ACCESS TO MARKETS FOR SMALLHOLDER FARMERS IN ALTO MOLÓCUE AND MOLUMBO, MOZAMBIQUE

Midline Survey Report of the INOVAGRO II Impact Evaluation Project

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May 2019

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DISCLAIMER: This report is a direct update of the Baseline Survey Report of INOVAGRO II Impact Evaluation Project by Erman, Ghebru and Mogues (2016). As such, all estimates in this report have been altered to reflect the 2017 midline data, and the text has been updated where applicable, however the entire structure and much of the text itself is lent from the original baseline report, following it closely, as its logical sequel, in order to facilitate direct comparison of the findings across the two reports.

ACKNOWELDGEMENTS: This work was undertaken as part of the CGIAR Research Program on Policies, Institutions, and Markets (PIM) led by the International Food Policy Research Institute (IFPRI). The PIM program leads action-oriented research to equip decisionmakers with the evidence required to develop food and agricultural policies that better serve the interests of poor producers and consumers, both men and women, combining the resources of CGIAR centers and numerous international, regional, and national partners. www.pim.cgiar.org

Financial support for this study was provided by the Swiss Agency for Development and Cooperation (SDC). This publication has not been peer reviewed. The opinions expressed here belong to the authors, and do not necessarily reflect those of SDC, PIM, IFPRI, or the CGIAR.

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EXECUTIVE SUMMARY

This report presents the data from a midline data collection effort as part of the impact evaluation of Phase II of the Innovation for Agribusiness (INOVAGRO II) intervention in northern Mozambique. INOVAGRO II is a development program intended to decrease rural poverty by improving the connectedness of farmers to market systems. The midline data were collected during the intervention phase, in two districts in Zambézia province – Alto Molócue and Molumbo – during the months of late October to December of 2017. The questionnaire focused on agricultural production and market access for all crops, and particularly for the INOVAGRO value chain crops – soybean, pigeon pea, and maize. The purpose of the report is to describe the data, focusing on key variables.

The first section contains general household characteristics. Average household size is 4.2 members. Female heads make up 19 percent of the total. The average age of the household head is 37.5 years. The literacy rate overall is 70 percent but varies substantially across groups. For example, among female household heads, 32 percent are literate; in the district of Molumbo, 49 percent of household heads are literate. Agricultural production is the primary economic activity of 90 percent of household heads. On average, households have access to 2.3 hectares of land divided across 1.6 parcels. Most parcels are located within the same *bairro* as the household's residence. Three quarters of households judged the soil quality of their land as good overall (83 percent in Molumbo, 61 percent in Alto Molócue)

The second section of the report describes in more detail the agricultural production of households in the survey. Topics cover access to market information and agricultural services (such as extension services and field days), household-level information on production (input usage, most common crops, yields, and production), INOVAGRO value chain crops (soybean, pigeon pea, and maize), and agricultural market participation, including sales. Overall, about two thirds (63 percent) of households received information during the last two years (2015-2017) on input and output markets from sources such as input sellers, output buyers, extension agents, and other formal actors. Market information seems to be more accessible in Molumbo than Alto Molócue – 78 percent of households in Molumbo received input or output market information, while only 50 percent of households did in Alto Molócue. Close to a quarter of households had at least one member in the family who is a member of a farmer association: 29 percent of households in Alto Molócue and 16 percent of households in Molumbo. Eighteen percent of households received information from an extension agent during the last two years – two thirds of those visits were reported in Molumbo.

The use of modern inputs is relatively low. A third of households used a modern input of some kind – chemical fertilizer, improved seed, pesticide/herbicide or inoculant – during the last two years. Input use is more common in Molumbo than Alto Molócue – 46 percent of households in Molumbo and 22 percent in Alto Molócue used any input. Use of family labor is common – 95 percent of households had more than one member of the household performing farm work. Female-headed households have smaller areas of total land size than male-headed households and fewer female-headed households use family labor (85 percent). Hired labor is much less common – 27 percent of households hired labor during the 2016/17 agricultural year. Use of hired labor is more common in Molumbo (31 percent) than in Alto Molócue (23 percent). Households with relatively pieces of cultivated land (above 1 hectare) are more likely to use hired labor as well. The agricultural tasks that least involve the entire family are sales and clearing the field.

Overall, maize, pigeon pea, and cassava were the most common crops cultivated during the 2016/17 agricultural year – 82 percent, 79 percent, and 53 percent of farmers grew each crop, respectively. Cassava

is more common in Alto Molócue, where 65 percent of households cultivate cassava, compared to 41% in Molumbo. The second season, which stretches from March to July, is less productive than the first season. About 30.4 percent of households use the second season for cultivation. Cassava is the most commonly listed primary crop cultivated during the second season in both districts (31 percent of all primary crops listed by second season farmers). On average during the first season, maize farmers dedicate 0.72 hectares for maize production and produce 494.9 kg in output, yielding 684.70 kg/ha. Pigeon pea farmers use 0.64 hectares and produce 324 kg, yielding 538.84 kg/ha. Maize and pigeon pea are value chain crops included in the INOVAGRO II program. Soybean is also included. Twenty-five percent of farmers grew soybean during the 2016/17 agricultural year, up from three percent in the baseline survey, most of them concentrated in Molumbo.

Among producing households, between 34 and 51 percent report having sold at least some of their production of soybean, pigeon pea, or maize during the 2016/17 agricultural year. Overall, pigeon pea seems to be the main cash crop among the value chain crops. Even though the ratio of those selling it to those growing it is lower than that of soybean, 458 producers of pigeon pea sold their produce (34.49 percent), while only 341 maize producers sold maize (23.83 percent), and 180 soybean producers sold soybean (51.14 percent). Greater shares of pigeon pea and maize farmers sold these crops in Molumbo compared to Alto Molócue. On the other hand, a larger share of soybean farmers engaged in sales in Alto Molócue than in Molumbo. The main buyers of soybean are private actors (43 percent), followed by retailers, agro-dealers and wholesalers. The main buyers of pigeon pea are the same group: private actors (31 percent), then followed by agro-dealers, retailers and wholesalers.

INTRODUCTION

This report presents summary descriptive information from midline data collected as part of an impact evaluation of the development intervention "INOVAGRO II" (Phase II of Innovation for Agribusiness). Financed by the Swiss Agency for Development and Cooperation (SDC), INOVAGRO's purpose is to reduce poverty by improving linkages between markets and small-scale farmers. The methodology is based on a Market System Development (MSD) approach, in which the goal is to make improvements along the value chain of the production and sales of select high-productivity crops as well as to improve the capacity and technology usage of small-holders. Clearly, poverty in the agricultural sector, in particular, must be addressed in a manner in which markets for agricultural outputs, inputs and processed goods are strengthened. SDC engaged the International Food Policy Research Institute (IFPRI) to conduct a technically rigorous impact evaluation of selected aspects of the second phase of the project. For this purpose, a baseline survey was conducted in August 2015, followed most recently by a midline survey conducted in November of 2017. An impact evaluation analysis is currently underway, using the panel dataset between these two surveys.

The next section briefly describes the INOVAGRO project as well as the methodology used for the impact evaluation. The bulk of the report consists of descriptive statistics from the midline data, including household and household head characteristics, agricultural production, access to agricultural labor and advanced inputs, level of agricultural commercialization, and land property rights. Data are analyzed using breakdowns by subgroup based on the gender of household head and farm size. Where applicable we compare our data to the national household agricultural survey, known as *Trabalho do Inquerito Agricola* (TIA), and the national household budget survey, known as *Inquerito ao Orcamento Familiar* (IOF). Collected through the Mozambique Ministry of Agriculture, the TIA provides nationally representative panel data. In this report we only consider the TIA observations from Molumbo and Alto Molócue districts, which amounted to 190 households in their 2012 survey. Managed by the National Institute of Statistics, the IOF survey was collected between August 2014 and August 2015 and covered 10,844 households nationwide. It is the most recently collected and available data in its series at the time of the writing of this report. Of the full set of households, 1,564 were from Zambézia province, in which Alto Molócue and Molumbo are located. Here we use province-level data to compare the results from our midline data.

INOVAGRO IMPACT EVALUATION

INOVAGRO applies a MSD approach to stimulate the inclusion of the economically active poor in growing and productive value chains. SDC's adoption of the MSD approach for INOVAGRO is based on the premise that the private sector has a financial incentive to see continuous growth in productivity by small farmers to supply more and higher quality products into the market, and should invest in supporting them to upgrade their practices, as well as to consider how to help enable greater intervention outreach scale and sustainability. If market systems can be made to function effectively, this can lead to greater outreach and more sustainable impact. The MSD approach (see figure 1 representing the market systems process within the project cycle) focuses on both input and output market systems to see what is working and what is not, and identifies the constraints to well-functioning market systems (for example, inadequacies in infrastructure or deficiencies in the rules, both formal and informal, that regulate the market system).

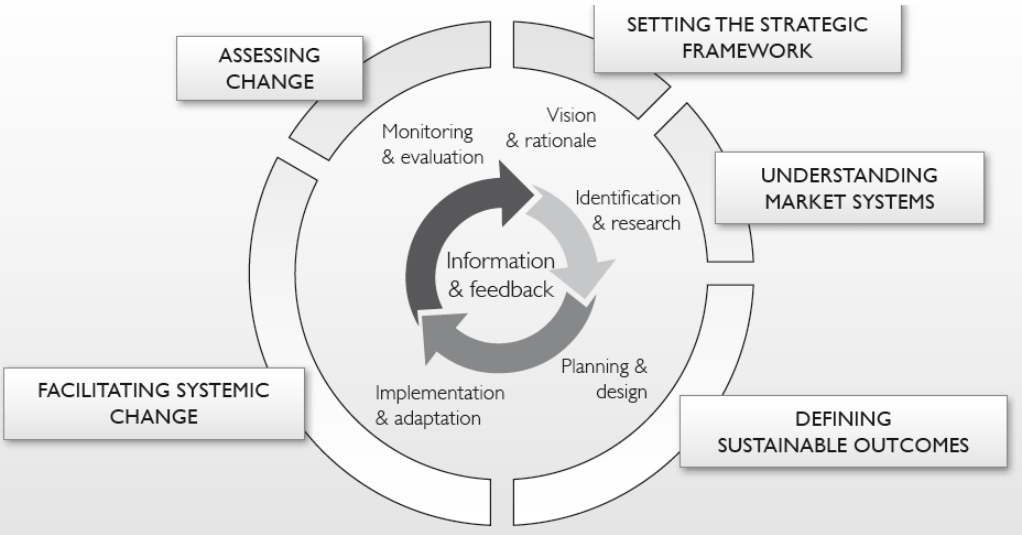


Figure 1: Market Systems Development process within the project cycle
Source: Tschumi and Hagan (2008)

The reality in northern Mozambique is that most agricultural market systems are very weak, and if steady growth in incomes of small farmers is to be achieved, it will likely occur only through their access/connectedness with larger market actors. Therefore, INOVAGRO is designed to seek out lead firms (input providers and large agro-buyers) as supporting drivers of smallholders' agricultural and income growth. In a first phase of the project (already completed), INOVAGRO served as a partner to pilot private sector models for both small business and farmers and to demonstrate the potential of the market system to benefit the poor. In a second phase, INOVAGRO II (currently underway and the focus of this impact evaluation), the project focuses on scaling up the outreach and sustainability of the commercial relationships between smallholder farmers and other value chain actors. The project activities—primarily field days, extension services, and capacitation of local agro-dealers— serve as a foundation for stimulating a crowding-in of other market actors, leading to the gradual build-up of the local market system for the full range of services needed.

The premise behind the MSD approach is that the market system is a critical element in poverty reduction. In particular, in the agriculture sector—on which the vast majority of the poor rely in many developing countries—enhancing the functioning of markets for the outputs of primary production, for inputs into production, and for processed products is crucial for addressing poverty. Identifying whether interventions that follow the MSD approach work, in what respects they work, and in what ways they can improve is a fundamental yet not well understood dimension in M4P activities. The impact evaluation of INOVAGRO II provides an excellent opportunity to answer these questions. Although INOVAGRO has been implemented in some districts in northern Mozambique, two previously untouched districts were selected for this impact evaluation – Alto Molócue and Molumbo. The impact evaluation will focus on two value chains – soybean and pigeon pea (with maize as a third important value chain). The INOVAGRO intervention has rolled out in selected treatment areas in these two districts and started in 2015.

The outcome variables we focus on to estimate the impact of INOVAGRO intervention are closely related to the objectives of the project itself. We focus on observed changes in agricultural input use, agricultural production, output sales, access to market services and information, and land property rights. We focus on these areas throughout this midline report.

SAMPLE SELECTION

The treatment unit of this evaluation is the community (*comunidade*) level. Communities are administrative units within localities (*localidades)*, which in turn are administrative units inside administrative posts (*posto administrativos)* – the largest units on a district level. Initially IFPRI, SDC, and the implementing agency DAI agreed that a randomized controlled trial (or experimental) approach would be used in the impact evaluation, and the research proposal was designed based on this approach. Shortly before conducting the baseline survey, however, it was determined that the experimental design, in which the treatment and control areas are selected randomly, was not feasible due to limitations faced by DAI.

Instead the implementing agency selected four communities in each district where INOVAGRO's intervention would be carried out. All selected treatment communities were located in the same administrative post within each district. The control communities were selected from comparable[1] localities in a different administrative post from where the treatment communities are located. We chose a different administrative post for the control communities to limit spillovers effects. The household listing exercise in both treatment and control areas secured information about the households regarding age and gender of household head and their soybean and/or pigeon pea production. This listing information was used to select the final set of control communities based on the extent of soybean and/or pigeon pea cultivation. The final sample is drawn from 16 communities in 4 administrative posts in two districts. The communities are listed in Table 1.

Table 1 Study areas and sample size

			2015		2017	
District	**Administrative post**	**Community**	**N**	**%**	**N**	**%**
Molumbo	**Treatment** Molumbo-Sede	Benesse	117	6.2	114	6.5
		Macolocotxo	100	5.3	89	5.1
		Mugoliua	120	6.4	105	6.0
		Nandie	108	5.7	97	5.6
	Control Corromana-Sede	Bediua	96	5.1	78	4.5
		Corromana-Sede	119	6.3	107	6.1
		Impindula-Sede	121	6.4	109	6.2
		Mucoco	125	6.6	116	6.6
Alto Molócue	**Treatment** Nauela	Mohiua	124	6.6	123	7.0
		Namilepe	120	6.4	114	6.5
		Carmano	123	6.5	123	7.0
		Caperula	125	6.6	124	7.1
	Control Alto-Molócue Sede	Murico	119	6.3	116	6.6
		Napalaca	122	6.5	108	6.2
		Lugela	125	6.6	124	7.1
		Inrule	122	6.5	102	5.8
Total			1,886	100	1,749	100

Power calculations during the planning stage of this project—which were based on the more demanding methodology of a randomized controlled trial, rather than the quasi-experimental approach ultimately

[1] As defined by the implementing agency.

pursued—indicated that about 2,000 households were needed, which is the approximate number generated when adjusting for design effect and attrition rate. As evidenced from the total number in Table 1, the baseline data collection only obtained 1,886 unique observations, due to cases of duplicate households and other problems identified in the process of data cleaning, and the midline data collection only obtained 1,749 due to attrition. Of these, 889 households were from the treatment communities and 860 were from the control communities.

Enumerators used Tablet Assisted Personal Interviewing to collect the data. The survey instrument was designed using CSPro and took an average 45 minutes to register. The field team consisted of 16 enumerators, supervised by two team leaders, and managed by two field coordinators. Listing and data collection took place in October–December 2017.

General Household Characteristics

This section looks more closely at some of the general characteristics of the surveyed households, such as demographics, education, and assets. Gender of household head, farm size, and district are the key subgroups used throughout the report. Table 2 shows the general distribution of gender and farm size to get a general idea of the weights involved in this subgroup division. Size of landholdings was calculated by summing the area of each of the individual fields listed by the household, according to the farmer's recollection and back-referencing the areas given by the same farmers in the baseline survey. As can be seen, there are only 1,749 households. A much greater number of households own more than one hectare compared to the baseline data. While the share of households holding under and over one hectare was roughly equivalent (about half in each group), in the midline survey, close to three fourths of households reported owning more than one hectare of land.

Table 2 Distribution of data by gender of household head and size of landholdings

	1 hectare and under		Above 1 hectare		Total
	N	%	N	%	N
All	458	26.19	1,291	73.81	1,749
Gender of household head					
Male	364	20.81	1,049	59.98	1,413
Female	94	5.37	242	13.84	336

Household demographics

The average number of household members is 4.15 in the sample (Table 3). For female-headed households, the number is lower – 3.60 members on average, both of these numbers up almost 25% in each case from 2015 and closer to the 2014/2015 IOF survey average household size in Zambézia province, of 4.7. Having smaller household sizes among female headed families is fairly common in developing countries, given that women often become head of the household when their spouse dies or they divorce or separate. The dependency ratio in our sample, defined as the number of children under the age of 15 or over the age of 64 as a proportion of adults aged 15-64, is 0.89. This means there are less non-actively contributing members in an average household than those considered in the age range of actively contributing members of the household. This is a relatively low number for a rural African context. In the report of the 2009 IOF survey results, the dependency ratio for Zambézia province (defined using the same age ranges we use here) is 1.06, which indicates that there are almost 106 dependents per 100 non-dependents. The difference between the IOF figure and ours may indicate that we have some underreporting of children under 15 years of age or senior citizens in the data or that our sample areas or our more recent survey period may be evidenced by higher ratios of able-bodied household members. It could also indicate that families with higher dependency ratios were not sufficiently represented in our study perhaps for the very reason that there is a higher burden on the principal care and income providers within these households. This is a worthwhile note to keep in mind when using and interpreting the data.

Table 3 General household characteristics

	Number of household members	Proportion of female household members	Household members average age	Dependency ratio
All	4.15	45.57%	21.57	0.89
Gender of household head				
Male	4.28	44.54%	21.19	0.87
Female	3.60	60.31%	23.13	0.97
Size of landholdings				
1 hectare and under	4.37	47.10%	20.97	0.76
Above 1 hectare	4.15	47.57%	21.57	0.93
District				
Alto Molócue	4.13	48.75%	21.24	0.88
Molumbo	4.18	46.23%	21.94	0.90

Among all family members older than 15 years, the average years of education attained is 3.89 for men and 2.40 for women. In total, 30.42 percent of household heads have no formal education. Relatively younger family members have received more years of education. Mean significance tests show that formal education of the household head is not significantly correlated with whether or not the household sold any of its crops in the last agricultural season, or if it sold a value chain crop (namely, soybean or pigeon pea) over the same period, however households with educated heads are 4.3 percent more likely to use an improved input of any kind than the average, and 9.71 percent less likely to use an improved input of any kind if the head lacks formal education, both results at the 1 percent level of significance. Similarly, households with educated heads are 2.23% more likely to hire labor for farm work compared to the average percentage of farmers employed hired labor, and 5.11 percent less likely to hire labor if the head lacks formal education, significant at the 5 percent and 1 percent levels, respectively. This might indicate that households with educated heads are better targeted for interventions related to improved input use and efficiency gains in production.

Figure 1 and Figure 2 display the distribution of all family members older than 15 but younger than 31 years old (2,050 individuals) and family members older than 30 years (1,902 individuals) across the number of years of formal schooling received. Counting all members older than 6 years for whom we recorded schooling, households have an average of 2.94 years per member. For households with an uneducated household head, the average years of schooling per family member older than 6 years is 1.71, while reaching 3.51 years per member in households with heads who have had any positive number of years of formal education.

Figure 1 Years of education attained for household members older than 15 but younger than 31 years old

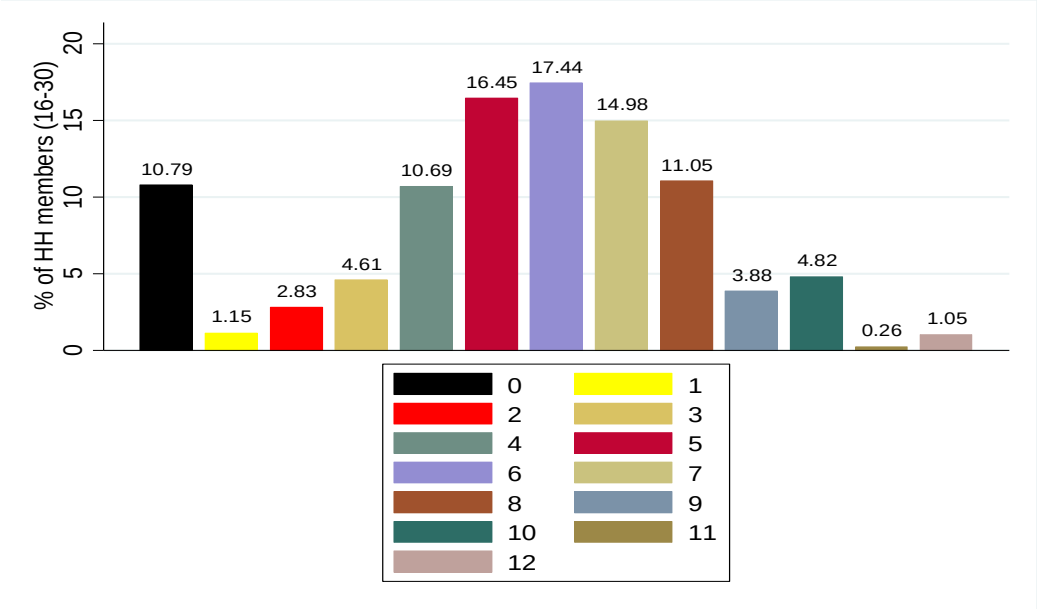
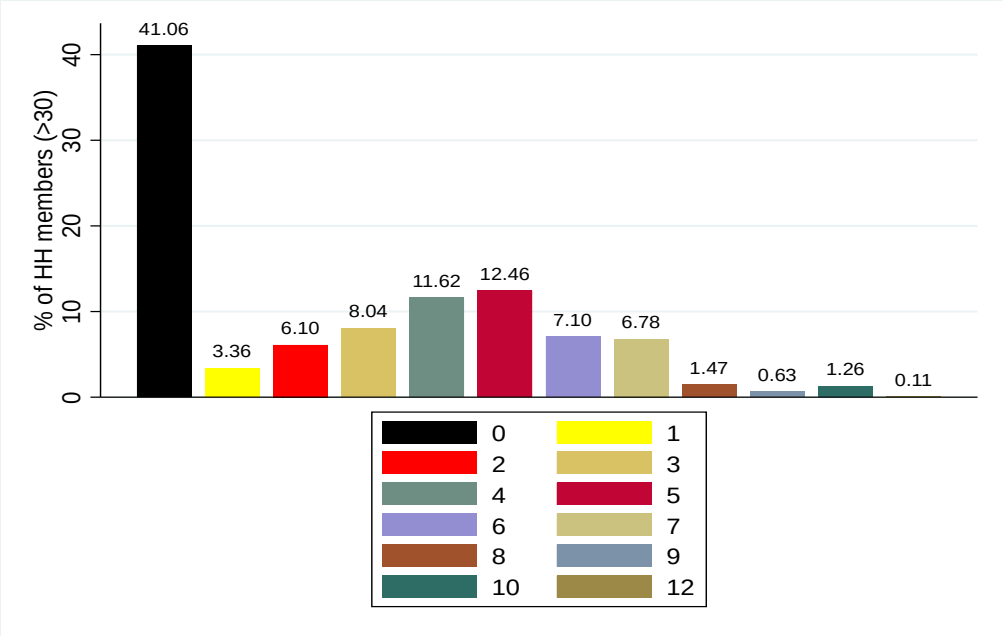


Figure 2 Years of education attained for household members older than 30 years old



Characteristics of the household head

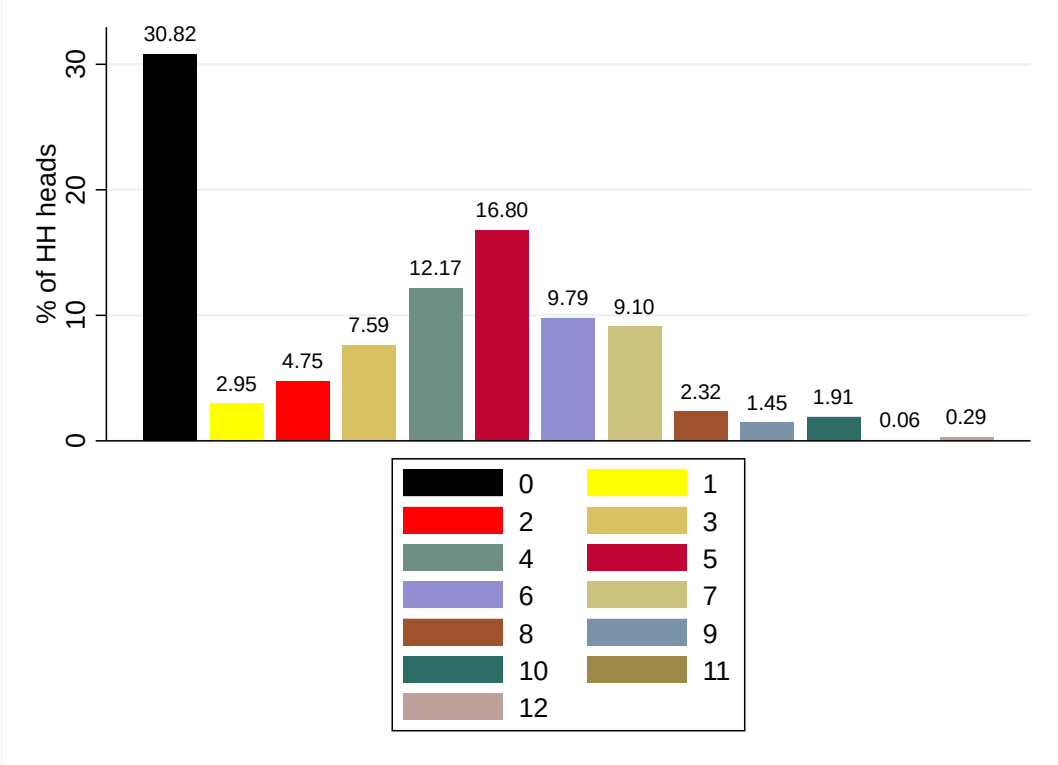
The average age of a household head is 37.46 years. Among all households, our survey results report that 20 percent are headed by a woman compared to the IOF survey, which reports that in Zambézia, the proportion of female household heads is 17.6 percent. Our data show that in 50.32 percent of households headed by a man, the head is married. Only in 16.67 percent of female-headed households does the head identify as married. The literacy rate for heads who are men is 57.96 percent while for women it is 31.85

percent. Alto Molócue has a higher literacy rate than Molumbo – 56.53 percent can read and write, in contrast to 48.83 percent in Molumbo. Overall, however, the literacy rate seems to be high, especially considering the low levels of schooling for household heads. The IOF finds that 46.1 percent can read and write among the population (not only household heads) 15 years and older, which seems like a more probable number (Table 4). Education levels for household heads are displayed in Figure 3.

Table 4 General characteristics of household heads

	Is literate	Is married	Age	Is without formal education
All	70.41%	67.13%	37.46	25.34%
Gender of household head				
Male	57.96%	50.32%	36.93	26.75%
Female	31.85%	16.67%	39.66	45.83%
Size of landholding				
1 hectare and under	45.20%	44.98%	37.02	36.68%
Above 1 hectare	55.69%	43.45%	37.62	28.20%
District				
Alto Molócue	56.53%	46.79%	36.76	21.84%
Molumbo	48.83%	40.49%	38.26	40.25%

Figure 3 Years of schooling for household heads



Most households' primary economic activity is agriculture: 90.4 percent of household heads report agricultural production as their primary economic activity (Table 5). The second most reported primary activity is Trade/Retail/Small business/Factory at 4.4 percent. The IOF data found that 78 percent of household heads were involved in agriculture as their primary occupation. The reason for the lower share in the IOF data could be that its survey area included more commercial urban areas while our study area is rural.

Table 5 Main economic activity of household heads

Economic activity	%
Trade/Retail/Small business/Factory	4.4
Agriculture	90.4
Public servant	1.5
Private employee	2.1
Too old to work	0.1
Retired	0.8
Other	0.3
Total	100

Distance to key locations and landholdings

Disaggregated by gender, female-headed households are slightly less remotely located than male-headed households, with the exception of distance to the closest farmers' association. Smaller farms tend to be located farther from agriculturally important sites – such as paved roads, markets, and farmers' associations. In Alto Molócue, it seems as though farmers are located relatively closer to rural roads and to a farmers' association compared to farmers in Molumbo. Markets, however, are located closer on average in Molumbo than in Alto Molócue, by about a 15 min walking distance.

Table 6 Distance to key locations

	Distance in minutes by foot	
	Closest market	Closest farmers' association
	Mean	Mean
All	29.47	31.05
Gender of household head		
Male	29.98	30.74
Female	27.46	32.11
Size of landholdings		
1 hectare and under	32.24	32.40
Above 1 hectare	28.55	30.62
District		
Alto Molócue	36.61	29.41
Molumbo	21.76	39.15

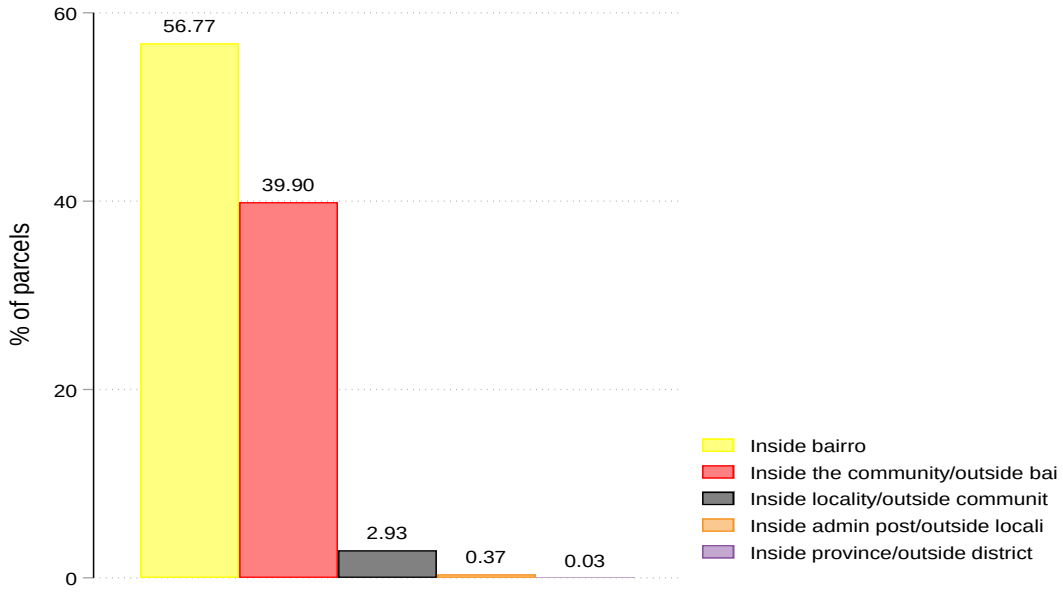
Considering that agricultural production is the primary activity for a great majority of farmers in our sample, land is probably their most important productive asset. On average, households have access to 2.32 hectares. Male headed households own slightly more land than female headed households (2.37 hectares compared to 2.12), and households in Molumbo own slightly more land than those in Alto Molócue (2.47 ha compared to 2.19). Heads with no formal education own an average 2.11 hectares on average while heads with formal education own 2.41 hectares, both mean differences significantly differ from the average landholding size across all households at the 5% level. Households keep 1.62 parcels on average, a number that does not vary greatly across subgroup of interest. Households with more than one hectare of land tend to have an average of 1.9 parcels compared to an average .98 parcels for those with one hectare of land or less (Table 7). Most parcels are located within the same *bairro* as the household's residence (57%). Less than 4 percent of parcels are located outside the community of the household's residence. Figure 4 describes the location of parcels in relation to household residence.

Table 7 Land size and number of parcels

	Total agricultural area (all parcels added (hectares)	**Number of parcels (total)**	
	Mean	Mean	SD
All	2.3218	1.6226	0.8036
Gender of household head			
Male	2.3686	1.627	0.8109
Female	2.1248	1.6042	0.7734
Size of landholdings			
1 hectare and under	0.9360	0.9803	0.3201
Above 1 hectare	2.8134	1.8505	0.8003
District			
Alto Molócue	2.1892	1.7227	0.7811
Molumbo	2.4737	1.508	0.8143

Note: SD = standard deviation.

Figure 4 Location of parcels in relation to household residence



Even though the average parcel size is 2.32 hectares as indicated in Table 7, distribution of land is unequal. As evident from the histogram below (Figure 5), the largest concentration of households peaks at 1 hectare of land in total. A significant amount of households have 2 or more hectares in total. The most common ways households said they acquired land is by inheritance, by means of the traditional authorities, or by simply occupying the land, each of these three was the means given by a little less than a fourth of all respondents. The remaining fourth said they either received the land as a gift (11%), rented it out(7%), borrowed it (rented it in, 7%), purchased or recived it from official authorities (1%). In Molumbo, a greater share of households said they received the land from traditional authorities (36%) than by occupying the land (12%).

Figure 5 Distribution of total agricultural land size (# of households)

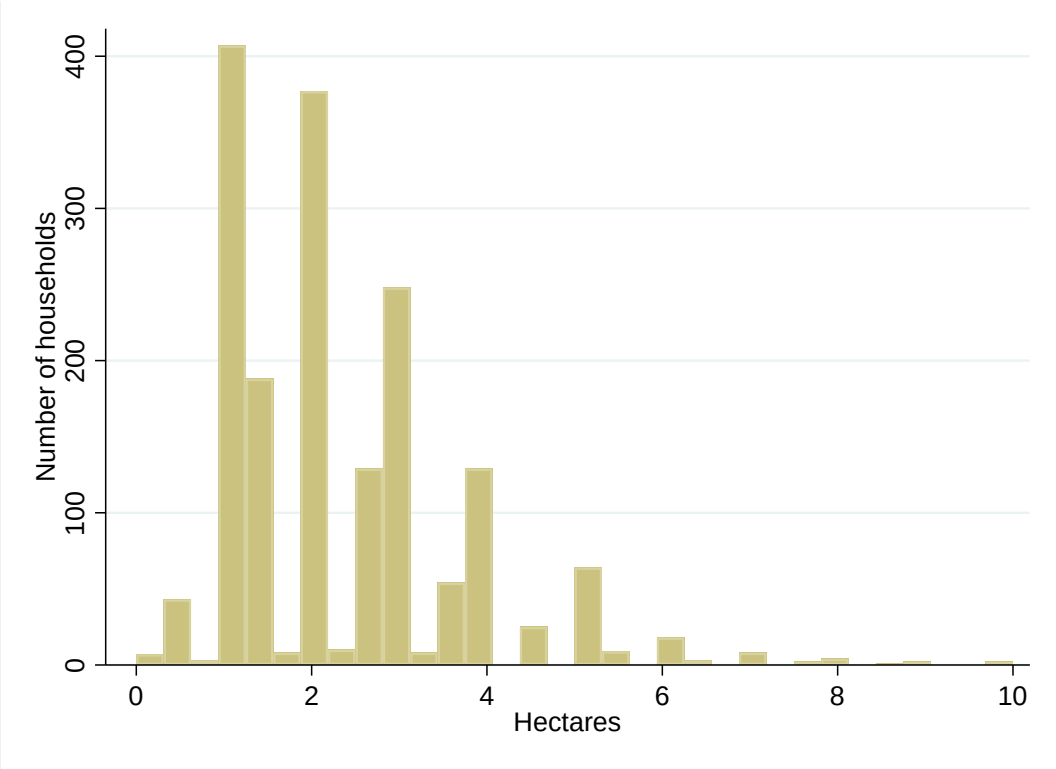
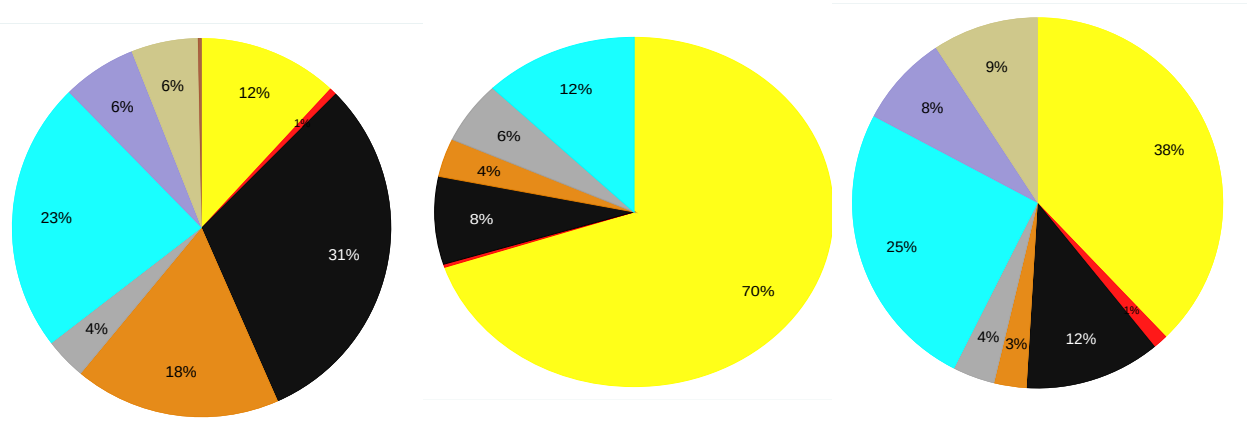


Figure 6 Mode of land acquisition (one observation per parcel)



Alto Molócue **Both districts** **Molumbo**

Table 8 shows households perceptions about the quality of the soil on their fields. Less than one percent thought their soil quality was bad, and close to 3/4ths judged the soil quality as good overall. This

percentage was greater for producers in Molumbo compared to those in Alto Molócue (82.8% compared to 60.8%).

Table 8 Household perceptions about soil quality

	What is the quality of the soil of this parcel?			
	Good	OK	Bad	Total
	%	%	%	%
All	71.0	28.3	0.7	100
District				
Alto Molócue	60.8	38.1	1.1	100
Molumbo	82.8	16.9	0.3	100

AGRICULTURE

This section discusses more detailed agricultural production information at the household level. It starts with topics related to access to market information and agricultural services – such as extension services and field days. It next provides details on household production aspects – households' input usage, most common crops, yields, and production. Its final focus is on the INOVAGRO value chain crops (soybean, pigeon pea, and maize) as well as agricultural market participation – including sales.

Access to information and agricultural services

One key aspect of agricultural production and sale is access to information on agricultural practices, input and output markets, and services such as extension services and field days. Molumbo and Alto Molócue are remote rural areas and farmers' limited access to information may be a major constraint to developing more productive cultivation and accessing markets to commercialize their production. Farmers can receive information from local agro-dealers, output buyers, or extension agents. Other ways for farmers to receive agricultural information are through participating in field days and being part of a farmers' association. The nature of the information could be related to input usage (for example, where to buy improved seeds), prices of agricultural products, or farming practices such as intercropping. Basic questions were integrated into the questionnaire to assess the state of farmers' access to different sources of market information and services.

Information on input and output markets

Households were asked if they had received any information about input or output markets from a list of key rural actors during the last two years. Input market information includes prices of input products, location of sellers of inputs, and new input technologies or practices and input services. Information about output markets includes prices of crops, transportation of harvest, and location of markets or commercial buyers of agricultural products. Table 9 provides an overview of the number of households that have received information from sources that are not familiar; that is, not neighbors or relatives. These sources include media, input sellers and output buyers, local authorities and extension agents, and NGOs. One general variable captured input and output information together while other variables covered input and output market information separately. Table 9 is broken down by subgroups to compare access to information generally across groups before turning to more specific information about sources and impacts of information.

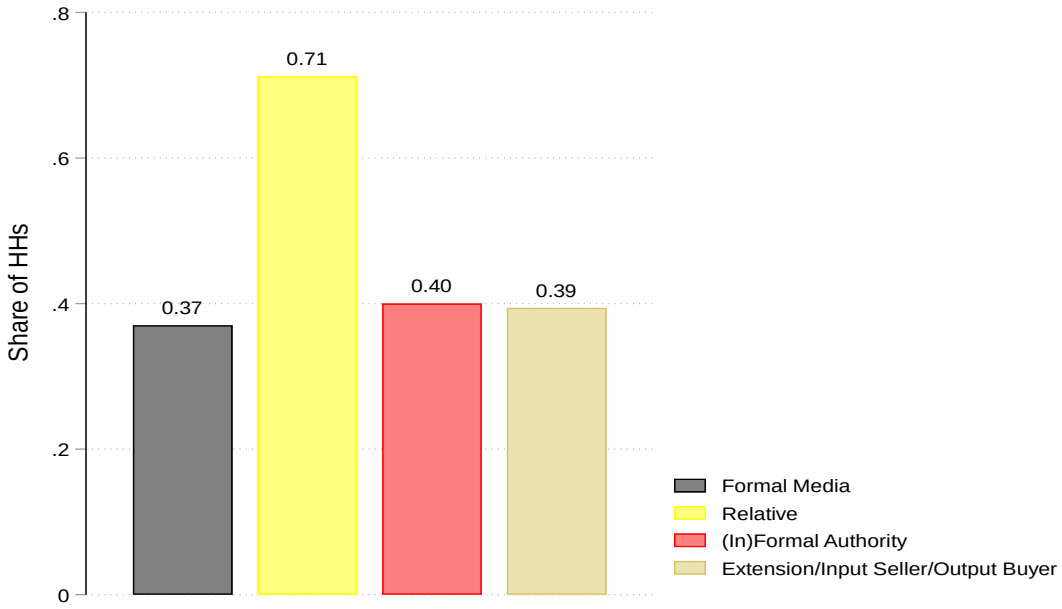
Table 9 shows that a greater share of male household heads receives market information on average than female household heads. Relatively larger farms are also more likely to receive information. The starkest difference is between districts – only 50.32 percent of households in Alto Molócue receive market information on inputs or outputs, while 77.91 percent of households in Molumbo receive such information. A slightly greater share in both districts, by about 2 percentage points in each case, have received more information about output market information than about input market information.

Table 9 Share of households that have received information

	Share of households that have received market information on agricultural…:					
	Inputs or Outputs		Inputs		Outputs	
	N	%	N	%	N	%
All	1105	63.18%	1040	59.46%	1084	61.98%
Gender of household head						
Male	916	64.83%	862	61.00%	901	63.77%
Female	189	56.25%	178	52.98%	183	54.46%
Size of landholdings						
1 hectare and under	253	55.24%	231	50.44%	250	54.59%
Above 1 hectare	852	66.00%	809	62.66%	834	64.60%
District						
Alto Molócue	470	50.32%	439	47.00%	462	49.46%
Molumbo	635	77.91%	601	73.74%	622	76.32%

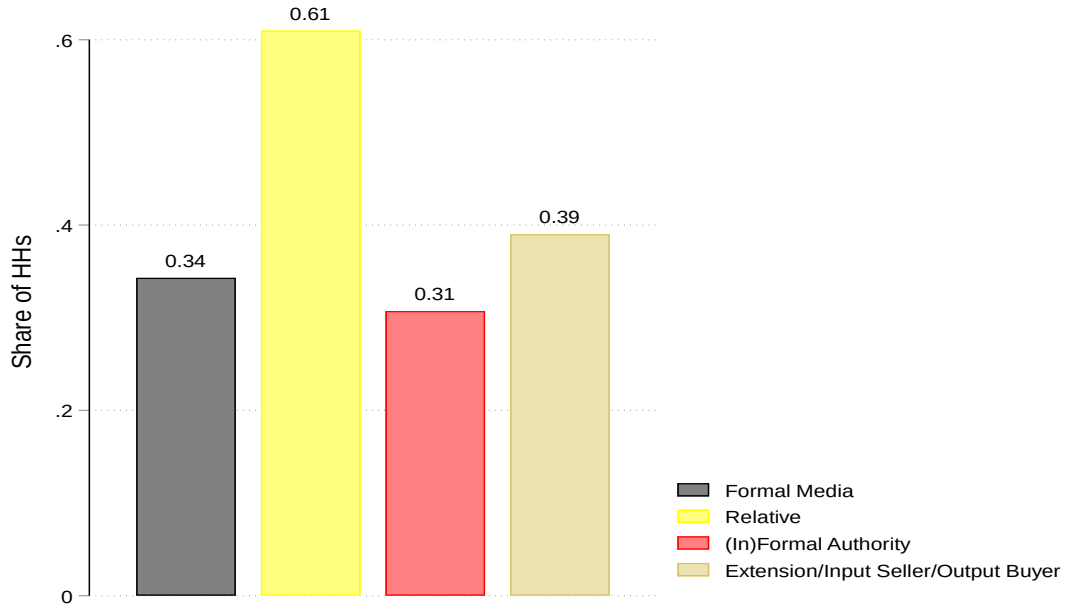
The next subsection looks in more detail at where information comes from. Again, this analysis includes familiar sources as well as non-familiar sources. Figure 7 shows the sources of input market information for households that receive information (the same household may receive information from multiple sources). The most common way to obtain input market information is from familiar sources including a non-household relative or family member, friend or neighbor (71 percent of households). Formal or informal authorities including village leaders, religious authorities, agriculture association leaders, the police or someone from a NGO is the second most important source of information (40 percent). Right behind, 39 percent of households receive input market information from an extension agent, input seller or an output buyer, and 37 percent of households receive information from formal media (the radio, newspaper or TV).

Figure 7 Sources of information about input markets



Households that receive output market information also primarily rely on relatives, friends and neighbors (61 percent, Figure 8). Formal media plays the third largest role, providing 34 percent of households with information about output markets.

Figure 8 Sources of information about output markets



To assess how households use the information they receive, households were asked if the information influenced any decision they may have made in regard to their agricultural production. Table 10 includes information about the households that did report receiving information from one or more of these four

categories of sources regarding input markets. Improved channels of input information are particularly important to the INOVAGRO intervention. The second and third columns give information on the number of farmers influenced or not, respectively, by the information they receive. Those farmers who do not use the information were asked why it did not influence them. The main response to that question is summarized in the last column.

Information received from either an extension worker, input seller or output buyer seems to have the largest impact – 65.9 percent of households that receive input market information from one of these sources stated that the information influenced them to make changes in their production. Formal media also seems to have a greater impact, among those who received it, than the information received by relatives, despite the latter source being the most common. Information received from any source had a greater than 50% positive response rate that the information was used to influence a decision made by the household in their agricultural production. The primary reasons listed for the information not having an influence differed by the source of the information. When information received by formal media or an informal authority (including a leader of an agricultural association, village leader, policeperson, etc.) did not influence production decisions, farmers mostly cited that this was because they did not understand the information being conveyed. The information that was not influential that was received by relatives was primarily due to it being considered irrelevant, and almost equally as much, because it was considered not trustable. Information from extension workers/input sellers, or output buyers seemed to be viewed the most credible and relevant, however almost half of the farmers who stated they did not change their agricultural decisions after receiving this information simply cited that they did not have the means to do so (Table 10).

Table 10 Impact of information received about input markets

Source of information	Information received influenced decisions made in ag production		Information received did not influence decisions made in ag production		Main reason why information did not have an influence
	N	%	N	%	
Relative	426	57.5	315	42.5	"It was not relevant to me"
Formal Media	231	60.0	154	40.0	"I did not understand the information"
(In)Formal Authority	224	53.8	192	46.2	
Extension/Input Seller/Output Buyer	270	65.9	140	34.1	"Was not able – did not have the means – to make changes based on information"
Total	1,151	59.0	801	41.0	

Contrary to the information received on input markets, information on output markets was not only most commonly received from relatives, but the information received from relatives was also the most influential by a slight margin. In fact, information from all four sources were almost as equally influential to farmers' decision-making, an average 63% of whom took the information they received and put it into practice (Table 11). Of the households who did not change their decisions based on the advice they received from relatives, the primary reason shifted from this information not being relevant as the top reason (still one fourth of those who did not heed their relative's advice) to finding they did not trust the information being provided (34 percent of those who did not change their agricultural decisions based on the output market advice received from relatives).

Table 11 Impact of information received about output markets

	Information received influenced decisions made in ag production		Information received did not influenced decisions made in ag production		Main reason why information did not have an influence
	N	%	N	%	
Relative	506	64.7	276	35.3	"I did not trust the information"
Formal Media	226	60.8	146	39.2	"I did not understand the information"
(In)Formal Authority	230	62.7	137	37.3	
Extension/Input Seller/Output Buyer	266	62.9	157	37.1	"Was not able – did not have the means, to make changes based on information"
Total	1,228	63.2	716	36.8	

Farmers' associations

A little less than a quarter of the farmers in our sample are members or have family members who are members of farmers' associations (representing 398 households, see Table 12). The percentage of male headed households compared to female headed households is greater in this regard. Households with more than 1 hectare in landholding are more than twice as likely to participate in farmers' associations than households with 1 hectare or less of agricultural land. This could be due to farmers' associations catering more to large-scale farmers, or large-scale farmers' slightly closer proximity to farmers' associations (recall the discussion on the distances to key locations). However, no causal conclusions can be based on the result. Olima Orera is the farmers' association in which most households reported to be a member (42 households), followed by Lugela (38 households). Most farmers' association members are concentrated in Alto Molócue; only 128 of the 398 households with a farmer association member are located in Molumbo. In the 2015 baseline data, around a third the number households in 2017 had a member who was a farmer association member. Of those that were, 60.47 percent reported that it was beneficial to be a member (Erman 2016).

Table 12 Membership in farmers' associations

	Member in farmers' association	
	N	%
All	398	22.76%
Gender of household head		
Male	332	23.50%
Female	66	19.64%
Size of landholdings		
1 hectare and under	53	11.57%
Above 1 hectare	345	26.72%
District		
Alto Molócue	270	28.91%
Molumbo	128	15.71%

Extension services

The total number of households that indicated that they had received information from an extension agent during the last two years is 315 (18.0 percent), 54% of whom received information twice or three times during that period (Table 13). This includes information received from any extension agent – including those working for District Services of Economic Affairs (SDAE), NGOs, private companies, etc. A noticeable difference exists between the two districts, over twice as many households received information from an extension worker in Molumbo than in Alto Molócue. Relatively larger farms also have more than twice the access to extension advice than farms under one hectare. While there are fewer female headed households, both male headed and female headed households have almost exactly the same level of access to extension officer information. The primary topics maintained an emphasis on marketing and commercialization, while expanding from an emphasis on using certified seed to also include more on land preparation and line-sowing, all three of these having a similar level of emphasis in farmer's perceptions of the primary focus on the field day in the midline survey. Seventy six percent of HHs said the information focused on a particular crop, and of those who said so, pigeon pea was listed as the most common crop of focus (34%), followed by maize (19%), soy (19%) and tobacco (13%).

Table 13 Penetration of extension services and field days

	Has received information from an extension officer in the last two years		Visited a field day in the last two years	
	N	%	N	%
All	315	18.0%	282	16.1%
Gender of household head				
Male	254	18.0%	231	16.4%
Female	61	18.2%	51	15.2%
Size of landholdings				
1 hectare and under	43	9.4%	56	12.2%
Above 1 hectare	272	21.1%	226	17.5%
District				
Alto Molócue	107	11.5%	101	10.8%
Molumbo	208	25.5%	181	22.2%

Field days

In total, 282 households (16.1 percent) reported that they had visited at least one field day during the last two years. Twenty two percent (181 households) of the households in Molumbo did, while only 11 percent of the households in Alto Molócue had (101 households). A quarter of all households in the two districts reported going twice or three times during that period. Many more households with greater than one hectare of land visited field days than those with less than a hectare. Male and female headed households appeared to have relatively equal visits to field days, with the share of male headed households slightly outweighing their counterparts. Field days are mainly put on by SDAE extension agents, followed by the cooperative/ag associations (which was the major group doing them as of the 2015 survey).

Use of inputs in agricultural production

Modern inputs

The modern inputs included in the analysis are improved seed, chemical fertilizer (urea, NPK, super phosphates), pesticide/herbicide (including insecticide, fungicide, and fumigants), and inoculant. Many more farmers in our study are using advanced inputs than were using them in the baseline study performed in 2015. To provide a general overview, we counted the households that stated they used any of these inputs during the last two years, for a total of 584 households (about 33.39 percent, up 26 percentage points from 2015). Considering the last season only, the figure falls to 28.19 percent. Improved seed is the most common modern input – 24.87 percent used modern seeds during the last two years. Table 14 illustrates the distribution of modern input use across subgroups. The use of advanced inputs, particularly improved seeds, seems to be larger in Molumbo than in Alto Molócue, surprising since Alto Molócue has relatively better access/connectedness to markets. This tendency is also evident when comparing results to those found in the TIA survey (Table 15). Beyond regional differences, Table 14 shows that male headed households and farmers with relatively larger farms are more likely to use modern inputs.

Table 14 Total use of modern inputs

	Used modern inputs during last two years		Used modern inputs during last agricultural year 2016/17		Used improved seed during last two years		Used improved seed during last season 2016/17	
	N	%	N	%	N	%	N	%
All	584	33.39%	493	28.19%	435	24.87%	418	23.90%
Gender of household head								
Male	488	34.54%	414	29.30%	361	25.55%	347	24.56%
Female	96	28.57%	79	23.51%	74	22.02%	71	21.13%
Size of landholding								
1 hectare and under	94	20.52%	75	16.38%	62	13.54%	61	13.32%
Above 1 hectare	490	37.96%	418	32.38%	373	28.89%	357	27.65%
District								
Alto Molócue	207	22.16%	182	19.49%	174	18.63%	169	18.09%
Molumbo	377	46.26%	311	38.16%	261	32.02%	249	30.55%

Table 15 Comparison of INOVAGRO and TIA data on use of modern inputs

	Use of modern inputs* during one agricultural year			Number of observations
	Alto Molócue	Molumbo	Total	
INOVAGRO Baseline Survey 2017	19.49%	38.16%	28.19%	1,749
TIA 2012	7.46%	24.39%	18.42%	190

Note: * In INOVAGRO it includes improved seed, fertilizer, pesticide/herbicide, and inoculant. In TIA it includes improved seed (for maize), fertilizer, and pesticide.

Labor inputs – family and hired labor

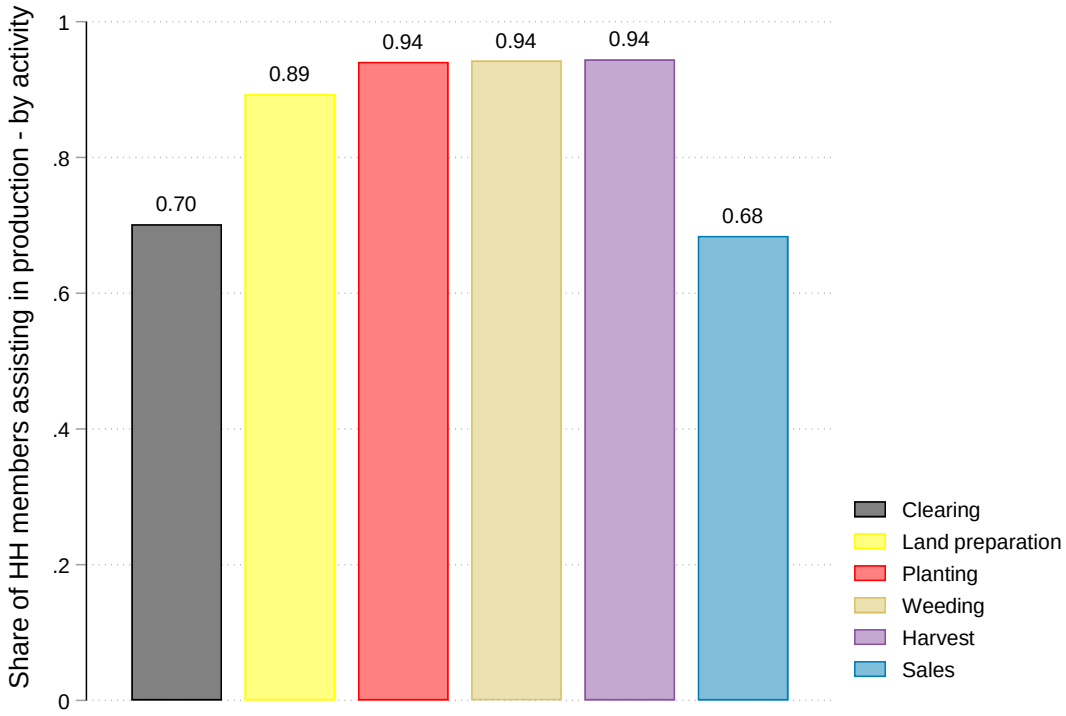
Most families use family labor in agricultural production. Nine out of ten families (94.57 percent) had more than one member of the household performing farm work (Table 16). Female-headed households have smaller areas of total land size than male-headed households and fewer female-headed households use family labor (only 85.42 percent). Almost three out of ten households (26.58 percent) hire external labor to assist in production. Larger farms and female-headed households are more likely to hire labor – perhaps to compensate for the lack of access to family labor. In Molumbo it is more common to hire labor.

Table 16 Use of labor in agricultural production

	Used family labor (more than one member of the household performed farm work)	Used hired labor
All	94.57%	26.58%
Gender of household head		
Male	96.74%	26.06%
Female	85.42%	28.74%
Size of landholding		
1 hectare and under	90.17%	17.80%
Above 1 hectare	96.13%	29.67%
District		
Alto Molócue	94.22%	22.70%
Molumbo	94.97%	31.03%

In the survey, we asked if family members aged 10 or older participate in different activities of the agricultural production process. We added the number of family members assisting and divided that by the total number of members aged 10 or older to generate a comparable number – the share of household members participating in production by activity. Figure 9 shows that almost all family members (89–94 percent) aged 10 or older participate in core agricultural activities, from land preparation to harvesting, while clearing and sales are less labor-intensive.

Figure 9 Share of household members (above the age of 10) assisting in agricultural production



Agricultural production during first and second season 2016/2017

This section focuses on agricultural production and output. It looks at the most important crops first from the entire 2016/17 agricultural year and then by season, before turning to production and yields for all major crops. Each crop's production is calculated as the sum of the harvested quantity of kilograms given by the survey respondent, across the household's fields.

Most common crops cultivated

Maize is the most important staple crop in northern Mozambique, and is the crop cultivated by the highest share of households (82 percent) in the two districts (Figure 10). The runner up is pigeon pea, cultivated by 79 percent of households, a slightly greater percentage of households in Alto Molócue producing pigeon pea. Pigeon pea is an emerging crop in Mozambique. During the past decade, much of the increase in pigeon pea production took place in Zambézia province, where both Alto Molócue and Molumbo are located, with a production level in 2012 that was more than double the national total in 2002. Production in Zambézia increased sevenfold in that time period. Five out of ten households (53 percent) in the sample cultivate cassava, another important staple crop in northern Mozambique. The province of Zambézia accounted for 45 percent of total national production of cassava in 2012, up from 28 percent in 2003. Both pigeon pea and cassava are commonly intercropped with maize. After these three widely produced crops are butter bean (32 percent), also known as common bean, soya (21 percent) and sorghum (15 percent).

Figure 10 Most commonly grown crops across both seasons

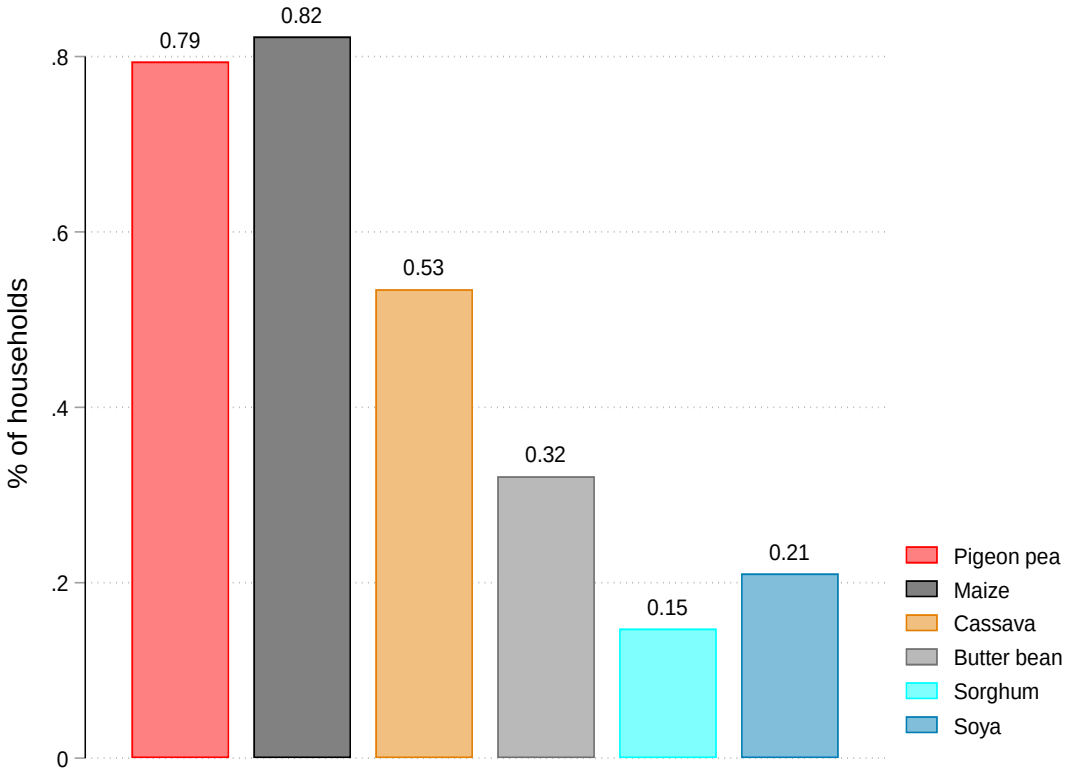


Table 17 compares the most commonly cultivated crops across subgroups. Farmers with more land have more space to diversify their production and therefore produce a greater variety of crops. A few differences exist between Alto Molócue and Molumbo. Growing cassava is more common in Alto Molócue, while growing soya is more common in Molumbo (39% compared to 5% in Alto Molócue). Pigeon pea, butter beans, and sorghum are also more commonly grown in Alto Molócue than in Molumbo.

Table 17 Most commonly grown crops by subgroup

	Pigeon pea	Maize	Cassava	Butter bean	Soya	Sorghum
All	79.42%	82.28%	53.46%	32.13%	21.04%	14.75%
Gender of household head						
Male	79.33%	82.38%	53.15%	33.05%	22.08%	14.86%
Female	79.76%	81.85%	54.76%	28.27%	16.67%	14.29%
Size of landholding						
1 hectare and under	66.81%	71.62%	44.54%	18.56%	8.30%	8.30%
Above 1 hectare	83.89%	86.06%	56.62%	36.95%	25.56%	17.04%
District						
Alto Molócue	80.51%	82.12%	64.67%	38.12%	5.14%	16.60%
Molumbo	78.16%	82.45%	40.61%	25.28%	39.26%	12.64%

First season

The first season is the primary growing season in northern Mozambique and stretches from November to February. Households were asked to indicate the primary crop for each parcel they cultivated during the first season of 2016/17. Primary crop is defined as the crop that *produced the most* on that parcel. After the primary crop, we asked for a secondary and tertiary crop for each parcel in case a household cultivated more than one crop on the parcel. Table 18 includes percentages of households with parcels cultivated with one, two, or three or more crops. The share of households with parcels cultivated with three or more crops is 62.26 percent, while 22.13 percent of households have a parcel with only one crop. Consistent with our intuition, farmers with larger landholdings are more likely to have more crops on their parcels. It is much more common to use parcels for three or more crops in Molumbo than in Alto Molócue. In Molumbo, 66.26 percent of households have a parcel with three or more crops while only 58.78 percent in Alto Molócue do. Cassava is the most common crop for mono-cropping, followed by pigeon pea, maize and cashew (Figure 11).

Table 18 Share of households with one, two, or three or more crops per parcel, for households with more than one parcel

	Mono crop parcel	Two crops on parcel	Three or more crops on parcel
All	22.13%	41.68%	62.26%
Gender of household head			
Male	21.94%	41.97%	62.28%
Female	22.92%	40.48%	62.20%
Size of landholding			
1 hectare and under	5.24%	41.27%	52.84%
Above 1 hectare	28.12%	41.83%	65.61%
District			
Alto Molócue	24.84%	43.58%	58.78%
Molumbo	19.02%	39.51%	66.26%

Figure 11 Crops primarily used as mono-crops (only one crop used on parcel)

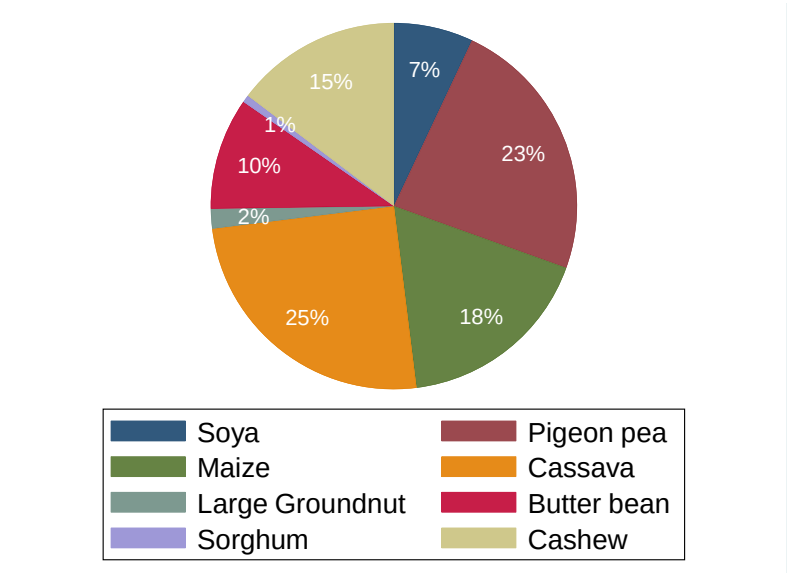


Figure 12, figure 13 and figure 14 include parcel-level information. Maize was indicated as the main crop on 31 percent of parcels during the first season. In Molumbo, pigeon pea is the most common main crop (36 percent) while in Alto Molócue, maize is the primary crop on 30 percent of parcels. Maize and Soya are also important primary crops in Molumbo. Across all parcels, maize is also the most commonly indicated secondary crop on parcels. As for tertiary crops, the results are more diverse. However, it appears to be common to grow cashew in addition to other crops since 27 percent of household responded that cashew is their third most important crop for the first season.

Figure 12 Primary crops of the first season

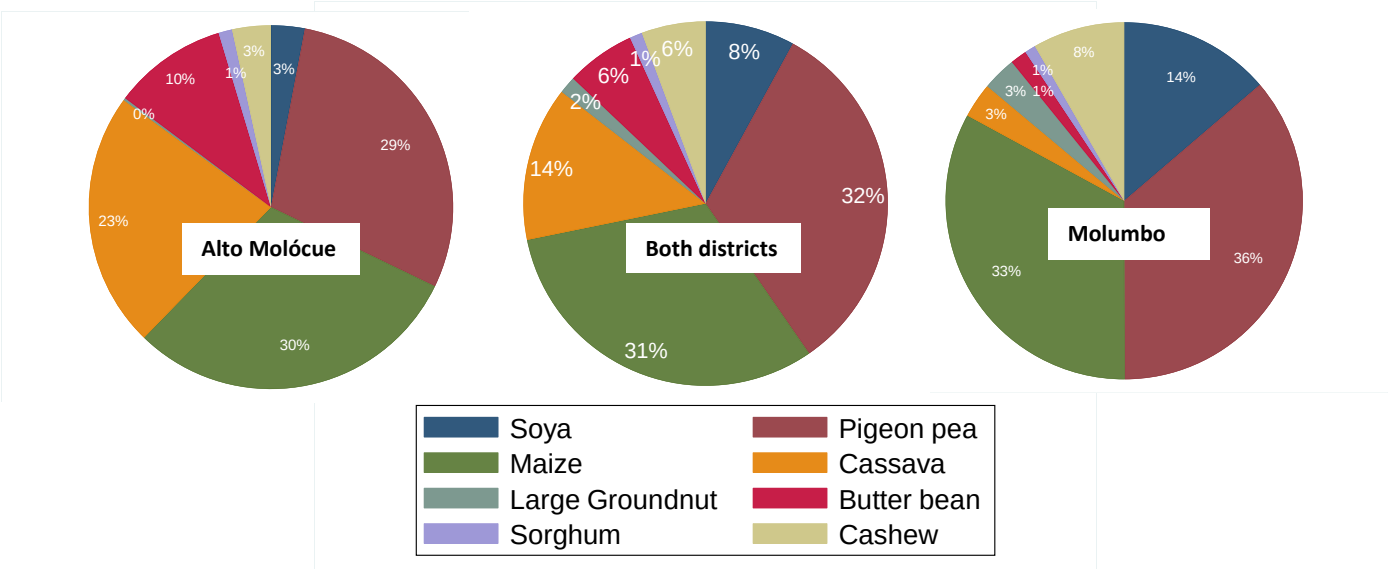


Figure 13 Secondary crops of the first season

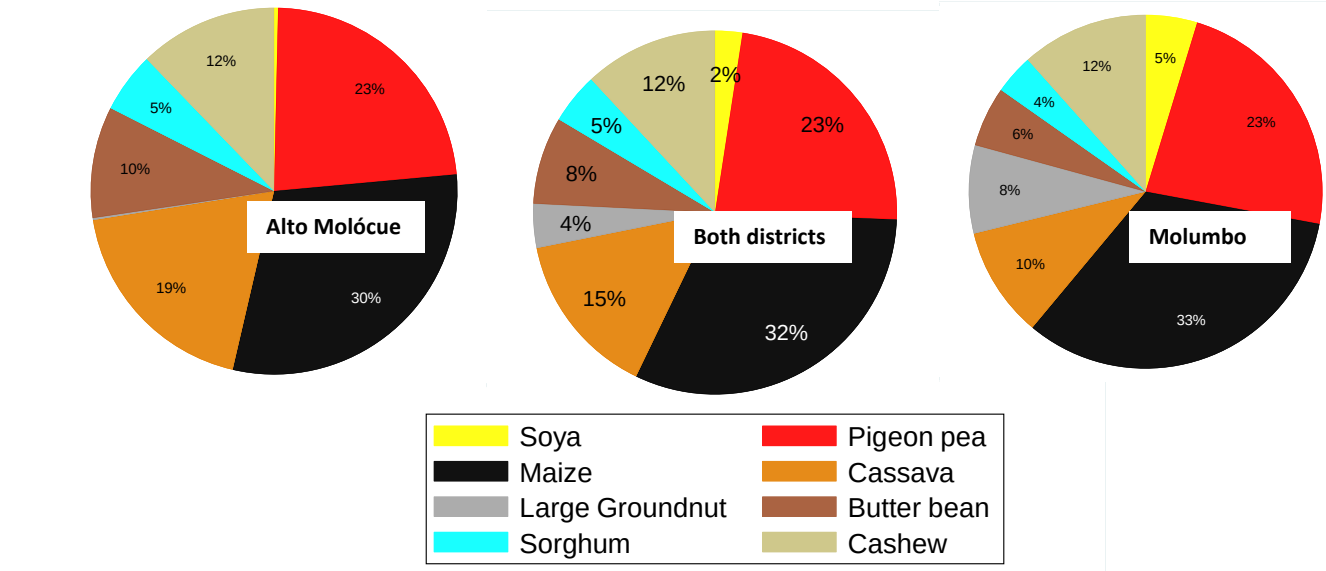
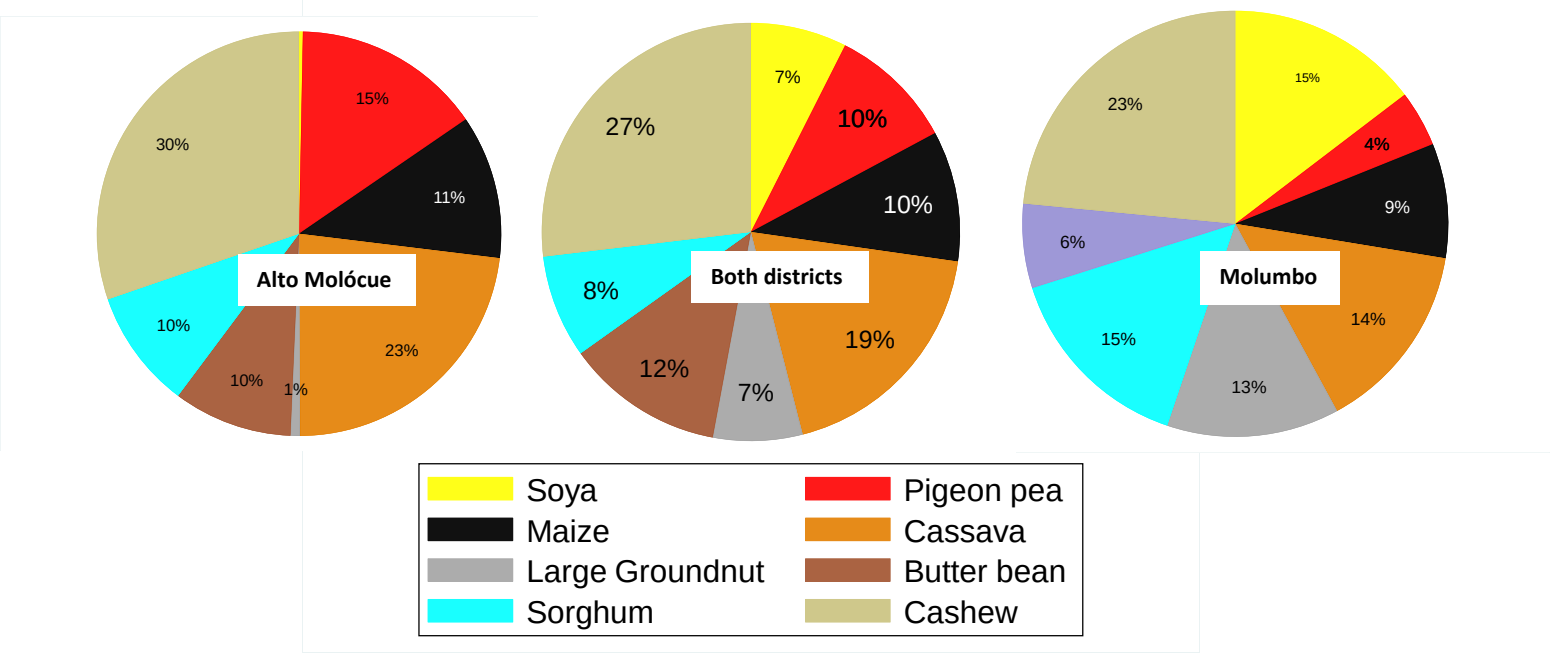


Figure 14 Tertiary crops of the first season



Second season

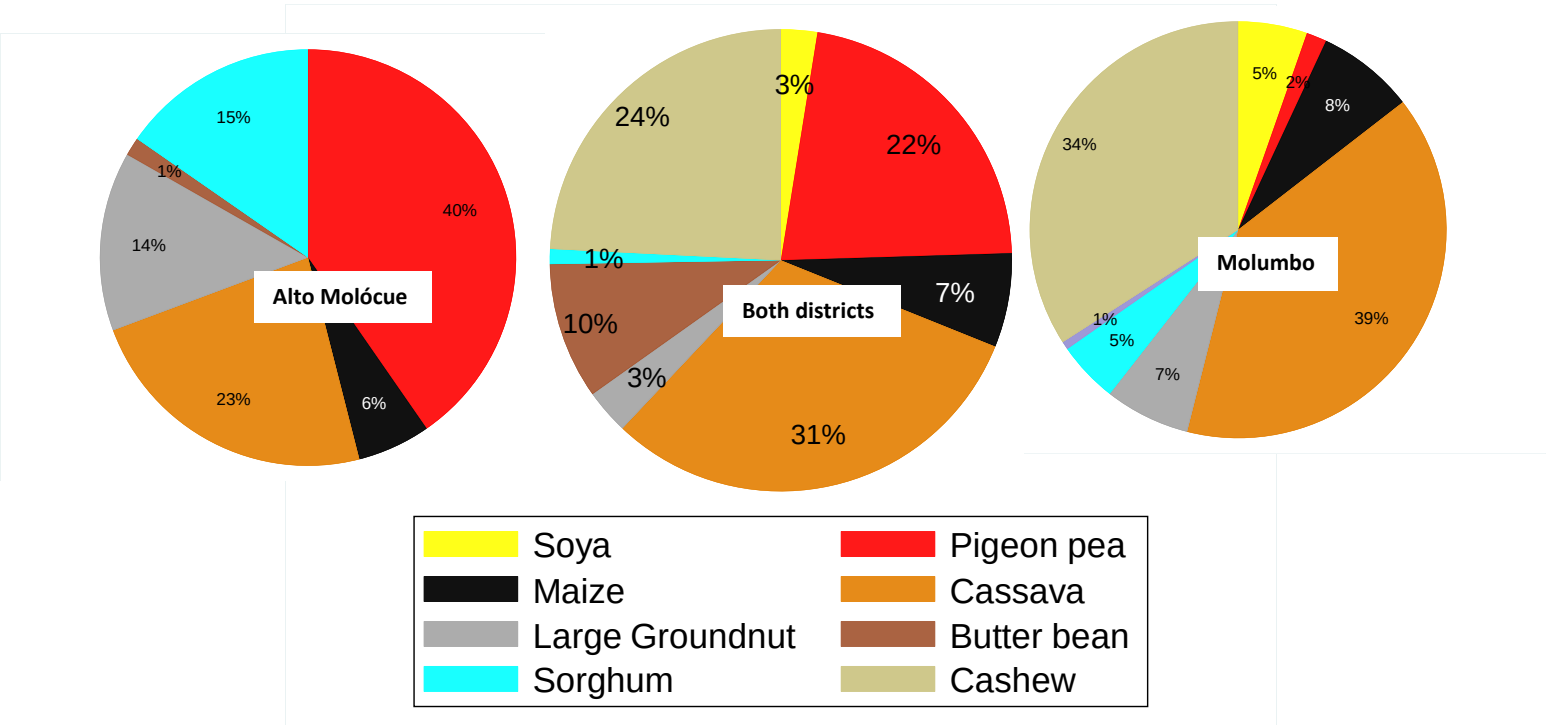
The second season in northern Mozambique is significantly less productive than the main season. It stretches from March to July. About 30.42 percent of farmers in the sample utilize the second season for agricultural production. Three times as many farmers among the relatively larger landholders utilize the second season and a slightly greater percentage of male-headed households and farmers in Molumbo cultivate during the second season, compared to female-headed households and farmers in Alto Molócue, respectively.

Table 19 Description of households that cultivate in the second season

		Gender of household head		Size of landholding		District	
	Total	**Male**	**Female**	**1 hectare and under**	**Above 1 hectare**	**Alto Molócue**	**Molumbo**
Cultivated second season	30.42%	31.49%	25.89%	11.79%	37.03%	29.23%	31.78%

Figure 15 displays the crops indicated as primary crops on parcels used for agricultural production during the second season of 2015. Cassava, cashew and pigeon pea are the most commonly grown crops in the second season. The common practice in the northern Mozambique is that cassava crop is established in August/September each year (before the first season for many of the other crops) from the stems obtained from the previous cassava harvest which takes place in July/August (Paulo Muchave, DAI, personal communication, December 12, 2018).

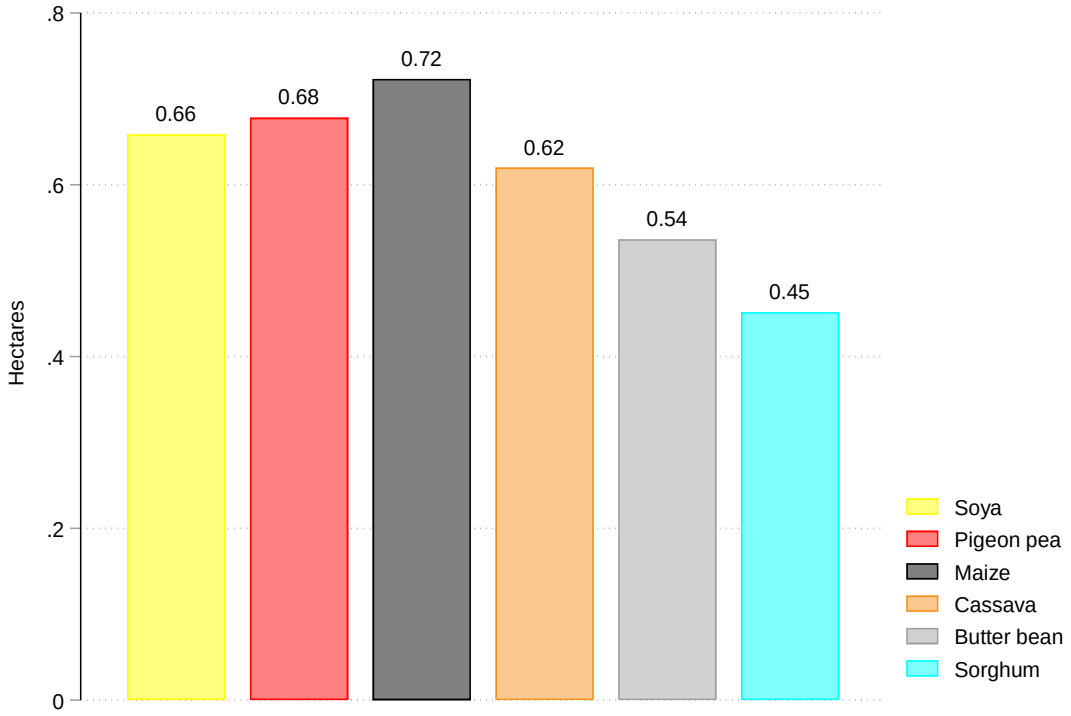
Figure 15 Primary crops of the second season



Area dedicated to primary crops

On average, households that grow maize dedicate 0.72 hectares to its production. Households that grow soya, pigeon pea or cassava are using an average area between 0.62 and 0.68 hectares (these are the areas as given for the first season). Figure 16 includes only households that cultivate the different crops. An average 0.54 hectares and 0.45 hectares is planted for butter bean and sorghum respectively. The next section provides more detail about the farmers of INOVAGRO's value chain crops.

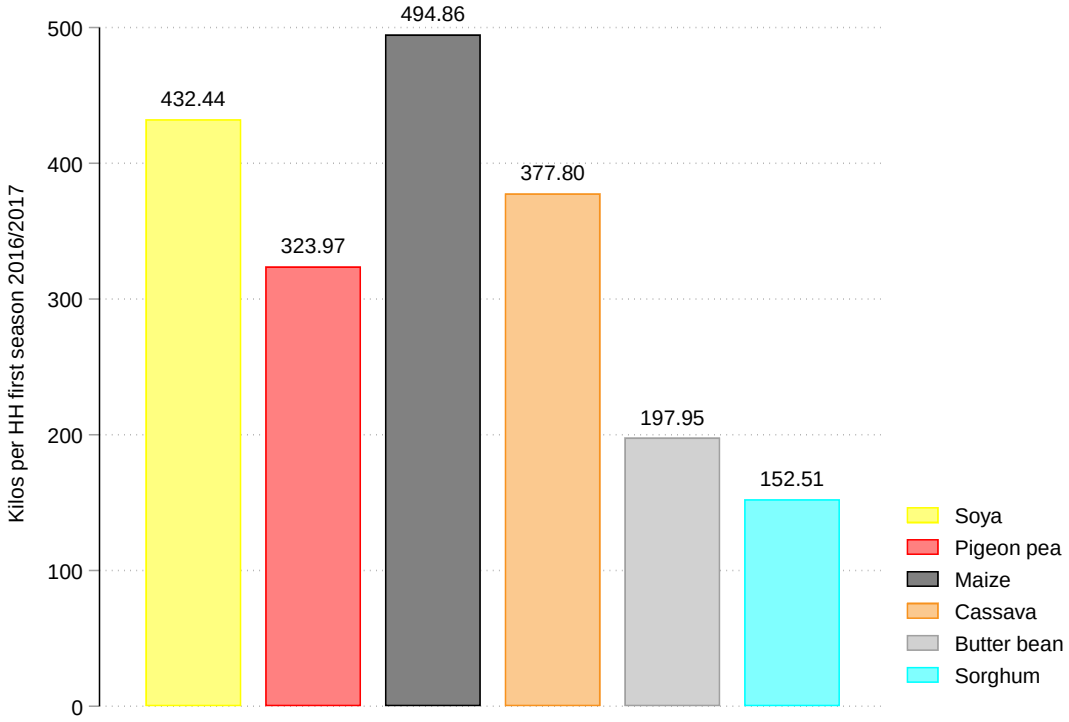
Figure 16 Average area (hectares) dedicated to most common crops among households growing each crop



Primary Crop Production

The reported crop production quantities were added together, focusing only on the main (first) season. The average production per household is included in Figure 17, counting only the households that grew the respective crop during the first season. According to our calculations based on the estimations provided by farmers, households dedicated to maize production produce 495 kg on average during the first season. Production of soybean is about 432 kg per household, and production of cassava is about 378 kg, while production of pigeon pea is slightly lower than these three on average. Butter bean and sorghum are produced in even lower quantities, primarily due to the smaller areas dedicated to their cultivation.

Figure 17 Average production (kg) per household by crop for the first season of 2016/17



Yields – primary crops

Dividing the production of each crop by its area calculates an estimated yield. Figure 18 presents yield levels for the most popular crops. These results are compared with findings of yield estimates from other studies in Mozambique, and northern Mozambique in particular. According to our findings, the yield of maize is 685 kg/ha. Households that use improved maize seed average a higher maize yield of 706 kg/ha however this difference is not significantly greater than the average across all maize growers (Table 20).

Figure 18 Yield of most commonly grown crops (kg/ha)

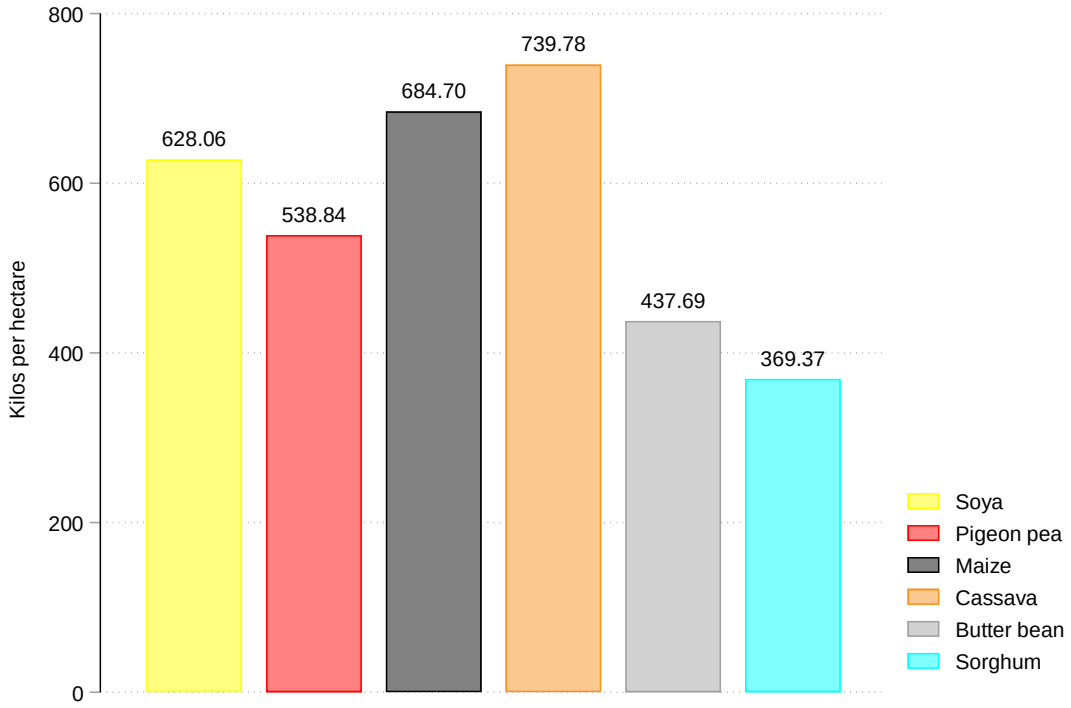


Table 20 Implication of improved seed use on yields of soybean, pigeon pea and maize in the 2016/17 season

	Soybean Yield	Pigeon Pea Yield	Maize Yield
All	628.06	538.84	684.70
HH did not use improved seed	534.57**	496.85**	681.51
HH used Improved Seed	749.37	1068.23	705.57

*, **, and *** means the t-test of the means is statistically significant at the 10, 5, and 1 percent level, respectively.

The average household in our study produces soybean with a yield of 628 kg/ha. While households that use improved soybean seed, again, produce greater soybean yields than average (by 121 kg/ha), this result is not significant at the $p > 0.1$ level. However, households who do not use improved soybean seed have soybean yields significantly lower than the average soybean yield across all soybean producers, by 94 kg/ha.

Our estimates for pigeon pea and cassava yields are particularly high in comparison to other studies. Our average estimate of pigeon pea yield is 539 kg/ha. Estimates using 2012 TIA data find that pigeon pea yield in Mozambique is about 356 kg/ha, quite a bit lower than our estimates (Walker et al. 2015). Households in our study who do not use improved pigeon pea seed, however, have pigeon pea yields significantly lower than the average yield across all pigeon pea producers, by 42 kg/ha.

Our estimated yield for cassava is 740 kg/ha, and this time our estimate is much lower than findings in the literature. In the FAOSTAT data, yield estimates for cassava in Mozambique vary substantially across years

– between 4,200 kg/ha in 2008 to 13,200 kg/ha in 2012. These numbers are somewhat different from the estimates in Dias (2012), who estimate that yield of cassava was 7,770 kg/ha in 2006 and 6,000 kg/ha in 2010 in Mozambique. Compared to either source, our estimate is substantially lower.

Our estimated yield of butter bean is 438 kg/ha, fairly in line with findings from other sources. A study on butter beans and fertilizer use from northern Mozambique found that yield without fertilizer was around 539 kg/ha (Amane et al. 2004). According to FAOSTAT, the yield of beans in general was between 250-370 kg/ha from 2008 to 2013. Our study's yield of sorghum is 369 kg/ha which again falls within the range of estimated sorghum yields reported by FAOSTAT from 2008 to 2013, of between 300 and 600 kg/ha.

INOVAGRO value chain crop production

This section goes into more detail on the production of the value chain crops that are central in the INOVAGRO intervention; soybean, pigeon pea and maize. The focus is primarily on area, production, and value of production and yield.

Soybean, pigeon pea, and maize

Table 21 includes dummy variables indicating if the household cultivated soybean, pigeon pea, or maize during the last two years. The information is broken down by subgroup. Alto Molócue has a more intense focus on pigeon pea than on maize, and less than 10 percent of farmers in Alto Molócue are growing soybean. Ninety one percent of farmers in Alto Molócue report pigeon pea cultivation during the last two years compared to 88 percent for maize. Among Molumbo's households, 80 percent report that they cultivated pigeon pea, but maize is more common (87 percent of households). Forty three percent of households in Molumbo grow soybean. More farmers with greater than 1 hectare of land grow any of these crops, and slightly more male headed households produce each crop, by about a 2 to 2.5% difference in each case.

Table 21 Production of value chain crops during the last two years

	Soybean	Pigeon pea	Maize
All	24.81%	86.11%	87.25%
Gender of household head			
Male	25.48%	86.41%	87.62%
Female	22.02%	84.82%	85.71%
Size of landholding			
1 hectare and under	12.01%	78.82%	80.57%
Above 1 hectare	29.36%	88.69%	89.62%
District			
Alto Molócue	9.31%	91.11%	87.90%
Molumbo	42.58%	80.37%	86.50%

Soybean production

A total of 352 households cultivated soybean during the 2016/17 agricultural year (Table 22). On average, 0.66 hectares were dedicated to soybean cultivation per household. Almost half (45.61 percent) used improved seed for their soybean production – which is comparatively high. Households with more than 1

hectare of land used improved seeds more frequently than those with less land, as did households in Alto Molócue compared to those in Molumbo. While there were fewer farmers that grew soybean in Alto Molócue (48 compared to 304 in Molumbo), those who did planted soybean over greater average areas (0.98 hectares compared to an average 0.61 hectares in Molumbo). Production per household for the first season was 432 kg on average for soybean farmers.

Table 22 Soybean production for households that cultivated soybean during first season of 2016/17

	Number of households that grew soybean first season	Average production (kg) by households that cultivated soybean first season	Average area (hectares) dedicated to soybean cultivation first season	Used improved seeds on soybean in 2016/17	
	N	Mean	Mean	%	N
All	352	432.4	0.66	45.61%	182
Gender of household head					
Male	299	454.9	0.67	45.18%	150
Female	53	301.0	0.58	47.76%	32
Size of landholding					
1 hectare and under	35	218.5	0.37	29.17%	14
Above 1 hectare	317	460.6	0.69	47.86%	168
District					
Alto Molócue	48	537.6	0.98	62.50%	40
Molumbo	304	414.0	0.61	42.39%	142

Pigeon pea production

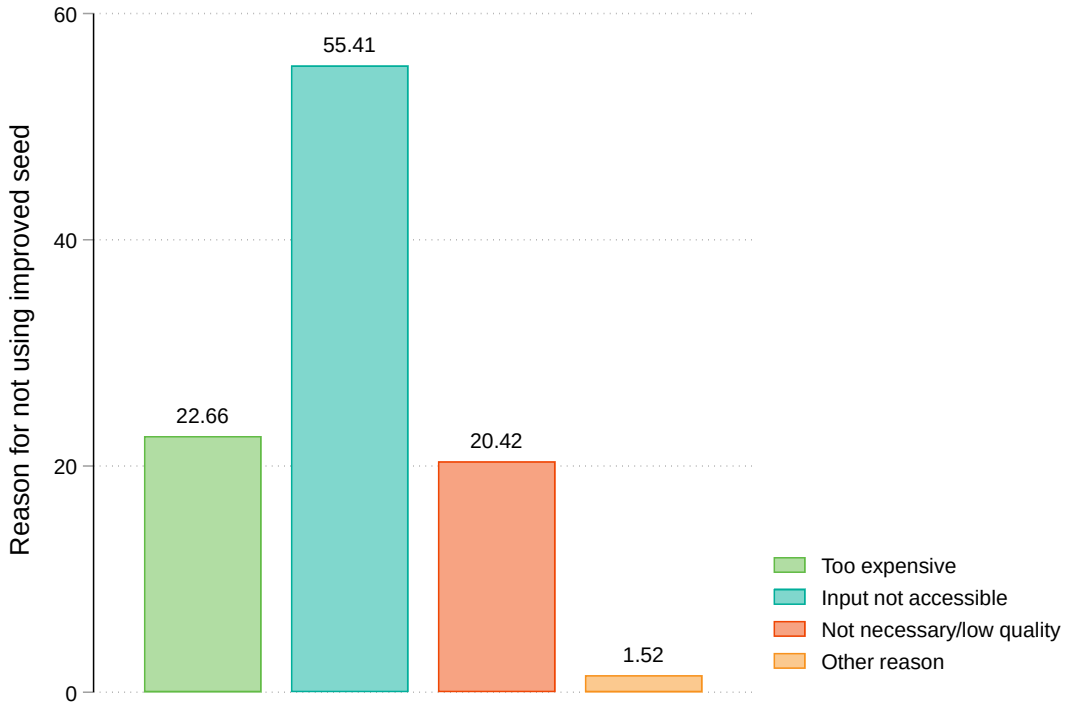
In total, 1,328 households (76 percent) produced pigeon pea during the first season of the 2016/17 agricultural year, on an average of 0.68 hectares. Seven percent of them used improved seed in their production, more of whom were in Alto Molócue than Molumbo. Surprisingly, a greater of household who had under 1 hectare of land than those with larger plots of land used improved seeds (25 out of 303, 7.53 percent, compared to only 76 out of 1,025, or 6.84 percent). The average production per household was 324 kg across both seasons for pigeon pea producers. Average area, production, and value of production are broken down by subgroups in Table 23.

Table 23 Pigeon pea production for households that cultivated pigeon pea during first season of 2016/17

	Number of households that grew pigeon pea first season	Average production (kg) by households that cultivated pigeon pea first season	Area (hectares) dedicated to pigeon pea cultivation first season	Used improved seeds on pigeon pea in 2016/17	
	N	Mean	Mean	%	N
All	1,328	324.0	0.68	7.00%	101
Gender of household head					
Male	1,069	330.7	0.69	7.34%	86
Female	259	296.0	0.62	5.54%	15
Size of landholding					
1 hectare and under	303	231.1	0.43	7.53%	25
Above 1 hectare	1,025	350.1	0.75	6.84%	76
District					
Alto Molócue	693	222.6	0.60	7.81%	62
Molumbo	635	431.0	0.77	6.01%	39

The main reason households gave for not using improved seed for pigeon pea was because the input was not accessible; that is, the input provider was located too far away, the quantity offered was too large for the farmer to buy, or the farmer did not know of any input providers. These reasons were given by 55.41 percent of the farmers who cultivated pigeon pea but did not use improved seed. High prices were cited by 22.66 percent of farmers, and low quality or the seed not being necessary was given as a response by 20.42 percent (Figure 19).

Figure 19 Reasons why pigeon pea farmers choose not to use improved seed



Maize production

As previously established, maize is the most commonly cultivated crop among the households in the sample, surpassing the share of households cultivating pigeon pea by just a few percentage points. During the 2016/17 agricultural year, 1,431 households (82 percent) produced maize (Table 24). On average, households dedicate 0.72 hectares to maize production. A 12.63 percent of them use improved seed in their production – the majority of which reside in Molumbo. Despite greater numbers of households growing maize residing in Alto Molócue, the number and the share of farmers from this area using improved seed is less than half the share of the maize producers in Molumbo, who also plant larger areas of maize, on average, as well. A larger share of households with larger plots also use more improved seeds (158 out of 1,104). Average production per household reached an estimated 495 kg during the first season for maize producers, with larger quantities produced by those in Molumbo.

Table 24 Maize production for households that cultivated maize during first season of 2016/17

	Number of households that grew maize first season	Average production (kg) by households that cultivated maize first season	Area (hectares) dedicated to maize cultivation first season	Used improved seeds on maize in 2016/17	
	N	Mean	Mean	%	N
All	1,431	494.9	0.72	12.63%	189
Gender of household head					
Male	1156	515.0	0.74	13.20%	160
Female	275	410.1	0.65	10.21%	29
Size of landholding					
1 hectare and under	327	280.9	0.39	8.78%	31
Above 1 hectare	1104	556.6	0.82	13.82%	158
District					
Alto Molócue	761	311.1	0.61	7.76%	62
Molumbo	670	698.8	0.85	18.22%	127

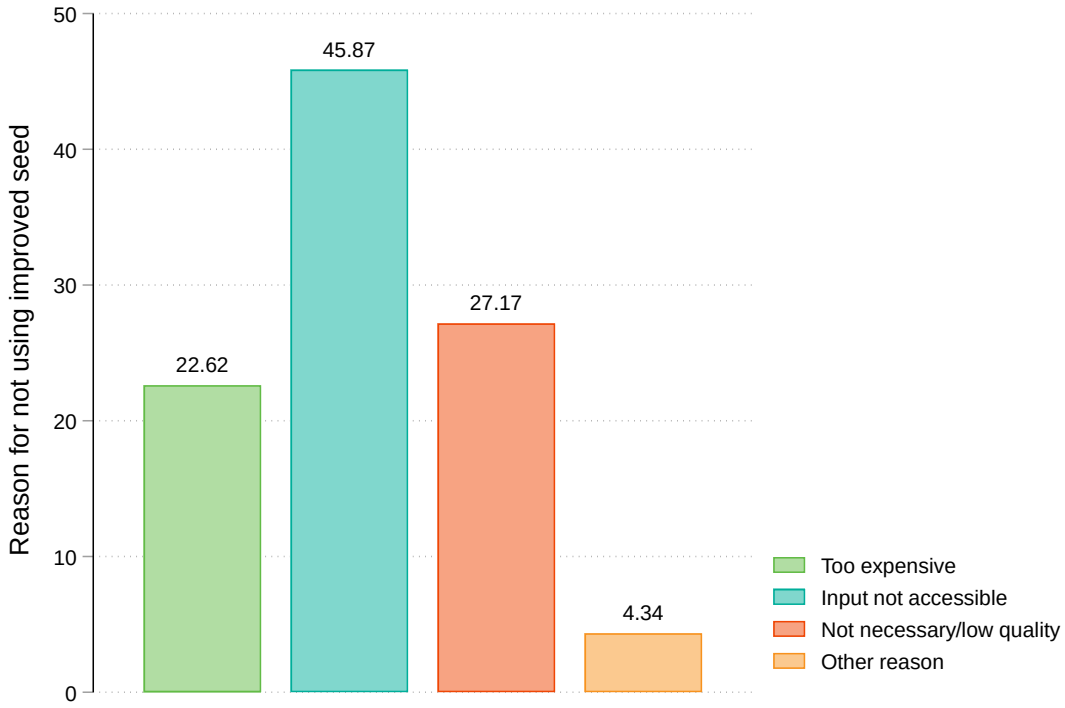
The usage rates in our 2017 survey closely resemble the rate of improved seed use among maize farmers in the TIA 2012 survey (Table 25). The TIA 2012 did not ask about improved seed usage for any other crop.

Table 25 Comparison of TIA and INOVAGRO data on improved seed use on maize

	Improved seed on maize			Number of observations (maize producers)
	Alto Molócue	**Molumbo**	**Total**	
INOVAGRO Baseline Survey 2017	7.76%	18.22%	12.63%	1,431
TIA 2012	7.46%	17.89%	17.89%	188

Most maize farmers who choose not to use improved seed in their cultivation indicate input inaccessibility as the main reason (45.87 percent). This could be because the farmer did not know an input provider who sells improved seed or improved seed was for other reasons not accessible to the farmer, e.g. not available for purchase when needed. Improved seed not being necessary or being of low quality was cited by 27.17 percent of maize producers, and high prices for improved seed was the primary reason listed by 22.62 percent as their reason for not using it (Figure 20).

Figure 20 Reasons why maize farmers choose not to use improved seed



Sales

Most of the households in the sample practice subsistence farming. However between 34 and 51 percent report having sold at least some of their production of soybean, pigeon pea, or maize during the 2016/17 agricultural year (Table 26). Overall, pigeon pea seems to be the main cash crop among the value chain crops. Even though the ratio of those selling it to those growing it is lower than that of soybean, 458 producers of pigeon pea sold their produce (34.49 percent), while only 341 maize producers sold maize (23.83 percent), and 180 soybean producers sold soybean (51.14 percent). Greater shares of larger farmers sell their cash crops than smaller farmers, with this disparity being the least among soybean producers -- while 52 percent of soybean producers with over one hectare sold soybean, 46 percent of producers with less than one hectare also sold soybean. Greater shares of pigeon pea and maize farmers sold these crops in Molumbo compared to Alto Molócue. On the other hand, a larger share of soybean farmers engaged in sales in Alto Molócue than in Molumbo.

Table 26 Households that engage in sales of soybean, pigeon pea, and/or maize, among producers of each crop

	Households that sold soybean in 2016/17		Households that sold pigeon pea in 2016/17		Households that sold maize in 2016/17	
	%	N	%	N	%	N
All	51.14%	180	34.49%	458	23.83%	341
Gender of household head						
Male	52.51%	157	35.17%	376	24.65%	285
Female	43.40%	23	31.66%	82	20.36%	56
Size of landholding						
1 hectare and under	45.71%	16	17.49%	53	11.31%	37
Above 1 hectare	51.74%	164	39.51%	405	27.54%	304
District						
Alto Molócue	52.08%	25	23.09%	160	14.45%	110
Molumbo	50.99%	155	46.93%	298	34.48%	231

Main buyers

Figure 20, Figure 21, and Figure 22 show how the main buyers of soybean, pigeon pea, and maize, respectively. The main buyers of soybean are private companies (43 percent), followed by retailers, agro-dealers and wholesalers. While we know that the categories of private companies, retailers and agro-dealers are not exclusive to one another, the respondents of the survey were simply given a list of options to choose from and asked to identify the type of actor that best described who they perceived themselves to be selling to. Retailers refer to those buying the produce to resell it in another market; wholesalers refer to those buying the produce to resell it in bulk; agro-dealers are persons known for their activity in buying and selling agricultural inputs; and private companies indicate that the buyer is known to also represent an output seller enterprise. The main buyers of pigeon pea are the same group: private companies (31 percent), then followed by agro-dealers, retailers and wholesalers. The main buyers of maize are more evenly split between private companies (30 percent) and agro-dealers (31 percent), followed by retailers, neighbors, and wholesalers. While 8 percent of maize sales are made to neighbors, about 6 percent of pigeon pea sales are also to neighbors, while this figure is closer to 2 percent for soybean.

Figure 21 Main buyers of soybean in 2016/17

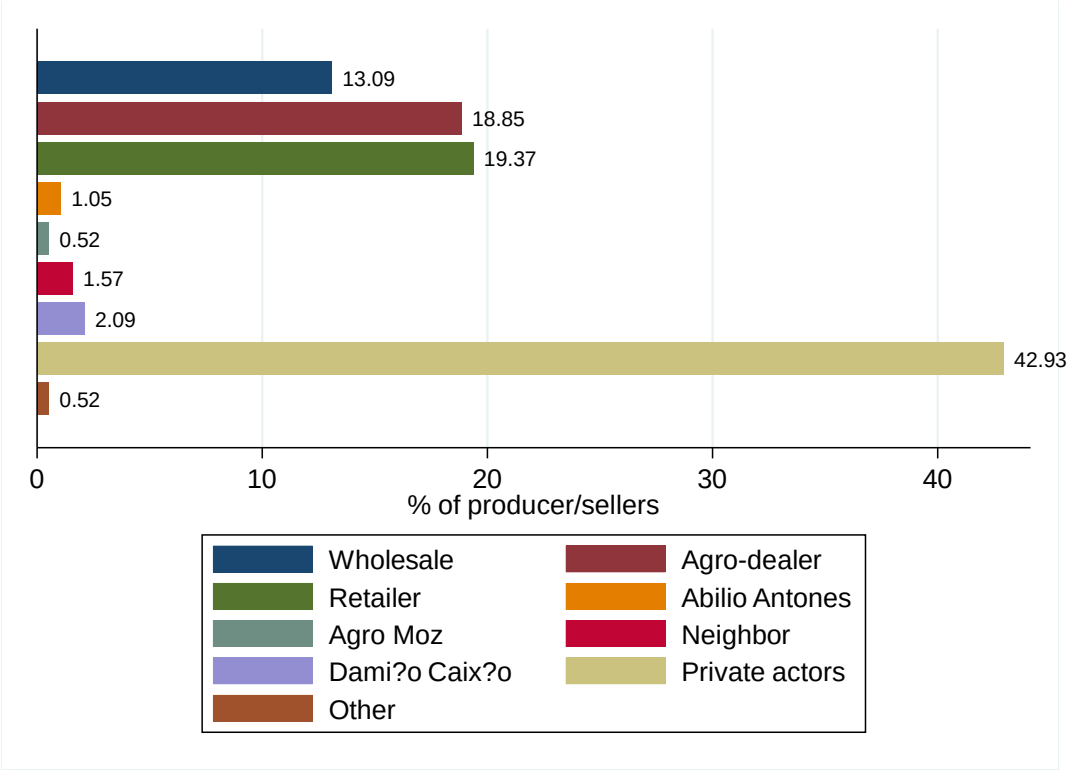


Figure 22 Main buyers of pigeon pea in 2016/17

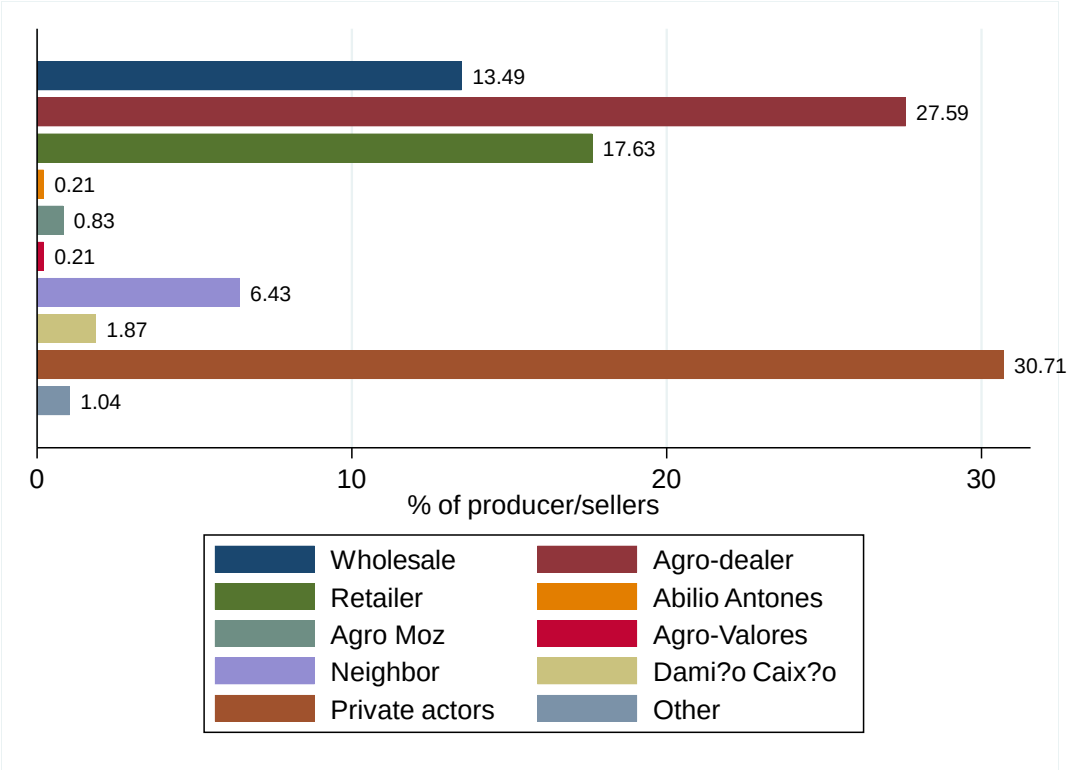
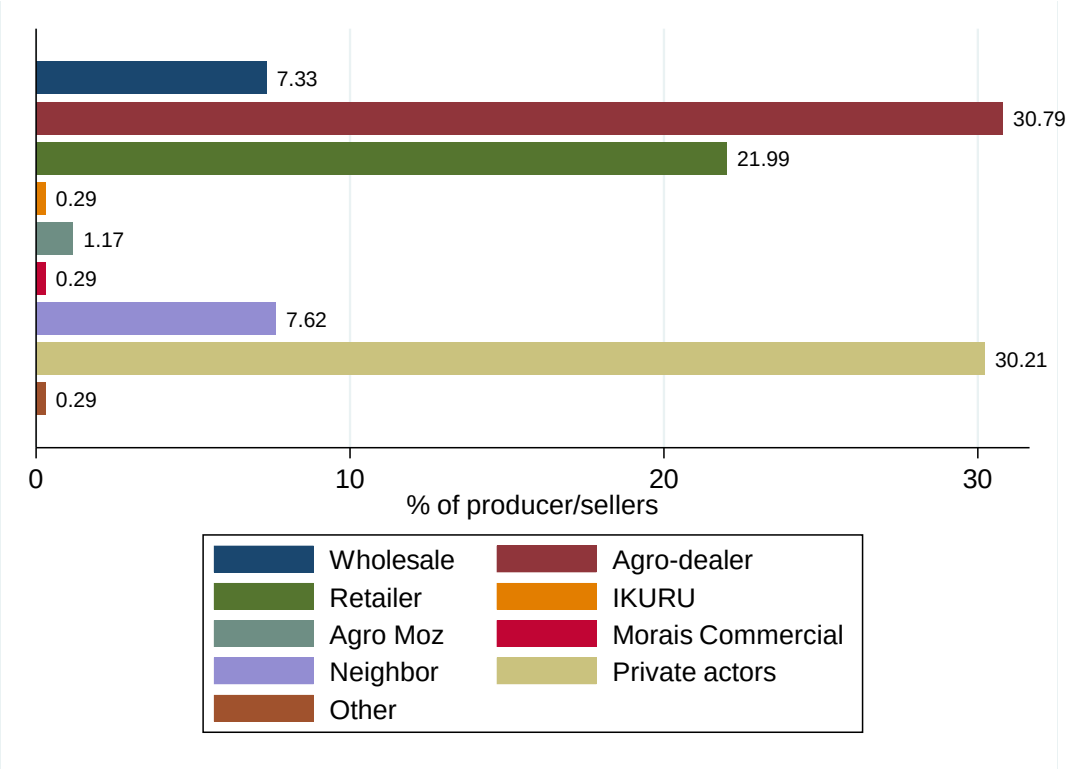


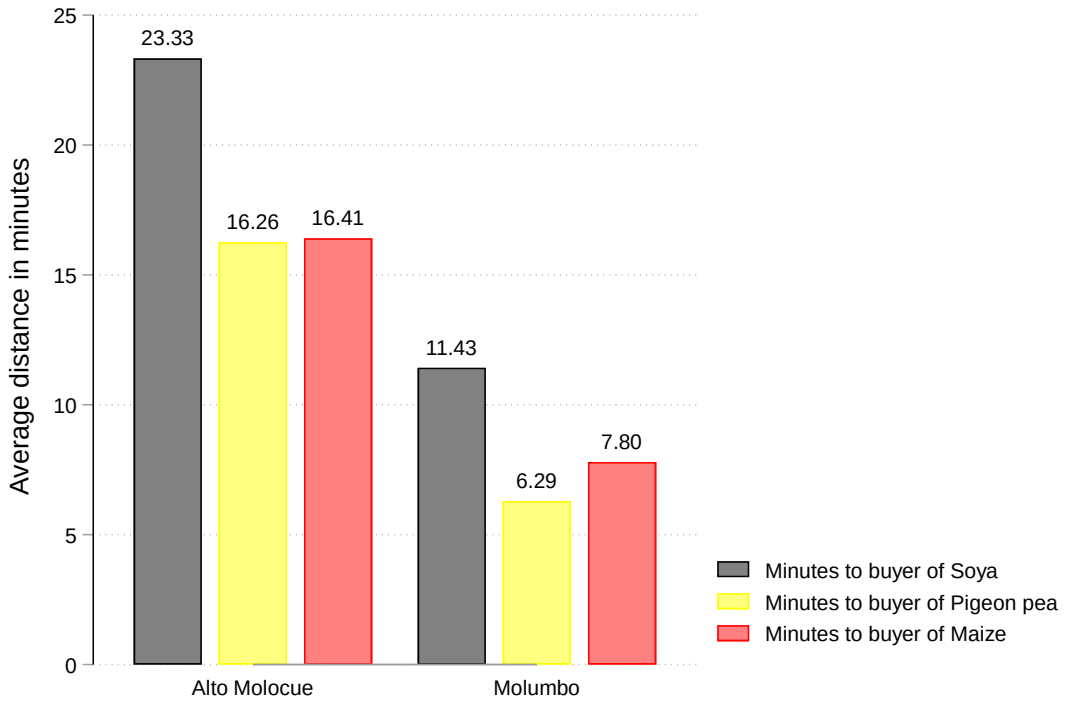
Figure 23 Main buyers of maize in 2016/17



Distance to main buyer

Figure 24 includes the average distance to the main buyers (indicated above) by households who sold their product, in minutes spent walking, differentiated across crop and district. Alto Molócue seems to be located farther from the main buyers for each of the three value chain crops. This is particularly clear for soybean, which may help explain the larger market participation of soybean farmers in Molumbo. The distance to main soybean buyers is about 12 minutes more by foot for retailing households in Alto Molócue than for those in Molumbo, and 10 minutes more, on average, for households selling pigeon pea in Alto Molócue compared to households selling pigeon pea in Molumbo, with this difference being a bit less than 9 minutes for maize sellers.

Figure 24 Distance to main buyers by households who sold their product, in minutes spent walking, across crop and district



SUMMARY AND NEXT STEPS

This report described some of the midline data collected as part of an ongoing impact evaluation of Phase II of the Innovation for Agribusiness (INOVAGRO II) intervention in northern Mozambique. The target population of the intervention being evaluated and of this report are small-scale farmers in the Zambézia province. The report concentrated on providing descriptive statistics on household characteristics, agricultural production and market access. The information was compared across gender, size of land holdings and the two districts participating in the impact evaluation – Alto Molócue and Molumbo.

While this report presents some of the key results and statistics of specific interest for the impact evaluation and the Market System Development (MSD) approach, the midline data cover more than what is presented here. The INOVAGRO II intervention is still currently under implementation in the intervention areas in Alto Molócue and Molumbo. The third and final data collection will take place during 2019.

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