaced; as a result, for most items in the report, actual sample size is 809 households.

harvest and disposal, as well as past-week, past-month, and past-year consumption expenditure that was used to calculate a consumption aggregate (see Section 4.5 below). By aggregating over all households in the survey, these indicators were then used to calculate various rates of prevalence. To distinguish households by wealth and consumption expenditure status – and therefore permit ranking – a measure of wealth based on asset ownership was also created (see Excursus I in Section 4.2.1 below). Locating households along the percentiles of these distributions then allowed comparability by, for example, rich versus poor and high- versus low-consumption households.

The community-level roster included modules on respondent demographics, age, sex, position and tenure in the community; on access to, use of, and satisfaction with basic services; on agricultural labor; on land acquisition, use and transfer; on extension services; on community size and membership in community groups; on availability of agricultural inputs, water access and use; and on rain and harvest assessments. Most questions centered on conditions experienced at the time of the survey but for some questions there were recall periods of up to one year (for input availability and prices, for example). The community survey was administered to a group of village officials and other knowledgeable persons, and consensus responses were sought and recorded. As part of the community-level enumeration, once the main roster was completed a separate collection of price data for 47 food items was taken, typically from a centrally-located main shop, with the shop's operator as the respondent.

Using these data, among the key indicators constructed for this report was a series of informant and village characteristics, including age, sex and years of experience in the community, along with population and elevation. Indicators describing availability of up to twenty main services – including education, health, transport, finance, market and administrative facilities – and the time cost to access them, were also constructed. Indicators focused on the practice of agriculture included types of water access, advice from extension agents and membership in research groups and cooperatives, along with labor allocation choices, land use patterns and customs governing land transaction. The set of community-level indicators further included main crops produced and consumed and the major agricultural problems affecting each community. I report on these indicators in Section 5.

3.5 Implementation

Pre-testing of the household and community surveys took place in January and February 2014, respectively. Training of survey teams lasted for three weeks and included an introductory session on the purpose of the survey and basic surveying techniques, followed by a detailed review of the household questionnaire and sessions of practice interviewing among trainees. A field test was also conducted in Bukoba. As electronic data capture was used, trainees were also immersed in the use of hand-held computers and reminded of the necessity of strict adherence to the quality control procedures. A special training module on collection of anthropometric data was also included. Headquarters-based training ended with assessment of practical and written tests and selection of

enumerators. After relocation to the field in Babati District, a full pilot in a non-survey village was conducted to test enumerator readiness.

Fieldwork began in the final week of February 2014 in the villages of Mer, Seloto and Shaurimoyo (Babati District) and lasted through the end of March 2014 when enumeration of households in Mautiya and Njoge (Kongwa District) was completed.[7] EDI's field-based unit comprised a field coordinator and three enumeration teams, each consisting of a supervisor and seven enumerators. Their work was complemented by that of a data processing coordinator who – together with the field coordinator – led the quality control measures and ensured that household revisits were conducted as required. Weekly allocations were determined prior to the start of each week and were recalibrated at the end of each day to take account of progress. Supervisors accompanied teams to the field and were responsible for on-the-ground problem solving and for moving teams and equipment between assignments. Supervisors also served as enumerators for the community-level survey.

Due to its length, the household questionnaire was typically administered over two sessions, at times with a short intermission to allow respondents to attend to daily household chores. In terms of the interview flow, the first session began with an introduction and explanation of the survey's purpose and the recording of the respondent's informed consent. Once underway, enumerators cycled through all twenty modules, usually completing head and household demographics and health status, along with agriculture-related topics, in the first session. The post-break session captured information on dwelling characteristics, household consumption and anthropometrics of women and children. Enumerators also captured global positioning system latitude and longitude information for each household, along with re-contact information, mainly the name, relationship, and telephone contacts of neighbors or other reference persons both within and outside the immediate community. Respondents represented either the head of household or, if the head was unavailable, the most knowledgeable member present.

3.6 Challenges

In terms of challenges, according to EDI the main issue encountered centered on household listing and verification of AR participants in Babati District. Many names initially thought to represent unique households turned out to be part of the same household as other participants and therefore had to be merged into a single household. Other participants were found to be living outside of intervention and control villages while still others – particularly a few from the experimental group – were students or other temporary residents at the time of the initial listing. Despite repeated attempts at verification, including some that lasted well into the early weeks of enumeration, a final few remained

[7] A week of revisits extended the fieldwork into early April.

unknown to village authorities. As already explained, these discrepancies affected the overall size of the sample.

During actual enumeration, survey teams were faced with challenges of adverse weather, difficult-to-reach households, heads of household away for work, refusals, fatigue due to the length of the survey and, in some villages, a deficit of trust on account of rumors that the survey exercise was religiously motivated. Except for the latter, these are all typical of survey work in general and, with EDI able to implement appropriate field-based adjustments and strategies, did not present any real threat to the survey's successful completion.

4 Household survey

4.1 Who is in the survey?

A sample of 810 households, comprising 5,109 individuals, had at least one member interviewed for the survey. These households were drawn from Africa RISING areas in north-central Tanzania (see Table 2 and Appendix, Table A1), covering the three districts and twenty-five villages in which AR was either operational or pre-operational at the date of the survey (February-April 2014).

Table 2. Tanzania Africa RISING Baseline Evaluation Survey (TARBES) sample, by district and type

	Villages			Households				
District	Interv.	Cont.	Total	Africa RISING	Exp.	Ind. bene.	Cont.	Total
Babati District	3	9	12	90	328	45	135	598
Kiteto District	1	2	3	3	0	15	30	48
Kongwa District	3	7	10	14	0	45	105	164
Total	7	18	25	107	328	105	270	810

Note: Africa RISING operates in two of Tanzania's thirty regions: Dodoma, in which the district of Kongwa falls, and Manyara, which includes Babati and Kiteto districts. Interv. - intervention, Cont. - control, Exp. - experiment, Ind. bene. - indirect beneficiaries. Of the 328 experiment households (see text for details), 186 were coupon/input recipients and 142 were non-recipients.
Source: Author's compilation based on TARBES 2014.

Five hundred and forty households come from the seven intervention villages within Africa RISING: Long, Sabilo, and Seloto in Babati District, Njoro in Kiteto District, and Chitego, Mlali-Iyegu, and Moleti in Kongwa District. These comprise 435 AR and experiment households and 105 indirect beneficiary households. In addition, 270 households were chosen from 18 control villages.

On average, survey households have six members (see Table 3), three of which are dependents. Among intervention villages, households are larger: AR and experiment households contain seven members. In contrast, control village households' average household size is 5.8. Figure 1 reveals a set of area disparities in which this pattern is confirmed at the district level: size increases with household involvement in (and proximity to) the activities of Africa RISING.[8] Further, the average age of household heads in the survey is 47 and the vast majority of heads (94 percent) either have no schooling or have not gone beyond primary school (see Table 3). However, 71 percent can read or write Kiswahili and another five percent can read or write both Kiswahili and English. Most heads are Christian (91.6 percent) and are or have been married (95.5 percent). As expected, most heads (88 percent) cite agriculture – either crop or livestock – as their primary economic activity.

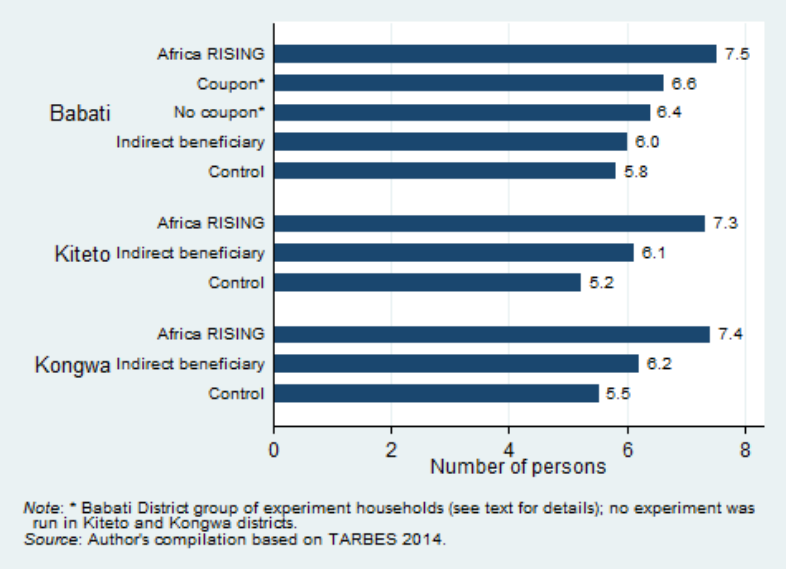
[8] The 2012 census and the nationally representative 2011-12 HIV/AIDS and Malaria Indicator Survey report nationwide average household size of 4.8 and 5.0, respectively. See NBS 2013 and TACAIDS et al. 2013.

Table 3. Household and household head demographics, by type, district and head gender

	Overall			Group					District			Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Bab.	Kit.	Kon.	Mal.	Fem.
Household size	810	6.31	2.79	7.5	6.6	6.4	6.1	5.6	6.5	5.6	5.9	6.4	5.7
Female	810	0.13	0.34	0.10	0.13	0.09	0.12	0.17	0.12	0.17	0.17	n.a.	n.a.
Age (in years)	809	47.3	14.6	50.6	47.3	46.1	43.4	47.8	47.6	47.8	46.0	46.5	52.3
Dependency rate	810	0.47	0.23	0.46	0.47	0.42	0.48	0.49	0.45	0.49	0.51	0.46	0.48
No school	798	0.24	0.43	0.16	0.16	0.16	0.17	0.39	0.18	0.49	0.39	0.20	0.47
Some primary school	798	0.70	0.46	0.79	0.77	0.77	0.74	0.57	0.76	0.49	0.55	0.73	0.50
Some secondary school	798	0.05	0.21	0.04	0.06	0.06	0.08	0.02	0.05	0.02	0.02	0.05	0.02
Cannot read or write	799	0.24	0.43	0.16	0.18	0.18	0.17	0.38	0.18	0.46	0.39	0.20	0.49
Read or write Kiswahili	799	0.71	0.46	0.80	0.75	0.75	0.75	0.60	0.75	0.50	0.60	0.74	0.49
Read/write both Kiswahili and English	799	0.05	0.22	0.04	0.07	0.06	0.09	0.03	0.06	0.04	0.02	0.06	0.03
Primary activity is agriculture	799	0.88	0.32	0.82	0.90	0.89	0.84	0.91	0.88	0.79	0.93	0.89	0.87
Ever married	799	0.95	0.21	1.00	0.95	0.90	0.96	0.97	0.96	0.98	0.94	0.96	0.90
Christian	809	0.92	0.28	0.94	0.96	0.97	0.85	0.87	0.94	0.54	0.93	0.92	0.90
Muslim	809	0.05	0.22	0.04	0.01	0.01	0.14	0.07	0.04	0.40	0.01	0.05	0.07

Note: Means, unless otherwise indicated. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon, (3) Non-coupon, (4) Indirect beneficiaries, (5) Control. Num. - number of households, S.d. - standard deviation. Districts: Bab. - Babati, Kit. - Kiteto, Kon. - Kongwa. Gender: Mal. - male head, Fem. - female head. N.a. - not applicable. All items are indicator variables except for household size (which ranges from 1 to 18) and age (which ranges from 18 to 96).
Source: Author's compilation based on TARBES 2014.

Figure 1. Average household size, by district and household type



Note: * Babati District group of experiment households (see text for details); no experiment was run in Kiteto and Kongwa districts.
Source: Author's compilation based on TARBES 2014.

Across household types, the group of Africa RISING beneficiaries has the oldest heads, the highest rate of marriage likelihood and a lower rate of primary activity in agriculture compared to other groups (see Table 3 and Table 4), while farmers in the control group are the least educated and

literate: the fraction of control group household heads with no education is 0.39, which is 23 percentage points higher than within any other group.

Female-headed households comprise less than one in seven (13.5 percent) of the survey total and these households tend to be smaller than male-headed counterparts (5.7 versus 6.4, p-value: 0.009; see Table 4). Female heads are also older (by six years, p-value: <.001), have less education, and were less likely to have ever been married (90 percent versus 96 percent, p-value: 0.002), while religious affiliation, and primary economic activity (in agriculture) are similar. In terms of area differences, except for religious affiliation and primary activity, households in Kiteto and Kongwa appear broadly similar. The share of household heads that are Muslim in Kiteto is 0.40, compared with 0.01 in Kongwa, while the likelihood of primary activity in agriculture is 0.79 and 0.93, respectively. Far more differences are in evidence between Babati and other districts. In addition to the previously mentioned difference in size of household, Babati has a lower dependency rate and a higher proportion of heads literate in both Kiswahili and English than Kongwa, a higher proportion of Christians and economically active (in agriculture) heads than Kiteto, and more educated heads overall than both of the other districts.

Table 4. Household head characteristics means-difference tests, by type, district, and gender

	Significance of difference												
Comparison	Hh. size	Age	Dep. rate	No sch.	Some pri. sch.	Some sec. sch. or more	Cannot read or write	Kis.	Kis./Eng.	Primary activity is agri-culture	Chris.	Mus.	Ever married
Type													
AR v. exp.	***	***								**		**	***
AR v. IB	***	***									**	***	**
AR v. cont.	***	*		***	***		***	***		**	**		**
Exp. v. IB		**									***	***	
Exp. v. cont.	***		**	***	***	**	***	***	**		***	***	**
IB v. cont.		**		***	***	***	***	***	**	*		**	
Coup. v. non-coup.			*										*
District													
Babati v. Kiteto	*			***	***		***	***		*	***	***	
Babati v. Kongwa	**		**	***	***		***	***	**			**	
Kiteto v. Kongwa										***	***	***	
Gender													
Male v. female	***	***		***	***		***	***					***

Note: Significance of difference from means difference tests among household types and districts and between male- and female-headed households. Stars indicate significance level: ***<0.01, **<0.05, *<0.1. Types: AR - Africa RISING, Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment (exp.) group of households (see text for details), IB - indirect beneficiary, Cont. - control. Hh. - household, Dep. - dependency, pri. sch. - primary school, sec. sch. - secondary school, Kis. - read or write Kiswahili; Kis./Eng. - read or write both Kiswahili and English; Chris. - Christian, Mus. - Muslim.

Source: Author's compilation based on TARBES 2014.

4.2 What are their living conditions?

Assessing the physical infrastructure of these households, Table 5 reveals that most houses are built with mud or stone for their walls (73 percent and 20.5 percent, respectively), mud or cement for their floors (83.9 percent and 15.5 percent, respectively), and their roofs are made using metal or thatch (62.9 percent and 33.8 percent, respectively). Water and sanitation facilities are mostly public or shared, either taps or wells (65.4 percent), or some combination of dams, lakes, rivers, and springs (30.2 percent) for water, and latrines (93 percent) for sanitation. Thirty-six percent light their dwellings by oil or kerosene lamps, and a near similar fraction use solar panels (33.6 percent). Cooking by wood is almost universal and electrification – either for lighting or cooking – is low, reaching only 3.5 percent of households.

Table 5. Home asset ownership and dwelling characteristics

	Summary statistics		
Item	Number of households	Mean	Standard deviation
Dwelling characteristics			
House has mud walls	804	0.730	0.444
House has stone walls	804	0.205	0.404
House has mud floors	793	0.839	0.368
House had cement floors	793	0.155	0.362
House has metal roof	808	0.629	0.483
House has thatch roof	808	0.338	0.473
Main water source is public tap or well	809	0.654	0.476
Main water source dam, lake, river or spring	809	0.302	0.459
Water closet is public or shared latrine	807	0.934	0.248
Uses lamp (oil, kerosene) for lighting	801	0.363	0.481
Uses solar for lighting	801	0.336	0.473
Uses torchlight	801	0.266	0.442
Uses wood for cooking	806	0.968	0.177
Electric light	801	0.035	0.184
Number of rooms	809	2.934	1.258
Ownership of home goods			
Improved charcoal or wood stove	809	0.194	0.396
Modern wood bed	809	0.577	0.494
Sofa chair	809	0.090	0.287
Modern chair	809	0.121	0.326
Modern table	809	0.213	0.409
Radio	809	0.518	0.500
Mobile phone	809	0.789	0.409
Bicycle	809	0.546	0.498
Motorcycle	809	0.093	0.290
Solar panel	809	0.083	0.276
Wood cabinet	809	0.094	0.292

Note: All items are indicator variables, except 'Number of rooms' which ranges in value from 1 to 9.
Source: Author's compilation based on TARBES 2014.

Respondents from a majority of households cite ownership of mobile telephones (78.9 percent), wood beds (57.7 percent), bicycles (54.6 percent), and radios (51.8 percent), and about one in five households include modern tables and improved charcoal or wood stoves (see Table 5). At the other extreme, less than five percent own such items as kerosene or gas stoves, metal beds, or televisions, and fewer than one percent own refrigerators or cars (see Appendix, Table A2).

Living conditions and home asset ownership of the survey households significantly vary by household type, location and gender (see Table 6 and Table 7). Compared to other program-associated groups, Africa RISING households used more modern materials (including stone and cement) for home-building and owned more modern furnishings, radios and mobile phones. Compared with the groups of experiment and control households, they also had a higher ownership of private means of transportation. And their use of solar panels for lighting was significantly above all other groups. Across the three districts differences reflected Kongwa households' heavier use of mud floors and Babati households' higher ownership of modern furnishings and telecommunication items. Finally, female-headed households faced deficits in dwelling type and home asset ownership: they were less likely to have walls built of stone, floors made of cement, or to use solar lighting (by 11.7 percentage points, 6.9 percentage points, and 11.8 percentage points, respectively, which all represent significant differences) and, within the home, they also had less modern furniture, radios, and mobile telephones, among other items.

Table 6. Home asset ownership and dwelling characteristics, by type, district and gender

Item	Mud wall	Stone wall	Mud floor	Cement floor	Thatch roof	Solar light	Mod. wood bed	Mod. chair	Radio	Mobile phone	Bicycle	Motorcycle
Type												
AR	0.600	0.280	0.706	0.286	0.230	0.536	0.786	0.254	0.690	0.921	0.698	0.167
Coup.	0.726	0.194	0.846	0.154	0.392	0.355	0.667	0.118	0.548	0.882	0.565	0.043
Non-coup.	0.739	0.197	0.816	0.170	0.423	0.379	0.563	0.106	0.514	0.845	0.479	0.085
Ind. Bene.	0.686	0.248	0.810	0.190	0.324	0.276	0.524	0.152	0.514	0.743	0.600	0.133
Cont.	0.800	0.174	0.915	0.078	0.317	0.235	0.454	0.071	0.424	0.662	0.491	0.089
District												
Babati District	0.7	0.230	0.821	0.170	0.370	0.402	0.668	0.141	0.548	0.853	0.544	0.092
Kiteto District	0.67	0.326	0.917	0.083	0.298	0.087	0.458	0.083	0.417	0.646	0.500	0.083
Kongwa District	0.85	0.080	0.878	0.122	0.232	0.161	0.280	0.061	0.439	0.598	0.567	0.098
Gender												
Male-head	0.712	0.221	0.828	0.164	0.325	0.352	0.593	0.131	0.543	0.802	0.572	0.101
Female-head	0.849	0.104	0.905	0.095	0.421	0.234	0.472	0.056	0.352	0.704	0.380	0.037

Note: All means. AR - Africa RISING; Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment group of households (see text for details); Ind. bene. - indirect beneficiary; Cont. - control. Mod. - modern.
Source: Author's compilation based on TARBES 2014.

Table 7. Home asset ownership and dwelling characteristics means-difference tests, by type, district, and gender

	Significance of difference											
Comparison	Mud wall	Stone wall	Mud floor	Cement floor	Thatch roof	Solar light	Mod. wood bed	Mod. chair	Radio	Mobile phone	Bicycle	Motorcycle
Type												
AR v. exp.	***	**	***	***	***	***	***	***	***	*	***	***
AR v. IB			*	*		***	***	*	***	***		
AR v. cont.	***	**	***	***	*	***	***	***	***	***	***	**
Exp. v. IB					**		*			***		***
Exp. v. cont.	*		***	***		***	***		**	***		*
IB v. cont.	**		***	***				**			*	
Coup. v. non-coup.							*					
District												
Babati v. Kiteto			*			***	***		*	***		
Babati v. Kongwa	***	***	*		***	***	***	***	**	***		
Kiteto v. Kongwa	***	***					**					
Gender												
Male v. female	***	***	**	*	*	**	**	**	***	**	***	**

Note: Significance of difference from means difference tests among household types and districts and between male- and female-headed households. Stars indicate significance level: ***<0.01, **<0.05, *<0.1. Types: AR - Africa RISING, Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment (exp.) group of households (see text for details), IB - indirect beneficiary, Cont. - control. Mod. - modern.

Source: Author's compilation based on TARBES 2014.

4.2.1 Excursus I: Using housing and asset data to construct the wealth index

Housing characteristics and asset ownership data can also be used to create a measure of household wealth, which then allows the ranking of households along the revealed wealth distribution (Filmer and Pritchett 2001). As a proxy of household wealth, I construct (by the method of principal components) a linear index of asset ownership and dwelling conditions reported by each household (see Table 8).

Table 8. Wealth index, by quintile

	Summary statistics				
Item	Number of households	Mean	Standard deviation	Minimum	Maximum
First quintile (poorest 20%)	156	-2.65	0.44	-3.82	-1.99
Second	156	-1.52	0.29	-1.99	-1.04
Third	156	-0.46	0.36	-1.04	0.18
Fourth	156	0.82	0.44	0.18	1.61
Fifth quintile (richest 20%)	156	3.80	2.48	1.61	13.07
OVERALL	780	0.00	2.51	-3.82	13.07

Source: Author's compilation based on TARBES 2014.

Table 8 shows the summary statistics from the index and the full list of variables used in the analysis is presented in the Appendix, Table A3. Although by definition unit-less, the higher the index is for any given household, the wealthier are its members, on average. For this report's analysis, I rank households into quintiles, or fifths, which means that the first quintile contains households in the poorest 20 percent, and each subsequent richer quintile also contains 20 percent of households. In various sections of this report, these wealth index quantiles are used to investigate differences in household outcomes between richer and poorer households.

4.3 What is the health and nutrition status of women and children?

This section provides information on use of, and spending at, health care facilities by survey households in the previous month, on physical measurements among adult women and children under five, and on health outcomes such as malnutrition and obesity within these samples. From the available pool, complete data appeared for 703 women and 557 children, representing response rates of 68 percent and 78 percent, respectively.

Table 9 provides summaries of household health spending and recent visits to health care providers, along with age, height, and weight measures of women and children. Forty percent of households report at least one visit to a health care provider in the previous month. These households also report spending, on average, 26,500 Tanzanian shillings (TZS, approximately US$16) for all previous-month visits. Taking the size of the household into account, previous-month health-visit spending on a per capita basis was 6,400 TZS, or US$4.

Table 9. Household, women, and children health statistics

	Summary statistics				
Item	Number of observations	Mean	Standard deviation	Minimum	Maximum
Household-level					
Visited health care provider, past month	810	0.40	0.49	0	1
Total household expenditure, recent health visits (in TZS)	324	26,456	222,360	0	4,000,000
Per capita household expenditure, recent health visits (in TZS)	324	6,393	74,022	0	1,333,333
Individual-level					
Woman's age (in years)	1,039	28.6	10.4	15	49
Woman's weight (in kg)	704	52.9	10.9	25	99.9
Woman's height (in cm)	703	156.2	7.0	129	207.2
Child's age (in months)	700	28.5	16.7	0	59
Child's weight (in kg)	557	11.1	3.1	2.5	22.2
Child's height (in cm)	557	82.5	12.7	48	109

Note: In 2014 the exchange rate between Tanzanian shillings and United States dollars was approximately TZS1,650: US$1.
Source: Author's compilation based on TARBES 2014.

Neither the incidence of past-month visits to a health care provider nor spending on visits differs by gender of the household, or between Babati and any other district; the one district-level difference that does emerge occurs for spending between Kiteto and Kongwa (see Table 10). In respect of household type, the likelihood of visits to a provider is higher among AR households when compared with experiment and with indirect beneficiary households, and spending (adjusted for household size) is higher for indirect beneficiary households when compared with experiment and control households. Across wealth quintiles, households in the poorest fifth of the wealth distribution are far less likely than households in any other quintile to have sent a member to a provider in the previous month, and their total spending is significantly less than second-, third-, and fourth-quintile counterparts, but that disparity disappears once expenditure is adjusted for household size. No other inter-quintile differences in visit incidence or spending prove significant.

Table 10. Health visits and spending means-difference tests, by type, district, gender, and wealth quintile

	Significance of differences		
Comparison	Visited HCP	Total expenditure	Per capita expenditure
Type			
AR v. exp.	**		
AR v. IB	**		
AR v. cont.		*	
Exp. v. IB		*	*
Exp. v. cont.			
IB v. cont.		*	*
Coup. v. non-coup.			
District			
Babati v. Kiteto			
Babati v. Kongwa			
Kiteto v. Kongwa		***	**
Gender			
Male-headed v. female-headed			
Wealth			
Quintile 1 v. quintile 2	***	**	
Quintile 1 v. quintile 3	***	**	
Quintile 1 v. quintile 4	***	***	
Quintile 1 v. quintile 5	***		
Quintile 2 v. quintile 3			
Quintile 2 v. quintile 4			
Quintile 2 v. quintile 5			
Quintile 3 v. quintile 4			
Quintile 3 v. quintile 5			
Quintile 4 v. quintile 5			

Note: Significance of difference from means difference tests among household types, districts, and wealth quintiles and between male- and female-headed households. Stars indicate significance level: ***<0.01, **<0.05, *<0.1. Types: AR - Africa RISING, Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment (exp.) group of households (see text for details), IB - indirect beneficiary, Cont. - control. HCP - health care provider.

Source: Author's compilation based on TARBES 2014.

In addition to revealing the extent of household interaction with the health care system, survey data also permit direct assessment of certain health outcomes such as malnutrition in children and obesity in women. The foundation for these assessments comes mainly from a set of anthropometric indicators based on the height and weight of each individual within each of these subgroups. TARBES 2014 collected physical measurements on height and weight and these (along with age and sex) are used to compute basic indicators generally associated with health and nutrition such as body mass index (BMI) for women and weight-for-height, weight-for-age, and height-for-age for infants and young children.[9] These indicators are then standardized by comparing them to corresponding indicators from a presumed healthy reference population; in the case of children, this standardization permits the calculation of z-scores.[10] Finally, the standardized data are split into categories identifying cases of below normal, normal, and above normal anthropometry (O'Donnell et al. 2008). For example, a child whose weight-for-height, height-for-age, or weight-for-age z-score is less than -2 is considered wasted, stunted, or underweight, respectively, while a woman whose BMI is 25 or above is considered overweight.[11] Table 11 presents summary statistics for the transformed data, listing the measures of body mass index (BMI) for women and weight-for-height, weight-for-age, and height-for-age z-scores for children.

Overall, mean BMI is 21.6 kilograms per square meter. Group-level variation is small, with a BMI minimum of 21.3 kg/m^2 in the control group and maximum of 22.0 kg/m^2 among the experimental subgroup of non-coupon recipients. District-level means rise from 21.2 kg/m^2 in Kongwa to 21.7 kg/m^2 and 22.3 kg/m^2 in Babati and Kiteto, respectively, while, at the household level, male-headed households are associated with higher levels of BMI in reproductive-age women than their female-headed peers (21.8 kg/m^2 versus 20.6 kg/m^2). And overall, average z-scores of children in the survey were -0.05, -1.73, and -1.01 for weight-for-height, weight-for-age, and height-for-age, respectively (more on this below).

[9] BMI is calculated by dividing weight in kilograms by height in meters squared.

[10] A z-score is the difference between a child's weight or height and the median value in the reference population, divided by the standard deviation of the reference population.

[11] Cases of extreme wasting, stunting, or underweight in children are associated with z-scores of less than -3 and of obesity in women with BMI of 30 and above.

Table 11. Anthropometric indicators for women and children, by type, district, and gender

Item	Women	Children		
	Body mass index	Weight-for-height z-score	Height-for-age z-score	Weight-for-age z-score
Overall				
Number	703	557	557	557
Mean	21.64	-0.05	-1.73	-1.01
Std. dev.	3.98	1.24	1.49	1.22
Minimum	8.56	-3.85	-4.97	-4.65
Maximum	42.29	4.47	2.89	3.90
Type				
AR	21.54	-0.22	-1.73	-1.12
Coup.	21.64	0.07	-1.69	-0.89
Non-coup.	22.04	-0.14	-1.83	-1.13
Ind. Bene.	21.88	0.07	-1.88	-1.03
Cont.	21.31	-0.08	-1.62	-0.97
District				
Babati District	21.69	-0.08	-1.68	-1.00
Kiteto District	22.30	-0.30	-1.53	-1.13
Kongwa District	21.16	0.13	-1.99	-1.05
Gender				
Male-head	21.79	-0.05	-1.73	-1.01
Female-head	20.61	-0.10	-1.72	-1.07

Note: Means, unless otherwise indicated. Types: AR - Africa RISING; Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment group of households (see text for details); Ind. bene. - indirect beneficiary; Cont. - control.

Source: Author's compilation based on TARBES 2014.

Table 12 categorizes women's BMI by common reference cutoffs and indicates that, overall, 12.7 percent of all reproductive-age women in the Africa RISING sample are overweight and 4.0 percent are obese. When put together, this means that 16.7 percent of adult women are classified as having elevated or extremely high weight levels. At the other extreme, 18.5 percent are classified as underweight, meaning they can be considered thin or undernourished. About two-thirds of all women (64.9 percent) are of normal weight.

When household types are compared no differences emerge in the prevalence of underweight or obesity (see Table 12 and Table 14). Indeed, across all sub-group comparisons, only the experimental group is found to be significantly unlike other groups, with a lower likelihood of normal weight when compared with indirect beneficiaries and the control household group, and a higher likelihood of overweight when compared with control households.

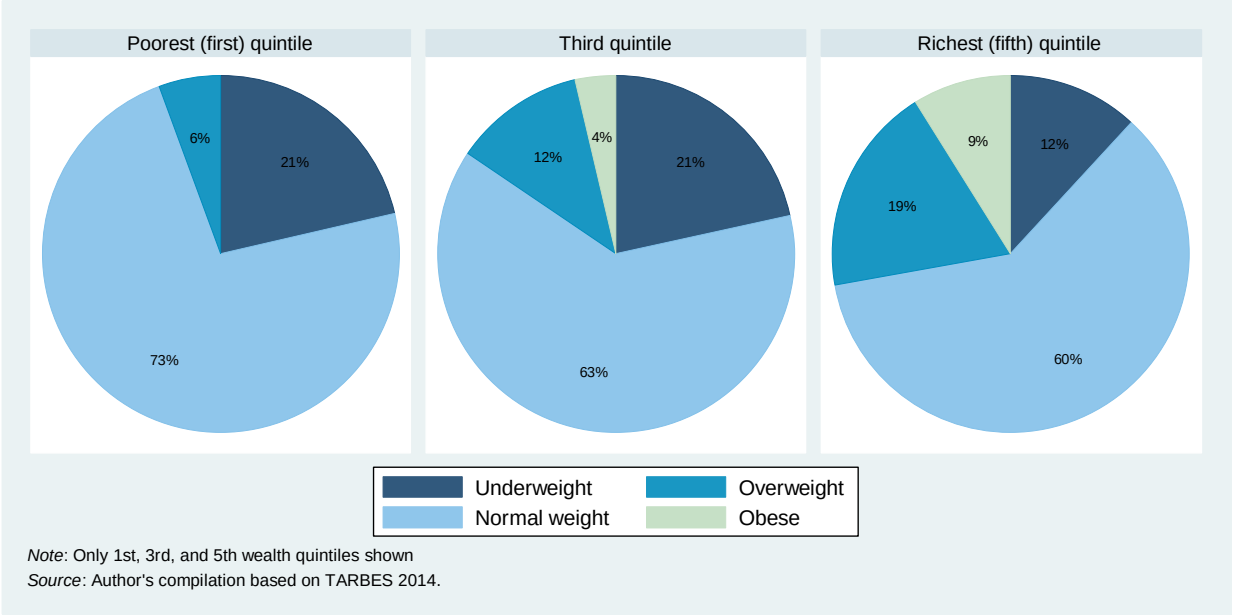
Table 12. Prevalence of overweight among women, by type, district, gender and wealth quintile

	Number	BMI categories			
		Underweight	Normal	Overweight	Obese
Type					
AR	130	0.200	0.623	0.131	0.046
Coup.	179	0.190	0.615	0.156	0.039
Non-coup.	132	0.189	0.621	0.144	0.045
Ind. Bene.	83	0.145	0.723	0.084	0.048
Cont.	179	0.184	0.687	0.101	0.028
District					
Babati District	566	0.200	0.618	0.140	0.042
Kiteto District	32	0.156	0.656	0.125	0.063
Kongwa District	105	0.114	0.810	0.057	0.019
Gender					
Male-headed	611	0.178	0.645	0.133	0.044
Female-headed	92	0.228	0.674	0.087	0.011
Quintile					
First quintile (poorest 20%)	89	0.213	0.730	0.056	0.000
Second	122	0.180	0.689	0.107	0.025
Third	135	0.215	0.630	0.119	0.037
Fourth	176	0.222	0.636	0.114	0.028
Fifth quintile (richest 20%)	169	0.118	0.604	0.189	0.089
OVERALL	703	0.185	0.649	0.127	0.040

Note: Types: AR - Africa RISING; Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment group of households (see text for details); Ind. bene. - indirect beneficiary; Cont. - control.
Number - number of women. Quintile totals do not add to 703 as not all women live in wealth-ranked households.
BMI - body mass index.
Source: Author's compilation based on TARBES 2014.

In addition, underweight and obesity prevalence both vary across the wealth distribution (see Table 12). First, women in the richest quintile unambiguously are less likely to be underweight and more likely to be overweight and obese than any of their poorer counterparts. Fifth-quintile women in fact are three times as likely to be overweight and half as likely to be underweight as those in the first quintile (p-values: <0.05) Second, unlike for the other quintiles, women in the poorest quintile are bunched in the two low-weight categories: one-fifth are underweight, 73 percent are of normal weight (the highest for this category), and none are obese. Figure 2 illustrates this distribution of weight outcomes across wealth quintiles.

Figure 2. Prevalence of under- and overweight among women, by wealth quintile



Note: Only 1st, 3rd, and 5th wealth quintiles shown
Source: Author's compilation based on TARBES 2014.

In terms of children's nutritional status, Table 13 shows that, overall, almost half (44.5 percent) of children under age 5 are stunted (have low heights for their age) and one in five (20.3 percent) are severely stunted. Among all children, more than one in five (21.4 percent) are also underweight (have low weight considering their age) and 4.7 percent are severely underweight. On the other hand, wasting (children considered thin given their height) is less prevalent, with 5.2 percent of children wasted and 1.8 percent severely wasted. Across household types, indirect beneficiary households have the highest proportion of severely stunted children (30.0 percent) and this is significantly above all other groups (see Table 13 and Table 14). Across districts, Kiteto stands out for having none of its children in the wasted category but the highest fraction of underweight children (36.8 percent). Stunting, usually taken as a signal of chronic under-nutrition, is highest in Kongwa, where more than half of all children under age 5 have low heights for their age, and Kongwa also has the highest fraction of children in the 'severe' categories of all three outcomes.

As with adult outcomes, some of the effects of wealth seem to transmit to child nutrition status also (see Table 13 and Table 14). The wealth penalty associated with being in the poorest fifth of all households compared to the richest fifth is an elevated (and significantly higher) risk of being underweight (31.7 percent versus 16.2 percent, p-value: 0.10), severely underweight (13.4 percent versus 1.7 percent, p-value: 0.001), and severely stunted (34.1 percent versus 14.5 percent, p-value: 0.001).

Table 13. Prevalence of malnutrition in children, by district, gender and wealth quintile

	Number	Weight-for-height		Height-for-age		Weight-for-age	
		Severely wasted	Wasted	Severely stunted	Stunted	Severely underweight	Underweight
Type							
AR	84	0.024	0.060	0.179	0.417	0.036	0.226
Coup.	134	0.007	0.037	0.149	0.425	0.052	0.172
Non-coup.	109	0.009	0.055	0.229	0.477	0.055	0.257
Ind. Bene.	80	0.025	0.050	0.300	0.463	0.050	0.213
Cont.	150	0.027	0.060	0.193	0.447	0.040	0.213
District							
Babati District	440	0.014	0.055	0.191	0.427	0.043	0.211
Kiteto District	19	0.000	0.000	0.158	0.368	0.000	0.368
Kongwa District	98	0.041	0.051	0.265	0.541	0.071	0.194
Gender							
Male-headed	500	0.020	0.056	0.196	0.448	0.042	0.204
Female-headed	57	0.000	0.018	0.263	0.421	0.088	0.298
Quintile							
First (poorest 20%)	82	0.049	0.073	0.341	0.537	0.134	0.317
Second	111	0.009	0.090	0.189	0.378	0.045	0.234
Third	114	0.009	0.053	0.228	0.474	0.053	0.211
Fourth	124	0.016	0.024	0.169	0.460	0.016	0.185
Fifth (richest 20%)	117	0.017	0.034	0.145	0.419	0.017	0.162
OVERALL	557	0.018	0.052	0.203	0.445	0.047	0.214

Note: Types: AR - Africa RISING; Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment group of households (see text for details); Ind. bene. - indirect beneficiary; Cont. - control. Number - number of children. Quintile totals do not add to 557 as not all children live in wealth-ranked households.

Source: Author's compilation based on TARBES 2014.

Table 14. Anthropometric outcomes means-difference tests, by type, district, gender, and wealth quintile

	Significance of difference									
	Women				Children					
Comparison	Under weight	Normal weight	Over weight	Obese	Sev. wasted	Wasted	Sev. stunted	Stunted	Sev. Under weight	Under weight
Type										
AR v. exp.										
AR v. IB							**			
AR v. cont.										
Exp. v. IB		**					**			
Exp. v. cont.		*	*							
IB v. cont.							*			
Coup. v. non-coup.										
District										
Babati v. Kiteto										
Babati v. Kongwa	**	***	**		*		*	**		
Kiteto v. Kongwa		*								*
Gender										
Male v. female										
Wealth										
Quint. 1 v. quint. 2					*		**	**	**	
Quint. 1 v. quint. 3				*	*		*		**	*
Quint. 1 v. quint. 4						*	***		***	**
Quint. 1 v. quint. 5	**	**	***	***			***		***	**
Quint. 2 v. quint. 3										
Quint. 2 v. quint. 4						**				
Quint. 2 v. quint. 5			*	**		*				
Quint. 3 v. quint. 4										
Quint. 3 v. quint. 5	**		*	*						
Quint. 4 v. quint. 5	**		*	**						

Note: Significance of difference from means difference tests among household types and districts and between male- and female-headed households. Stars indicate significance level: ***<0.01, **<0.05, *<0.1. Types: AR - Africa RISING; Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment (exp.) group of households (see text for details); IB - indirect beneficiary; Cont. - control. Quint. - quintile. Sev. - severely.

Source: Author's compilation based on TARBES 2014.

4.4 What type of agriculture is practiced and under what conditions?

4.4.1 Agricultural inputs and technology

Household heads reported spending almost ten months working in the previous year, mainly in agriculture, but 41 percent complemented their farming activities by operating a non-farm business (see Table 15). Among the major crops in the survey areas, farming households devoted 54 person-days to the cultivation of maize, followed by 39 person-days on pigeon pea and sunflower, and 38 person-days on beans; the other crops of Irish potato, sorghum, and groundnut each accounted for

between 33 to 35 person-days, on average. On average, survey households operated two parcels across two plots and used six acres of land across all parcels for farming. However, the median size is 3.5 acres, which indicates the undue influence on this statistic of a few large land users in the overall distribution. Nine in ten households own at least some portion of the parcels on which they farm and 84 percent have (time) access to main parcel of less than thirty minutes.

Table 15. Agricultural inputs and technology I: labour and land

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Labor (general)										
Total months worked	786	9.6	2.9	9.3	10.0	9.6	9.8	9.3	9.7	9.6
Worked in agriculture	800	0.973	0.164	0.944	0.984	0.965	1.000	0.970	0.936	0.978
Worked in non-farm business	800	0.413	0.493	0.435	0.465	0.404	0.423	0.367	0.394	0.415
Labor (person days spent)										
Beans	490	38.5	45.9	44.0	37.8	40.2	35.2	30.5	26.9	40.1
Groundnut	64	33.1	27.7	40.7	n.o.	n.o.	28.0	33.7	24.6	34.9
Irish potato	70	35.4	44.1	36.7	30.5	53.6	23.0	24.7	18.8	37.0
Maize	781	54.3	67.4	63.3	47.5	49.4	55.7	56.2	43.5	56.0
Pigeon pea	362	39.2	49.5	40.5	36.7	37.2	61.0	34.3	29.9	40.6
Sorghum	86	34.2	38.8	21.3	46.7	18.8	24.1	38.1	37.9	33.6
Sunflower	183	39.4	41.6	54.9	21.9	27.1	47.4	42.8	36.3	39.9
Land										
Number of parcels	810	2.1	1.2	2.7	2.1	1.9	2.0	2.0	1.9	2.1
Number of plots	806	2.2	1.3	3.0	2.2	2.0	2.1	2.1	2.0	2.3
Area farmed (acres)	810	6.0	13.7	9.8	3.6	3.3	6.0	7.1	5.7	6.0
Owns land	810	0.916	0.277	0.960	0.930	0.951	0.857	0.888	0.927	0.914
< 30 minutes to main parcel	801	0.844	0.363	0.886	0.913	0.944	0.692	0.789	0.811	0.849

Note: Means, unless otherwise indicated; for full-sample minimum and maximum values, see Appendix, Table A4. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon (3) No coupon (4) Indirect beneficiaries, (5) Control. N.o. - no observations. < - less than.

Source: Author's compilation based on TARBES 2014.

With respect to land- and labor-related differences among household types, AR farmers operated a higher number of parcels and plots than all other groups while their farmed acreage (along with that of indirect beneficiary and control households) outstripped that of the experimental peer group (see Table 15, Table 16). Land ownership and access to main parcel were higher among AR and experimental households compared to the other groups. Additionally, AR farmers devoted more person-days to farming beans and maize than control and experimental farmers, respectively, while for pigeon pea, person-days spent by indirect beneficiaries were significantly above that of all other groups. In contrast, farming of sunflower within the experimental group of households was significantly below all other groups, in terms of person-days spent.

Labor allocation differed by gender of household head for two of the top three crops: while male heads spent 56 person-days on maize and 40 person-days on beans, female heads spent 13 days less

cultivating both crops, on average (p-value: 0.078 and 0.036, respectively; see Table 16). This, along with some of the other significant gender differences of this section, is represented in Figure 3.

Figure 3. Agricultural inputs and technology – significant gender differences

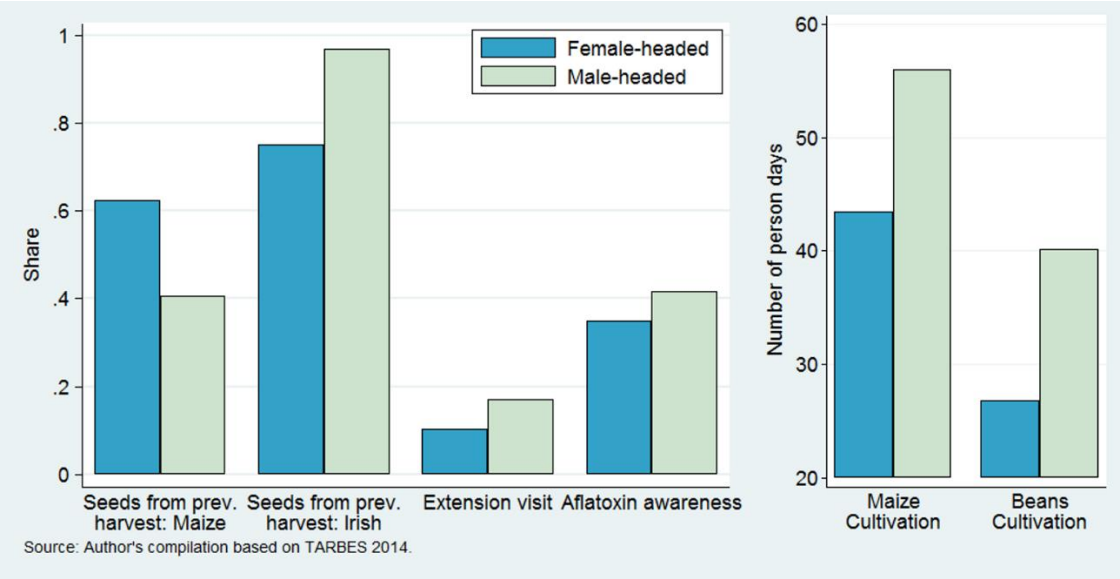


Table 16. Agricultural inputs and technology means-difference tests: labour and land

	Significance of differences							
Item	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	Male v. female
Months worked	*				**			
Worked in agriculture	*	**				*		**
Worked in business					*			
Person days: Beans			**					
Person days: Groundnut								**
Person days: Irish potato								
Person days: Maize	**							
Person days: Pigeon pea		*		**		**		*
Person days: Sorghum								
Person days: Sunflower	***			***	***			
Number of parcels	***	***	***					**
Number of plots	***	***	***				*	*
Area farmed (acres)	***			***	***			
Owns land		***	**	***	**			
Main parcel in 30 minutes		***	**	***	***	**		

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1.

Source: Author's compilation based on TARBES 2014.

With respect to sustainability strategies, one in six households practiced crop rotation on their first-listed plot and – for those reporting the use of manure – 86 percent reported regular use (either every year or "most years"), but only half were able to generate manure on-farm for own use (see Table 17). As well, for the leading crops, while almost all farmers used a measure of seed saved from the previous harvest (91 percent for beans and 93 percent for pigeon pea), only 43 percent did so in the cultivation of the most important crop, maize. The practice of sustainable agriculture through the use of on-farm-generated materials proved even more difficult for those raising livestock, with only 11 percent to 13 percent of households reporting the event.

Table 17. Agricultural inputs and technology II: sustainability and storage

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Sustainability										
Practices crop rotation	806	0.158	0.365	0.200	0.205	0.183	0.124	0.109	0.168	0.156
Uses manure every year o.m.y.	410	0.856	0.351	0.897	0.862	0.817	0.806	0.883	0.886	0.852
Uses manure generated on-farm	410	0.502	0.501	0.551	0.537	0.527	0.528	0.415	0.500	0.503
Used saved seed: Beans	493	0.917	0.276	0.892	0.903	0.938	0.976	0.901	0.917	0.917
Used saved seed: Groundnut	64	0.875	0.333	0.714	n.o.	n.o.	0.733	0.952	1.000	0.849
Used saved seed: Irish potato	74	0.946	0.228	0.950	0.923	0.944	1.000	1.000	0.750	0.970
Used saved seed: Maize	783	0.434	0.496	0.238	0.330	0.261	0.610	0.615	0.625	0.405
Used saved seed: Pigeon pea	362	0.925	0.263	0.892	0.940	0.976	0.900	0.889	0.915	0.927
Used saved seed: Sorghum	86	0.849	0.360	0.778	1.000	1.000	1.000	0.804	0.917	0.838
Used saved seed: Sunflower	171	0.871	0.336	0.833	0.882	0.952	0.841	0.873	0.909	0.866
Used on-farm feed: Large rum.	539	0.115	0.319	0.147	0.117	0.176	0.082	0.055	0.070	0.120
Used on-farm feed: Small rum.	490	0.108	0.311	0.178	0.112	0.154	0.058	0.050	0.091	0.110
Used on-farm feed: Mono.	590	0.129	0.335	0.165	0.148	0.140	0.133	0.081	0.083	0.135
Storage										
Mth. to exhaustion: Beans	163	4.2	2.7	3.4	4.3	4.9	4.3	3.9	4.9	4.1
Mth. to exhaustion: Groundnut	37	4.3	2.9	6.3	n.o.	n.o.	4.1	4.1	4.6	4.2
Mth. to exhaustion: Irish potato	36	2.6	1.7	1.7	2.1	2.4	3.3	5.3	2.5	2.6
Mth. to exhaustion: Maize	305	3.8	2.9	2.8	4.1	3.5	4.4	4.0	4.2	3.8
Mth. to exhaustion: Pigeon pea	167	4.0	2.8	3.9	4.2	4.0	2.9	3.6	4.6	3.9
Mth. to exhaustion: Sorghum	45	4.4	3.0	3.8	1.8	10.0	3.5	4.7	5.0	4.3
Mth. to exhaustion: Sunflower	26	4.8	2.6	7.0	2.5	4.5	3.8	5.5	5.8	4.6

Note: Means, unless otherwise indicated; for full-sample minimum and maximum values, see Appendix, Table A5. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon, (3) No coupon, (4) Indirect beneficiaries, (5) Control. O.m.y. - or most years, rum. - ruminants, mono. - monogastrics, mth. - months, n.o. - no observations.

Source: Author's compilation based on TARBES 2014.

Sustainability practices varied across household types in several ways. AR and experimental households outperformed control group households in practicing crop rotation, generating manure on-farm for own use, and feeding livestock with on-farm-generated materials; for the livestock sub-category of small ruminants, AR households similarly outperformed indirect beneficiary households (see Table 17, Table 18). In contrast, AR households were less likely to use saved seed in the cultivation of beans (compared with indirect beneficiaries), groundnut (compared with control

households, a result shared with indirect beneficiaries), maize (compared with indirect beneficiaries and control households, a result shared with experimental households), and pigeon pea (compared with experimental households, a result shared with control households). And AR households exhausted stored crops more rapidly for beans (compared with experimental households), maize (compared with all other groups), and Irish potato (compared with control households, a result shared with experimental households). Within the experimental group, coupon households were able to keep sorghum in stored reserve longer than their no-coupon peers.

In terms of gender differences, women used significantly more seed saved from previous harvest for maize (22 percentage point difference, p-value: <.001), and significantly less for Irish potato (also 22 percentage point difference, p-value: 0.009) (see Table 17, Figure 3). In terms of storage, post-harvest supplies of the leading crops lasted between 2.6 months and 4.8 months before being exhausted, with no significant gender differences.

Table 18. Agricultural inputs and technology means-difference tests: sustainability and storage

	Significance of differences							
Item	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	Male v. female
Sustainability								
Practices crop rotation			**		***			
Uses manure every year o.m.y.								
Uses manure generated on-farm			*		*			
Used saved seed: Beans		*						
Used saved seed: Groundnut			**			**		
Used saved seed: Irish potato								*
Used saved seed: Maize		***	***	***	***			***
Used saved seed: Pigeon pea	**				**			
Used saved seed: Sorghum								
Used saved seed: Sunflower								
Used on-farm feed: Large rum.			**		***			
Used on-farm feed: Small rum.		**	***		**			
Used on-farm feed: Mono.			**		**			
Storage								
Mth. to exhaustion: Beans	*							
Mth. to exhaustion: Groundnut								
Mth. to exhaustion: Irish potato			**		***			
Mth. to exhaustion: Maize	*	**	**					
Mth. to exhaustion: Pigeon pea								
Mth. to exhaustion: Sorghum							**	
Mth. to exhaustion: Sunflower								

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1. O.m.y. - or most years, rum. - ruminants, mono. - monogastrics, mth. - months.

Source: Author's compilation based on TARBES 2014.

Agricultural knowledge diffusion systems typically use a wide array of methods to advise and train farmers on sound agricultural practices, but survey data show that, at least in the survey areas, these efforts are falling short. Only one in six farmers report receiving advice from an extension agent in the last year and – of those receiving advice – 19 percent claim regular visits (defined as one visit per month or more) by this source during the last cropping season (see Table 19).

In contrast, while farmers were less likely to get advice from other sources – friends, neighbors, model farmers, or representatives of farmer groups – in the same period (at least 10 percentage points less), they naturally interact with these on a more regular basis. For example, 38 percent and 42 percent of farmers say they received regular visits by model farmers and friends, respectively. This suggests that alternative opportunities for knowledge diffusion exist but are possibly being left unexploited by the formal system. On the whole, farmers appear unwilling to proactively participate in organized systems and institutions of knowledge diffusion, whether it be farmer training centers, research groups, or environmental groups, and also to try new agricultural practices. In fact, each of these carries a likelihood of 10 percent or less. In closing, it bears remarking too that – two years into the program – 80 farmers, or 10 percent of those polled, had heard of the Africa RISING program by survey date.

Table 19. Agricultural inputs and technology III: knowledge and loans

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Knowledge										
Advice: Friend/neighbor	809	0.064	0.245	0.063	0.070	0.070	0.029	0.067	0.056	0.066
Advice: Model farmer	809	0.036	0.186	0.040	0.059	0.056	0.019	0.019	0.046	0.034
Advice: Farmer research group	809	0.044	0.206	0.119	0.059	0.049	0.010	0.011	0.056	0.043
Advice: Extension agent	809	0.162	0.369	0.317	0.269	0.190	0.076	0.052	0.102	0.171
Visits: Friend/neighbor	52	0.423	0.499	0.500	0.462	0.500	0.000	0.389	0.333	0.435
Visits: Model farmer	29	0.379	0.494	0.600	0.273	0.125	0.500	0.800	0.400	0.375
Visits: Farmer res. grp.	36	0.333	0.478	0.467	0.182	0.286	0.000	0.333	0.333	0.333
Visits: Extension agent	131	0.191	0.394	0.275	0.260	0.111	0.000	0.143	0.182	0.192
Participate: Farmer training center	809	0.101	0.302	0.214	0.156	0.134	0.029	0.037	0.083	0.104
Participate: Environmental group	809	0.052	0.222	0.103	0.102	0.063	0.019	0.015	0.065	0.050
Participate: Civic organization	809	0.204	0.403	0.397	0.226	0.162	0.152	0.152	0.204	0.204
Participate: Farmer research group	808	0.066	0.248	0.167	0.119	0.063	0.000	0.015	0.074	0.064
Tried new technologies/practices	809	0.088	0.283	0.206	0.140	0.120	0.019	0.019	0.074	0.090
Heard of Africa RISING	809	0.099	0.299	0.151	0.172	0.155	0.029	0.033	0.083	0.101
Heard of Aflatoxin	810	0.407	0.492	0.556	0.403	0.444	0.362	0.342	0.349	0.417
Aware Aflatoxin harmful	330	0.242	0.429	0.471	0.253	0.222	0.263	0.065	0.105	0.260
Loans										
Applied	809	0.252	0.435	0.341	0.301	0.204	0.324	0.186	0.222	0.257
Received	205	0.941	0.235	0.907	0.964	0.966	1.000	0.920	0.880	0.950

Note: Means, unless otherwise indicated. All items are indicator variables. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon (3) No coupon (4) Indirect beneficiaries, (5) Control.

Source: Author's compilation based on TARBES 2014.

Female-headed households suffered even less access to extension advice than male-headed households, by a full 6.9 percentage points. However, there was no gender penalty for other knowledge indicators, save for knowledge of the harmful effects of Aflatoxin for stored crops, which was 26 percent among male-headed households but only 11 percent among female-headed households. Finally, in the previous year, one-fourth of all households sought loans (for a minimum of 10,000 TZS) to boost consumption, and almost all were successful. Female-headed households applied for and received loans at slightly lower rates than male-headed households, but neither of these represented a significant difference (p-values: > 0.15).

In terms of group differences, Table 19 and Table 20 show that – consistent with results found elsewhere in this report – the subgroups of coupon and non-coupon households within the experimental group are for the most part similar. Except for receiving advice from an extension agent, participating in a research group, and applying for loans, where in each case coupon households have a higher likelihood, no other differences between these groups are detected.

Table 20. Agricultural inputs and technology means-difference tests: knowledge and loans

	Significance of differences							
Item	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	Male v. female
Knowledge								
Advice: Friend/neighbor				*				
Advice: Model farmer					**			
Advice: Farmer research group	**	***	***	**	***			
Advice: Extension agent	**	***	***	***	***		*	*
Visits: Friend/neighbor								
Visits: Model farmer	*				***			
Visits: Farmer res. grp.								
Visits: Extension agent		*						
Participate: Farmer training center	**	***	***	***	***			
Participate: Environmental group		**	***	**	***			
Participate: Civic organization	***	***	***					
Participate: Farmer research group	**	***	***	***	***		*	
Tried new technologies/practices	**	***	***	***	***			
Heard of Africa RISING		***	***	***	***			
Heard of Aflatoxin	**	***	***		*			
Aware Aflatoxin harmful	***	**	***		***	***		**
Loans								
Applied	*		***		*	***	**	
Received		*				*		

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1.

Source: Author's compilation based on TARBES 2014.

Other comparisons, however, reveal less well-matched groups and, among them, a consistent pattern of stronger knowledge and participation indicators in direct relation to engagement with the AR program. Thus, AR households differ from the groups of experimental and control households by receiving more technical advice from research group representatives and extension agents and more visits from model farmers, by participating more heavily in research, training, and civic groups (and, as a result, in trying new technologies at a higher rate), by recognizing more readily the harmful effects of Aflatoxin (having heard of it at an initially higher rate), and by applying more often for loans. And, for the most part, these differences are repeated when experimental households are compared with their control peers – the one key reversal being a far higher likelihood of control group households receiving visits from model farmers. The data also confirm that AR and experimental households were more aware of the AR program than households chosen solely to serve as comparators.

With regard to possession of farm assets such as farming implements and livestock, ownership of hoes is almost universal (97.4 percent) across survey areas, and a majority of households have cutlasses (87.9 percent) and axes (67.9 percent), while more than one in five own shovels (40.3 percent), ox-ploughs and winnowers (both 37.6 percent), yokes (28.5 percent), and sprayers, sickles, and animal carts (all between 20 percent and 25 percent) (see Table 21). On average, farmers own four hoes, two cutlasses and yokes, and approximately one of every other itemized tool or piece of farming equipment. Further, 70 percent of farm households raise chickens (each owning about seven chickens, on average), about half rear (local) cows and goats (four and eight owned, respectively), and approximately one-third have draught cattle (four owned), sheep (five owned), and local calves (four owned; see Table 23).[12]

Closer examination of survey households' ownership of farm equipment and livestock reveals a few differences according to household type and gender (see Table 22 and Table 24). Compared to other program-associated groups, Africa RISING households are more likely to own the main farm tools and equipment and, if they do, they typically own a higher number, on average. For example, AR households are almost twice as likely to own sprayers, sickles, and winnowers as experimental households, while for axes, ox-ploughs, yokes, shovels, and animal carts the gap in ownership is at least 10 percentage points. Similarly, when compared with the groups of experiment and control households, they also had a higher likelihood of ownership of some of the most common farm animals such as draught cattle, local calves, and sheep. When the number of livestock is considered, however, the situation is reversed as control households account for a larger number of local bulls, heifers, calves, and goats. And finally, in a result mirroring earlier findings on home assets, female-headed households faced some deficits in ownership of both types of farm assets, typically working with fewer tools and raising a smaller number of farm animals.

[12] For a complete list of livestock summary statistics see Appendix, Table A7.

Table 21. Agricultural inputs and technology IV: farm goods

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Ownership										
Cutlass	809	0.879	0.326	0.963	0.978	0.972	0.829	0.747	0.759	0.897
Ax	809	0.679	0.467	0.850	0.720	0.683	0.657	0.587	0.630	0.686
Sprayer	809	0.205	0.404	0.393	0.199	0.218	0.162	0.145	0.083	0.224
Sickle	809	0.221	0.415	0.421	0.253	0.155	0.152	0.182	0.176	0.228
Ox-plough	809	0.376	0.485	0.589	0.435	0.500	0.219	0.245	0.213	0.401
Yoke	809	0.286	0.452	0.430	0.317	0.338	0.190	0.216	0.139	0.308
Harrow	809	0.040	0.195	0.019	0.038	0.049	0.038	0.045	0.019	0.043
Shovel	809	0.403	0.491	0.598	0.430	0.423	0.362	0.312	0.296	0.419
Hoe	809	0.974	0.159	0.991	0.995	0.965	0.981	0.955	0.972	0.974
Winnower	809	0.376	0.485	0.598	0.323	0.232	0.429	0.379	0.398	0.372
Animal cart	809	0.234	0.423	0.402	0.247	0.275	0.200	0.149	0.111	0.252
Number										
Cutlass	809	1.43	1.04	1.74	1.56	1.67	1.16	1.20	1.08	1.49
Ax	809	0.81	0.68	1.03	0.82	0.82	0.77	0.72	0.69	0.82
Sprayer	809	0.23	0.50	0.47	0.22	0.25	0.16	0.15	0.08	0.25
Sickle	809	0.31	0.67	0.58	0.34	0.27	0.20	0.24	0.20	0.32
Ox-plough	809	0.45	0.66	0.74	0.49	0.54	0.26	0.34	0.23	0.49
Yoke	809	0.54	1.06	0.86	0.60	0.63	0.34	0.40	0.23	0.59
Harrow	809	0.04	0.22	0.02	0.04	0.05	0.04	0.05	0.02	0.05
Shovel	809	0.51	0.71	0.79	0.54	0.54	0.47	0.39	0.33	0.54
Hoe	809	3.67	2.16	4.93	3.70	3.92	3.29	3.16	3.20	3.74
Winnower	809	0.48	0.72	0.82	0.38	0.29	0.58	0.49	0.49	0.48
Animal cart	809	0.24	0.44	0.42	0.25	0.27	0.23	0.15	0.11	0.26

Note: Means, unless otherwise indicated. Items: Ownership - all indicator variables, Number - for full-sample minimum and maximum values, see Appendix, Table A6. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon (3) No coupon (4) Indirect beneficiaries, (5) Control.

Source: Author's compilation based on TARBES 2014.

Table 22. Agricultural inputs and technology means-difference tests: farm goods

	Significance of differences							
Item	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	Male v. female
Ownership								
Cutlass		***	***	***	***	*		***
Ax	***	***	***		***			
Sprayer	***	***	***		*			***
Sickle	***	***	***				**	
Ox-plough	**	***	***	***	***			***
Yoke	**	***	***	**	***			***
Harrow								
Shovel	***	***	***		**			**
Hoe					**		**	
Winnower	***	*	***	***	**		*	
Animal cart	***	***	***		***			***
Number								
Cutlass		***	***	***	***			***
Ax	***	***	***					**
Sprayer	***	***	***		**			***
Sickle	***	***	***					*
Ox-plough	***	***	***	***	***			***
Yoke	*	***	***	**	**			***
Harrow								
Shovel	***	***	***		**			***
Hoe	***	***	***	**	***			**
Winnower	***		***	***	***			
Animal cart	***	***	***		***			***

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1.

Source: Author's compilation based on TARBES 2014.

Table 23. Agricultural inputs and technology V: livestock

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Ownership										
Draught cattle	809	0.373	0.484	0.570	0.430	0.458	0.257	0.257	0.259	0.391
Local bull	809	0.168	0.374	0.168	0.204	0.113	0.114	0.193	0.120	0.175
Improved bull	809	0.020	0.139	0.047	0.022	0.035	0.019	0.000	0.009	0.021
Local cow	809	0.507	0.500	0.636	0.640	0.585	0.333	0.390	0.407	0.522
Improved cow	809	0.084	0.278	0.187	0.081	0.099	0.048	0.052	0.037	0.091
Local heifer	809	0.101	0.302	0.159	0.108	0.085	0.067	0.097	0.083	0.104
Improved heifer	809	0.014	0.116	0.009	0.027	0.021	0.010	0.004	n.o.	0.016
Local calf	809	0.331	0.471	0.486	0.382	0.352	0.257	0.253	0.241	0.345
Improved calf	809	0.035	0.183	0.084	0.038	0.042	0.010	0.019	0.009	0.039
Horse/donkey/mule	809	0.080	0.272	0.065	0.091	0.085	0.019	0.100	0.102	0.077
Local goat	809	0.522	0.500	0.579	0.543	0.634	0.429	0.461	0.463	0.531
Improved goat	809	0.031	0.173	0.047	0.043	0.035	0.019	0.019	0.028	0.031
Sheep	809	0.344	0.475	0.486	0.409	0.373	0.248	0.264	0.185	0.368
Local pig	809	0.112	0.316	0.131	0.081	0.063	0.124	0.149	0.102	0.114
Improved pig	809	0.015	0.121	0.047	0.022	0.007	n.o.	0.007	0.009	0.016
Chicken	809	0.700	0.459	0.794	0.785	0.739	0.543	0.643	0.648	0.708
Honey bees	809	0.021	0.144	n.o.	0.022	0.035	0.029	0.019	0.009	0.023
Number										
Draught cattle	809	1.45	2.23	2.35	1.60	1.77	0.97	1.01	0.91	1.54
Local bull	809	0.59	2.03	0.52	0.56	0.32	0.36	0.85	0.29	0.63
Improved bull	809	0.03	0.23	0.05	0.03	0.07	0.02	0.00	0.01	0.03
Local cow	809	2.01	5.77	2.64	1.53	1.97	1.23	2.41	1.13	2.14
Improved cow	809	0.14	0.54	0.36	0.13	0.18	0.08	0.07	0.06	0.16
Local heifer	809	0.48	3.36	0.55	0.26	0.19	0.27	0.85	0.21	0.53
Improved heifer	809	0.01	0.13	0.01	0.03	0.03	0.01	n.o.	n.o.	0.02
Local calf	809	1.19	5.13	1.29	0.77	0.83	0.90	1.74	0.58	1.28
Improved calf	809	0.06	0.35	0.15	0.05	0.07	0.01	0.04	0.02	0.06
Horse/donkey/mule	809	0.21	0.89	0.12	0.18	0.19	0.06	0.33	0.20	0.21
Local goat	809	4.31	11.01	3.99	2.94	4.04	3.25	5.95	3.19	4.49
Improved goat	809	0.09	0.75	0.11	0.09	0.07	0.19	0.04	0.06	0.09
Sheep	809	1.88	4.70	2.46	1.57	1.77	1.27	2.14	0.79	2.04
Local pig	809	0.23	0.88	0.27	0.16	0.21	0.24	0.28	0.18	0.24
Improved pig	809	0.07	0.67	0.31	0.07	0.01	n.o.	0.02	0.01	0.07
Chicken	809	5.05	6.74	6.59	5.73	5.55	3.83	4.19	4.06	5.20
Honey bees	809	0.33	3.82	n.o.	0.40	0.29	0.38	0.41	0.74	0.26

Note: Means, unless otherwise indicated. Items: Ownership - all indicator variables, Number - for full-sample minimum and maximum values, see Appendix, Table A7. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon (3) No coupon (4) Indirect beneficiaries, (5) Control. N.o. - no observations, … - less than 0.005.

Source: Author's compilation based on TARBES 2014.

Table 24. Agricultural inputs and technology means-difference tests: livestock

	Significance of differences							
Item	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	Male v. female
Ownership								
Draught cattle	***	***	***	***	***			***
Local bull						*	**	
Improved bull			***		***	**		
Local cow		***	***	***	***			**
Improved cow	***	***	***		*			*
Local heifer		*						
Improved heifer					*			
Local calf	**	***	***	**	***			**
Improved calf	*	**	***					
Horse/donkey/mule		*		**		***		
Local goat		**	**	***	***		*	
Improved goat								
Sheep	*	***	***	***	***			***
Local pig					***			
Improved pig		**	**					
Chicken		***	***	***	***	*		
Honey bees	*	*						
Number								
Draught cattle	***	***	***	***	***			***
Local bull					**	*		
Improved bull			***		**	**		
Local cow	*	**						*
Improved cow	**	***	***		**			*
Local heifer	**				**			
Improved heifer					*			
Local calf	***				*			
Improved calf	*	**	**					
Horse/donkey/mule				*	*	**		
Local goat					**		*	
Improved goat								
Sheep	*	**						**
Local pig								
Improved pig	**	*	***					
Chicken		***	***	**	***			
Honey bees								

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1.

Source: Author's compilation based on TARBES 2014.

4.4.2 Agricultural output

Overall, farmers planted three crops on average, with group averages ranging from a low of 2.4 crops grown by control households to 3.2 crops grown by AR households, a significant difference (see Table 25, Table 26). Among the three crops grown most widely, farmers devoted the highest acreage (three acres on average) to maize cultivation, almost three times the acreage for pigeon pea (1.1 acres) and five times that for beans. For the next three main crops – where data exist for a far smaller number of farmers – sorghum cultivation consumed the most land (2.2 acres on average), followed by groundnut (1.8 acres) and Irish potato (1.3 acres).

Table 25. Agricultural output I: number of crops, crop cultivation and harvest

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Crops	803	2.77	0.95	3.15	3.04	2.92	2.64	2.39	2.72	2.77
Cult. (acres)										
Beans	305	0.62	0.64	0.80	0.55	0.57	0.51	0.74	0.58	0.62
Groundnut	63	1.77	1.73	1.54	n.o.	n.o.	1.62	1.86	1.18	1.89
Irish potato	74	1.27	1.52	1.65	1.47	1.09	1.00	0.35	0.81	1.33
Maize	771	3.00	5.36	4.49	1.71	1.53	3.09	4.17	2.80	3.03
Pigeon pea	353	1.10	2.80	1.75	0.82	0.71	1.75	1.23	1.79	1.00
Sorghum	83	2.19	2.76	1.86	0.53	0.50	1.26	2.79	1.80	2.25
Harv. (kg)										
Beans	305	103.5	127.8	130.6	107.7	110.0	72.2	68.9	73.6	108.3
Groundnut	63	378.4	434.5	303.7	n.o.	n.o.	296.5	421.2	270.8	401.2
Irish potato	74	1,752.1	2,261.9	2,514.7	1,912.1	1,555.8	1,010.7	602.9	1,138.5	1,826.5
Maize	771	1,968.0	2,944.2	3,337.6	1,976.1	1,969.3	1,742.7	1,489.2	1,227.3	2,082.2
Pigeon pea	353	362.2	525.1	450.6	332.0	276.7	575.5	349.2	330.1	367.0
Sorghum	83	450.2	479.1	604.5	311.1	568.8	309.6	460.6	245.2	484.8

Note: Means, unless otherwise indicated; for full-sample minimum and maximum values, see Appendix, Table A8. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon, (3) No coupon, (4) Indirect beneficiaries, (5) Control. Cult. - cultivation, harv. - harvest, kg - kilograms, n.o. - no observations.
Source: Author's compilation based on TARBES 2014.

Across household types, the largest acreage devoted to one crop was 4.4 acres for maize cultivation in AR households, which was significantly above cultivated acreage in the experimental group (1.7 acres and 1.5 acres for coupon and no-coupon households, respectively). Indeed, maize acreage within this group also fell short of – and significantly below – that cultivated by indirect beneficiary and control houesholds (see Table 25, Table 26). This pattern was repeated in the cultivation of pigeon pea and sorghum. Of these main crops, pigeon pea cultivation also provided the sole case of a significant gender difference in this category, with an acreage gap of 80 percent in favor of female farmers, on average.

Table 26. Agricultural output means-difference tests: number, cultivation and harvest

Item	Significance of differences							
	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	Male v. female
Number of crops		***	***	***	***	**		
Cultivation (acres)								
Beans	*				*			
Groundnut	n.a.			n.a.	n.a.		n.a.	
Irish potato								
Maize	***			***	***	*		
Pigeon pea	*			***	***	*		*
Sorghum	*			**	**			
Harvest (kilograms)								
Beans			*		*			
Groundnut	n.a.			n.a.	n.a.		n.a.	
Irish potato								
Maize	***	**	***		***			***
Pigeon pea	*			***				
Sorghum								

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1. N.a. - not applicable (at least one category with no observations).

Source: Author's compilation based on TARBES 2014.

Among these main crops, farmers harvested almost 2,000 kilograms of maize from this acreage, and the next five crops in order of kilograms harvested were Irish potato (1,752 kg on average), sorghum (450 kg), groundnut (372 kg), pigeon pea (362 kg), and beans (103 kg) (see Excursus II in Section 4.4.3 below for explanation of harvest computations). A few group differences emerged, first in the harvesting of beans – with AR and experimental households able to extract a higher volume than control households – and, next, maize – where, in turn, AR households extracted over 3,300 kg (significantly above all other groups), experimental households extracted over 1,900 kg (significantly above control households), and male-headed households extracted over 2,000 kg (significantly above female-headed households). These results occurred in spite of a non-trivial degree of crop failure across these crops, with between one in eight and one in four households falling victim (see Table 27).

Ultimately, in overcoming these constraints, farmers were able to achieve crop yields that ranged from a low of 226 kilograms per acre (or kg/a) for beans to 1,534 kg/a for Irish potatoes (see Table 28). Maize, the leading crop, averaged 960 kg/a, and was trailed by sorghum at 435 kg/a, pigeon pea at 425 kg/a, and groundnut at 254 kg/a. By crop and across household type, significantly higher yields were achieved for maize and sorghum – by AR and experimental households when compared with control housholds – and for beans – by experimental households when compared with control households. Maize yield among indirect beneficiaries was also signicantly below that of AR and

control households. And maize yield achieved in male-headed households was over 40 percent higher than in female-headed households (see below for district- and wealth-quintile comparisons of yield and sales).

Table 27. Agricultural outcomes II: crop failure and harvest allocation

Item	Beans	Groundnut	Irish potato	Maize	Pigeon pea	Sorghum
Suffered crop failure						
Number of households	98	33	69	488	288	31
Mean	0.18	0.12	0.23	0.21	0.16	0.19
S.d.	0.39	0.33	0.43	0.41	0.37	0.40
Harvest use (proportion)						
Animal feed	0.488	0.204	n.o.	0.226	0.614	0.760
Residue	0.393	0.446	0.098	0.107	0.367	0.660
Saved seed	0.362	0.177	0.177	0.064	0.140	0.127
Gifts	0.303	0.006	0.085	0.119	0.100	0.102
Own consumption	0.581	0.598	0.236	0.631	0.286	0.776
Sales	0.543	0.627	0.750	0.469	0.698	0.555
Other use	0.333	0.015	0.068	0.156	0.234	0.395

Note: Means, unless otherwise indicated. For harvest use, means for reporting households in each category only; as a result, column totals do not add to one. S.d. - standard deviation.
Source: Author's compilation based on TARBES 2014.

In terms of allocation, three in four households reported using some portion of sorghum harvest for animal feed, the highest proportion in this category; of reporting households, three in five used pigeon pea and half used beans for this purpose also (see Table 27). Sorghum also produced the highest use of any main crop for residue, with over three in five households citing the practice; at the other extreme, only one in ten households left any product of the Irish potato or maize harvest on the field. Beans produced the highest possibility for seed to be saved, as 36.2 percent of all households were successful in doing so, more than twice as high as groundnut and Irish potato, both at 17.7 percent of reporting households. One in three households engaged in gifting and other non-commercial exchange of beans while similar use of groundnut was negligible; for all other crops about one in ten households reported gifting. Use of crops for own consumption was reported by a majority of households for all crops except Irish potato and pigeon pea; the highest such use was for sorghum (77.7 percent of households), followed by maize (63.1 percent), groundnut (59.8 percent), and beans (58.1 percent).

All of the main crops were used to generate market income, led in this regard by Irish potato (with three of every four households assigning some portion of total harvest for sales), pigeon pea and groundnut (69.8 percent and 62.7 percent of reporting households, respectively), and sorghum and beans (both above 50 percent of reporting households); for maize, 46.9 percent of reporting households sold some portion of total harvest (see Table 27). Measured by weight, average sales recorded were 1,518.4 kg for maize and 1,447.5 kg for Irish potato, followed by groundnut (402.8 kg), pigeon pea (345.1 kg), sorghum (295.8 kg), and beans (145.4 kg). Across household types, sales of

maize were highest in AR households, at 3,015 kg – almost double the full-sample average and significantly above sales earned by experimental and control households (see Table 28, Table 29). Average sales of pigeon pea of about 280 kg was lowest among experimental households, and were significantly below sales achieved in AR households (469.2 kg) and by indirect beneficiaries (577.5 kg, the highest for this crop). And, among the other crops, the highest sales for beans, Irish potato, and sorghum were recorded by AR households, although these were not significantly above that recorded by other groups.

To complement the aforementioned full-sample results, an examination of district- and wealth-level heterogeneity provides a more detailed picture of agricultural outcomes, with two notable results. First, from a district perspective, maize yield was highest in Babati, at 1,179 kg/a, almost six times as high as in Kongwa (see Table 30), where yield was 209 kg/a. In addition, sales of maize reached almost 3,000 kilograms in Kiteto, more than twice as much as in Kongwa, where sales totaled 1,138 kilograms (see Table 31). For other crops, a similar district-level distribution of high and low yield between Babati and Kongwa districts was recorded for groundnut (534 kg/a and 166 kg/a, respectively), pigeon pea (448 kg/a and 114 kg/a, respectively), and sorghum (763 kg/a and 128 kg/a, respectively), while Kiteto District led in sales of groundnut and pigeon pea (678 kg and 1097 kg, respectively) and Babati District led in sales of sorghum (340 kg).

Table 28. Agricultural output III: yield and sales, by type and gender

	Full sample			Group					Gender	
Item	Num.	Mean	S.d.	(1)	(2)	(3)	(4)	(5)	Female	Male
Yield (kilogram per acre)										
Beans	305	226.1	196.4	205.9	258.0	221.4	227.3	172.5	180.9	233.3
Groundnut	63	254.2	299.1	189.4	n.o.	n.o.	226.4	275.4	204.1	264.8
Irish potato	73	1,534.3	1,330.9	1,492.6	1,499.3	1,931.4	1,300.1	795.9	1,542.2	1,533.4
Maize	771	959.6	866.3	1,147.8	1,220.1	1,324.7	706.8	584.0	708.2	998.4
Pigeon pea	353	425.7	343.4	434.6	464.5	405.3	454.8	365.4	407.0	428.5
Sorghum	83	434.7	506.2	611.6	629.0	1,207.7	358.3	323.8	225.1	470.1
Sales (kilograms)										
Beans	99	145.4	208.3	198.2	141.2	162.1	93.3	102.0	79.2	155.4
Groundnut	33	402.8	372.9	180.6	n.o.	n.o.	380.3	463.2	449.9	396.3
Irish potato	69	1,447.5	1,868.0	2,149.4	1,385.8	1,358.7	615.8	938.4	1,077.6	1,489.2
Maize	489	1,518.4	2,944.7	3,015.0	1,283.6	1,168.8	1,539.5	1,158.7	1,051.6	1,576.3
Pigeon pea	289	345.1	565.7	469.2	281.0	277.0	577.5	322.2	337.3	346.2
Sorghum	31	295.8	281.5	478.0	307.3	460.0	361.2	227.7	248.7	302.8

Note: Means, unless otherwise indicated; for full-sample minimum and maximum values, see Appendix, Table A8. Num. - number of households. S.d. - standard deviation. Numbered columns represent the following groups: (1) Africa RISING, (2) Coupon, (3) No coupon, (4) Indirect beneficiaries, (5) Control. N.o. - no observations.

Source: Author's compilation based on TARBES 2014.

Table 29. Agricultural output means-difference tests: yield and sales

	Significance of differences							
Item	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)	M. v. f.
Yield (kilogram per acre)								
Beans					**			
Groundnut	n.a.			n.a.	n.a.		n.a.	
Irish potato								
Maize		***	***	***	***			***
Pigeon pea								
Sorghum			***		***			
Sales (kilograms)								
Beans								
Groundnut	n.a.			n.a.	n.a.		n.a.	
Irish potato								
Maize	***		***					
Pigeon pea	*			***				
Sorghum								

Note: Significance of difference from means difference tests among household types and between male- and female-headed households. Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1. N.a. - not applicable (at least one category with no observations). M. v. f. - male v. female.
Source: Author's compilation based on TARBES 2014.

Table 30. Agricultural outcomes IV: yield, by district and wealth quintile

		Quintile					
Main crops	Num.	First	Second	Third	Fourth	Fifth	All
Beans overall	305	235.7	224.8	232.7	224.1	221.5	227.2
Babati District	302	239.6	228.1	236.3	224.1	221.5	228.0
Kiteto District	3	80.0	20.0	5.0	-	-	35.0
Kongwa District	-	-	-	-	-	-	-
Maize overall	771	498.3	931.7	901.6	1,030.7	1,435.2	966.9
Babati District	584	793.6	1,171.9	1,019.0	1,174.6	1,586.0	1,178.9
Kiteto District	44	409.1	341.9	519.8	651.9	848.5	487.6
Kongwa District	143	182.9	191.7	213.0	232.8	254.3	209.5
Pigeon pea overall	353	301.5	458.8	372.1	456.3	492.7	429.0
Babati District	324	340.4	480.7	376.2	481.8	514.3	447.5
Kiteto District	15	160.4	129.1	233.0	293.4	368.9	246.0
Kongwa District	14	38.5	200.0	-	131.7	168.3	114.2
Groundnut overall	63	197.2	231.3	362.4	306.7	213.4	261.9
Babati District	10	493.0	24.0	574.1	729.2	493.0	533.9
Kiteto District	6	80.0	482.4	677.9	-	-	480.5
Kongwa District	47	184.4	170.6	151.2	137.7	173.4	165.8
Irish potato overall	73	1,870.5	1,390.4	1,977.4	1,158.6	1,485.2	1,534.3
Babati District	73	1,870.5	1,390.4	1,977.4	1,158.6	1,485.2	1,534.3
Kiteto District	-	-	-	-	-	-	-
Kongwa District	-	-	-	-	-	-	-
Sorghum overall	83	188.0	430.4	419.0	551.7	856.7	438.8
Babati District	39	827.2	703.8	654.2	582.4	1,088.0	762.5
Kiteto District	2	80.0	-	-	936.0	-	508.0
Kongwa District	42	97.5	122.8	116.6	331.4	162.7	127.6

Note: Num. - number of households. Yield measured in kilograms per acre. Source: Author's compilation based on TARBES 2014.

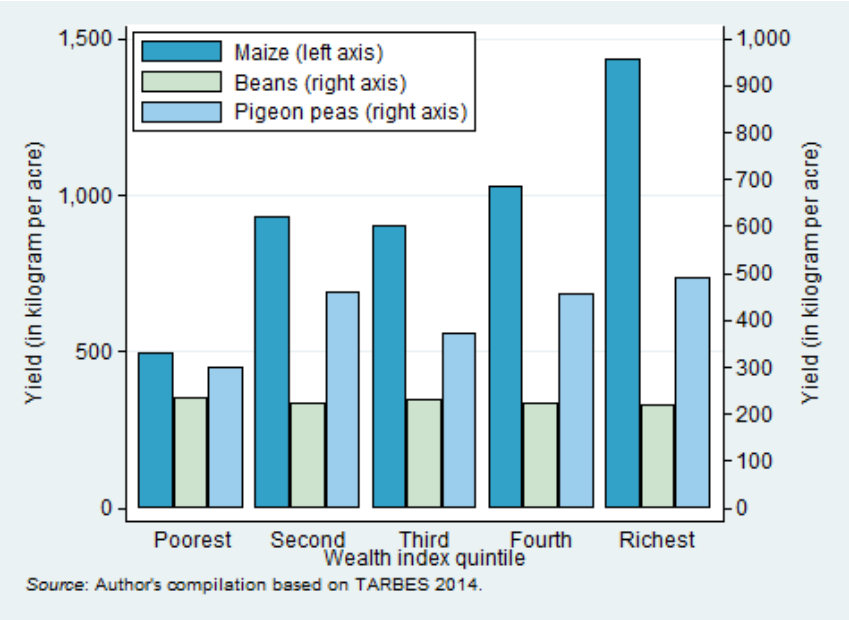
Table 31. Agricultural outcomes V: sales, by district and wealth quintile

		Quintile					
Main crops	Number	First	Second	Third	Fourth	Fifth	All
Beans overall	99	61.4	162.4	126.8	165.0	217.1	145.4
Babati District	99	61.4	162.4	126.8	165.0	217.1	145.4
Kiteto District	-	-	-	-	-	-	-
Kongwa District	-	-	-	-	-	-	-
Maize overall	489	452.1	906.7	984.6	1,563.2	2,906.7	1,526.3
Babati District	391	343.6	912.9	911.8	1,357.3	2,726.6	1,466.3
Kiteto District	31	726.4	923.5	1,913.8	6,319.8	9,061.4	2,996.6
Kongwa District	67	504.7	853.7	1,177.8	1,588.5	1,861.2	1,138.5
Pigeon pea overall	289	115.6	227.7	276.8	309.5	583.8	344.0
Babati District	266	119.4	224.2	268.6	309.4	474.1	313.4
Kiteto District	14	138.5	281.4	505.7	702.4	2,922.1	1,097.4
Kongwa District	9	25.0	-	-	50.0	171.7	110.7
Groundnut overall	33	358.6	390.0	435.9	560.8	249.9	411.5
Babati District	9	431.4	-	606.4	909.0	102.7	598.2
Kiteto District	3	-	708.7	616.3	-	-	677.9
Kongwa District	21	340.4	230.7	263.8	328.7	299.0	279.7
Irish potato overall	69	2,142.0	880.4	1,168.3	2,148.2	1,885.9	1,447.5
Babati District	69	2,142.0	880.4	1,168.3	2,148.2	1,885.9	1,447.5
Kiteto District	-	-	-	-	-	-	-
Kongwa District	-	-	-	-	-	-	-
Sorghum overall	31	127.0	390.7	313.4	382.4	173.8	295.8
Babati District	22	80.0	450.1	327.2	415.0	173.8	339.9
Kiteto District	1	-	-	-	187.2	-	187.2
Kongwa District	8	138.7	93.6	285.6	-	-	188.2

Note: Number - number of households. Sales measure in kilograms.
Source: Author's compilation based on TARBES 2014.

Second, the 'yield bonus' typically earned by rich farmers, though real and significant, was not uniform across all crops. Comparing the fifth and first wealth quintiles, the yield gap between (asset) rich and poor farmers is 936.9 kg/a (1,435.2 kg/a versus 498.3 kg/a), or a factor of 2.9, for maize production, and 191.2 kg/a (429 kg/a versus 301.5 kg/a, factor of 1.6) for pigeon pea production. Remarkably, however, there is no yield gap for beans: crop yield in the first quintile (235.7 kg/a) even slightly outstrips the average achieved in each of the subsequent four quintiles (but is not significantly above them, with p-values from inter-quintile means-difference tests all above 0.3) (see Table 30, Figure 4). When within district differences in wealth are considered, the yield gaps are even more striking. For example, the yield gap for pigeon pea in Kongwa District is 129.8 kg/a (factor of 4.4), while that for maize and pigeon pea in Kiteto District is 439.4 kg/a and 208.5 kg/a, respectively, which in both cases results in a factor above 2.0, meaning that rich farmers enjoy twice as high yield *in the same district* as their less well-off counterparts.

Figure 4. Yield of selected crops, by wealth quintile



4.4.3 Excursus II: Converting local units to standardized units

For some of the indicators used in this report a complication arises when crop quantities at the household level are reported in different nonstandard units, for example in buckets, heaps, pieces and the like. These units are often location-specific, meaning that a heap of tomatoes in one location could be different in volume from a similarly named heap in another place. While it is in the interest of the surveyor to use units that are well known and relevant to local communities, this practice prevents use of these raw data directly to measure yield (and any other indicator based on reported quantity). To overcome this difficulty, an equivalence must be established that translates locally reported units into common and comparable weight measures – in this case, kilograms – for every crop in the survey. The adopted approach relies on data both internal and external to TARBES 2014 to build such a table of equivalence.

In terms of internal data, reported equivalences between commonly used local units and standardized (kilogram) weight were collected as part of the community survey. This permitted computation of conversion factors in two steps. First, for every community-crop-local unit combination an average of the reported weight in kilograms was computed and assigned as the best representative of the convertible value from nonstandard units to kilograms. In cases where no data existed for a specific crop unit in a community, an average from the next higher level of aggregation (in this case, wards) was assigned, and this iteration was repeated using district- and region-level averages if the case so warranted. When no sample-wide measure was available, however, resort was made to data from outside of the survey – in this case to two recent World Bank east African survey datasets – to construct the appropriate conversion factors. In the end, a dataset containing

conversion factors relevant to each community-crop-local unit combination reported in the TARBES 2014 was attained. In the previous section, these conversion factors were applied in the computation of crop harvest, yield and sales.

4.5 What is their level of consumption?

Average annual consumption expenditure (for purchased items only) was 1,963,896 TZS amongst all survey households (see Table 32). Food consumption expenditure was 993,336 TZS and non-food consumption expenditure was 970,562 TZS. In descending order, above-average consumption expenditure was recorded in AR (2,790,141 TZS), indirect beneficiary (2,277,082 TZS), and coupon households (2,009,304 TZS), while no-coupon and control households had below-average consumption expenditure (1,888,601 TZS and 1,523,983 TZS, respectively). By district, household consumption in Kiteto was the highest, at 2,743,288 TZS, almost double Kongwa's average consumption (1,438,442 TZS). Babati's households recorded the highest level of food consumption (1,049,449 TZS) and Kiteto's households spent the most on non-food items (1,789,073 TZS). In terms of allocations, the overall food share was 52.9 percent, emphasizing the importance of the food budget in overall consumption. This food share was matched at the district level by Babati (52.4 percent), exceeded that in Kiteto by five percentage points, and trailed Kongwa's high share of 56.2 percent. Except for AR households, all other groups spent more than half of all purchases on food.

By area of expenditure, five categories constitute the bulk of food purchases: grains, cereals, and flour (22 percent of food expenditure), milk, oil, salt and spices (17 percent), meat, poultry and fish (16 percent), sugars (15 percent), and fruit and vegetables (14 percent) (see Table 33).

Table 32. Consumption expenditure (TZS and share), by type and district

		Consumption expenditure (TZS)			Share	
	Number	Total	Food	Non-food	Food	Non-food
Group						
AR	107	2,790,141	1,227,611	1,562,531	0.492	0.508
Coupon	186	2,009,304	1,070,394	938,910	0.533	0.467
No coupon	142	1,883,601	1,017,373	866,228	0.523	0.477
Indirect beneficiaries	105	2,277,082	1,072,442	1,204,640	0.547	0.453
Control	269	1,523,983	803,299	720,684	0.536	0.464
District						
Babati District	597	2,045,578	1,049,449	996,128	0.524	0.476
Kiteto District	48	2,743,288	954,214	1,789,073	0.470	0.530
Kongwa District	164	1,438,442	800,518	637,923	0.562	0.438
OVERALL	809	1,963,896	993,336	970,561	0.529	0.471

Note: Means, unless otherwise indicated. Number - number of households.
Source: Author's compilation based on TARBES 2014.

Table 33. Consumption expenditure (TZS and share), by food groups

Items	Summary statistics				
	Number	Mean	Std. dev.	Minimum	Maximum
Consumption expenditure	809	1,963,896	1,835,861	40,429	20,070,128
of which: food	809	993,336	862,467	0	7,732,786
- grains, cereals, and flour	809	234,134	304,666	0	2,586,286
- roots and tubers	809	56,037	128,660	0	1,147,143
- sugar, sugarcane, etc.	809	116,363	158,398	0	2,974,750
- pulses, nuts, and seeds	809	43,139	106,031	0	834,286
- fruit and vegetables	809	120,592	264,950	0	6,465,715
- meat, poultry, and fish	809	207,366	320,137	0	2,659,286
- milk, oil, salt, etc.	809	117,265	131,555	0	1,048,071
- tea, coffee, and other drinks	809	43,757	172,072	0	2,190,000
- meals outside the home	809	54,682	235,386	0	3,910,715
of which: non-food	809	970,561	1,301,673	0	16,808,592
Food share	809	0.529	0.212	0.000	1.000
- grains, cereals, and flour	803	0.216	0.255	0.000	1.000
- roots and tubers	803	0.046	0.099	0.000	0.870
- sugar, sugarcane, etc.	803	0.148	0.178	0.000	1.000
- pulses, nuts, and seeds	803	0.041	0.099	0.000	0.640
- fruit and vegetables	803	0.135	0.147	0.000	1.000
- meat, poultry, and fish	803	0.163	0.212	0.000	1.000
- milk, oil, salt, etc.	803	0.167	0.193	0.000	1.000
- tea, coffee, and other drinks	803	0.036	0.111	0.000	0.956
- meals outside the home	803	0.048	0.156	0.000	1.000

Note: Number - number of households, std. dev. - standard deviation.
Source: Author's compilation based on TARBES 2014.

Although it is well-known that spending on food increases with total consumption, it is also often the case that, because the former is not proportionate to the overall increase, the food share declines. In the case of Tanzania, ordering survey households into quintiles of total consumption expenditure (see Table 34, Figure 5) reveals instead a food share peak of 56.8 percent in the fourth (or second highest) quintile; indeed, the lowest share of food purchases (46.9 percent) occurs among household who spend the least overall (the first quintile). Of interest also is that households in the fifth quintile spend only marginally more on food than their first-quintile counterparts.

At the group level both AR households and indirect beneficiary households deviate from this pattern with food share peaks of 56.9 percent and 59.6 percent, respectively, occurring in the first quintile (see Table 34). By comparison, fifth-quintile households in these groups allocate substantially less (between 13 percentage points and 14 percentage points) than their first-quintile counterparts. Overall, AR households have the lowest food share, at 49.2 percent, and indirect beneficiaries the highest, at 54.7 percent.

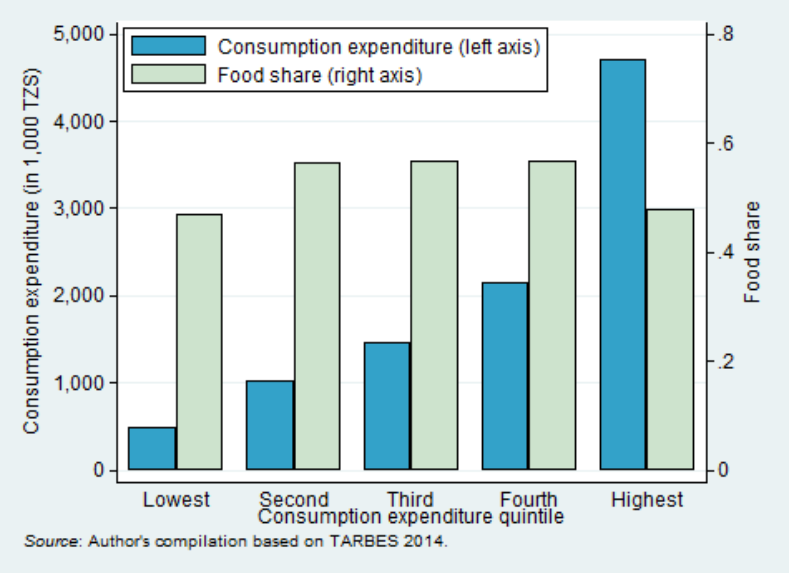
Table 34. Food share, by type, district, gender, and expenditure quintile

	Number	Quintile					
		First	Second	Third	Fourth	Fifth	All
Group							
AR	107	0.569	0.531	0.479	0.562	0.430	0.492
Coupon	186	0.404	0.567	0.551	0.596	0.508	0.533
No coupon	142	0.432	0.543	0.563	0.531	0.545	0.523
Indirect beneficiaries	105	0.596	0.579	0.543	0.561	0.470	0.547
Control	269	0.454	0.575	0.617	0.575	0.462	0.536
District							
Babati District	597	0.448	0.561	0.551	0.564	0.491	0.524
Kiteto District	48	0.459	0.533	0.574	0.542	0.318	0.470
Kongwa District	164	0.516	0.582	0.615	0.593	0.492	0.562
Gender							
Male-headed	108	0.473	0.545	0.557	0.566	0.477	0.526
Female-headed	701	0.452	0.720	0.622	0.583	0.497	0.549
OVERALL	809	0.468	0.565	0.564	0.568	0.479	0.529

Note: Number - number of households.

Source: Author's compilation based on TARBES 2014.

Figure 5. Consumption expenditure and food share, by expenditure quintile



While the full sample pattern of high food shares in the middle of the distribution is maintained at district level, a few differences emerge in magnitude and ranking (see Table 34). First, peak food share occurs in the third quintile for households in Kiteto and Kongwa (57.4 percent and 61.5 percent, respectively), unlike in Babati (fourth quintile, 56.4 percent). Second, in contrast to the full sample (and to Babati), low food share in Kiteto and Kongwa occurs in the fifth (or highest) quintile. And third, while the inter-quintile range of food share in Babati and Kongwa (11.6 percentage points and

12.3 percentage points, respectively) hovers slightly above the overall range (10.0 percentage points), Kiteto's households produce a starker difference of 25.6 percentage points.

In terms of gender, female-headed households account for a higher share spent on food than male-headed households (54.9 percent versus 52.6 percent), differences that are largest in the second quintile (72.0 percent versus 54.5 percent), smallest in the fourth quintile (58.3 percent versus 56.6 percent), and reversed (though not significantly different) in the first quintile (45.2 percent versus 47.3 percent, p-value: 0.614).

4.6 How vulnerable are they?

An examination of data on household vulnerability reveals the difficult conditions governing daily life. Faced with a series of threats at the area level, including adverse weather, pest, and market events, some households were further buffeted by household-level, idiosyncratic shocks such as illness or death. In combination, such events posed a risk both to production and consumption.

Two in five households reported facing a problem related to crop production during the past season (see Table 35). Leading causes included drought, crops pests and diseases, and unfavorable weather (see Table 36). Just over one in ten suffered from livestock-related problems (mainly disease and limited access to grazing land), and a similar fraction faced problems related to output sales (mainly price fluctuation). Least common of all were problems related to storage, with poor storage conditions the most commonly cited cause. To combat these challenges farming households adopted a mix of strategies, with transportation rental the most frequently cited option. More directly targeted actions included pesticide use and adapting input use to conditions (for production problems), home storage, delaying crop sale or selling piecemeal, and asking others for advice.

These direct, recent shocks were complemented by longer-term disruptions. Three in five households reported facing a severe shock to household welfare at some time in the previous five years (see Figure 6). The most cited shocks (see Table 35) were droughts or floods (23.6 percent of households), closely followed by crop pests (23.1 percent of households), increases in the price of food (13.5 of households), decreases in the price of crops for sale (12 percent of households), and livestock disease (10.9 percent of households). Among this group, drought was felt most intensely, being cited as the most significant shock (of a possible three) of the past half-decade by 72.6 percent of those affected (see Table 37). Crop pests and livestock disease was felt most sharply by 49 percent of those affected while, of those facing higher prices for food or decreases in crop sale prices, 36 percent and 26.7 percent cited these as most significant. Table 37 also illustrates that, for the five major longer-term shocks,[13] householders' main response was to draw down on savings, while the next most realized option – for four of the five shocks – was to take no action.

[13] Those affecting more than 50 households.

Table 35 . Vulnerability to agricultural and household shocks and food insecurity

Item	Summary statistics		
	Number of households	Mean	Standard deviation
Agricultural problems (past season): Incidence			
Crop production	808	0.417	0.493
Crop storage	803	0.072	0.259
Crop sale	783	0.097	0.296
Livestock husbandry and sale	769	0.114	0.319
Severe shocks (past 5 years): Incidence			
Drought or floods	809	0.236	0.425
Strong winds/storms	809	0.049	0.217
Crop pests	809	0.231	0.422
Livestock disease, died or stolen	809	0.109	0.312
Household business failure, non-agricultural	809	0.021	0.144
Loss of salaried employment or non-payment of salary	809	0.001	0.035
Large fall in sale prices for crops	809	0.120	0.325
Large rise in price of food	809	0.135	0.342
Large rise in agricultural input prices	809	0.075	0.264
Severe water shortage	809	0.064	0.245
Loss of land	809	0.015	0.121
Chronic/severe illness or accident of household member	809	0.047	0.212
Death of a member of household	809	0.043	0.204
Death of other family member	809	0.062	0.241
Break-up of the household	809	0.011	0.105
Jailed	809	0.009	0.093
Fire	809	0.014	0.116
Hijacking/robbery/burglary/assault	809	0.012	0.111
Dwelling damaged, destroyed	809	0.007	0.086
Immediate need of money and selling crop at lowest price	809	0.067	0.250
Political, tribal, and farmers' livestock conflict	809	0.020	0.139
Other	809	0.002	0.050
Food vulnerability (past week and past year): incidence			
Worried not enough food, previous week	809	0.177	0.382
Did not have enough food at least once, past 12 months	809	0.141	0.348

Note: All items are indicator variables.

Source: Author's compilation based on TARBES 2014.

Table 36. Agricultural problems: main causes and responses

Item	Num.	Proportion*
Main problems (and proportion citing)		
Crop production: Drought	85	25.22
Crop production: Crop pests or diseases	74	21.96
Crop production: Unfavorable weather conditions	55	16.32
Crop production: Shortage of agricultural inputs	39	11.57
Crop storage: Poor storage condition	35	60.34
Crop storage: Destruction by animals	11	18.97
Crop storage: Too small	6	10.34
Crop sale: Fluctuating output price	65	85.53
Crop sale: Long distance to output market	9	11.84
Livestock husbandry: Disease	42	47.73
Livestock husbandry: Limited access to grazing land	22	25.00
Livestock husbandry: Limited access to drinking water	9	10.23
Main strategies (and proportion citing)		
Crop production: Rent/hire transport	233	76.39
Crop production: Adjust input use to conditions	26	8.52
Crop production: Use pesticide	26	8.52
Crop production: Ask advice from family/friends /extension agents	8	2.62
Crop storage: Rent/hire transport	41	70.69
Crop storage: Store crops in home	7	12.07
Crop storage: Use pesticides	6	10.34
Crop sale: Rent/hire transport	50	65.79
Crop sale: Postpone sale of produce	11	14.47
Crop sale: Sale produce in piecemeal	10	13.16
Livestock husbandry: Rent/hire transport	55	62.5
Livestock husbandry: Sell/slaughter animals	6	6.82
Livestock husbandry: Ask advice from family/friends/extension	6	6.82

Note: * Frequency citing, for main reasons and choices only; do not add to one. Num. - number of households.
Source: Author's compilation based on TARBES 2014.

Figure 6. Share of households experiencing severe shocks in the past five years

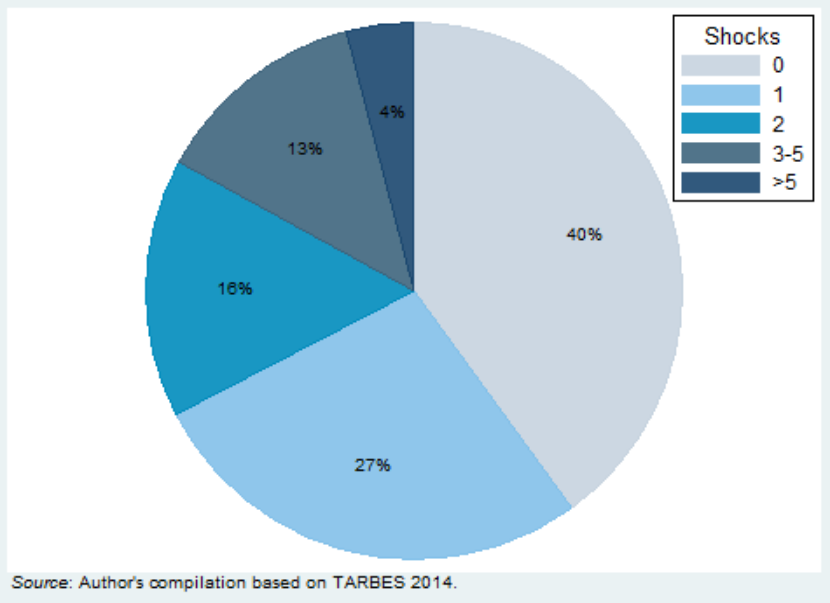


Table 37. Household shocks and responses

Item	Summary statistics		
	Num.	Mean*	S.d.
Shock is ranked as most significant shock			
Drought or floods	179	0.726	0.447
Strong winds/storms	27	0.370	0.492
Crop pests	157	0.490	0.502
Livestock disease, died or stolen	71	0.493	0.504
Household business failure, non-agricultural	11	0.636	0.505
Large fall in sale prices for crops	75	0.267	0.445
Large rise in price of food	75	0.360	0.483
Large rise in agricultural input prices	38	0.368	0.489
Severe water shortage	32	0.313	0.471
Loss of land	9	0.444	0.527
Chronic/severe illness or accident of household member	38	0.816	0.393
Death of a member of household	34	0.912	0.288
Death of other family member	37	0.730	0.450
Break-up of the household	8	0.875	0.354
Jailed	7	0.857	0.378
Fire	11	0.818	0.405
Hijacking/robbery/burglary/assault	9	0.444	0.527
Dwelling damaged, destroyed	6	0.833	0.408
Immediate need of money and selling crop at lowest price	42	0.500	0.506
Political, tribal, and farmers' livestock conflict	16	0.500	0.516
Shocks: main responses			
Drought or floods: relied on own savings	92	51.69	n.a.
Drought or floods: took no action	63	35.39	n.a.
Crop pests: relied on own savings	72	48.32	n.a.
Crop pests: took no action	61	40.94	n.a.
Large rise in price of food: relied on own savings	52	69.33	n.a.
Large rise in price of food: took no action	17	22.67	n.a.
Large fall in sale prices for crops: took no action	40	54.79	n.a.
Large fall in sale prices for crops: relied on own savings	29	39.73	n.a.
Livestock disease: relied on own savings	36	52.94	n.a.
Livestock disease: took no action	25	36.76	n.a.

Note: * For responses to shocks, reported value is frequency citing, for main responses only. Numbers do not add to one. All top panel items are indicator variables. Num. - number of households, S.d. - standard deviation.
Source: Author's compilation based on TARBES 2014.

Past-season production problems and longer-term shocks can expose households to food consumption risks. Indeed we find that, overall, almost one of every six households (17.7 percent) reported having worried about insufficient food in the previous week (see Table 35). More concretely, food insecurity, measured as the proportion of households which experienced an actual instance of food insufficiency in the previous year, was 14.1 percent across the survey areas, which means that more than one in seven households were affected. Overall, a majority of households (75.4 percent) cited low stocks due to drought and poor rains as the main cause of their past-year food-shortage episode, distantly followed by crop pest damage (7.0 percent) (see Table 38).

Table 38. Food insecurity, by reason and importance

Item	Summary statistics		
	Number of households	Mean	Standard deviation
Food insecurity: reason			
Inadequate household stocks due to drought/poor rains	114	0.754	0.432
Inadequate household food stocks due to crop pest damage	114	0.070	0.257
Inadequate household food stocks due to small land size	114	0.018	0.132
Inadequate household food stocks due to lack of farm inputs	114	0.009	0.094
Food in the market was very expensive	114	n.o.	n.o.
Not able to reach the market due to high transportation costs	114	n.o.	n.o.
No food in the market	114	0.018	0.132
Floods/water logging/hailstorm	114	0.035	0.185
No money	114	0.044	0.206
Theft	114	n.o.	n.o.
Fire	114	0.009	0.094
Other	114	0.044	0.206

Note: All indicator variables. N.o. - no observations.
Source: Author's compilation based on TARBES 2014.

Comparing household types and locations, an elevated risk of food *worry* was experienced by indirect beneficiary and control households, at 19 percent and 27.9 percent, respectively, and by households in Kiteto and Kongwa districts, at 22.9 and 36 percent, respectively (see Table 39). Correspondingly, across household types, the danger of food *insecurity* was highest among control households, at 21.2 perccent, and lowest in the group of AR households, at 7.5 percent. By location, food insecurity was highest in Kongwa District, where almost one-third of all households (29.9 percent) suffered a food-insufficiency episode in the past year (see Table 40). This was more than three times the proportion recorded in Babati District, where 9.9 percent of households went without sufficient food in the same period.

Focusing solely on actual food insufficiency episodes the data reveal that poor households, who are by definition under-resourced, faced extreme difficulty: the proportion of food-insecure first-quintile households was 32.7 percent (see Table 40). The gradient of food-insecurity was also very steep between the poorest and slightly less poor households: the rate drops by 18 percentage points between the first and second quintiles, and more gradually thereafter, losing between three and four percentage points each time. Food insecurity in the richest quintile was 3.8 percent.

Finally, and confirming one of the recurring themes of this report, gender matters for exposure to this type of vulnerability. Female-headed households are more than twice as likely to suffer from food insecurity as male-headed households (25.0 percent versus 12.4 percent, p-value: <0.001) (see Table 40). Gender differences also appear within the wealth quintiles (see Figure 7). Among male-headed households, food insecurity mostly affects those in the poorest quintile who, indeed, are three times as much affected as those in the second wealth quintile. For female-headed households,

on the other hand, a significant food insecurity risk also exists in the second wealth quintile. In other words, women remain at risk at higher wealth levels than men do. These large gender differences, however, completely disappear in the third and fourth wealth quintile, and no women in the richest quintile are affected.[14]

Table 39. Vulnerability to food worry, by type, gender, district and wealth quintile

		Means and significance of differences			
Comparison	Number	First category	Second category	Difference	Significance of difference
		Food worry (past week)			
AR v. experiment	435	0.121	0.110	0.011	
AR v. indirect beneficiaries	212	0.121	0.190	-0.069	*
AR v. control	376	0.121	0.279	-0.157	***
Experiment v. indirect beneficiaries	433	0.110	0.190	-0.080	**
Experiment v. control	597	0.110	0.279	-0.169	***
Indirect beneficiaries v. control	374	0.190	0.279	-0.088	*
Coupon v. non-coupon	328	0.124	0.085	0.039	
Male-headed v. female-headed	809	0.150	0.352	-0.202	***
Babati v. Kiteto	645	0.122	0.229	-0.107	**
Babati v. Kongwa	761	0.122	0.360	-0.237	***
Kiteto v. Kongwa	212	0.229	0.360	-0.131	*
Quintile 1 v. quintile 2	312	0.410	0.173	0.237	***
Quintile 1 v. quintile 3	312	0.410	0.154	0.256	***
Quintile 1 v. quintile 4	312	0.410	0.090	0.321	***
Quintile 1 v. quintile 5	312	0.410	0.045	0.365	***
Quintile 2 v. quintile 3	312	0.173	0.154	0.019	
Quintile 2 v. quintile 4	312	0.173	0.090	0.083	**
Quintile 2 v. quintile 5	312	0.173	0.045	0.128	***
Quintile 3 v. quintile 4	312	0.154	0.090	0.064	*
Quintile 3 v. quintile 5	312	0.154	0.045	0.109	***
Quintile 4 v. quintile 5	312	0.090	0.045	0.045	

Note: Significance of difference from means difference tests between male- and female-headed households and between all type, district and wealth-quintile pairs. Stars indicate significance level: ***<0.01, **<0.05, *<0.1
Not all households are ranked by the wealth quintile measure for lack of data.

Source: Author's compilation based on TARBES 2014.

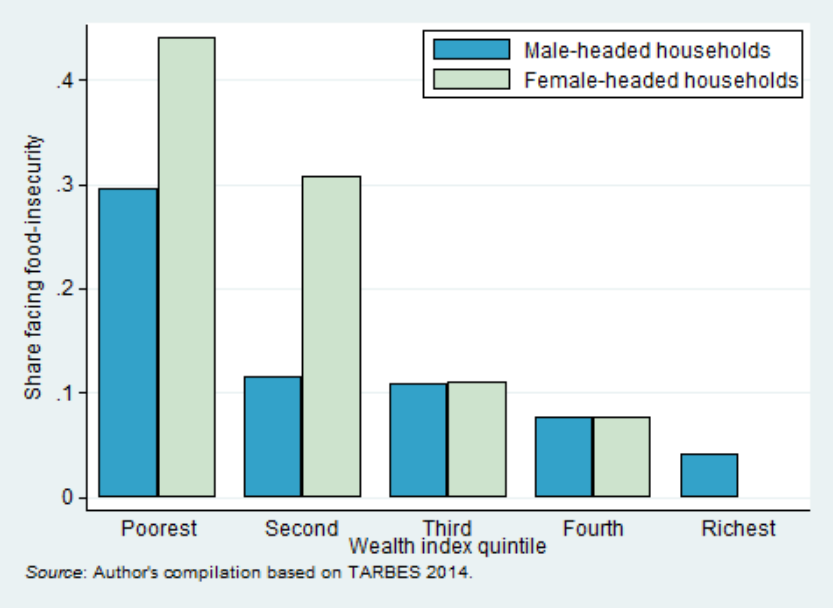
[14] Note that this is not due to an absence of female-headed households in the top quintile.

Table 40. Vulnerability to food insecurity, by type, gender, district and wealth quintile

Comparison	Number	Means and significance of differences: First category	Second category	Difference	Significance of difference
		Food insecurity (past year)			
AR v. experiment	435	0.075	0.094	-0.019	
AR v. indirect beneficiaries	212	0.075	0.171	-0.097	**
AR v. control	376	0.075	0.212	-0.137	***
Experiment v. indirect beneficiaries	433	0.094	0.171	-0.078	**
Experiment v. control	597	0.094	0.212	-0.118	***
Indirect beneficiaries v. control	374	0.171	0.212	-0.040	
Coupon v. non-coupon	328	0.102	0.085	0.018	
Male-headed v. female-headed	809	0.124	0.250	-0.126	***
Babati v. Kiteto	645	0.099	0.125	-0.026	
Babati v. Kongwa	761	0.099	0.299	-0.200	***
Kiteto v. Kongwa	212	0.125	0.299	-0.174	**
Quintile 1 v. quintile 2	312	0.327	0.147	0.179	***
Quintile 1 v. quintile 3	312	0.327	0.109	0.218	***
Quintile 1 v. quintile 4	312	0.327	0.077	0.250	***
Quintile 1 v. quintile 5	312	0.327	0.038	0.288	***
Quintile 2 v. quintile 3	312	0.147	0.109	0.038	
Quintile 2 v. quintile 4	312	0.147	0.077	0.071	**
Quintile 2 v. quintile 5	312	0.147	0.038	0.109	***
Quintile 3 v. quintile 4	312	0.109	0.077	0.032	
Quintile 3 v. quintile 5	312	0.109	0.038	0.071	**
Quintile 4 v. quintile 5	312	0.077	0.038	0.038	

Note: Significance of difference from means difference tests between male- and female-headed households and between all type, district and wealth-quintile pairs. Stars indicate significance level: ***<0.01, **<0.05, *<0.1
Not all households are ranked by the wealth quintile measure for lack of data.
Source: Author's compilation based on TARBES 2014.

Figure 7. Share of households facing food insecurity, by gender and wealth quintiles



5 Community survey

5.1 Community, chairperson and informant demographics

Across the twenty-five villages, community response to the survey was good, with five informants on average (minimum: three per village, maximum: seven) being polled (see Table 41). These included senior village executives (25 chairpersons and 81 executive officers, counselors, and development committee members), teachers (nine), representatives of business and religion (eight) and, in one case (the village of Gidas), a "model farmer" (see Appendix, Table A9). Of all 124 informants, three in four were male, while only one village chairperson (in Chitego) was female (see Table 41; for village-level information, see Appendix, Table A9). Average age among informants was forty-three years and all had long-standing village tenure, having spent twenty-six years living in the village, on average. Most informants reported spending their entire lives in their home village. Village chairpersons were four years older but had significantly more village experience than the typical informant, with average tenure of thirty-nine years. Based on these measures and the extensive knowledge about community conditions that they reflect, the sample of community respondents appears to have been well chosen.

Table 41. Village, chairperson and informant characteristics

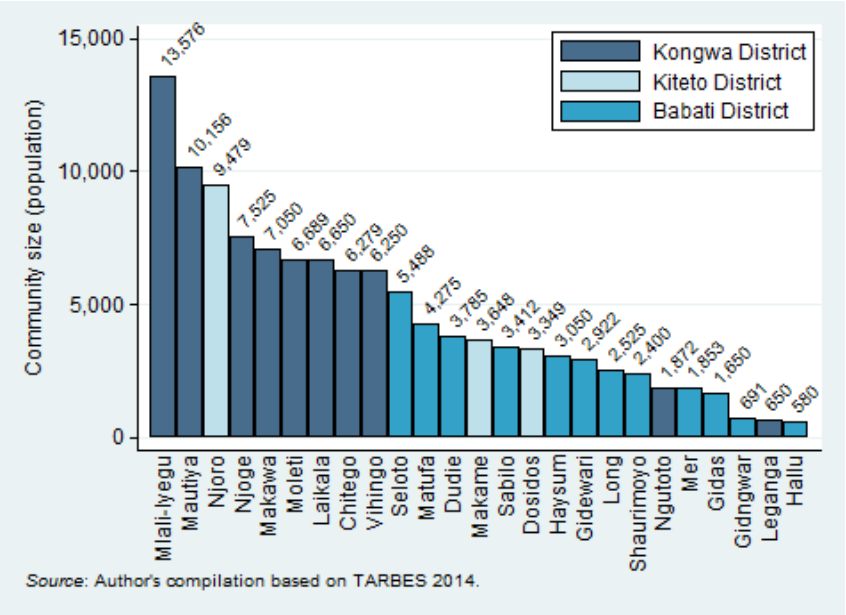
	Summary statistics					Group means	
Item	Num.	Mean	Std. dev.	Min.	Max.	Program target	Control
Village							
Population	25	4,632	3,256	580	13,576	6,778	3,798
Elevation in meters	25	1,438	322	1,017	2,195	1,576	1,385
Chairperson							
Female	25	0.04	0.20	0	1	0.14	0
Age	25	46.8	6.2	36	62	49.6	45.7
Years in village	25	39.0	15.8	5	62	38.4	39.3
Informants							
Number	25	5.0	1.2	3	7	5.0	4.9
Share female	25	0.22	0.18	0	0.67	0.32	0.18
Avg. age	25	43.3	4.2	35.5	51.6	46.2	42.1
Avg. years in village	25	26.3	13.0	3.5	48.3	29.5	25.0

Note: Num. - number of communities, std. dev. - standard deviation, min. - minimum, max. - maximum.
Source: Author's compilation based on TARBES 2014.

Village size is 4,600 on average, measured by population, and most number below 7,500, with Hallu (580) and Mlali-Iyegu (13,576) the smallest and largest villages, respectively, among surveyed communities (see Figure 8, Table 41). Villages in Kiteto District and particularly Kongwa District are significantly larger than in Babati District. Elevation rises above 2,000 meters in two cases (see

Appendix, Table A9): Gidngwar (at 2,168 meters) and Long (2,195 meters), while those closer to sea level include Matufa (1,017 meters), Shaurimoyo (1,021 meters), Makame (1,030 meters), and Mautiya (1,051 meters). For these initial village-level characteristics, program villages differed from control villages by being larger (by population), being represented by older informants, and having a higher share of females among them.[15]

Figure 8. Community size, by district



5.2 Access to basic services

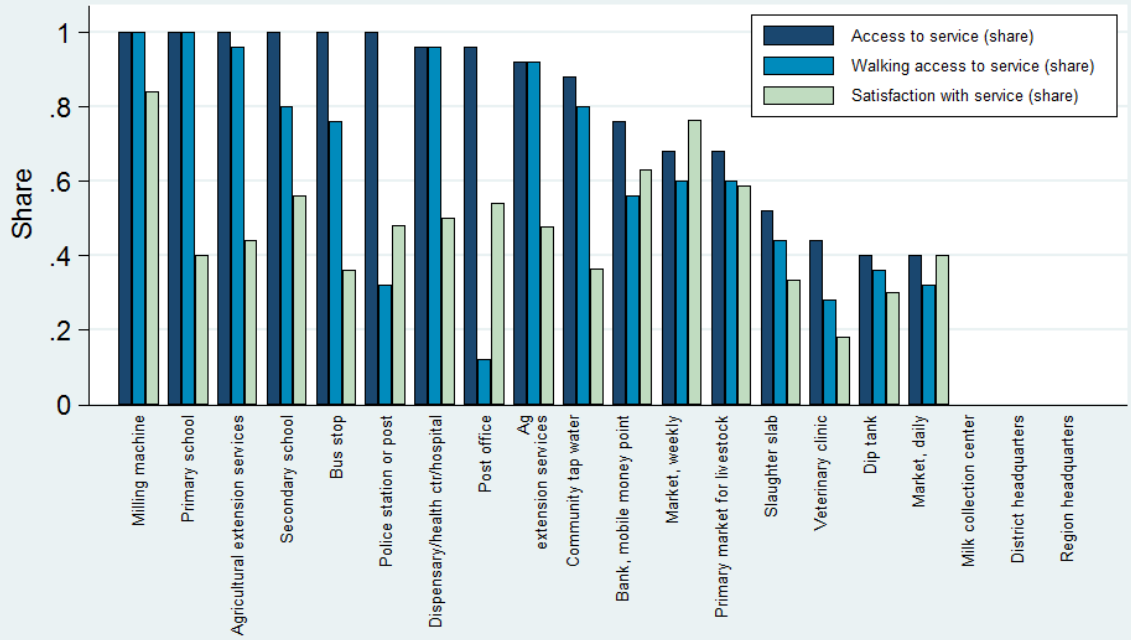
Most basic services are available, with over 90 percent of communities having access to education (pre-primary through secondary schools), healthcare (via dispensaries, health centers, or hospitals), public transportation (bus stop), and post and police stations (see Figure 9). In contrast, communities face more difficulty accessing agricultural and economic and financial services, including markets (daily and weekly, 40 percent and 68 percent of communities, respectively), banks or mobile money points (76 percent), slaughter slabs (52 percent), and veterinary centers (44 percent). Milling stations are a feature in all communities and public water taps in almost all (88 percent), but none claim access to a milk collection center.

For all services, fewer communities report having direct walking access, with the largest difference appearing for police stations (all communities with access, 32 percent of communities with walking access) and post stations (96 percent and 12 percent, respectively). By usual mode of access, services most quickly reached include pre-primary and primary schools (eight and nine minutes, by walking)

[15] To recall, program villages include Long, Sabilo, and Seloto (Babati District), Njoro (Kiteto District), and Chitego, Mlali-Iyegu, and Moleti (Kongwa District).

and milling stations (nine minutes walking), while health centers, weekly markets and public water taps are available in less than half an hour's walk (see Figure 10). Farthest away are livestock markets (99 minutes walking), and post stations (131 minutes) and extension services (143 minutes), the latter both typically accessible by car. Regional and district headquarters – for which no direct access is claimed by any community[16] – are remote, costing 167 minutes and 127 minutes in travel time by car, respectively.

Figure 9. Access to and satisfaction with services

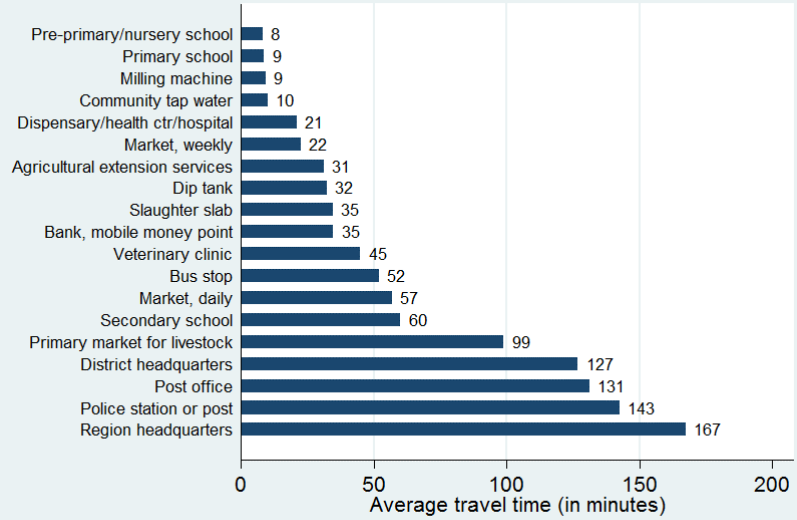


Note: Satisfaction is the share satisfied with service among those with access to it.
Source: Author's compilation based on TARBES 2014.

Perhaps reflecting this variation in accessibility, reported satisfaction with these services also presents a mixed picture (see Figure 9). Of the seventeen service areas for which data are available, only six have a majority of communities who view their operation favorably. The highest level of satisfaction[17] is attached to milling machines (84 percent or over four in five communities), followed by weekly markets (76 percent) and banks/mobile money points (63 percent), while livestock markets, secondary schools, and post stations all score favorably with over 50 percent of communities. On the low end, less than one in three communities are satisfied with slaughter slabs and dip tanks, and only 18 percent with veterinary centers.

[16] Distance (in minutes to access service) data was provided for all cases, including those with no reported access.
[17] Measured as the share of communities responding "Satisfied" or "Very satisfied".

Figure 10. Travel time to access services



Note: Times for mode of transport most frequently used - car for the last four items; walking for all others.
Source: Author's compilation based on TARBES 2014.

In terms of access to water (see Table 42),[18] a majority of communities are serviced by piped water (72 percent), as well as lakes or ponds (68 percent). Forty-four percent of communities have access to boreholes or wells. Access to piped water is universal among program villages and above average in Kongwa District, while access to lakes or ponds and boreholes or wells is average or above average among control villages and in Babati District. Access to all water sources is average or below average for Kiteto District.

Table 42. Access to and dependence on water sources

	Access to water source				Proportion of comm. relying on water source				
	Piped water	Borehole/ well	Lake/ pond/etc.	Other	Rain	Piped water	Borehole/ well	Lake/ pond/etc.	Other
District									
Babati District	0.67	0.58	0.83	0.08	1	35	29	35	1
Kiteto District	0.67	0.33	0.67	0.00	0	32	28	40	0
Kongwa District	0.80	0.30	0.50	0.10	4	64	12	20	0
Group									
Program target	1.00	0.43	0.57	0.14	0	74	19	5	2
Control	0.61	0.44	0.72	0.05	2	33	25	40	0
OVERALL	0.72	0.44	0.68	0.08	2	43	23	31	0

Note: Villages excluded from the district and overall averages as the sum of all the proportions of community relying on water source does not add up to 100. District rows represent averages over the villages in the district.
Source: Author's compilation based on TARBES 2014.

[18] In TARBES 2014, data on both general access to each of the water sources and access for private use were collected. As the answers were identical, we are only reporting data on general access.

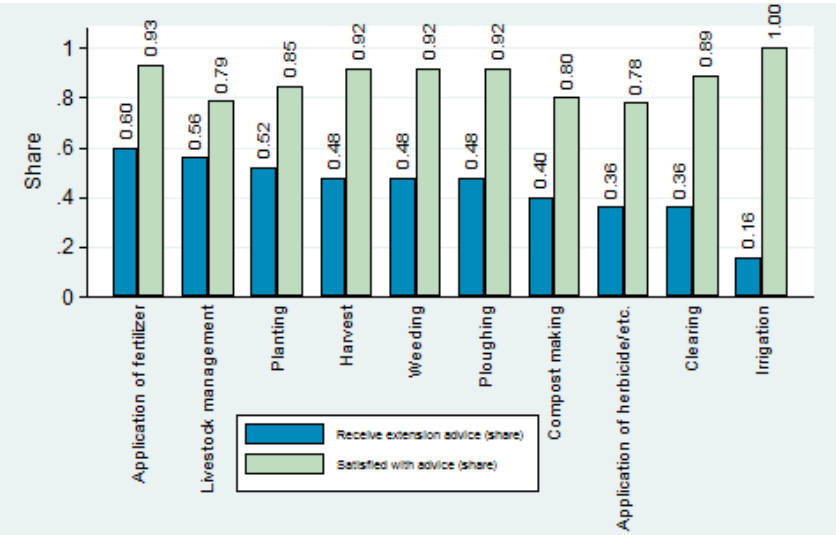
Overall, just below half of households in the community mainly rely on piped water, while 23 percent and 31 percent, respectively, mainly rely on boreholes or wells and lakes or ponds. Congruent with the district's more expansive access to piped water, the proportion of households in communities mainly relying on that source of water in Kongwa is about twice as large as in the other districts. For this indicator also, program villages have a higher proportion of residents who mainly rely on piped water than control villages, a gap of over 40 percentage points. In both Babati and Kiteto, about a third of households in the communities rely on each of the three main water sources. Reliance on rain is a rare phenomenon, met overall by only two percent of households in all communities. Seven communities report no availability of piped water: Gidas, Gidewari, Hallu, Shaurimoyo (in Babati District), Mautiya, Vihingo (in Kongwa District), and Dosidos (in Kiteto District) (see Appendix, Table A10). In substitution, households in these areas rely more heavily on a combination of rain, lakes, ponds, rivers, streambeds, and other similar sources.

5.3 Extension advice, farmer groups, and labor use

While survey communities typically receive extension services, examination of advice applied to activities throughout the production chain provides a more revealing picture (see Figure 11). Advice from within the system of extension is most widely available for fertilizer application, with three of every five communities benefiting, followed by livestock management (56 percent) and planting (52 percent). Forty percent to 48 percent of communities have access to harvest, weeding, ploughing and compost making. At the low end, just over one-third of all communities report receiving advice on clearing and the application of herbicides and pesticides, and only one in six have access to advice on irrigation.

Even though irrigation is the extension service the smallest number of communities have access to, it is the one most appreciated by those who do: all communities that report having received irrigation advice are satisfied with it (see Figure 11). But for all types of extension advice, survey communities who have access to it uniformly report positive satisfaction, ranging from 78 percent to 100 percent. After irrigation advice, the types of advice most appreciated are fertilizer application (93 percent), and harvest, weeding and ploughing (92 percent each). Compost making, livestock management, and application of herbicides are (comparatively) the least appreciated, but satisfaction is still high (80 percent or just below).

Figure 11. Extension advice: Access and satisfaction



Note: Satisfaction is the share satisfied with advice among those who receive it.
Source: Author's compilation based on TARBES 2014.

Survey communities seem underserved by research groups and other cooperative institutions, a fate suffered equally by program and control villages as no significant group differences emerged for any of the following indicators. No more than one in three communities have either farmer research groups or Savings and Credit Cooperatives (SACCOs), and the eight communities with research groups contain an average of four groups servicing over 100 members each (see Table 43). In turn, SACCOs appear in seven communities and are patronized on average by 139 members, while membership in SACCOs is 63 percent female.

Table 43. Membership in farmer research groups and SACCOs, child labor

	Summary statistics					Group means	
Item	Num.	Mean	Std. dev.	Min.	Max.	Program target	Control
Community has farmer cooperative	25	0.32	0.48	0	1	0.29	0.33
Number of cooperatives	8	4.25	2.76	2	10	3.00	4.70
Number of farmers in cooperative	8	106.5	61.7	26	190	108.0	106.0
Community has SACCO	25	0.28	0.46	0	1	0.43	0.22
Number of farmers in SACCO	7	138.6	181.9	28	527	227.3	72
Percentage of SACCO membership that is female	7	63.14	24.95	20	100	46.7	75.5
Children sometimes taken out of school for farm work	25	0.28	0.46	0	1	0.14	0.33

Note: Num. - number of communities, std. dev. - standard deviation, min. - minimum, max. - maximum.
Source: Author's compilation based on TARBES 2014.

Viewed from a labor allocation perspective, agriculture within these communities remains a family-run system. Survey data reveal that labor use for all aspects of agricultural operations skews heavily towards family members and hired labor, with communal labor the least preferred option (see Table 44). Compost making attracted the lowest use of family labor, in 76 percent of all communities, trailing irrigation (80 percent), application of pesticides and herbicides (88 percent), and application of fertilizer (96 percent); all other aspects universally used family members. The use of hired labor reveals a similar, if slightly moderated, pattern across the activity chain. However, no more than one in five reported practicing communal labor for any activity; the highest was for ploughing (20 percent of communities), followed by clearing, planting, weeding, and harvest (all 16 percent). Child labor in agriculture is not uncommon, with over one quarter of communities reporting that children are sometimes taken out of school for farm work (see Table 43 last row).

Table 44. Labor use in agriculture

	Types of labor used for task (averages over communities)		
Task	Family labor	Hired labor	Communal labor
Ploughing	1.00	1.00	0.20
Clearing	1.00	1.00	0.16
Planting	1.00	1.00	0.16
Weeding	1.00	1.00	0.16
Harvest	1.00	1.00	0.16
Livestock management	1.00	0.76	0.00
Application of fertilizer	0.96	0.80	0.12
Application of herbicide/etc.	0.88	0.84	0.08
Irrigation	0.80	0.64	0.04
Compost making	0.76	0.56	0.00

Source: Author's compilation based on TARBES 2014.

5.4 Land and major crops

On average, 55 percent of available land in survey communities is under cultivation (see Table 45). On this measure, the village of Dudie is least favored, with 22 percent of land under cultivation and, at the other end, Hallu devotes fully 80 percent of all land to cultivation (see Appendix, Table A11). Put together, individual (household) cultivation (72 percent on average) and livestock grazing (18 percent on average) together account for 90 percent of use of land under cultivation, the residual devoted to a combination of agro-business, communal cultivation and other activities (see Table 45). Program villages assign a significantly higher proportion of cultivable land towards individual cultivation than control villages (by 15 percentage points), the only significant difference among this group of indicators. Two communities use less than half of available cultivable land for individual cultivation: Matufa in Babati District and Makame in Kiteto District (both at 40 percent), but this is balanced in these areas by larger allocations for agro-business or plantation farming activities and livestock grazing, respectively (see Appendix, Table A11). Providing a direct contrast, three

communities have no other activity in such land beyond household cultivation: Seloto (Babati District), Mautiya (Kongwa District), and Dosidos (Kiteto District).

Table 45. Community land – types and use

Community land	Summary statistics				Group means	
	Mean	Std. dev.	Min.	Max.	Program target	Control
Proportion cultivable	55.0	15.50	22	80	53.8	55.4
Proportion residential	24.7	8.53	14	54	22.6	25.5
Proportion forest	8.7	7.52	0	30	10.7	7.9
Proportion business	4.4	3.98	0	12	5.4	3.9
Proportion wetland	2.8	2.72	0	10	2.9	2.8
Proportion other	4.4	7.17	0	30	4.6	4.4
Use of community cultivable land						
Proportion individual cultivation	72.3	17.73	40	100	81.7	68.6
Proportion lifestock grazing	17.6	14.26	0	60	15.1	18.6
Proportion agro-business	5.7	14.15	0	60	0.0	7.9
Proportion communal cultivation	0.9	2.09	0	6	1.7	0.5
Proportion other	3.5	9.82	0	46	1.4	4.3

Note: Std. dev. - standard deviation, min. - minimum, max. - maximum.
Source: Author's compilation based on TARBES 2014.

The market for land recognizes family inheritance as the main channel through which land is transferred in 18 communities (or 72 percent), versus seven communities via village government allocation or private sale (see Table 46). Overall, many of these communities also permit spousal inheritance, with about half of the communities allowing transfers of a wife's land to the widower and about two thirds allowing widows to inherit their deceased husband's land. In program villages, land transfer through family inheritance is higher than in control villages, while inheritance following spouse death is lower, although these differences are not significant. Regardless of the route or land certification protocols (at survey date, twelve communities possessed a Village Lands Certificate, thirteen did not), these transfers occur in a settled environment. Overwhelmingly, land markets have not been subject to upheaval, with no reallocations in these communities due to appropriation for outside investors or government set-asides for nature reserves, and only one (Vihingo, Kiteto District) facing a public-use reassignment in the previous year.

Table 46. Land and cultivation summary statistics

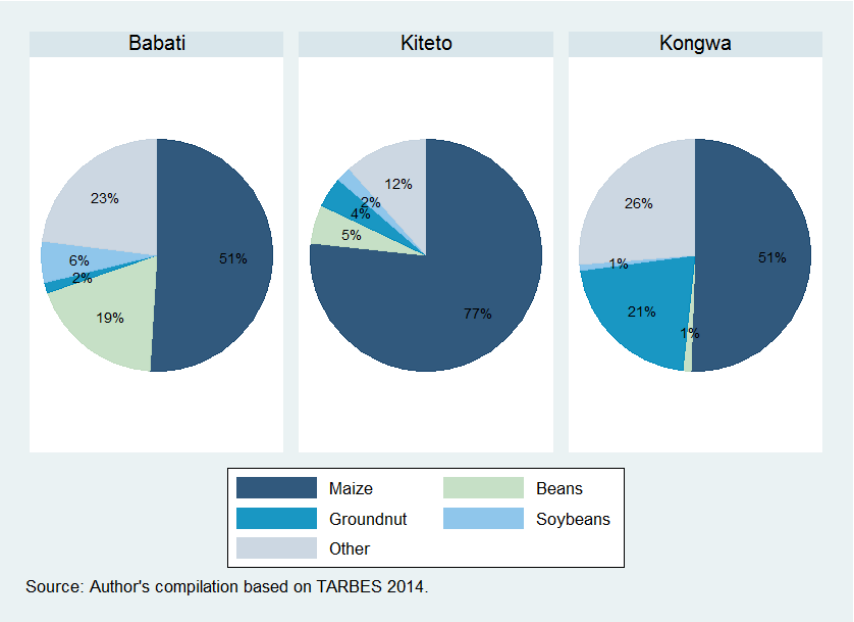
	Summary statistics				Group means	
Item	Num.	Mean	Min.	Max.	Program target	Control
Land transfers						
Land obtained through family inheritance	25	0.72	0	1	0.86	0.67
Widower can inherit wife's land	23	0.52	0	1	0.33	0.59
Widow can inherit husband's land	25	0.64	0	1	0.43	0.72
Land security						
Community has Certificate of Village Lands	25	0.48	0	1	0.29	0.55
Appropriation of land for outside investors	25	0	0	0	0	0
Government set-aside as reserve land	25	0	0	0	0	0
Allocation of land for public use	25	0.04	0	1	0	0.05
Crops cultivated						
Most important crop: Maize	25	0.80	0	1	1.00	0.72
Second most important crop: Beans	25	0.24	0	1	0.14	0.28
Second most important crop: Sunflower	25	0.20	0	1	0.57	0.06
Second most important crop: Groundnut	25	0.16	0	1	n.o.	0.22
Third most important crop: Beans	25	0.20	0	1	0.29	0.17
Third most important crop: Sunflower	25	0.24	0	1	n.o.	0.33
Third most important crop: Groundnut	25	0.12	0	1	0.29	0.06

Note: Num. - number of communities, min. - minimum, max. - maximum, n.o. - no observations.
Source: Author's compilation based on TARBES 2014.

Community data confirm maize as the leading crop within the survey areas. Twenty communities list maize as the area's "mostimportant crop", including the seven program villages, and it is cultivated on 54 percent of available land, on average (see Table 46). Important differences in cultivation emerge at the district level: it is the Kiteto communities that are most heavily maize-based, with 77 percent of available land devoted to the crop, 26 percentage points higher than Babati and Kongwa (see Figure 12).

In Babati, beans are an important secondary crop, accounting for almost one fifth of the available land, while they are of minor importance in Kongwa and Kiteto. In Kongwa, on the other hand, groundnuts are the second major crop system, accounting for just over one fifth of all land under crop cultivation, while they are hardly cultivated in the other districts.

Figure 12. Proportion of cultivated land dedicated to various crops, by district



Source: Author's compilation based on TARBES 2014.

Unsurprisingly, a broad network of suppliers appears to exist in support of these maize-dependent local economies. Improved seed for maize cultivation was available in 20 communities and fetched an average of 3,300 Tanzanian shillings ("TZS") per kilogram (see Table 47). Across districts, average prices were highest in Babati (4,000 TZS) and lowest in Kongwa (2,300 TZS), and they appeared similar (3,350 TZS per kilogram) for the five communities where improved seed had to be sourced from outside communities.

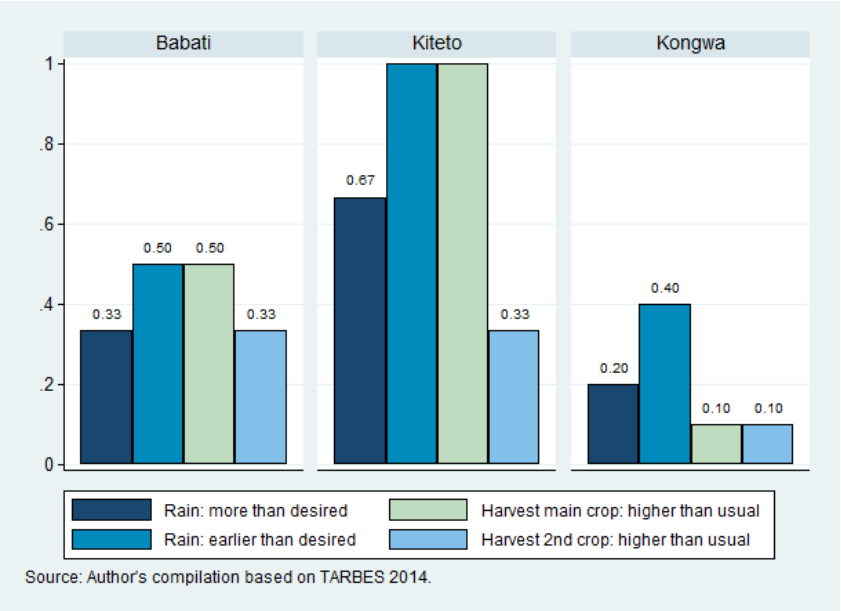
Table 47. Prices of improved maize seeds

	Summary statistics				
Item	Number of observations	Mean	Std. Dev.	Min.	Max.
Price of improved seeds when available in same community (in TZS per kg)					
Babati	11	4,032	78	4,000	4,250
Kiteto	3	2,667	1,607	1,500	4,500
Kongwa	6	2,333	1,402	1,000	4,500
OVERALL	20	3,318	1,209	1,000	4,500
Price of improved seeds when not available in same community (in TZS per kg)					
OVERALL	5	3,350	1,025	2,000	4,250

Note: Std. dev. - standard deviation, min. - minimum, max. - maximum.
Source: Author's compilation based on TARBES 2014.

Overall, in terms of cropping conditions, respondents from one of every three communities felt that the previous season's rainfall was more than desired. By district, assessments of excessive rain occurred in a minority of communities in Babati (33 percent) and Kongwa (20 percent), but not so for Kiteto's three surveyed communities, where it was reported in both Dosidos and Makame (see Figure 13). Approximately 40 percent of control villages also reported excessive rain, almost three times the proportion reported among program villages (see Figure 14). Further, while overall approximately half of all communities report that these rains came earlier than desired, district-level data make clear that this was the case uniformly across Kiteto, for precisely half of Babati's twelve communities, and for two-fifths of Kongwa's ten communities; by group, early rains affected more than twice as many control villages as program villages.

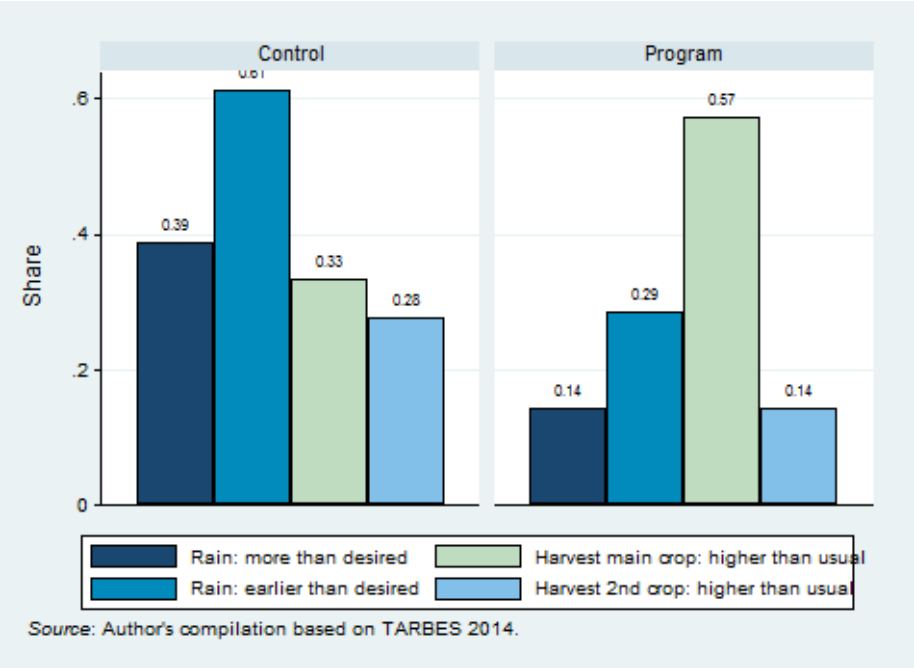
Figure 13. Assessment of last season's rain and harvest, by district



Source: Author's compilation based on TARBES 2014.

Asked to give an overall assessment of agricultural outcomes, community leaders were, in the main, modest in their assessments of harvest from the most recent season. In Kongwa, in particular, the harvest of both the main crop and the second most important crop was higher than usual in only 10 percent of communities (see Figure 13). For both Babati and Kiteto, outcomes were better for the main crop than for the second most important crop: all three Kiteto communities experienced an above average harvest for the main crop (mostly maize), and half of Babati communities did; in both districts one third of communities also experienced a good season for their second most important crop (typically beans, groundnuts, or sunflower). And, among communities targeted by AR, harvest was higher than usual in four of seven villages (for the main crop) compared with one of every three control villages (see Figure 14).

Figure 14. Assessment of last season's rain and harvest, by village type



Source: Author's compilation based on TARBES 2014.

5.5 Shocks

In the cropping season prior to the survey, some communities faced a series of shocks (see Table 48, column 1). Most prevalent among them were price shocks – increases in food prices (in 12 communities) and increases in crop input prices (11 communities). While a fall in crop sale prices was among the less prevalent shocks overall (5 communities), it did affect one third of communities in Babati (see Figure 15). Inclement weather was another prevalent shock, with droughts or floods affecting nine communities (storms, however, affected only one community) (see Table 48). Among these most prevalent shocks, Kiteto and Babati communities were most affected by food-price and crop input-price increases (two out of three for Kiteto and 42 percent for Babati), while Kongwa communities were worst hit by droughts or floods (60 percent of communities) (see Figure 15). Also, four in seven AR program villages were affected by increases in the price of food and crop inputs, a higher proportion than in control villages where these – along with droughts or floods – likewise constituted the leading shocks (see Figure 16).

Among the less prevalent shocks, we can observe important differences between districts as well: one third of Babati communities were affected by fire, but none in the other districts. One quarter of Babati communities suffered from theft, vandalism or robberies, but only one community elsewhere. Political, tribal, or farmers' livestock conflicts on the other hand – also among the less important shocks overall (five communities) – affected 40 percent of communities in Kongwa. Furthermore, livestock and crop disease (one and four communities, respectively) were less prevalent, and none suffered loss of land or mentioned other, unlisted shocks.

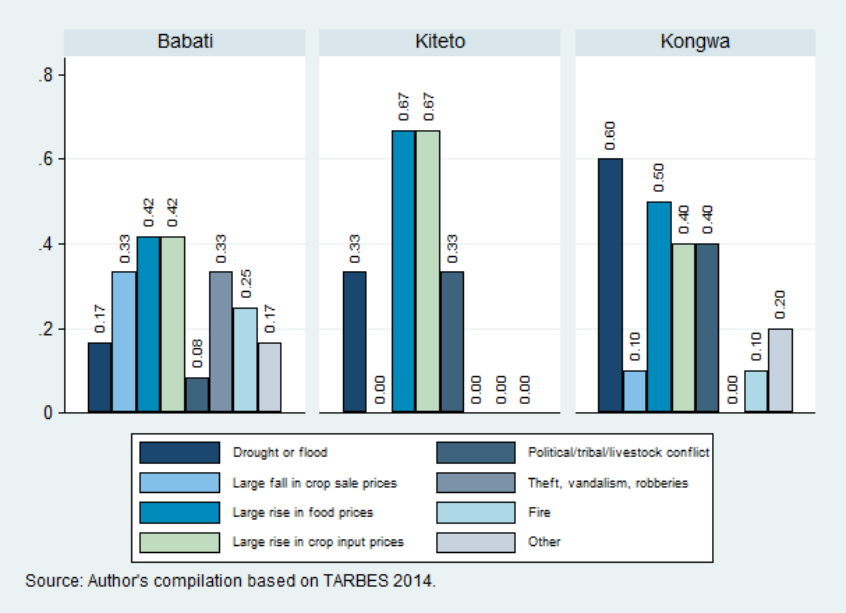
Table 48. Number of villages affected by various shocks and shock incidence

Shocks	No. of villages affected	Summary statistics: proportion of community affected			
		Mean	Standard deviation	Min.	Max.
Large rise in food prices	12	60.8	27.5	5	100
Large rise in crop input prices	11	72.7	26.6	10	100
Drought or flood	9	56.1	26.8	25	100
Political, tribal, and farmers' livestock conflict	6	16.2	12.6	2	33
Large fall in crop sale prices	5	73.0	39.3	5	100
Crop disease or pest	4	38.3	31.1	3	75
Theft, vandalism, robberies	4	3.0	2.7	1	7
Fire	4	3.0	1.6	1	5
Strong winds/storm	1	5.0	n.a.	5	5
Livestock disease	1	8.0	n.a.	8	8
Loss of land	0	--	--	--	--
Other	0	--	--	--	--

Note: Summary statistics are among villages affected by the shock, i.e., the latter variable corresponds to the number of observations. Min. - minimum, max. - maximimum, -- - no data.

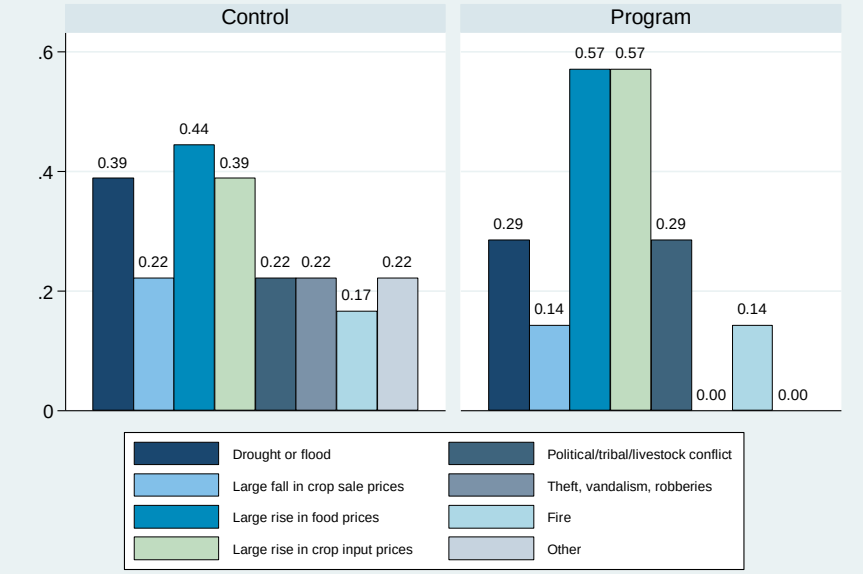
Source: Author's compilation based on TARBES 2014.

Figure 15. Share of communities facing various shocks, by district



Source: Author's compilation based on TARBES 2014.

Figure 16. Share of communities facing various shocks, by village type



Source: Author's compilation based on TARBES 2014.

Comparing individual communities, Shaurimoyo in Babati District appeared a special case, being worst hit overall with nine of eleven listed shocks (see Appendix, Table A12); the next most affected communities were Haysum, Matufa, Njoge and Njoro, each buffeted by four shocks. Four communities escaped all listed shocks during this period: Seloto, Dudie, Mer, and Leganga, suggesting more propitious conditions for agricultural operations than in other surveyed communities.

In terms of incidence, all types of price shocks as well as droughts or floods affected by far the largest number of people in the communities experiencing the shock, on average 73 percent of households for input price increases as well as crop price drops (see Table 48). Food price increases and droughts or floods affected on average 61 percent and 56 percent respectively of households in the affected communities. However, the shock incidence varies considerably between affected communities: from as little as five percent (the case of food price increase in Gidngwar) or 10 percent of households in the community (the case of input price increase in Mlali-Iyegu) to as much as 100 percent of households in the community (the cases of food price increase and drought or flood in Laikala and input price increase in Gidngwar and Njoge) could be affected by the shock (see Appendix, Table A12). The only other village-wide shock – in the sense of affecting all households in the community – was a fall in crop sale prices in Gidas and Matufa (see Appendix, Table A12).

5.6 Food item prices

For grains and flours, rice averaged 1,720 TZS per kilogram (range: maximum, 2,500 TZS in Makame, minimum, 1,500 TZs in nine other communities), green maize was 258 TZS per piece (maximum, 500 TZS in Long, low of 100 TZS in Shaurimoyo), maize grain was 8,250 TZS per bucket (12,000 TZS in

Makame, 6,000 TZS in five communities), and millet and sorghum grain 9,333 TZS per bucket (maximum, 14,000 TZS in Long, minimum, 6,000 TZS in Sabilo) (see Table 49). Bread cost 1,450 TZS per unit. At the district level, rice averaged about the same in Babati and Kongwa (1,675 TZS and 1,710 TZS), but was elevated in Kiteto (1,933 TZS), and a similar pattern was observed for green maize. And, across village types, rice was 12 percent cheaper in AR program villages than in control villages while most other grains traded at price differentials of five to seven percent.

Table 49. Grain prices, by district and village type

			Summary statistics				
Prices (in TZS)			Number of communities	Mean	Standard deviation	Min.	Max.
Rice (per kg)		Overall	25	1,720	266	1,500	2,500
	District	Babati	12	1,675	201	1,500	2,200
		Kiteto	3	1,933	513	1,500	2,500
		Kongwa	10	1,710	251	1,500	2,000
	Group	Program	7	1,571	111	1,500	1,800
		Control	18	1,778	288	1,500	2,500
Green maize (per piece)		Overall	18	258	88	100	500
	District	Babati	10	255	112	100	500
		Kiteto	1	300		300	300
		Kongwa	7	257	53	200	300
	Group	Program	5	300	122	200	500
		Control	13	242	70	100	300
Maize grain (per bucket)		Overall	20	8,250	1,773	6,000	12,000
	District	Babati	10	7,000	1,333	6,000	10,000
		Kiteto	2	10,000	2,828	8,000	12,000
		Kongwa	8	9,375	744	8,000	10,000
	Group	Program	5	7,800	1,483	6,000	10,000
		Control	15	8,400	1,882	6,000	12,000
Millet/sorghum (per bucket)		Overall	9	9,333	2,291	6,000	14,000
	District	Babati	4	9,500	3,416	6,000	14,000
		Kiteto	0				
		Kongwa	5	9,200	1,304	7,000	10,000
	Group	Program	3	9,000	4,359	6,000	14,000
		Control	6	9,500	837	8,000	10,000
Bread (per unit)		Overall	9	1,450	641	350	2,200
	District	Babati	6	1,425	745	350	2,200
		Kiteto	0				
		Kongwa	3	1,500	500	1,000	2,000
	Group	Program	4	1,500	597	1,000	2,000
		Control	5	1,410	754	350	2,200

Note: Min. - minimum, max. - maximum.

Source: Author's compilation based on TARBES 2014.

Sugar cost 2,076 TZS per kg, and this price traded within a narrow band of 2,000 TZS and 2,500 TZS across all communities (highest in Makame, Makawa, and Mer), resulting in low variability at district level. Sugarcane by the piece cost just under 500 TZS on average, but consumers in Kiteto's sole

reporting community of Dosidos paid twice this amount (see Table A13). Among root vegetables and tubers, fresh cassava fetched 1,388 TZS by the heap on the open market, with a high and low, respectively, of 5,000 TZS in Vihingo and 500 TZS in Matufa. At the district level, Kongwa had the highest prices for fresh cassava, 1,500 TZS per heap. Sweet potatoes cost 6,777 TZS per bucket, on average, and was highest in Babati District at 7,333 TZS per bucket. With respect to pulses and nuts, beans cost the average householder 1,720 TZS per kilogram, while lentils sold for just under 1,500 TZS per kilogram. At the district level, while Babati's consumers faced the lowest average prices for beans (1,570 TZS), they paid the most for lentils (1,750 TZS per kilogram). Shelled groundnuts cost approximately 5,200 TZS per bucket, while unshelled groundnuts cost 2,200 TZS per kilogram; prices for groundnuts were highest in Babati. Of this group of crops, and except for sugarcane by the piece, prices were lower (or equal, in the case of beans) in program villages than in control villages.

Fruit and vegetable prices were similar throughout the survey communities: oranges, mangoes, avocadoes, onions, tomatoes, carrots, green peppers, and eggplant all within the 100 TZS to 325 TZS range (per selling unit) on average, with no significant differences at district-level (see Appendix, Table A14). As an exception, cabbage cost 908 TZS per head. Except for carrots, fruit and vegetables cost more in program villages than in control villages.

For meats and poultry, chicken was most widely available and also greatly varied in price across communities. On average, chickens cost 7,521 TZS per piece (high: 12,000 TZS in Sabilo, low 3,000 TZS in Makame), with district-level prices of just under 8,000 TZS in Babati and Kongwa, and far cheaper in Kiteto, at 5,700 TZS (see Table 50). Goat and beef each cost slightly more than 5,000 TZS per kilogram, followed by pork at 4,900 TZS per kilogram. Meat and poultry prices were uniformly higher in program villages than in control villages.

Among the remaining items for which prices were collected, fresh milk sold for 905 TZS per liter (range: 300 TZS in Laikala to 1200 TZS in Moleti), cooking oil cost 3,200 TZS per liter, tea fetched 330 TZS per gram, and non-alcoholic drinks (in bottles or cans) cost 709 TZS for each unit (see Appendix, Table A15). Finally, alcoholic drinks were available at a significant discount for local brews versus their non-local counterparts: 445 TZS per liter for local brew versus 2,067 TZS per bottle for bottled beer, on average. And, for this final set of food items, no discernible pattern in price differentials between program and control villages could be detected in the data.

Table 50. Meat and poultry prices, by district and village type

Prices (in TZS)			Summary statistics				
			Number of comunities	Mean	Standard deviation	Min.	Max.
Goat (per kg)		Overall	22	5,455	510	5,000	6,000
	District	Babati	11	5,182	405	5,000	6,000
		Kiteto	2	6,000	-	6,000	6,000
		Kongwa	9	5,667	500	5,000	6,000
	Group	Program	7	5,571	534	5,000	6,000
		Control	15	5,400	507	5,000	6,000
Beef (per kg)		Overall	22	5,182	501	5,000	7,000
	District	Babati	11	5,182	603	5,000	7,000
		Kiteto	2	5,500	707	5,000	6,000
		Kongwa	9	5,111	333	5,000	6,000
	Group	Program	7	5,429	787	5,000	7,000
		Control	15	5,067	258	5,000	6,000
Pork (per kg)		Overall	19	4,868	467	4,000	6,000
	District	Babati	10	4,700	483	4,000	5,000
		Kiteto	0				
		Kongwa	9	5,056	391	4,500	6,000
	Group	Program	6	5,000	-	5,000	5,000
		Control	13	4,808	560	4,000	6,000
Chicken (per piece)		Overall	23	7,522	1,974	3,000	12,000
	District	Babati	10	7,900	2,132	6,000	12,000
		Kiteto	3	5,667	2,517	3,000	8,000
		Kongwa	10	7,700	1,494	5,000	10,000
	Group	Program	6	9,167	1,835	7,000	12,000
		Control	17	6,941	1,713	3,000	10,000

Note: Min. - minimum, max. - maximum.

Source: Author's compilation based on TARBES 2014.

6 Comparability of sample groups

A final question surrounds the extent to which, for current assessment of targeting effectiveness and future project and policy evaluation purposes, specific sampled groups are similar with respect to observable baseline characteristics, and hence may potentially serve as comparison groups for each other. To make this determination, this section integrates and summarizes the evidence on group differences presented in the previous analytical sections.

As previously documented, at the household level the baseline survey comprises four distinct groups: (1) general Africa RISING beneficiaries, (2) Africa RISING beneficiaries inducted into an input-provision experiment in Babati District in late 2013, (3) indirect beneficiaries included with the purpose of assessing within-village spillover, and (4) non-beneficiaries included to potentially serve as a control group for beneficiaries. And at the community level there are two groups: (1) program villages in which AR was operational at survey date and (2) control villages chosen as comparators and potential program inductees. In the following, we conduct a review of the top-level group sample means for the set of household and community characteristics presented in this report and discuss whether the groups are significantly different from each other. In addition, we compare sample means for the two sub-groups into which participants in the experimental group ((2) above) were randomized: input coupon recipients and non-recipients.

Taking the village-level question first, we have seen that program villages differed from control villages in a number of ways. Program villages are larger, have more access to – and so are more reliant on – piped water, and devote a higher proportion of cultivable land to individual cultivation. And in these villages maize is universally the main crop. Cropping conditions were also more favorable in these areas, with milder and more well-timed rains affecting the most recent season and a higher harvest emanating therefrom. Adversely, program villages were more subject to food and input price *increases* than control villages. In terms of price *levels*, no consistent pattern was detected in the data: among grains and tubers, rice and sweet potato, respectively, were cheaper in program villages, while for meat and fruit, chicken and oranges were more expensive, on average. And, in terms of access to extensive services and the use of networks, both groups of villages were underserved by formal and semi-formal systems tasked with transmitting technical knowledge. Thus while the program is certainly well-placed to work with farmers already engaged in (primarily) maize-based agricultural systems and in need of technical support, on the village-level evidence alone it is not possible to draw a firm conclusion whether Africa RISING's original targeting was well specified.[19]

Turning to the household-level data, the evidence is less circumspect. With respect to the two sub-groups of the experimental group, as Appendix Table A16 reports (group means in the second data column, sub-group averages in the fifth and sixth data columns, significance of the difference between sub-group means in the thirteenth data column), the randomization seems to have been

[19] Caution is further warranted because of the small number of observations (maximum: 25), which makes detection of additional village-level significant differences – if they actually exist – difficult.

successful: these two sub-groups prove to be broadly similar in terms of household demographics, health expenditure and use of facilities, anthropometric outcomes of women and children, household assets and dwelling characteristics, agricultural practices and output, household consumption, and household vulnerability. This suggests that these groups should be maintained as research participants through the end of the program.

In contrast, none of the two-way comparisons between the four groups discussed above presents evidence of well-matched groups at baseline for the purposes of evaluation. The group of Africa RISING beneficiaries (1) differs from the group of experimental counterparts (2) by having a larger household size, an older head, a higher rate of marriage likelihood, and more followers of the Muslim faith (see Appendix, Table A16; the first two data columns for the means and the seventh for the significance of the difference). In addition, these beneficiaries own more household and farm assets (both equipment and livestock) and use stone and cement – and less mud – at higher rates in home construction. They also farm a larger acreage and spend more days in farming the main crop, maize, than their experimental peers. Not surprisingly, they are also able to generate more sales of this important crop. From the perspective of knowledge and networking, they are more likely to receive technical advice from a farmers' research group and to participate in these groups and in civic organizations, and their knowledge of the harmful effects of Aflatoxin was more widespread. And, overall, they enjoy higher consumption levels. All these differences are statistically significant. Therefore, while the experiment seems internally valid (see previous paragraph), it will be hard to extrapolate its findings to the general group of Africa RISING beneficiaries.

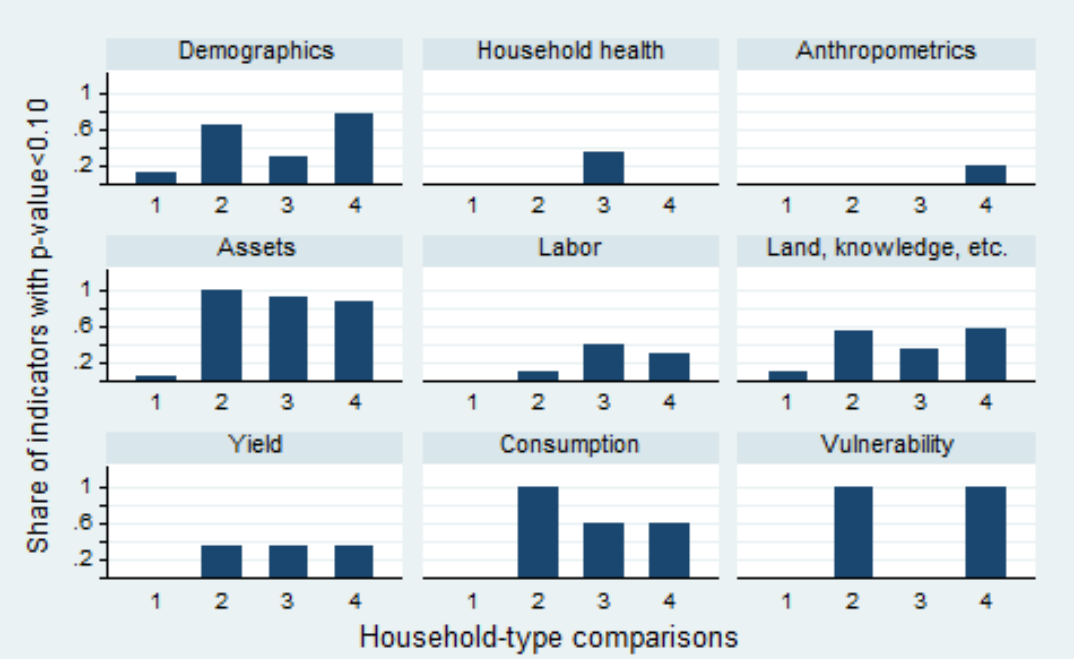
A similar evaluative challenge arises from a review of baseline characteristics of households that were selected expressly to serve as controls (group (4)) and of their Africa RISING counterparts (groups (1) and (2)). Comparing this control group to either the more generic group of beneficiaries (1) or to the experimental group (2) reveals a large number of significant differences along key dimensions (see first, second, fourth, ninth, and eleventh data columns in Appendix, Table A16). To begin with, farmers in the control group are less educated and literate: the fraction of control group household heads with no education is 0.39, which is 23 percentage points higher than within any group of beneficiary heads. Their homes are also more rudimentary and they own less modern appliances in the home and equipment and livestock on the farm. For example, the use of mud as a main material for walls and floors is between 6 percentage points and 20 percentage points higher in this group, while ownership of modern wood beds, mobile phones, cutlasses, shovels, ox-ploughs, draught cattle, and local cows is between 10 percentage points and 35 percentage points lower.

In terms of sustainable practices, farmers in group (4) are about half as likely to practice crop rotation and one-third to one-half as likely to use on-farm-generated feed for small and large ruminants as farmers in groups (1) and (2). At the same time, they are more than twice as likely to use saved seed for maize cultivation as their beneficiary peers. They farm a smaller acreage (by almost three acres) than original Africa RISING famers, though this was twice as large as farmers in the experimental group, and their main parcel is farther away from the home. And, compared to their beneficiary

peers, they practice agriculture with almost no technical advice from extension agents or research group representatives. Predictably, and most harmfully, their economic outcomes suggest an elevated state of vulnerability: they achieve the lowest yields of all groups, at 584 kg/a for maize (at most, half the yield of others), they consume the least (between 20 percent and 50 percent less), and they are more than two and a half times as likely to experience food worry and food insecurity. Empirically, therefore, on none of these dimensions can this group be considered a good evaluative set of households for Africa RISING beneficiaries.

To summarize this household-level evidence, Figure 17 presents, for each of these two-way comparisons, the share of indicators – grouped broadly by subject area – with statistically significant differences in means. For example, for the set of demographic indicators including age, education and religion the control group differs most clearly from both the AR and experiment groups (comparisons shown in categories labeled (2) and (4), respectively), while few differences exist between the AR and experiment groups as a whole (category (3)) or between experiment's subgroups of coupon- and non-coupon recipients (category (1)).[20]

Figure 17. Household-type differences, by indicator groupings



Note: 1 Coupon v. no-coupon (i.e., the experiment group (see text for details)), 2 AR v. control, 3 AR v. experiment, 4 Experiment v. control.
Source: Author's compilation based on TARBES 2014.

[20] As a test of sensitivity, similar graphs at other – more stringent – conventional significance levels of 5% and 1% were generated and are available upon request; the results remained largely unchanged.

7 Conclusion

Prior to TARBES 2014, Africa RISING's implementation in Tanzania suffered for lack of a systematic, area-wide description of agricultural production systems among its originally chosen communities of operation. By this lack, early-stage research interventions – naturally designed to reflect local conditions and problems – also may have failed to capture area- and system-wide features and commonalities that could be used to promote deeper research integration. Further, the program's monitoring capability was hampered by lack of appropriate baseline indicators from which ongoing changes in key outcomes could be periodically measured. And efforts to analyze program effectiveness and impact could not be guaranteed without the ability to identify and closely track program participants. In fulfilling one of its central mandates, TARBES 2014 was conceptualized, designed, and implemented by IFPRI to address these concerns and to fill these data and analysis gaps.

This report, based on an analysis of this new dataset, therefore fulfils several key goals of the program and of its monitoring and evaluation partner, IFPRI. First, it closes the data gap that resulted from an absence of unit-level (household and community) information on the program's preselected areas of operation. Ideally taken prior to program implementation, this second-best quasi-baseline information set permits characterizing production systems, socioeconomic challenges, and household decisionmaking. It also partially remedies the implementation-before-information anomaly that, up to early 2014, was a feature of the program. In addition these data and related findings may also serve as an input into the emerging monitoring and evaluation information system, including online project mapping tools, being developed by IFPRI. And, finally, these results may promote new or appropriately adjusted research directions as different project-level iterations of the program are developed annually by project scientists and researchers. As a bonus, TARBES 2014 also represents a new east African dataset that can serve to shed light on area-appropriate research questions posed by future data users.

On the evidence presented in this report, three main conclusions can be drawn. The first relates to the overall targeting of communities and households by the Africa RISING program. At the village level, while the top-level evidence shows that the program's focus and objectives are aligned with conditions in the initially selected set of operational villages, it is inconclusive on the question of program expansion to a broader set of villages. Selection of comparator (and potential inductee) villages was carried out without the benefit of unit-level data for matching purposes and instead relied on the knowledge and advice of local-area extensionists and officials. In contrast, for the purposes of future program and project evaluation, the evidence from household-level data is more clear cut: group comparability is assured only within the experimental cohort (that is, for the two sub-groups of coupon and non-coupon households), but is not supported for any other two-way cohort comparisons. For program impact research, therefore, this means that the experimental group should be followed throughout the progam's life but that future findings based on this experiment ought not to be generalized to all Africa RISING beneficiaries.

The second major conclusion is that, to achieve maximum impact, Africa RISING must attempt to go beyond relatively well-resourced areas and farmers to reach poorer households and households headed by women where risks of production and consumption are higher and less easily faced. In the case of women, such a focus promises other benefits, as their social network participation – a possibly underused channel for agricultural technology dissemination – is higher. Women can also be encouraged to serve as model farmers, thereby providing a local-area link between the average farmer and the (under-accessed) formal system of extension. Of course, a heightened focus on improving the reach of, and access to, this formal system should also be encouraged; at the least, Africa RISING should ensure that village authorities are made aware that their assessments of the usefulness of the system are not matched by those of the average farmer. And, other things equal, providing poorer households with enhanced technical support and modern inputs should also result in higher returns.

The third and final conclusion follows from this and points to the possibilities for research adaptation to both match the area-level heterogeneity revealed by the data and to search for and exploit program-wide commonalities for deeper research integration. On the former, as one example, since it is clear that other crops besides maize are used to support livelihoods in these communities, they too deserve foregrounding. On the latter, a cross-program lens highlights the problem of low willingness to try new techniques: only one out of every ten farmers are so minded. An urgent priority, therefore, is for all researchers to more deeply probe the mechanisms restraining technology adoption and to design new interventions to ameliorate them.

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Appendix

Table A1. Tanzania Africa RISING Baseline Evaluation Survey (TARBES) sample, by type, district and village

	Households						Individuals					
Village	AR	Coup.	Non-coup.	Ind. bene.	Cont.	Total	AR	Coup.	Non-coup.	Ind. bene.	Cont.	Total
(Babati District)	90	186	142	45	135	598	677	1,232	908	271	786	3,874
Dudie	--	--	--	--	15	15	--	--	--	--	73	73
Gidngwar	--	--	--	--	15	15	--	--	--	--	117	117
Gidewari	--	--	--	--	15	15	--	--	--	--	86	86
Gidas	--	--	--	--	15	15	--	--	--	--	87	87
Hallu	--	--	--	--	15	15	--	--	--	--	94	94
Haysum	--	--	--	--	15	15	--	--	--	--	84	84
Long	22	41	32	15	--	110	160	283	202	86	--	731
Mer	--	--	--	--	15	15	--	--	--	--	81	81
Matufa	--	--	--	--	15	15	--	--	--	--	84	84
Sabilo	23	64	53	15	--	155	186	439	373	92	--	1,090
Seloto	45	81	57	15	--	198	331	510	333	93	--	1,267
Shaurimoyo	--	--	--	--	15	15	--	--	--	--	80	80
(Kiteto District)	3	0	0	15	30	48	22	0	0	92	157	271
Dosidos	--	--	--	--	15	15	--	--	--	--	64	64
Njoro	3	0	0	15	--	18	22	--	--	92	--	114
Makame	--	--	--	--	15	15	--	--	--	--	93	93
(Kongwa District)	14	0	0	45	105	164	104	0	0	280	580	964
Chitego	1	0	0	15	--	16	6	--	--	65	--	71
Leganga	--	--	--	--	15	15	--	--	--	--	81	81
Laikala	--	--	--	--	15	15	--	--	--	--	96	96
Mlali-Iyegu	6	0	0	15	--	21	42	--	--	101	--	143
Moleti	7	0	0	15	--	22	56	--	--	114	--	170
Mautiya	--	--	--	--	15	15	--	--	--	--	99	99
Makawa	--	--	--	--	15	15	--	--	--	--	73	73
Ngutoto	--	--	--	--	15	15	--	--	--	--	75	75
Njoge	--	--	--	--	15	15	--	--	--	--	68	68
Vihingo	--	--	--	--	15	15	--	--	--	--	88	88
Total	107	186	142	105	270	810	803	1,232	908	643	1,523	5,109

Note: AR - Africa RISING; Coup. and Non-coup. - coupon recipients and non-recipients, together making up the experiment group of households (see text for details); Ind. bene. - indirect beneficiary; Cont. - control.

Source: Author's compilation based on TARBES 2014.

Table A2. Home asset ownership and dwelling characteristics in more detail, Part 1

	Summary statistics				
Item	Number of households	Mean	Standard deviation	Minimum	Maximum
Dwelling characteristics					
House has mud walls	804	0.730	0.444	0	1
House has stone walls	804	0.205	0.404	0	1
House has mud floors	793	0.839	0.368	0	1
House had cement floors	793	0.155	0.362	0	1
House has metal roof	808	0.629	0.483	0	1
House has thatch roof	808	0.338	0.473	0	1
Main water source is public tap or well	809	0.654	0.476	0	1
Main water source dam, lake, river or spring	809	0.302	0.459	0	1
Water closet is public or shared latrine	807	0.934	0.248	0	1
Uses lamp (oil, kerosene) for lighting	801	0.363	0.481	0	1
Uses solar for lighting	801	0.336	0.473	0	1
Uses torchlight	801	0.266	0.442	0	1
Uses wood for cooking	806	0.968	0.177	0	1
Electric light	801	0.035	0.184	0	1
Number of rooms	809	2.934	1.258	1	9
Ownership of home goods					
Improved charcoal or wood stove	809	0.194	0.396	0	1
Kerosene stove	809	0.048	0.214	0	1
Modern wood bed	809	0.577	0.494	0	1
Sofa chair	809	0.090	0.287	0	1
Modern chair	809	0.121	0.326	0	1
Modern table	809	0.213	0.409	0	1
Modern metal bed	809	0.017	0.130	0	1
Radio	809	0.518	0.500	0	1
Television	809	0.036	0.186	0	1
Refrigerator	809	0.007	0.086	0	1
Mobile phone	809	0.789	0.409	0	1
Bicycle	809	0.546	0.498	0	1
Motorcycle	809	0.093	0.290	0	1
Car/truck	809	0.004	0.061	0	1
Solar panel	809	0.083	0.276	0	1
Wood cabinet	809	0.094	0.292	0	1
CD/DVD player	809	0.027	0.163	0	1

Source: Author's compilation based on TARBES 2014.

Table A3. Wealth index variables (continued on next page)

Item	Summary statistics				
	Number of households	Mean	Standard deviation	Minimum	Maximum
Cement wall	804	0.029	0.167	0	1
Cement floor	793	0.155	0.362	0	1
Cement roof	808	0.001	0.035	0	1
Water piped into dwelling	809	0.044	0.206	0	1
Water closet is improved type	807	0.017	0.131	0	1
Electric light	801	0.035	0.184	0	1
Improved charcoal or wood stove	809	0.194	0.396	0	1
Kerosene stove	809	0.048	0.214	0	1
Gas stove	809	0.009	0.093	0	1
Modern wood bed	809	0.577	0.494	0	1
Modern metal bed	809	0.017	0.130	0	1
Sofa chair	809	0.090	0.287	0	1
Modern chair	809	0.121	0.326	0	1
Modern table	809	0.213	0.409	0	1
Radio	809	0.518	0.500	0	1
Television	809	0.036	0.186	0	1
Electric fan	809	0.001	0.035	0	1
Refrigerator	809	0.007	0.086	0	1
Landline	809	0.000	0.000	0	0
Mobile phone	809	0.789	0.409	0	1
Bicycle	809	0.546	0.498	0	1
Motorcycle	809	0.093	0.290	0	1
Car/truck	809	0.004	0.061	0	1
Satellite dish	809	0.017	0.130	0	1
Solar panel	809	0.083	0.276	0	1
Wood cabinet	809	0.094	0.292	0	1
CD/DVD player	809	0.027	0.163	0	1
Cutlass	809	0.879	0.326	0	1
Ax	809	0.679	0.467	0	1
Sprayer	809	0.205	0.404	0	1
Sickle	809	0.221	0.415	0	1
Ox-plough	809	0.376	0.485	0	1
Yoke	809	0.286	0.452	0	1
Harrow	809	0.040	0.195	0	1
Shovel	809	0.403	0.491	0	1
Hoe	809	0.974	0.159	0	1
Winnower	809	0.376	0.485	0	1
Animal cart	809	0.234	0.423	0	1
Power tiller	809	0.001	0.035	0	1
Tractor	809	0.011	0.105	0	1
Disc plough	809	0.009	0.093	0	1
Ox-ridger	809	0.007	0.086	0	1
Ripper	809	0.015	0.121	0	1
Draught cattle	809	0.373	0.484	0	1
Local bull	809	0.168	0.374	0	1
Improved bull	809	0.020	0.139	0	1
Local fattening cattle	809	0.006	0.078	0	1

Wealth index variables (continued)

Item	Summary statistics				
	Number of households	Mean	Standard deviation	Minimum	Maximum
Improved fattening cattle	809	0.000	0.000	0	0
Local cow	809	0.507	0.500	0	1
Improved cow	809	0.084	0.278	0	1
Local heifer	809	0.101	0.302	0	1
Improved heifer	809	0.014	0.116	0	1
Local calf	809	0.331	0.471	0	1
Improved calf	809	0.035	0.183	0	1
Horse/donkey/mule	809	0.080	0.272	0	1
Local goat	809	0.522	0.500	0	1
Improved goat	809	0.031	0.173	0	1
Sheep	809	0.344	0.475	0	1
Local pig	809	0.112	0.316	0	1
Improved pig	809	0.015	0.121	0	1
Chicken	809	0.700	0.459	0	1
Fish	809	0.000	0.000	0	0
Other livestock	809	0.007	0.086	0	1
Honey bees	809	0.021	0.144	0	1

Source: Author's compilation based on TARBES 2014.

Table A4. Agricultural inputs and technology in more detail, Part 1

	Summary statistics				
	Number of households	Mean	Standard deviation	Minimum	Maximum
Labor (general)					
Total months worked	786	9.6	2.9	1	12
Worked in agriculture	800	0.973	0.164	0	1
Worked in non-farm business	800	0.413	0.493	0	1
Labor (person days spent)					
Beans	490	38.5	45.9	4	541
Groundnut	64	33.1	27.7	4	133
Irish potato	70	35.4	44.1	5	331
Maize	781	54.3	67.4	4	645
Pigeon pea	362	39.2	49.5	4	446
Sorghum	86	34.2	38.8	4	221
Sunflower	183	39.4	41.6	4	285
Land					
Number of parcels	810	2.1	1.2	1	11
Number of plots	806	2.2	1.3	1	13
Area farmed (acres)	810	6.0	13.7	…	300
Owns land	810	0.916	0.277	0	1
Less than 30 minutes to main parcel	801	0.844	0.363	0	1

Note: … - less than .0001.

Source: Author's compilation based on TARBES 2014.

Table A5. Agricultural inputs and technology in more detail, Part 2

Item	Full sample				
	Number of households	Mean	Standard deviation	Minimum	Maximum
Sustainability					
Practices crop rotation	806	0.158	0.365	0	1
Uses manure every year/most years	410	0.856	0.351	0	1
Uses manure generated on-farm	410	0.502	0.501	0	1
Used saved seed: Beans	493	0.917	0.276	0	1
Used saved seed: Groundnut	64	0.875	0.333	0	1
Used saved seed: Irish potato	74	0.946	0.228	0	1
Used saved seed: Maize	783	0.434	0.496	0	1
Used saved seed: Pigeon pea	362	0.925	0.263	0	1
Used saved seed: Sorghum	86	0.849	0.360	0	1
Used saved seed: Sunflower	171	0.871	0.336	0	1
Used on-farm feed: Large ruminants	539	0.115	0.319	0	1
Used on-farm feed: Small ruminants	490	0.108	0.311	0	1
Used on-farm feed: Monogastrics	590	0.129	0.335	0	1
Storage					
Months to exhaustion: Beans	163	4.2	2.7	0	11
Months to exhaustion: Groundnut	37	4.3	2.9	0	10
Months to exhaustion: Irish potato	36	2.6	1.7	0	8
Months to exhaustion: Maize	305	3.8	2.9	0	12
Months to exhaustion: Pigeon pea	167	4.0	2.8	0	10
Months to exhaustion: Sorghum	45	4.4	3.0	0	11
Months to exhaustion: Sunflower	26	4.8	2.6	1	10

Source: Author's compilation based on TARBES 2014.

Table A6. Agricultural inputs and technology in more detail, Part 3

	Full sample				
Item	Number of households	Mean	Standard deviation	Minimum	Maximum
Ownership of farm goods					
Cutlass	809	0.879	0.326	0	1
Ax	809	0.679	0.467	0	1
Sprayer	809	0.205	0.404	0	1
Sickle	809	0.221	0.415	0	1
Ox-plough	809	0.376	0.485	0	1
Yoke	809	0.286	0.452	0	1
Harrow	809	0.040	0.195	0	1
Shovel	809	0.403	0.491	0	1
Hoe	809	0.974	0.159	0	1
Winnower	809	0.376	0.485	0	1
Animal cart	809	0.234	0.423	0	1
Number of farm goods					
Cutlass	809	1.43	1.04	0	10
Ax	809	0.81	0.68	0	5
Sprayer	809	0.23	0.50	0	6
Sickle	809	0.31	0.67	0	5
Ox-plough	809	0.45	0.66	0	4
Yoke	809	0.54	1.06	0	10
Harrow	809	0.04	0.22	0	2
Shovel	809	0.51	0.71	0	4
Hoe	809	3.67	2.16	0	27
Winnower	809	0.48	0.72	0	4
Animal cart	809	0.24	0.44	0	2

Source: Author's compilation based on TARBES 2014.

Table A7. Agricultural inputs and technology in more detail, Part 4

Item	Full sample				
	Number of households	Mean	Standard deviation	Minimum	Maximum
Ownership of livestock					
Draught cattle	809	0.373	0.484	0	1
Local bull	809	0.168	0.374	0	1
Improved bull	809	0.020	0.139	0	1
Local cow	809	0.507	0.500	0	1
Improved cow	809	0.084	0.278	0	1
Local heifer	809	0.101	0.302	0	1
Improved heifer	809	0.014	0.116	0	1
Local calf	809	0.331	0.471	0	1
Improved calf	809	0.035	0.183	0	1
Horse/donkey/mule	809	0.080	0.272	0	1
Local goat	809	0.522	0.500	0	1
Improved goat	809	0.031	0.173	0	1
Sheep	809	0.344	0.475	0	1
Local pig	809	0.112	0.316	0	1
Improved pig	809	0.015	0.121	0	1
Chicken	809	0.700	0.459	0	1
Honey bees	809	0.021	0.144	0	1
Number of livestock					
Draught cattle	809	1.45	2.23	0	16
Local bull	809	0.59	2.03	0	30
Improved bull	809	0.03	0.23	0	3
Local cow	809	2.01	5.77	0	100
Improved cow	809	0.14	0.54	0	5
Local heifer	809	0.48	3.36	0	80
Improved heifer	809	0.01	0.13	0	2
Local calf	809	1.19	5.13	0	100
Improved calf	809	0.06	0.35	0	4
Horse/donkey/mule	809	0.21	0.89	0	10
Local goat	809	4.31	11.01	0	200
Improved goat	809	0.09	0.75	0	18
Sheep	809	1.88	4.70	0	70
Local pig	809	0.23	0.88	0	14
Improved pig	809	0.07	0.67	0	13
Chicken	809	5.05	6.74	0	94
Honey bees	809	0.33	3.82	0	80

Source: Author's compilation based on TARBES 2014.

Table A8. Agricultural output in more detail

	Full sample				
Item	Number of households	Mean	Standard deviation	Minimum	Maximum
Number of crops	803	2.77	0.95	1	7
Cultivation (acres)					
Beans	305	0.62	0.64	0.05	6.10
Groundnut	63	1.77	1.73	0.25	11.00
Irish potato	74	1.27	1.52	0.02	8.50
Maize	771	3.00	5.36	0.13	80.00
Pigeon pea	353	1.10	2.80	0.10	50.00
Sorghum	83	2.19	2.76	0.10	18.00
Harvest (kilograms)					
Beans	305	103.5	127.8	2.0	1,300.0
Groundnut	63	378.4	434.5	2.0	1,848.8
Irish potato	74	1,752.1	2,261.9	60.0	14,821.2
Maize	771	1,968.0	2,944.2	2.0	44,505.9
Pigeon pea	353	362.2	525.1	5.0	5,619.4
Sorghum	83	450.2	479.1	20.0	2,808.0
Yield (kilogram per acre)					
Beans	305	226.1	196.4	5.0	1,111.1
Groundnut	63	254.2	299.1	2.0	1,417.4
Irish potato	73	1,534.3	1,330.9	248.4	8640
Maize	771	959.6	866.3	3.3	10,444.4
Pigeon pea	353	425.7	343.4	8.0	1,910.6
Sorghum	83	434.7	506.2	26.7	2,246.4
Sales (kilograms)					
Beans	99	145.4	208.3	20.0	1,430.0
Groundnut	33	402.8	372.9	6.0	1,602.3
Irish potato	69	1,447.5	1,868.0	72.0	12,585.6
Maize	489	1,518.4	2,944.7	10.0	40,055.3
Pigeon pea	289	345.1	565.7	10.0	5,394.6
Sorghum	31	295.8	281.5	40.0	1,404.0

Source: Author's compilation based on TARBES 2014.

Table A9. Village, chairperson and informant characteristics, village level

	Village		Chairperson			Informants					
Village name	Population	Elevation in meters	Female	Age	Years in vill.	Number	(1)	(2)	(3)	(4)	(5)
(Babati District)	2,719	1,608		47.2	42.2	5.2					
Dudie	3,785	1,572	0	47	47	6	1	4	1	0	0
Gidas	1,650	1,597	0	40	40	6	1	3	0	1	1
Gidewari	2,922	1,583	0	45	45	5	1	3	0	1	0
Gidngwar	691	2,168	0	54	54	4	1	2	0	1	0
Hallu	580	1,264	0	46	46	5	1	3	1	0	0
Haysum	3,050	1,662	0	45	45	6	1	4	1	0	0
Long	2,525	2,195	0	47	47	5	1	4	0	0	0
Matufa	4,275	1,017	0	52	14	4	1	2	1	0	0
Mer	1,853	1,847	0	46	40	5	1	4	0	0	0
Sabilo	3,412	1,659	0	48	34	6	1	4	0	1	0
Seloto	5,488	1,709	0	58	56	5	1	3	1	0	0
Shaurimoyo	2,400	1,021	0	38	38	5	1	3	0	1	0
(Kiteto District)	5,492	1,354		46.0	35.3	3.3					
Dosidos	3,349	1,470	0	48	48	3	1	2	0	0	0
Makame	3,648	1,030	0	42	42	4	1	2	0	1	0
Njoro	9,479	1,561	0	48	16	3	1	2	0	0	0
(Kongwa District)	6,670	1,260		46.6	36.4	5.2					
Chitego	6,279	1,346	1	44	14	3	1	2	0	0	0
Laikala	6,650	1,179	0	47	47	5	1	4	0	0	0
Leganga	650	1,288	0	36	5	4	1	2	0	1	0
Makawa	7,050	1,339	0	62	62	7	1	5	1	0	0
Mautiya	10,156	1,051	0	40	40	4	1	3	0	0	0
Mlali-Iyegu	13,576	1,339	0	56	56	7	1	6	0	0	0
Moleti	6,689	1,226	0	46	46	6	1	4	0	1	0
Ngutoto	1,872	1,209	0	46	5	4	1	2	0	1	0
Njoge	7,525	1,404	0	50	50	6	1	4	1	0	0
Vihingo	6,250	1,224	0	39	39	6	1	4	1	0	0
OVERALL	4,632	1,438		46.8	39.0	5.0					

Note: Years in vill. - Years spent in village, (1) Number of chairmen, (2) Number of executive officers / devevelopment committee members, (3) Number of business persons / religious leaders, (4) Number of teachers, (5) Number of model farmers.

Source: Author's compilation based on TARBES 2014.

Table A10. Access to and dependence on water sources, village level

	Access to water source				Proportion of comm. relying on water source				
Village	Piped water	Borehole/ well	Lake/ pond/etc.	Other	Rain	Piped water	Borehole/ well	Lake/ pond/etc.	Other
(Babati District)	0.67	0.58	0.83	0.08	1	35	29	35	1
Dudie	1	1	1	0	0	50	30	20	0
Gidas°	0	1	1	0	100	0	70	30	0
Gidewari	0	1	0	0	5	0	95	0	0
Gidngwar	1	0	1	0	0	95	0	5	0
Hallu	0	0	1	0	0	0	0	100	0
Haysum	1	0	1	0	0	50	0	50	0
Long	1	1	0	0	0	5	95	0	0
Matufa	1	1	1	0	0	30	65	5	0
Mer	1	0	1	0	0	30	0	70	0
Sabilo°	1	1	1	0	0	80	25	3	0
Seloto	1	0	1	1	0	86	0	6	8
Shaurimoyo	0	1	1	0	0	0	3	97	0
(Kiteto District)	0.67	0.33	0.67	0.00	0	32	28	40	0
Dosidos	0	0	1	0	0	0	0	100	0
Makame	1	1	0	0	0	15	85	0	0
Njoro	1	0	1	0	0	80	0	20	0
(Kongwa District)	0.80	0.30	0.50	0.10	4	64	12	20	0
Chitego	1	0	0	0	0	100	0	0	0
Laikala	1	0	0	0	15	85	0	0	0
Leganga	1	0	1	0	0	50	0	50	0
Makawa°	1	0	0	0	5	100	0	0	0
Mautiya	0	1	1	0	10	0	70	20	0
Mlali-Iyegu	1	0	0	0	0	100	0	0	0
Moleti°	1	1	1	0	80	80	60	20	0
Ngutoto	1	0	1	0	0	50	0	50	0
Njoge°	1	0	0	1	0	100	0	0	100
Vihingo°	0	1	1	0	0	0	100	100	0
OVERALL	0.72	0.44	0.68	0.08	2	43	23	31	0

Note: ° Villages excluded from the district and overall averages as the sum of all the proportions of community relying on water source does not add up to 100. District rows represent averages over the villages in the district.

Source: Author's compilation based on TARBES 2014.

Table A11. Proportion of land that is cultivable and use of that land

Village	Proportion of comm. land that is cultivable	Use of community cultivable land (proportions)				
		Communal cultivation	Individual cultivation	Agro-business	Lifestock grazing	Other
(Babati District)	53.9	0.8	72.9	7.2	12.9	6.2
Dudie	22	0	54	0	0	46
Gidas	48	0	80	0	20	0
Gidewari	50	0	80	0	20	0
Gidngwar	70	0	85	0	13	2
Hallu	80	0	90	0	10	0
Haysum	48	0	50	0	30	20
Long	26	0	80	0	20	0
Matufa	75	0	40	60	0	0
Mer	40	0	70	0	30	0
Sabilo	68	6	90	0	4	0
Seloto	62	0	100	0	0	0
Shaurimoyo	58	4	56	26	8	6
(Kiteto District)	60.0	0.0	72.0	0.0	26.7	1.3
Dosidos	45	0	100	0	0	0
Makame	60	0	40	0	60	0
Njoro	75	0	76	0	20	4
(Kongwa District)	54.8	1.2	71.6	5.6	20.6	1
Chitego	70	0	70	0	30	0
Laikala	50	0	68	0	32	0
Leganga	75	0	50	20	30	0
Makawa	52	6	52	30	12	0
Mautiya	65	0	100	0	0	0
Mlali-Iyegu	44	6	80	0	8	6
Moleti	32	0	76	0	24	0
Ngutoto	60	0	70	0	30	0
Njoge	50	0	70	6	20	4
Vihingo	50	0	80	0	20	0
OVERALL	55	0.88	72.28	5.68	17.64	3.52

Note: District rows represent averages over the villages in the district.
Source: Author's compilation based on TARBES 2014.

Table A12. Number of shocks and shock incidence, village level

Village	Number	Proportion of community affected			
		Drought/ flood	Crop sale prices	Food prices	Input prices
(Babati District)	2.3	27.5	90	55	81
Dudie	0				
Gidas	3		100	70	90
Gidewari	3			95	
Gidngwar	2			5	100
Hallu	2			30	
Haysum	2				
Long	2		80		80
Matufa	4	30	100		50
Mer	0				
Sabilo	1			75	
Seloto	0				
Shaurimoyo	9	25	80		85
(Kiteto District)	2	25		55	60
Dosidos	1				60
Makame	1			60	
Njoro	4	25		50	60
(Kongwa District)	2.3	70.8	5	69	68.8
Chitego	2				75
Laikala	3	100		100	90
Leganga	0				
Makawa	2	50			
Mautiya/Mautia	1	70			
Mlali-Iyegu	3	50		50	10
Moleti	2			40	
Ngutoto	3		5		
Njoge	4	75		75	100
Vihingo	3	80		80	
OVERALL	2.28	56.1	73	60.8	72.7

Note: Empty cells indicate that the respective shock was not experienced in the community. District rows represent averages over the villages in the district.

Source: Author's compilation based on TARBES 2014.

Table A13. Sugars, tubers, and pulses prices, by district and village type (Continued on next page)

Prices (in TZS)			Summary statistics				
			Number of communities	Mean	Standard deviation	Min.	Max.
Sugar (per kg)		Overall	25	2,076	179	2,000	2500
	District	Babati	12	2,042	144	2,000	2500
		Kiteto	3	2,167	289	2,000	2500
		Kongwa	10	2,090	191	2,000	2500
	Group	Program	7	2,000	0	2,000	2000
		Control	18	2,106	204	2,000	2500
Sugar cane (per piece)		Overall	19	479	268	100	1000
	District	Babati	11	391	130	100	500
		Kiteto	1	1,000	0	1,000	1000
		Kongwa	7	543	351	100	1000
	Group	Program	5	560	261	300	1000
		Control	14	450	274	100	1000
Fresh cassava (per heap)		Overall	9	1,389	1,431	500	5000
	District	Babati	2	1,250	1,061	500	2000
		Kiteto	1	1,000	0	1,000	1000
		Kongwa	6	1,500	1,732	500	5000
	Group	Program	3	833	289	500	1000
		Control	6	1,667	1,772	500	5000
Sweet potato (per bucket)		Overall	9	6,778	2,489	3,000	12000
	District	Babati	6	7,333	2,944	3,000	12000
		Kiteto	1	6,000		6,000	6000
		Kongwa	2	5,500	707	5,000	6000
	Group	Program	4	5,000	1,414	3,000	6000
		Control	5	8,200	2,280	6,000	12000
Beans (per kg)		Overall	20	1,720	324	800	2000
	District	Babati	7	1,571	464	800	2000
		Kiteto	3	1,700	265	1,500	2000
		Kongwa	10	1,830	177	1,500	2000
	Group	Program	5	1,720	217	1,500	2000
		Control	15	1,720	507	800	2000
Lentils (per kg)		Overall	9	1,467	566	700	2500
	District	Babati	4	1,750	759	700	2500
		Kiteto	0				
		Kongwa	5	1,240	251	1,000	1500
	Group	Program	0				
		Control	9	1,467	566	700	2500

Sugars, tubers, and pulses prices, by district and village type (Continued 2/2)

Prices (in TZS)			Summary statistics				
			Number of communities	Mean	Standard deviation	Min.	Max.
Groundnuts (shelled) (per bucket)		Overall	11	5,182	1,722	3,000	10000
	District	Babati	2	7,500	3,536	5,000	10000
		Kiteto	1	5,000		5,000	5000
		Kongwa	8	4,625	744	3,000	5000
	Group	Program	2	5,000	0	5,000	5000
		Control	9	5,222	1,922	3,000	10000
Groundnuts (unshelled) (per kg)		Overall	22	2,209	345	1,500	3000
	District	Babati	11	2,336	361	2,000	3000
		Kiteto	2	2,250	354	2,000	2500
		Kongwa	9	2,044	283	1,500	2500
	Group	Program	7	2,200	480	1,500	3000
		Control	15	2,213	283	2,000	2800

Note: Min. - minimum, max. - maximum.

Source: Author's compilation based on TARBES 2014.

Table A14. Fruit and vegetable prices, by distric and village type (Continued on next page)

Prices (in TZS)			Summary statistics				
			Number of communities	Mean	Standard deviation	Min.	Max.
Oranges (per piece)		Overall	13	169	48	100	200
	District	Babati	8	163	52	100	200
		Kiteto	1	200		200	200
		Kongwa	4	175	50	100	200
	Group	Program	5	200	0	200	200
		Control	8	150	53	100	200
Mangoes (per piece)		Overall	19	174	56	100	300
	District	Babati	10	190	57	100	300
		Kiteto	1	200		200	200
		Kongwa	8	150	53	100	200
	Group	Program	6	183	75	100	300
		Control	13	169	48	100	200
Avocados (per piece)		Overall	12	279	116	100	500
	District	Babati	9	250	94	100	400
		Kiteto	0				
		Kongwa	3	367	153	200	500
	Group	Program	4	350	57	300	400
		Control	8	244	124	100	500
Onions (per heap)		Overall	12	325	136	200	500
	District	Babati	8	288	136	200	500
		Kiteto	2	400	141	300	500
		Kongwa	2	400	141	300	500
	Group	Program	3	333	153	200	500
		Control	9	322	139	200	500
Tomatoes (per heap)		Overall	11	282	117	200	500
	District	Babati	7	300	141	200	500
		Kiteto	1	200		200	200
		Kongwa	3	267	58	200	300
	Group	Program	2	350	212	200	500
		Control	9	267	100	200	500
Carrots (per piece)		Overall	6	133	82	100	300
	District	Babati	3	100	0	100	100
		Kiteto	1	100		100	100
		Kongwa	2	200	141	100	300
	Group	Program	1	100	0	100	100
		Control	5	140	89	100	300
Green peppers (per piece)		Overall	11	127	75	50	300
	District	Babati	4	150	100	100	300
		Kiteto	1	200		200	200
		Kongwa	6	100	55	50	200
	Group	Program	2	175	177	50	300
		Control	9	117	50	50	200

Fruit and vegetable prices, by distric and village type (Continued 2/2)

Prices (in TZS)			Summary statistics				
			Number of communities	Mean	Standard deviation	Min.	Max.
Eggplant (per piece)		Overall	3	283	189	150	500
	District	Babati	1	500		500	500
		Kiteto	0				
		Kongwa	2	175	35	150	200
	Group	Program	2	325	247	150	500
		Control	1	200	0	200	200
Cabbage (per piece)		Overall	13	908	366	200	1,500
	District	Babati	7	871	435	200	1,500
		Kiteto	1	1,000		1,000	1,000
		Kongwa	5	940	336	700	1,500
	Group	Program	3	1,100	360	800	1,500
		Control	10	850	366	200	1,500

Note: Min. - minimum, max. - maximum.

Source: Author's compilation based on TARBES 2014.

Table A15. Other prices, by district and village type

Prices (in TZS)			Summary statistics				
			Number of communities	Mean	Standard deviation	Min.	Max.
Fresh milk (per liter)		Overall	19	905	201	300	1,200
	District	Babati	8	913	125	700	1,000
		Kiteto	3	867	231	600	1,000
		Kongwa	8	913	270	300	1,200
	Group	Program	5	1,000	141	800	1,200
		Control	14	871	213	300	1,000
Cooking oil (per liter)		Overall	18	3,206	344	2,500	3,800
	District	Babati	8	3,225	324	3,000	3,800
		Kiteto	3	3,000	500	2,500	3,500
		Kongwa	7	3,271	320	2,700	3,500
	Group	Program	6	3,250	413	2,700	3,800
		Control	12	3,183	321	2,500	3,500
Dry tea (per gram)		Overall	15	330	204	100	600
	District	Babati	7	393	184	100	500
		Kiteto	3	533	58	500	600
		Kongwa	5	120	27	100	150
	Group	Program	3	250	218	100	500
		Control	12	350	206	100	600
Non-alcoholic drinks (per bottle/can)		Overall	21	710	145	500	1,000
	District	Babati	8	600	93	500	800
		Kiteto	3	900	173	700	1,000
		Kongwa	10	740	97	700	1,000
	Group	Program	7	657	53	600	700
		Control	14	736	169	500	1,000
Bottled beer (per bottle)		Overall	21	2,067	418	500	2,500
	District	Babati	8	2,088	181	2,000	2,500
		Kiteto	3	2,333	289	2,000	2,500
		Kongwa	10	1,970	556	500	2,500
	Group	Program	7	2,100	191	2,000	2,500
		Control	14	2,050	500	500	2,500
Local brew (per liter)		Overall	11	445	106	250	600
	District	Babati	8	425	120	250	600
		Kiteto	0				
		Kongwa	3	500	0	500	500
	Group	Program	4	400	122	250	500
		Control	7	471	95	300	600

Note: Min. - minimum, max. - maximum.

Source: Author's compilation based on TARBES 2014.

Table A16. Sample group comparability (Continued on next 3 pages)

	Group mean				Sub-group mean		Significance of differences						
Item	(1)	(2)	(3)	(4)	(5)	(6)	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)
Demographics													
Household size	7.5	6.5	6.1	5.7	6.6	6.4	***	***	***		***		
Female	0.103	0.117	0.124	0.171	0.134	0.092			*		*		
Age (in years)	50.6	46.8	43.4	47.8	47.3	46.1	***	***	*	**		**	
Dependency rate	0.463	0.446	0.477	0.485	0.465	0.417					**		*
No school	0.161	0.156	0.175	0.388	0.157	0.156			***		***	***	
Some primary school	0.790	0.769	0.738	0.574	0.773	0.773			***		***	***	
Some secondary school	0.040	0.062	0.078	0.019	0.059	0.057					**	***	
Adult or vocational training	0.008	0.007	0.010	0.019	0.005	0.007							
Cannot read or write	0.161	0.176	0.165	0.375	0.178	0.177			***		***	***	
Read or write Kiswahili	0.798	0.749	0.748	0.598	0.751	0.752			***		***	***	
Read or write English	0.000	0.007	0.000	0.000	0.005	0.007							
Read/write both Kiswahili and English	0.040	0.068	0.087	0.027	0.065	0.064					**	**	
Primary activity is agriculture	0.823	0.899	0.845	0.909	0.897	0.887	**		**			*	
Ever married	1.000	0.925	0.961	0.966	0.951	0.901	***	**	**		**		*
Christian	0.944	0.968	0.848	0.870	0.962	0.972		**	**	***	***		
Muslim	0.040	0.010	0.143	0.074	0.011	0.007	**	***		***	***	**	
Health visits and spending													
Visited HCP	0.492	0.375	0.352	0.413	0.392	0.359	**	**					
Total expenditure (in 1,000 TZS)	17.75	15.98	117.8	11.80	15.19	18.41			*	*		*	
Per capita expenditure (in 1,000 TZS)	2.31	2.42	37.59	2.37	2.27	2.73				*		*	
Anthro: Women													
Underweight	0.185	0.197	0.145	0.184	0.190	0.189							
Normal	0.649	0.603	0.723	0.687	0.615	0.621				**	*		
Overweight	0.126	0.155	0.084	0.101	0.156	0.144					*		
Obese	0.040	0.045	0.048	0.028	0.039	0.045							
Anthro: Children													
Severely wasted	0.022	0.009	0.025	0.027	0.007	0.009							
Wasted	0.054	0.047	0.050	0.060	0.037	0.055							
Severely stunted	0.163	0.191	0.300	0.193	0.149	0.229		**		**		*	
Stunted	0.424	0.447	0.463	0.447	0.425	0.477							
Severely underweight	0.033	0.055	0.050	0.040	0.052	0.055							
Underweight	0.217	0.213	0.213	0.213	0.172	0.257							

Sample group comparability (Continued 1/3)

	Group mean				Sub-group mean		Significance of differences						
Item	(1)	(2)	(3)	(4)	(5)	(6)	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)
Assets, dwellings, livestock													
Mud walls	0.600	0.738	0.686	0.800	0.726	0.739	***		***		*	**	
Stone walls	0.280	0.188	0.248	0.174	0.194	0.197	**		**				
Mud floors	0.706	0.839	0.810	0.915	0.846	0.816	***	*	***		***	***	
Cement floors	0.286	0.155	0.190	0.078	0.154	0.170	***	*	***		***	***	
Thatch roof	0.230	0.405	0.324	0.317	0.392	0.423	***		*		**		
Solar lighting	0.536	0.362	0.276	0.235	0.355	0.379	***	***	***		***		
Modern wood bed	0.786	0.618	0.524	0.454	0.667	0.563	***	***	***	*	***		*
Modern chair	0.254	0.100	0.152	0.071	0.118	0.106	***	*	***			**	
Radio	0.690	0.531	0.514	0.424	0.548	0.514	***	***	***		**		
Mobile phone	0.921	0.861	0.743	0.662	0.882	0.845	*	***	***	***	***		
Bicycle	0.698	0.515	0.600	0.491	0.565	0.479	***		***			*	
Motorcycle	0.167	0.052	0.133	0.089	0.043	0.085	***		**	***	*		
Cutlass	0.960	0.977	0.829	0.747	0.978	0.972		***	***	***	***	*	
Sprayer	0.365	0.207	0.162	0.145	0.199	0.218	***	***	***		*		
Ox-plough	0.587	0.456	0.219	0.245	0.435	0.500	**	***	***	***	***		
Yoke	0.429	0.320	0.190	0.216	0.317	0.338	**	***	***	**	***		
Shovel	0.611	0.411	0.362	0.312	0.430	0.423	***	***	***		**		
Animal cart	0.405	0.249	0.200	0.149	0.247	0.275	***	***	***		***		
Draught cattle	0.587	0.427	0.257	0.257	0.430	0.458	***	***	***	***	***		
Local cow	0.651	0.608	0.333	0.390	0.640	0.585		***	***	***	***		
Improved cow	0.175	0.087	0.048	0.052	0.081	0.099	***	***	***		*		
Local calf	0.484	0.362	0.257	0.253	0.382	0.352	**	***	***	**	***		
Sheep	0.484	0.388	0.248	0.264	0.409	0.373	*	***	***	***	***		
Agriculture: Labor, land													
Months worked	9.3	9.9	9.8	9.3	10.0	9.6	*				**		
Worked in agriculture	0.944	0.977	1.000	0.970	0.984	0.965	*	**				*	
Worked in business	0.435	0.440	0.423	0.367	0.465	0.404					*		
Person days: Beans	44.0	39.0	35.2	30.5	37.8	40.2			**				
Person days: Groundnut	40.7	.	28.0	33.7	.	.							
Person days: Irish potato	36.7	39.1	23.0	24.7	30.5	53.6							
Person days: Maize	63.3	48.8	55.7	56.2	47.5	49.4	**						
Person days: Pigeon pea	40.5	37.1	61.0	34.3	36.7	37.2		*		**		**	
Person days: Sorghum	21.3	34.0	24.1	38.1	46.7	18.8							
Person days: Sunflower	54.9	23.5	47.4	42.8	21.9	27.1	***			***	***		
Area farmed (acres)	9.8	3.5	6.0	7.1	3.6	3.3	***			***	***		
Owns land	0.960	0.942	0.857	0.888	0.930	0.951		***	**	***	**		
Main parcel in 30 minutes	0.886	0.925	0.692	0.789	0.913	0.944		***	**	***	***	*	

Sample group comparability (Continued 2/3)

	Group mean				Sub-group mean		Significance of differences						
Item	(1)	(2)	(3)	(4)	(5)	(6)	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)
Agriculture: Sustainability													
Practices crop rotation	0.200	0.195	0.124	0.109	0.205	0.183			**		***		
Uses manure regularly	0.897	0.837	0.806	0.883	0.862	0.817							
Uses on-farm manure	0.551	0.520	0.528	0.415	0.537	0.527			*		*		
Saved seed: Beans	0.892	0.921	0.976	0.901	0.903	0.938		*					
Saved seed: Groundnut	0.714	.	0.733	0.952	.	.			**			**	
Saved seed: Irish potato	0.950	0.925	1.000	1.000	0.923	0.944							
Saved seed: Maize	0.238	0.305	0.610	0.615	0.330	0.261		***	***	***	***		
Saved seed: Pigeon pea	0.892	0.957	0.900	0.889	0.940	0.976	**				**		
Saved seed: Sorghum	0.778	1.000	1.000	0.804	1.000	1.000							
Saved seed: Sunflower	0.833	0.907	0.841	0.873	0.882	0.952							
On-farm feed: Large rum.	0.147	0.144	0.082	0.055	0.117	0.176			**		***		
On-farm feed: Small rum.	0.178	0.130	0.058	0.050	0.112	0.154		**	***		**		
On-farm feed: Mono.	0.165	0.149	0.133	0.081	0.148	0.140			**		**		
Agriculture: Storage													
Mths to exhaust: Beans	3.4	4.5	4.3	3.9	4.3	4.9	*						
-- do --: Groundnut	6.3	.	4.1	4.1	.	.							
-- do --: Irish potato	1.7	2.3	3.3	5.3	2.1	2.4			**		***		
-- do --: Maize	2.8	3.9	4.4	4.0	4.1	3.5	*	**	**				
-- do --: Pigeon pea	3.9	4.2	2.9	3.6	4.2	4.0							
-- do --: Sorghum	3.8	3.4	3.5	4.7	1.8	10.0							**
-- do --: Sunflower	7.0	3.8	3.8	5.5	2.5	4.5							
Agriculture: Knowledge													
Advice: Neighbor	0.063	0.074	0.029	0.067	0.070	0.070				*			
Advice: Model farmer	0.040	0.055	0.019	0.019	0.059	0.056					**		
Advice: FRG	0.119	0.055	0.010	0.011	0.059	0.049	**	***	***	**	***		
Advice: Ext. agent	0.317	0.223	0.076	0.052	0.269	0.190	**	***	***	***	***		*
Visits from: Neighbor	0.500	0.478	0.000	0.389	0.462	0.500							
Visits from: Model farmer	0.600	0.176	0.500	0.800	0.273	0.125	*				***		
Visits from: FRG	0.467	0.235	0.000	0.333	0.182	0.286							
Visits from: Ext. agent	0.275	0.174	0.000	0.143	0.260	0.111		*					
Participation: FTC	0.214	0.136	0.029	0.037	0.156	0.134	**	***	***	***	***		
Participation: Env. group	0.103	0.074	0.019	0.015	0.102	0.063		**	***	**	***		
Participation: Civic org.	0.397	0.188	0.152	0.152	0.226	0.162	***	***	***				
Participation: FRG	0.167	0.091	0.000	0.015	0.119	0.063	**	***	***	***	***		*

Sample group comparability (Continued 3/3)

	Group mean				Sub-group mean		Significance of differences						
Item	(1)	(2)	(3)	(4)	(5)	(6)	(1) v.(2)	(1) v.(3)	(1) v.(4)	(2) v.(3)	(2) v.(4)	(3) v.(4)	(5) v.(6)
Tried new practices	0.206	0.123	0.019	0.019	0.140	0.120	**	***	***	***	***		
Heard of Africa RISING	0.151	0.159	0.029	0.033	0.172	0.155		***	***	***	***		
Head of Aflatoxin	0.556	0.421	0.362	0.342	0.403	0.444	**	***	***		*		
Aware Aflatoxin harmful	0.471	0.238	0.263	0.065	0.253	0.222	***	**	***		***	***	
Applied for loans	0.341	0.249	0.324	0.186	0.301	0.204	*		***		*	***	**
Received loans	0.907	0.961	1.000	0.920	0.964	0.966		*				*	
Agriculture: Output													
Yield: Beans	214	242	227	173	258	221					**		
Yield: Maize	1,151	1,271	707	585	1,220	1,325		***	***	***	***		
Yield: Pigeon pea	434	441	455	365	464	405							
Sales: Beans	176	153	93	108	141	162							
Sales: Maize	2,787	1,229	1,539	1,159	1,284	1,169	***		***				
Sales: Pigeon pea	434	284	578	322	281	277	*			***			
Consumption													
Expenditure (in 1,000 TZS):													
Total	2,774	1,910	2,277	1,524	2,009	1,884	***		***	*	***	***	
-- do --: Food	1,274	1,017	1,072	803	1,070	1,017	**		***		***	***	
-- do --: Non-food	1,500	893	1,205	721	939	866	***		***	**	**	***	
Share: Food	0.502	0.527	0.547	0.536	0.533	0.523		*					
Share: Non-food	0.498	0.473	0.453	0.464	0.467	0.477							
Vulnerability													
Food worry	0.111	0.110	0.190	0.279	0.124	0.085		**	***	**	***	*	
Food insecurity	0.079	0.094	0.171	0.212	0.102	0.085		*	***	**	***		

Note: Numbered columns represent the following groups: (1) Africa RISING, (2) Experiment, (3) Indirect beneficiaries, (4) Control. Sub-groups of experimental group: (5) Coupon, (6) No coupon. Stars indicate significance level: *** <0.01, **<0.05, *<0.1.

Source: Author's compilation based on TARBES 2014.