

SECTION D: Farm Characteristics, Crops and Productivity

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Section Highlights

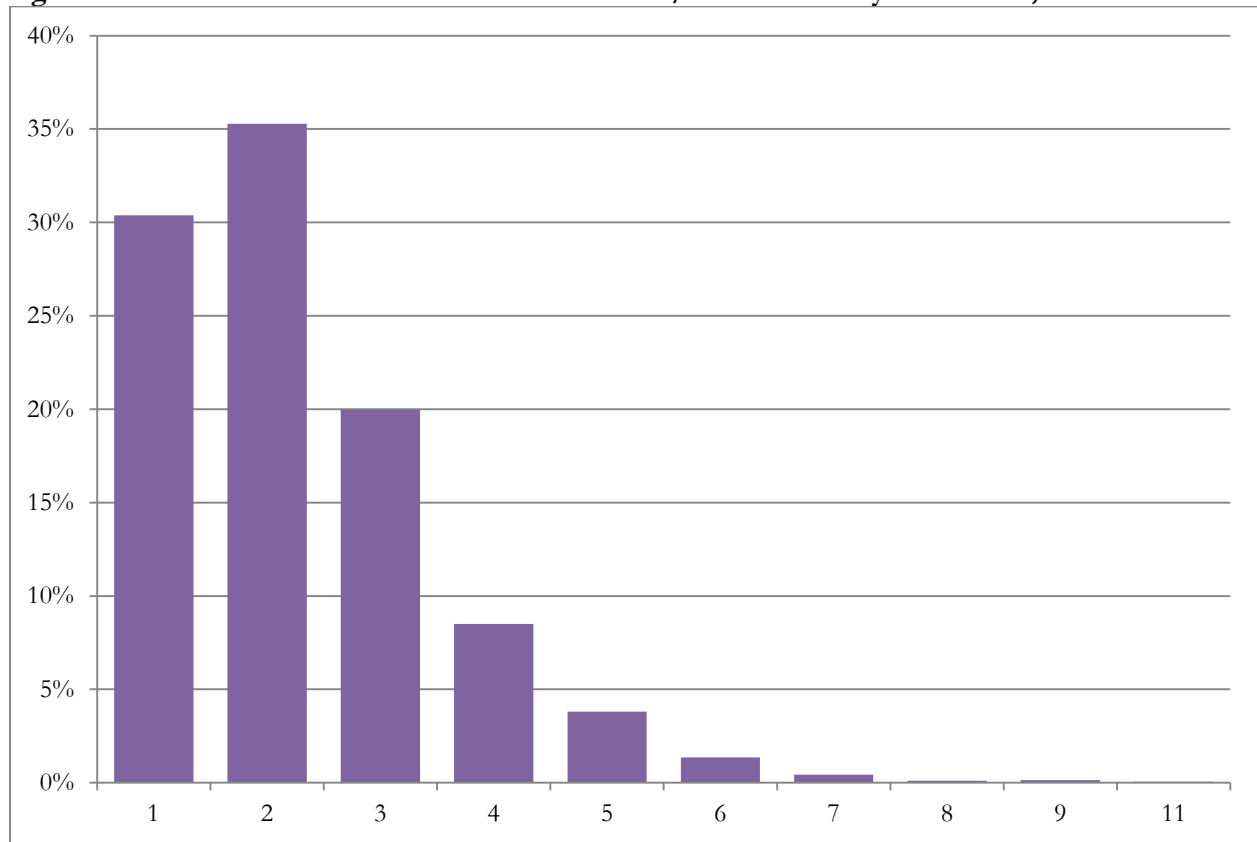
- Mean household landholding size is 5.2 acres, the median is 3 acres; 70% of households own less than 5 acres total.
- Landholding size varies significantly by zone, with Western zone having the largest landholdings at 8.5 acres, and Zanzibar the lowest at 2 acres.
- The average number of plots cultivated is 2.3 per household, for those households that cultivated land.
- The most commonly cultivated crop was maize, with 83% of households cultivating at least one plot of maize. Cassava (35%) and beans (34%) were the next most commonly cultivated crops.
- The number of crops grown by households also varies by zone, with Lake zone having the most crops grown per household (an average of six) and Zanzibar and Central zone the fewest (just over three).
- 17% of households in the sample reported cultivating rice.
- 57% of households cultivated in the long rainy season only; 39% of households cultivated in both the short and long rainy seasons.
- 92% of household reported owning a hoe, but just under 8% owned a plough.
- Crops cultivated were relatively similar between male- and female-headed households, although male-headed households were more likely to grow cassava, millet, and mangos than female-headed households
- Average labor productivity at the national level in the long rainy season was \$1.52 per day of work, while average land productivity was \$45.50 per acre.
- Paddy had the highest land and labor productivity.
- Land productivity and yields for maize, paddy, and cassava tended to be higher in households with smaller landholdings and on smaller plots.
- Intercropping is common: 63% of all plots are intercropped. Labor productivity tends to be higher on intercropped plots.
- Roughly 40% of plots reported some pre-harvest losses, with damage by animals being the most common reason for losses.
- Lack of agricultural equipment and tools were the most commonly cited reasons why farmers did not plant the full area of a plot. 12% of maize farmers and 13% of paddy farmers reported this constraint in the long rainy season.

Basic Farm Characteristics

Of the total 3,265 households surveyed in the LSMS, 2,474 households completed the agricultural module. Households completed the agricultural module if they owned or cultivated a plot, if they owned livestock, and/or if they participated in aquaculture. Of the 2,474 agricultural households, 80 households had livestock, but no plots, and 20 households participated in aquaculture but did not own or cultivate a plot. The remaining 2,374 households cultivated or owned a plot. However, of those that reported cultivating or owning a plot, only 2,298 also reported a plot size and plot data for their plot.

On average, households that owned and/or cultivated at least 1 plot cultivated 2.3 plots with a total landholding size of 5.2 acres. On this land they grew 4.7 different crops spread between the long and short rainy seasons and including fruit and permanent crops. As shown in *Figure 1*, while a few households cultivated five or more plots, more than 65% cultivated only one or two plots.

Figure 1: Distribution of Number of Plots Owned and/or Cultivated by Household, N=2298*

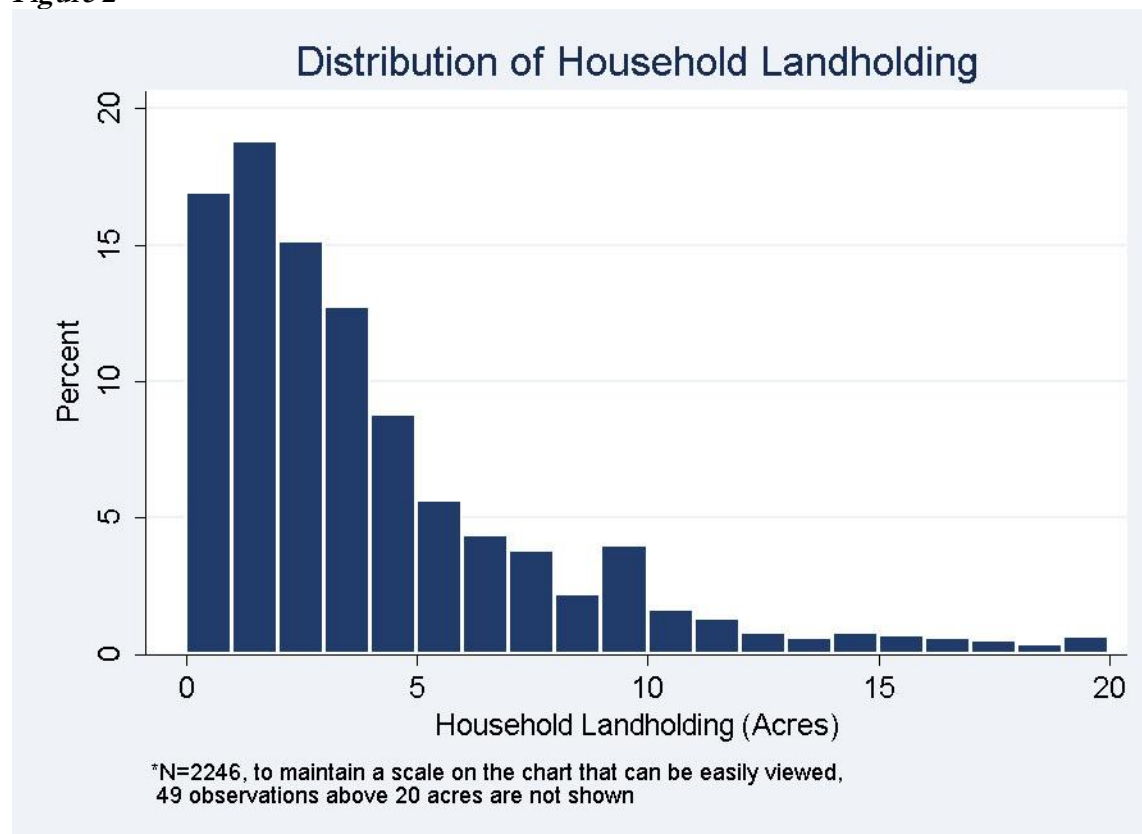


* Households that own or cultivate at least one plot

Questions st2q1, st2q2, st2q3, st2q4, s2aq4, & s2bq4

Figure 2 shows the distribution of household landholding size is skewed toward smaller acreages. Although the mean is 5.2 acres, the median is 3 acres and 70% of households own less than 5 acres total.

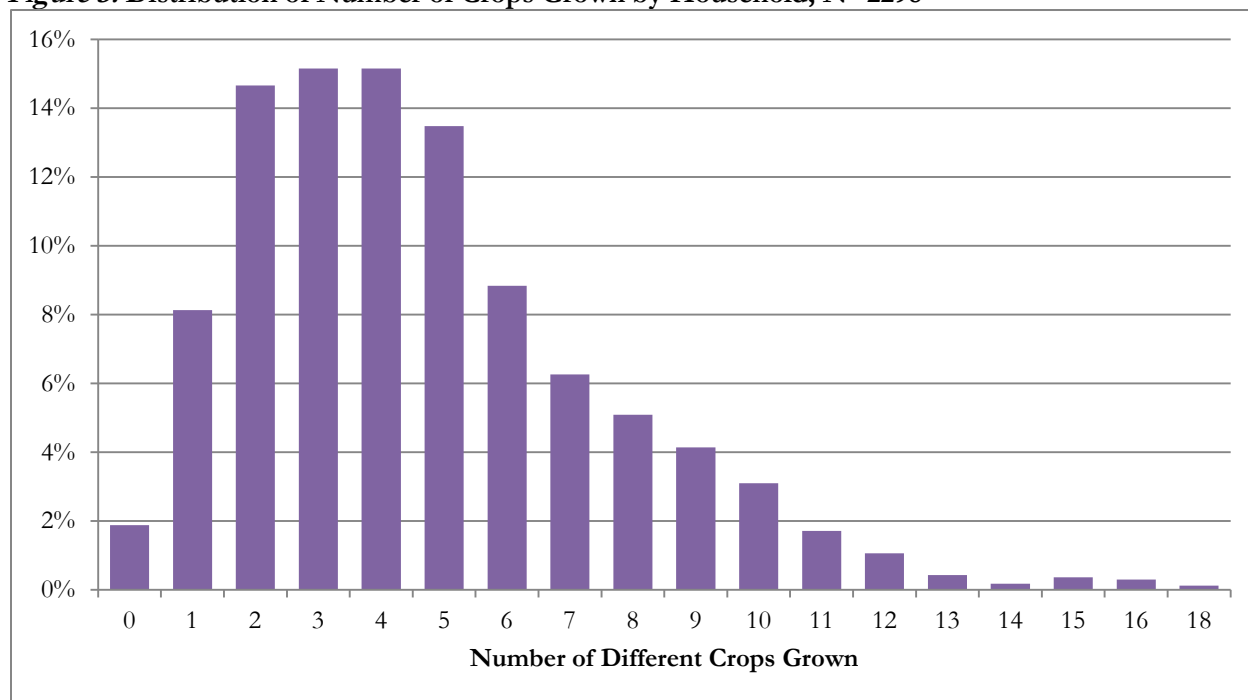
Figure 2



Questions s2aq4 & s2bq9

Most households grow a variety of crops (*Figure 3*). As mentioned above, the mean number of crops grown was 4.7 crops per household. Fifty percent of households grew four or more crops, and 25% of households grew more than six.

Figure 3: Distribution of Number of Crops Grown by Household, N=2298*



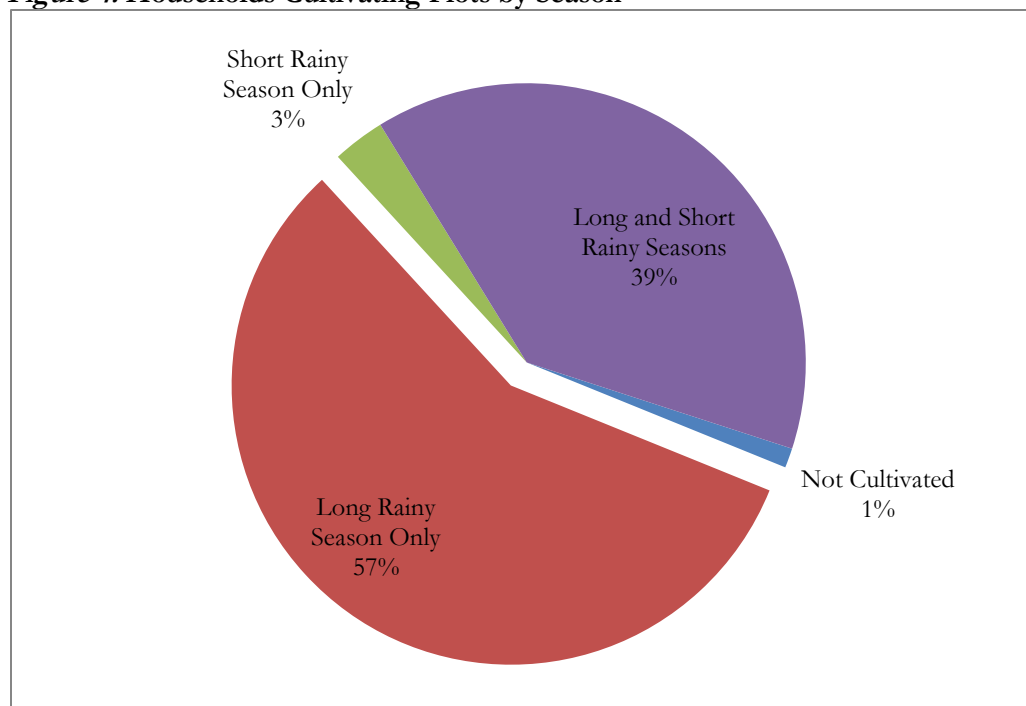
* Households that own or cultivate at least one plot

*Question zaocode

As shown in *Figure 4*, the majority of households only cultivated plots during the long rainy season.¹ About 39% of households cultivated during both the long and short rainy seasons, and less than 5% cultivated only during the short rainy season or did not cultivate their plot at all. Of those plots cultivated during the short rainy season, about 42% were from the Lake zone, 29% were in the Northern zone, 12% were in the Eastern zone, and 9% were in the Western zone. *Appendix A* includes full descriptive statistics for basic farm characteristics.

¹ Tanzania has two major rainfall regions. The majority of the country has one long rainy season that typically lasts from December through April. The North and Northeastern parts of the country are bimodal: in addition to the long rainy season lasting from March through May, they also have a short rainy season characterized by lighter rainfall that lasts from October to December (Minot, N. (2010). *Staple food prices in Tanzania*. Washington, D.C. International Food Policy Research Institute).

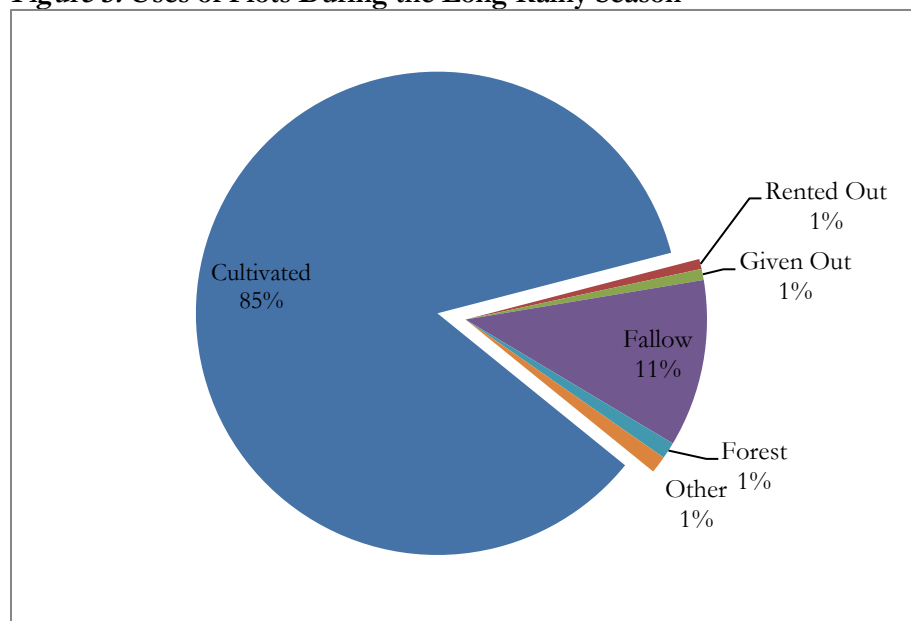
Figure 4: Households Cultivating Plots by Season



**N=2,230 households that owned and/or cultivated a plot*

As shown in *Figure 5*, cultivation was by far the most common use for plots during the long rainy season with 85% reported as cultivated and 11% left fallow. Almost half of plots were reported as fallow during the short rainy season, and only about a quarter were cultivated. However, these findings could be due in part to the fact that some people living in areas without a short rainy season reported uses for their plots in both rainy seasons. For example, there were 475 observations of plot uses for the short rainy season in the Southern Zone, which does not have a short rainy season. Ninety-five percent of these plots were reported as fallow during the short rainy season.

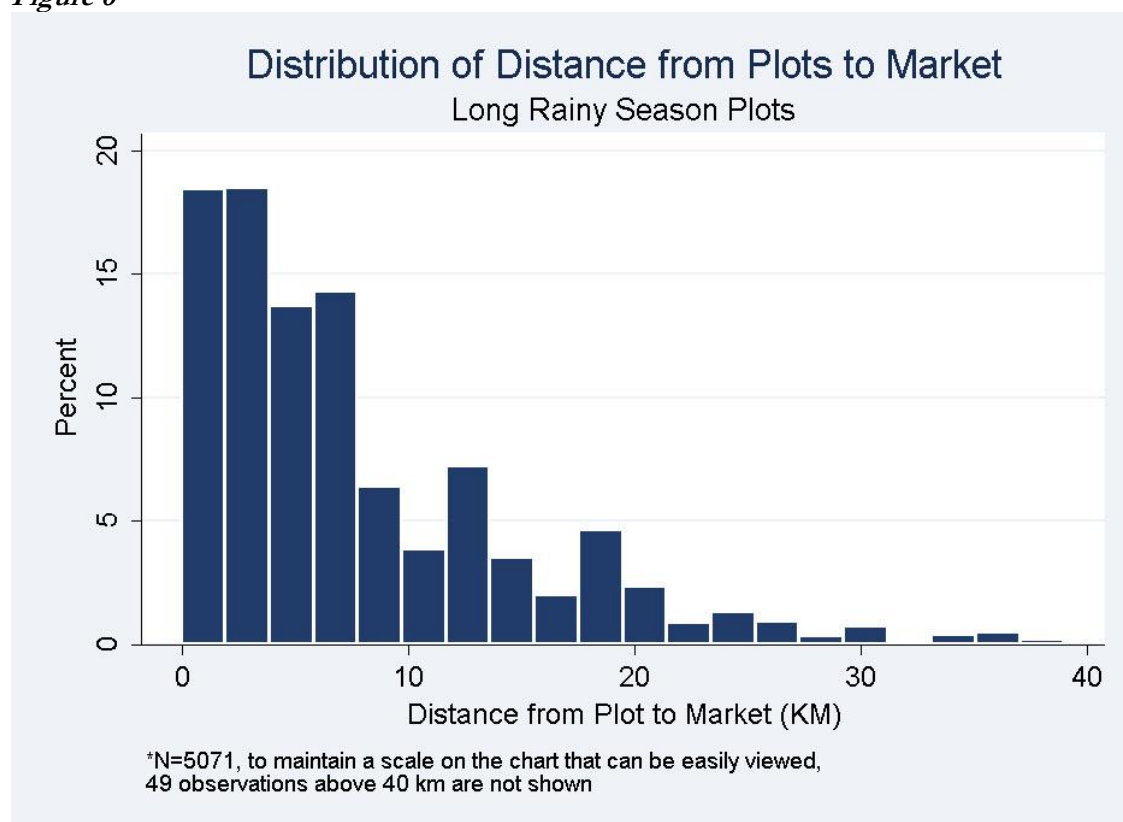
Figure 5: Uses of Plots During the Long Rainy Season



**Question s3aq3*

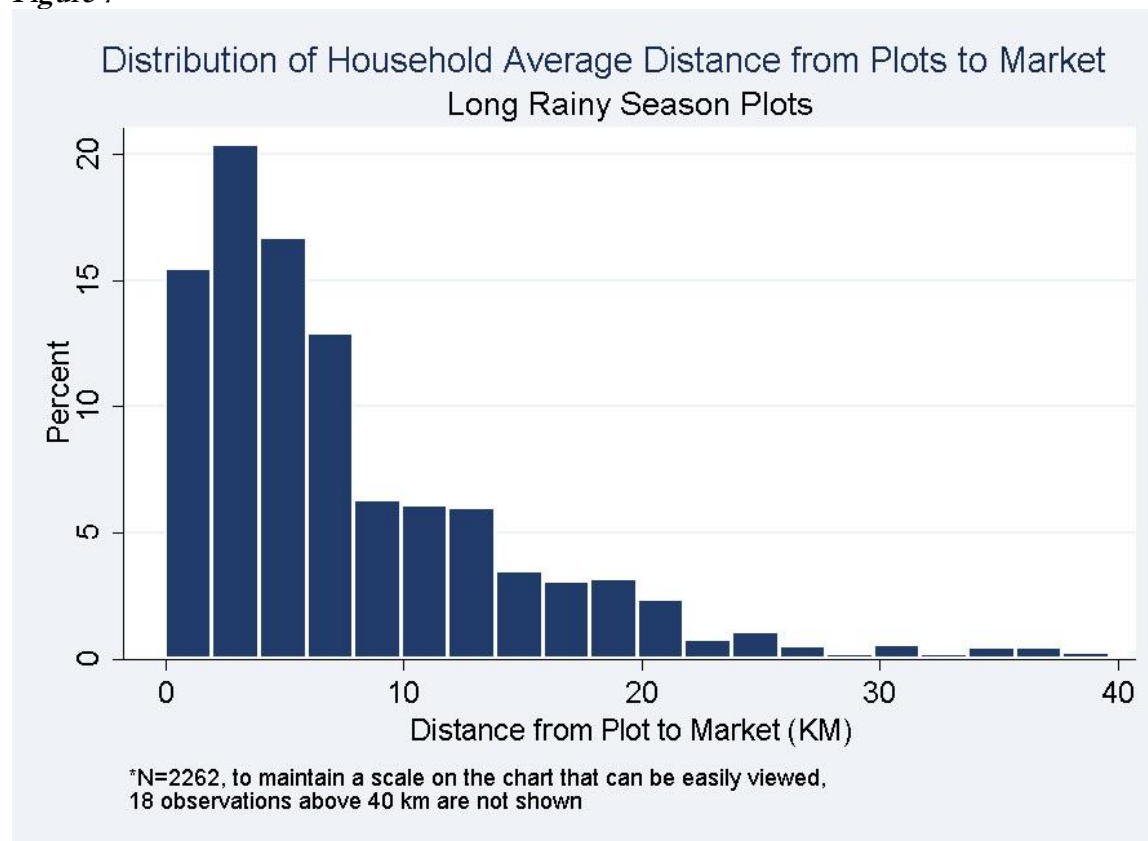
The average distance from plots to the market was 8.2 km. *Figure 6* shows the distribution of the distance of plots to the market (*What is the distance from [PLOT] to: market?*).

Figure 6



**Question s3aq2_3*

Figure 7



**Question s3aq2_3*

While most households that owned or cultivated a plot owned hoes (92%), ownership of other farm implements was rare (see Table 1) (*How many [ITEMS] does your household own?*).

Table 1: Proportion of Agricultural Households that Own Farm Implements

	Estimated Proportion who Own Implement*	Mean Number Owned	Observations
Hoes	92.1%	3.1	2077
Plough etc.	7.7%	1.3	144
Spraying machine	4.5%	1.3	100
Water pumping set †	0.9%	-	23
Trailer for tractors etc. †	0.5%	-	8
Hand milling machine †	0.4%	-	10
Tractor †	0.2%	-	4
Harrow †	0.2%	-	3
Reapers †	0.0%	-	1
Harvesting and threshing machine	0.0%	-	
Fertilizer distributor	0.0%	-	

**N=2297 households that own or cultivate at least one plot*

Questions sncode & sng1

*† Insufficient observations to calculate reliable mean for number
owned*

Male- and Female-Headed Households

Male-headed households on average had more plots, larger household landholding size and grew more crops than female-headed households (See *Table 2*). *Appendix C* includes full descriptive statistics comparing priority crop cultivation and basic farm characteristics of male- and female-headed households.

Table 2: Basic Farm Characteristics of Male- and Female-Headed Households

	Male-headed households	Female-headed households
Average Number of Plots***	2.4	2.0
Average Household Landholding (acres)***	5.8	3.5
Average Number of Crops Grown***	4.8	4.2

* Statistically significant at the .10 level

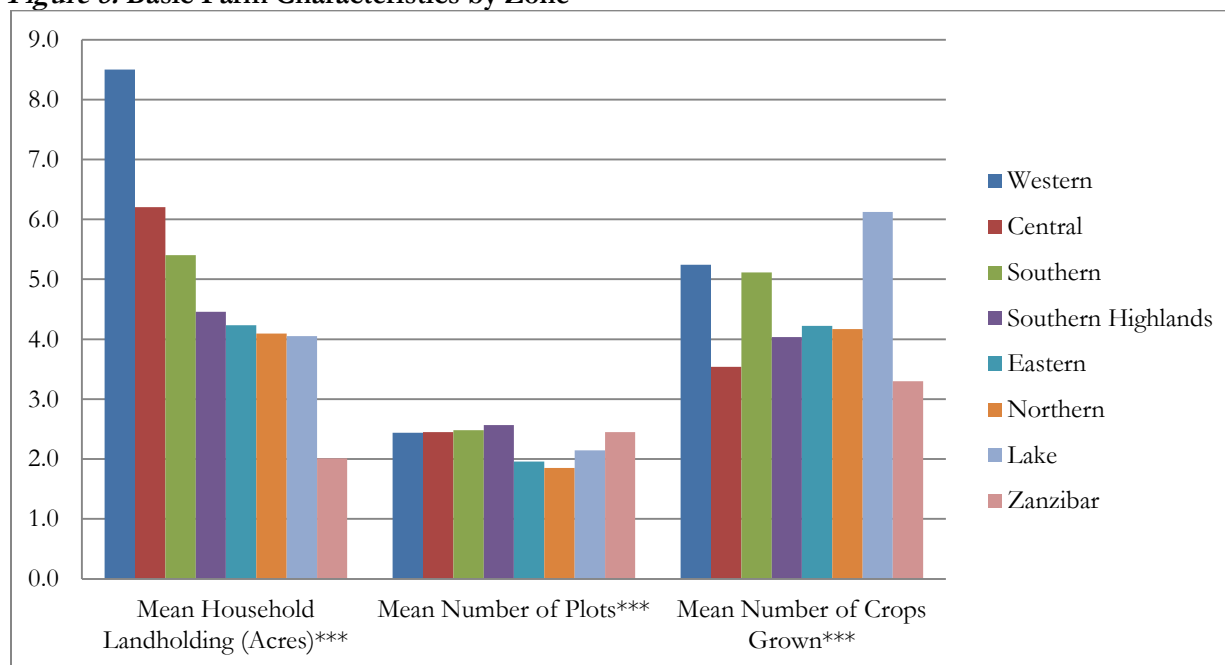
** Statistically significant at the .05 level

*** Statistically significant at the .01 level

Analysis by Zone

As shown in *Figure 8*, the average household landholding size varied substantially by zone (ranging from 2.0 acres in Zanzibar to 8.5 acres in the Western zone). However, the average number of plots owned was fairly similar across zones, ranging from 1.9 plots in the Northern zone to 2.6 in the Southern Highlands. The average number of crops grown by household varied from just over three in Zanzibar to slightly more than six in the Lake zone. *Table 3* shows the means displayed in *Figure 8* and *Appendix E* includes confidence intervals.

Figure 8: Basic Farm Characteristics by Zone



* F-test shows statistically significant variation between zones at the .10 level

** F-test shows statistically significant variation between zones at the .05 level

*** F-test shows statistically significant variation between zones at the .01 level

Table 3: Mean Basic Farm Characteristics by Zone

	Mean Household Landholding (Acres)***	Mean Number of Plots***	Mean Number of Crops Grown***	Observations
Western	8.5	2.4	5.2	136
Central	6.2	2.5	3.5	195
Southern	5.4	2.5	5.1	343
Southern Highlands	4.5	2.6	4.0	246
Eastern	4.2	2.0	4.2	340
Northern	4.1	1.9	4.2	456
Lake	4.1	2.1	6.1	320
Zanzibar	2.0	2.4	3.3	262

* F-test shows statistically significant variation between zones at the .10 level

** F-test shows statistically significant variation between zones at the .05 level

*** F-test shows statistically significant variation between zones at the .01 level

BMGF Priority Crops in Tanzania

Basic descriptive analysis was conducted for the 10 BMGF priority crops in Tanzania as well as mangoes, which were cultivated by 33% of agricultural households. The 10 BMGF priority crops included are: maize, paddy (rice), sorghum, millet, beans, cowpeas, sweet potatoes, yams, groundnuts, and cassava. *Table 4* shows the estimated proportion of agricultural households that cultivated each priority crop. Maize was most commonly cultivated, followed by cassava, beans, and mango.

Table 4: Households Cultivating Priority Crops (N=2298)

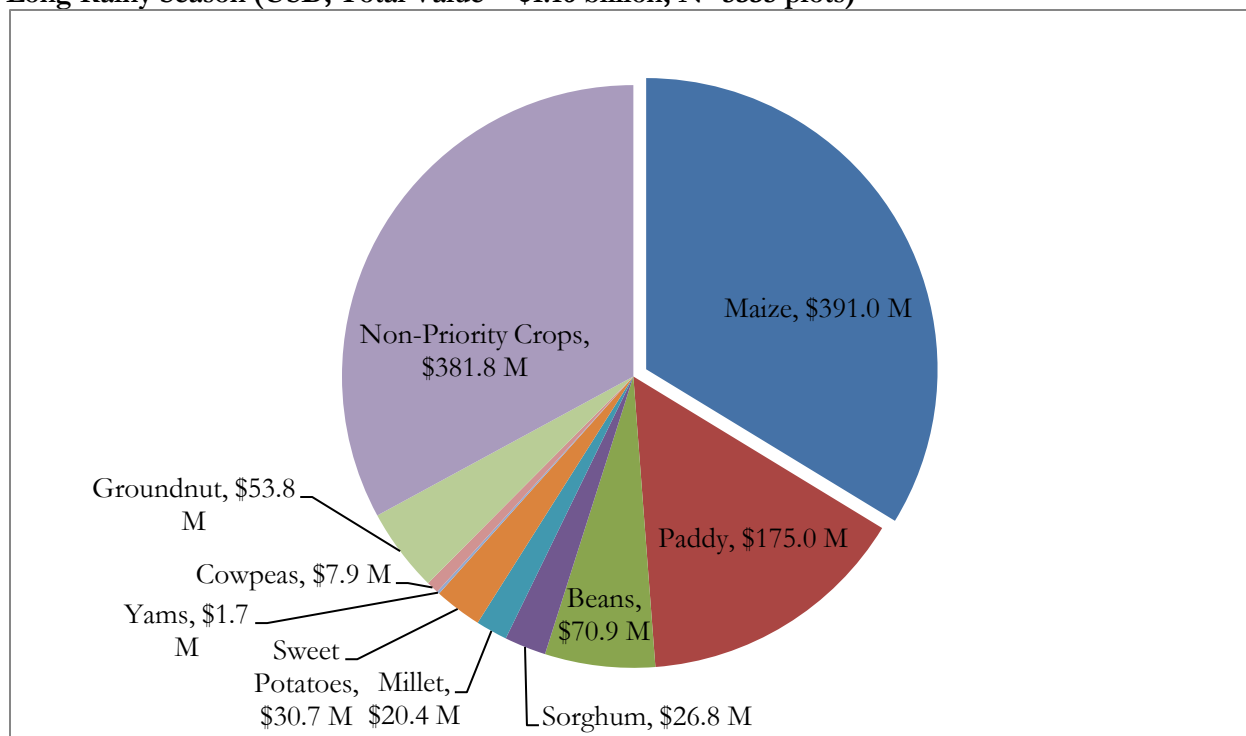
Crop	Estimated Proportion of Households that Cultivate	95% C.I.
Maize	83%	[80%, 85%]
Cassava	35%	[31%, 38%]
Beans	34%	[30%, 38%]
Mango	33%	[30%, 36%]
Groundnut	22%	[19%, 25%]
Paddy	17%	[14%, 20%]
Sweet potatoes	15%	[13%, 17%]
Sorghum	13%	[10%, 15%]
Cowpeas	8%	[7%, 10%]
Millet	6%	[4%, 8%]
Yams	1%	[0%, 1%]

*Question *zao*code

The estimated total value of crops produced during the long rainy season in 2008 was US\$1.16 billion. Maize harvests made up about 34% of this total, followed by paddy, which accounted for 15% of the value (see *Figure 9*). The third highest value priority crop nationwide was beans, which made up about 6% of the total harvest value in the long rainy season. Note that \$219.4 million of the \$381.8 million generated by non-priority crops in the long rainy season came from tobacco, cotton, and sunflower, which made up 10%, 5% and 4% of the total value generated respectively.

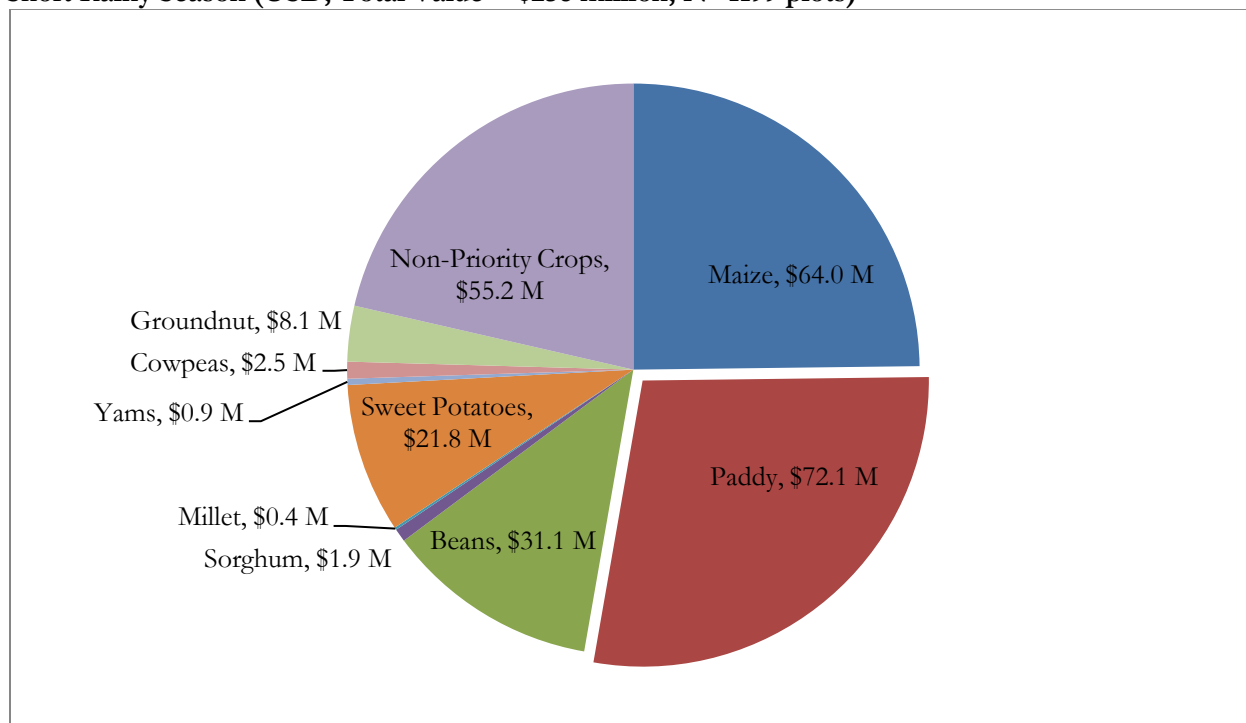
As shown in *Figure 10*, value generated from crops in the short rainy season was less diversified than value generated in the long rainy season. Of the estimated total, \$258 million, 28% came from paddy, 25% came from maize, and 12% came from beans. While value generated by sweet potatoes was less in the short rainy season compared to the long rainy season, \$21.8 million compared to \$30.7 million, it made up a larger share of the total value generated in the short rainy season—8% compared to 3%. Of the estimated \$55.2 million generated by non-priority crops, \$26.3 million came from cotton and \$6 million from tobacco, making up 10% and 2% of the total value generated in the short rainy season respectively (*What was the estimated value of the harvested crop? How much was harvest worth in the market during harvest season?*).

Figure 9: Proportion of Value Generated by BMGF Priority Crops out of all Crops Cultivated in the Long Rainy Season (USD, Total Value = \$1.16 billion, N=5335 plots)



Question 4a q16

Figure 10: Proportion of Value Generated by BMGF Priority Crops out of all Crops Cultivated in the Short Rainy Season (USD, Total Value = \$258 million, N=1199 plots)

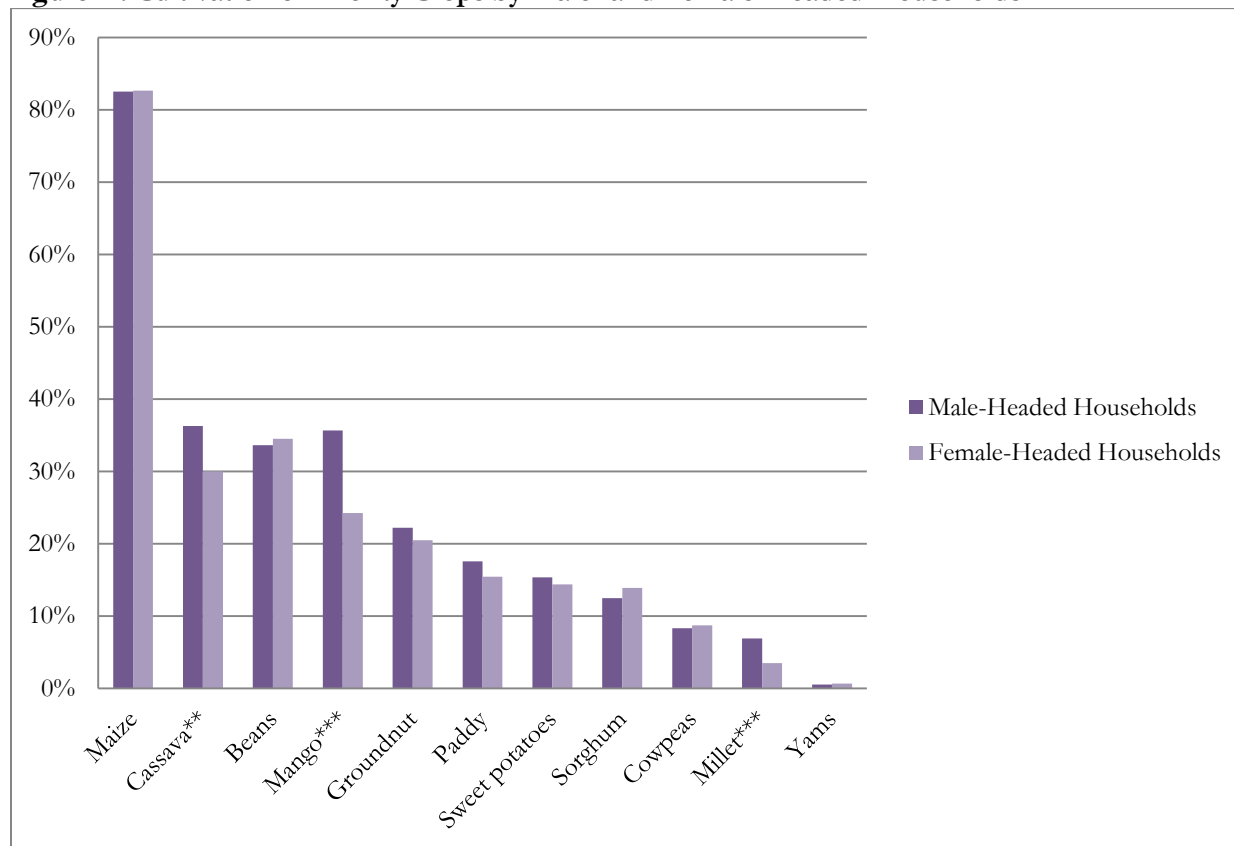


Question 4b q16

Male- and Female-Headed Households

Male-headed households were statistically significantly more likely to grow cassava, millet, and mangoes than female-headed households (see *Figure 11* for significance levels and comparison of male- and female-headed households for all crops).

Figure 11: Cultivation of Priority Crops by Male- and Female-Headed Households



*Statistically significant at the .10 level

**Statistically significant at the .05 level

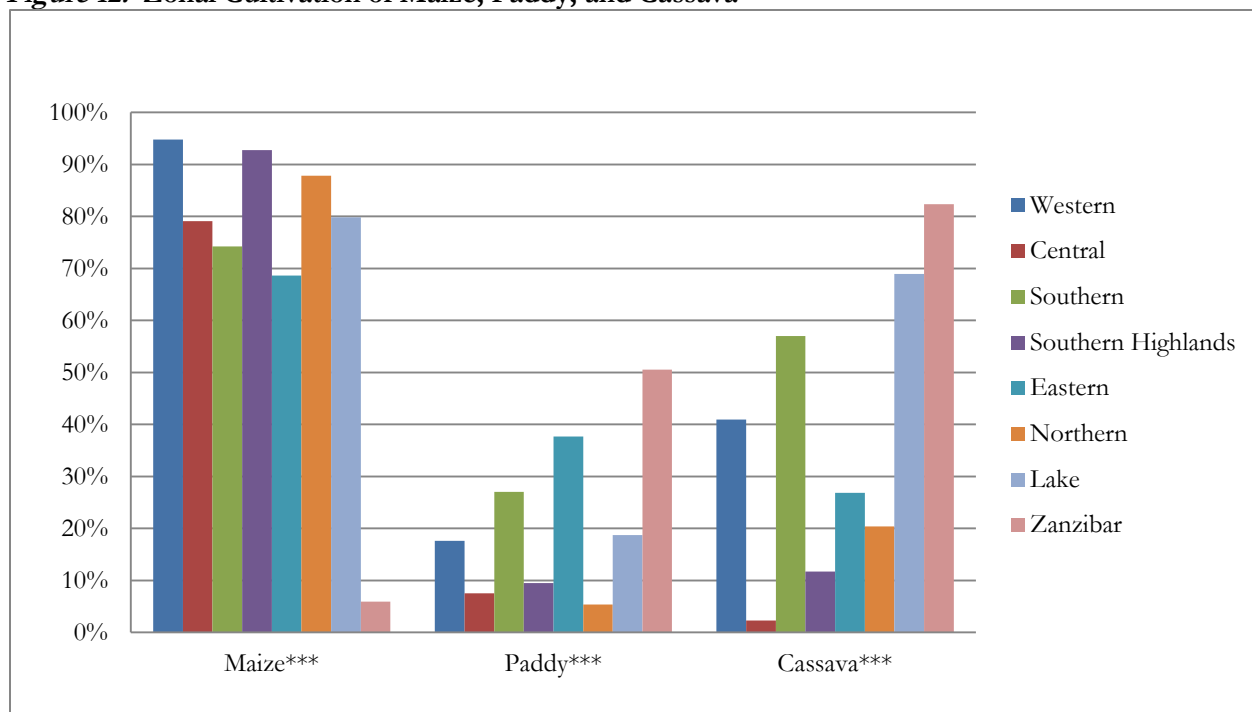
***Statistically significant at the .01 level

Questions zaocode, sbmemmo & sbq2

Zones

Priority crop cultivation showed statistically significant variation by zone (*Figure 12*). Maize was most commonly cultivated by households in the Eastern and Southern Highland zones, with over 90% of households cultivating maize on at least one of their plots. By contrast, less than 10% of Zanzibar households cultivated maize; cultivation of paddy and cassava was much more common. *Figure 13* shows the same data organized by zone. Maize was most commonly cultivated in every zone except for Zanzibar. The Central zone and Southern Highlands had much higher cultivation rates of maize than either paddy or cassava. The Lake and Southern zones had a more balanced mix of the three crops.

Figure 12: Zonal Cultivation of Maize, Paddy, and Cassava



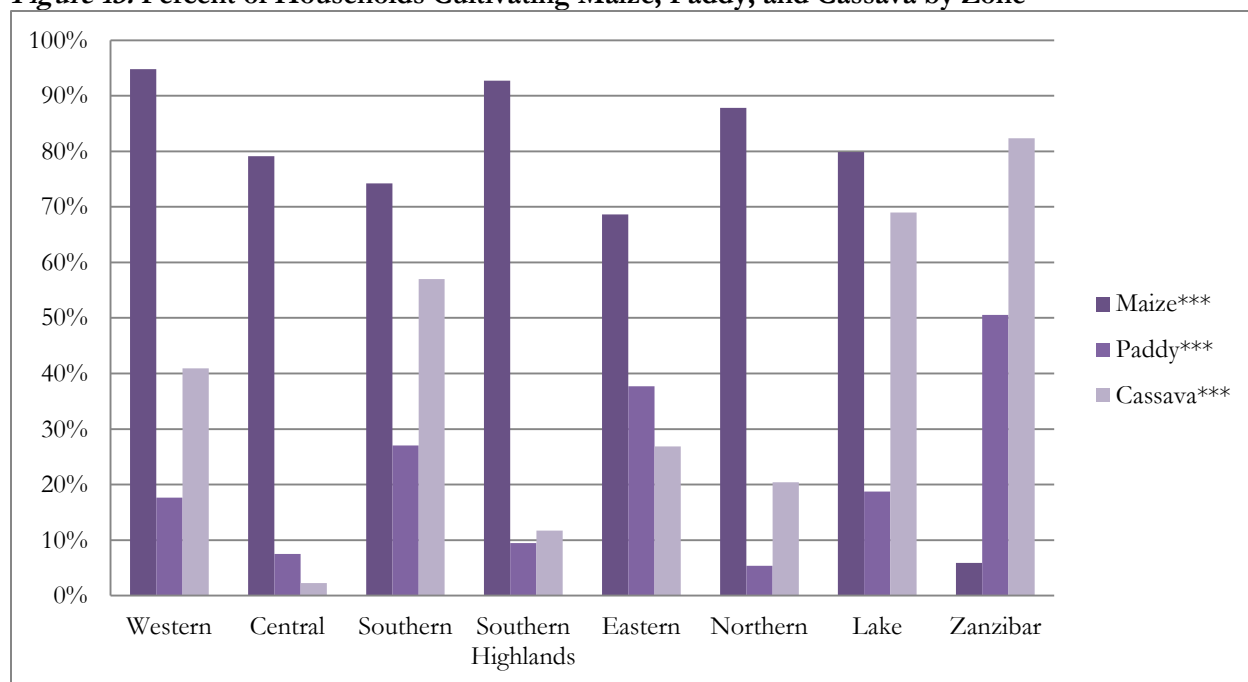
* F-test shows statistically significant variation between zones at the .10 level

** F-test shows statistically significant variation between zones at the .05 level

*** F-test shows statistically significant variation between zones at the .01 level

Questions zaocode & strataid

Figure 13: Percent of Households Cultivating Maize, Paddy, and Cassava by Zone



* F-test shows statistically significant variation between zones at the .10 level

** F-test shows statistically significant variation between zones at the .05 level

*** F-test shows statistically significant variation between zones at the .01 level

Questions zaocode & strataid

Land and Labor Productivity

Land productivity was calculated as the combined harvest value of all crops per acre planted. The value included the estimated value of harvest for the long and short rainy seasons as well as the value sold of fruits and permanent crops and an estimated value of fruit and permanent crops that were not sold (*What is the estimated value of the harvested crop? How much was harvest worth in the market during harvest season?*). See *Appendix G* for a more thorough explanation of the methodology used to calculate land and labor productivity figures.

These figures were calculated at the plot, household, and country level. The country level estimate is generally calculated as a single summary measure (e.g. the total value of all crops per acre) and is the estimate reported unless otherwise noted. Household and plot level productivity figures are averages across all sample observations, and hence produce a distribution of estimates. These measures are used for analysis across household level or plot level characteristics, for example, for looking at how land productivity varies by household demographics, or by plot size. See *Appendix U* for a more thorough explanation on the differences between country, household, and plot level estimates. *Appendix F* contains productivity figures broken down by season at all three levels.

Table 5: Tanzania Country Level Productivity

	Season	Value (USD)	Observations (number of plots used to calculate country average)
Average Land Productivity for crops only (USD/acre)	Long Rainy Season	\$45.50	3375
	Short Rainy Season	\$42.32	829
	Fruit	\$35.57	1459
	Permanent Crops	\$38.08	1336
	All Seasons	\$68.35	4415
Average Labor Productivity (USD/day of work)	Long Rainy Season	\$1.52	3364
	Short Rainy Season	\$1.27	814

Mean household land productivity is \$95.06 per acre across all seasons, but as shown in *Figure 14*, the majority of households produce less than \$75 USD per acre when the proceeds from all crops are combined. Mean household land productivity including the value of livestock by-products produced by the household is \$123.76. The median land productivity for all crops is \$52.84 per acre. Twenty-five percent of households have land productivity of less than \$25 per acre when all crops and seasons are combined and 75% of households make less than \$115 per acre. Note that the land productivity estimates do not take into account the density with which plots were planted. Therefore a one acre plot with one mango tree and one banana tree may appear to have low land productivity for fruit, while the all seasons estimate takes into account other crops that were also planted on that plot throughout the year. See the *Intercropping* section for more analysis on the effects of intercropping on productivity. The land productivity figures also include the entire household landholding of the household, regardless of whether some plots were left fallow.

Figure 14

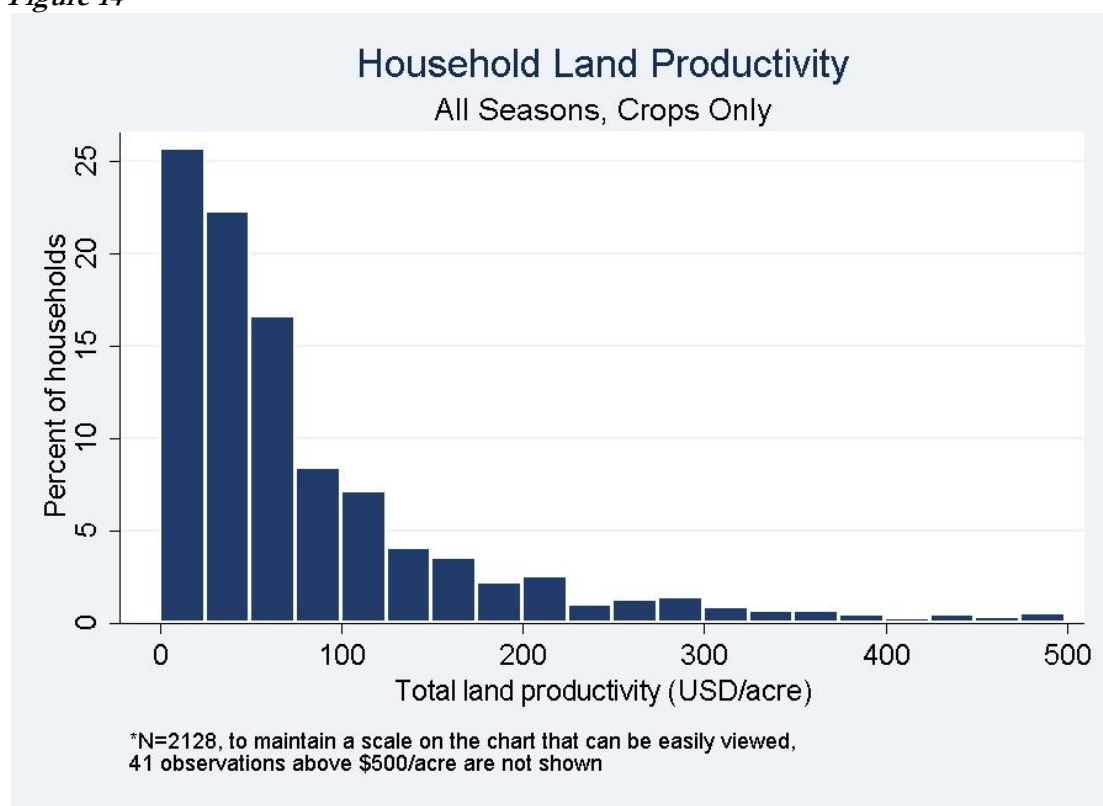
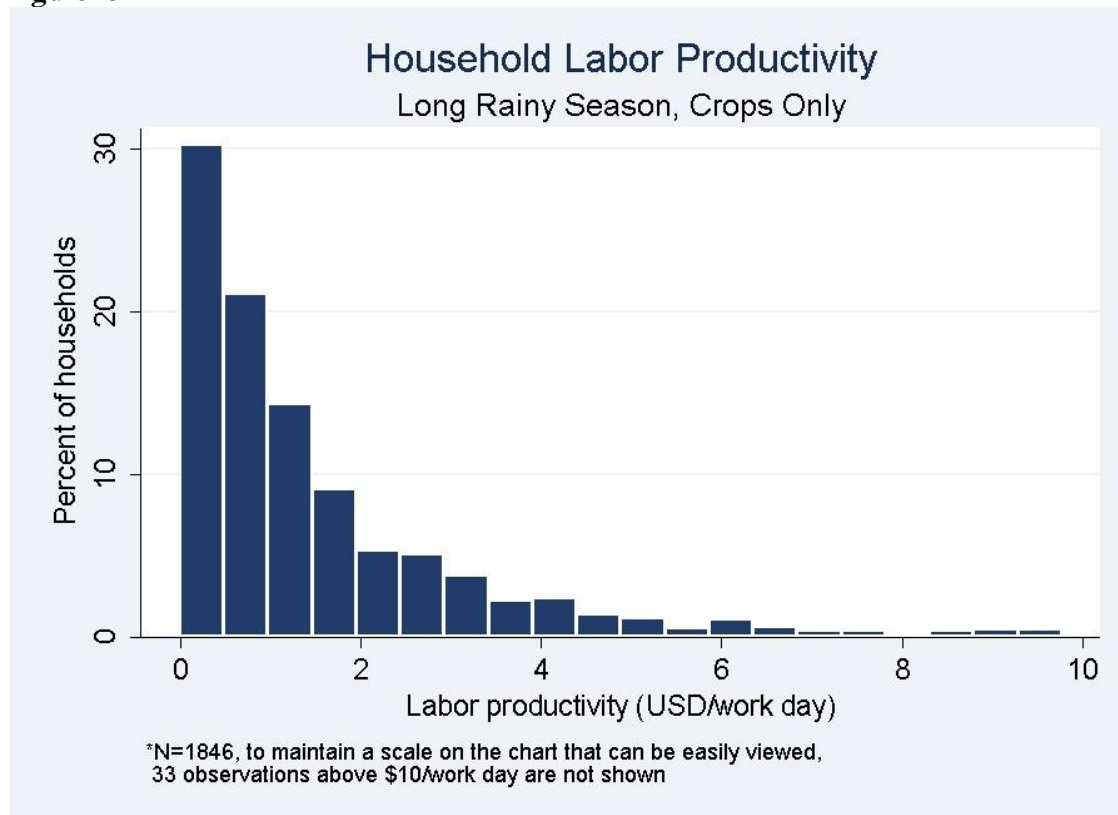


Figure 15 shows the distribution of household labor productivity for crops harvested in the long rainy season. The average household produced about \$1.73 per work day in the long rainy season. The median of \$0.98 suggests that a few households produced disproportionately more per work day than the majority of households. Twenty-five percent of households produced less than \$0.42 per work day in the long rainy season. The top 25% produced more than \$2.11 per work day.

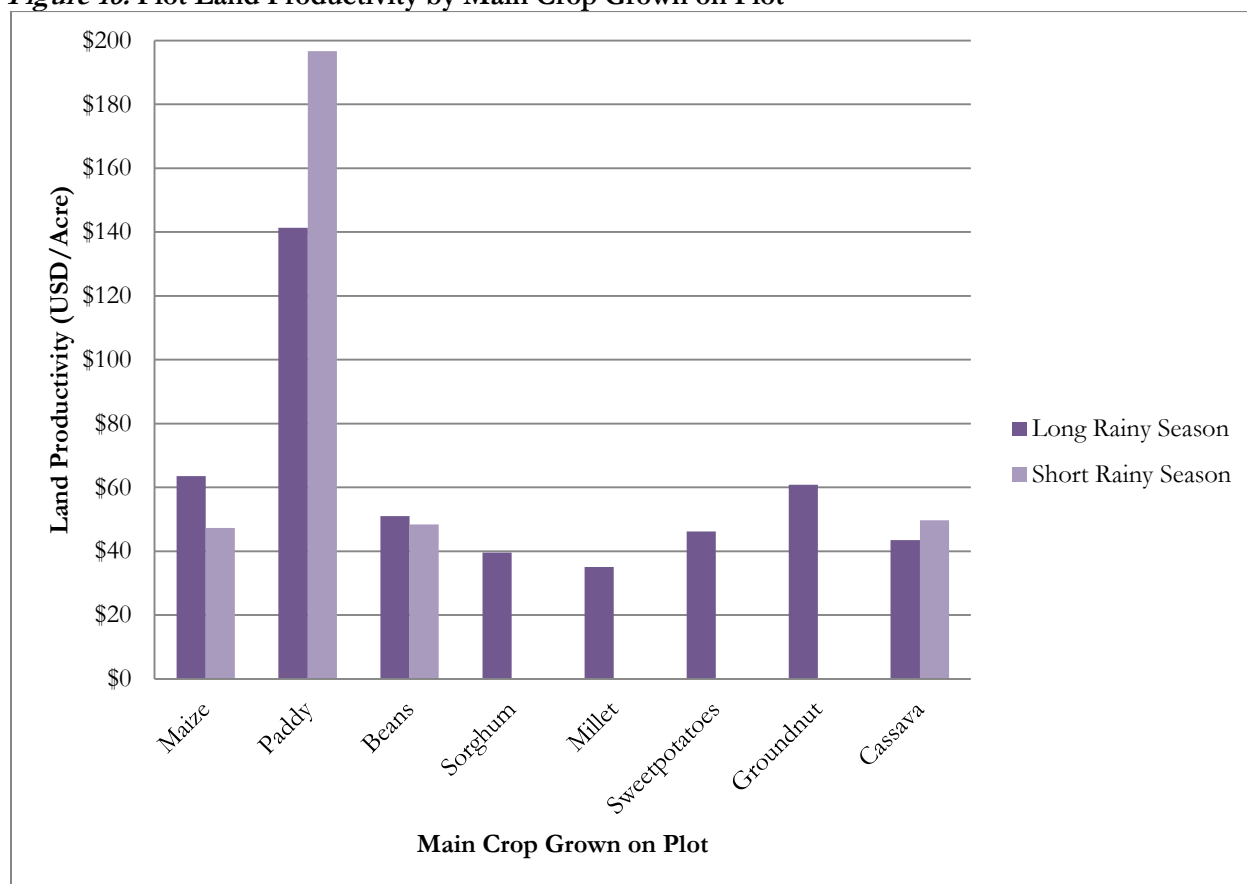
Figure 15



Main Crop Cultivated on Plot

As shown in *Figure 16*, land productivity varied by the main crop planted on a particular plot. Among the BMGF priority crops, plots with paddy as the main crop produced the most value per acre in both the short and long rainy seasons. Plots with millet and sorghum as the main crop cultivated produced the lowest value per acre during the long rainy season.

Figure 16: Plot Land Productivity by Main Crop Grown on Plot

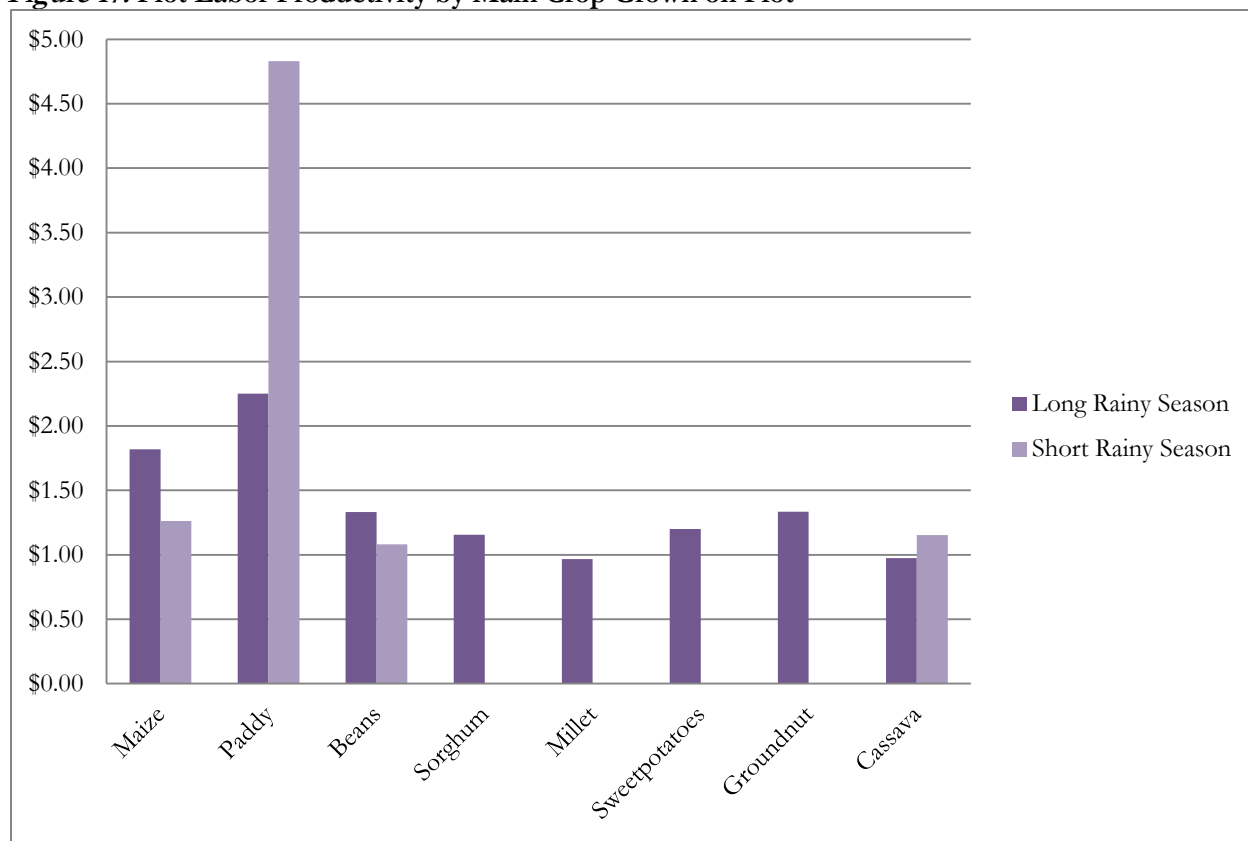


**Note, productivity figures include the value of all crops produced on the plot*

***Productivity variables, s3aq5, & s3bq5*

Labor productivity showed a similar trend (*Figure 17*): plots with maize, paddy, groundnuts, and beans as the main crops had the highest value per day worked, while plots with millet and sorghum were the lowest. Once again, paddy plots during the short rainy season had the highest productivity (\$4.83/work day), although this was affected by the relatively small sample size (44 observations) and unequal distribution. The median labor productivity for paddy in the short rainy season was \$2.25/work day. However, the higher mean is not due to just a few outliers. The mean falls right around the 65th percentile (\$4.31/work day). Of the eight observations greater than \$10/work day, six came from the Northern Zone. *Appendix I* includes mean land and labor productivity figures for each of the priority crops in the long and short rainy seasons.

Figure 17: Plot Labor Productivity by Main Crop Grown on Plot

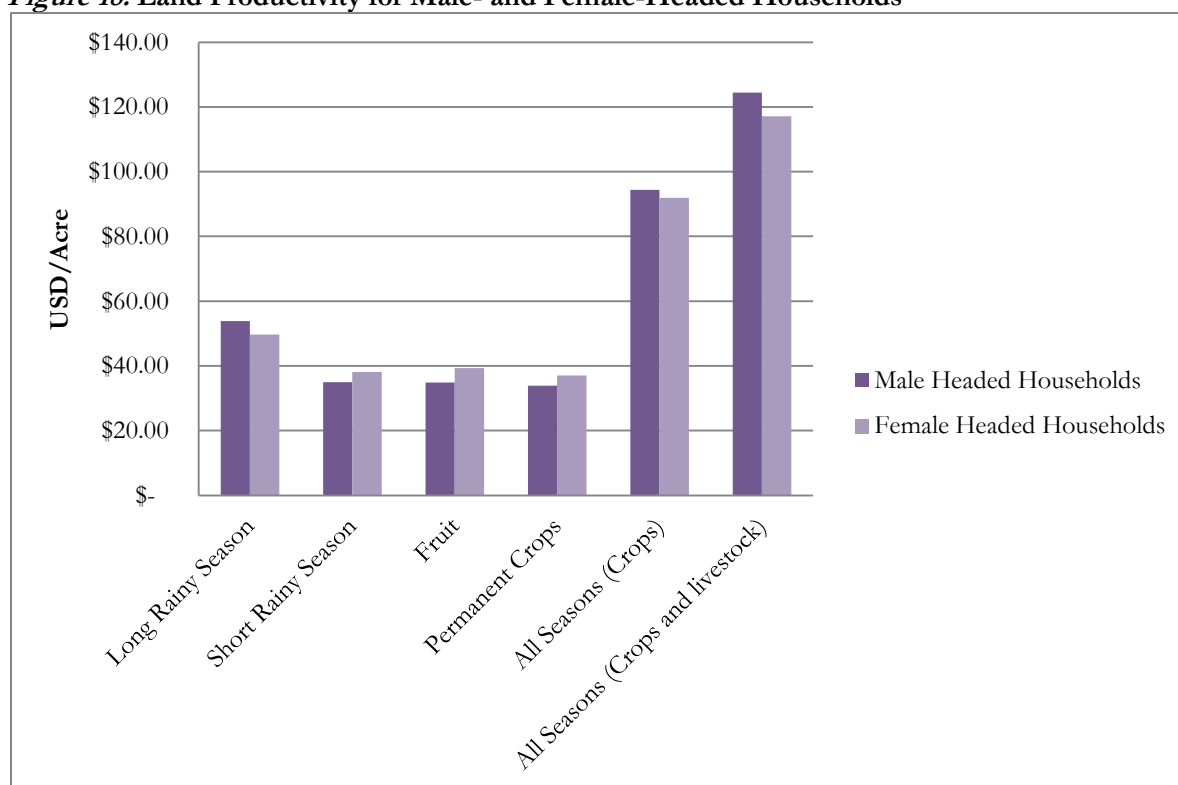


Productivity variables, $s3aq5$, & $s3bq5$

Male- and Female-Headed Households

Figure 18 shows productivity broken down by male- and female-headed households. Although productivity differed somewhat between male- and female-headed households, there is no statistically significant difference overall or in any individual season.² While male-headed households had higher land productivity for long rainy season harvests and livestock, female-headed households were more productive in the short rainy season and with fruit and permanent crops.

Figure 18: Land Productivity for Male- and Female-Headed Households

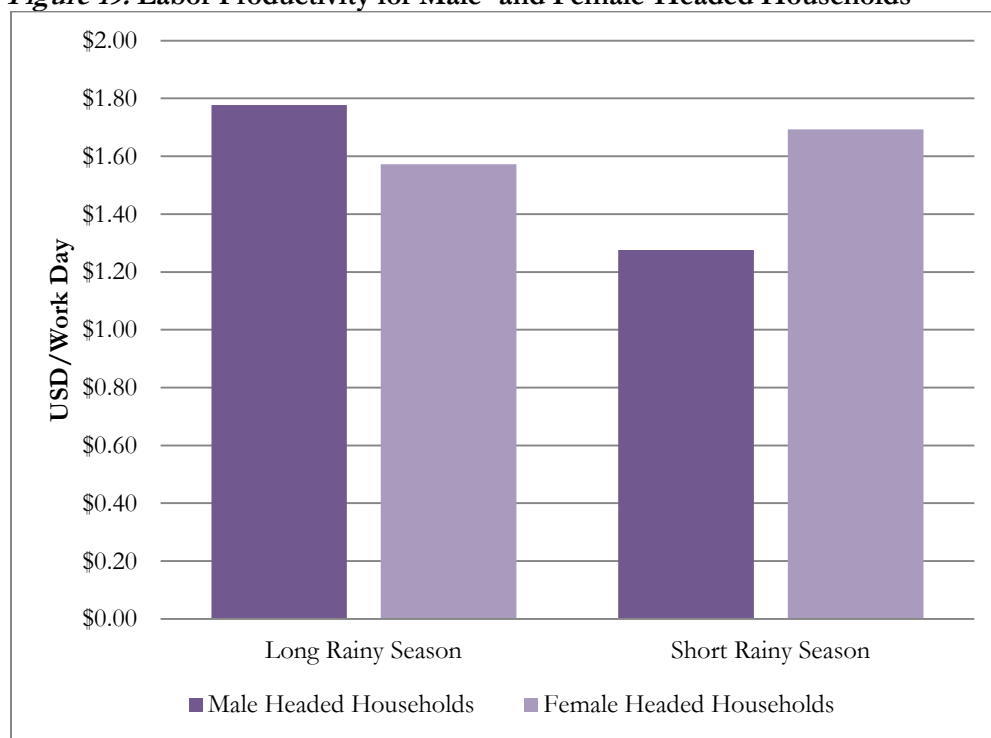


Productivity variables, sbmemno, & sbq2

² Land productivity p-values range from .55 to .65.

Male-headed households also had slightly higher labor productivity in the long rainy season (\$1.79 compared to \$1.58 per work day), and female-headed households had slightly higher productivity in the short rainy season (\$1.39 compared to \$1.34 per work day). Once again, these differences were not statistically significant.³ See *Appendix J* for full comparison of productivity by male- and female-headed households and confidence intervals.

Figure 19: Labor Productivity for Male- and Female-Headed Households



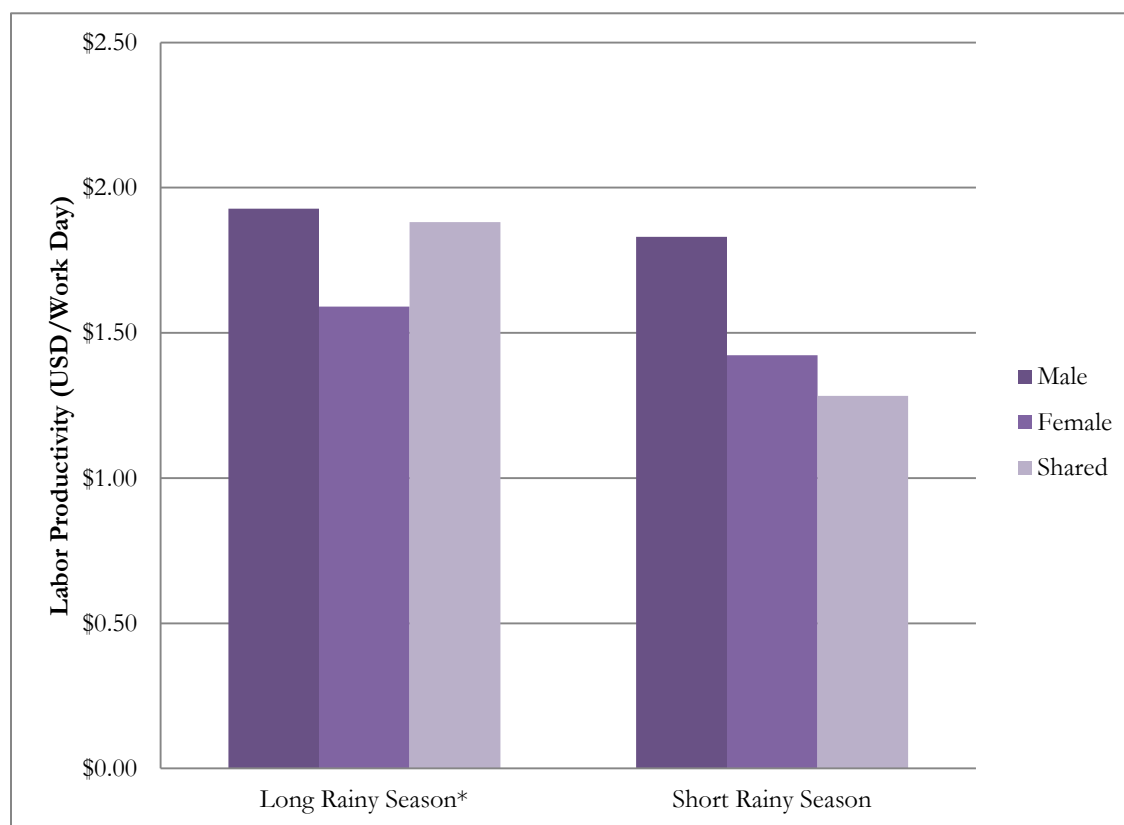
Productivity variables, sbmemno, & sbq2

³ Labor productivity p-values are .13 and .84 for long and short rainy seasons respectively.

Plot Level Decision-Making by Gender

Respondents were asked “Who decided what to plant on this plot in the long rainy season?” (s3aq6 and s3bq6 for the short rainy season). They could list up to three people, meaning that decision making could be made exclusively by males, females, or shared by people of both genders. The decision making for who decides what to plant on a particular plot could be a proxy for plot management. However, it is possible that the control over harvest may be distributed differently than the decision-making about planting. Productivity for all crops at the plot level was highest for plots with shared decision making (\$118.19/acre) and lowest for plots with female decision making (\$105.43/acre), with plots with male decision-makers in the middle (\$111.49/acre). However, the variation was not statistically significant.⁴ As shown in *Figure 20*, there was statistically significant variation in labor productivity by the gender of the plot decision-maker during the long rainy season. Plots where only females decided what to plant fared the poorest, with \$1.53/work day, while plots with male decision-makers had the highest labor productivity – \$1.93/work day. In the short rainy season plots with shared decision making had the lowest productivity, although the variation was not statistically significant.

Figure 20: Labor Productivity by Gender of Decision-Maker



Productivity variables, sbmemno, sbq2, s3aq6, & s3bq6

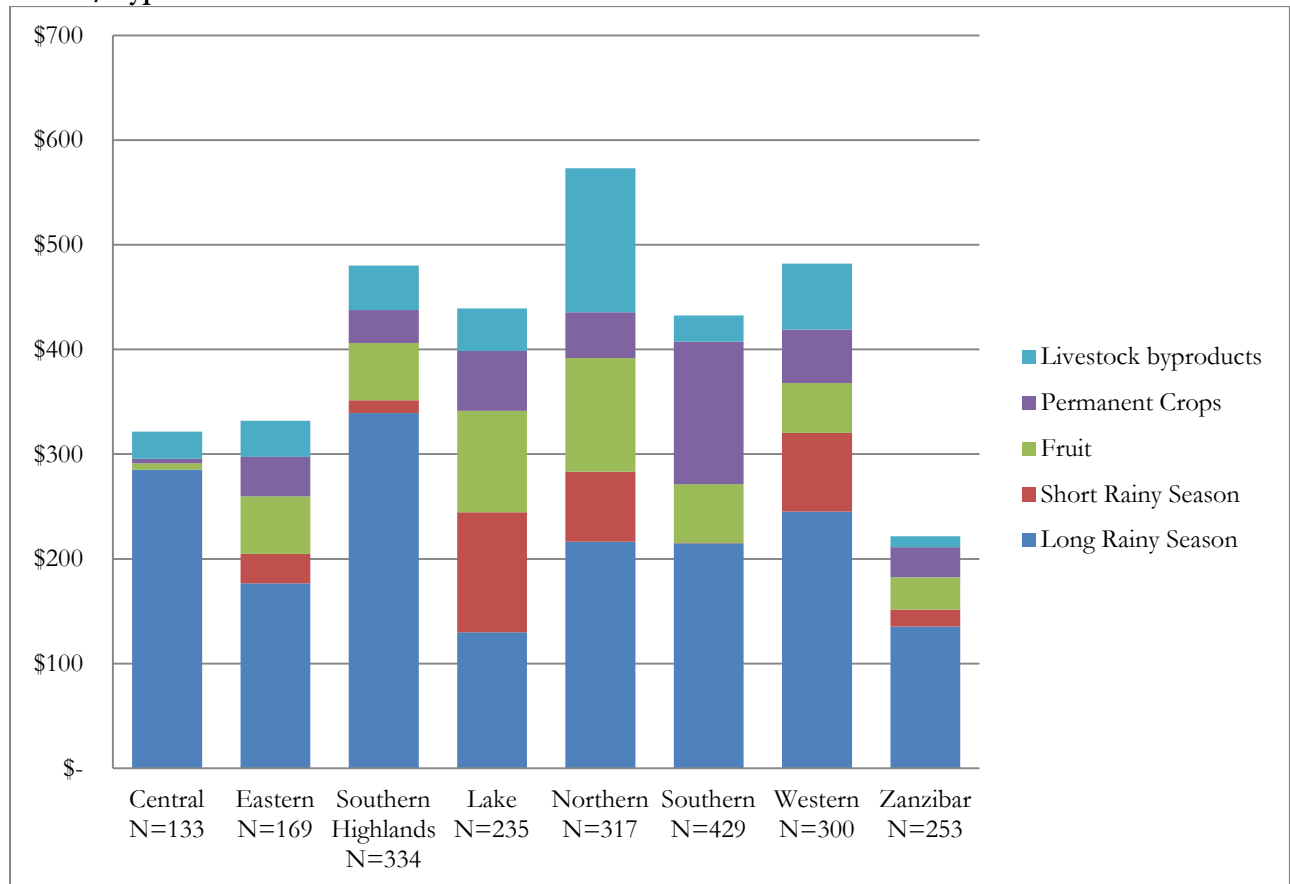
See *Appendix K* for a comparison of land and labor productivity by gender of decision-maker for all seasons.

⁴ P=.3218. The difference in productivity between plots with female decision making and shared decision making were also not statistically significant as well as the difference between plots with female and male decision making.

Zones

Productivity differed by zone, due in part to differing natural conditions and mix of agricultural activities in each zone. *Figure 21* shows the average annual value produced by households in each zone distinguished by the types of agricultural activities that produced that value.

Figure 21: Average Household Value Produced from Agricultural Activities by Zone and Season/Type of Product



The survey did not provide information on land dedicated to livestock husbandry, so the livestock by-products may falsely elevate land productivity if respondents did not graze/care for their animals on the plots that they reported cultivating and/or owning in the agricultural module. *Figure 22* shows value produced by zone not including livestock by-products. Note that the Northern zone produces similar value to the other zones when livestock by-products are not included in the value produced.

Figure 22: Average Household Value Produced from Agricultural Activities by Zone and Season/Type of Crop (excluding livestock by-products)

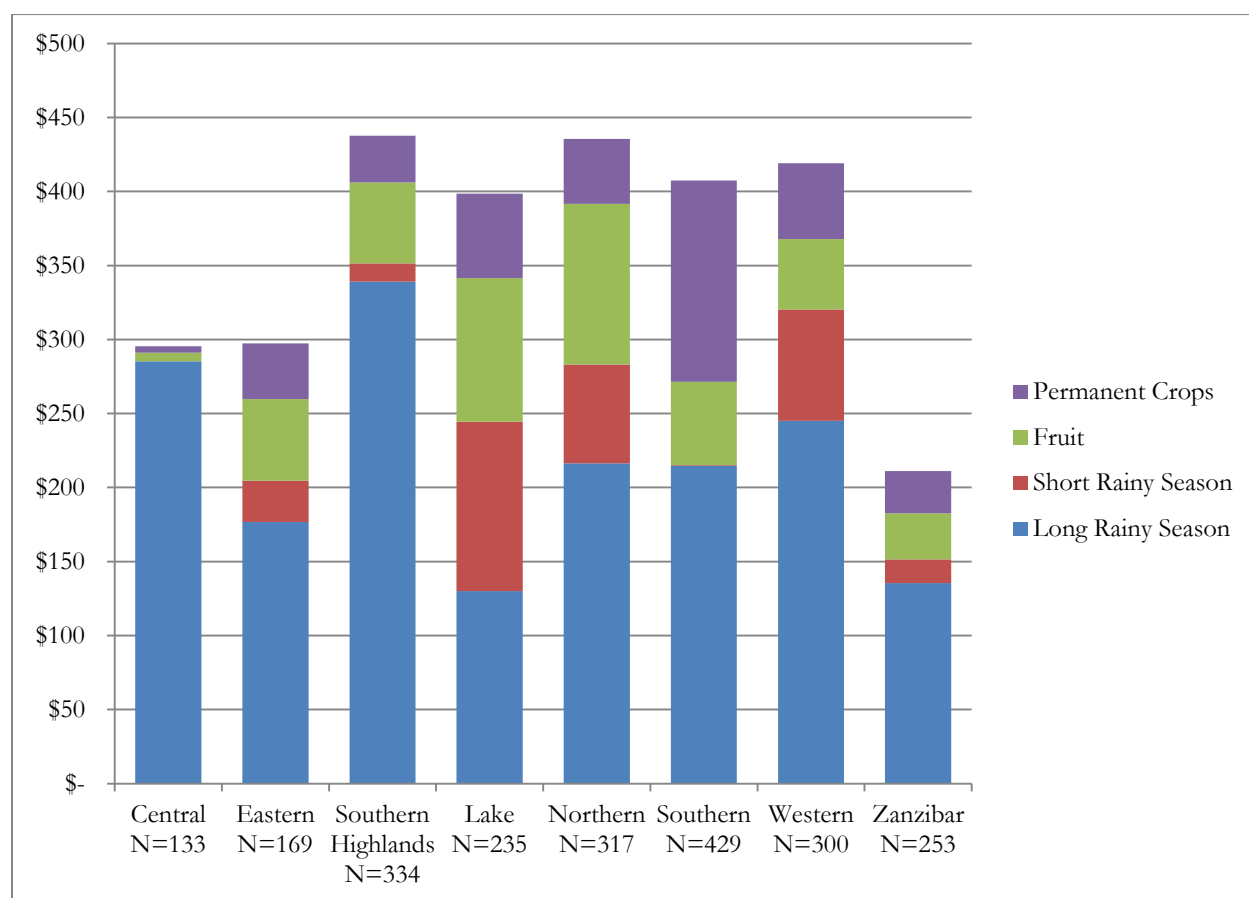


Figure 23 shows the total household land productivity from all crops and livestock, broken down by zone. Note that although the Northern zone appears to be much more productive, much of this may be due to the large value obtained from livestock by-products as shown in Figure 21. Figure 24 shows labor productivity by zone for the long rainy season.

Figure 23: Total Household Land Productivity from All Crops & Livestock by Zone

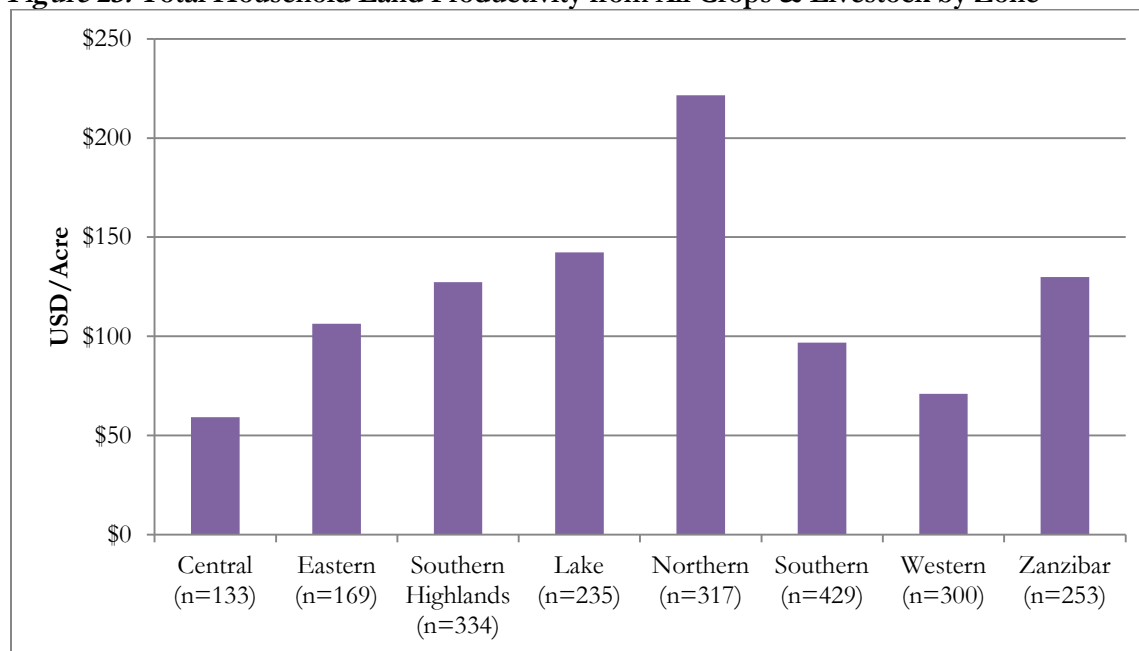
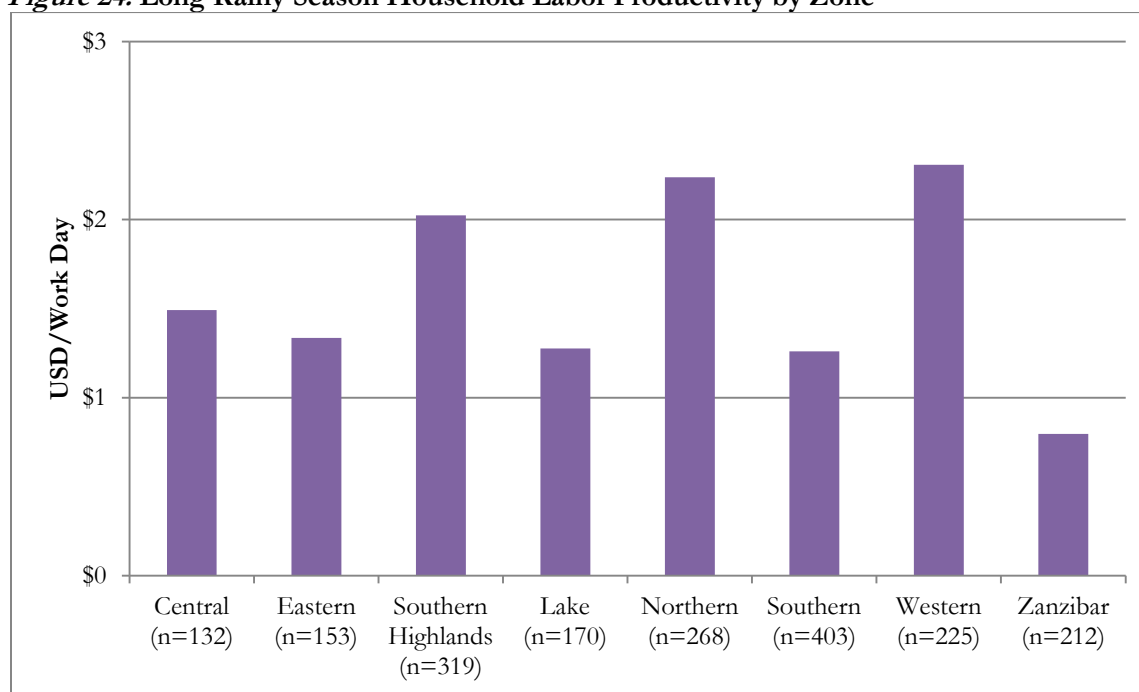


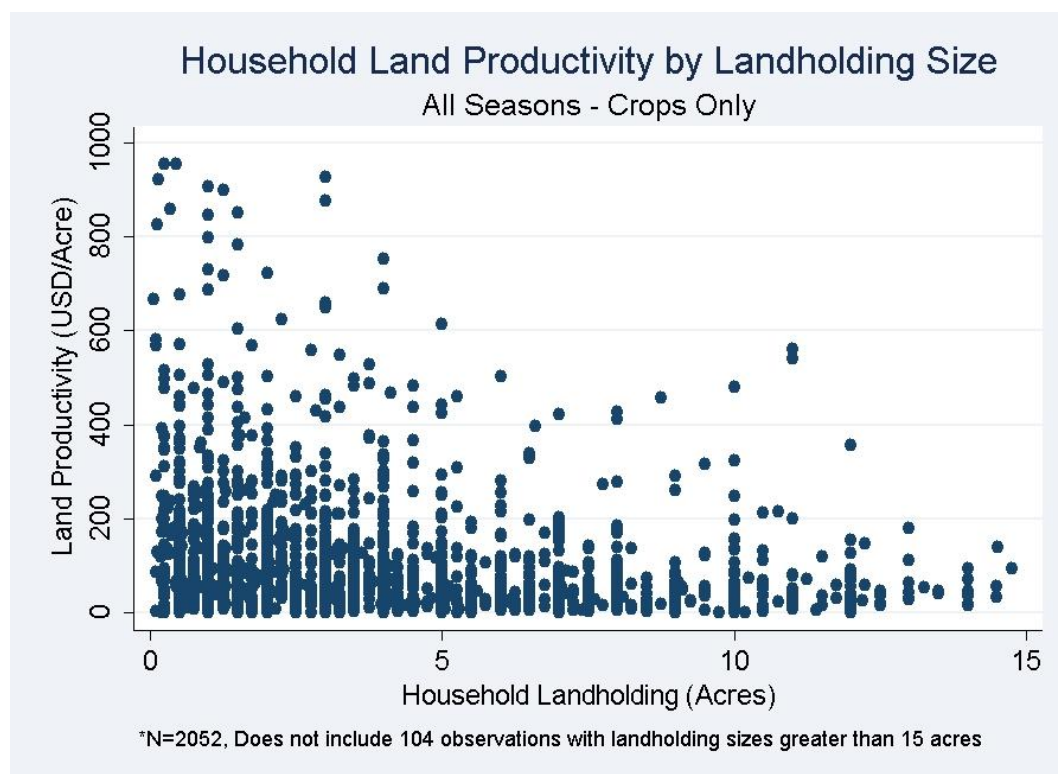
Figure 24: Long Rainy Season Household Labor Productivity by Zone



Farm Characteristics and Productivity

As shown in *Figure 25*, household land productivity is negatively correlated with landholding size,⁵ meaning higher productivity is associated with smaller landholding size, although the correlation is weak.⁶

Figure 25



**Note: scatter plot is of un-weighted data and therefore is not nationally representative*

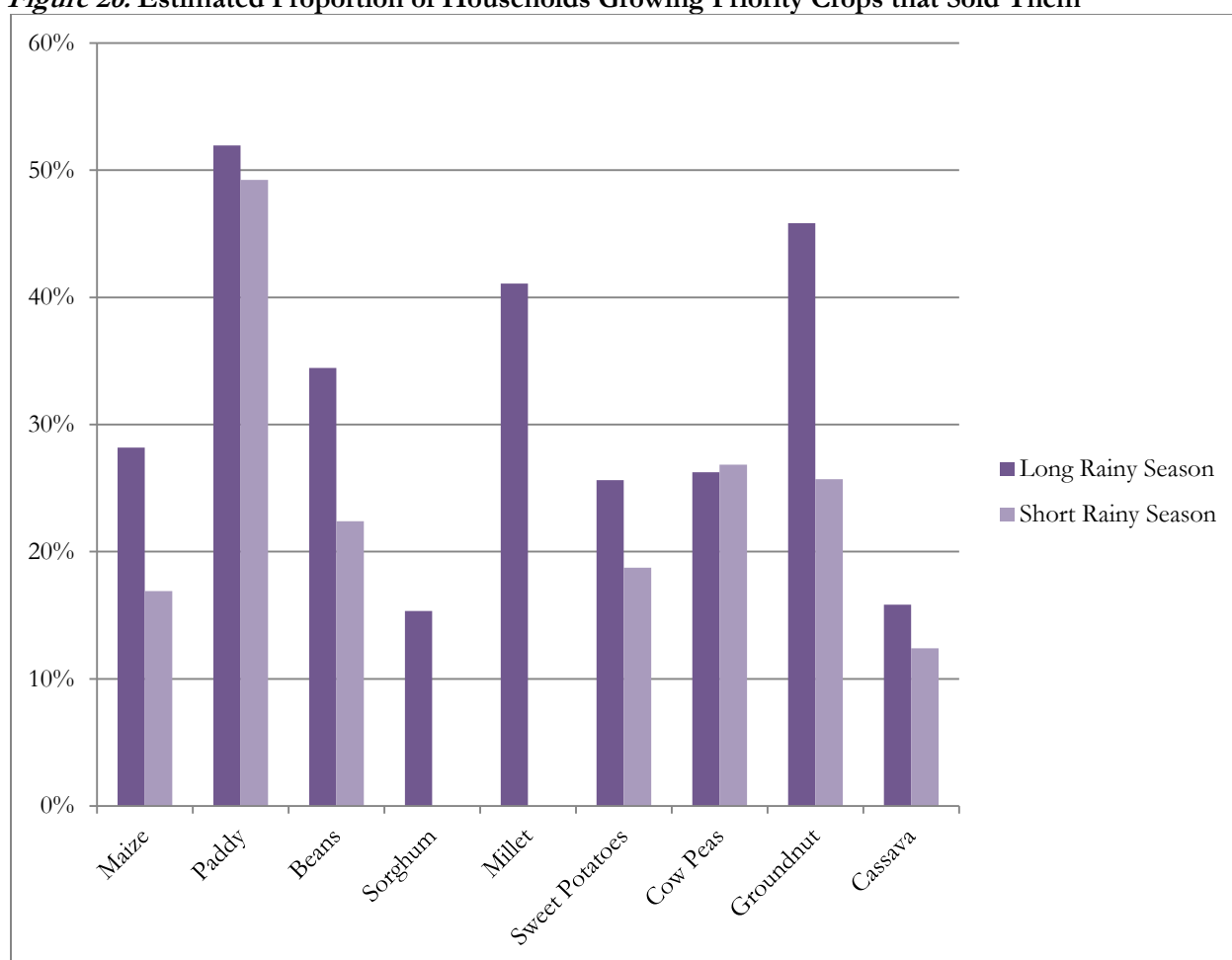
⁵ Landholding size includes all plots owned and/or cultivated by a household.

⁶ $r = -.187$ for landholdings of less than 15 acres and $r = -.089$ for all landholding sizes ($p < .0001$)

Crop Sales

The majority of farmers growing priority crops did not sell any of their harvest, with the exception of the 52% of paddy growers in the long rainy season (see *Figure 26*). The crops that were least often sold in the long rainy season were sorghum and cassava; 15% and 16% of households that grew these crops sold them, respectively. Between 20% and 30% of households that cultivated sweet potatoes, cowpeas, and maize in the long rainy season sold some of these crops. Millet and groundnuts were most commonly sold after paddy, with more than 40% of households selling some of what they produced in the long rainy season. Generally, a greater proportion of households sold their crops in the long rainy season than in the short rainy season (*Did you sell any of the [CROP] produced in the long rainy season 2008 / last completed short rainy season?*). *Appendix N* includes the means along with confidence intervals and number of observations for the proportion of households cultivating each of the priority crops that sold them in the long and short rainy season as well as permanent crops and fruit.

Figure 26: Estimated Proportion of Households Growing Priority Crops that Sold Them

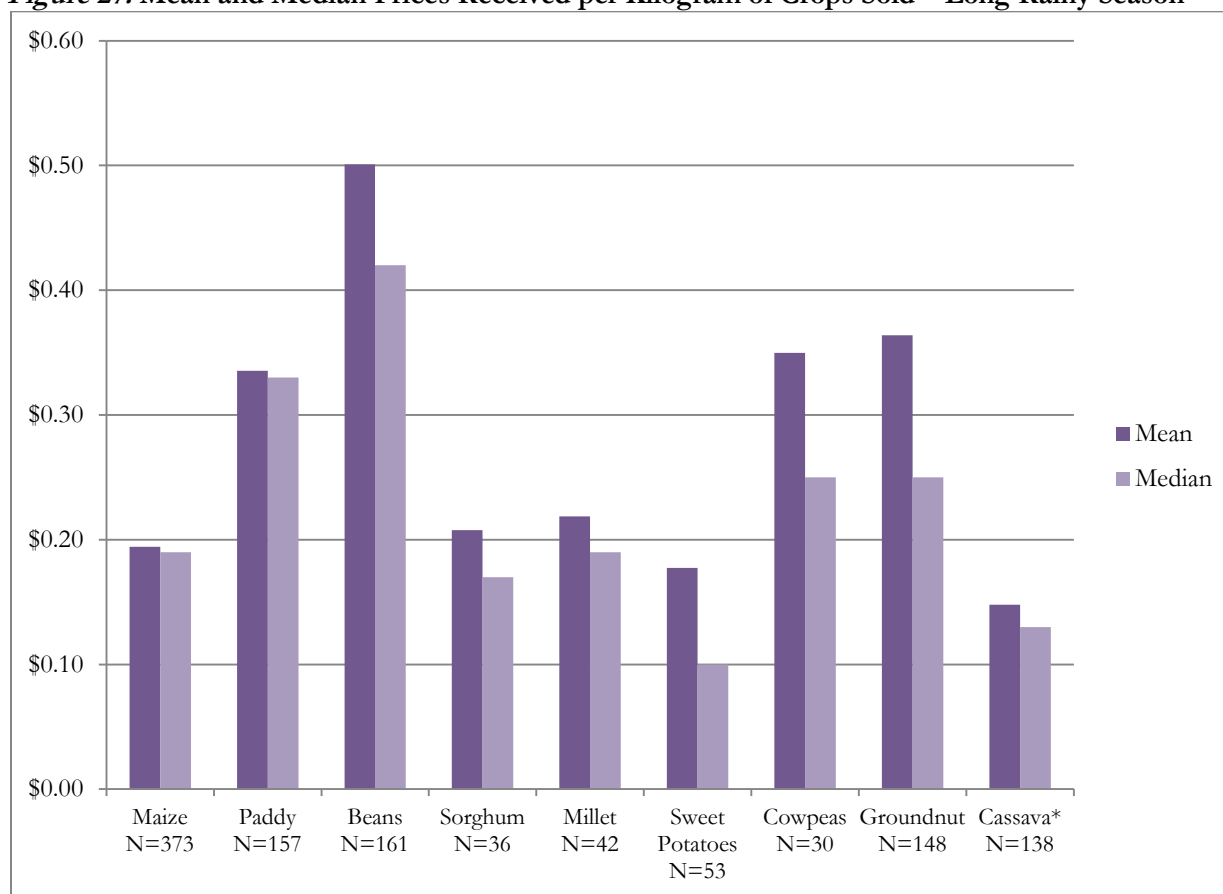


† Insufficient observations to obtain reliable proportions for sorghum and millet in the short rainy season and yams in the long and short rainy seasons

Questions *zqrcode*, *s5aq1* & *s5aq2*

Figure 27 shows the mean and median prices received per kilogram of crops sold in the long rainy season. The means and medians are very similar for maize, paddy, and cassava, indicating that the prices are somewhat evenly distributed. Beans were the most valuable crop per kilogram; respondents received an average of \$0.50 per kilogram (median = \$0.42) in the long rainy season. Cassava was the least valuable crop per kilogram, with an average price of \$0.15 per kilogram (median = \$0.13) (*What was the quantity sold? What was the total value of sales?*).⁷ Appendix O includes the mean and median prices for all priority crops in the long and short rainy seasons and for permanent crops and fruit with confidence intervals.

Figure 27: Mean and Median Prices Received per Kilogram of Crops Sold – Long Rainy Season



*Permanent crop observations

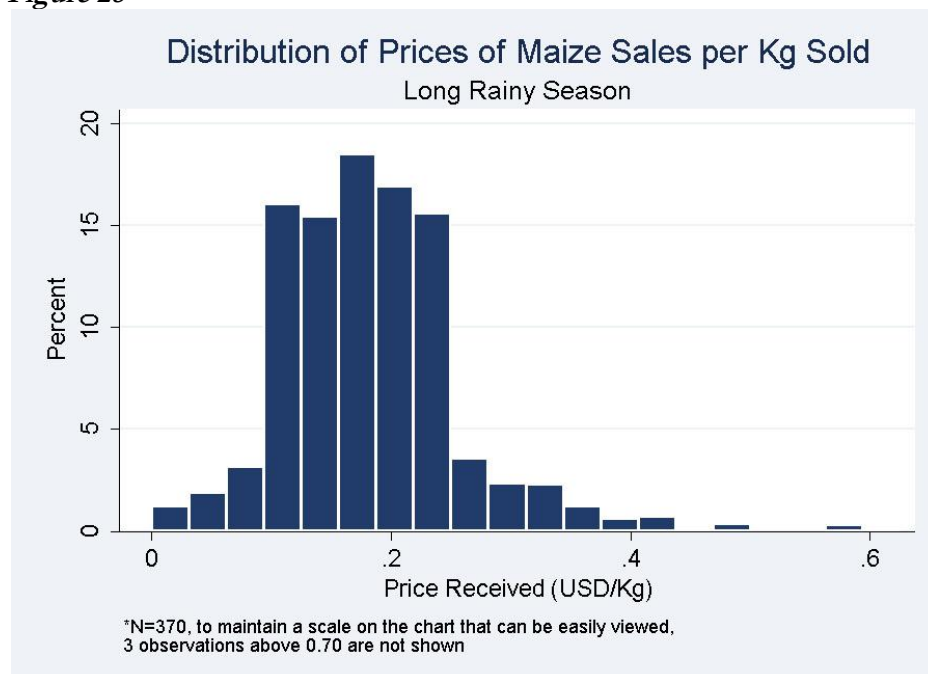
Questions *zaocode*, *s5aq2* & *s5aq3*

† Insufficient observations to obtain a reliable mean for yams

⁷ Prices were calculated by dividing the total value by the quantity sold

The distributions of amount received per kilogram of maize, paddy, and cassava were fairly symmetrical (see *Figure 28*, *Figure 29*, and *Figure 30*). As shown in *Figure 28*, most prices received for maize per kilogram were clustered around the mean and median (\$0.19). Over 90% of the observations were between \$0.09 and \$0.34 per kilogram. Variations in prices may reflect local supply and demand differences due to the location of the seller, or due to the time of sale.

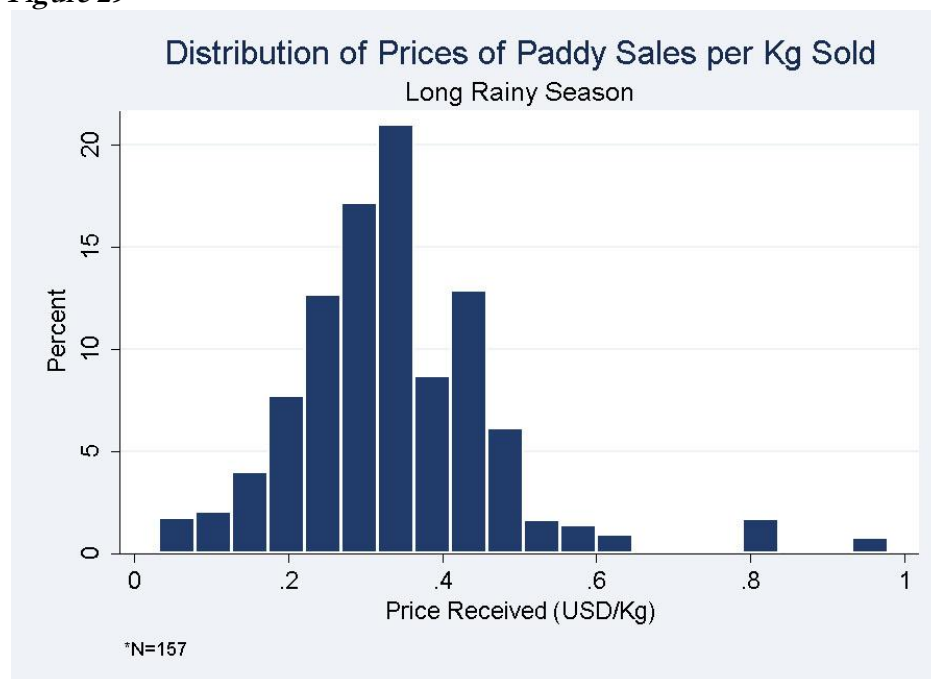
Figure 28



Questions zaocode, s5aq2 & s5aq3

As shown in *Figure 29*, the price received for paddy during the long rainy season was also fairly symmetrical, with a peak at just above \$0.30, and another slightly above \$0.40 per kilogram. The mean price received was \$0.34 per kilogram, and the median was \$0.33 per kilogram. Twenty-five percent of paddy growers who sold their crops received \$0.25 per kilogram or less, and 25% received more than \$0.41 per kilogram.

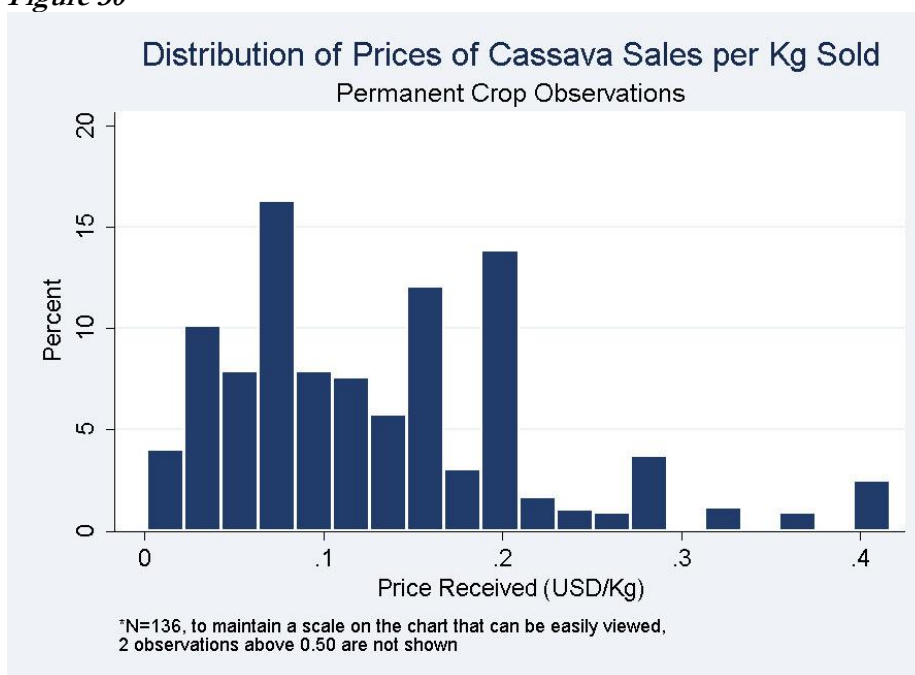
Figure 29



Questions *zao*code, *s5aq2* & *s5aq3*

Figure 30 illustrates that the prices received for cassava were generally lower than those received for maize and paddy, and the distribution was somewhat flatter, which may be due to sellers able to take advantage of multiple peak times for selling the crop over the year. The mean amount received per kilogram was \$0.15, and the median was \$0.13. Twenty-five percent of households received less than \$0.07 per kilogram, and 10% of households received \$0.27 per kilogram or more.

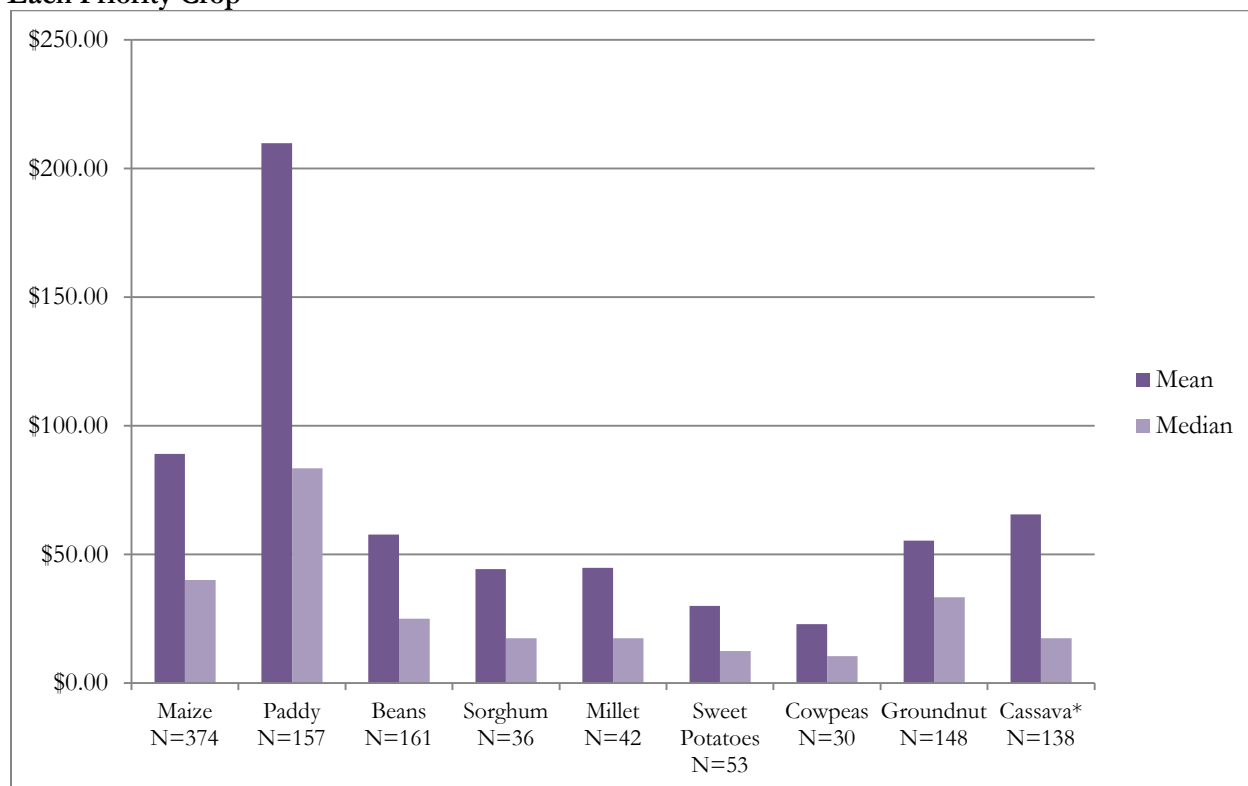
Figure 30



Questions *zao*code, *s5aq2* & *s5aq3*

Figure 31 shows the mean and median values of crops sold by household. Most of the mean values were more than twice as much as the medians, indicating that a small group of households earned disproportionately more from sales of each of these crops. Since the price per kilogram was less varied (see Figure 27), it suggests that the disparity between the mean and median value of crops sold by households is driven by large differences in the quantities sold, rather than in the prices received. The mean and median values for each of the priority crops in the long and short rainy seasons and for permanent crops and fruit with confidence intervals and numbers of observations can be found in *Appendix P*.

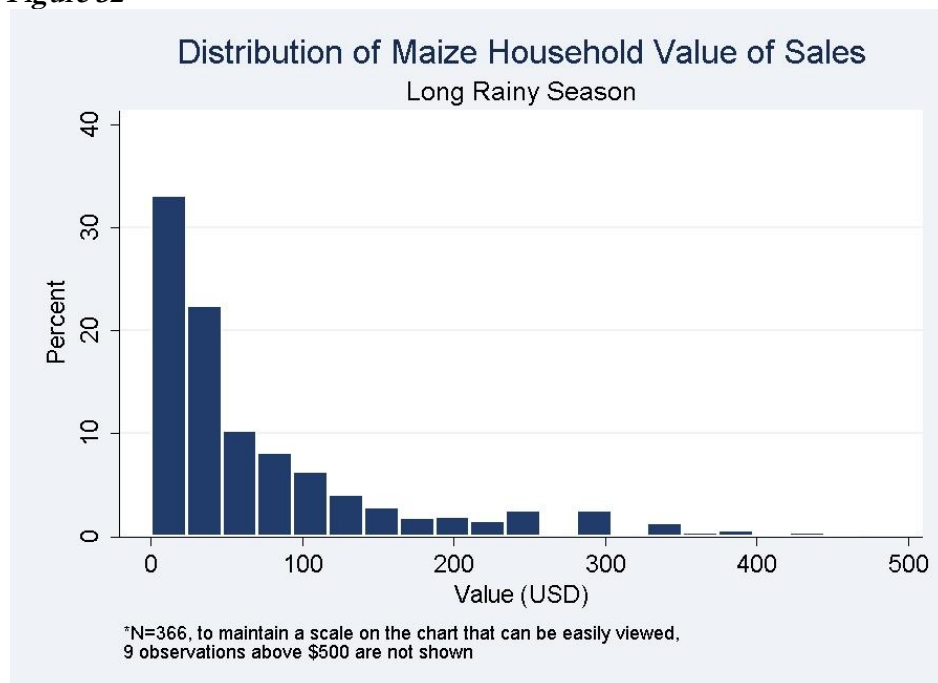
Figure 31: Mean and Median Value of Crop Sold in the Long Rainy Season of Households Growing Each Priority Crop



Questions zaoode & s5aq3

The distributions of total value of sales for maize and paddy in the long rainy season and cassava permanent crop observations are shown in Figure 32, Figure 33, and Figure 34. While the mean value of maize sales per household was \$89.09 in the long rainy season, the median was \$40.04, and 40% of households earned \$30 or less. Twenty-five percent of households received \$100 or more for maize sales in the long rainy season.

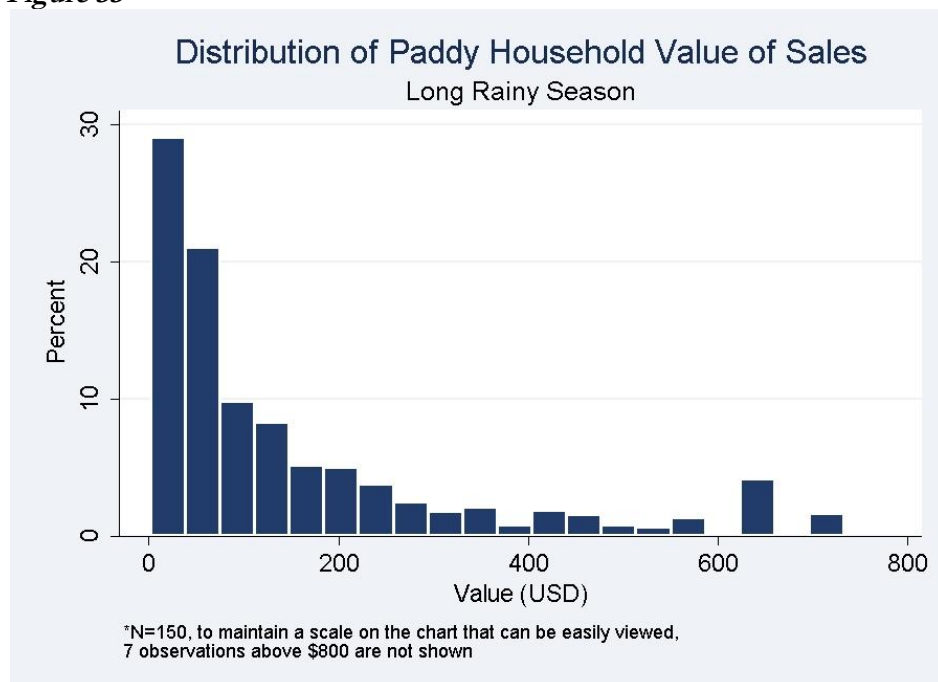
Figure 32



Questions [qaocode](#) & [s5aq3](#)

As shown in *Figure 33*, the distribution of household value of sales for paddy in the long rainy season follows a similar pattern to that of maize. The mean value of sales per household was \$209.77, and the median was much lower: \$83.42. Twenty-five percent of households earned less than \$30 from paddy sales, and 25% earned more than \$233.

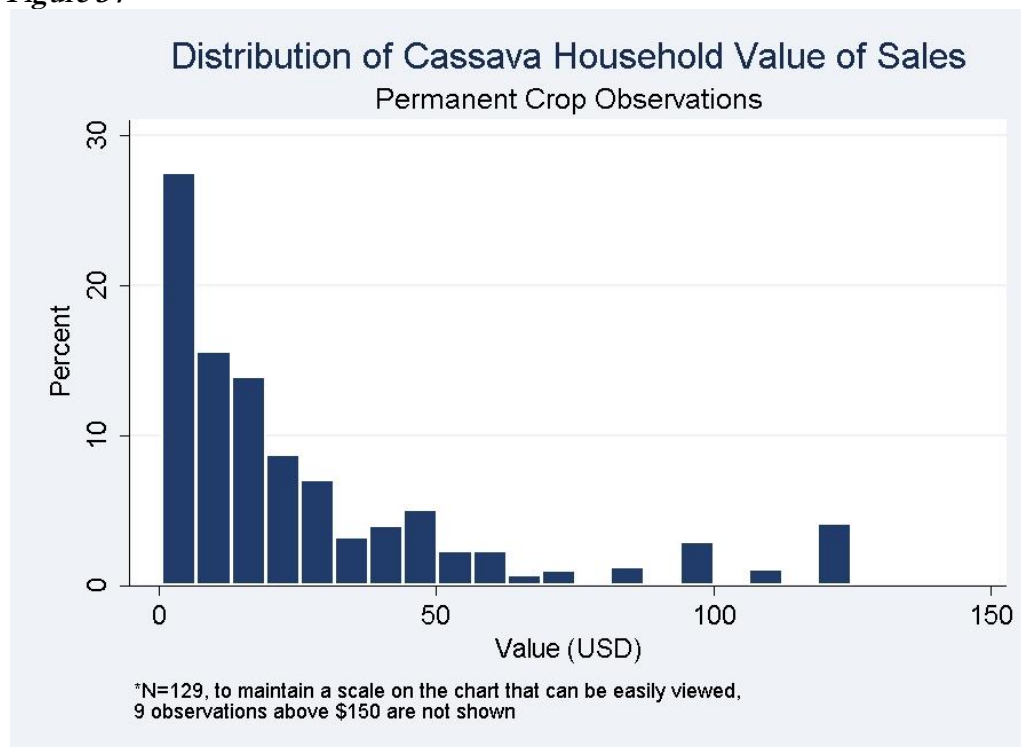
Figure 33



Questions [qaocode](#) & [s5aq3](#)

As shown in *Figure 34*, households generally received less value from sales for cassava than for either maize or paddy, with most households earning less than \$18. The mean value of \$65.53 was at about the 82nd percentile, meaning that only 18% of households earned this much or more. The majority of households made less than \$18 from sales of cassava, and 25% of households made less than \$7.

Figure 34

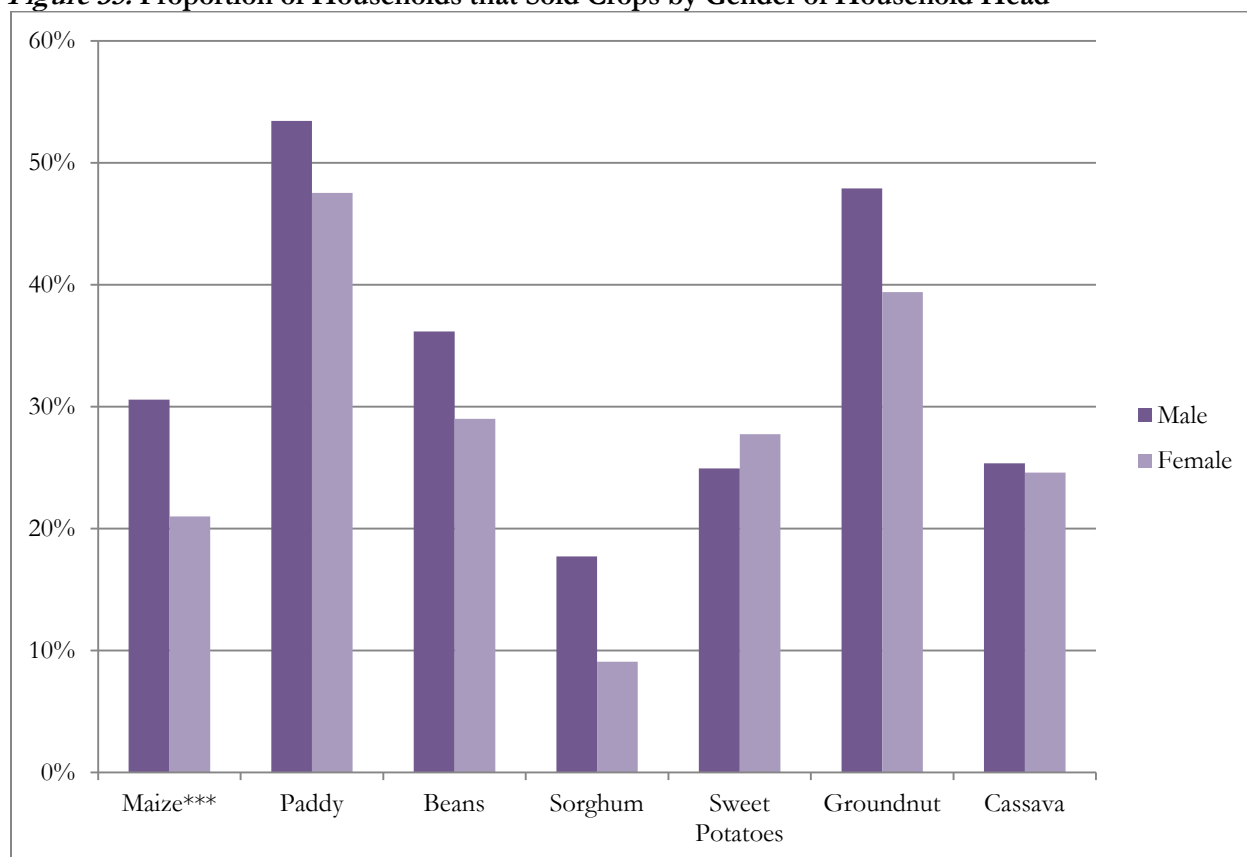


Questions zuocode & s5aq3

Male- and Female-Headed Households

With the exception of households that grew sweet potatoes, male-headed households that grew each of the priority crops during the long rainy season were more likely to sell those crops than female-headed households (for crops with sufficient observations, see *Figure 35*). However, maize was the only priority crop for which the difference was statistically significant. 31% of male-headed households that grew maize in the long rainy season sold some of their crop (305 out of 1,010 observations), while only 21% of female-headed households did so (69 out of 327 observations). *Appendix Q* includes a comparison of the proportion of households selling each priority crops in the long rainy season by gender of household head with confidence intervals and levels of statistical significance.

Figure 35: Proportion of Households that Sold Crops by Gender of Household Head



* Statistically significant at the .10 level

** Statistically significant at the .05 level

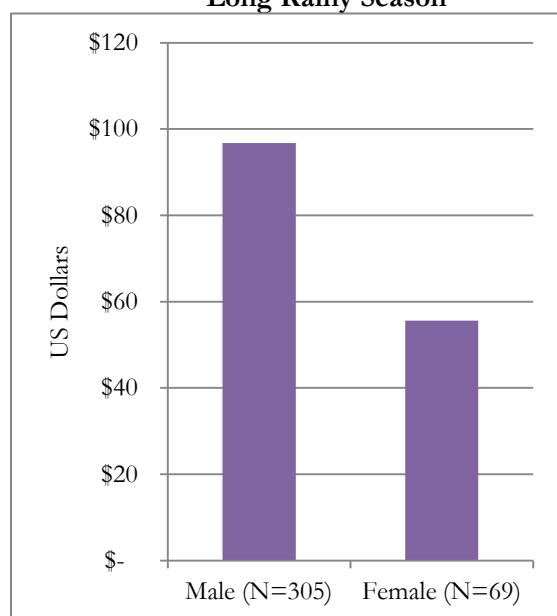
*** Statistically significant at the .01 level

† Insufficient observations to calculate reliable estimates for millet, yams, and cowpeas

Questions sbmemno, sbq2 & s5aq1

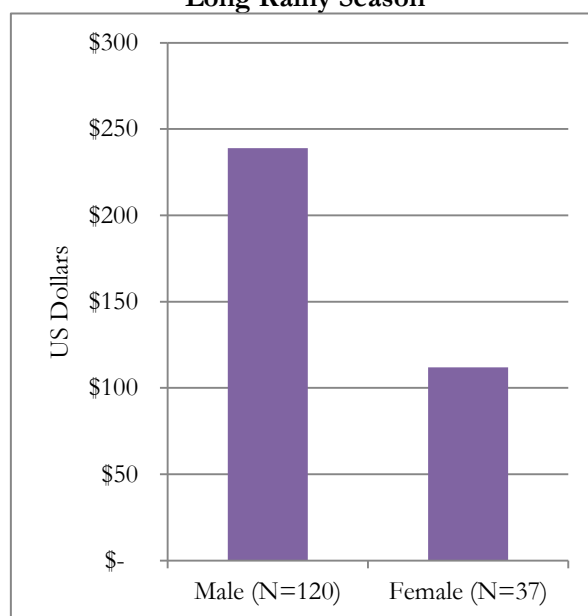
In addition to being more likely to sell their crops, male-headed households also earned more, on average, from sales of their maize crops in the long rainy season than did female-headed households (see *Figure 36*). Male-headed households made an average of \$96.73 from maize sales in the long rainy season; female-headed households made an average of \$55.64. This difference was statistically significant at the 99% confidence level. Female-headed households also earned less from paddy sales, an average of \$111.99, compared to the mean of \$238.92 earned by male-headed households in the long rainy season (see *Figure 37*), a difference significant at the 95% confidence level.

Figure 36: Mean Value of Maize Sales by Gender of Household Head – Long Rainy Season



***Difference is statistically significant at the .01 level
Questions sbmemno, sbq2 & s5aq3

Figure 37: Mean Value of Paddy Sales by Gender of Household Head – Long Rainy Season



**Difference is statistically significant at the .05 level
Questions sbmemno, sbq2 & s5aq3

Zones

As shown in *Figure 38*, the proportion of households who sold some of their harvest varied by zone. The Southern Highlands had the highest proportion of households that sold each of the three crops shown (maize, paddy, and cassava; 43%, 88% and 37% of households sold these crops respectively). Households in the Eastern zone were less likely to sell their crops; only 17% sold any of their maize harvest, just over 40% sold paddy, and 28% sold cassava. Notably, although Zanzibar has the highest proportion of households that grow paddy (51%), 0 out of 130 households reported selling any of their harvest. Full results for proportion of households selling each priority crop by zone with confidence intervals and numbers of observations can be found in *Appendix R*.

Figure 38: Proportion of Households that Sold Crops by Zone



* Permanent crop observations

Questions zone, zaocode, s5aq1 & s7bq2

**Note: of the 130 observations of households that grew paddy in

Zanzibar, zero reported selling any of their harvest

† Insufficient observations to obtain reliable estimates for paddy

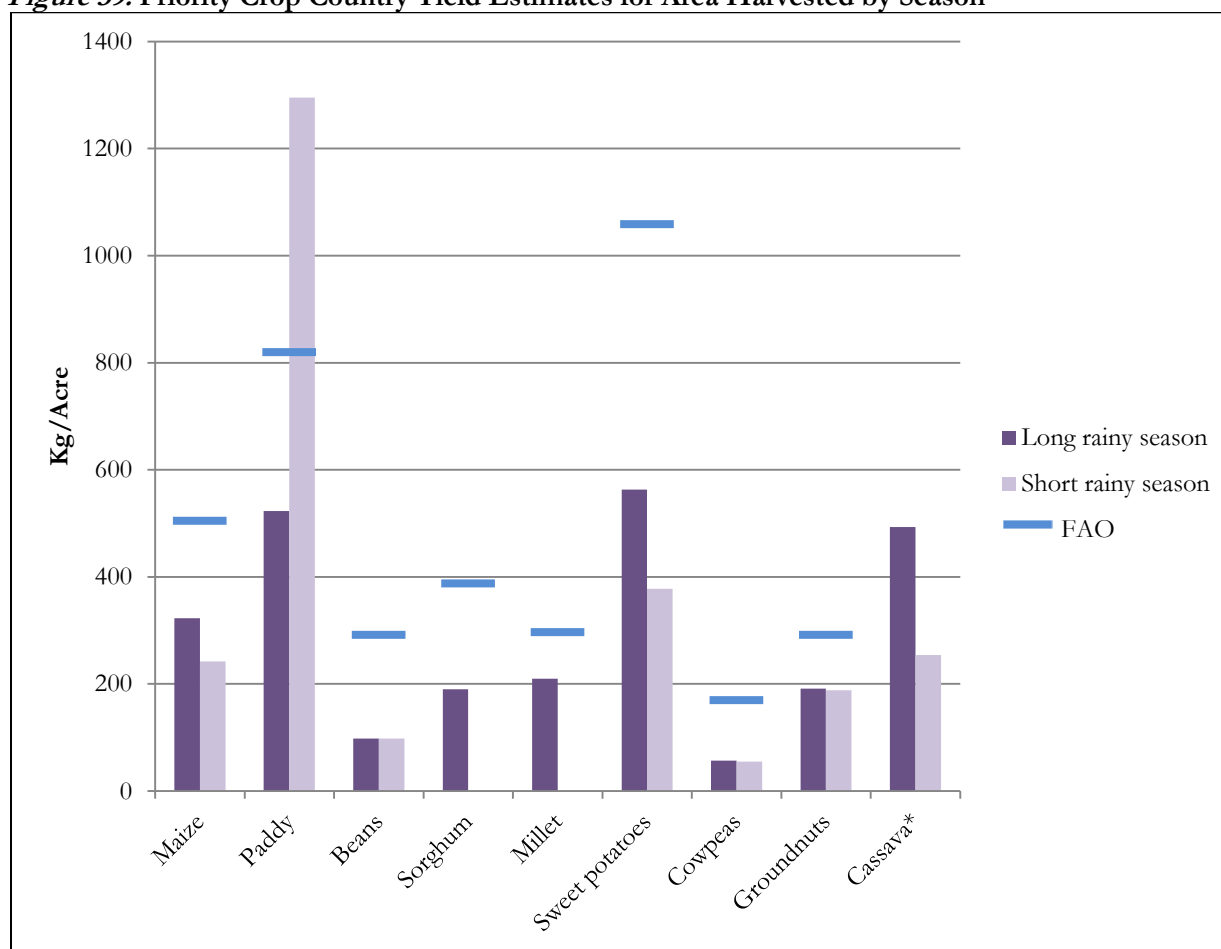
and cassava in the Central Zone, paddy in the Lake and

Northern Zone and maize in Zanzibar

Yield Measures

Figure 39 shows country yields for area harvested for each priority crop for the short and long rainy seasons compared to commonly used yield numbers from the Food and Agriculture Organization (FAO).⁸ As evidenced in the table, the calculations obtained through LSMS data were consistently below FAO yield estimates for the same year. While the FAO estimates are annual,⁹ the LSMS data separates crop information by season. Short and long rainy season crops are typically harvested at the end of each season, while permanent crops, for example cassava, may be left in the ground for up to several years (*What was the area harvested in the long rainy season 2008/ last short rainy season? What was the quantity harvested?*).

Figure 39: Priority Crop Country Yield Estimates for Area Harvested by Season



* The FAO 2008 yield estimate for cassava is 2,605 kg/acre.

There were also 609 observations of plots with cassava yields recorded as a permanent crop. The country yield for these plots was 183 kg/acre, assuming the entire plot was planted with cassava.

† Insufficient observations to calculate reliable yield estimates for sorghum and millet in the short rainy season and for yams in the long and short rainy seasons.

Questions s4aq8, s4bq8, s4aq15 & s4bq15

⁸ FAO yield estimates were pulled from FAOSTAT on June 6, 2011.

⁹ The FAO calculates yield measures at the country level, using the total production divided by the total amount of land harvested. Using LSMS data, yields can be calculated at the plot and the household levels by dividing the quantity harvested by the area harvested and planted for each plot and for each household. <http://faostat.fao.org/site/379/DesktopDefault.aspx?PageID=379>

There were insufficient observations (fewer than 30) to calculate reliable yield estimates for sorghum and millet in the short rainy season and for yams in both the long and short rainy seasons. The yield estimates for these crops are included in *Appendix S*, along with yield estimates at the plot, household and country level for all ten priority crops and mangos. Note that the area harvested question in the survey does ask respondents to specify the density of the area planted. Respondents could have planted less of a crop on a plot due to intercropping and reported the same area harvested as someone who did not intercrop. For more information on the frequency of intercropping and its effect on yields and productivity see the *Intercropping* section.

Table 6 shows six different yield estimates for maize that can be calculated using LSMS data as compared to FAO estimates from the same year (2008). The bolded estimate was calculated using country-level estimates of crop output per area harvested, the methodology most similar to the FAO.

*Area harvested and area planted*¹⁰

Yield calculations from the LSMS-ISA are possible using the area harvested or the area planted in the denominator. Area harvested is a more common measure, though it hides crop losses during the season or during harvest. The area planted includes plots where no harvest took place due to destruction. It also includes the portions of plots that were planted but not harvested due to drought, rains, fire, insects, animals, crop theft, diseases and community problems, lack of casual labor, and other reasons. See *Appendix T* for a fuller description of the differences between the area planted and area harvested variables and the *Pre- and Post-Harvest Losses* section for information on the magnitude and reasons for pre-harvest losses.

Table 6: Yield Comparison for Maize

Maize, Long Rainy Season		Mean Yield (kg/acre)	Confidence Interval	FAO: 505 Observations
Country	Harvested	323		1811
	Planted	225		1888
Household	Harvested	367	[345, 390]	1284
	Planted	293	[272, 313]	1324
Plot	Harvested	372	[347, 396]	1811
	Planted	304	[283, 326]	1888
Maize, Short Rainy Season		Mean Yield (kg/acre)	Confidence Interval	Observations
Country	Harvested	242		396
	Planted	142		440
Household	Harvested	284	[240, 328]	311
	Planted	204	[166, 242]	339
Plot	Harvested	273	[234, 313]	396
	Planted	197	[165, 229]	440

¹⁰ In order to include these factors in our analysis, we have created two different measurements for yields. One method mirrors the FAO by using the area harvested in the denominator of the yield calculation. The other method uses the area planted, which we calculated by multiplying the plot size by the percentage of the plot planted with the crop under analysis.

The country level yield estimate is simply the sum, over all plot observations, of the quantity produced (kilograms harvested) divided by the area harvested or planted. There are no standard error estimates for country level yields. *Appendix S* includes all six yield calculations for each priority crop.

As shown in *Figure 40*, *Figure 41*, and *Figure 42*, the distribution of household yields varies across crops.

Figure 40

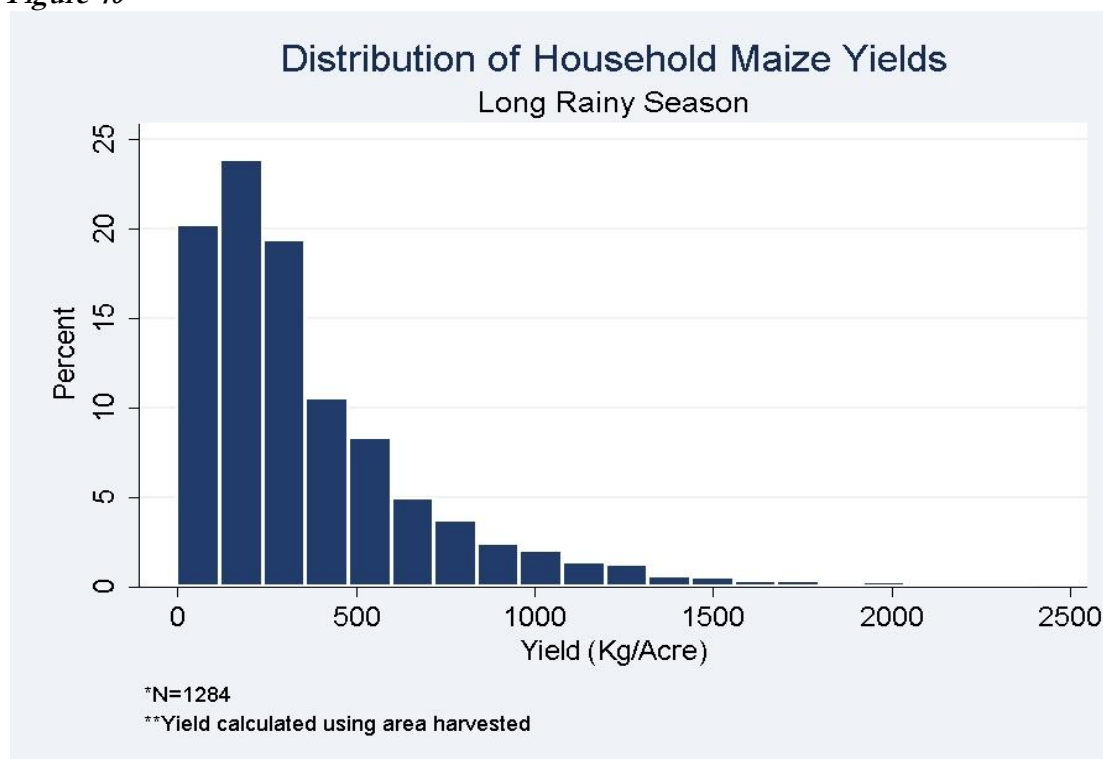


Figure 41

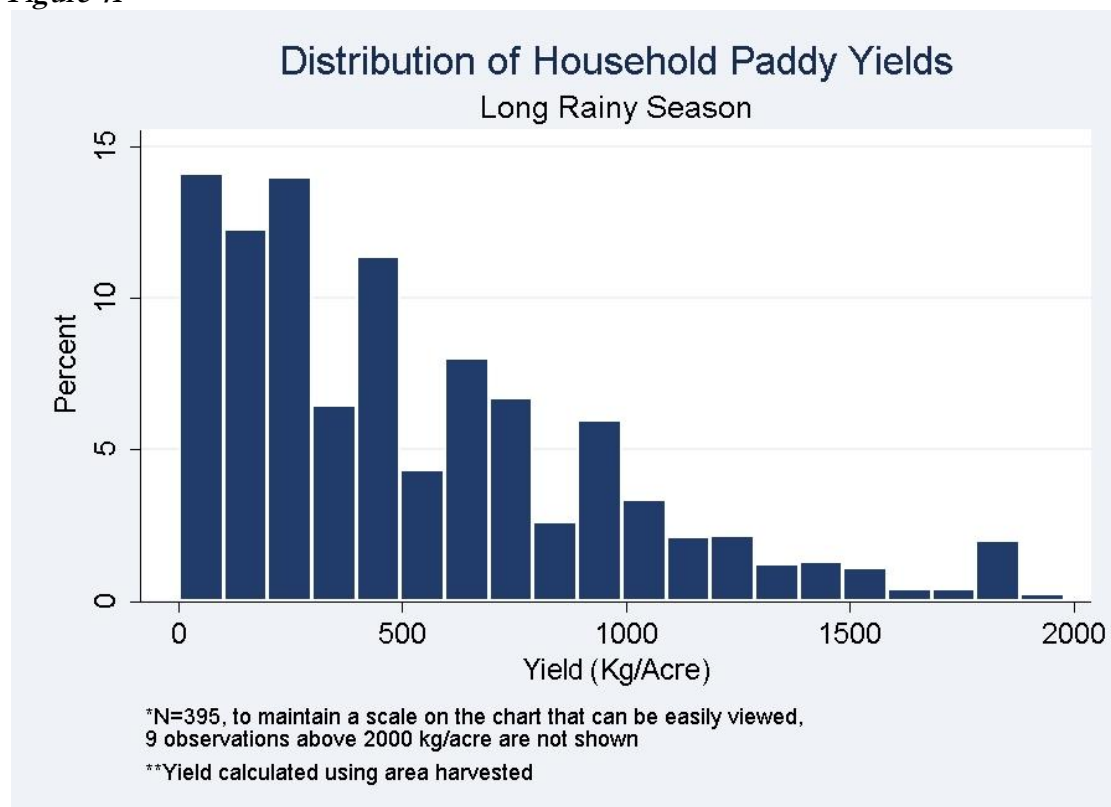
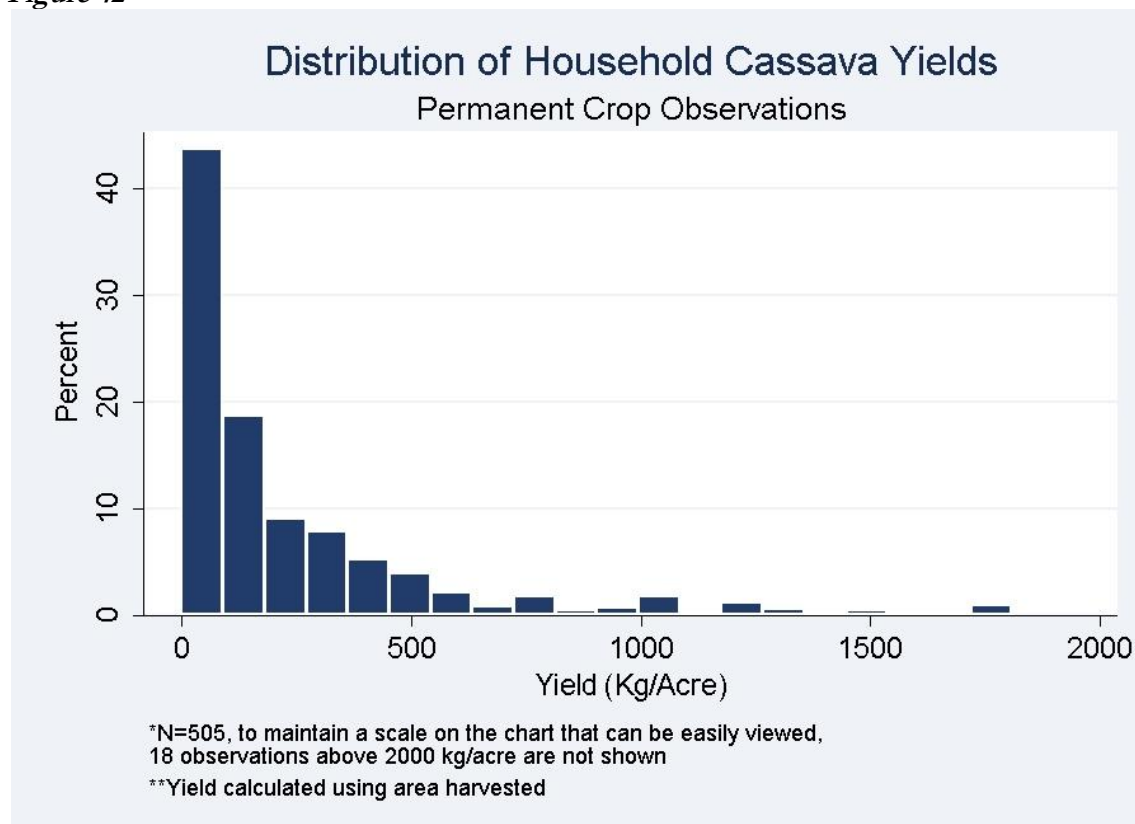


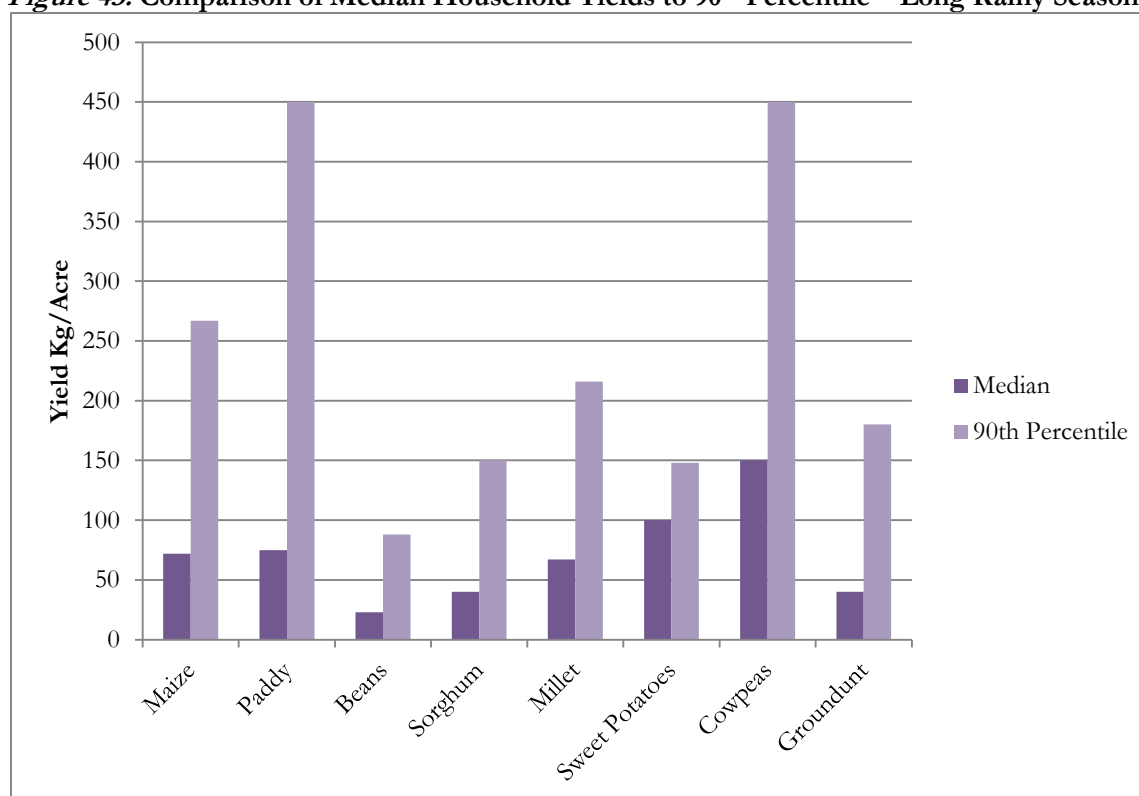
Figure 42



Household Yield Gap

As shown in *Figure 43*, the median household yields for each priority crop were generally much lower than the 90th percentile, indicating that many farmers could potentially achieve higher yields. Paddy yields in the long rainy season had the largest disparity between the median and the 90th, with the most productive households producing 500% more kilograms per acre than the median households. Sweet potatoes had the smallest yield gap; the 90th percentile produced 48% more kilograms per acre than the median household.

Figure 43: Comparison of Median Household Yields to 90th Percentile – Long Rainy Season



†Insufficient observations to calculate reliable yield estimates for yams

Complications with Cassava Observations:

Cassava generally is not planted and harvested within one rainy season, so it was supposed to be listed as a permanent crop by the survey enumerators. However, some enumerators listed cassava as a crop in the long and short rainy seasons and subsequently asked the questions associated with those seasons to survey respondents. The questions asked about crops in the long and short rainy seasons differed from the questions asked about fruit and permanent crops, so all of the cassava observations could not be combined into one dataset. For example, fruit and permanent crop observations do not have data on the portion of the plot planted with each crop, on the area harvested, or on improved variety seeds. Therefore, yield calculations for cassava as a permanent crop differed from the calculations of cassava and other crops during the long and short rainy seasons. Generally when comparing across crops this report uses long rainy season observations of cassava.

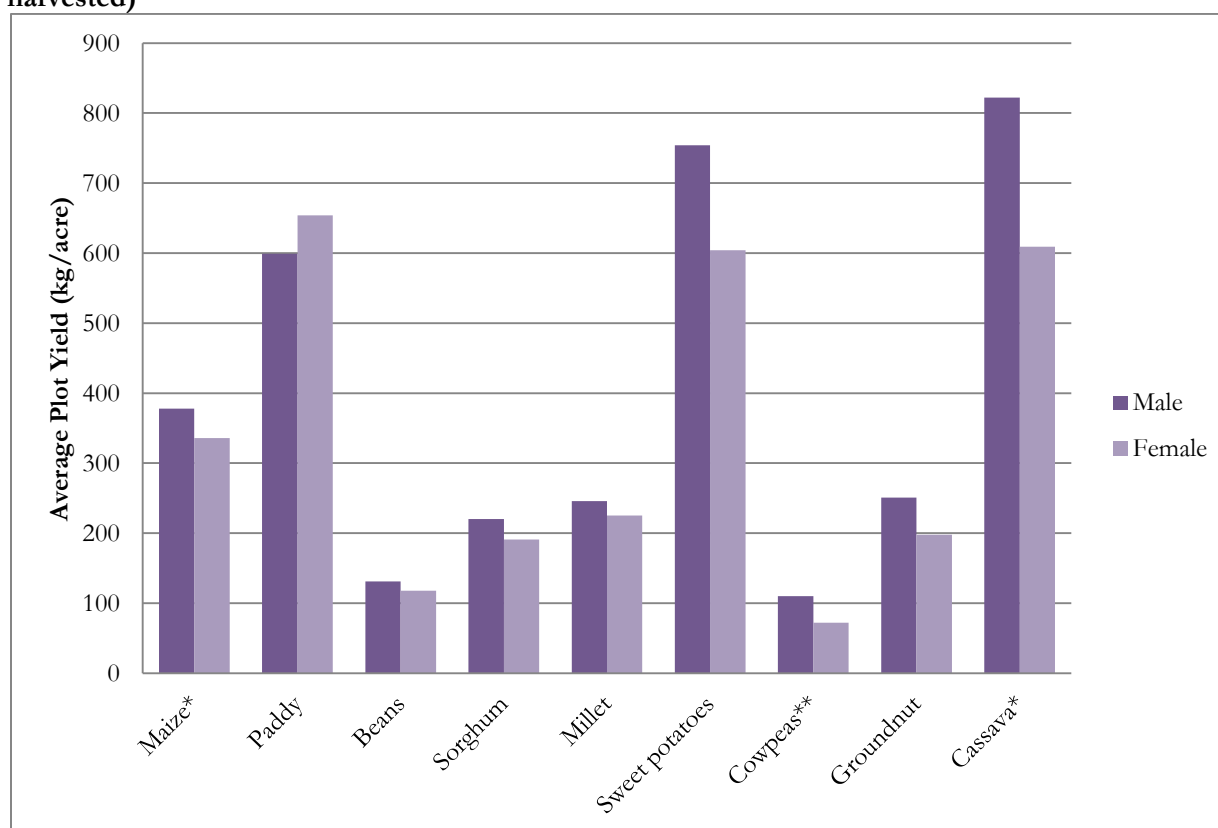
However, the data collection errors were not distributed evenly, which calls into question whether yield calculations for cassava are truly nationally representative. The vast majority of long rainy season yield observations for cassava were located in Zanzibar, followed by the Southern zone (179 and 38 plot yield observations respectively out of 221 total observations for area harvested yields). In the short rainy season, 43 out of 45 plot yield observations were located in Zanzibar. The permanent crop observations were more evenly distributed among zones.

There were several other issues with the data that affected the yield estimates. For a more detailed account of these issues and how they may affected the yield estimates, see *Appendix MM*.

Male- and Female-Headed Households

Male-headed households produced higher yields than female-headed households for all crops except paddy in the long rainy season (see *Figure 44*). However, in most cases the magnitude of difference was small and not statistically significant. While average cassava yields reported in the long rainy season were statistically significantly higher for male-headed households (822 kg/acre compared to 609 kg/acre), average cassava yields reported as permanent crops (with more observations than for the long rainy season) were higher for female-headed households (331 kg/acre compared to 441 kg/acre).

Figure 44: Comparison of Long Rainy Season Plot Yields by Gender of Household Head (area harvested)



* Statistically significant at the .10 level

** Statistically significant at the .05 level

*** Statistically significant at the .01 level

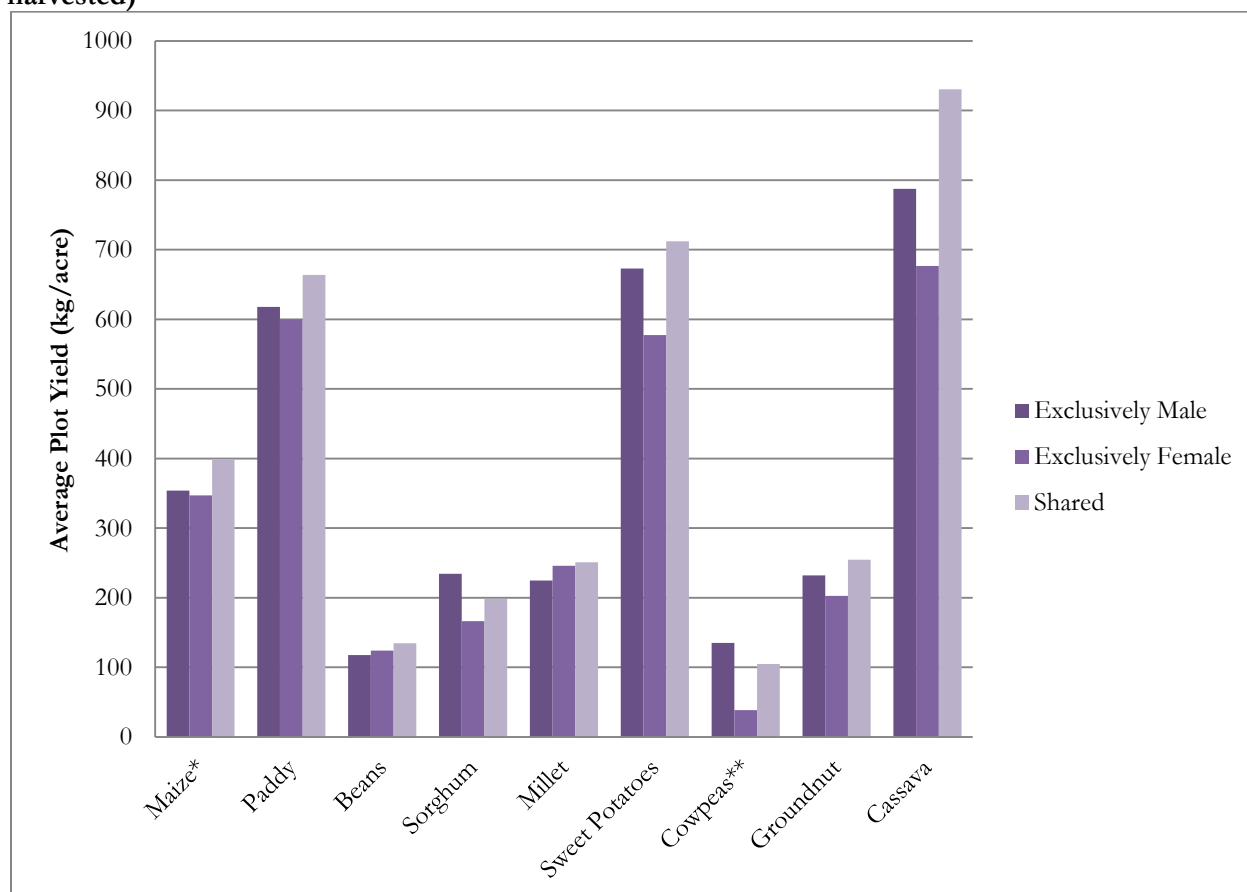
† Insufficient observations to calculate reliable yield estimates for yams

Yield variables, sbmemno, & sbq2

Plot Level Decision-Making by Gender

Respondents reported on who decided what to plant on each plot in the long and short rainy seasons. They could list up to three people, meaning that decision making could be made exclusively by males, females, or shared by people of both genders. With the exception of sorghum and cowpeas, yields during the long rainy season were highest on plots where decision-making was shared between males and females (see *Figure 45*). Plots that had exclusively female decision-makers had the lowest yields for every long rainy season crop analyzed, with the exception of millet where yields were slightly lower for plots with exclusive male decision-making. However, the magnitude in difference in yields by gender of decision-makers was generally not large and the differences were not statistically significant for most of the priority crops. This simple relationship between the gender of the decision-maker and yield also does not control for other potentially important variables such as plot size, quality, and input use. In addition, other aspects of plot decision making, such as control over harvest decisions, may also have important impacts on yields that are not captured by this question. See *Appendix V* for a full comparison for all crops in each season with test results for statistical significance (*Who decided what to plant on this plot in the long rainy season?*).

Figure 45: Comparison of Long Rainy Season Plot Yields by Gender of Decision-Maker (area harvested)



* Statistically significant at the .10 level

** Statistically significant at the .05 level

*** Statistically significant at the .01 level

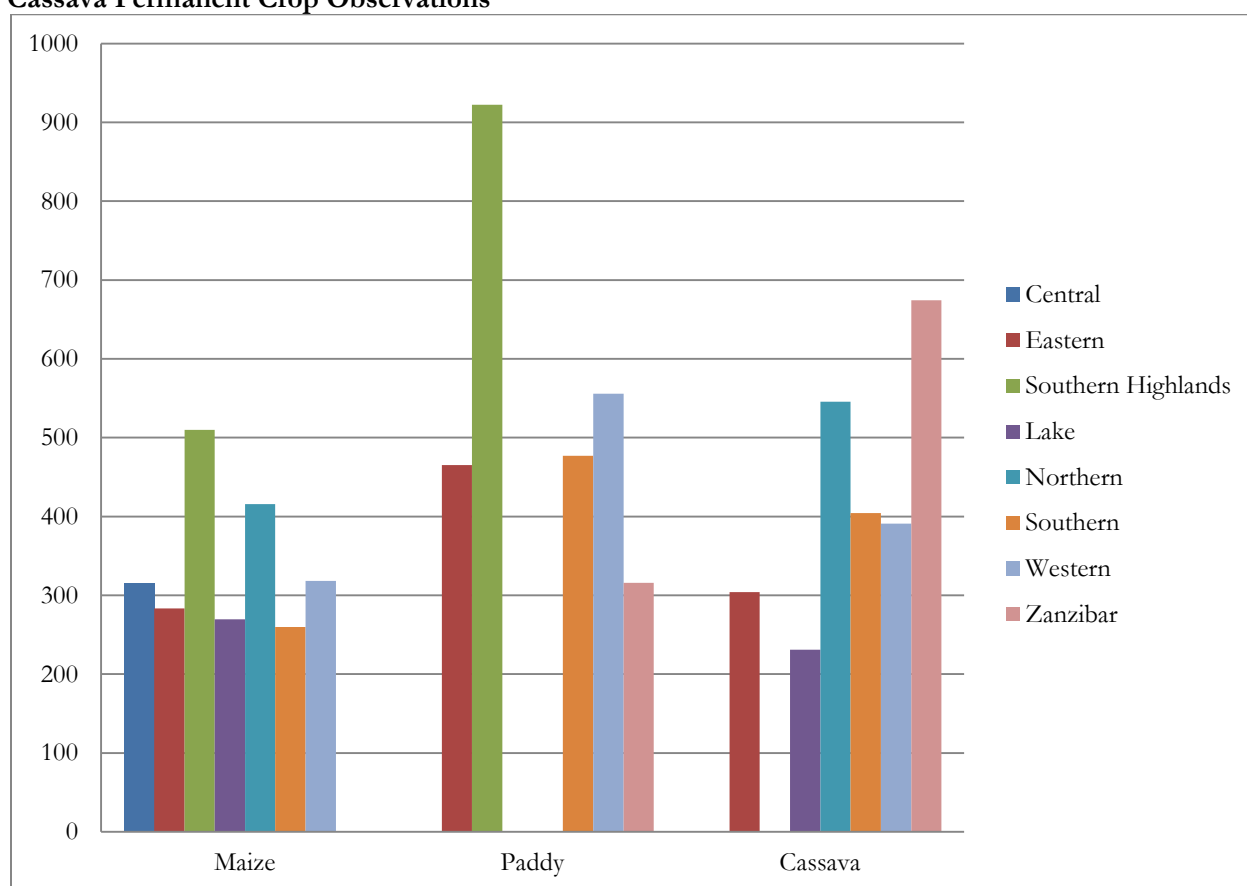
† Insufficient observations to calculate reliable yield estimates for yams

Yield variables, sbmemno, sbq2, s3aq6, &s3bq6

Zones

As shown in *Figure 46*, yields vary by zone. The Southern Highlands, for example had the highest average yields of any zone with sufficient observations for maize and paddy in the long rainy season (510 and 922 kg/acre respectively). While the median yields were generally lower than the means, the zonal variation followed the same pattern. The Southern Highlands had the highest median yields for both maize and paddy (396 and 750 kg/acre respectively). While Zanzibar had the lowest average paddy yield, 316 kg/acre, the average household cassava yields of 674 kg/acre in Zanzibar exceeded those of any other zone. Zanzibar also had the lowest median paddy yield (224 kg/acre) and the highest median cassava yield (420 kg/acre). The Lake zone had lower average yields for maize and cassava and several other priority crops. See *Appendix X* for a full report of average long and short rainy season household yields by zone and *Section B – Median Farmer Profile* for the median yields by zone.

Figure 46: Average Household Yield by Zone for Maize and Paddy in the Long Rainy Season and Cassava Permanent Crop Observations



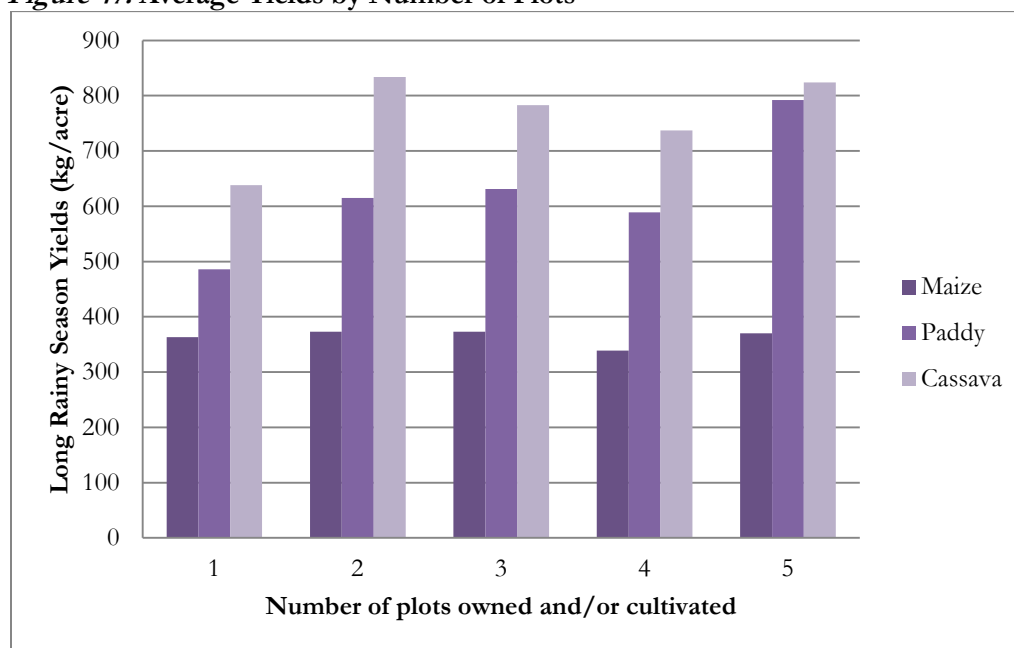
**Note: Yield values calculated using the area harvested*

†Insufficient observations to calculate reliable average yields for maize in Zanzibar; paddy in the Central, Lake and Northern zones; and Cassava in the Central zone and the Southern Highlands

Farm Characteristics

As shown in *Figure 47*, paddy yields were higher for households that own more plots, though maize and cassava do not show a clear relationship between the number of plots owned by a particular household and average yield.

Figure 47: Average Yields by Number of Plots



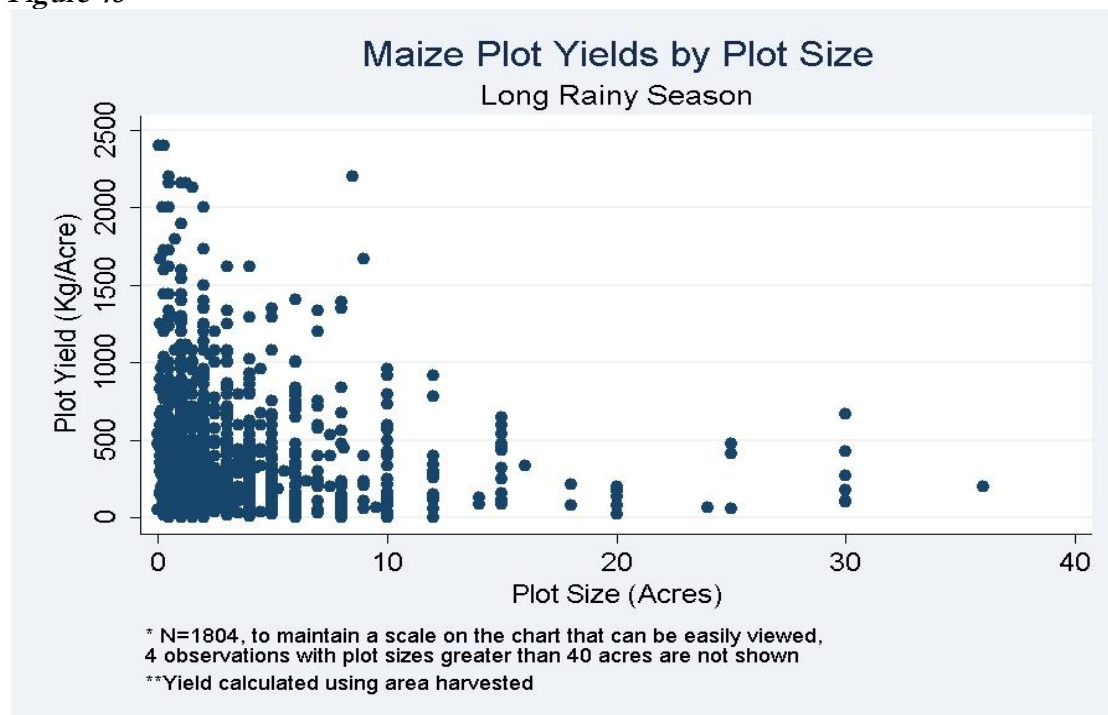
Yield variables, st2q1, st2q2, st2q3, st2q4, s2aq4, & s2bq4

As shown in *Figure 48*, smaller plots tended to produce higher yields of maize in the long rainy season. The correlation was weak, but was statistically significant at the 99% confidence level.¹¹ Paddy and cassava yields were also negatively correlated with plot size and these correlations were statistically significant¹² (see *Figure 49* and *Figure 50*). See *Appendix Y* for correlation coefficients of all priority crops with plot size.

¹¹ $r = -0.0634$, $p = 0.007$

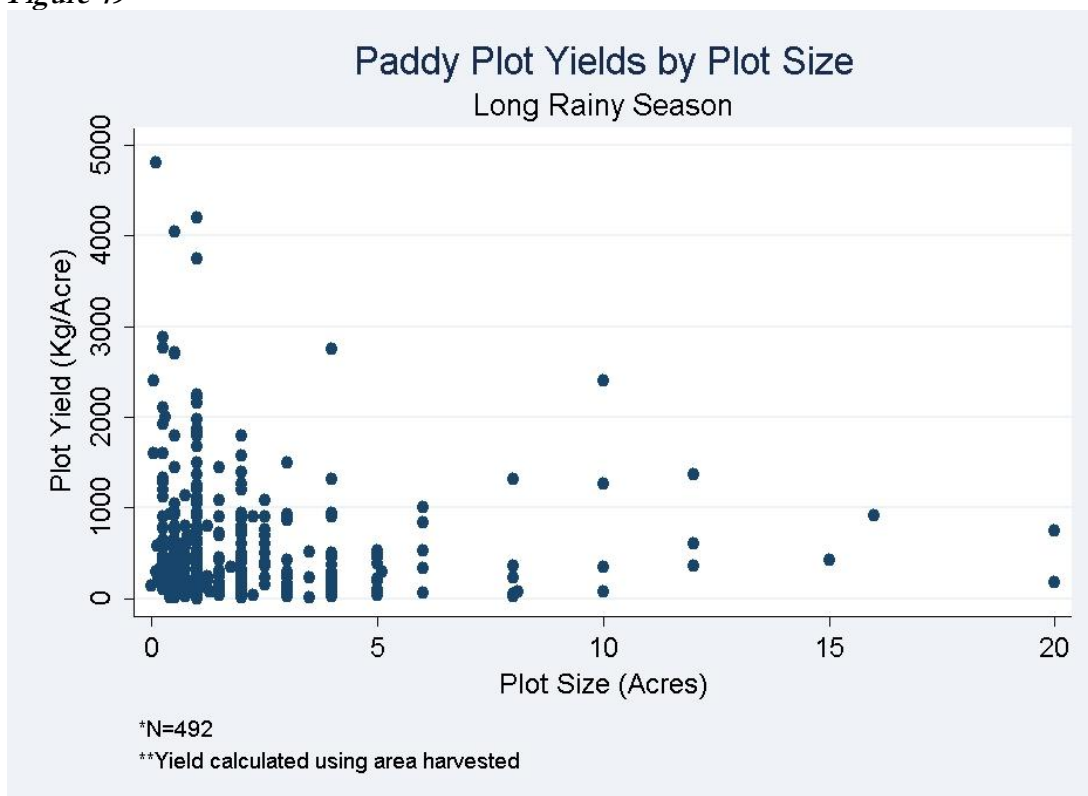
¹² Paddy LRS: $r = 0.0748$, $p = 0.0975$; cassava permanent crop observations: $r = -0.163$, $p = 0.0001$

Figure 48



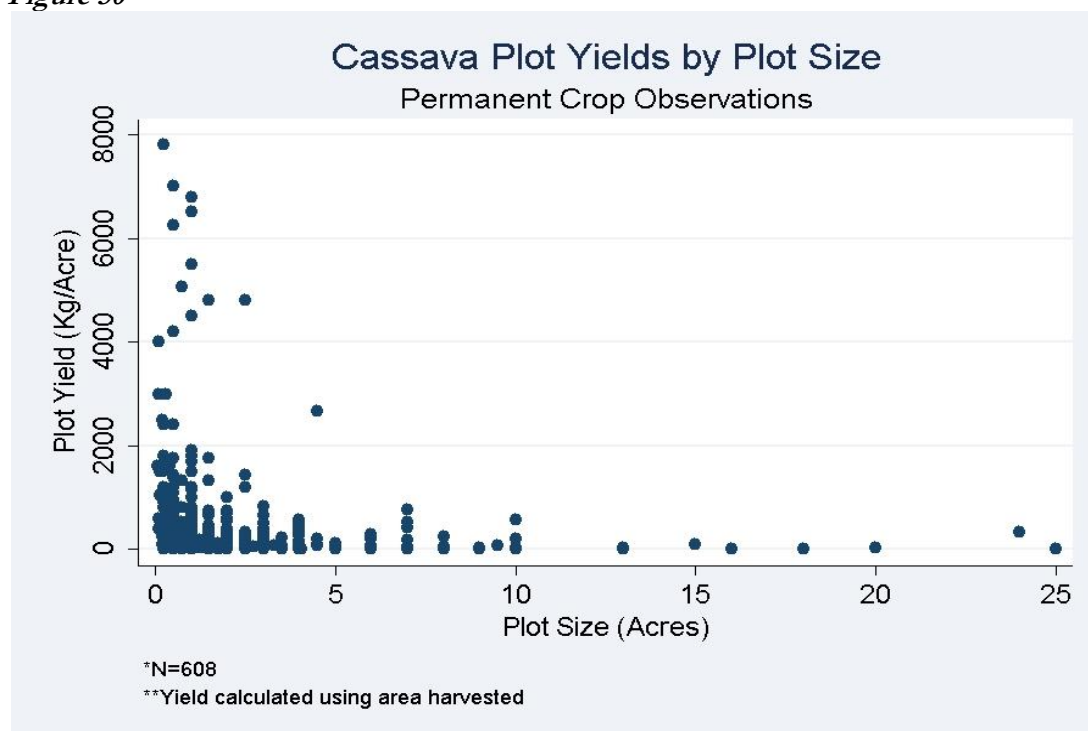
**Note: scatter plot is of un-weighted data and therefore is not nationally representative*

Figure 49



**Note: scatter plot is of un-weighted data and therefore is not nationally representative*

Figure 50



**Note: scatter plot is of un-weighted data and therefore is not nationally representative*

Intercropping

An estimated 63% of plots reported in the LSMS-ISA were intercropped. Intercropping varied by season and type of crop, with the lowest proportion of intercropping occurring during the long rainy season and fruit the most likely to be intercropped (see *Table 7*), as measured by the number of plots that contain a fruit tree and additional crop – independent of the quantity of either crop (*Was cultivation intercropped?*).

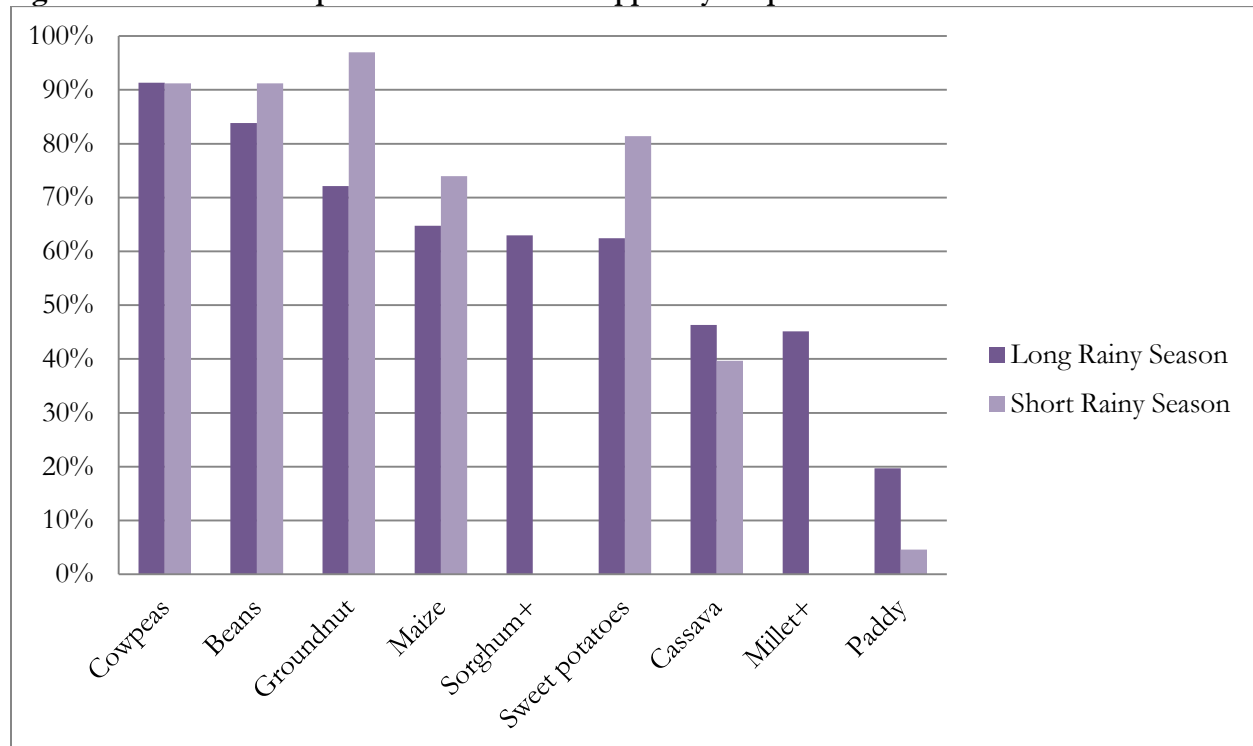
Table 7: Estimated Proportion of Plots Intercropped by Season

Season	Estimated proportion	95% C.I.	Observations
Fruit	82%	[79%, 86%]	1650
Permanent Crops	78%	[75%, 82%]	1788
All Short Rainy Season Plots	67%	[62%, 72%]	786
All Long Rainy Season Plots	54%	[51%, 57%]	3355
All Crops/Seasons	63%	[60%, 65%]	4561

* Questions *s4aq6*, *s4bq6*, *s6aq5* & *s6bq5*

As evident in *Figure 51*, intercropping varied substantially by crop planted. Legumes were most commonly intercropped, and paddy was intercropped much less than any other priority crops. *Appendix Z* includes proportion of plots intercropped by crop for the long and short rainy seasons, permanent crops and fruit.

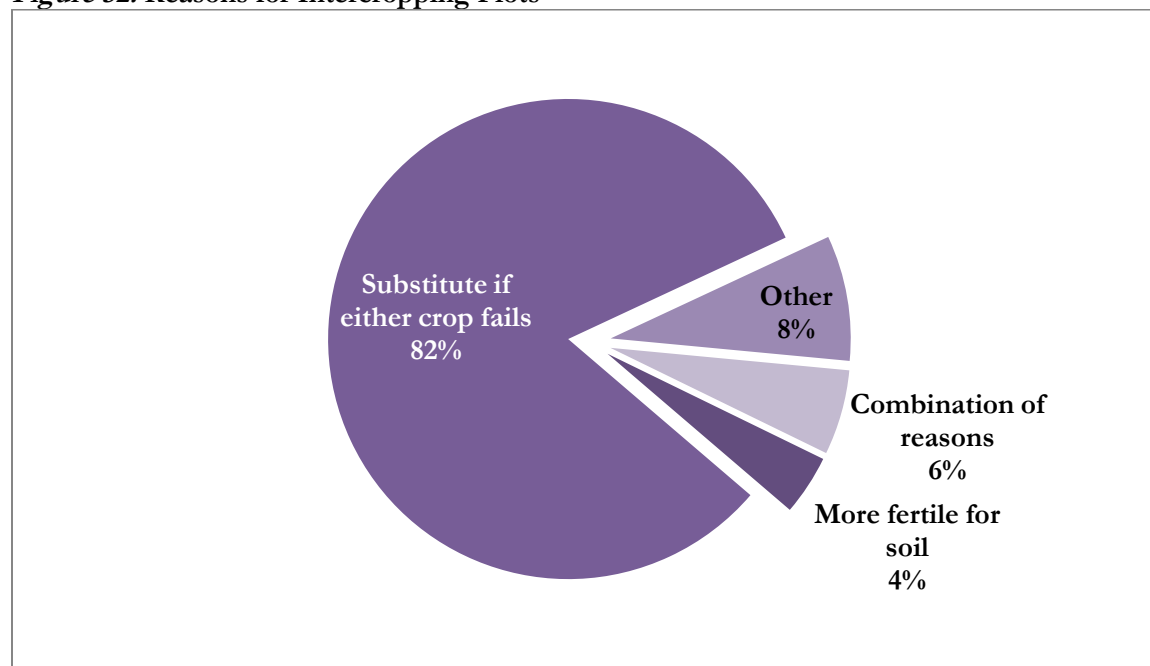
Figure 51: Estimated Proportion of Plots Intercropped by Crop Planted



† Insufficient observations to calculate reliable yield estimates for sorghum and millet in the short rainy season and for yams in the long and short rainy seasons.

As shown in *Figure 52*, the majority of plots were intercropped to mitigate the risk of crop failure. Full results and confidence intervals for reasons for intercropping are in *Appendix Z*. (*Reason for intercropping options: substitute if either crop fails, more fertile for the soil, other*)

Figure 52: Reasons for Intercropping Plots



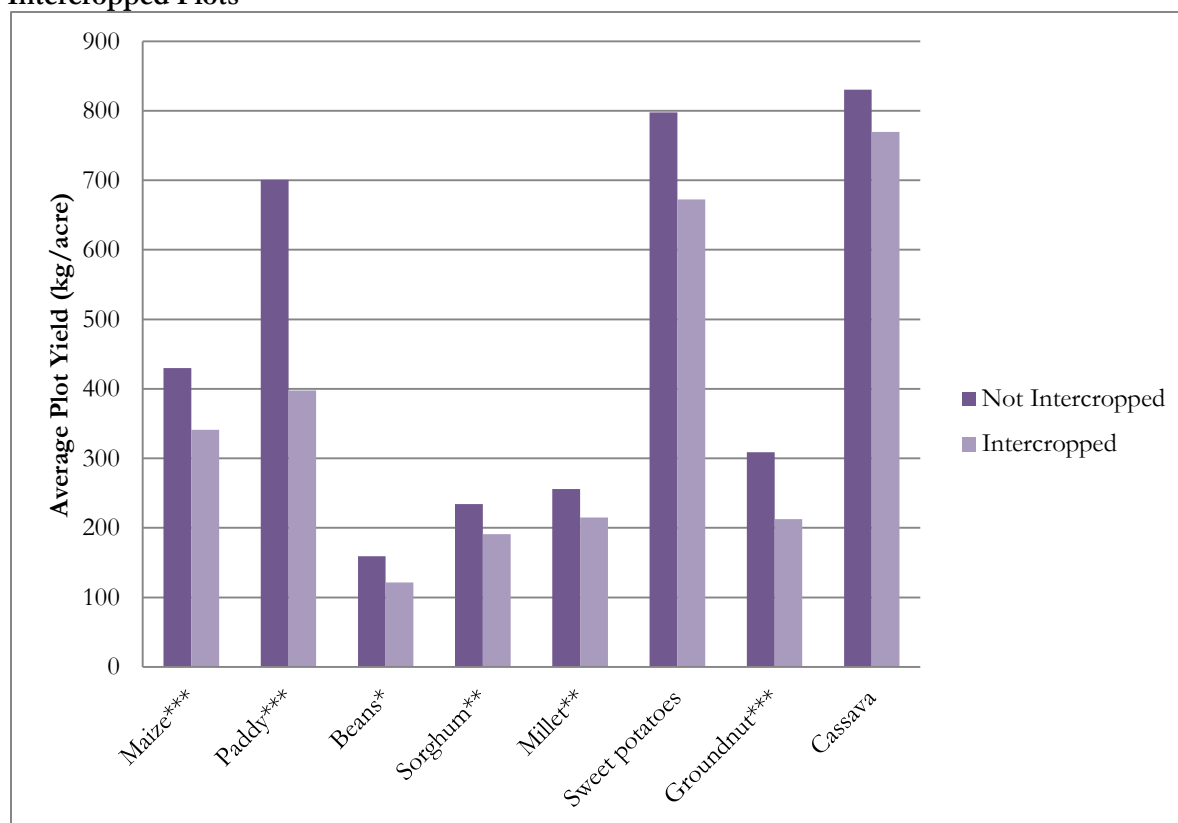
*N=2,733 plots; Includes long and short rainy season and fruit and permanent crop observations

** Questions s4aq7, s4bq7, s6aq6 & s6bq6

Intercropping and Yields

With the exception of sweet potatoes, each priority crop had statistically significant lower yields in intercropped plots than in crops that were not intercropped during the long rainy season (see *Figure 53*), though this result does not account for difference in planting density on intercropped and monocropped plots. Paddy had the largest discrepancy in yields between intercropped and non-intercropped fields, which may explain in part why it is so infrequently intercropped compared to other priority crops. Maize was the only crop in the short rainy season with enough observations to reliably compare yields of intercropped and non-intercropped plots. Yields for intercropped plots were 265 kg/acre, compared to 298 kg/acre for non-intercropped plots. However, this difference was not statistically significant. For a comparison of yields for all priority crops in both rainy seasons see *Appendix AA*.

Figure 53: Long Rainy Season Plot Yields for Crops that were Intercropped Compared to Non-Intercropped Plots



* Statistically significant at the .10 level

** Statistically significant at the .05 level

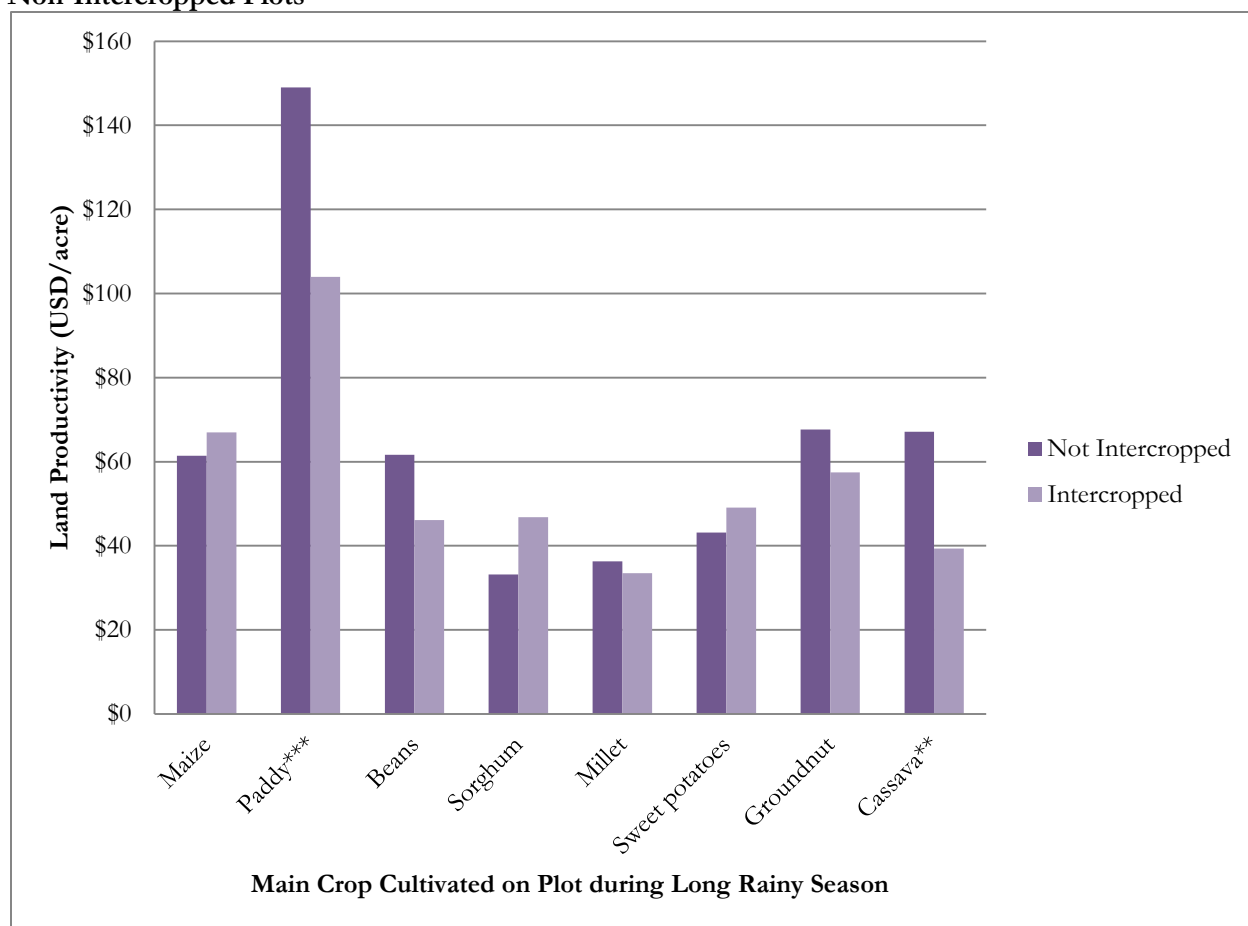
*** Statistically significant at the .01 level

† Insufficient observations to calculate reliable yield estimates for yams and cowpeas

Intercropping and Land and Labor Productivity

As seen in Figure 54, when we take into account the value from all crops harvested on a plot, intercropped plots with main crops of maize, sorghum, and sweet potatoes all produced more value per acre than non-intercropped plots with these main crops. However, none of these differences are statistically significant. Non-intercropped plots with main crops of paddy, beans, millet, groundnut, and cassava produced more value per acre than intercropped plots with these main crops. The difference was only statistically significant for plots with paddy and cassava as the main crop.

Figure 54: Long Rainy Season Land Productivity for Plots that were Intercropped Compared to Non-Intercropped Plots



* Statistically significant at the .10 level

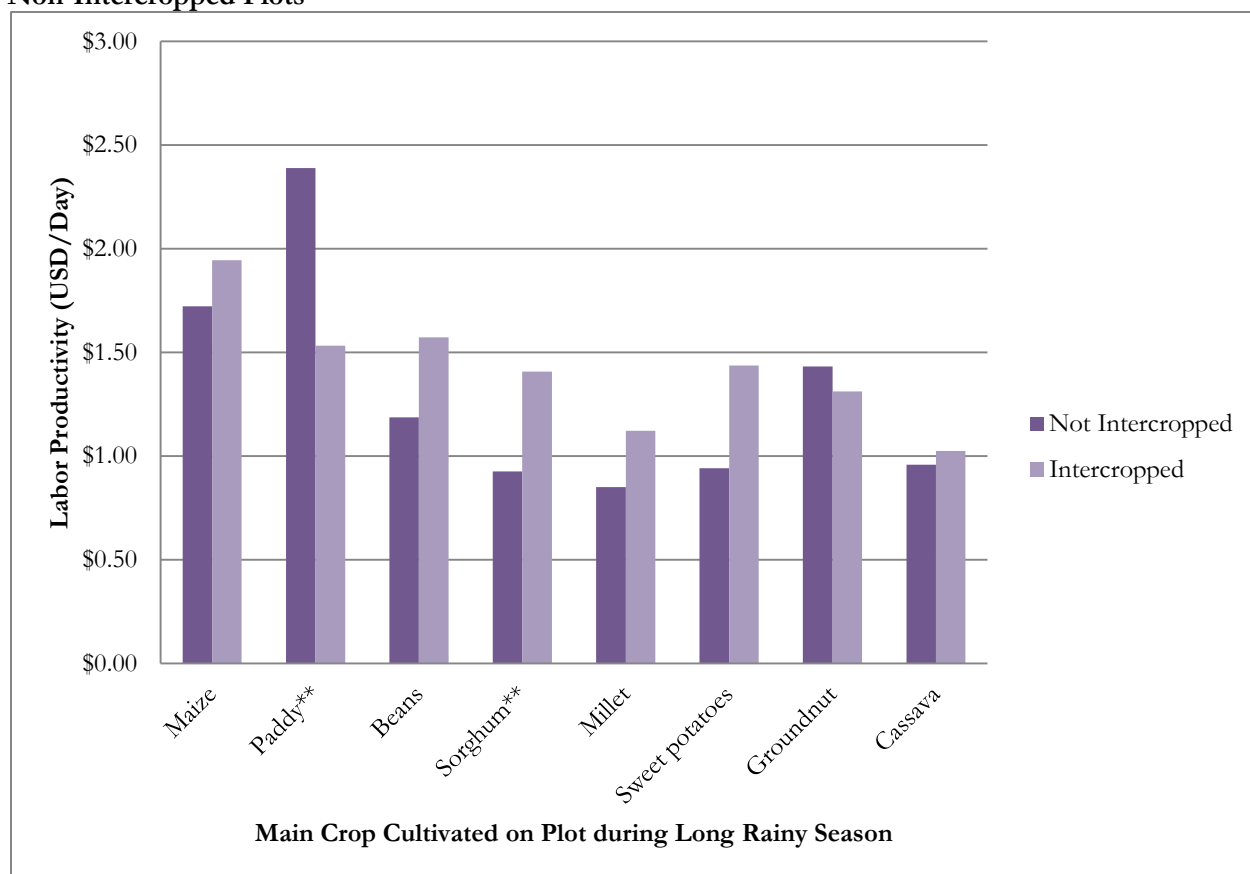
**Statistically significant at the .05 level

***Statistically significant at the .01 level

† Insufficient observations to calculate reliable yield estimates for yams and cowpeas

However, although non-intercropped plots with cassava as the main crop had statistically significantly higher land productivity, the labor productivity was actually slightly lower for these plots, though this difference was not statistically significant (see Figure 55). Paddy and groundnuts were the only two main crops that had higher labor productivity for non-intercropped plots than for non-intercropped plots. All other priority crops had higher labor productivity on intercropped plots, suggesting that intercropping may create some labor efficiencies. As shown in Figure 54 and Figure 55, most of the productivity differences between intercropped and non-intercropped plots were inconsistent by crop and not statistically significant. Intercropping is a very complex topic and may warrant further research and analysis in order to more fully understand its effects on productivity. Appendix BB has the full results from the bivariate analysis of productivity and intercropping.

Figure 55: Long Rainy Season Labor Productivity for Plots that were Intercropped Compared to Non-Intercropped Plots



* Statistically significant at the .10 level

**Statistically significant at the .05 level

***Statistically significant at the .01 level

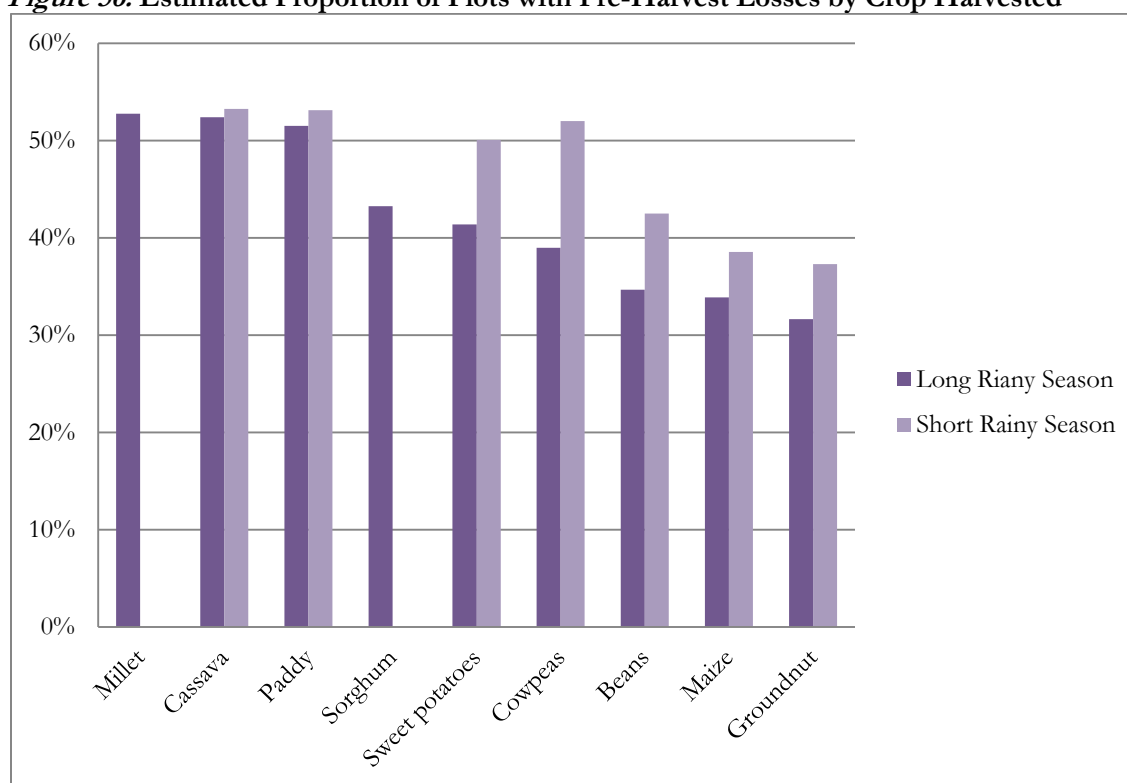
† Insufficient observations to calculate reliable yield estimates for yams and cowpeas

Pre- and Post-Harvest Losses

Pre-Harvest Losses

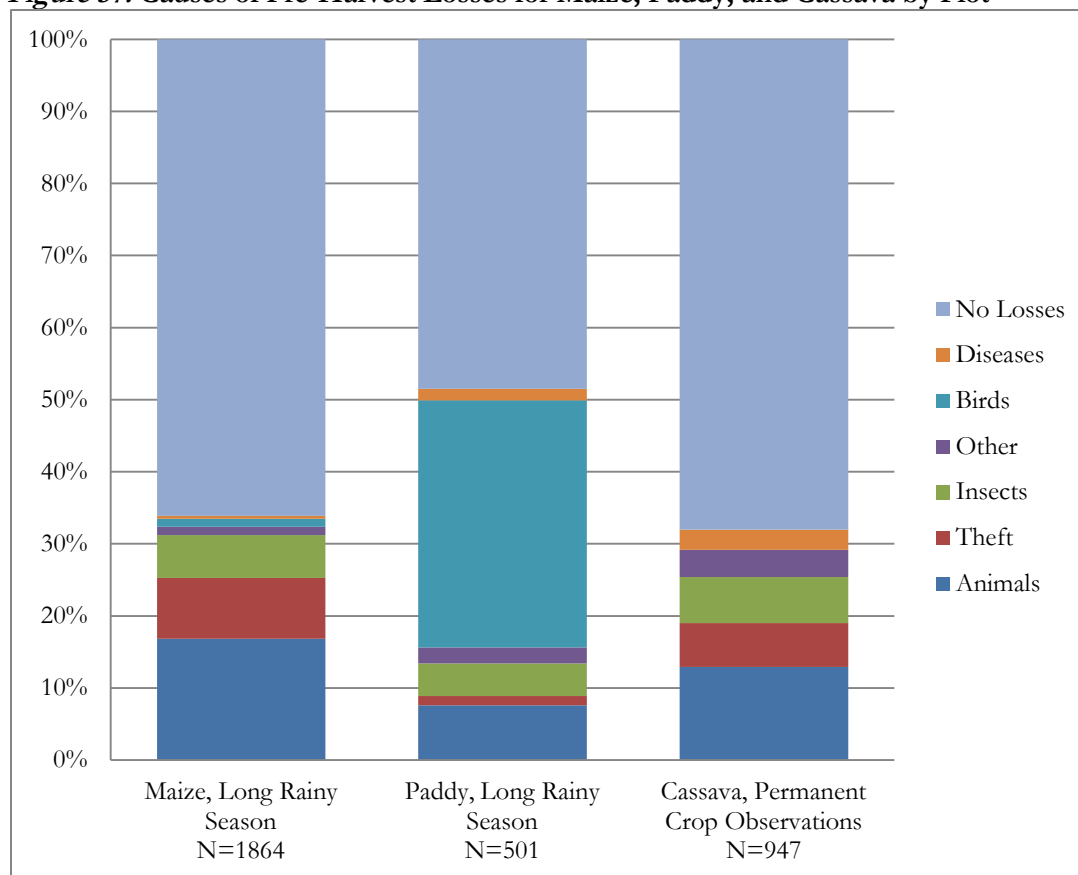
About a third to a half of priority crop plots lost a portion of the area planted to pre-harvest losses. Generally, pre-harvest losses were more common in the short rainy season than in the long rainy season (see *Figure 56*). As shown in *Figure 57*, the causes of pre-harvest losses varied by crop. Birds were the most common cause of pre-harvest losses for paddy, while maize and cassava experienced the highest proportion of losses due to animals. *Appendix CC* has summary statistics for the proportion of all priority crops that have pre-harvest losses in the long and short rainy seasons and permanent crops and fruit. *Appendix DD* includes the causes of pre-harvest losses for priority crops in the long rainy season and permanent crops and fruit (*Were there any losses of crops before the harvest? What was the cause of these losses?*).

Figure 56: Estimated Proportion of Plots with Pre-Harvest Losses by Crop Harvested



Questions *s4aq17*, *s4bq17* *s6aq9* & *s6bq9*

Figure 57: Causes of Pre-Harvest Losses for Maize, Paddy, and Cassava by Plot

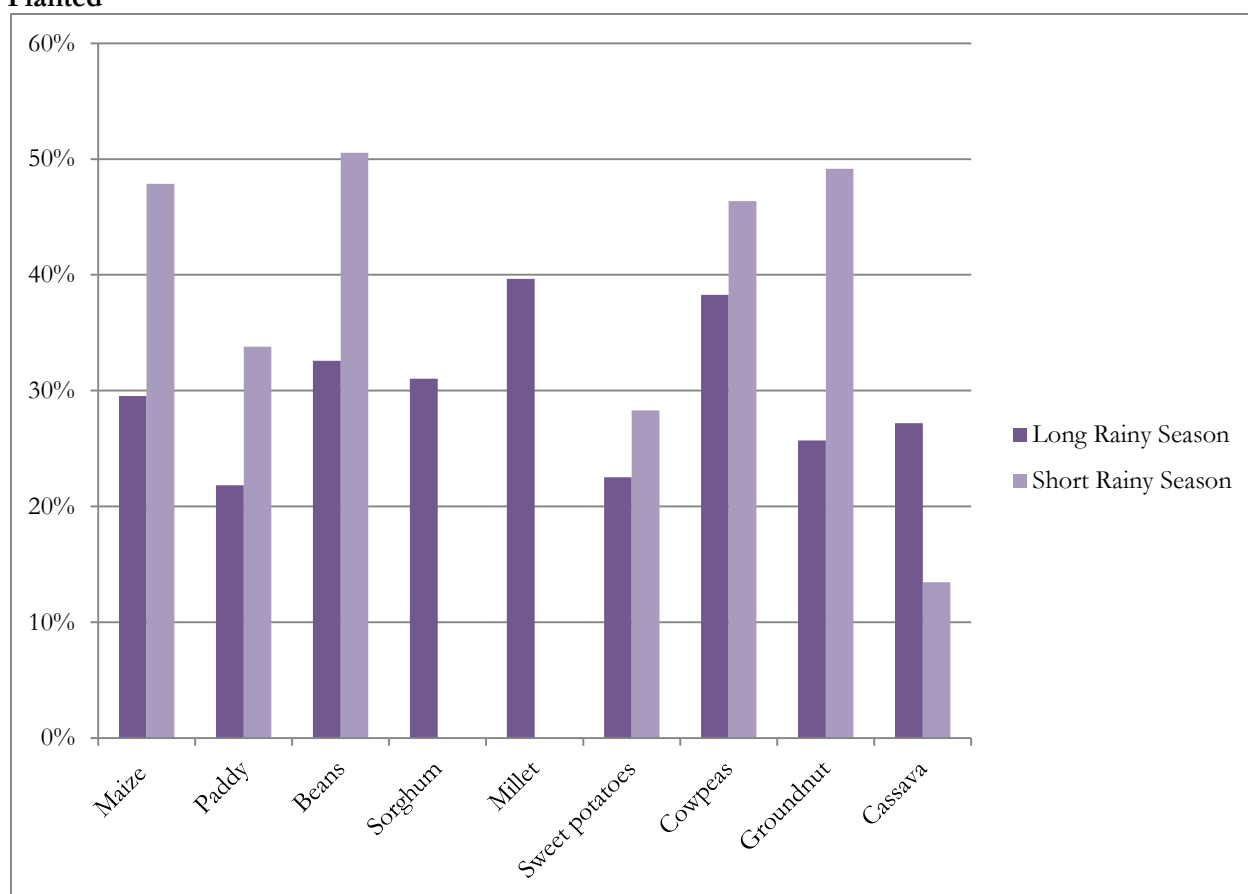


Questions *s4aq18*, *s4bq18*, *s6aq10* & *s6bq10*

Plots with Area Harvested Less than Area Planted

Figure 58 shows the estimated proportion of priority crop plots that had a smaller area harvested than the area planted in the long and short rainy seasons. With the exception of cassava, a higher proportion of plots had a smaller area harvested than planted in the short rainy season than in the long rainy season. Millet, cowpeas, and beans had the highest proportion of plots with a smaller area harvested in the long rainy season—40%, 38% and 33% respectively. Paddy and sweet potatoes had the lowest proportion of plots affected in the long rainy season. In the short rainy season, over 45% of maize, cowpeas, and groundnut plots had a smaller area harvested than the area planted, and over 50% of bean plots were not fully harvested (*Was area harvested less than area planted?*). See Appendix EE for full results and confidence intervals.

Figure 58: Estimated Proportion of Priority Crop Plots with an Area Harvested less than the Area Planted

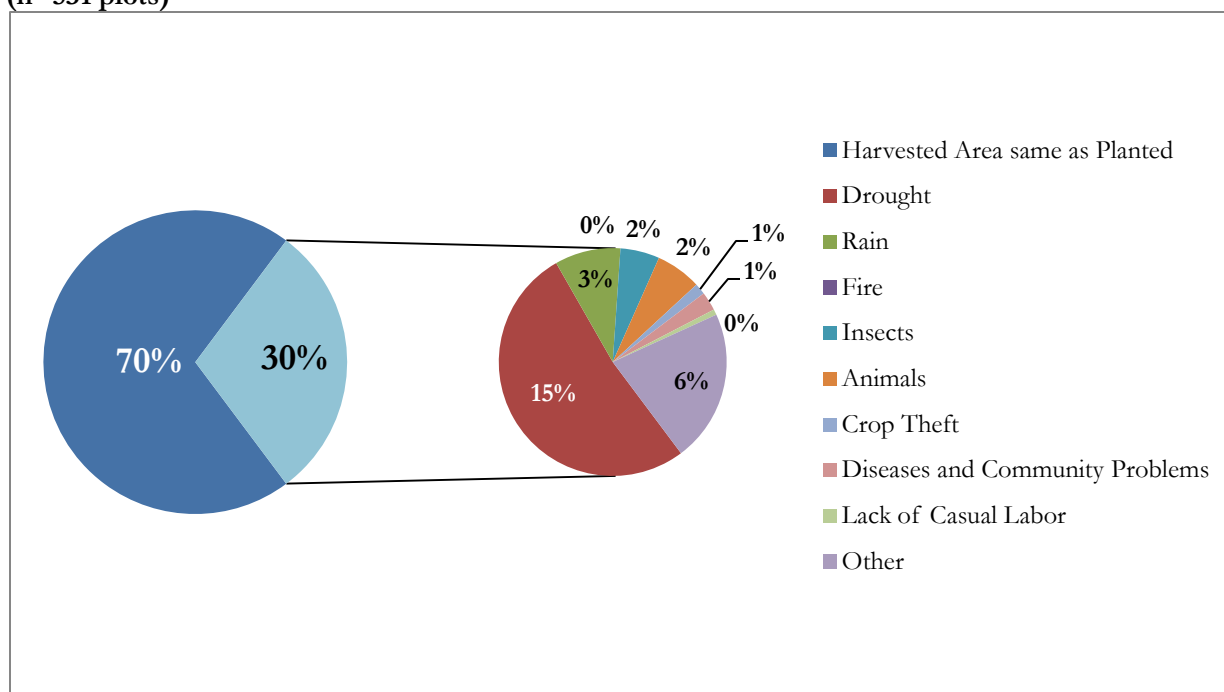


† Insufficient observations to calculate reliable estimates for sorghum and millet in the short rainy season and for yams in the long and short rainy seasons.

Questions *zao*code *s4aq9* & *s4bq9*

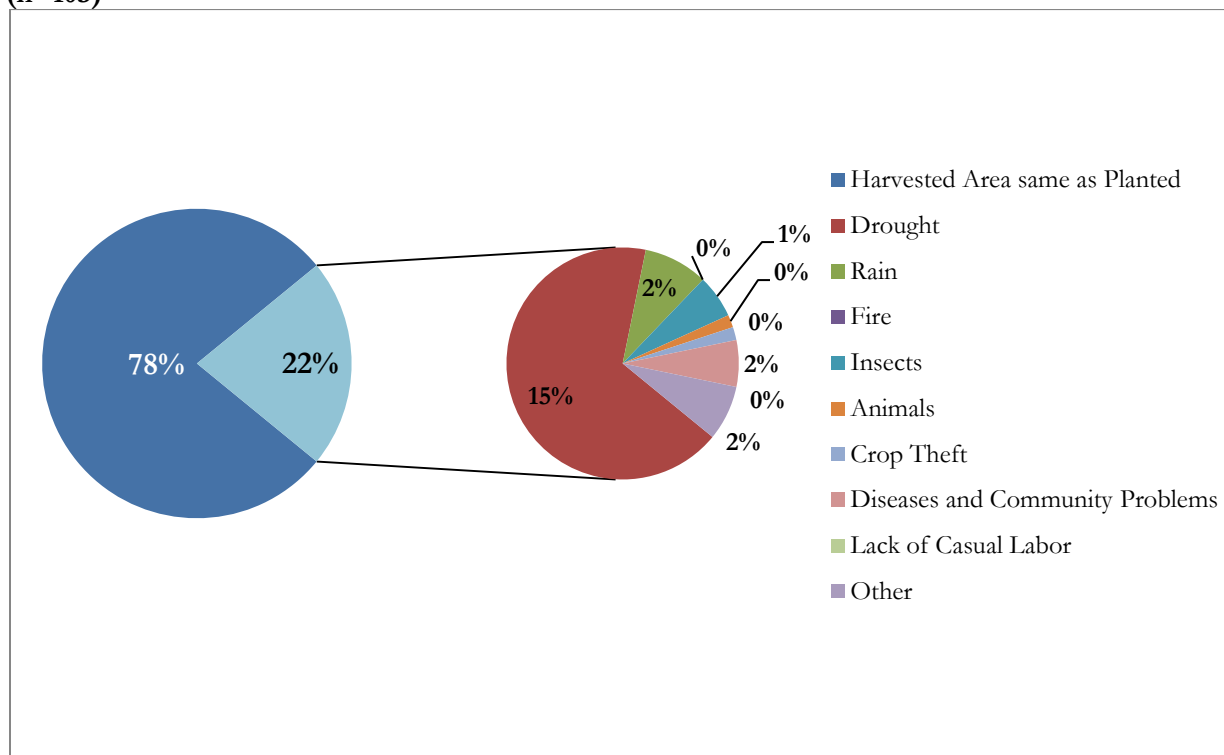
Figure 59, Figure 60 and Figure 61 show the reasons why the area harvested was less than the area planted for maize, paddy, and cassava plots in the long rainy season. Drought was the most prominent reason for both maize and paddy plots during the long rainy season. Fifteen percent of plots were not fully harvested due to this reason for both crops. Drought was less of a problem for cassava, accounting for smaller areas harvested on only 3% of plots. Insects were a relatively larger problem for cassava; 16% of cassava plots in the long rainy season had a smaller area harvested than planted due to insects (*What was the reason it was less than the area planted? Options: drought; effects of rains, fire, insects, animals, crop theft, diseases and community problems, lack of casual labor or other*). See Appendix FF for reasons for smaller areas harvested for all priority crops in the long rainy season.

Figure 59: Reasons for Area Harvested less than Area Planted on Maize Plots – Long Rainy Season (n=531 plots)



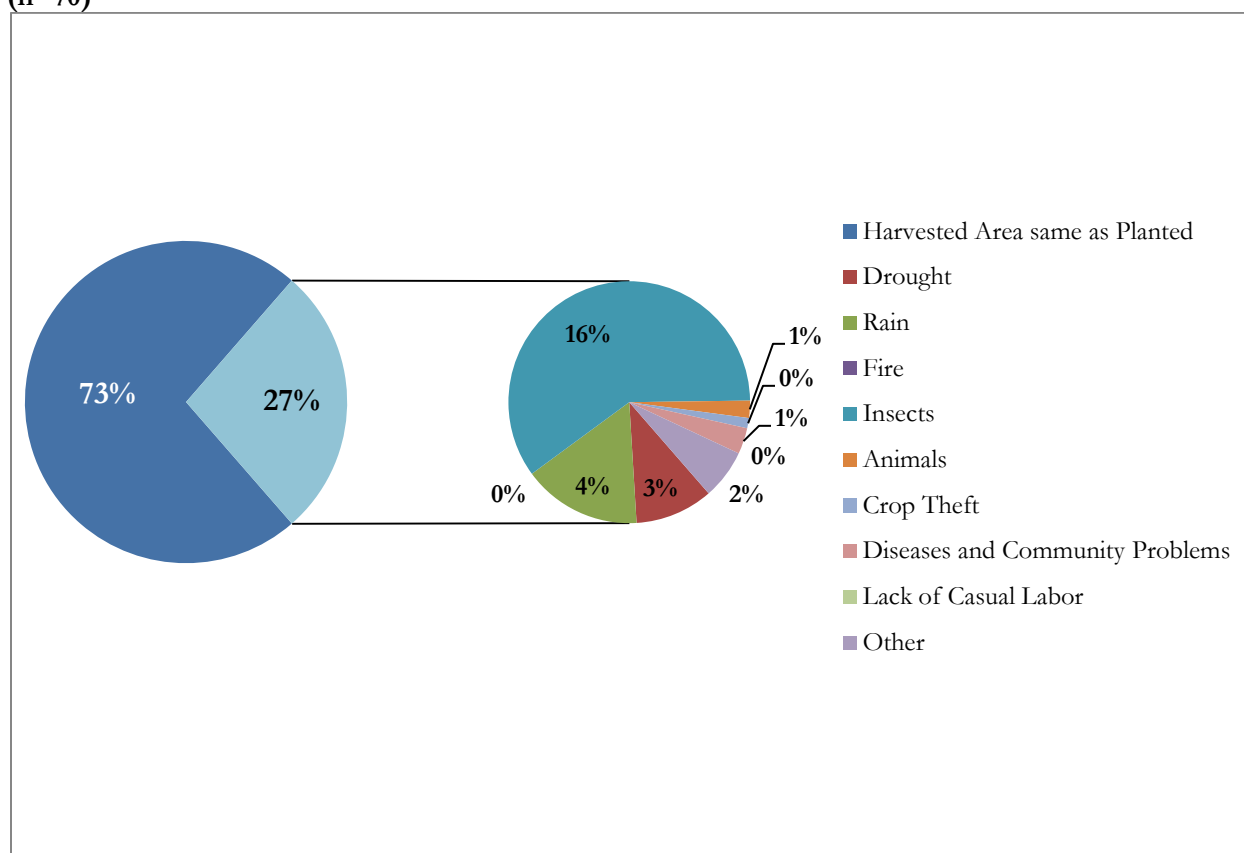
Questions zaocode s3aq10

Figure 60: Reasons for Area Harvested less than Area Planted on Paddy Plots – Long Rainy Season (n=103)



Questions zaocode s3aq10

Figure 61: Reasons for Area Harvested less than Area Planted on Cassava Plots – Long Rainy Season (n=70)



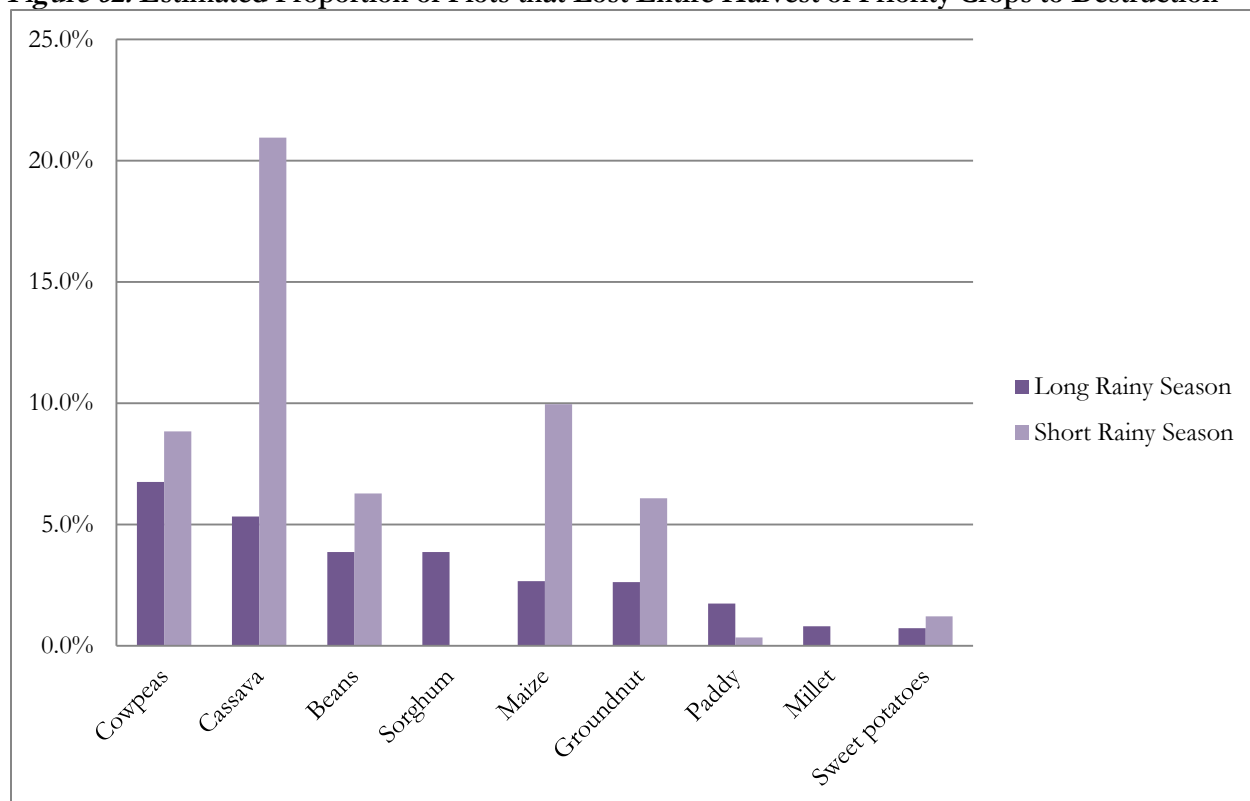
Questions zaocode s3aq10

Entire Plots not Harvested due to Destruction

Several respondents indicated that their entire harvest was lost due to destruction (see Figure 62). Losses of the entire harvest were generally higher in the short rainy season, with respondents indicating losses of over 5% of plots for five different priority crops (cowpeas, cassava, beans, maize, and groundnuts). The highest reported losses were of cassava in the short rainy season, where an estimated 20.9% of plots were not harvested due to destruction (10 out of 55 observations). In the long rainy season, farmers reported losing harvests from less than 1% of plots (millet and sweet potatoes) to over 5% for cowpeas and cassava (11 out of 140 observations and 15 out of 207 observations respectively). Appendix GG shows estimated proportions and confidence intervals for all priority crops that were not harvested due to destruction in the short and long rainy seasons (*Did you harvest any [CROP] on this plot in the long-rainy [or short-rainy] season 2008? Why didn't you harvest any [CROP] on this plot?*¹³).

¹³ The options for response were “Not mine to harvest, Still in plot, Destruction and Other”. There was no indication on what reasons could be meant by “Other”. In the long rainy season, respondents reported 154 crops not harvested on a plot due to “Destruction” and 204 not harvested due to “Other”. In the short rainy season there were 94 observations of “Destruction” and 83 observations of “Other”. Due to the lack of information on the reasons for “Other” these responses were not included in this analysis. Responses of “Not mine to harvest and Still in plot” were also not included since the outcome of the harvest was unknown.

Figure 62: Estimated Proportion of Plots that Lost Entire Harvest of Priority Crops to Destruction



Questions s4aq2 & s4bq2

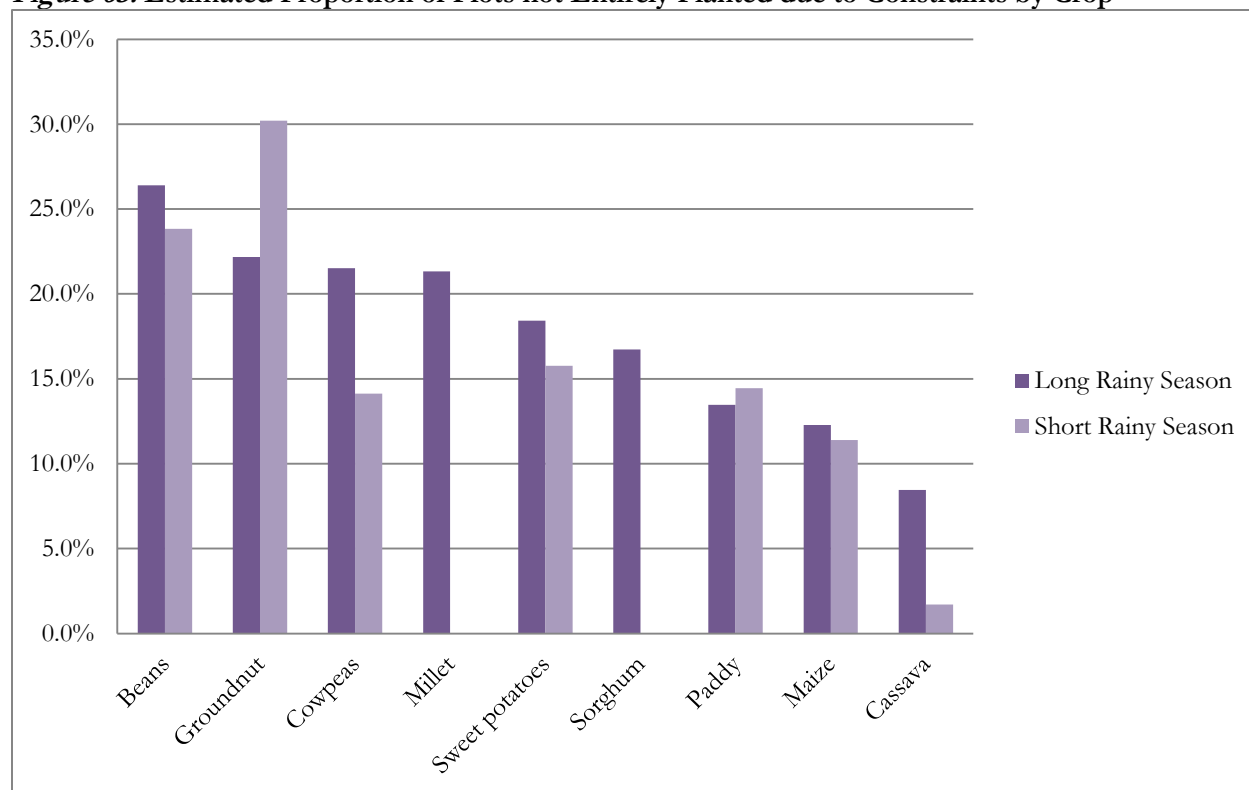
Portions of Plots not Planted due to Constraints

A substantial portion of farmers did not plant an entire plot due to a constraint—drought, lack of tools/equipment, lack of seeds, floods, lack of loans, or lack of agricultural equipment.¹⁴ In the long rainy season, over 25% of bean plots were not fully planted due to some type of constraint (see *Figure 63*).

Constraints to maize, paddy, and cassava affected the smallest proportion of plots; less than 15% of plots were not fully planted with these crops due to constraints (*Was [CROP] planted in entire area of plot? Why didn't you plant the entire plot with [CROP]?*).

¹⁴ “Was divided” and “Other” were also listed as options, but have been excluded from this analysis as they are not necessarily constraints.

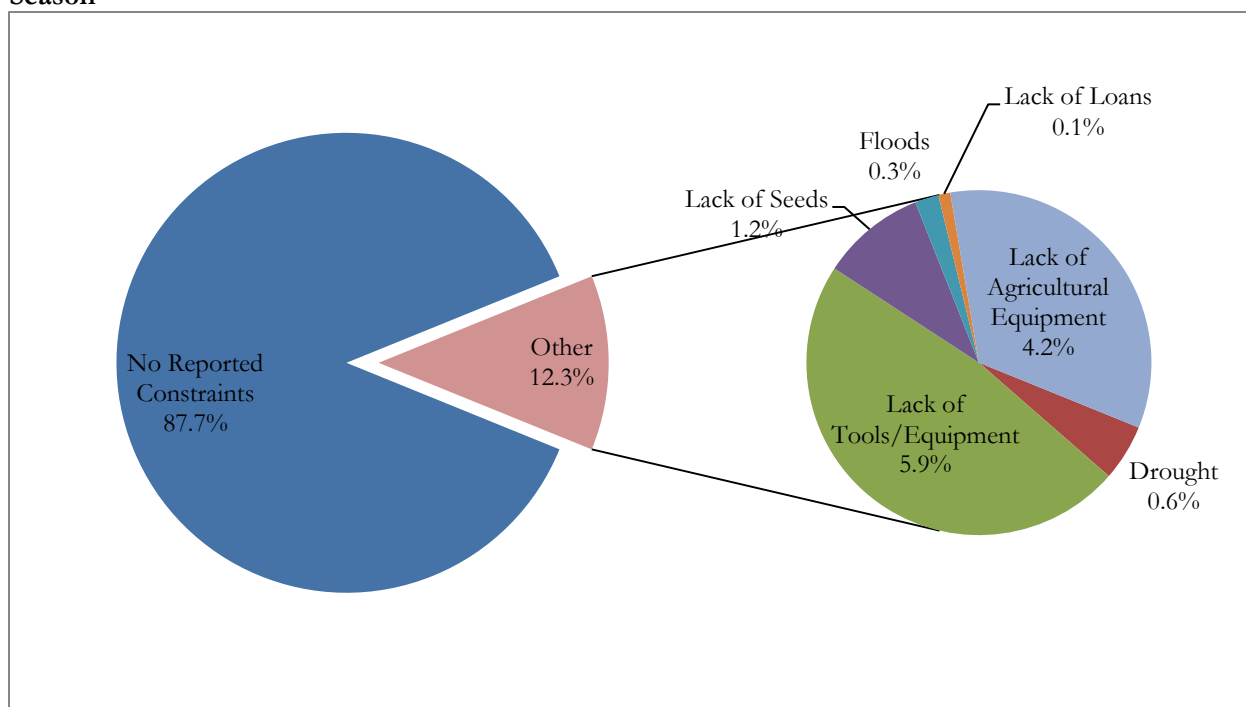
Figure 63: Estimated Proportion of Plots not Entirely Planted due to Constraints by Crop



Questions s4aq3 & s4bq3

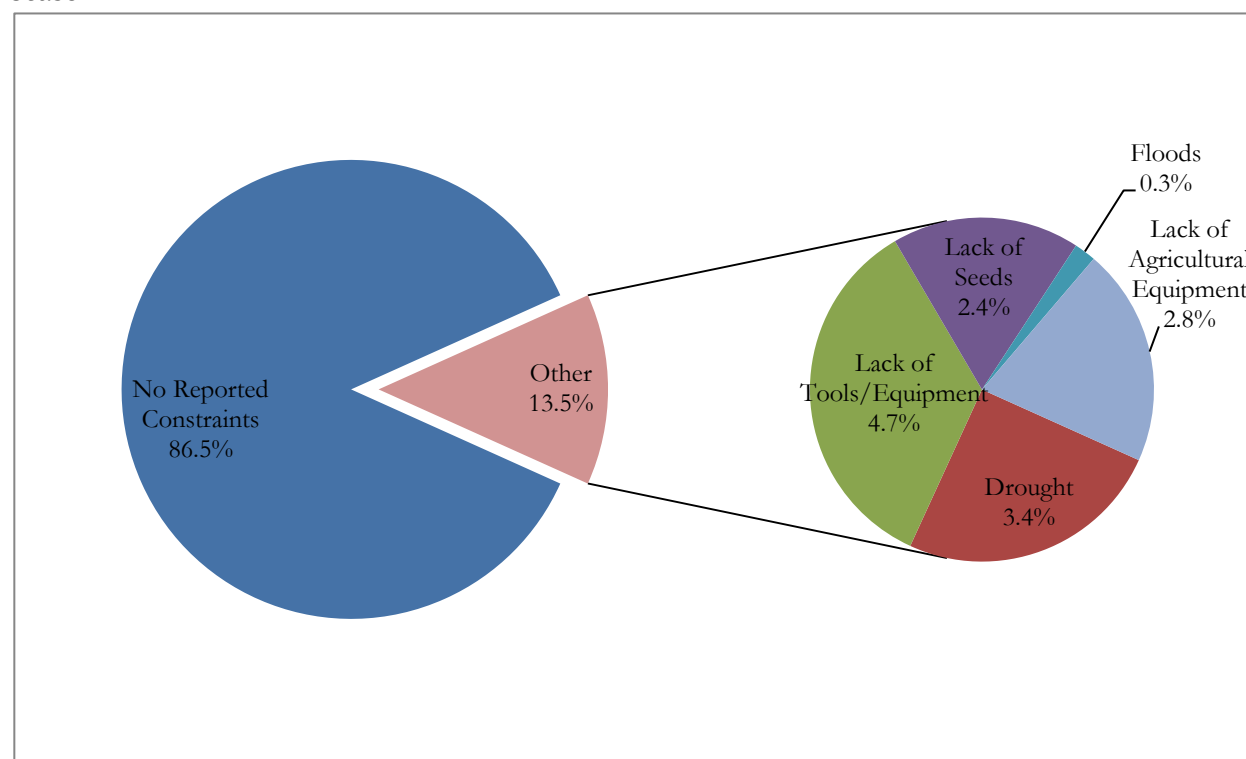
As shown in *Figure 64*, *Figure 65*, and *Figure 66*, each crop faced different constraints, although lack of access to agricultural tools and equipment was the most prevalent constraint for maize, paddy, and cassava. This finding is not surprising given the low proportion of farming households that own farm implements as shown earlier in *Table 1*. While lack of seeds was not a large constraint for maize or paddy (affecting 1% and 2% of plots respectively), it was a much larger problem for beans—9% of plots were not fully planted with beans due to a lack of seeds.

Figure 64: Constraints that Caused Farmers not to Plant Entire Plot with Maize – Long Rainy Season



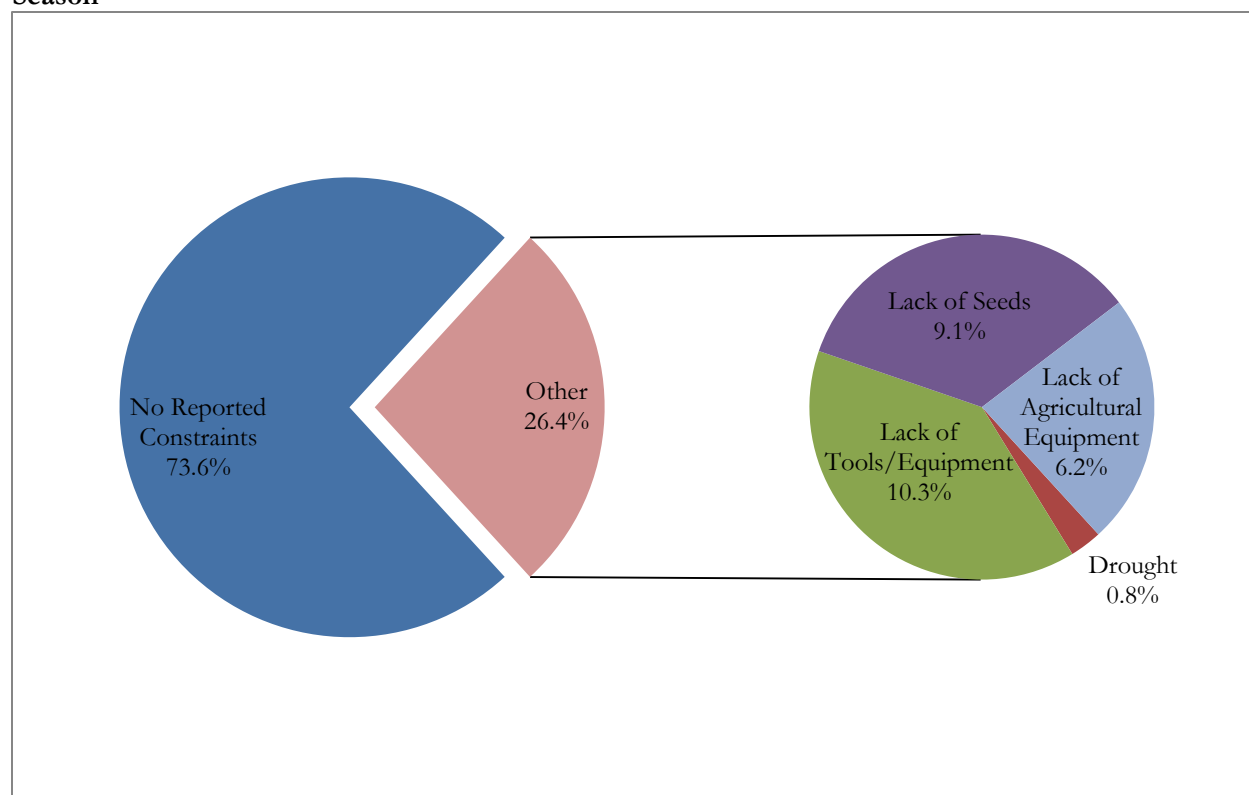
Questions zaoode & s4aq5

Figure 65: Constraints that Caused Farmers not to Plant Entire Plot with Paddy – Long Rainy Season



Questions zaoode & s4aq5

Figure 66: Constraints that Caused Farmers not to Plant Entire Plot with Beans – Long Rainy Season

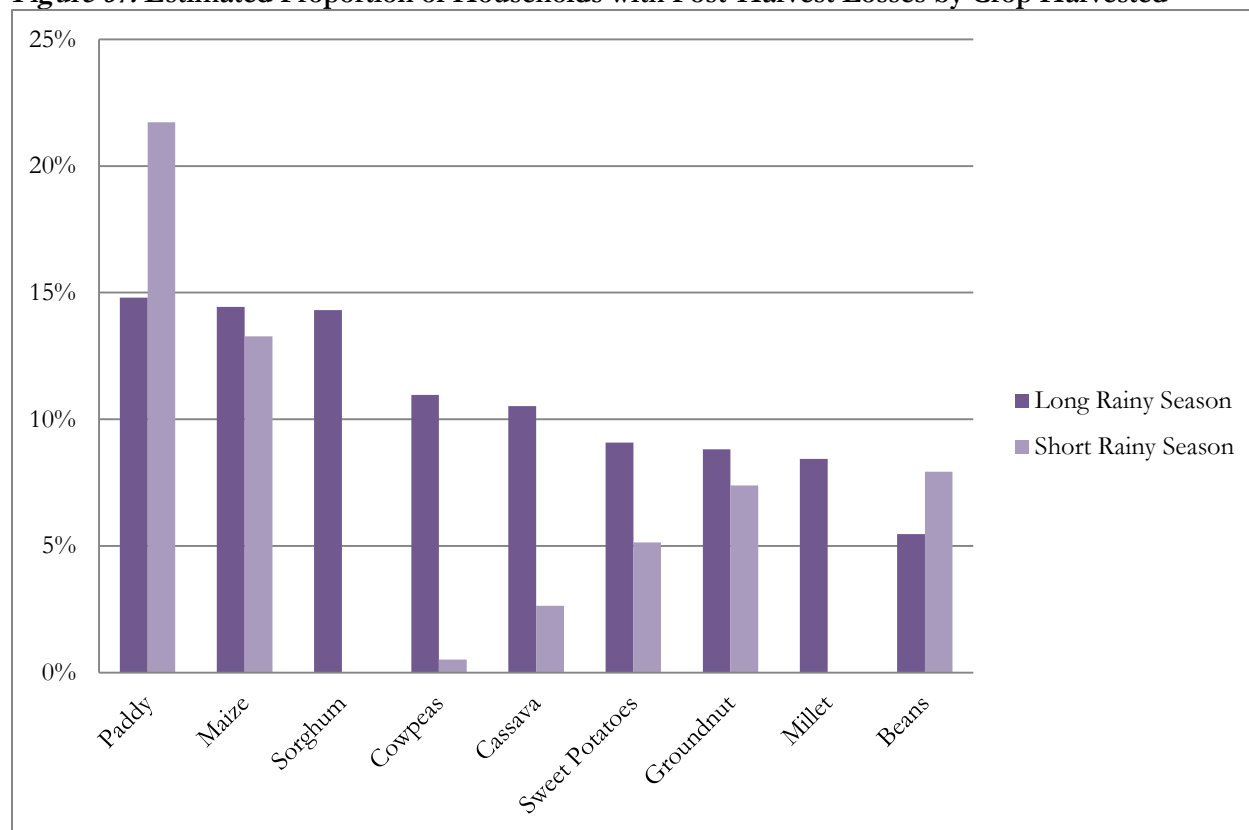


Questions zquocde & s4aq5

Post-Harvest Losses

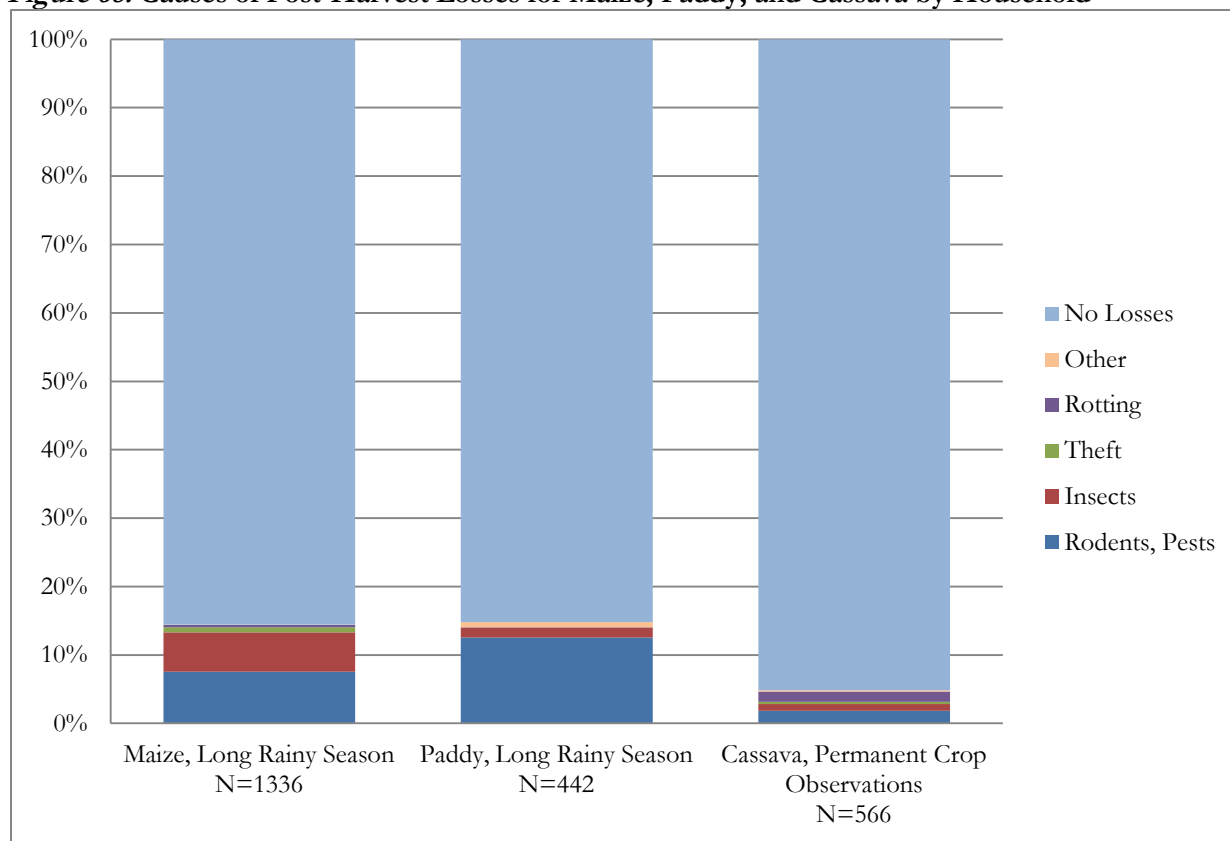
Post-harvest losses by households varied by crop; from about 5% of households reporting post-harvest losses of beans to 15% of households reporting losses of paddy in the long rainy season (see *Figure 67*). For some crops, such as paddy and beans, the proportion of plots with reported post-harvest losses was greater in the short rainy season than the long rainy season. However, for all other priority crops with sufficient observations, a higher percentage of households reported post-harvest losses in the long rainy season. Rodents and pests were the most common causes of post-harvest losses for maize and paddy during the long rainy season and cassava permanent crop observations (*Figure 68*). However, this pattern did not hold for most other crops (see *Appendix JJ* and *Appendix KK* for full summary statistics by crop and season) (*Was any portion of the production lost post-harvest to rotting, insects, rodents, theft, etc.? Reason for loss*). On average, maize farmers in the long rainy season who suffered post-harvest losses reported losing about 18% of their harvest, and paddy farmers reported losing about 15% in response to the question (*Out of 10 units of [CROP], how many were lost?*). *Appendix LL* includes the percentage lost by each crop for all priority crops.

Figure 67: Estimated Proportion of Households with Post-Harvest Losses by Crop Harvested



Questions *s5aq14* & *s5bq14*

Figure 68: Causes of Post-Harvest Losses for Maize, Paddy, and Cassava by Household



Question s5aq15 & s5bq15

Appendix A Basic Farm Characteristic Descriptive Statistics

Household Cultivation of Plots by Season			
	Estimated Proportion	95% C.I.	Observations
Not Cultivated	1.9%	[1.2%, 2.7%]	37
Long Rainy Season Only	80.2%	[76.7%, 83.8%]	1817
Short Rainy Season Only	1.8%	[0.9%, 2.6%]	30
Long and Short Rainy Seasons	16.1%	[12.6%, 19.5%]	346

Uses of Plots during the Long Rainy Season			
Plot Use	Estimated Proportion	95% C.I.	Observations
Cultivated	85.1%	[83.4%, 86.8%]	4408
Rented Out	0.7%	[0.4%, 1%]	29
Given Out	0.7%	[0.4%, 1.1%]	39
Fallow	11.2%	[9.7%, 12.7%]	524
Forest	1.1%	[0.8%, 1.4%]	82
Other	1.2%	[0.3%, 2%]	44

Uses of Plots during the Short Rainy Season			
Plot Use	Estimated Proportion	95% C.I.	Observations
Cultivated	24.0%	[19.8%, 28.2%]	570
Rented Out	0.5%	[0.2%, 0.8%]	14
Given Out	1.0%	[0.5%, 1.5%]	34
Fallow	49.1%	[41.8%, 56.4%]	1404
Forest	1.6%	[1.1%, 2.1%]	149
Other	23.7%	[16.5%, 31%]	557

Average Distance from Plot to Home/Road/Market, (N=5125 long rainy season plots)		
	Mean Distance (KM)	95% C.I.
Distance to Home	3.2	[2.9, 3.5]
Distance to Road	2.1	[1.9, 2.3]
Distance to Market	8.2	[7.4, 8.9]
Household Average (N=2280 households)		
Distance to Market	8.0	[7.3, 8.6]

Appendix B Farm Implements Descriptive Statistics

Percent of Households Owning Farm Implements of Households that Own or Cultivate at Least One Plot (N=2298)		
Implement	Estimated Proportion	95% C.I.
Hoes	92.1%	[90.8%, 93.5%]
Spraying machine	4.5%	[3.5%, 5.5%]
Water pumping set	0.9%	[0.5%, 1.4%]
Reapers	0.0%	[0%, 0%]
Tractor	0.2%	[0%, 0.5%]
Trailer for Tractors, etc.	0.5%	[0.1%, 0.8%]
Plough etc.	7.7%	[5.9%, 9.5%]
Harrow	0.2%	[0%, 0.3%]
Hand milling machine	0.4%	[0.1%, 0.7%]
Harvesting and threshing machine	0.0%	-
Fertilizer distributer	0.0%	-

Mean Number of Farm Implements Owned by Agricultural Households that Own and/or Cultivate at Least One Plot and Own Implement			
Implement	Mean Number Owned	95% C.I.	Observations
Hoes	3.1	[3, 3.2]	2078
Spraying machine	1.3	[1.1, 1.5]	100
Water pumping set	1.0	[1, 1]	23
Reapers	1.0	-	1
Tractor	1.5	[1, 2.1]	4
Trailer for Tractors, etc.	1.1	[0.9, 1.3]	8
Plough etc.	1.3	[1.2, 1.4]	144
Harrow	1.4	[0.8, 1.9]	3
Hand milling machine	1.0	-	10
Harvesting and threshing machine	-	-	0
Fertilizer distributer	-	-	0

Appendix C Priority Crop Cultivation and Basic Farm Characteristics by Gender of Household Head

Households Cultivating Priority Crops by Gender of Household Head					
	Household Head	Estimated Proportion	95% C.I.	Observations	Wald test P-value
Maize	Male	82%	[80%, 85%]	1740	0.9506
	Female	83%	[79%, 86%]	558	
Paddy	Male	18%	[14%, 21%]	1740	0.2503
	Female	15%	[11%, 20%]	558	
Beans	Male	34%	[29%, 38%]	1740	0.7671
	Female	34%	[28%, 41%]	558	
Sorghum	Male	12%	[10%, 15%]	1740	0.5149
	Female	14%	[10%, 18%]	558	
Millet	Male	7%	[5%, 9%]	1740	0.0021
	Female	4%	[2%, 6%]	558	
Sweet Potatoes	Male	15%	[13%, 18%]	1740	0.6368
	Female	14%	[11%, 18%]	558	
Yams	Male	1%	[0%, 1%]	1740	0.661
	Female	1%	[0%, 1%]	558	
Cowpeas	Male	8%	[6%, 10%]	1740	0.8023
	Female	9%	[6%, 12%]	558	
Groundnut	Male	22%	[19%, 26%]	1740	0.4751
	Female	20%	[16%, 25%]	558	
Cassava	Male	36%	[32%, 40%]	1740	0.016
	Female	30%	[25%, 35%]	558	
Mango	Male	36%	[32%, 39%]	1740	<0.0001
	Female	24%	[20%, 29%]	558	

Basic Farm Characteristics by Gender of Household Head					
	Household Head	Mean	95% C.I.	Observations	Wald test P-value
Number of Plots	Male	2.4	[2.3, 2.5]	1740	<0.0001
	Female	2.0	[1.9, 2.2]	558	
Household Landholding (acres)	Male	5.8	[5.3, 6.2]	1738	<0.0001
	Female	3.5	[2.8, 4.3]	557	
Number of Crops Grown	Male	4.8	[4.6, 5.1]	1740	0.0001
	Female	4.2	[3.9, 4.5]	558	

Appendix D Households Cultivating Priority Crops by Zone

Households Cultivating Priority Crops by Zone					
	Zone	Estimated Proportion	95% C.I.	Observations	Wald test P-value
Maize	Western	95%	[92%, 98%]	320	<0.0001
	Southern Highlands	93%	[89%, 96%]	343	
	Northern	88%	[83%, 93%]	340	
	Lake	80%	[72%, 88%]	246	
	Central	79%	[69%, 89%]	136	
	Southern	74%	[68%, 81%]	456	
	Eastern	69%	[57%, 80%]	195	
	Zanzibar	6%	[0%, 12%]	262	
Paddy	Zanzibar	51%	[38%, 64%]	262	<0.0001
	Eastern	38%	[23%, 52%]	195	
	Southern	27%	[20%, 34%]	456	
	Lake	19%	[10%, 28%]	246	
	Western	18%	[11%, 25%]	320	
	Southern Highlands	9%	[3%, 16%]	343	
	Central	8%	[-5%, 20%]	136	
	Northern	5%	[0%, 11%]	340	
Beans	Lake	54%	[40%, 68%]	246	<0.0001
	Southern Highlands	52%	[41%, 62%]	343	
	Northern	40%	[31%, 50%]	340	
	Western	38%	[26%, 49%]	320	
	Central	11%	[1%, 21%]	136	
	Eastern	10%	[1%, 19%]	195	
	Southern	9%	[3%, 15%]	456	
	Zanzibar	0%	-	262	
Sorghum	Central	44%	[28%, 59%]	136	<0.0001
	Southern	24%	[17%, 30%]	456	
	Lake	14%	[7%, 20%]	246	
	Western	14%	[8%, 20%]	320	
	Zanzibar	6%	[0%, 12%]	262	
	Eastern	3%	[-1%, 7%]	195	
	Northern	3%	[1%, 6%]	340	
	Southern Highlands	1%	[0%, 2%]	343	

Millet	Central	38%	[20%, 55%]	136	<0.0001
	Southern Highlands	5%	[2%, 8%]	343	
	Southern	4%	[1%, 7%]	456	
	Western	4%	[1%, 6%]	320	
	Northern	2%	[0%, 5%]	340	
	Lake	1%	[0%, 2%]	246	
	Zanzibar	1%	[0%, 2%]	262	
	Eastern	0%	-	195	
Sweet Potatoes	Lake	44%	[35%, 54%]	246	<0.0001
	Western	25%	[18%, 33%]	320	
	Zanzibar	11%	[5%, 18%]	262	
	Southern Highlands	6%	[3%, 9%]	343	
	Southern	6%	[3%, 10%]	456	
	Northern	5%	[3%, 8%]	340	
	Eastern	4%	[1%, 6%]	195	
	Central	3%	[0%, 7%]	136	
Yams	Zanzibar	8%	[2%, 14%]	262	0.017
	Eastern	1%	[-1%, 2%]	195	
	Lake	1%	[0%, 2%]	246	
	Southern	1%	[0%, 2%]	456	
	Central	0%	-	136	
	Southern Highlands	0%	-	343	
	Northern	0%	-	340	
	Western	0%	[0%, 1%]	320	
Cowpeas	Eastern	17%	[10%, 23%]	195	0.0028
	Central	13%	[6%, 20%]	136	
	Western	10%	[6%, 14%]	320	
	Northern	8%	[3%, 12%]	340	
	Southern	8%	[6%, 11%]	456	
	Lake	6%	[0%, 12%]	246	
	Zanzibar	5%	[1%, 8%]	262	
	Southern Highlands	3%	[1%, 6%]	343	
Groundnut	Central	54%	[38%, 69%]	136	<0.0001
	Western	44%	[35%, 53%]	320	
	Southern Highlands	24%	[15%, 33%]	343	
	Lake	15%	[9%, 22%]	246	
	Southern	15%	[10%, 20%]	456	
	Zanzibar	5%	[-2%, 11%]	262	
	Eastern	3%	[-1%, 7%]	195	
	Northern	2%	[0%, 4%]	340	

Cassava	Zanzibar	82%	[76%, 89%]	262	<0.0001
	Lake	69%	[60%, 78%]	246	
	Southern	57%	[49%, 65%]	456	
	Western	41%	[29%, 53%]	320	
	Eastern	27%	[15%, 38%]	195	
	Northern	20%	[11%, 29%]	340	
	Southern Highlands	12%	[5%, 19%]	343	
	Central	2%	[0%, 5%]	136	
Mango	Lake	47%	[38%, 57%]	246	<0.0001
	Eastern	40%	[28%, 52%]	195	
	Western	38%	[30%, 47%]	320	
	Southern	33%	[26%, 40%]	456	
	Southern Highlands	28%	[20%, 37%]	343	
	Northern	27%	[19%, 36%]	340	
	Zanzibar	14%	[8%, 21%]	262	
	Central	12%	[4%, 20%]	136	

Appendix E Basic Farm Characteristics by Zone

Basic Farm Characteristics by Zone					
	Household Head	Mean	95% C.I.	Observations	Wald test P-value
Number of Plots	Southern Highlands	2.6	[2.3, 2.8]	343	<0.0001
	Central	2.5	[2.2, 2.7]	136	
	Southern	2.5	[2.3, 2.7]	456	
	Zanzibar	2.5	[2.2, 2.7]	262	
	Western	2.4	[2.2, 2.7]	320	
	Lake	2.1	[1.9, 2.4]	246	
	Eastern	2.0	[1.8, 2.1]	195	
	Northern	1.9	[1.6, 2.1]	340	
Household Landholding (acres)	Western	8.5	[6.4, 10.6]	320	<0.0001
	Central	6.2	[4.5, 7.9]	136	
	Southern	5.4	[4.6, 6.2]	456	
	Southern Highlands	4.5	[3.7, 5.2]	343	
	Eastern	4.2	[3.3, 5.1]	194	
	Lake	4.1	[3.3, 4.8]	245	
	Northern	4.1	[3.4, 4.8]	340	
	Zanzibar	2.0	[1.8, 2.2]	261	
Number of Crops Grown	Lake	6.1	[5.3, 7]	246	<0.0001
	Western	5.2	[4.7, 5.8]	320	
	Southern	5.1	[4.7, 5.5]	456	
	Eastern	4.2	[3.3, 5.1]	195	
	Northern	4.2	[3.5, 4.8]	340	
	Southern Highlands	4.0	[3.6, 4.5]	343	
	Central	3.5	[3.3, 3.8]	136	
	Zanzibar	3.3	[3, 3.6]	262	

Appendix F Land and Labor Productivity Summary Statistics

		Average Labor Productivity (USD/day of work)	Average Labor Productivity (TZS/day of work)	95% C.I.	Number of Observations
Long Rainy Season	Country	\$1.52	TZS 1,821		3364
	Household	\$1.74	TZS 2,086	[1905, 2266]	1882
	Plot	\$1.83	TZS 2,190	[2008, 2373]	3365
Short Rainy Season	Country	\$1.27	TZS 1,521		814
	Household	\$1.35	TZS 1,616	[1270, 1963]	575
	Plot	\$1.55	TZS 1,854	[1450, 2258]	814
		Average Land Productivity (USD/acre)	Average Land Productivity (TZS/acre)	95% C.I.	Number of Observations
Long Rainy Season (Crops only)	Country	\$45.50	TZS 54,546		3375
	Household	\$52.80	TZS 63,291	[58962, 68880]	1880
	Plot	\$69.93	TZS 83,831	[78209, 89453]	3380
Short Rainy Season (Crops only)	Country	\$42.32	TZS 50,727		829
	Household	\$38.78	TZS 46,489	[36772, 56206]	588
	Plot	\$60.93	TZS 73,035	[59416, 86655]	838
Fruit (Crops only)	Country	\$35.57	TZS 42,644		1459
	Household	\$35.84	TZS 42,969	[34684, 51253]	1166
	Plot	\$71.41	TZS 85,607	[71527, 99687]	1460
Permanent Crops (Crops only)	Country	\$38.08	TZS 45,653		1336
	Household	\$34.62	TZS 41,505	[34148, 48863]	961
	Plot	\$66.83	TZS 80,108	[66389, 93827]	1337
All Seasons (Crops only)	Country	\$68.35	TZS 81,936		4415
	Household	\$95.06	TZS 113,951	[104179, 123722]	2170
	Plot	\$111.47	TZS 133,622	[123001, 144243]	4419
All Seasons (Crops and livestock by-products)	Household	\$123.76	TZS 148,363	[133038, 163689]	2170

Appendix G Methodology for Productivity

The productivity estimations use the value of production from the long rainy season, short rainy season, fruit, permanent crops, and livestock by-products.

The value of long and short rainy season productivity was calculated by summing the estimated value of harvest for each crop on a given plot (*What is the estimated value of the harvested crop? How much was harvest worth in the market during the harvest season?*). If the respondent had not finished the harvest, the value of the crop not yet harvested was projected by assigning the same value/kilogram to the amount left to be harvested (*What fraction of the crop remains to be harvested in this period?*).

Respondents were not asked the estimated value of production for fruit and permanent crops. The value of these crops was calculated by adding the value of the crop that was sold to an estimated value of crops not sold that was calculated using a shadow price. For observations that did sell some of a crop, the price/kg that they received for what they sold was applied to the remaining amount that they did not sell. Many producers, however, did not report selling any of the fruit and permanent crops that they produced. For these observations, the shadow price applied was the country-wide average price received for the crop grown (*What was the total amount of [FRUIT/CROP] harvested in the past 12 months? What was the total quantity sold of the quantity collected? What was the total value of [FRUIT/CROP] sold?*).

For both rainy seasons, fruit, and permanent crops, values of zero were treated as missing unless some type of destruction was cited as a reason for producing no value (*For long and short rainy seasons: Why didn't you harvest any [CROP] on this plot?*). Responses of “destruction” were counted as values of zero, while all other options were counted as missing (such as “not mine to harvest” and “still in plot”) (*Fruit and permanent crops: What was the cause of these losses?*). Responses of “birds, animals, insects, and diseases” were counted as values of zero and “theft and other” were counted as missing.

Livestock by-products included traditional and improved cow milk and eggs, honey, skins and hides, and other by-products. The value of these products was calculated by multiplying the average quantity produced per month by the number of months that the household produced that by-product and applying prices and shadow prices using the same methodology as was used for fruit and permanent crops (*During the last 12 months, for how many months did your household produce any [PRODUCT]? During these months, what was the average quantity of [PRODUCT] produced per month? How much of the [PRODUCT] produced did you sell in the last 12 months? What was the total value of sales of [PRODUCT] in the last 12 months?*).

Land productivity was calculated for the long rainy season, short rainy season, fruit and permanent crops individually by dividing the value from that season/type of crop by the plot size/household landholding/country area cultivated depending on the level. See *Appendix T* for an explanation of the differences between plot, household, and country level calculations. Note that at the household level if a respondent cultivated on any one of his/her plots during a particular season, the entire household landholding was factored into the land productivity figure, regardless of whether or not that household cultivated on all plots. The productivity figure for all crops was calculated by adding up the value from the long and short rainy seasons, fruit, and permanent crops, and dividing by the number of acres at each level (plot, household, and country). The value of livestock by-products was added in for a final estimate of productivity at the household level. The survey did not ask about the land used by livestock, so this productivity estimation assumes that households use exclusively their own plots for livestock production, as opposed to any communal grazing land (*Please list all plots anyone in your household cultivated during the 2008 long rainy season/short rainy season – Area, Acres*).

Labor productivity was calculated for each season by dividing the value produced by long and short rainy season crops by the days of household labor and hired labor dedicated to land preparation and planting, weeding, and harvesting in each season. The survey did not include questions about labor for fruit and permanent crop cultivation or for animal husbandry. Therefore this report only includes labor productivity estimations for crops grown in the long and short rainy seasons (*During the long rainy season 2008/last completed short rainy season how many days did [NAME] spend on the following activities on this plot – land preparation and planting, weeding, harvesting? During the long rainy season 2008/last completed short rainy season how many days did your household have hired labor for this plot for [...]?*).

Appendix H Productivity Data Issues

Issue	Description	Number of observations affected	Direction of effect	Magnitude of effect
Fruits and Permanent crops without household prices	Respondents are only asked for the value of fruit and permanent crops that were sold, and not for the value of these crops that were harvested. The value of the harvest is calculated by multiplying the price/kg of the crop that was sold by the total harvested amount (to account for sold and consumed product). For households that did not report any sales, the mean price/kg reported by households that did sell a given crop was used.	Shadow prices created for 3,978 out of 5,696 fruit/permanent crop observations (69.8%)	Unknown, but most likely overestimates productivity because crops that are not sold may have lower values than crops sold	Unknown; overall effect could be large due to the high percentage of observations with shadow prices. Some shadow prices were created from a very small number of observations.
Fruits and Permanent crops without prices in entire data set	There were a few fruit and permanent crops that were not reported as sold by any of the households who grew those crops. These crops were excluded from productivity calculations as there was no way to estimate their value.	Total of 54 out of 5,696 fruit permanent crop observations (0.9%) Crops include: Malay apple, Rubber, Wattle, Tamarin, Grapefruit, Grapes, God fruit, Mitobo, Pomegranate, Tungamaa, Firewood/fodder, Medicinal plant, Fence tree, or 999 (other)	Underestimates productivity because no value is attributed to these crops	Unknown; overall effect is small due to the limited number of observations
Inaccurate responses/recall	Many of the questions require respondents to give information that they may not know precisely or	All responses subject to	Unknown; in the case of land size,	Unknown

	accurately remember (e.g. kilograms of fruit harvested in the past 12 months or total estimated value of maize harvest in the long rainy season).	inaccuracies	overestimates productivity because respondents tended to report smaller plots than those that were measured	
Recall issues with days worked	Respondents were asked to list the different people that worked on a number of agricultural activities during the long and short rainy seasons and the number of days that they spent on that activity during the season. There were a number of responses of 99, indicating that the respondent did not remember the number of days worked. ¹⁵ Observations for which the respondent answered 99 for all labor sources were not included in this analysis. However, if the respondent reported work days for some labor sources and could not recall others, the observations were included and only the labor sources with 99 responses were treated as missing, not the entire household observation.	Long rainy season: 297 out of 3364 plot observations (8.8%) Short rainy season: 109 out of 814 plot observations (13.4%)	Should overestimate labor productivity due to unreported labor excluded from denominator; however, when observations with 99's were excluded from these summary statistics, labor productivity actually increased	Mean long rainy season plot labor productivity with all observations: 2174 TSH/day of labor Mean long rainy season plot labor productivity excluding observations with 99's: 2184 TSH/day of labor Mean short rainy season plot labor productivity with all observations: 1712 TSH/day of labor Mean short rainy season plot labor productivity excluding observations with 99's: 1743 TSH/day of labor

¹⁵ The meaning of 99 as a response for this question is not indicated anywhere on the survey, in the manual for enumerators, or in the data. However, the manual for enumerators does indicate that 99 should be used when respondents cannot remember the answer for several other questions, so we infer that 99 has the same meaning for this question.

Appendix I Plot Land and Labor Productivity by Primary Crop Planted on Plot

Long Rainy Season Land Productivity by Primary Crop Planted on Plot			
	Mean (USD/Acre)	95% C.I.	Observations
Yams	\$156.54	[\$41.48, \$271.59]	15
Paddy	\$141.36	[\$121.29, \$161.43]	460
Maize	\$63.47	[\$59.01, \$67.94]	1547
Groundnut	\$60.83	[\$44.44, \$77.22]	110
Cowpeas	\$51.17	[\$24.56, \$77.79]	15
Beans	\$51.00	[\$38.39, \$63.6]	148
Sweet Potatoes	\$46.22	[\$37.95, \$54.48]	76
Cassava	\$43.47	[\$34.65, \$52.3]	352
Sorghum	\$39.61	[\$28.8, \$50.42]	150
Millet	\$35.06	[\$27.58, \$42.54]	69

Short Rainy Season Land Productivity by Primary Crop Planted on Plot			
	Mean (USD/Acre)	95% C.I.	Observations
Yams	\$202.36	[\$90.74, \$313.98]	3
Paddy	\$196.68	[\$106.76, \$286.59]	43
Sweet Potatoes	\$74.96	[\$31.46, \$118.45]	28
Sorghum	\$53.91	[\$-7.18, \$114.99]	11
Cassava	\$49.69	[\$26.28, \$73.1]	109
Beans	\$48.41	[\$35.63, \$61.19]	86
Maize	\$47.26	[\$37.15, \$57.37]	385
Groundnut	\$39.30	[\$22.66, \$55.94]	21
Millet	\$22.19	[\$10.04, \$34.35]	5
Cowpeas	\$13.75	[\$3.65, \$23.85]	16

Long Rainy Season Labor Productivity by Primary Crop Planted on Plot			
	Mean (USD/Work Day)	95% C.I.	Observations
Paddy	\$2.25	[\$1.83, \$2.67]	470
Cowpeas	\$2.18	[\$0.35, \$4]	15
Maize	\$1.82	[\$1.64, \$1.99]	1538
Yams	\$1.63	[\$0.51, \$2.75]	15
Groundnut	\$1.34	[\$1.01, \$1.66]	110
Beans	\$1.33	[\$1.01, \$1.65]	147
Sweet Potatoes	\$1.20	[\$0.77, \$1.63]	77
Sorghum	\$1.16	[\$0.82, \$1.49]	151
Millet	\$0.97	[\$0.76, \$1.17]	69
Cassava	\$0.97	[\$0.73, \$1.22]	352

Short Rainy Season Labor Productivity by Primary Crop Planted on Plot			
	Mean (USD/Work Day)	95% C.I.	Observations
Paddy	\$4.83	[\$2.59, \$7.07]	44
Yams	\$4.26	[\$-1.06, \$9.58]	3
Sweet Potatoes	\$1.55	[\$0.27, \$2.83]	28
Sorghum	\$1.28	[\$0.03, \$2.52]	11
Maize	\$1.26	[\$0.98, \$1.54]	383
Cassava	\$1.15	[\$0.58, \$1.73]	108
Beans	\$1.08	[\$0.76, \$1.4]	85
Groundnut	\$0.88	[\$0.49, \$1.27]	21
Cowpeas	\$0.83	[\$0.47, \$1.18]	14
Millet	\$0.14	[\$0.03, \$0.25]	4

Appendix J Household Land and Labor Productivity by Gender of Household Head

Land Productivity for Male- and Female-Headed Households (USD/Acre)					
	Household Head	Mean (USD/Acre)	95% C.I.	No. of Observations	Wald test P-value
Long Rainy Season	Male	\$53.85	[\$49.28, \$58.41]	1,425	0.56
	Female	\$51.72	[\$44.97, \$58.47]	455	
Short Rainy Season	Male	\$37.78	[\$30.04, \$45.52]	463	0.65
	Female	\$42.25	[\$22.92, \$61.59]	125	
Fruit	Male	\$34.87	[\$27.49, \$42.25]	917	0.55
	Female	\$39.30	[\$25.41, \$53.20]	249	
Permanent Crops	Male	\$33.91	[\$27.21, \$40.61]	752	0.56
	Female	\$37.00	[\$27.13, \$46.87]	209	
All Seasons (Crops)	Male	\$95.89	[\$86.82, 104.95]	1,646	0.62
	Female	\$92.53	[\$80.08, 104.98]	524	
All Seasons (crops & livestock by-products)	Male	\$125.73	[\$111.38, \$140.08]	1,648	0.55
	Female	\$117.75	[\$94.13, \$ 141.38]	522	

Labor Productivity for Male- and Female-Headed Households (USD/Work day)					
	Household Head	Mean (USD/Acre)	95% C.I.	No. of Observations	Wald test P-value
Long Rainy Season	Male	\$1.79	[\$1.62, \$1.96]	1,426	0.13
	Female	\$1.58	[\$1.33, \$1.84]	456	
Short Rainy Season	Male	\$1.34	[\$1.01, \$1.66]	451	0.84
	Female	\$1.39	[\$0.90, \$1.89]	124	

+ A value lower than the critical p-value of .05 (or .01) is necessary to confidently reject the null hypothesis that the difference between male and female headed households is zero.

Appendix K Plot Land and Labor Productivity by Gender of Decision-Maker

Land Productivity for Male, Female, and Shared Decision Making					
		Mean Productivity (USD/Acre)	95% C.I.	Observations	Wald test P-value
Long Rainy Season	Male	\$69.82	[\$62.5, \$77.14]	1230	0.3069
	Female	\$65.49	[\$58.29, \$72.68]	773	
	Shared	\$72.57	[\$65.7, \$79.43]	1338	
Short Rainy Season	Male	\$58.86	[\$42.6, \$75.12]	202	0.7319
	Female	\$58.17	[\$41.08, \$75.26]	159	
	Shared	\$52.40	[\$34.12, \$70.69]	255	
Permanent Crops	Male	\$68.25	[\$46.42, \$90.08]	426	0.7797
	Female	\$59.61	[\$44.16, \$75.07]	247	
	Shared	\$64.52	[\$47.64, \$81.4]	528	
Fruit	Male	\$60.89	[\$49.26, \$72.53]	468	0.3092
	Female	\$70.82	[\$49.86, \$91.77]	279	
	Shared	\$76.93	[\$58.09, \$95.78]	558	
All Crops	Male	\$111.49	[\$99.44, \$123.54]	1492	0.3218
	Female	\$105.43	[\$93.63, \$117.23]	905	
	Shared	\$118.19	[\$104.37, \$132]	1592	

Labor Productivity for Male, Female, and Shared Decision Making					
		Mean Productivity (USD/Acre)	95% C.I.	Observations	Wald test P-value
Long Rainy Season	Male	\$1.93	[\$1.7, \$2.15]	1231	0.0548
	Female	\$1.59	[\$1.36, \$1.82]	776	
	Shared	\$1.88	[\$1.68, \$2.08]	1338	
Short Rainy Season	Male	\$1.83	[\$1.2, \$2.46]	195	0.202
	Female	\$1.42	[\$0.99, \$1.86]	156	
	Shared	\$1.28	[\$0.81, \$1.76]	248	

Appendix L Value of Agricultural Products by Zone and Season/Type of Product

Average Value of Agricultural Products Produced by Household by Zone			
	Mean (USD)	95% C.I.	Observations
Northern	\$576.53	[\$470.33, \$682.72]	317
Western	\$483.62	[\$317.33, \$649.90]	300
Southern Highlands	\$480.17	[\$369.05, \$591.30]	334
Lake	\$441.55	[\$312.92, \$570.18]	235
Southern	\$432.53	[\$337.97, \$527.10]	429
Eastern	\$332.62	[\$259.19, \$406.05]	169
Central	\$321.56	[\$154.00, \$489.12]	133
Zanzibar	\$221.66	[\$175.32, \$268.00]	253

Average Proportion of Agricultural Value Produced by Zone and Season/Agricultural Activity				
	Zone	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	Central	89%	[86%, 92%]	133
	Southern Highlands	71%	[64%, 77%]	334
	Zanzibar	61%	[54%, 68%]	253
	Eastern	53%	[42%, 64%]	169
	Western	51%	[43%, 59%]	300
	Southern	50%	[44%, 55%]	429
	Northern	38%	[30%, 45%]	317
	Lake	29%	[23%, 35%]	235
Short Rainy Season	Lake	26%	[20%, 32%]	235
	Western	16%	[10%, 21%]	300
	Northern	12%	[7%, 16%]	317
	Eastern	8%	[3%, 14%]	169
	Zanzibar	7%	[5%, 10%]	253
	Southern Highlands	3%	[0%, 5%]	334
	Central	0%	-	133
	Southern	0%	[0%, 0%]	429
Fruit	Lake	22%	[15%, 29%]	235
	Northern	19%	[13%, 25%]	317
	Eastern	17%	[12%, 21%]	169
	Zanzibar	14%	[10%, 18%]	253
	Southern	13%	[11%, 15%]	429
	Southern Highlands	11%	[8%, 15%]	334
	Western	10%	[7%, 13%]	300
	Central	2%	[0%, 4%]	133

Permanent Crops	Southern	31%	[26%, 36%]	429
	Lake	13%	[9%, 17%]	235
	Zanzibar	13%	[10%, 16%]	253
	Eastern	11%	[4%, 18%]	169
	Western	11%	[5%, 16%]	300
	Northern	8%	[4%, 11%]	317
	Southern Highlands	7%	[3%, 10%]	334
	Central	1%	[0%, 2%]	133
Livestock By-Products	Northern	24%	[19%, 29%]	317
	Western	13%	[10%, 16%]	300
	Eastern	10%	[5%, 16%]	169
	Southern Highlands	9%	[6%, 11%]	334
	Lake	9%	[6%, 13%]	235
	Central	8%	[7%, 9%]	133
	Southern	6%	[4%, 7%]	429
	Zanzibar	5%	[2%, 7%]	253

Appendix M Household Land and Labor Productivity by Zone

Household Land Productivity by Zone		Average Land Productivity (USD/acre)	95% C.I.	Number of Observations
Long Rainy Season (Crops only)	Zanzibar	\$78.92	[68.77, 89.07]	210
	Southern Highlands	\$70.92	[60.27, 81.56]	317
	Northern	\$63.36	[50.53, 76.19]	270
	Central	\$49.27	[31.41, 67.13]	133
	Western	\$47.63	[39.14, 56.12]	225
	Eastern	\$44.71	[32.95, 56.47]	152
	Southern	\$41.62	[34.99, 48.24]	403
	Lake	\$38.41	[32.24, 44.59]	170
Short Rainy Season (Crops only)	Southern	\$65.11	[-59.72, 189.95]	3
	Northern	\$48.45	[23.05, 73.85]	150
	Lake	\$40.51	[29.85, 51.18]	181
	Southern Highlands	\$35.47	[20.73, 50.21]	26
	Eastern	\$35.23	[15.79, 54.66]	52
	Zanzibar	\$31.36	[20.39, 42.34]	71
	Western	\$25.93	[16.95, 34.9]	105
	Central			0
Fruit (Crops only)	Northern	\$ 63.61	[41.68, 85.53]	171
	Lake	\$53.93	[32.62, 75.24]	155
	Eastern	\$31.99	[21.38, 42.6]	101
	Southern Highlands	\$25.29	[11.77, 38.81]	182
	Southern	\$23.68	[16.3, 31.05]	252
	Zanzibar	\$23.33	[13.21, 33.45]	141
	Western	\$12.70	[6.98, 18.42]	141
	Central	\$7.67	[1.45, 13.88]	23

(Crops only)	Southern Highlands	\$52.79	[29.25, 76.33]	80
Permanent Crops	Eastern	\$43.74	[11.84, 75.65]	75
	Zanzibar	\$42.86	[30.98, 54.74]	101
	Southern	\$40.96	[28.44, 53.48]	328
	Northern	\$35.08	[19.83, 50.34]	116
	Lake	\$27.12	[17.2, 37.03]	157
	Central	\$20.21	[-13.21, 53.63]	13
	Western	\$19.26	[12.71, 25.81]	91
<hr/>				
Total (Crops only)	Northern	\$131.45	[103.69, 159.22]	316
	Lake	\$114.27	[86.7, 141.83]	236
	Zanzibar	\$110.30	[97.22, 123.39]	252
	Southern Highlands	\$103.74	[86.02, 121.46]	333
	Eastern	\$97.50	[70.39, 124.61]	169
	Southern	\$87.44	[73.33, 101.55]	430
	Western	\$57.82	[47.72, 67.91]	301
	Central	\$52.53	[34.35, 70.7]	133
<hr/>				
Total	Northern	\$221.50	[162.89, 280.12]	317
(Crops and livestock by- products)	Lake	\$142.26	[106.62, 177.91]	235
	Zanzibar	\$129.84	[112.45, 147.22]	253
	Southern Highlands	\$127.27	[103.91, 150.63]	334
	Eastern	\$106.32	[77.65, 135]	169
	Southern	\$96.82	[80.96, 112.69]	429
	Western	\$70.93	[58.51, 83.34]	300
	Central	\$59.15	[39.5, 78.81]	133
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Household Labor Productivity by Zone

		Average Labor Productivity (USD/day of work)	95% C.I.	Number of Observations
Long Rainy Season	Western	\$2.31	[1.84, 2.78]	225
	Northern	\$2.24	[1.74, 2.73]	268
	Southern Highlands	\$2.02	[1.68, 2.37]	319
	Central	\$1.49	[0.96, 2.03]	132
	Eastern	\$1.34	[0.98, 1.69]	153
	Lake	\$1.28	[0.97, 1.59]	170
	Southern	\$1.26	[1.07, 1.45]	403
	Zanzibar	\$ 0.80	[0.63, 0.96]	212
Short Rainy Season	Northern	\$1.78	[0.93, 2.62]	151
	Southern Highlands	\$1.35	[0.81, 1.88]	23
	Western	\$1.24	[0.72, 1.76]	102
	Lake	\$1.23	[0.85, 1.62]	180
	Eastern	\$0.99	[0.56, 1.43]	49
	Zanzibar	\$0.92	[0.37, 1.48]	67
	Southern	\$0.78	[-0.56, 2.12]	3
	Central			0

Appendix N Proportion of Households that Sold Priority Crops in the Long and Short Rainy Seasons

		Estimated Proportion	95% C.I.	Observations
Maize	Long Rainy Season	28%	[25%, 31%]	374 out of 1337
	Short Rainy Season	17%	[12%, 22%]	55 out of 322
Paddy	Long Rainy Season	52%	[44%, 60%]	157 out of 423
	Short Rainy Season	49%	[33%, 65%]	22 out of 53
Beans	Long Rainy Season	34%	[28%, 41%]	161 out of 457
	Short Rainy Season	22%	[14%, 30%]	45 out of 200
Sorghum	Long Rainy Season	15%	[11%, 20%]	37 out of 255
	Short Rainy Season	5%	[-4%, 14%]	1 out of 17
Millet	Long Rainy Season	41%	[31%, 51%]	42 out of 97
	Short Rainy Season	17%	[-15%, 49%]	1 out of 5
Sweet Potatoes	Long Rainy Season	26%	[19%, 33%]	53 out of 200
	Short Rainy Season	19%	[8%, 29%]	14 out of 70
Yams	Long Rainy Season	53%	[25%, 81%]	10 out of 18
	Short Rainy Season	8%	[-9%, 25%]	1 out of 5
Cowpeas	Long Rainy Season	26%	[16%, 37%]	30 out of 121
	Short Rainy Season	27%	[10%, 44%]	9 out of 42
Groundnuts	Long Rainy Season	46%	[37%, 54%]	148 out of 315
	Short Rainy Season	26%	[9%, 43%]	14 out of 53
Cassava	Long Rainy Season	16%	[8%, 24%]	23 out of 189
	Short Rainy Season	12%	[-2%, 27%]	5 out of 58

Appendix O Average Price per Kilogram of Sales of Priority Crops

		Mean (\$USD/Kg)	95% C.I.	Observations	Median
Maize	Long Rainy Season	\$0.19	[\$0.18, \$0.21]	373	\$0.19
	Short Rainy Season	\$0.17	[\$0.12, \$0.21]	54	\$0.18
Paddy	Long Rainy Season	\$0.34	[\$0.31, \$0.36]	157	\$0.33
	Short Rainy Season	\$0.22	[\$0.03, \$0.41]	22	\$0.14
Beans	Long Rainy Season	\$0.50	[\$0.46, \$0.55]	161	\$0.42
	Short Rainy Season	\$0.44	[\$0.33, \$0.56]	44	\$0.42
Sorghum	Long Rainy Season	\$0.21	[\$0.17, \$0.25]	36	\$0.17
	Short Rainy Season	\$0.08	-	1	\$0.08
Millet	Long Rainy Season	\$0.22	[\$0.18, \$0.26]	42	\$0.19
	Short Rainy Season	\$0.01	-	1	\$0.01
Sweet Potatoes	Long Rainy Season	\$0.18	[\$0.11, \$0.24]	53	\$0.10
	Short Rainy Season	\$0.03	[\$0, \$0.07]	14	\$0.00
Yams	Long Rainy Season	\$0.25	[\$0.1, \$0.4]	10	\$0.15
	Short Rainy Season	\$0.00	-	1	\$0.00
Cowpeas	Long Rainy Season	\$0.35	[\$0.28, \$0.42]	30	\$0.25
	Short Rainy Season	\$0.08	[\$-0.02, \$0.19]	9	\$0.01
Groundnuts	Long Rainy Season	\$0.36	[\$0.31, \$0.41]	148	\$0.25
	Short Rainy Season	\$0.31	[\$0.14, \$0.48]	14	\$0.25
Cassava	Long Rainy Season	\$0.25	[\$0.16, \$0.34]	23	\$0.18
	Short Rainy Season	\$0.01	[\$-0.01, \$0.04]	5	\$0.00
	Permanent	\$0.15	[\$0.12, \$0.17]	138	0.13
Mango		\$0.13	[\$0.09, \$0.17]	123	0.08

Appendix P Average Value of Sales of Priority Crops by Household

		Mean (\$US)	95% C.I.	Observations	Median
Maize	Long Rainy Season	\$89.09	[\$73.14, \$105.05]	374	\$40.04
	Short Rainy Season	\$53.48	[\$31.98, \$74.99]	54	\$20.85
Paddy	Long Rainy Season	\$209.77	[\$146.3, \$273.24]	157	\$83.42
	Short Rainy Season	\$388.67	[\$145.74, \$631.59]	22	\$250.26
Beans	Long Rainy Season	\$57.71	[\$41.89, \$73.53]	161	\$25.03
	Short Rainy Season	\$42.55	[\$19.53, \$65.57]	44	\$16.68
Sorghum	Long Rainy Season	\$44.30	[\$19.24, \$69.36]	36	\$17.52
	Short Rainy Season	\$40.04	-	1	\$40.04
Millet	Long Rainy Season	\$44.81	[\$16.62, \$73]	42	\$17.52
	Short Rainy Season	\$20.02	-	1	\$20.02
Sweet Potatoes	Long Rainy Season	\$30.06	[\$18.46, \$41.66]	54	\$12.51
	Short Rainy Season	\$21.23	[\$7, \$35.46]	14	\$12.51
Yams	Long Rainy Season	\$76.81	[\$5.81, \$147.82]	10	\$46.71
	Short Rainy Season	\$175.18	-	1	\$175.18
Cowpeas	Long Rainy Season	\$22.95	[\$8.57, \$37.33]	30	\$10.51
	Short Rainy Season	\$32.19	[\$9.5, \$54.89]	9	\$20.02
Groundnuts	Long Rainy Season	\$55.32	[\$42.47, \$68.18]	148	\$33.37
	Short Rainy Season	\$45.59	[\$11.17, \$80]	14	\$25.03
Cassava	Long Rainy Season	\$90.01	[\$28.52, \$151.5]	24	\$41.71
	Short Rainy Season	\$30.77	[\$-6.8, \$68.34]	5	\$5.01
	Permanent	\$65.53	[\$27.23, \$103.82]	138	17.52
Mango		\$45.77	[\$18.87, \$72.68]	123	\$16.68

Appendix Q Crop Sales by Gender of Head of Household

Proportion of Households Selling Crops Produced by Gender of Household Head					
Season	Head of Household	Estimated Proportion	95% C.I.	Observations	Wald test P-value
Maize					
Long Rainy Season	Male	31%	[27%, 34%]	305 out of 1,010	0.0011
	Female	21%	[16%, 26%]	69 out of 327	
Short Rainy Season	Male	19%	[13%, 24%]	45 out of 239	0.1304
	Female	11%	[3%, 20%]	9 out of 75	
Paddy					
Long Rainy Season	Male	53%	[45%, 62%]	120 out of 325	0.3923
	Female	48%	[35%, 60%]	37 out of 98	
Short Rainy Season	Male	54%	[36%, 72%]	20 out of 46	0.1127
	Female	28%	[1%, 55%]	2 out of 7	
Beans					
Long Rainy Season	Male	36%	[29%, 43%]	132 out of 350	0.1703
	Female	29%	[19%, 39%]	29 out of 107	
Short Rainy Season	Male	24%	[16%, 32%]	35 out of 139	0.2788
	Female	18%	[6%, 30%]	9 out of 52	
Sorghum					
Long Rainy Season	Male	18%	[12%, 24%]	32 out of 191	0.1135
	Female	9%	[1%, 17%]	5 out of 64	
Short Rainy Season	Male	0%	[0%, 0%]		
	Female	0%	[0%, 0%]		
Millet					
Long Rainy Season	Male	40%	[29%, 50%]	34 out of 83	0.4421
	Female	50%	[25%, 74%]	8 out of 14	
Short Rainy Season	Male	0%	[0%, 0%]		
	Female	0%	[0%, 0%]		
Sweet Potatoes					
Long Rainy Season	Male	25%	[18%, 32%]	41 out of 151	0.7020
	Female	28%	[14%, 42%]	12 out of 49	
Short Rainy Season	Male	18%	[7%, 29%]	11 out of 54	0.6388
	Female	23%	[1%, 45%]	3 out of 12	
Yams					
Long Rainy Season	Male	0%	[0%, 0%]		
	Female	0%	[0%, 0%]		
Short Rainy Season	Male	0%	[0%, 0%]		
	Female	0%	[0%, 0%]		

Cowpeas					
Long Rainy Season	Male	31%	[18%, 43%]	26 out of 94	0.0122
	Female	10%	[0%, 21%]	4 out of 27	
Short Rainy Season	Male	31%	[11%, 50%]	7 out of 29	0.4277
	Female	20%	[-5%, 44%]	2 out of 13	
Groundnut					
Long Rainy Season	Male	48%	[39%, 57%]	116 out of 236	0.2538
	Female	39%	[26%, 53%]	32 out of 79	
Short Rainy Season	Male	25%	[7%, 43%]	12 out of 45	0.7868
	Female	30%	[-5%, 65%]	2 out of 8	
Cassava					
Long Rainy Season	Male	12%	[5%, 19%]	17 out of 153	0.2043
	Female	31%	[3%, 59%]	6 out of 36	
Short Rainy Season	Male	14%	[-3%, 31%]	4 out of 48	0.5291
	Female	7%	[-8%, 21%]	1 out of 9	
Permanent Obs.	Male	25%	[20%, 30%]	111 out of 443	0.8606
	Female	25%	[16%, 33%]	27 out of 123	
Mango					
	Male	22%	[17%, 28%]	102 out of 485	0.6089
	Female	20%	[10%, 29%]	21 out of 114	

Mean Value of Sales by Gender of Household Head (Long Rainy Season)					
Crop	Head of Household	Mean (\$US)	95% C.I.	Observations	Wald test P-value
Maize	Male	\$96.73	[\$78.21, \$115.25]	305	0.0062
	Female	\$55.64	[\$32.62, \$78.66]	69	
Paddy	Male	\$238.92	[\$160.72, \$317.12]	120	0.0272
	Female	\$111.99	[\$34.12, \$189.86]	37	

Appendix R Crop Sales by Zone

	Estimated Proportion	95% C.I.	Observations
Maize			
Zanzibar	82%	[53%, 112%]	11 out of 13
Southern Highlands	43%	[35%, 52%]	129 out of 297
Central	27%	[17%, 36%]	28 out of 106
Lake	26%	[17%, 35%]	23 out of 85
Northern	24%	[18%, 31%]	57 out of 230
Southern	23%	[17%, 30%]	72 out of 320
Western	21%	[14%, 27%]	38 out of 177
Eastern	17%	[9%, 25%]	16 out of 109
Paddy			
Southern Highlands	88%	[74%, 102%]	28 out of 32
Northern	84%	[65%, 103%]	11 out of 13
Central	71%	[33%, 109%]	7 out of 10
Southern	56%	[43%, 70%]	62 out of 118
Western	48%	[30%, 66%]	21 out of 45
Lake	44%	[25%, 64%]	8 out of 17
Eastern	41%	[25%, 56%]	20 out of 58
Zanzibar	0%	-	0 out of 130
Beans			
Eastern	46%	[8%, 83%]	9 out of 18
Lake	41%	[23%, 59%]	29 out of 70
Southern	39%	[21%, 57%]	14 out of 34
Southern Highlands	37%	[26%, 49%]	65 out of 168
Central	32%	[9%, 54%]	5 out of 16
Northern	32%	[18%, 46%]	29 out of 91
Western	16%	[6%, 26%]	10 out of 60
Zanzibar	0%	-	0 out of 0
Sorghum			
Northern	26%	[-6%, 58%]	2 out of 7
Lake	21%	[2%, 39%]	5 out of 21
Western	17%	[6%, 29%]	5 out of 29
Central	14%	[7%, 22%]	9 out of 62
Southern Highlands	14%	[-13%, 41%]	1 out of 5
Southern	14%	[8%, 20%]	15 out of 111
Eastern	0%	-	0 out of 5
Zanzibar	0%	-	0 out of 15

Millet			
Southern Highlands	86%	[70%, 103%]	14 out of 16
Southern	43%	[18%, 67%]	7 out of 16
Western	43%	[-5%, 92%]	4 out of 9
Central	32%	[23%, 41%]	16 out of 51
Northern	26%	[-22%, 74%]	1 out of 4
Eastern	0%	-	0 out of 0
Lake	0%	-	0 out of 0
Zanzibar	0%	-	0 out of 1
Sweet Potatoes			
Northern	53%	[32%, 74%]	8 out of 15
Southern	45%	[20%, 70%]	9 out of 20
Central	41%	[6%, 76%]	2 out of 5
Eastern	38%	[-2%, 78%]	3 out of 11
Zanzibar	35%	[9%, 62%]	6 out of 17
Lake	24%	[12%, 36%]	15 out of 65
Western	17%	[7%, 28%]	8 out of 50
Southern Highlands	12%	[-3%, 28%]	2 out of 17
Cowpeas			
Southern Highlands	60%	[38%, 82%]	7 out of 12
Eastern	29%	[-2%, 60%]	5 out of 24
Southern	28%	[12%, 44%]	9 out of 31
Central	21%	[-5%, 48%]	3 out of 15
Western	20%	[-5%, 46%]	2 out of 10
Northern	19%	[-5%, 43%]	3 out of 15
Lake	11%	[0%, 22%]	1 out of 9
Zanzibar	0%	-	0 out of 5
Groundnut			
Zanzibar	82%	[63%, 101%]	9 out of 11
Eastern	60%	[-1%, 122%]	3 out of 5
Southern Highlands	50%	[33%, 68%]	37 out of 73
Western	48%	[32%, 64%]	37 out of 73
Central	45%	[27%, 62%]	31 out of 69
Southern	42%	[30%, 54%]	27 out of 62
Lake	24%	[0%, 48%]	3 out of 11
Northern	21%	[-21%, 63%]	1 out of 5

Cassava (Permanent Crop Observations)			
Southern Highlands	37%	[12%, 61%]	12 out of 35
Northern	37%	[20%, 53%]	18 out of 49
Eastern	28%	[14%, 42%]	14 out of 45
Zanzibar	27%	[5%, 48%]	10 out of 41
Western	25%	[16%, 35%]	19 out of 77
Lake	22%	[13%, 31%]	23 out of 107
Southern	20%	[13%, 27%]	42 out of 211
Central	0%	-	0 out of 1
Mango (Fruit Observations)			
Central	51%	[28%, 73%]	6 out of 12
Eastern	42%	[18%, 67%]	23 out of 59
Northern	31%	[18%, 44%]	24 out of 77
Zanzibar	23%	[5%, 40%]	7 out of 30
Southern Highlands	21%	[10%, 32%]	19 out of 95
Western	18%	[8%, 27%]	17 out of 101
Southern	13%	[4%, 21%]	17 out of 131
Lake	11%	[3%, 19%]	10 out of 94

Appendix S Yield Calculations for Priority Crops

Maize, Long Rainy Season		Mean Yield (kg/acre)	Confidence Interval	FAO: 505 Observations
Country	Harvested	323		1811
	Planted	225		1888
Household	Harvested	367	[345, 390]	1284
	Planted	293	[272, 313]	1324
Plot	Harvested	372	[347, 396]	1811
	Planted	304	[283, 326]	1888
Maize, Short Rainy Season				
Country	Harvested	242		396
	Planted	142		440
Household	Harvested	284	[240, 328]	311
	Planted	204	[166, 242]	339
Plot	Harvested	273	[234, 313]	396
	Planted	197	[165, 229]	440
Paddy, Long Rainy Season		Mean Yield (kg/acre)	Confidence Interval	FAO: 820 Observations
Country	Harvested	523		492
	Planted	422		506
Household	Harvested	612	[526, 699]	404
	Planted	487	[416, 558]	413
Plot	Harvested	636	[546, 726]	492
	Planted	513	[433, 593]	506
Paddy, Short Rainy Season				
Country	Harvested	1295		47
	Planted	1264		48
Household	Harvested	1045	[748, 1342]	44
	Planted	1018	[651, 1385]	45
Plot	Harvested	1064	[769, 1360]	47
	Planted	1018	[655, 1380]	48

Beans, Long Rainy Season			FAO: 292	
		Mean Yield (kg/acre)	Confidence Interval	Observations
Country	Harvested	98		546
	Planted	63		572
Household	Harvested	128	[113, 142]	442
	Planted	89	[78, 99]	463
Plot	Harvested	127	[112, 142]	546
	Planted	91	[80, 102]	572
Beans, Short Rainy Season				
Country	Harvested	98		248
	Planted	62		265
Household	Harvested	121	[102, 139]	205
	Planted	91	[73, 108]	218
Plot	Harvested	126	[106, 145]	248
	Planted	92	[74, 110]	265
Sorghum, Long Rainy Season			FAO: 388	
		Mean Yield (kg/acre)	Confidence Interval	Observations
Country	Harvested	190		266
	Planted	145		277
Household	Harvested	212	[177, 248]	241
	Planted	163	[129, 197]	252
Plot	Harvested	206	[171, 240]	266
	Planted	160	[128, 193]	277
Sorghum, Short Rainy Season				
Country	Harvested	146		16
	Planted	100		19
Household	Harvested	213	[112, 313]	16
	Planted	169	[74, 265]	19
Plot	Harvested	213	[112, 313]	16
	Planted	169	[74, 265]	19

Millet, Long Rainy Season			FAO: 297	
		Mean Yield (kg/acre)	Confidence Interval	Observations
Country	Harvested	210		106
	Planted	168		108
Household	Harvested	242	[204, 281]	91
	Planted	206	[173, 240]	93
Plot	Harvested	234	[197, 271]	106
	Planted	199	[169, 228]	108
Millet, Short Rainy Season				
Country	Harvested	116		4
	Planted	65		5
Household	Harvested	161	[72,249]	4
	Planted	128	[63, 192]	5
Plot	Harvested	161	[72, 249]	4
	Planted	128	[63, 192]	5
Sweet Potatoes, Long Rainy Season			FAO: 1059	
		Mean Yield (kg/acre)	Confidence	Observations
Country	Harvested	563		209
	Planted	305		211
Household	Harvested	715	[566, 864]	200
	Planted	505	[410, 599]	201
Plot	Harvested	709	[565, 853]	209
	Planted	488	[400, 576]	211
Sweet Potatoes, Short Rainy Season				
Country	Harvested	378		82
	Planted	309		82
Household	Harvested	555	[429, 681]	70
	Planted	471	[352, 590]	70
Plot	Harvested	536	[401, 671]	82
	Planted	472	[328, 616]	82

Yams, Long Rainy Season			FAO: 2214	
		Mean Yield (kg/acre)	Confidence Interval	Observations
Country	Harvested	376		22
	Planted	351		23
Household	Harvested	521	[294, 748]	18
	Planted	504	[306, 702]	18
Plot	Harvested	559	[303,814]	22
	Planted	546	[328, 765]	23
Yams, Short Rainy Season				
Country	Harvested	763		5
	Planted	909		5
Household	Harvested	700	[489, 911]	5
	Planted	1209	[520, 1899]	5
Plot	Harvested	700	[489, 911]	5
	Planted	1209	[520, 1899]	5
Cowpeas, Long Rainy Season			FAO: 170	
		Mean Yield (kg/acre)	Confidence	Observations
Country	Harvested	57		125
	Planted	36		139
Household	Harvested	103	[73, 132]	115
	Planted	57	[43, 70]	129
Plot	Harvested	99	[70, 127]	125
	Planted	55	[43, 68]	139
Cowpeas, Short Rainy Season				
Country	Harvested	55		39
	Planted	35		46
Household	Harvested	98	[50, 145]]	37
	Planted	66	[21, 112]	43
Plot	Harvested	101	[53, 150]	39
	Planted	67	[23, 111]	46

Groundnut, Long Rainy Season			FAO: 292	
		Mean Yield (kg/acre)	Confidence	Observations
Country	Harvested	191		340
	Planted	104		349
Household	Harvested	238	[199, 277]	308
	Planted	192	[153, 231]	317
Plot	Harvested	236	[200, 271]	340
	Planted	178	[144, 212]	349
Groundnut, Short Rainy Season				
Country	Harvested	188		56
	Planted	104		63
Household	Harvested	193	[146, 240]	52
	Planted	144	[82, 206]	58
Plot	Harvested	189	[141, 237]	56
	Planted	142	[81, 202]	63

Cassava, Long Rainy Season			FAO: 2605	
		Mean Yield (kg/acre)	Confidence	Observations
Country	Harvested	493		203
	Planted	409		221
Household	Harvested	777	[525, 1028]	154
	Planted	610	[437, 783]	164
Plot	Harvested	801	[564, 1038]	203
	Planted	661	[490, 833]	221
Cassava, Short Rainy Season				
Country	Harvested	254		45
	Planted	81		55
Household	Harvested	617	[369, 866]	39
	Planted	473	[262, 684]	47
Plot	Harvested	588	[358, 818]	45
	Planted	456	[262, 650]	55
Cassava Permanent Observations, (Whole Plot)				
Country	Harvested	183		609
	Planted	166		658
Household	Harvested	350	[272, 427]	523
	Planted	306	[238, 375]	553
Plot	Harvested	368	[292, 444]	609
	Planted	318	[250, 386]	658
Cassava Permanent Observations, (Half Plot)				
Country	Harvested	288		609
	Planted	263		658
Household	Harvested	583	[460, 706]	523
	Planted	521	[406, 636]	553
Plot	Harvested	611	[492, 731]	609
	Planted	537	[426, 648]	658
Mango Tree Yield				
		Mean Yield (kg/acre)	Confidence	Observations
Country	Harvested	80		630
	Planted	79		639
Household	Harvested	94	[81, 107]	557
	Planted	93	[80, 106]	565
Plot	Harvested	95	[82, 108]	630
	Planted	92	[80, 105]	639

Appendix T Comparison of Area Harvested and Area Planted Yield Calculations

To calculate the area planted for the denominator in our yield calculations for the long and short rainy seasons, the plot size was multiplied by the percentage of the plot cultivated with the crop. This calculation includes areas of plots that were cultivated but had no harvest as a result of destruction and the full planted area of plots that were not fully harvested due to a variety of reasons (see Sections *Plots with Area Harvested Less than Area Planted*, *Entire Plots not Harvested due to Destruction*, and *Portions of Plots not Planted due to Constraints* for information on how many plots were affected by these factors and their causes).

The area harvested for each crop in the long and short rainy seasons is the response to a direct question in the survey (*What was the area harvested in the long rainy season 2008/Last completed short rainy season?*).

These questions were not asked for fruit and permanent crops. Therefore, the area planted yield calculations for fruit and permanent crops include the entire plot size of each plot planted with the crop. If the respondent indicated a harvest of zero kilograms, the value of zero was not included unless that respondent also reported pre-harvest losses. In the area harvested calculations, all values of zero were counted as missing data. To compensate for the lack of information on the area planted with permanent crops, two yield estimates were calculated: one assuming that the entire plot was planted with each crop and another that assumes half the plot was planted with each crop. Both of these yield estimates are reported in *Appendix S*.

Appendix U Explanation of Plot, Household, and Country level Calculations

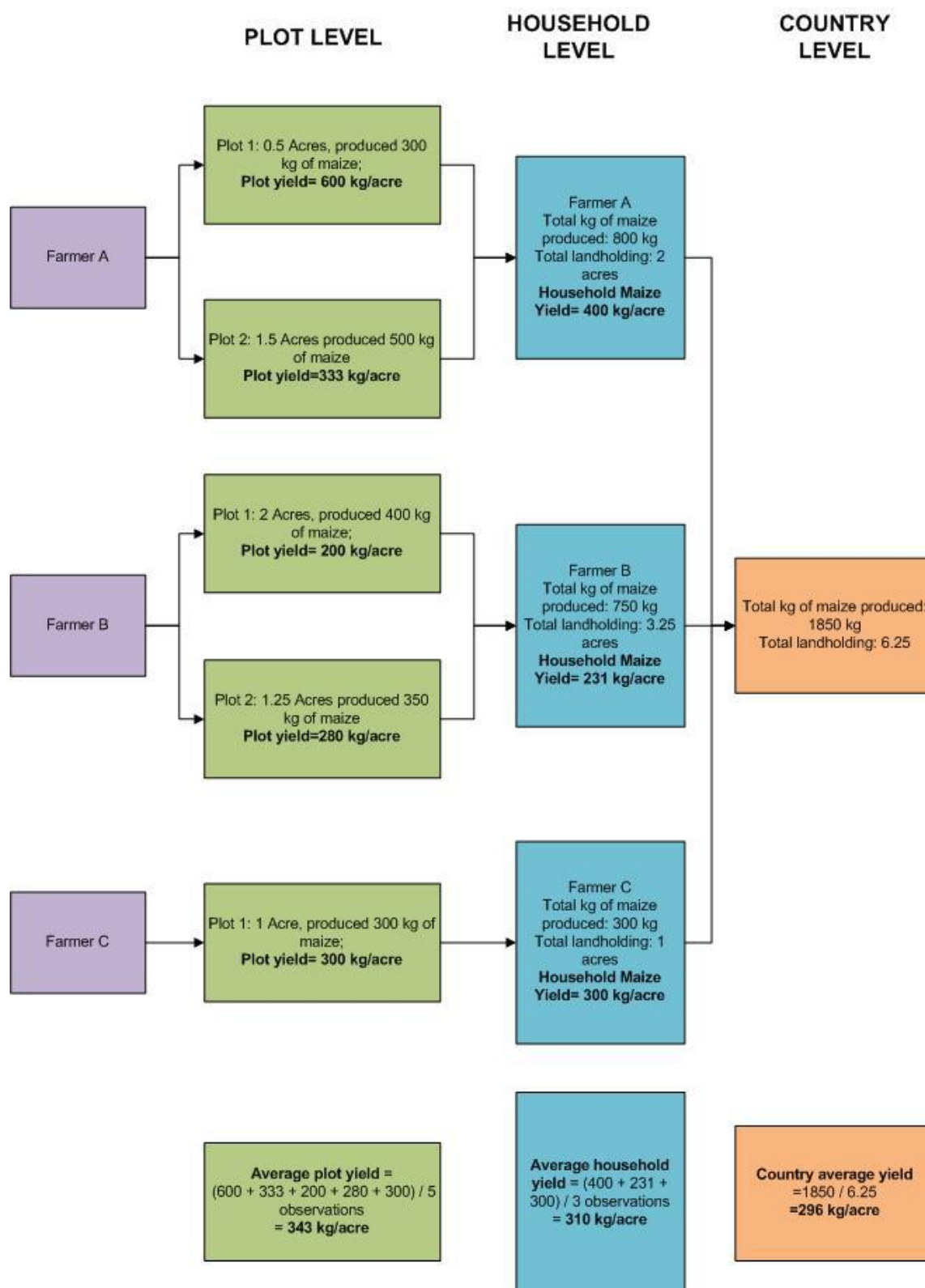
The yield measures as well as land and labor productivity were all calculated at the plot, household, and country level, producing different descriptive statistics at each of these levels. The different calculations allow analysis of variables that may affect yields and productivity at different levels. For example, it would be impossible to examine the relationship between yields and gender of plot decision-maker if we did not calculate yields at the plot level. However, it makes more sense to examine yields for an entire household and not by plot when examining the relationship between yields and the gender of the household head. Country level estimates can be used to distinguish between different seasons and years.

Figure 69 (below) shows an example of how yield figures can differ when calculated at the different levels. This example imagines a country with only three households. Two households cultivate maize on two plots and one household cultivates maize on one plot. The average plot yield, household yield and country yield appear at the bottom of the figure (343 kg/acre, 310 kg/acre and 296 kg/acre respectively). Similarly to the actual observations, in this example smaller plots produce higher yields.

At the plot level, each plot counts as one yield observation, making five total observations. To calculate the average plot yield, the yield of each plot is added together and divided by five. The acreage is taken into account as the denominator when the yield is initially calculated, but when calculating the plot average, the 600 kg/acre yield of the half acre plot is counted as one observation and the 200 kg/acre yield of the two acre plot is also counted as one observation, even though the second plot is four times the size of the first. At the household level, the entire harvest for each household is divided by the total landholding size for that household. The resulting average yield is lower than the plot average yield. This finding is caused by averaging out the yields in households that have more than one plot. While Farmer A harvested a large amount of maize per acre on his smaller plot, when averaged with the more modest yield on his larger plot, his household average kilograms/acre is lower. There are only three observations at the household level – one for each household.

The country level adds up the amount harvested for every household in the country and divides by the total area harvested. Therefore, there is only one observation at the country level and smaller plots with higher yields do not have as large of an effect.

Figure 69: Example of Yield Calculations at the Plot, Household and Country Levels



Appendix V Comparison of Plot Yields by Gender of Decision-Maker (area harvested)

		Average Yield (kg/acre)		No. of Observations	Wald test P- value
Season	Decision-Making		95% C.I.		
Maize					
Long Rainy Season*	Exclusively Male	354	[321, 387]	594	0.062
	Exclusively Female	346	[302, 391]	392	
	Shared	398	[362, 434]	815	
Short Rainy Season	Exclusively Male	259	[194, 324]	86	0.119
	Exclusively Female	196	[150, 242]	80	
	Shared	275	[208, 343]	114	
Paddy					
Long Rainy Season	Exclusively Male	618	[478, 758]	208	0.836
	Exclusively Female	600	[426, 773]	112	
	Shared	664	[514, 814]	164	
Short Rainy Season**	Exclusively Male	1425	[282, 2568]	8	0.020
	Exclusively Female	494	[-129, 1116]	3	
	Shared	1740	[1198, 2283]	12	
Beans					
Long Rainy Season	Exclusively Male	118	[96, 139]	160	0.401
	Exclusively Female	124	[92, 156]	119	
	Shared	135	[117, 152]	264	
Short Rainy Season	Exclusively Male	118	[68, 168]	35	0.576
	Exclusively Female	153	[100, 205]	47	
	Shared	128	[103, 153]	88	
Sorghum					
Long Rainy Season	Exclusively Male	234	[172, 296]	96	0.158
	Exclusively Female	167	[120, 213]	57	
	Shared	198	[159, 237]	108	
Short Rainy Season	Exclusively Male	508	[39, 978]	2	0.057
	Exclusively Female	97	[42, 151]	4	
	Shared	153	[141, 164]	2	
Millet					
Long Rainy Season	Exclusively Male	225	[173, 276]	54	0.769
	Exclusively Female	246	[173, 318]	15	
	Shared	251	[195, 307]	34	
Short Rainy Season	Exclusively Male				
Sweet Potatoes					
Long Rainy Season	Exclusively Male	673	[421, 925]	58	0.527
	Exclusively Female	577	[402, 752]	55	
	Shared	712	[557, 866]	93	

Short Rainy Season*	Exclusively Male	300	[117, 483]	15	0.072
	Exclusively Female	307	[137, 476]	11	
	Shared	563	[338, 788]	26	
Cowpeas					
Long Rainy Season**	Exclusively Male	135	[64, 206]	35	0.000
	Exclusively Female	38	[24, 52]	29	
	Shared	105	[79, 130]	60	
Short Rainy Season	Exclusively Male	212	[-98, 522]	9	0.734
	Exclusively Female	86	[26, 145]	15	
	Shared	90	[60, 121]	11	
Groundnut					
Long Rainy Season	Exclusively Male	232	[181, 284]	121	0.149
	Exclusively Female	203	[135, 270]	82	
	Shared	255	[209, 300]	133	
Short Rainy Season	Exclusively Male	172	[121, 223]	15	0.859
	Exclusively Female	137	[16, 257]	5	
	Shared	159	[102, 216]	18	
Cassava					
Long Rainy Season	Exclusively Male	788	[559, 1016]	138	0.492
	Exclusively Female	676	[448, 905]	41	
	Shared	931	[231, 1630]	22	
Short Rainy Season**	Exclusively Male	673	[443, 903]	30	0.002
	Exclusively Female	693	[314, 1071]	11	
	Shared	149	[-24, 322]	2	
Permanent Obs.**	Exclusively Male	239	[159, 318]	189	0.023
	Exclusively Female	443	[308, 577]	133	
	Shared	360	[256, 464]	260	
Mango					
	Exclusively Male	109	[86, 133]	188	0.471
	Exclusively Female	98	[69, 126]	101	
	Shared	91	[73, 109]	266	

Appendix W Comparison of Yields by Gender of Head of Household

Yields for Male and Female Headed Households (Area Harvested)					Wald test P- value
Season	Head of Household	Average Yield (kg/acre)	95% C.I.	No. of Observations	
Maize					
Long Rainy Season*	Male	378	[354, 401]	978	0.0720
	Female	336	[291, 380]	306	
Short Rainy Season*	Male	304	[256, 351]	235	0.0617
	Female	223	[145, 302]	76	
Paddy					
Long Rainy Season	Male	599	[506, 692]	312	0.6494
	Female	654	[438, 870]	92	
Short Rainy Season**	Male	1177	[819, 1535]	37	0.0017
	Female	442	[162, 722]	7	
Beans					
Long Rainy Season	Male	131	[118, 144]	338	0.3362
	Female	118	[88, 147]	104	
Short Rainy Season	Male	118	[100, 136]	149	0.5935
	Female	127	[93, 162]	56	
Sorghum					
Long Rainy Season	Male	220	[180, 259]	184	0.3463
	Female	191	[137, 246]	57	
Short Rainy Season	Male	263	[115, 411]	10	0.1169
	Female	131	[41, 221]	6	
Millet					
Long Rainy Season	Male	246	[204, 287]	77	0.5951
	Female	225	[154, 296]	14	
Sweet Potatoes					
Long Rainy Season	Male	754	[563, 945]	150	0.2494
	Female	604	[438, 771]	50	
Short Rainy Season	Male	559	[415, 703]	58	0.8870
	Female	537	[269, 804]	12	
Cowpeas					
Long Rainy Season**	Male	110	[84, 136]	91	0.0497
	Female	72	[22, 122]	24	
Short Rainy Season	Male	106	[39, 173]	25	0.5580
	Female	81	[28, 133]	12	

Groundnut					
Long Rainy Season	Male	251	[208, 294]	233	0.1253
	Female	198	[139, 258]	75	
Short Rainy Season	Male	199	[146, 252]	45	0.2659
	Female	146	[67, 226]	7	
Cassava					
Long Rainy Season*	Male	822	[537, 1107]	125	0.0827
	Female	609	[366, 852]	29	
Short Rainy Season	Male	630	[352, 907]	34	0.4810
	Female	497	[274, 721]	5	
Permanent Obs.	Male	331	[240, 422]	411	0.2485
	Female	418	[298, 539]	112	
Mango					
	Male	95	[81, 108]	452	0.9228
	Female	93	[61, 125]	105	

Appendix X Comparison of Household Yields by Zone

Household Yields by Zone (area harvested)				
Season	Zone	Average Yield (kg/acre)	95% C.I.	No. of Observations
Maize				
Long Rainy Season	Southern			
	Highlands	510	[449, 571]	291
	Zanzibar	501	[267, 736]	13
	Northern	416	[360, 472]	218
	Western	318	[266, 370]	176
	Central	315	[267, 364]	106
	Eastern	283	[204, 363]	93
	Lake	269	[217, 322]	85
	Southern	260	[224, 296]	302
Short Rainy Season	Zanzibar	651	[-100, 1402]	2
	Southern			
	Highlands	433	[243, 622]	7
	Northern	336	[245, 427]	106
	Western	296	[157, 435]	48
	Eastern	258	[127, 390]	26
	Lake	244	[193, 295]	120
	Southern	27	-	2
	Central	0	-	0
Paddy				
Long Rainy Season	Lake	1037	[688, 1386]	18
	Northern	929	[614, 1243]	13
	Southern			
	Highlands	922	[719, 1125]	31
	Central	613	[385, 842]	10
	Western	556	[419, 693]	43
	Southern	477	[341, 614]	109
	Eastern	465	[241, 690]	54
	Zanzibar	316	[272, 360]	126
Short Rainy Season	Northern	1611	[1439, 1782]	10
	Southern			
	Highlands	1225	-	1
	Western	1069	[-138, 2277]	7
	Lake	862	[608, 1117]	20
	Eastern	768	[-39, 1574]	5
	Zanzibar	672	-	1
	Central	0	-	0
	Southern	0	-	0

Beans				
Long Rainy Season	Lake	152	[106, 198]	69
	Central	145	[94, 195]	15
	Northern	133	[105, 162]	85
	Southern			
	Highlands	124	[104, 144]	165
	Western	111	[81, 140]	59
	Southern	94	[64, 125]	34
	Eastern	79	[17, 142]	15
	Zanzibar	0	-	0
Short Rainy Season	Southern			
	Highlands	141	[81, 201]	15
	Lake	127	[101, 153]	100
	Western	115	[70, 160]	39
	Northern	104	[74, 134]	49
	Eastern	67	-	2
	Central	0	-	0
	Southern	0	-	0
	Zanzibar	0	-	0
Sorghum				
Long Rainy Season	Northern	290	[100, 481]	8
	Western	285	[176, 394]	28
	Central	237	[173, 301]	62
	Eastern	201	[163, 239]	5
	Lake	194	[109, 278]	20
	Zanzibar	169	[84, 254]	13
	Southern	138	[99, 176]	101
	Southern			
	Highlands	113	[46, 181]	4
Short Rainy Season	Lake	265	[130, 399]	10
	Western	90	[80, 99]	3
	Northern	88	[44, 132]	3
	Central	0	-	0
	Eastern	0	-	0
	Southern			
	Highlands	0	-	0
	Southern	0	-	0
	Zanzibar	0	-	0

Millet				
Long Rainy Season	Southern			
	Highlands	291	[257, 326]	15
	Central	248	[196, 300]	48
	Western	220	[89, 351]	9
	Southern	199	[102, 296]	14
	Northern	96	[58, 134]	4
	Zanzibar	20	-	1
	Eastern	0	-	0
	Lake	0	-	0
Short Rainy Season	Northern	258	[173, 343]	2
	Lake	120	-	1
	Western	60	-	1
	Central	0	-	0
	Eastern	0	-	0
	Southern			
	Highlands	0	-	0
	Southern	0	-	0
	Zanzibar	0	-	0
Sweet Potatoes				
Long Rainy Season	Southern			
	Highlands	1027	[645, 1409]	15
	Northern	927	[394, 1461]	15
	Western	862	[370, 1354]	50
	Lake	610	[471, 750]	65
	Southern	580	[325, 835]	22
	Eastern	563	[223, 902]	11
	Zanzibar	423	[241, 605]	17
	Central	341	[184, 499]	5
Short Rainy Season	Northern	668	[288, 1048]	3
	Southern			
	Highlands	644	[444, 845]	2
	Lake	585	[441, 728]	49
	Zanzibar	488	[165, 810]	6
	Western	329	[158, 500]	7
	Eastern	213	[199, 226]	3
	Central	0	-	0
	Southern	0	-	0

Yams				
Long Rainy Season	Zanzibar	804	[633, 975]	12
	Eastern	480	-	1
	Southern	400	[-23, 822]	4
	Western	200	-	1
	Central	0	-	0
	Southern Highlands	0	-	0
	Lake	0	-	0
	Northern	0	-	0
Short Rainy Season	Zanzibar	930	[642, 1219]	3
	Lake	637	[406, 867]	2
	Central	0	-	0
	Eastern	0	-	0
	Southern Highlands	0	-	0
	Northern	0	-	0
	Southern	0	-	0
	Western	0	-	0
Cowpeas				
Long Rainy Season	Lake	230	[158, 303]	9
	Western	142	[58, 225]	10
	Southern Highlands	95	[70, 121]	11
	Northern	92	[45, 138]	14
	Central	82	[42, 122]	15
	Southern	74	[40, 107]	33
	Eastern	60	[40, 79]	21
	Zanzibar	13	[3, 23]	2
Short Rainy Season	Northern	146	[20, 272]	11
	Eastern	95	[39, 151]	9
	Western	74	[9, 139]	7
	Lake	54	[37, 72]	5
	Zanzibar	41	[21, 62]	5
	Central	0	-	0
	Southern Highlands	0	-	0
	Southern	0	-	0

Groundnut				
Long Rainy Season	Zanzibar	301	[75, 527]	11
	Central	267	[180, 353]	69
	Southern			
	Highlands	255	[174, 337]	73
	Western	236	[193, 279]	78
	Eastern	231	[-19, 482]	5
	Lake	175	[83, 268]	11
	Southern	149	[121, 178]	56
	Northern	122	[12, 231]	5
Short Rainy Season	Western	212	[131, 293]	26
	Lake	181	[128, 234]	20
	Eastern	140	-	1
	Northern	137	[-24, 298]	3
	Zanzibar	133	[127, 139]	2
	Central	0	-	0
	Southern			
	Highlands	0	-	0
	Southern	0	-	0

Cassava				
Long Rainy Season	Southern			
	Highlands	2000	-	1
	Lake	1750	-	2
	Eastern	1250	-	1
	Zanzibar	806	[625, 987]	119
	Southern	351	[76, 627]	31
	Central	0	-	0
	Northern	0	-	0
	Western	0	-	0
Short Rainy Season	Zanzibar	753	[521, 985]	37
	Northern	500	-	1
	Lake	80	-	1
	Central	0	-	0
	Eastern	0	-	0
	Southern			
	Highlands	0	-	0
	Southern	0	-	0
	Western	0	-	0
Permanent Obs.	Zanzibar	674	[401, 948]	40
	Northern	546	[95, 996]	42
	Southern	404	[256, 553]	192
	Western	391	[227, 554]	74
	Southern			
	Highlands	379	[154, 605]	28
	Eastern	304	[170, 438]	41
	Lake	231	[102, 360]	104
	Central	218	[189, 246]	2
Mango				
	Southern	162	[114, 209]	123
	Northern	128	[77, 179]	73
	Southern			
	Highlands	126	[87, 165]	88
	Central	80	[31, 129]	12
	Eastern	80	[55, 104]	50
	Lake	59	[44, 75]	92
	Western	56	[35, 76]	99
	Zanzibar	48	[15, 81]	20

Appendix Y Correlations of Plot Yields by Plot Size

Correlation Between Plot size and Plot Yield by Crop for Area Harvested Yield Calculations				
Crop	Season	Correlation Coefficient	Significance	No. of Observations
Maize	Long Rainy Season	-0.0634	0.007	1809
	Short Rainy Season	0.0032	0.95	396
Paddy	Long Rainy Season	-0.0748	0.0975	492
	Short Rainy Season	-0.0113	0.9401	47
Beans	Long Rainy Season	0.0289	0.5009	546
	Short Rainy Season	-0.0319	0.6175	248
Sorghum	Long Rainy Season	0.0239	0.6976	266
	Short Rainy Season	-0.2241	0.404	16
Millet	Long Rainy Season	-0.0425	0.6653	106
	Short Rainy Season	0.572	0.428	4
Sweet Potatoes	Long Rainy Season	0.1548	0.0253	209
	Short Rainy Season	-0.0808	0.4708	82
Yams	Long Rainy Season	-0.3914	0.0708	22
	Short Rainy Season	0.5775	0.3079	5
Cowpeas	Long Rainy Season	-0.0076	0.9333	125
	Short Rainy Season	0.4441	0.79	39
Groundnut	Long Rainy Season	0.0269	0.6222	339
	Short Rainy Season	0.3025	0.0234	56
Cassava	Long Rainy Season	-0.1849	0.0083	203
	Short Rainy Season	-0.108	0.4802	45
	Permanent Crop Observations	-0.163	0.0001	608
Mango	Fruit	-0.0167	0.6748	630

Appendix Z Intercropping by Crop and Reasons for Intercropping

Estimated Proportion of plots intercropped by crop planted, Long Rainy Season			
Crop	Estimated proportion	95% C.I.	Observations
Cowpeas	91%	[86%, 96%]	129
Beans	84%	[78%, 89%]	557
Groundnut	72%	[66%, 78%]	346
Yams	71%	[44%, 99%]	22
Maize	65%	[61%, 68%]	1864
Sorghum	63%	[55%, 71%]	273
Sweet potatoes	62%	[53%, 72%]	213
Cassava	46%	[36%, 57%]	207
Millet	45%	[32%, 58%]	110
Paddy	20%	[14%, 26%]	502

Estimated Proportion of plots intercropped by crop planted, Short Rainy Season			
Crop	Estimated proportion	95% C.I.	Observations
Yams	100%	-	5
Groundnut	97%	[93%, 101%]	57
Beans	91%	[86%, 96%]	250
Cowpeas	91%	[83%, 100%]	41
Sweet potatoes	81%	[75%, 88%]	82
Maize	74%	[68%, 80%]	400
Sorghum	58%	[26%, 90%]	16
Millet	41%	[-6%, 89%]	4
Cassava	40%	[15%, 64%]	45
Paddy	5%	[-1%, 10%]	47

Estimated Proportion of plots intercropped by crop planted, Permanent Crops & Fruit			
Crop	Estimated proportion	95% C.I.	Observations
Cassava	83%	[79%, 87%]	947
Mango	81%	[76%, 85%]	808

Reasons for Intercropping			
	Estimated proportion	95% C.I.	Observations
More fertile for soil	4%	[3%, 5%]	121
Substitute if either crop fails	82%	[79%, 85%]	2243
Other	8%	[6%, 11%]	218
Combination of reasons	6%	[5%, 7%]	151

Appendix AA Yields and Intercropping

Yields for Not Intercropped and Intercropped Headed Households (area harvested)					
Season	Head of Household	Average Yield (kg/acre)	95% C.I.	Observations	Wald test P-value
Maize					
Long Rainy Season*	Not Intercropped	430	[387, 473]	581	0.0000
	Intercropped	341	[317, 365]	1230	
Short Rainy Season	Not Intercropped	298	[243, 354]	106	0.2579
	Intercropped	265	[221, 308]	290	
Paddy					
Long Rainy Season	Not Intercropped	700	[602, 799]	403	0.0000
	Intercropped	398	[302, 493]	89	
Short Rainy Season	Not Intercropped	1048	[721, 1375]	44	0.6905
	Intercropped	1279	[254, 2304]	3	
Beans					
Long Rainy Season	Not Intercropped	159	[119, 199]	85	0.0703
	Intercropped	121	[106, 137]	461	
Short Rainy Season	Not Intercropped	158	[117, 199]	23	0.1353
	Intercropped	123	[102, 143]	225	
Sorghum					
Long Rainy Season	Not Intercropped	234	[189, 279]	79	0.0424
	Intercropped	191	[155, 226]	187	
Short Rainy Season	Not Intercropped	312	[125, 500]	6	0.0853
	Intercropped	141	[66, 216]	10	
Millet					
Long Rainy Season	Not Intercropped	256	[206, 306]	47	0.0486
	Intercropped	215	[181, 249]	59	
Short Rainy Season	Not Intercropped				
	Intercropped				
Sweet Potatoes					
Long Rainy Season	Not Intercropped	798	[472, 1124]	64	0.4153
	Intercropped	672	[558, 787]	145	
Short Rainy Season	Not Intercropped	679	[434, 925]	15	0.1588
	Intercropped	513	[373, 653]	67	
Yams					
Long Rainy Season	Not Intercropped				
	Intercropped				
Short Rainy Season	Not Intercropped				
	Intercropped				

Cowpeas					
Long Rainy Season	Not Intercropped	103	[50, 155]	8	0.8795
	Intercropped	98	[68, 128]	117	
Short Rainy Season	Not Intercropped	118	[87, 149]	7	0.5556
	Intercropped	100	[47, 152]	32	
Groundnut					
Long Rainy Season	Not Intercropped	309	[226, 391]	77	0.0091
	Intercropped	212	[188, 237]	263	
Short Rainy Season	Not Intercropped	275	[108, 442]	6	0.2992
	Intercropped	186	[138, 234]	50	
Cassava					
Long Rainy Season	Not Intercropped	830	[557, 1103]	119	0.7872
	Intercropped	770	[401, 1138]	84	
Short Rainy Season	Not Intercropped	652	[343, 961]	35	0.5378
	Intercropped	491	[131, 852]	10	
Permanent Obs.	Not Intercropped	645	[404, 886]	144	0.0056
	Intercropped	303	[238, 367]	465	
Mango					
	Not Intercropped	96	[66, 125]	133	0.9505
	Intercropped	95	[80, 109]	497	

Appendix BB Productivity and Intercropping

		Mean Land Productivity (USD/acre)	95% C.I.	No. of Observations	Wald test P- value
Maize	Not Intercropped	\$61.44	[\$53.94, \$68.93]	572	0.2169
	Intercropped	\$66.98	[\$61.87, \$72.08]	955	
Paddy***	Not Intercropped	\$149.03	[\$127.51, \$170.56]	408	0.0079
	Intercropped	\$103.99	[\$75.87, \$132.11]	53	
Beans	Not Intercropped	\$61.68	[\$36.46, \$86.9]	68	0.2997
	Intercropped	\$46.14	[\$33.03, \$59.25]	73	
Sorghum	Not Intercropped	\$33.16	[\$19.98, \$46.33]	69	0.1173
	Intercropped	\$46.78	[\$32.12, \$61.44]	80	
Millet	Not Intercropped	\$36.27	[\$21.13, \$35.88]	39	0.6784
	Intercropped	\$33.47	[\$27.3, \$43.15]	30	
Sweet Potatoes	Not Intercropped	\$43.12	[\$31.87, \$54.37]	40	0.4963
	Intercropped	\$49.12	[\$36.49, \$61.74]	37	
Yams+	Not Intercropped	\$170.20	[\$-17.8, \$358.21]	6	0.925
	Intercropped	\$160.33	[\$41.55, \$279.11]	9	
Cowpeas+	Not Intercropped	\$29.49	[\$12.04, \$46.94]	4	0.1012
	Intercropped	\$61.86	[\$27.24, \$96.49]	10	
Groundnut	Not Intercropped	\$67.66	[\$47.8, \$87.53]	51	0.5120
	Intercropped	\$57.44	[\$32.34, \$82.55]	57	
Cassava**	Not Intercropped	\$67.14	[\$43.2, \$91.07]	133	0.0263
	Intercropped	\$39.32	[\$30.4, \$48.24]	204	

		Mean Labor Productivity (USD/day)		No. of Observations	Wald test P-value
			95% C.I.		
Maize	Not Intercropped	\$1.72	[\$1.47, \$1.98]	572	0.1122
	Intercropped	\$1.94	[\$1.75, \$2.14]	954	
Paddy**	Not Intercropped	\$2.39	[\$1.92, \$2.86]	407	0.0135
	Intercropped	\$1.53	[\$1.03, \$2.04]	53	
Beans	Not Intercropped	\$1.19	[\$0.78, \$1.6]	68	0.2373
	Intercropped	\$1.57	[\$1.08, \$2.06]	73	
Sorghum**	Not Intercropped	\$0.93	[\$0.58, \$1.27]	69	0.0482
	Intercropped	\$1.41	[\$0.94, \$1.87]	80	
Millet	Not Intercropped	\$0.85	[\$0.63, \$1.07]	39	0.1351
	Intercropped	\$1.12	[\$0.81, \$1.43]	30	
Sweet Potatoes	Not Intercropped	\$0.94	[\$0.57, \$1.31]	40	0.1923
	Intercropped	\$1.44	[\$0.73, \$2.14]	37	
Yams+	Not Intercropped	\$1.76	[\$-0.43, \$3.95]	6	0.9537
	Intercropped	\$1.69	[\$0.92, \$2.47]	9	
Cowpeas+	Not Intercropped	\$1.40	[\$0.37, \$2.44]	4	0.4112
	Intercropped	\$2.56	[\$-0.01, \$5.14]	10	
Groundnut	Not Intercropped	\$1.43	[\$0.97, \$1.9]	51	0.7225
	Intercropped	\$1.31	[\$0.84, \$1.78]	57	
Cassava	Not Intercropped	\$0.96	[\$0.54, \$1.38]	131	0.7811
	Intercropped	\$1.02	[\$0.75, \$1.3]	204	

Appendix CC Frequency of Pre-Harvest Losses

Estimated proportion of plots with pre-harvest losses by crop planted, Long Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Millet	53%	[39%, 66%]	110
Cassava	52%	[42%, 63%]	207
Paddy	52%	[44%, 59%]	501
Sorghum	43%	[35%, 52%]	273
Sweet Potatoes	41%	[32%, 50%]	213
Cowpeas	39%	[30%, 48%]	129
Beans	35%	[29%, 40%]	557
Maize	34%	[30%, 37%]	1864
Groundnut	32%	[26%, 38%]	346
Yams	3%	[-2%, 8%]	22

Estimated Proportion of plots with pre-harvest losses by crop planted, Short Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Millet	100%	-	4
Cassava	53%	[31%, 75%]	45
Paddy	53%	[34%, 72%]	47
Cowpeas	52%	[33%, 71%]	41
Sweet Potatoes	50%	[30%, 70%]	82
Sorghum	49%	[22%, 77%]	16
Beans	42%	[33%, 52%]	250
Maize	39%	[32%, 45%]	400
Groundnut	37%	[23%, 51%]	57
Yams	0%	-	5

Estimated Proportion of plots with pre-harvest losses by crop planted, Permanent Crops & Fruit			
Crop	Estimated proportion	95% C.I.	No. of Observations
Mango	58%	[53%, 62%]	808
Cassava	32%	[27%, 37%]	947

Appendix DD Causes of Pre-Harvest Losses – Long Rainy Season

Causes of Pre-Harvest Losses, Maize LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Animals	50%	[44%, 55%]	330
Theft	25%	[20%, 30%]	160
Insects	18%	[14%, 22%]	116
Other	3%	[2%, %]	23
Birds	3%	[2%, 5%]	19
Diseases	1%	[0%, 2%]	8

Causes of Pre-Harvest Losses, Paddy LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Birds	67%	[57%, 76%]	167
Animals	15%	[7%, 23%]	35
Insects	9%	[5%, 12%]	40
Other	4%	[0%, 9%]	14
Diseases	3%	[2%, 5%]	32
Theft	2%	[0%, 5%]	7

Causes of Pre-Harvest Losses, Beans LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Insects	48%	[36%, 59%]	92
Animals	16%	[11%, 22%]	31
Diseases	15%	[7%, 23%]	26
Other	11%	[5%, 16%]	20
Theft	7%	[3%, 10%]	13
Birds	4%	[0%, 7%]	6

Causes of Pre-Harvest Losses, Sorghum LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Birds	76%	[68%, 84%]	80
Animals	12%	[6%, 19%]	24
Insects	8%	[1%, 15%]	9
Theft	2%	[-1%, 6%]	3
Diseases	1%	[0%, 2%]	5
Other	0%	-	0

Causes of Pre-Harvest Losses, Millet LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Birds	71%	[59%, 83%]	37
Animals	19%	[10%, 28%]	12
Insects	10%	[1%, 18%]	5
Diseases	0%	-	0
Theft	0%	-	0
Other	0%	-	0

Causes of Pre-Harvest Losses, Sweet Potatoes LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Animals	37%	[24%, 51%]	29
Insects	32%	[20%, 44%]	29
Theft	16%	[5%, 27%]	13
Other	11%	[4%, 18%]	9
Diseases	3%	[0%, 7%]	7
Birds	0%	-	0

Causes of Pre-Harvest Losses, Yams LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Animals	100%	-	1
Birds	0%	-	0
Insects	0%	-	0
Diseases	0%	-	0
Theft	0%	-	0
Other	0%	-	0

Causes of Pre-Harvest Losses, Cowpeas LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Insects	59%	[43%, 75%]	29
Animals	27%	[12%, 42%]	12
Birds	9%	[-4%, 22%]	3
Theft	3%	[-1%, 8%]	3
Other	1%	[0%, 2%]	2
Diseases	0%	[0%, 1%]	1

Causes of Pre-Harvest Losses, Groundnut LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Insects	48%	[35%, 61%]	51
Animals	37%	[26%, 49%]	43
Birds	7%	[2%, 11%]	10
Theft	4%	[-1%, 9%]	5
Other	3%	[-1%, 8%]	5
Diseases	1%	[-1%, 3%]	1

Causes of Pre-Harvest Losses, Cassava LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Diseases	48%	[34%, 62%]	73
Animals	18%	[4%, 32%]	13
Insects	16%	[5%, 27%]	17
Theft	8%	[2%, 14%]	11
Birds	6%	[0%, 12%]	6
Other	4%	[0%, 8%]	4

Causes of Pre-Harvest Losses, Cassava Permanent Crop Observations			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Animals	40%	[31%, 50%]	123
Insects	20%	[14%, 26%]	53
Theft	19%	[13%, 25%]	59
Other	12%	[7%, 16%]	35
Diseases	9%	[5%, 13%]	29
Birds	0%	-	0

Causes of Pre-Harvest Losses, Mango			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Theft	35%	[29%, 41%]	152
Animals	19%	[14%, 24%]	90
Insects	18%	[14%, 22%]	90
Birds	12%	[8%, 15%]	44
Other	12%	[7%, 16%]	57
Diseases	5%	[3%, 7%]	22

Appendix EE Frequency of Smaller Areas Harvested than Areas Planted of Priority Crop Plots

Estimated proportion of plots with area harvested less than area planted, Long Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Maize	30%	[26%, 33%]	522 out of 1862
Paddy	22%	[16%, 28%]	99 out of 500
Beans	33%	[28%, 37%]	176 out of 557
Sorghum	31%	[22%, 40%]	83 out of 272
Millet	40%	[31%, 48%]	41 out of 110
Sweet Potatoes	23%	[15%, 30%]	44 out of 213
Yams	0%	-	0 out of 22
Cowpeas	38%	[30%, 47%]	43 out of 129
Groundnut	26%	[19%, 32%]	86 out of 346
Cassava	27%	[19%, 35%]	69 out of 207

Estimated Proportion of plots with area harvested less than area planted, Short Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Maize	48%	[40%, 55%]	188 out of 400
Paddy	34%	[16%, 51%]	14 out of 47
Beans	51%	[41%, 60%]	126 out of 250
Sorghum	51%	[26%, 77%]	8 out of 16
Millet	51%	[1%, 102%]	2 out of 4
Sweet Potatoes	28%	[18%, 39%]	21 out of 82
Yams	38%	[-20%, 97%]	1 out of 5
Cowpeas	46%	[26%, 67%]	19 out of 41
Groundnut	49%	[30%, 68%]	31 out of 57
Cassava	13%	[2%, 25%]	7 out of 45

Appendix FF Reasons for Smaller Areas Harvested than Areas Planted – Long Rainy Season

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Maize LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 531)
Drought	52%	[46%, 58%]	262
Other	22%	[17%, 26%]	125
Rain	9%	[6%, 13%]	46
Insects	6%	[3%, 8%]	31
Animals	6%	[4%, 9%]	41
Diseases and Community Problems	3%	[1%, 4%]	13
Crop Theft	2%	[0%, 3%]	9
Lack of Casual Labor	1%	[0%, 2%]	4
Fire	0%	-	

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Paddy LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 103)
Drought	67%	[51%, 84%]	51
Rain	9%	[1%, 17%]	12
Other	8%	[1%, 15%]	9
Insects	6%	[1%, 11%]	19
Diseases and Community Problems	6%	[1%, 12%]	9
Animals	2%	[-1%, 5%]	2
Crop Theft	2%	[-2%, 5%]	1
Fire	0%	-	0
Lack of Casual Labor	0%	[0%, 0%]	0

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Beans LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 176)
Drought	32%	[24%, 39%]	56
Insects	25%	[17%, 32%]	44
Other	21%	[13%, 28%]	37
Rain	15%	[8%, 21%]	24
Diseases and Community Problems	4%	[1%, 8%]	7
Animals	3%	[0%, 5%]	5
Crop Theft	1%	[-1%, 2%]	1
Lack of Casual Labor	1%	[-1%, 3%]	2
Fire	0%	-	0

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Sorghum LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 85)
Drought	59%	[46%, 71%]	42
Other	17%	[3%, 30%]	16
Insects	11%	[3%, 18%]	11
Animals	8%	[1%, 14%]	11
Rain	4%	[-1%, 9%]	2
Diseases and Community Problems	2%	[-1%, 6%]	2
Fire	0%	-	0
Crop Theft	0%	-	0
Lack of Casual Labor	0%	-	1

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Millet LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 41)
Drought	51%	[30%, 71%]	20
Other	21%	[11%, 32%]	9
Animals	13%	[2%, 25%]	6
Insects	8%	[1%, 16%]	3
Diseases and Community Problems	5%	[-4%, 14%]	2
Crop Theft	2%	[-2%, 5%]	1
Rain	0%	-	0
Fire	0%	-	0
Lack of Casual Labor	0%	-	0

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Sweet Potatoes LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 44)
Drought	30%	[15%, 45%]	10
Rain	7%	[-1%, 15%]	3
Fire	0%	-	0
Insects	19%	[7%, 30%]	12
Animals	16%	[5%, 27%]	8
Crop Theft	3%	[-3%, 10%]	1
Diseases and Community Problems	2%	[-2%, 7%]	1
Lack of Casual Labor	0%	-	0
Other	23%	[9%, 37%]	9

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Cowpeas LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 43)
Drought	40%	[23%, 57%]	17
Insects	28%	[12%, 43%]	10
Other	13%	[-1%, 27%]	6
Rain	7%	[-1%, 16%]	3
Animals	7%	[-2%, 16%]	4
Lack of Casual Labor	3%	[-2%, 8%]	2
Fire	1%	[-1%, 3%]	1
Crop Theft	0%	-	0
Diseases and Community Problems	0%	-	0

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Groundnut LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 87)
Drought	42%	[26%, 58%]	35
Insects	26%	[13%, 38%]	20
Other	12%	[4%, 21%]	13
Rain	10%	[3%, 17%]	10
Animals	6%	[0%, 11%]	6
Diseases and Community Problems	2%	[-1%, 5%]	2
Lack of Casual Labor	2%	[-2%, 5%]	1
Fire	0%	-	0
Crop Theft	0%	-	0

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Cassava LRS			
Causes	Estimated Proportion	95% C.I.	Observations (No. of Plots out of 70)
Insects	60%	[42%, 78%]	49
Rain	16%	[-6%, 38%]	4
Drought	10%	[1%, 20%]	7
Other	7%	[-1%, 14%]	4
Diseases and Community Problems	3%	[-1%, 8%]	3
Animals	2%	[-1%, 5%]	2
Crop Theft	1%	[-1%, 4%]	1
Fire	0%	-	0
Lack of Casual Labor	0%	-	0

Appendix GG Frequency of Crops not Harvested due to Destruction

Estimated proportion of plots with pre-harvest losses by crop planted, Long Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Cowpeas	6.8%	[2.4%, 11.1%]	11 out of 140
Cassava	5.3%	[2.2%, 8.5%]	15 out of 207
Beans	3.9%	[1.9%, 5.8%]	23 out of 580
Sorghum	3.9%	[1.9%, 5.8%]	9 out of 281
Yams	2.8%	[-2.1%, 7.7%]	1 out of 23
Maize	2.7%	[1.7%, 3.6%]	48 out of 1912
Groundnut	2.6%	[0.4%, 4.9%]	8 out of 354
Paddy	1.7%	[0.2%, 3.2%]	12 out of 514
Millet	0.8%	[-0.9%, 2.5%]	1 out of 111
Sweet Potatoes	0.7%	[-0.7%, 2.1%]	1 out of 214

Estimated Proportion of plots with pre-harvest losses by crop planted, Short Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Cassava	20.9%	[3.2%, 38.7%]	10 out of 55
Millet	17.6%	[-8.8%, 43.9%]	1 out of 5
Sorghum	10.1%	[-3.2%, 23.3%]	3 out of 19
Maize	10.0%	[6%, 13.9%]	45 out of 445
Cowpeas	8.8%	[1.3%, 16.4%]	6 out of 47
Beans	6.3%	[3.1%, 9.4%]	17 out of 267
Groundnut	6.1%	[-2.1%, 14.3%]	6 out of 63
Sweet Potatoes	1.2%	[-1.2%, 3.6%]	1 out of 83
Paddy	0.3%	[-0.4%, 1%]	1 out of 48
Yams	0.0%	-	0 out of 5

Appendix HH Frequency of Plots Not Fully Planted due to Constraints

Estimated proportion of plots not fully planted due to constraints, Long Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Beans	26.4%	[20.8%, 32%]	136 out of 517
Groundnut	22.2%	[17.1%, 27.2%]	72 out of 318
Cowpeas	21.5%	[12.1%, 30.9%]	21 out of 115
Millet	21.3%	[11.7%, 30.9%]	22 out of 101
Yams	18.9%	[-2.9%, 40.6%]	4 out of 22
Sweet Potatoes	18.4%	[12.8%, 24.1%]	36 out of 189
Sorghum	16.7%	[10.9%, 22.6%]	37 out of 261
Paddy	13.5%	[8.8%, 18.1%]	47 out of 496
Maize	12.3%	[10.2%, 14.4%]	215 out of 1770
Cassava	8.4%	[3.6%, 13.2%]	13 out of 206

Estimated Proportion of plots not fully planted due to constraints, Short Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Millet	51.2%	[0.7%, 101.8%]	2 out of 4
Groundnut	30.2%	[13.1%, 47.3%]	14 out of 50
Beans	23.8%	[16.1%, 31.5%]	52 out of 227
Sorghum	20.5%	[6%, 35.1%]	3 out of 15
Sweet Potatoes	15.8%	[6.9%, 24.6%]	11 out of 73
Paddy	14.5%	[1.1%, 27.9%]	7 out of 47
Cowpeas	14.1%	[2.3%, 26%]	5 out of 31
Maize	11.4%	[7.7%, 15.1%]	39 out of 368
Cassava	1.7%	[-1.7%, 5.2%]	1 out of 44
Yams	0.0%	-	0 out of 3

Appendix II Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Maize LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Tools/Equipment	47.8%	[39.7%, 55.8%]	104
Lack of Agricultural Equipment	33.8%	[25.6%, 42%]	72
Lack of Seeds	9.8%	[5.6%, 14%]	20
Drought	5.3%	[2.2%, 8.4%]	13
Floods	2.2%	[0.1%, 4.4%]	4
Lack of Loans	1.1%	[-0.6%, 2.9%]	2

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Paddy LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Tools/Equipment	34.7%	[17%, 52.4%]	19
Drought	25.1%	[6.3%, 43.9%]	9
Lack of Agricultural Equipment	20.5%	[6.5%, 34.4%]	
Lack of Seeds	17.7%	[6.6%, 28.7%]	9
Floods	2.0%	[-1.8%, 5.8%]	1
Lack of Loans	0.0%	-	9

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Beans LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Tools/Equipment	39.1%	[28%, 50.1%]	50
Lack of Seeds	34.4%	[25.1%, 43.6%]	50
Lack of Agricultural Equipment	23.6%	[12.7%, 34.5%]	32
Drought	3.0%	[-0.6%, 6.6%]	4
Floods	0.0%	-	0
Lack of Loans	0.0%	-	0

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Sorghum LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Tools/Equipment	48.5%	[27.8%, 69.2%]	20
Drought	32.1%	[11.2%, 53%]	9
Lack of Seeds	14.3%	[0.6%, 28.1%]	6
Lack of Agricultural Equipment	5.1%	[-2.7%, 12.9%]	2
Floods	0.0%	-	0
Lack of Loans	0.0%	-	0

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Millet LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Agricultural Equipment	35.2%	[7.2%, 63.3%]	7
Lack of Tools/Equipment	31.4%	[4.3%, 58.4%]	8
Drought	16.2%	[-7.8%, 40.3%]	3
Lack of Seeds	13.6%	[-0.3%, 27.4%]	3
Floods	3.6%	[-3.4%, 10.7%]	1
Lack of Loans	0.0%	-	0

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Sweet Potatoes LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Tools/Equipment	49.1%	[31.8%, 66.4%]	16
Lack of Seeds	31.4%	[16.3%, 46.5%]	14
Lack of Agricultural Equipment	9.8%	[-0.6%, 20.2%]	3
Drought	9.7%	[-2.4%, 21.9%]	3
Floods	0.0%	-	0
Lack of Loans	0.0%	-	0

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Yams LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Seeds	84.8%	[55%, 114.6%]	3
Lack of Agricultural Equipment	15.2%	[-14.6%, 45%]	1
Drought	0.0%	-	0
Lack of Tools/Equipment	0.0%	-	0
Floods	0.0%	-	0
Lack of Loans	0.0%	-	0

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Cowpeas LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Tools/Equipment	46.4%	[25.3%, 67.6%]	9
Lack of Agricultural Equipment	20.0%	[1.1%, 38.8%]	5
Lack of Seeds	19.7%	[1.2%, 38.2%]	4
Drought	7.1%	[-3.5%, 17.7%]	2
Floods	6.8%	[-6.3%, 19.9%]	1
Lack of Loans	0.0%	-	0

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Groundnut LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Seeds	47.4%	[34.6%, 60.3%]	34
Lack of Tools/Equipment	28.6%	[17.3%, 40%]	22
Lack of Agricultural Equipment	18.7%	[7.2%, 30.2%]	12
Drought	2.6%	[-1.3%, 6.4%]	2
Floods	1.8%	[-1.8%, 5.4%]	1
Lack of Loans	0.8%	[-0.8%, 2.5%]	1

Constraints Impeding Planting of Entire Plot of Plots that were not Fully Planted, Cassava LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Lack of Seeds	33.3%	[4.7%, 61.9%]	4
Lack of Tools/Equipment	32.3%	[5.7%, 59%]	5
Lack of Agricultural Equipment	24.8%	[4.9%, 44.7%]	3
Drought	9.5%	[-9%, 28.1%]	1
Floods	0.0%	-	0
Lack of Loans	0.0%	-	0

Appendix JJ Frequency of Post-Harvest Losses

Estimated proportion of plots with post-harvest losses by crop planted, Long Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Paddy	15%	[10%, 20%]	442
Maize	14%	[12%, 17%]	1336
Sorghum	14%	[9%, 19%]	254
Cowpeas	11%	[4%, 17%]	121
Cassava	11%	[4%, 17%]	186
Sweet Potatoes	9%	[5%, 13%]	200
Groundnut	9%	[5%, 13%]	315
Millet	8%	[3%, 14%]	96
Beans	5%	[3%, 8%]	457
Yams	0%	-	18

Estimated proportion of plots with post-harvest losses by crop planted, Short Rainy Season			
Crop	Estimated proportion	95% C.I.	No. of Observations
Sorghum	34%	[10%, 57%]	17
Paddy	22%	[9%, 35%]	53
Maize	13%	[8%, 18%]	313
Beans	8%	[3%, 13%]	191
Groundnut	7%	[-1%, 15%]	53
Sweet Potatoes	5%	[1%, 10%]	66
Cassava	3%	[-3%, 8%]	57
Cowpeas	1%	[-1%, 2%]	42
Millet	0%		5
Yams	0%		5

Estimated proportion of plots with post-harvest losses by crop planted, Fruit & Permanent			
Crop	Estimated proportion	95% C.I.	No. of Observations
Mango	18%	[14%, 23%]	599
Cassava	5%	[3%, 7%]	566

Appendix KK Causes of Post-Harvest Losses

Causes of Post-Harvest Losses, Maize LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rodents, Pests	52%	[43%, 61%]	90
Insects	40%	[32%, 48%]	68
Theft	5%	[2%, 8%]	9
Rotting	2%	[0%, 5%]	3
Other	1%	[-1%, 2%]	1

Causes of Post-Harvest Losses, Paddy LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rodents, Pests	85%	[75%, 95%]	51
Insects	10%	[1%, 18%]	11
Other	5%	[-2%, 12%]	2
Rotting	0%	[0%, 1%]	1
Theft	0%	-	0

Causes of Post-Harvest Losses, Beans LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Insects	70%	[49%, 90%]	16
Rodents, Pests	15%	[-4%, 33%]	3
Theft	8%	[-3%, 19%]	2
Rotting	8%	[-4%, 19%]	2
Other	0%	-	0

Causes of Post-Harvest Losses, Sorghum LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Insects	48%	[29%, 67%]	14
Rodents, Pests	44%	[24%, 64%]	13
Theft	4%	[-4%, 12%]	1
Rotting	4%	[-4%, 11%]	1
Other	0%	-	0

Causes of Post-Harvest Losses, Millet LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Insects	70%	[32%, 108%]	4
Rodents, Pests	30%	[-8%, 68%]	2
Rotting	0%	[%, %]	0
Theft	0%	-	0
Other	0%	-	0

Causes of Post-Harvest Losses, Sweet Potatoes LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rotting	49%	[22%, 76%]	9
Insects	29%	[6%, 52%]	5
Rodents, Pests	22%	[-5%, 48%]	4
Theft	0%	-	0
Other	0%	-	0

Causes of Post-Harvest Losses, Yams LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rotting	0%	-	0
Insects	0%	-	0
Rodents, Pests	0%	-	0
Theft	0%	-	0
Other	0%	-	0

Causes of Post-Harvest Losses, Cowpeas LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rodents, Pests	54%	[26%, 82%]	4
Theft	46%	[18%, 74%]	0
Rotting	0%	-	0
Insects	0%	-	5
Other	0%	-	0

Causes of Post-Harvest Losses, Groundnut LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rodents, Pests	75%	[57%, 92%]	19
Insects	17%	[2%, 32%]	4
Rotting	8%	[-3%, 19%]	2
Theft	0%	-	0
Other	0%	-	0

Causes of Post-Harvest Losses, Cassava LRS			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rotting	71%	[41%, 102%]	13
Theft	16%	[-5%, 37%]	3
Insects	13%	[0%, 27%]	3
Rodents, Pests	0%	-	0
Other	0%	-	0

Causes of Post-Harvest Losses, Cassava Permanent Crop Observations			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rodents, Pests	39%	[11%, 66%]	8
Rotting	31%	[12%, 50%]	9
Insects	20%	[6%, 34%]	11
Theft	7%	[-5%, 19%]	1
Other	4%	[-2%, 9%]	2

Causes of Post-Harvest Losses, Mango			
Causes	Estimated Proportion	95% C.I.	No. of Observations
Rotting	87%	[81%, 94%]	101
Insects	7%	[2%, 12%]	11
Theft	4%	[0%, 8%]	4
Rodents, Pests	2%	[-1%, 4%]	2
Other	1%	[0%, 2%]	2

Appendix LL Percentage of Crop lost to Post-Harvest Losses by Crop

Percentage of crop lost to post-harvest losses, Long Rainy Season			
Crop	Estimated Proportion	95% C.I.	No. of Observations
Cassava	23%	[17%, 30%]	16
Beans	21%	[13%, 30%]	23
Maize	18%	[15%, 21%]	168
Sorghum	17%	[13%, 22%]	28
Paddy	15%	[11%, 19%]	50
Millet	14%	[9%, 18%]	6
Cowpeas	14%	[10%, 18%]	9
Sweet Potatoes	13%	[11%, 16%]	18
Groundnuts	13%	[11%, 15%]	25
Yams	-	-	-

Appendix MM Yields Data Issues

Issue	Description	Number of observations affected	Direction of effect	Magnitude of effect
Area Harvested and Planted Yield Calculations				
Immature trees counted in fruit yield estimates.	Mango trees take up to 5 years to reach full production. The survey asks how many trees were planted in the past 12 months (s6aq4) and these trees have been removed from yield calculations.	Unknown, however 45 out of 630 observations reported planting the majority of trees in 2003 or later	Underestimate fruit yields	Unknown; when observations are removed of plots where the majority of trees were planted post 2003, average yield increases from 95 to 98 kg/tree
Inaccurate responses/recall	Many of the questions require respondents to give information that they may not know precisely or accurately remember (e.g. kilos of fruit harvested in the past 12 months or total estimated value of maize harvest in the long rainy season).	All responses subject to inaccuracies	Unknown; in the case of land size, overestimates yields because respondents tended to report smaller plots than those that were measured	Unknown
Area Harvested Yield Calculations				
Area harvested reported as zero	Values of 0 acres for area harvested in the long rainy season (s4aq8) when a value is reported for amount harvested (s4aq15). These observations were therefore excluded from area harvested calculations. Note: this issue only occurs in the long rainy season data and not in the short rainy season data.	Total of 66 observations ; largest effect on maize yields with 32 out of 1,859 observations	Unknown, but may overestimate yields ; observations reporting zero acres harvested tended to produce more maize	Small: average maize quantity harvested including the 32 observations was 496 kg ; excluding the observations the average harvest was 500 kg .
Area harvested not reported for permanent crops	Respondents are not asked the area harvested for permanent crops or the number of trees harvested for fruit. Therefore, we have created two estimates for cassava; one assuming that the entire plot was harvested and one assuming that 50% was harvested.	Unknown , however an estimated proportion of 27% plots growing cassava harvested less than the area planted in the long rainy season and 13% harvested less area than planted in the	Underestimate permanent crop cassava yields	Country level cassava yields for the long and short rainy seasons were 493 and 254 kg/acre respectively. For permanent crops the yields were 183 kg/acre under the assumption of harvesting the full plot and 288 kg/acre

		short rainy season.		under the assumption of harvesting half of the plot.
Area Planted Yield Calculations				
Percent of plot planted not recorded for permanent crops	Respondents were not asked how much of their plot they planted with a particular crop for permanent crops (cassava).	Unknown; however an estimated proportion of 27% did not plant the entire plot with cassava in the long rainy season and 13% in the short rainy season.	Underestimate permanent crop cassava yields	Country level yields for cassava area planted were 409 and 81 kg/acre for the long and short rainy season respectively. The average yield for permanent crop observations was 166 kg/acre assuming the entire plot was harvested and 263 kg/acre assuming half the plot was harvested
Crops that were planted but not harvested for unknown reasons	Respondents who did not harvest any of the crop planted were asked the reason that no crop was harvested (s4aq2 & s4bq2); a large portion of the responses were “other”. These observations were eliminated from the analysis.	Total of 204 observations in the long rainy season and 83 observations in the short rainy season, spread out amongst all crops (e.g. Maize long rainy season 74 observations out of 1,888)	Overestimate yields	Small due to the small number of observations
Area planted variables less than area harvested	In several cases the calculated area planted variable was smaller than the area harvested variable (s4aq8 and s4bq8)	For the case of maize long rainy season there are 114 observations out of 1909 where the area harvested is greater than the area planted.	Overestimate yields	The average difference between the two variables when the area planted was smaller was 0.39 acres.