Evans School of Public Affairs
UNIVERSITY OF WASHINGTON

LSMS – Integrated Surveys on Agriculture
United Republic of Tanzania:
Inputs

EPAR Request No. 163

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SECTION F: Inputs

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Section Highlights

Soil and Water

- A majority of long rainy season plots have loam soil (a mix of clay, silt and sand), most common response was that plots are of good quality and have flat bottoms.
- 15% of plots reported suffering from erosion, the majority of which was caused by rain (94%).
- 19% of plots used some form of erosion control in the long rainy season. Terraces were the most common form (38%).
- Fewer than 5% of plots were irrigated in either the long or short rainy season, and of those, flooding from a river or stream was the main source of water.

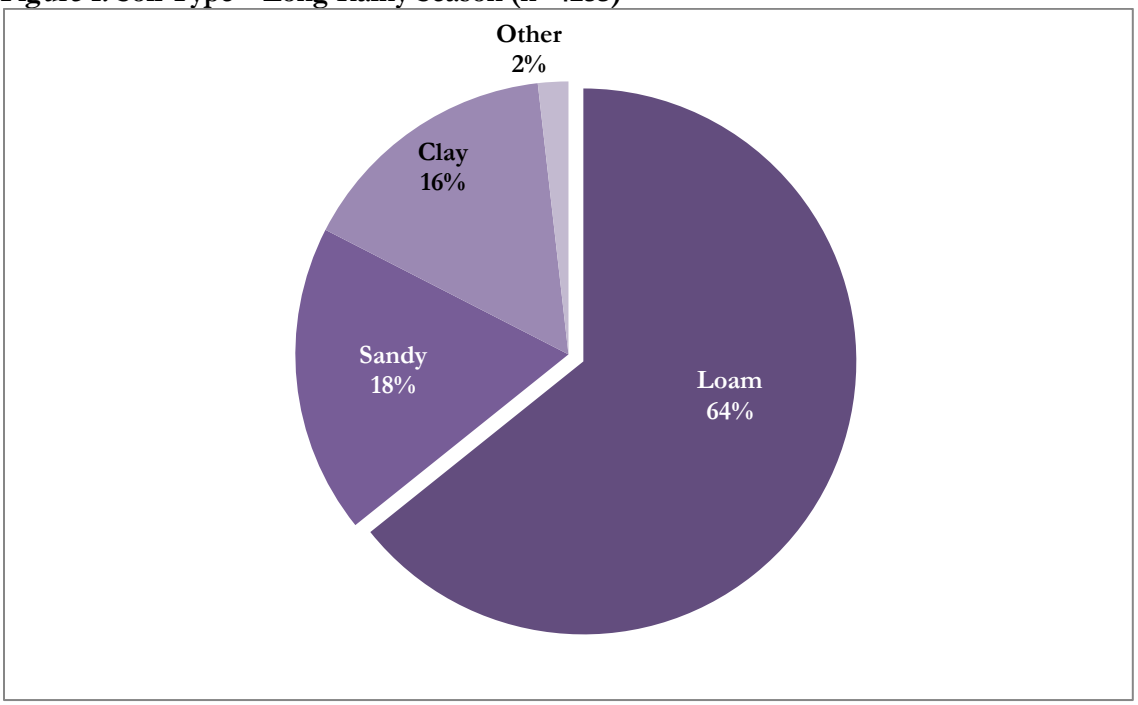
Inputs

- An estimated 26% of plots were treated with some form of agricultural input (fertilizer, pesticides, herbicides, or fungicides) at some point during one or both rainy seasons in 2008, but only 1.2% of plots were treated with inputs purchased on credit.
- Organic fertilizer was used most frequently, and was applied on 12-13% of plots cultivated in both the short and long rainy seasons. 11% of long rainy season plots and only 4% of short rainy season plots were treated with inorganic fertilizers.
- Pesticides were used on an estimated 2% of plots in 2008 (83 plots in the sample), and roughly 80% of plots treated with pesticides received 1 kg/acre or less.
- Herbicides were used on 7.86% of plots. Nearly half of herbicide-treated plots were maize plots. However, cash crops were by far the most likely crops to be cultivated using herbicides, including cotton (27 out of 28 plots with cotton as the main crop in the long rainy season) and tomatoes (9 out of 10 plots with tomatoes as the main crop in the long rainy season).
- Pesticides, herbicides, and fungicides were almost never used on cassava plots, but 11% of paddy plots and 11% of maize plots were treated with at least one of these inputs during the long rainy season.
- Maize plots were the most frequently treated with fertilizer: roughly 16% plots were treated with organic fertilizer during the long rainy season, a rate three times greater than paddy or cassava plots. 16% of maize plots were treated with inorganic fertilizer, versus 9% for paddy and only 1% for cassava plots.
- Plots where decision-making was exclusively male were significantly more likely to be treated with at least one kind of input than either female or shared decision-making plots. Some of this difference may arise from differences in crops cultivated by male versus female plot-owners.
- The percentage of households using inorganic fertilizer was highest in the Southern Highlands zone, while usage of organic fertilizer by households was highest in the Central and Northern zones.

Soil Characteristics

Figure 1 shows the proportion of responses to the question, *What was the soil type of this plot?* for long rainy season plots. In both long and short rainy seasons, the majority of plots were characterized as having loam[1] soil (n=2,625), followed by sandy soil (n=895) and clay soil (n=640).

Figure 1: **Soil Type – Long Rainy Season (n=4253)**

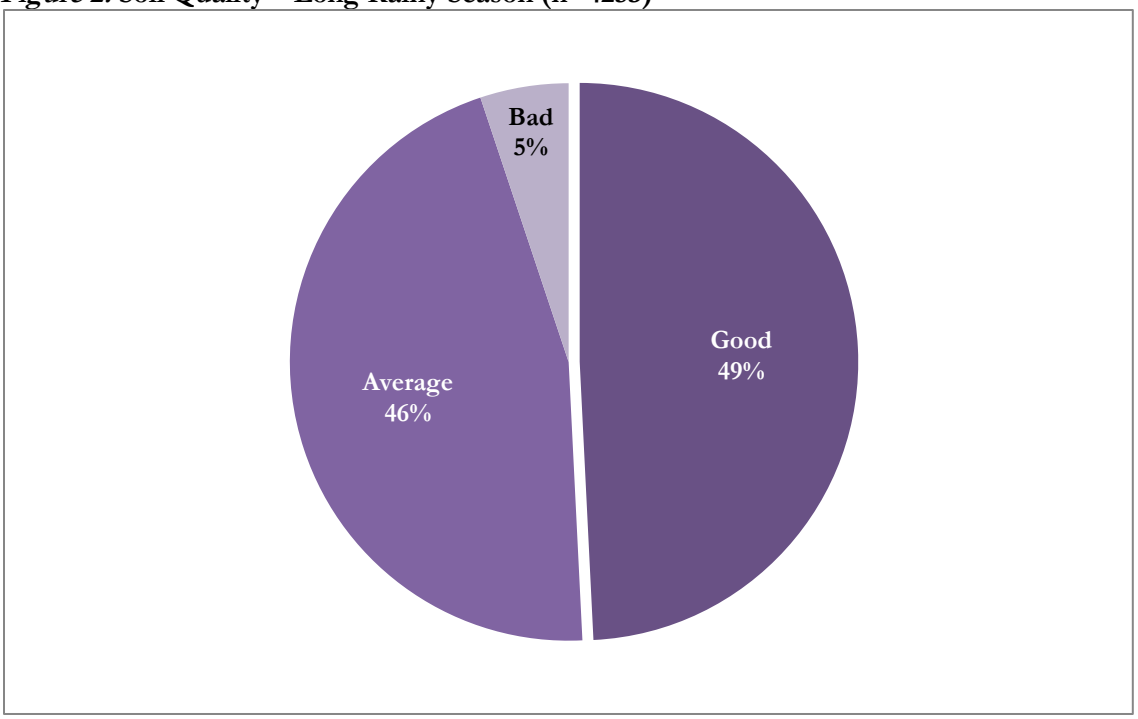


**Question s3aq7*

Soil quality, categorized as good, average, or bad, is shown for the long rainy season in *Figure 2*. Most plots during the long rainy season were characterized as having good soil quality (49%, n=4253), while most plots during the short rainy season had only average soil quality (65%, n=84) (*What was the soil quality of this plot?).*

[1] Loam is a mixture of clay, silt, and sand

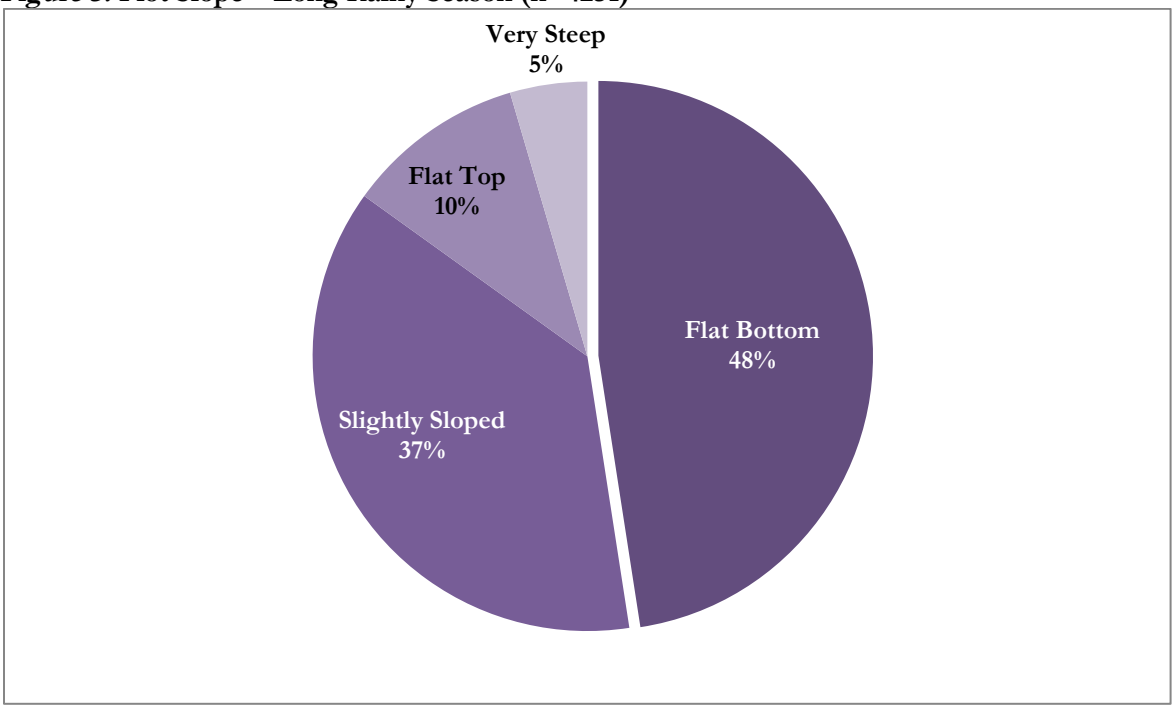
Figure 2: **Soil Quality – Long Rainy Season (n=4253)**



** Question s3aq8*

Finally, *Figure 3* below shows the average slope of the plot for the long rainy season (*How steep is the slope of this plot?*). For both the long and short rainy seasons, around half of the plots were described as having a flat bottom, followed by the category of slightly sloped.

Figure 3: **Plot Slope – Long Rainy Season (n=4251)**

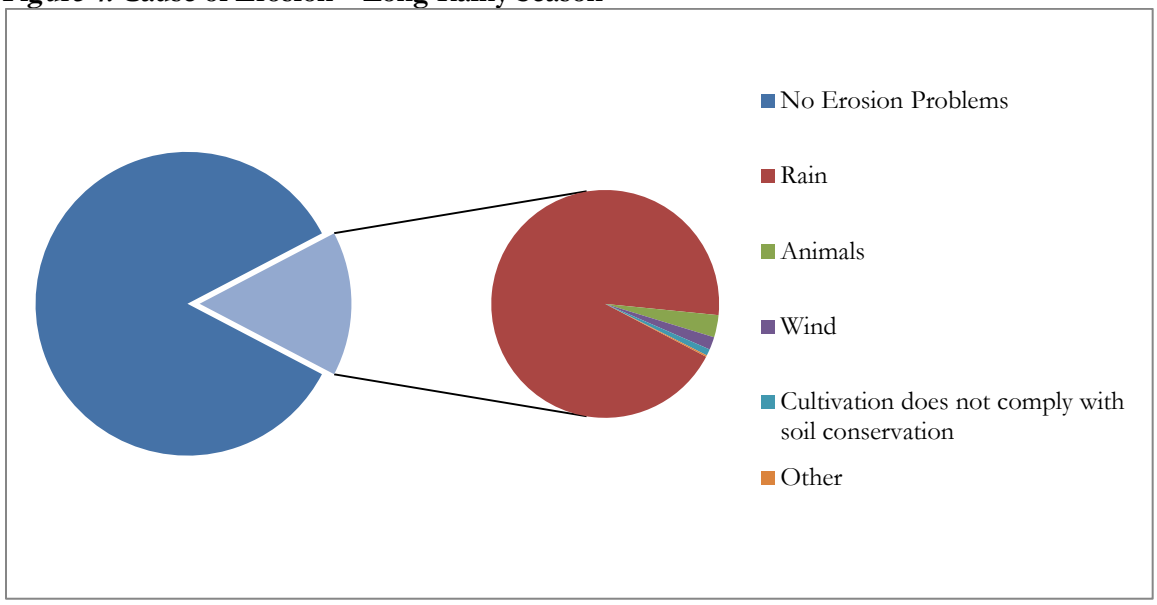


**Question s3aq14*

Soil Management

Figure 4 below shows the proportion of plots that were reported as having erosion problems during the long rainy season (15%). This 15% represents 555 plots, with rain as the main cause of erosion reported on 94% of these plots (*What was the cause of these erosion problems?).*

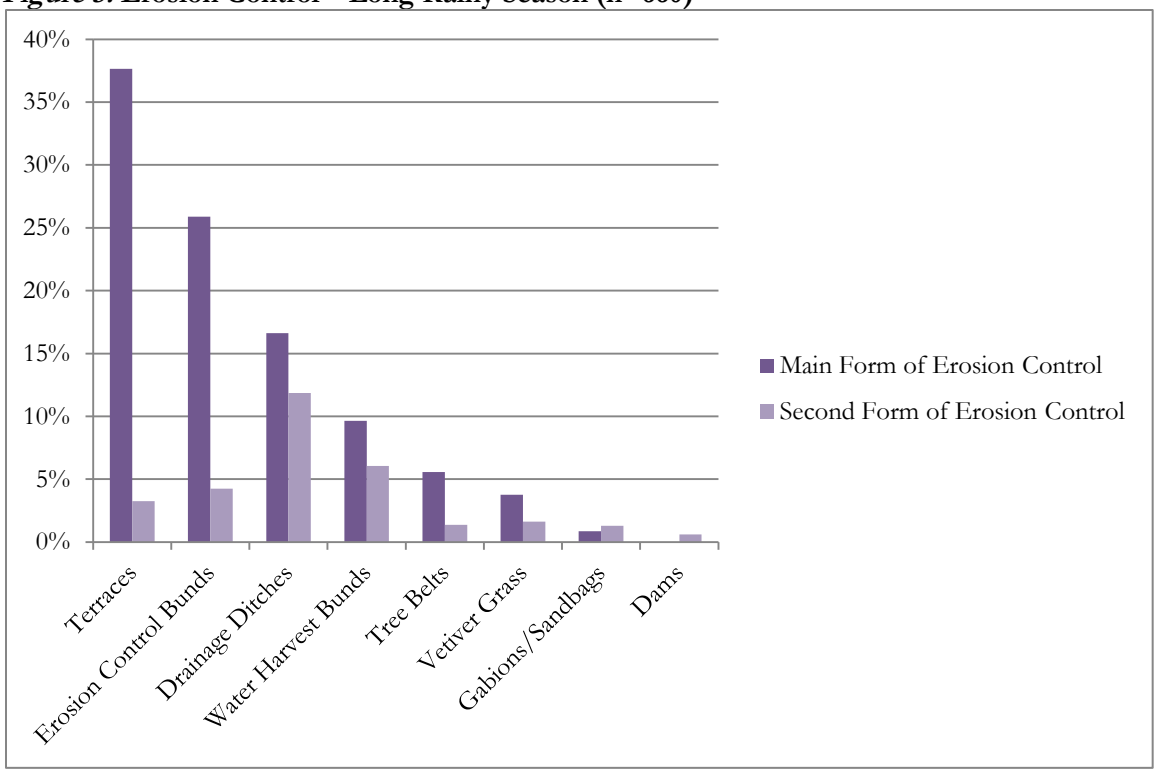
Figure 4: **Cause of Erosion – Long Rainy Season**



**Question s3aq11*

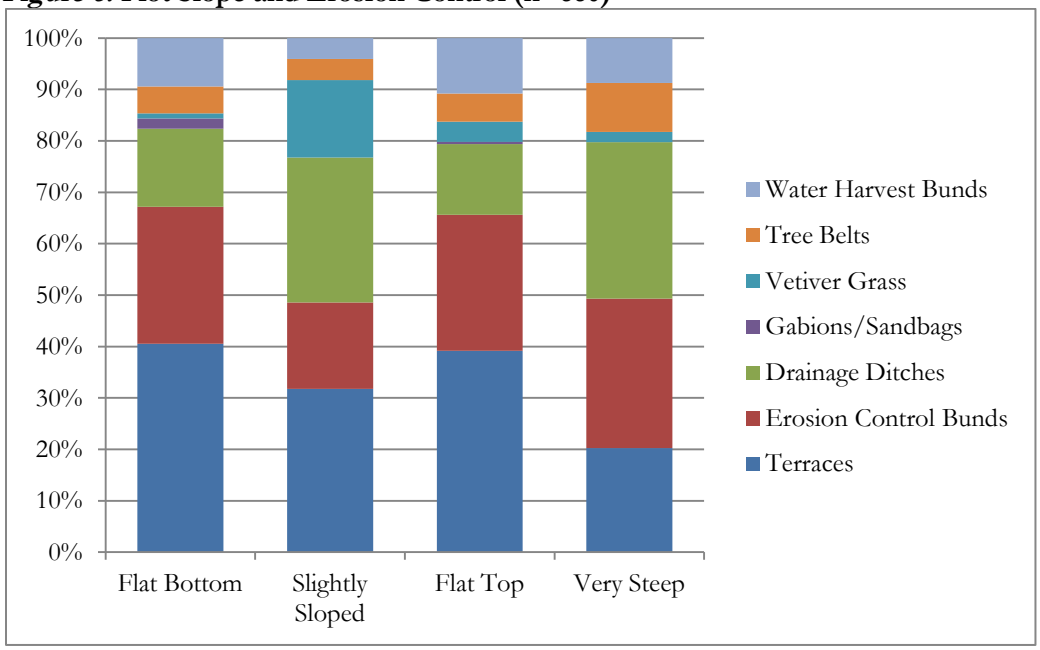
Among all plots, 660 (19%) were reported to have some type of erosion control. Of those plots, *Figure 5* shows what types of erosion control were used during the long rainy season. The figure shows both the proportion of plots reporting each type of erosion control as the main or secondary form (*What type of erosion control/water harvesting facility was on this plot?*). *Figure 6* shows the proportion of plots reporting the primary form of erosion control by plot slope.

Figure 5: **Erosion Control – Long Rainy Season (n=660)**



***** *Questions s3aq13_1 & s3aq13_2*

Figure 6: **Plot Slope and Erosion Control (n=660)**

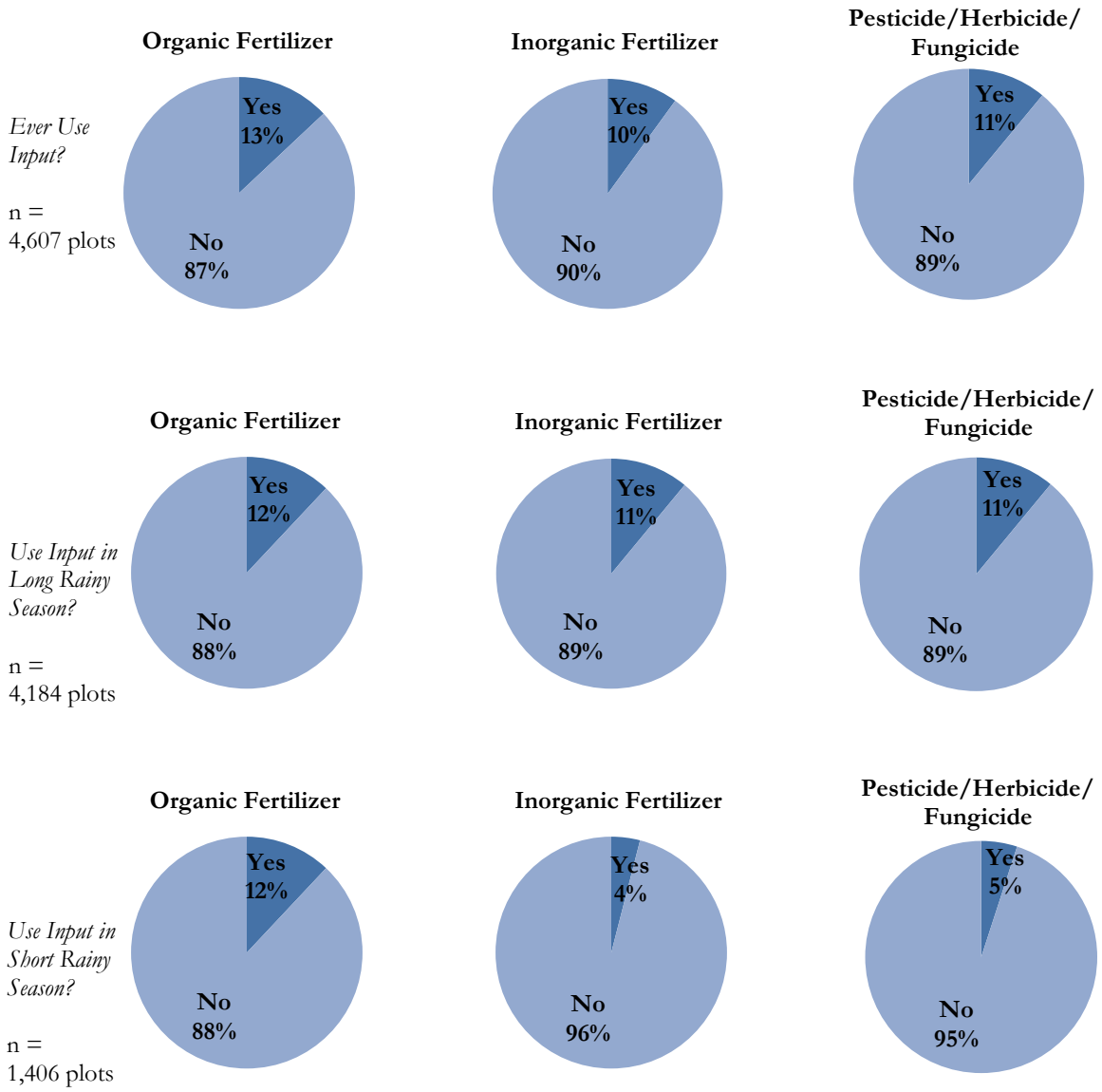


**Questions s3aq13_1 and s3aq14*

Input Use: Plot Level

An estimated 26% of Tanzanian plots were treated with some form of agricultural input (fertilizer, pesticides, herbicides, or fungicides) at some point during one or both rainy seasons in 2008. *Figure 7* summarizes the estimated proportion of agricultural plots on which any amount of organic fertilizer, inorganic fertilizer, or pesticides/herbicides/fungicides was applied during either the long or short rainy season *(Did you use any organic fertilizer/inorganic fertilizer on [PLOT] in the long rainy season 2008/last completed short rainy season? Did you use any pesticide/herbicide on [PLOT] in the long rainy season 2008/last completed short rainy season?)*.

Figure 7: **Agricultural Input Use, Proportion of Plots by Season**



**Questions s3aq37, s3bq37, s3aq43, s3bq43, s3aq49, & s3bq49*

As evident in *Figure 7*, although about a quarter of plots were treated with some input during the year, the use of any one input never exceeded 13% of plots for either rainy season. Organic fertilizer was used most

frequently, and was applied on 12-13% of plots cultivated in both the short and long rainy seasons. Inorganic fertilizer use was slightly less common, with 11% of long rainy season plots and only 4% of short rainy season plots treated. Finally, although some form of pesticide or herbicide or fungicide was applied on 11% of plots, the use of pesticides/herbicides/ fungicides was largely limited to the long rainy season.

A more detailed distribution of input use among pesticide/herbicide/fungicide users is summarized in *Table 1*. Use of pesticides and fungicides was rare (estimated to be less than 2% of plots in 2008) *(What type of pesticide/herbicide did you apply? – options: pesticide, herbicide, fungicide and other).*

Table 1: **Use of Pesticides, Herbicides and Fungicides in the Long Rainy Season**

Input	Number of Plots	Estimated Proportion of Plots
Pesticide	83	1.98%
Herbicide	329	7.86%
Fungicide	24	0.57%

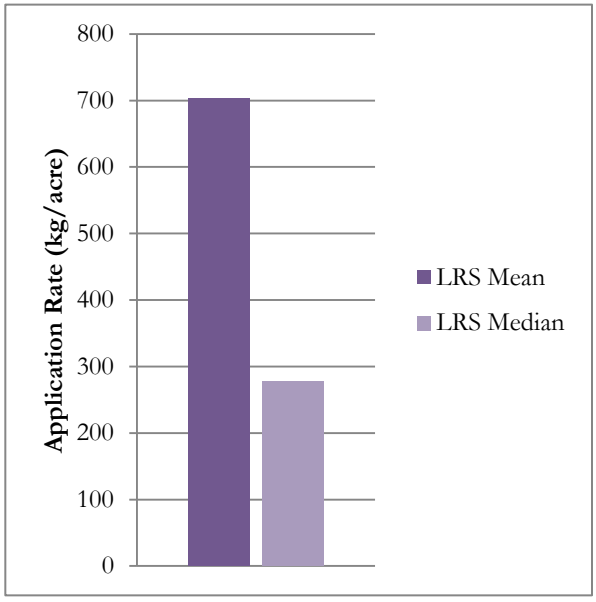
n = 4185 **Questions s3aq49 & s3aq50*

Full results for all inputs by season are shown in *Appendix C*.

Input Use: Plot Level Application Rates

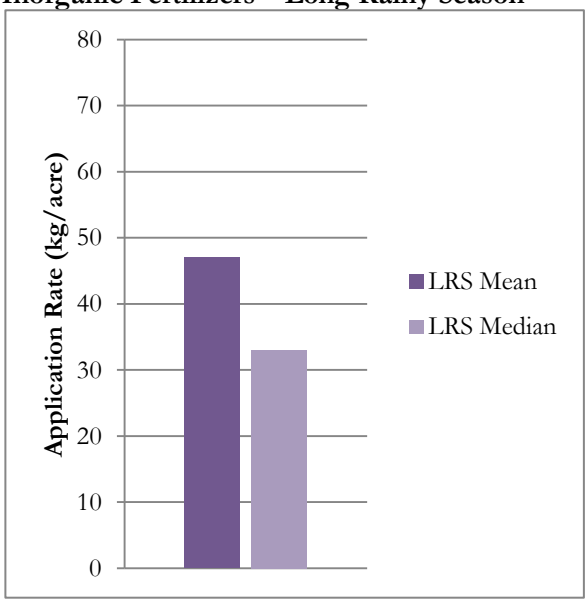
The mean and median application rates for each input in kg/acre are shown in *Figure 8*, *Figure 9*, and *Figure 10*[2] *(What quantity of this organic fertilizer/inorganic fertilizer/pesticide/herbicide did you use?).*

Figure 8: **Mean and Median Application Rates of Organic Fertilizers – Long Rainy Season**



Question: s3aq38

Figure 9: **Mean and Median Application Rates of Inorganic Fertilizers – Long Rainy Season**



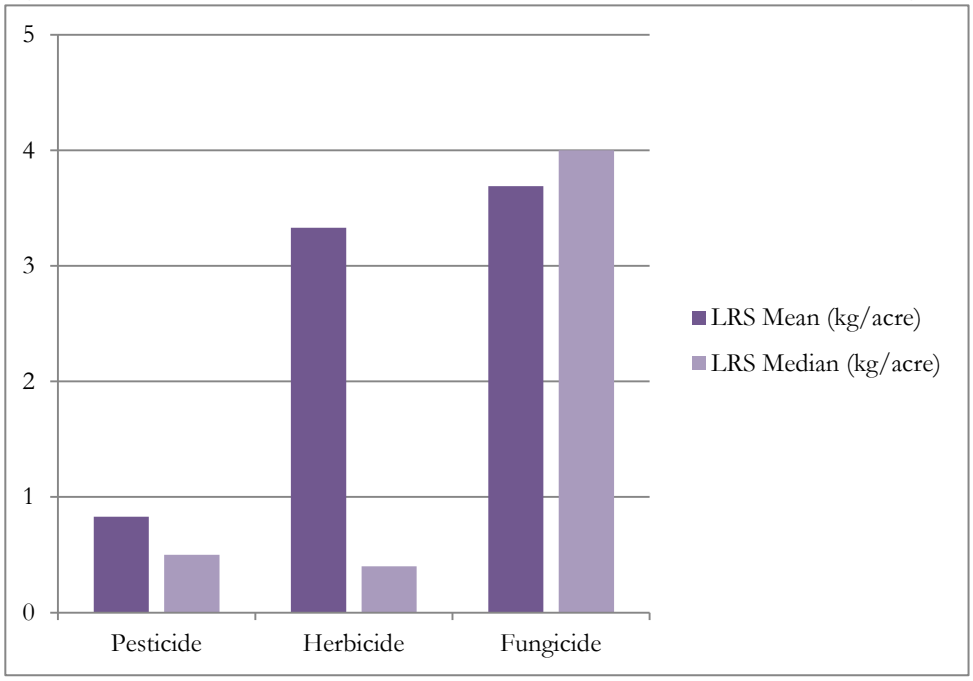
Question s3aq45

[2] Mean application rates are based on average input use by users, that is, non-users (with applications rates of zero) are excluded. A small number of extreme outliers (up to 2% of the sample) were excluded from the mean estimates.

The vertical axes in *Figure 8* and *Figure 9* differ by a factor of 10, since inorganic fertilizer is typically applied at a lower rate than organic fertilizer. Note that for both organic *(Figure 8)* and inorganic (*Figure 9*) fertilizer the mean application rate is higher than the median – in the case of organic fertilizer much higher. This difference implies that the majority of input users apply a relatively small amount of any given input to their fields, but a small number of input users apply a great deal more. Plots where fertilizer was applied at a much higher rate (more than 1000 kg/acre) tended to be smaller with an average size of 1.2 acres (N=69 plots) compared to 2.2 acres for the average size of a plot where fertilizer was applied at a rate of less than 1000 kg/acre (N=357). Also, 48% of the plots that had an application rate of organic fertilizer greater than 1000 kg/acre were located in the Northern zone, indicating that higher application rates may be related to geographic characteristics.[3] See *Figure 11* and *Figure 12* for the distribution of organic and inorganic fertilizer application rates.

Owing to the very low application rates of pesticides (n=83), herbicides (n=329), and fungicides (n=24), *Figure 10* summarizes mean and median application rates for these inputs at a different scale.

***Figure 10*: Mean & Median Application Rates of Pesticides/Herbicides/Fungicides – Long Rainy Season**



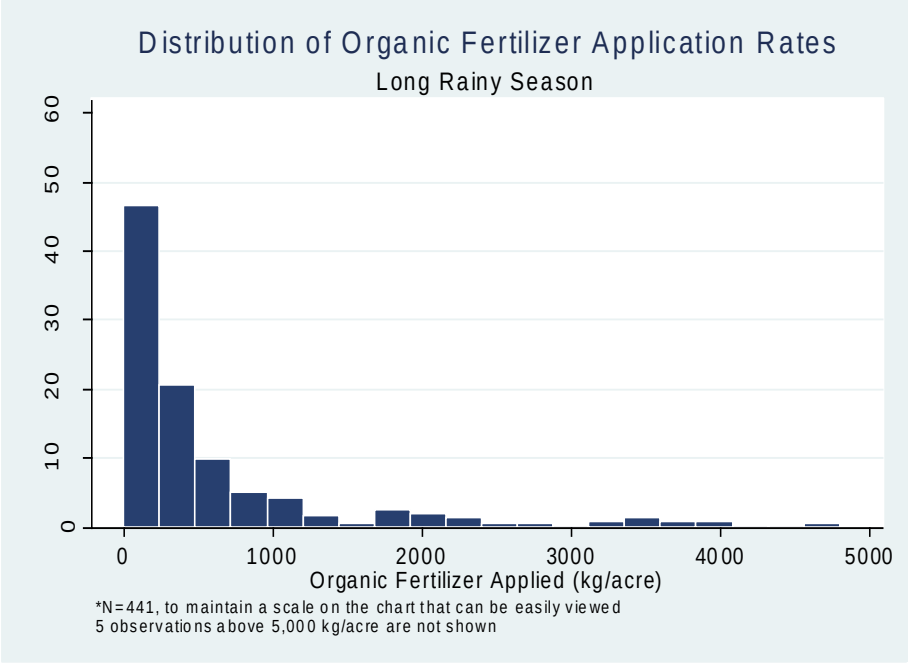
**Questions s3aq50 & s3aq51*

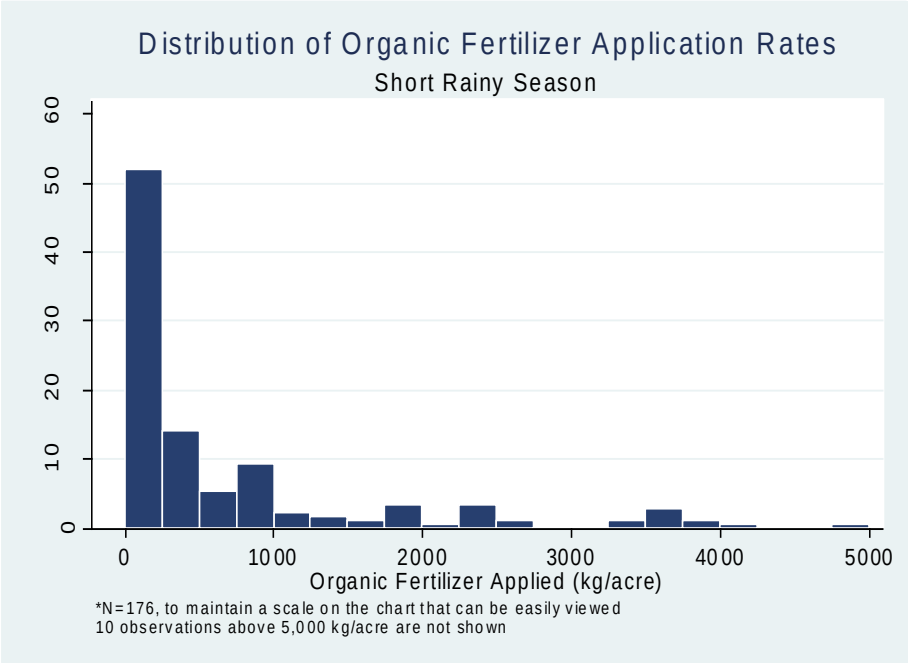
Additional results, including mean and median input application rates for the short rainy season, are provided in *Appendix D*. The application rates in kg/acre for both organic fertilizer and inorganic fertilizer are relatively higher during the short rainy season as compared to the long rainy season. However, these differences are not statistically significant, owing in part to the very small sample size for the short rainy season (with 176 plots using organic fertilizer and 59 plots using inorganic fertilizer during the short rainy season).

[3] Note that the Northern zone also contained 27% of plots that were treated with organic fertilizer-more than any other zone. However, the proportion of plots treated with more than 1000 kg/acre was still disproportionately high in this zone.

The distribution of input application rates by season is illustrated in *Figure 11*, *Figure 12*, and *Figure 13*. Among plots treated with organic fertilizer the mean application rate in the long rainy season was 703 kg/acre (median: 278 kg/acre). The mean application rate among plots fertilized in the short rainy season was somewhat higher, at 1,159 kg/acre (median: 300 kg/acre). The distributions of application rates indicate that the majority of organic fertilizer users apply less than 500 kg/acre.

Figure 11: **Organic Fertilizer Application Rates by Season (plot-level)**



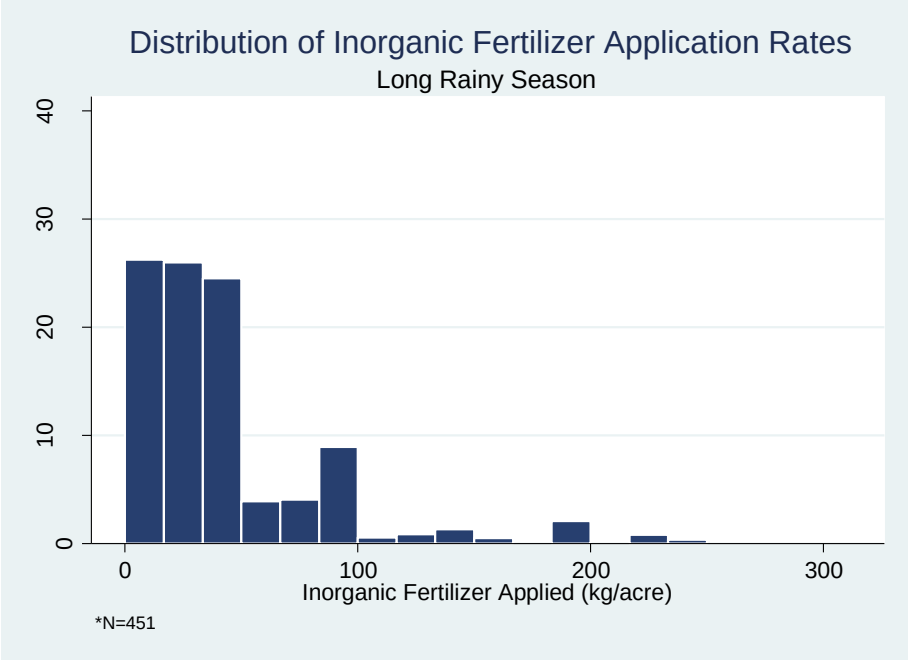


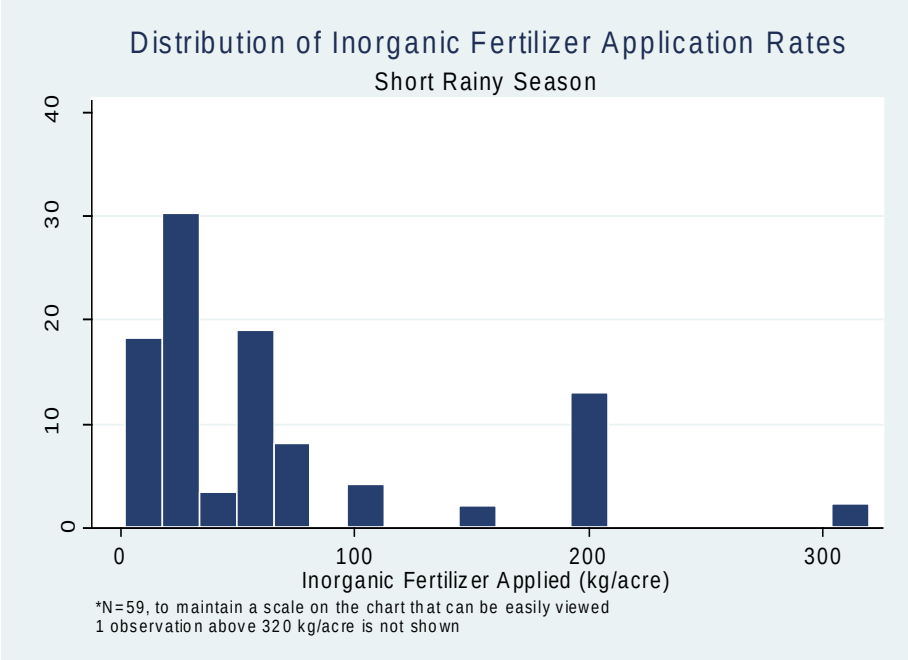
**Question s3aq38 & s3bq38*

Only 16% of fertilized plots were treated with purchased organic fertilizer from off-farm sources *(Was any of this [organic fertilizer] purchased?)*.

Among plots treated with inorganic fertilizer the mean application rate in the long rainy season was 47 kg/acre (median: 33 kg/acre). The mean application rate among plots fertilized in the short rainy season was higher at 83 kg/acre (median: 40 kg/acre), however the sample of short rainy season fertilized plots was very small - only 59 plots in all.

Figure 12: **Inorganic Fertilizer Application Rates by Season (plot-level)**

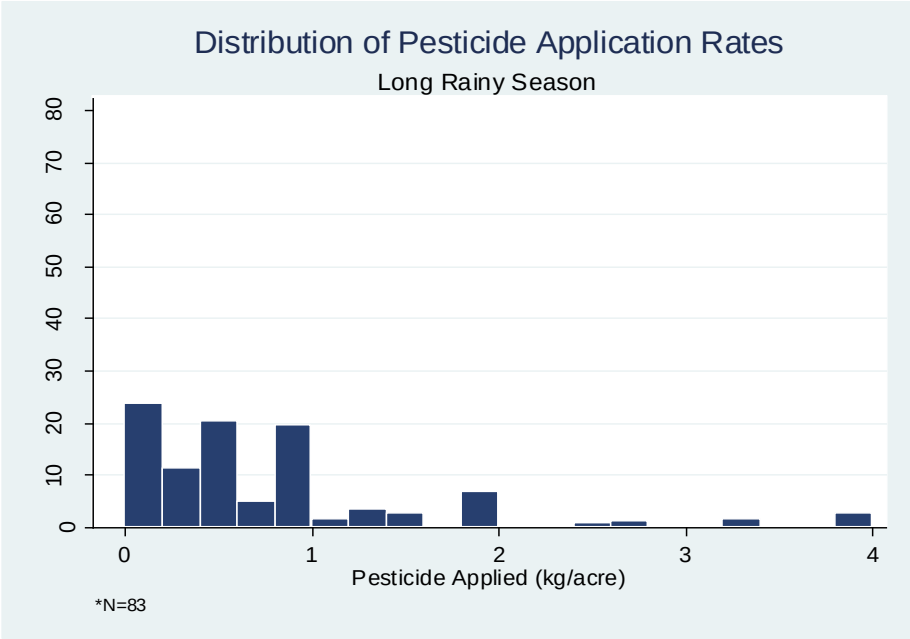




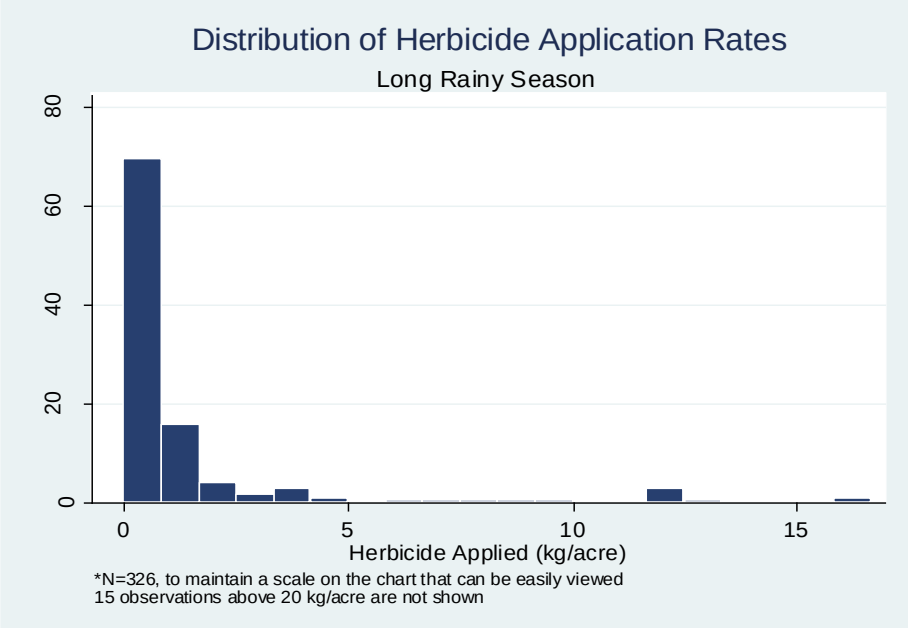
**Question s3aq45 & s3bq45*

Figure 13 shows the distribution of pesticide and herbicide application rates among plots treated with these inputs. Fungicide was rarely used (24 plots in the long rainy season) hence no distribution is shown.[4] Of the 24 plots using fungicide, 9 came from two households (both households listed Irish potatoes as the main crop cultivated on each of the plots).

Figure 13: **Pesticide and Herbicide Application Rates by Season (plot-level, note different scales)**



**Question s3aq50, s3aq51_amount & s3aq51_measure*



**Question s3aq50, s3aq51_amount& s3aq51_measure*

[4] For pesticides, herbicides, and fungicides survey respondents provided the amount of each input used, with some providing responses in kilograms, others in liters, and still others in milliliters. For the purposes of these summary analyses we assume 1 kilogram = 1 liter = 1,000 milliliters of each input.

Pesticides were used on an estimated 2% of plots in 2008 (83 plots in the sample), and only in small volumes relative to other inputs: roughly 80% of plots treated with pesticides received 1 kg/acre or less. Pesticide use was almost exclusively limited to maize (30 plots) and paddy (29 plots).

Herbicide use was relatively more common (although still limited to only 7.86% of plots). Nearly half of herbicide-treated plots were growing maize (145 out of 329 herbicide-treated plots). However cash crops were by far the most likely crops to be cultivated using herbicides, including cotton (27 out of 28 plots in the sample) and tomatoes (9 out of 10 plots). Among plots treated with herbicides the mean application rate in the long rainy season was 3.33 kg/acre. While some high herbicide application rates were reported, the majority of plots were treated with less than 1 kg/acre (median: 0.4 kg/acre).[5]

Other Input Use: Credit

One possible explanation for the lack of input use on many agricultural plots may be a lack of access to credit. In 2008 only 1.2% of plots were treated with fertilizers, pesticides, herbicides, or fungicides that had been purchased on credit *(Did you receive any seeds, fertilizers, pesticides or herbicides for [PLOT] on credit to be paid later on during the long rainy agricultural season 2008/last completed short rainy season?).*

[5] The potency of inputs was not reported, thus it is possible that some farmers may have reported application volumes including water used to dilute the input, while others reported pre-dilution volumes. This difference may be important, since 1 kg of concentrate applied to an acre of land may be a substantial amount, while 1 kg of pre-mixed (mostly water) input applied to an acre could be "just enough" or "hardly any".

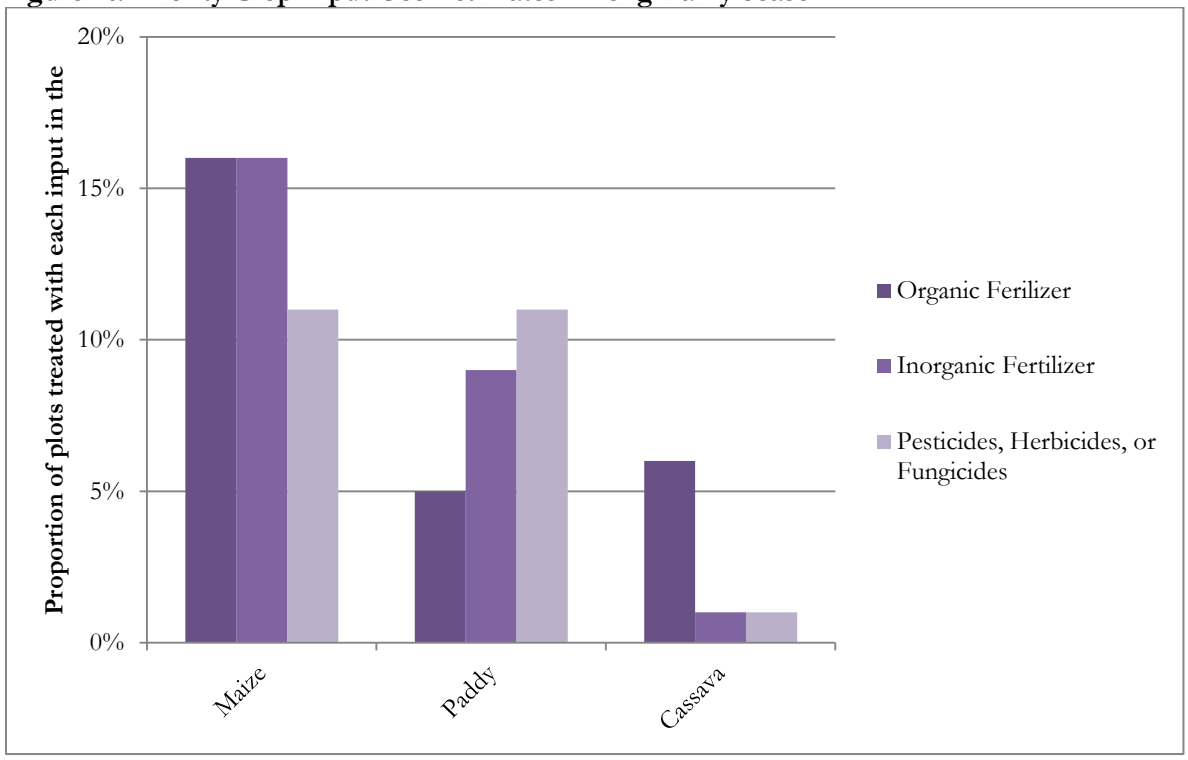
Input Use: by Priority Crops

Figure 14 shows the use of inputs across plots in which the primary crop cultivated was maize (1,607 plots), paddy (487 plots), or cassava (669 plots). Overall, maize plots were most likely to be treated with some kind of input, while cassava plots rarely received any inputs besides organic fertilizer *(What was the main crop cultivated on this plot in the long rainy season 2008?).*

Roughly 16% of maize plots were treated with organic fertilizer during the long rainy season: maize plots were as much as three times more likely to be treated with organic fertilizer than either paddy or cassava plots. Maize plots were also more likely to be treated with inorganic fertilizer (16% of maize plots, versus 9% for paddy and only 1% for cassava plots).

Pesticides, herbicides, and fungicides were almost never used on cassava plots, but 11% of paddy plots and 11% of maize plots were treated with at least one of these inputs during the long rainy season.

Figure 14: **Priority Crop Input Use Estimates – Long Rainy Season**



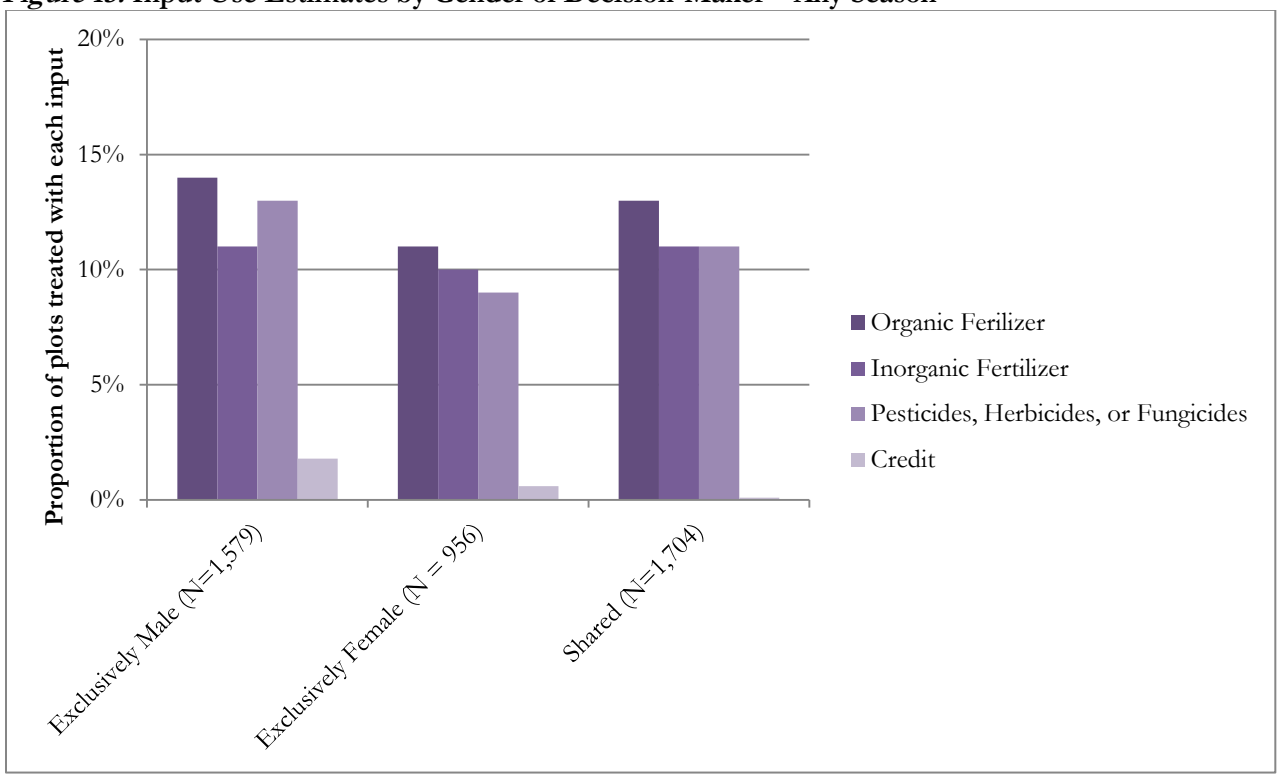
**Questions s3aq5code, s3aq37, s3aq43c& s3aq49*

Appendix E further decomposes input use by season and by priority crop (either as the primary crop cultivated on the plot or simply as a crop on the plot).

Input Use & Decision-Making by Gender

Figure 15 summarizes patterns of input use across plots characterized by male versus female versus shared decision-making *(Who decided what to plant on this plot in the long rainy season?).*

Figure 15: **Input Use Estimates by Gender of Decision-Maker – Any Season**



**Questions s3aq6_1-s3aq6_3, s3bq6_1-s3bq6_3, sbq2, s3aq37, s3bq37, s3aq43, s3bq43, s3aq49, s3bq49, s3aq55& s3bq55*

As shown in *Appendix F,* there were no statistically significant differences in the proportion of plots treated with various inputs across male, female, or shared decision-making structures.

However, as shown in *Table 2*, plots where decision-making was exclusively male were more likely to be treated with at least one kind of input (fertilizer or pesticides, herbicides, or fungicides) than either female or shared decision-making plots and this difference is statistically significant. Some of this difference may arise from differences in crops cultivated by male versus female plot decision-makers.

Table 2: **Proportion of Overall Input Use by Gender of Decision-Maker – Any Season**

Any Input (Fertilizer or Pesticides, Herbicides, or Fungicides)				
	Estimated Proportion	95% C.I.	Observations	Wald Test p-value
Exclusively Male	29%	[25%, 34%]	1,578	0.042
Exclusively Female	23%	[18%, 27%]	956	
Shared	26%	[22%, 30%]	1,704	

Questions s3aq6_1 - s3aq6_3, s3bq6_1- s3bq6_3, sbq2, s3aq37, s3bq37, s3aq43, s3bq43, s3aq49, s3bq49, s3aq55 & s3bq55

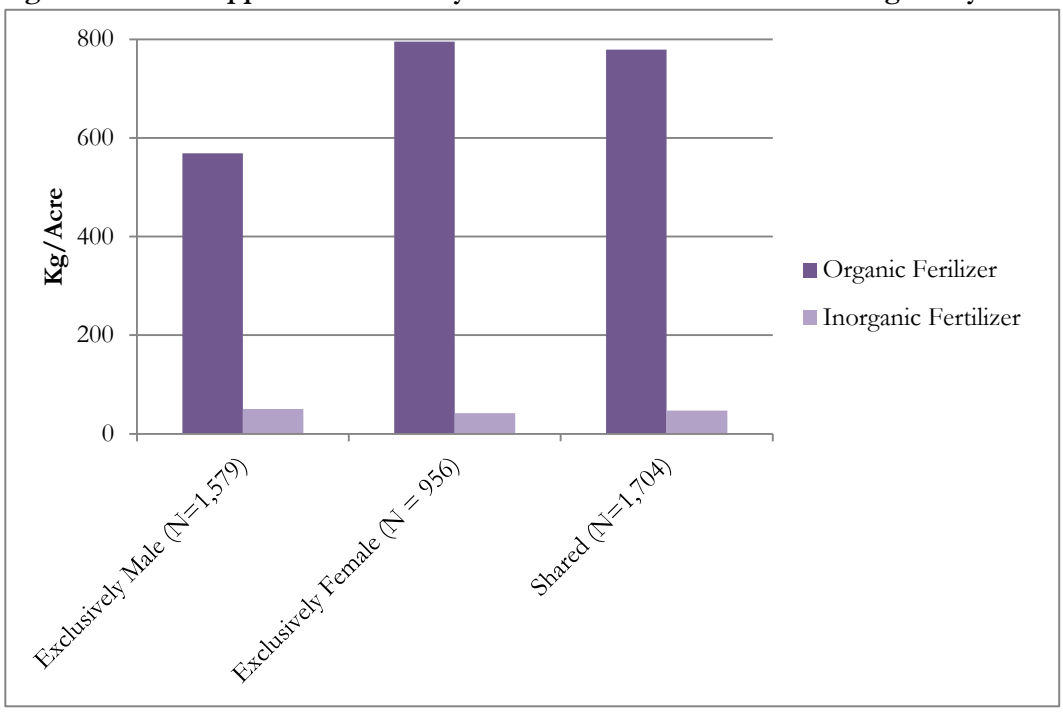
Finally, although the difference is not statistically significant, it appears that plots with male decision-making authority may be more likely to be treated with inputs purchased on credit than female plots (1.8% for male plots versus 0.6% for female plots) though the sample of plots using any credit at all was very small. Meanwhile, shared plots were almost *never* treated with inputs purchased on credit.

Amount of Input Use by Gender of Decision-Maker

Analysis revealed no statistically significant differences at the 95% confidence level in the amount of inputs applied across male versus female versus shared plots.

These results are summarized in *Figure 16* and in greater detail in *Appendix F*.

Figure 16: **Mean Application Rates by Gender of Decision-Maker – Long Rainy Season**



Questions s3aq6_1 - s3aq6_3, s3bq6_1- s3bq6_3, sbq2, s3aq38 & s3aq45

Notably, among plots receiving any organic fertilizer (16% of plots in the sample), male-owned plots were relatively more likely to use purchased organic fertilizer (23% of male-owned plots) followed by female-owned plots (16%). Plots over which decision-making was shared were least likely to use purchased fertilizer (10%).[6]

Additional male-female patterns in input use (by the gender of the household head) are discussed below.

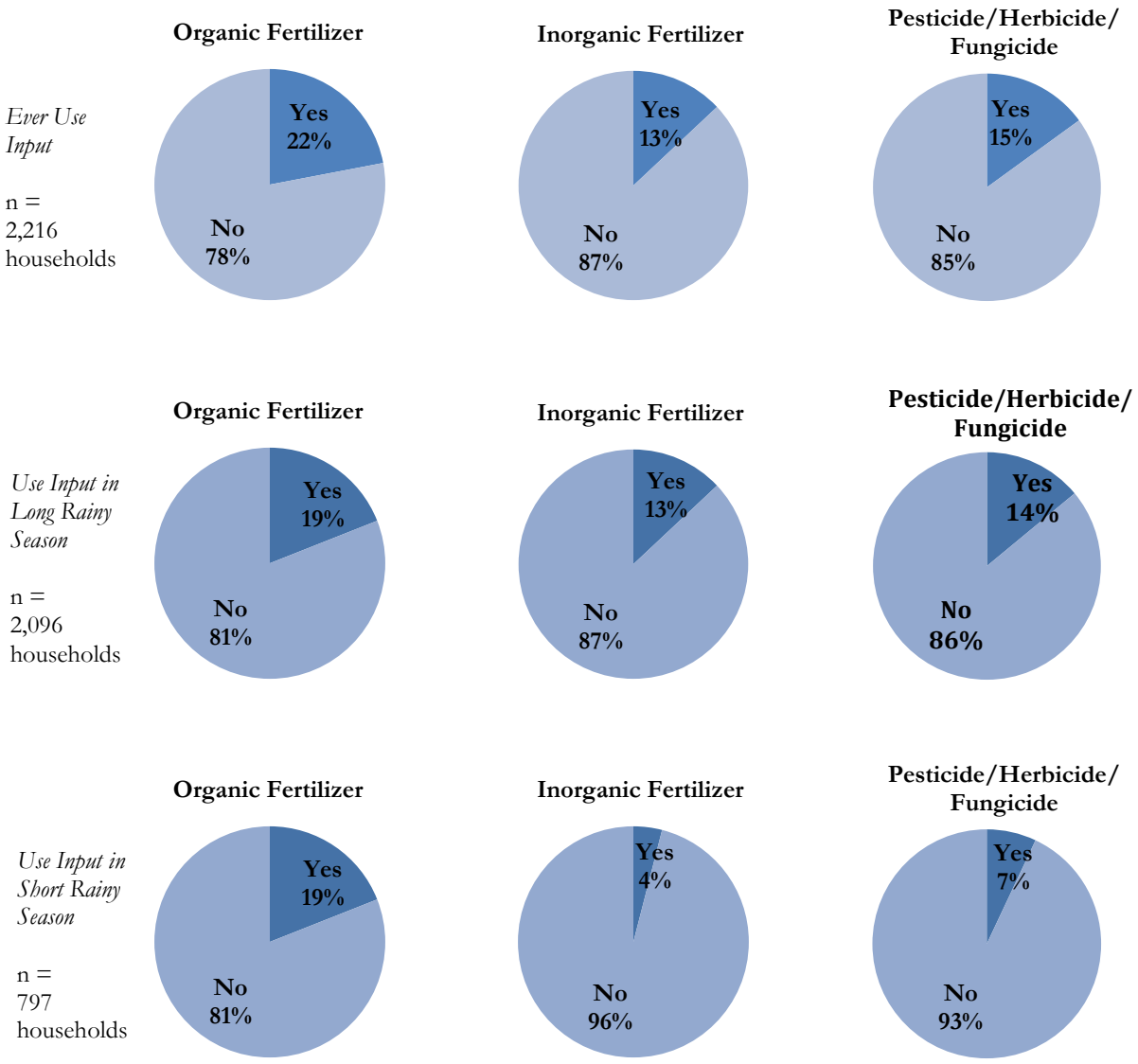
[6] These differences were all significant at the 98% confidence level (p = 0.016).

Input Use: Household Level

A total of 36% of households in the sample used some form of agricultural input (fertilizer, pesticides, herbicides, or fungicides) on at least one plot at some point during one or both rainy seasons in 2008. *Figure 17* summarizes the proportion of agricultural households using any amount of organic fertilizer, inorganic fertilizer, or pesticides/herbicides/fungicides during either the long or short rainy season.

When compared with *Figure 7* (plot-level input use) the results in *Figure 17* suggest that many households use inputs on some, but not all, of their agricultural plots. For example, while 22% of households in the sample used organic fertilizer on at least one plot (*Figure 17*), only 13% of plots in the sample were treated with organic fertilizer (*Figure 7*).

Figure 17: **Agricultural Input Use, Proportion of Households by Season**

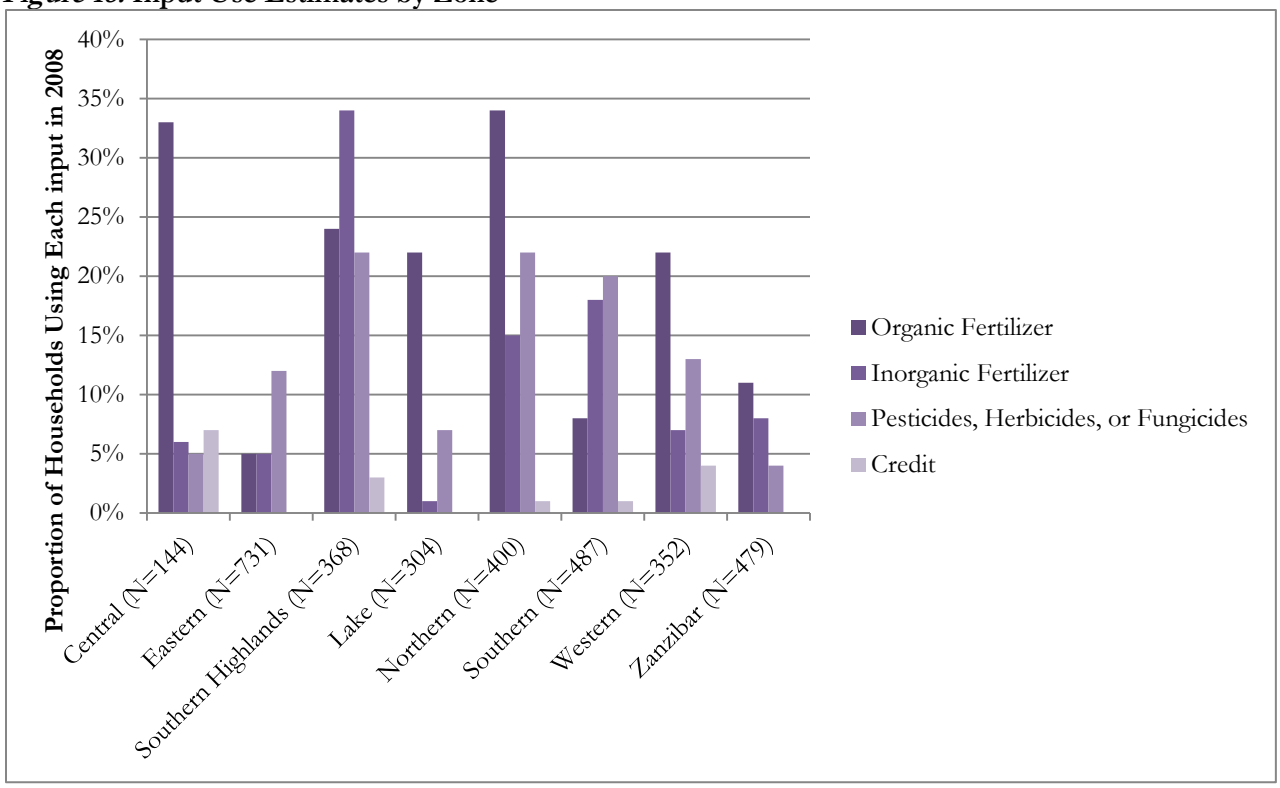


**Questions s3aq37, s3bq37, s3aq43, s3bq43, s3aq49, & s3bq49*

Household Input Use across Zones

As shown in *Figure 18* there was a great deal of variability in input use across different zones. The figure below contrasts use of any inputs (fertilizers, pesticides, herbicides, or fungicides) across zones in Tanzania. The percentage of households using inorganic fertilizer was highest in the Southern Highlands zone, while usage of organic fertilizer by households was highest in the Central and Northern zones.

Figure 18: **Input Use Estimates by Zone**



Note: In the Eastern, Lake and Zanzibar zones there were zero households who reported purchasing inputs on credit.

**Questions strataid, s3aq37, s3bq37, s3aq43, s3bq43, s3aq49, s3bq49, s3aq55c& s3bq55*

Notably, while organic fertilizer was the most common input used in most zones, in the Eastern and Southern zones the use of pesticides/herbicides/fungicides was relatively more common than fertilizer use.[7]

Usage of inorganic fertilizer was driven by three regions: Iringa and Mbeya in the Southern Highlands and Ruvuma in Southern. Inorganic fertilizer was applied to 44% of plots in Iringa and 26% in Mbeya during the long rainy season and 34% of plots in Ruvuma. The only other region with comparable rates was Kilimanjaro, where 23% of plots used inorganic fertilizer.

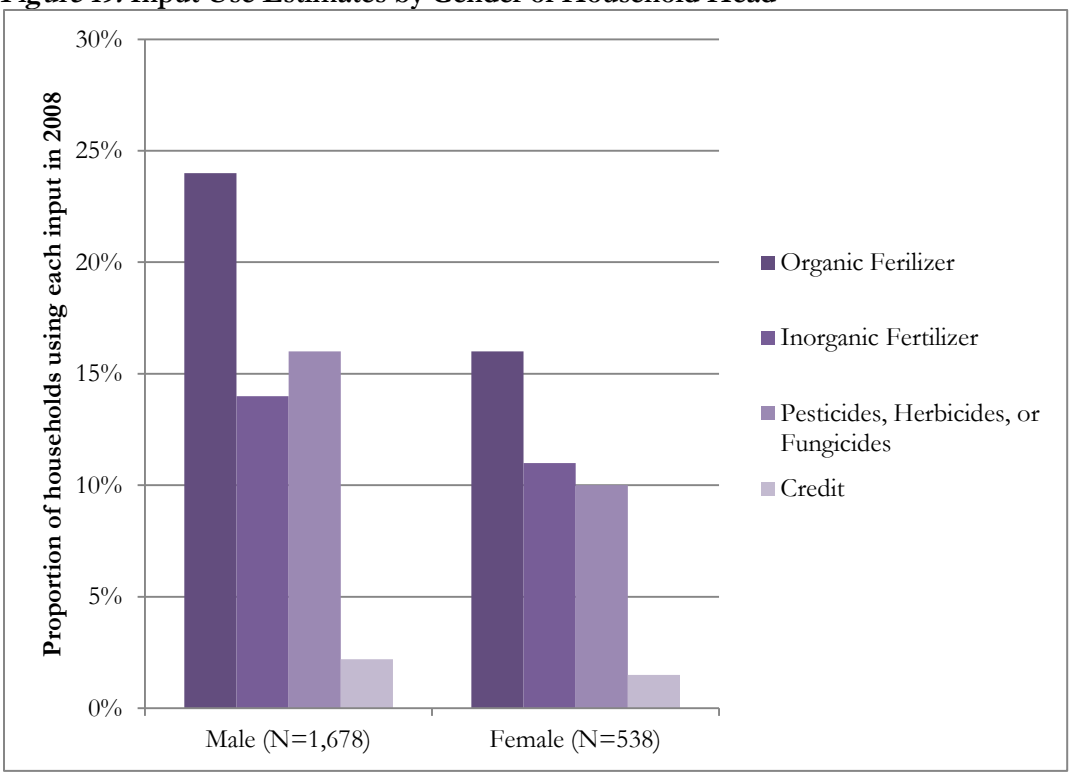
More detailed descriptive statistics including seasonal variation by zone are provided in *Appendix H*.

Household Input Use across Gender of Head-of-Household

Overall male-headed households were significantly more likely to use inputs at some point on at least one plot during 2008. *Figure 19* shows the estimated proportion of male- versus female-headed households using each input. More detailed results by season are provided in *Appendix J*.

[7] Recall that this category primarily reflects herbicide use, with pesticides and fungicides relatively uncommon.

Figure 19: **Input Use Estimates by Gender of Household Head**

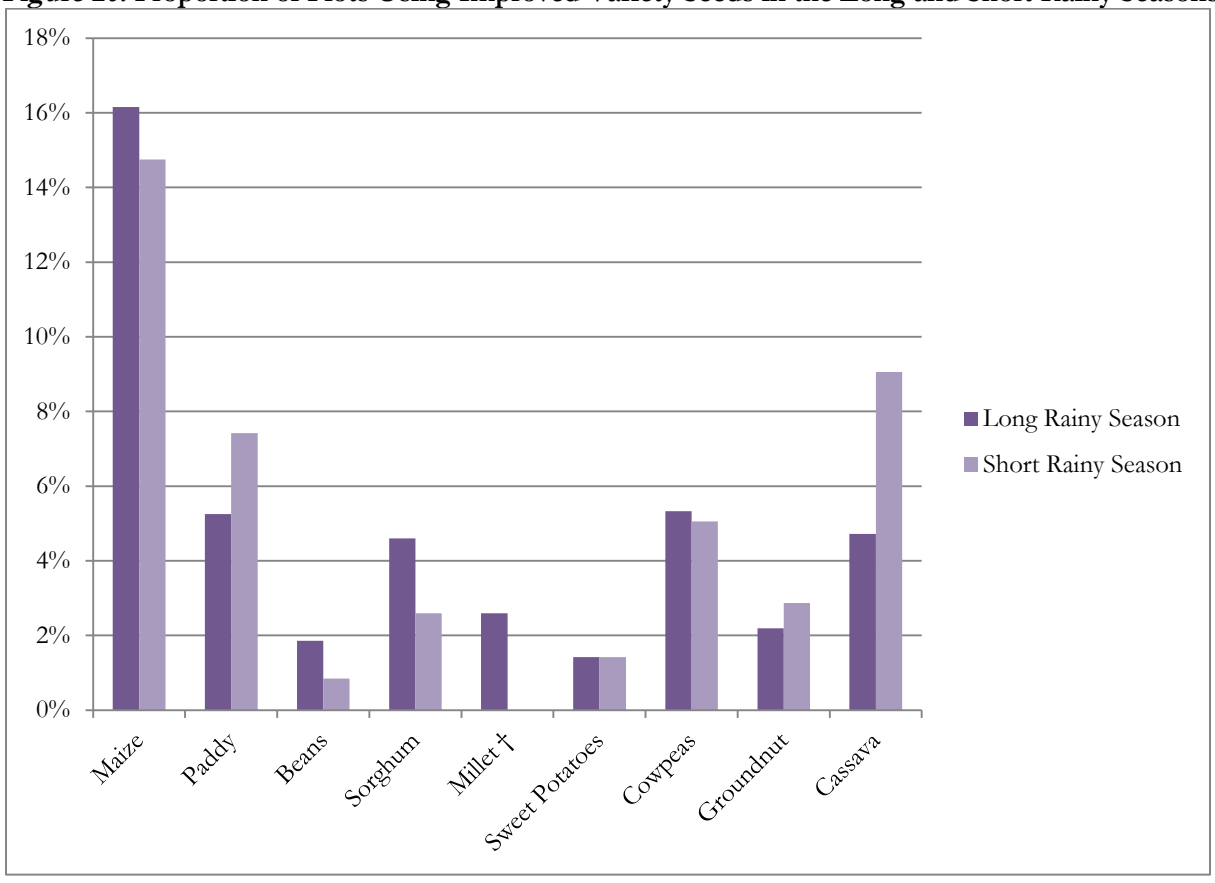


**Questions sbmemno, sbq2, s3aq37, s3bq37, s3aq43, s3bq43, s3aq49, s3bq49, s3aq55, s3bq55*

Improved Variety Seeds

Most plots were planted using traditional seeds as opposed to improved variety seeds (see *Figure 20).* Improved variety seeds were most commonly used for maize, with just over 16% of plots planted with them in the long rainy season and almost 15% in the short rainy season. All other BMGF priority crops were rarely planted with improved variety seeds, with over 94% of plots planted with traditional seeds in the long rainy season *(What type of seed did you purchase?).* About 88% of farmers who used improved variety maize seeds used certified seeds, while the remaining 12% used quality declared in the long rainy season *(What type of seed did you purchase? Options: certified, quality declared).* See *Appendix K* for descriptive statistics on improved variety seed use at the plot and household level and the types of seeds used for all priority crops in the long and short rainy seasons.

Figure 20: **Proportion of Plots Using Improved Variety Seeds in the Long and Short Rainy Seasons**



† *Insufficient observations to calculate a reliable proportion for millet in the short rainy season and yams in the long and short rainy seasons*

**Questions zaocode, s4aq22 & s4bq22*

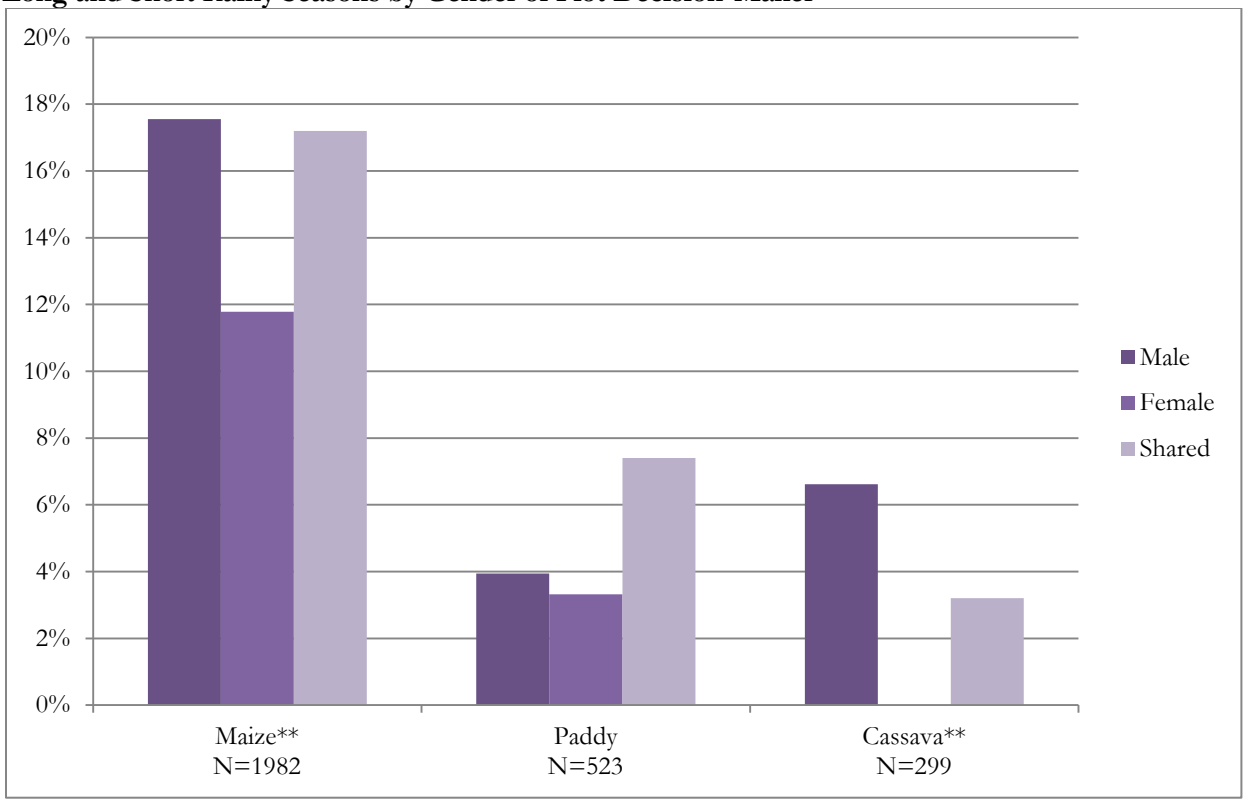
Table 3 shows the proportion of households using improved variety seeds for each of the BMGF priority crops. The proportion of households using improved variety maize seeds in the long rainy season is slightly higher than the proportion of plots planted with improved variety maize seeds, indicating that some households plant some of their plots with traditional maize seeds and some with improved variety seeds.

Table 3: **Proportion of Households Using Improved Variety Seeds – Long Rainy Season**

Crop	Estimated Proportion	95% C.I.	Observations
Maize	18%	[15%, 21%]	235 out of 1393
Paddy	5%	[2%, 8%]	25 out of 435
Beans	2%	[1%, 4%]	11 out of 490
Sorghum	5%	[0%, 10%]	11 out of266
Millet	2%	[-2%, 6%]	2 out of 99
Sweet Potatoes	2%	[0%, 3%]	3 out of 214
Yams	0%	-	0 out of 21
Cowpeas	5%	[1%, 9%]	8 out of 137
Groundnut	2%	[1%, 4%]	10 out of 327
Cassava	4%	[1%, 8%]	9 out of 221

For most crops, plots with female decision-makers were generally less likely to be planted with improved variety seeds than for plots with male or shared decision-makers. As shown in *Figure 21*, less than 12% of maize plots with female decision-makers were planted with improved variety seeds, while over 17% of plots with male or shared decision-makers were planted with improved variety seeds in the long rainy season. There were 0 observations out of 66 cassava plots with female decision-makers that used improved variety seeds, while 12 out of 192 cassava plots with male decision-makers used improved variety seeds.

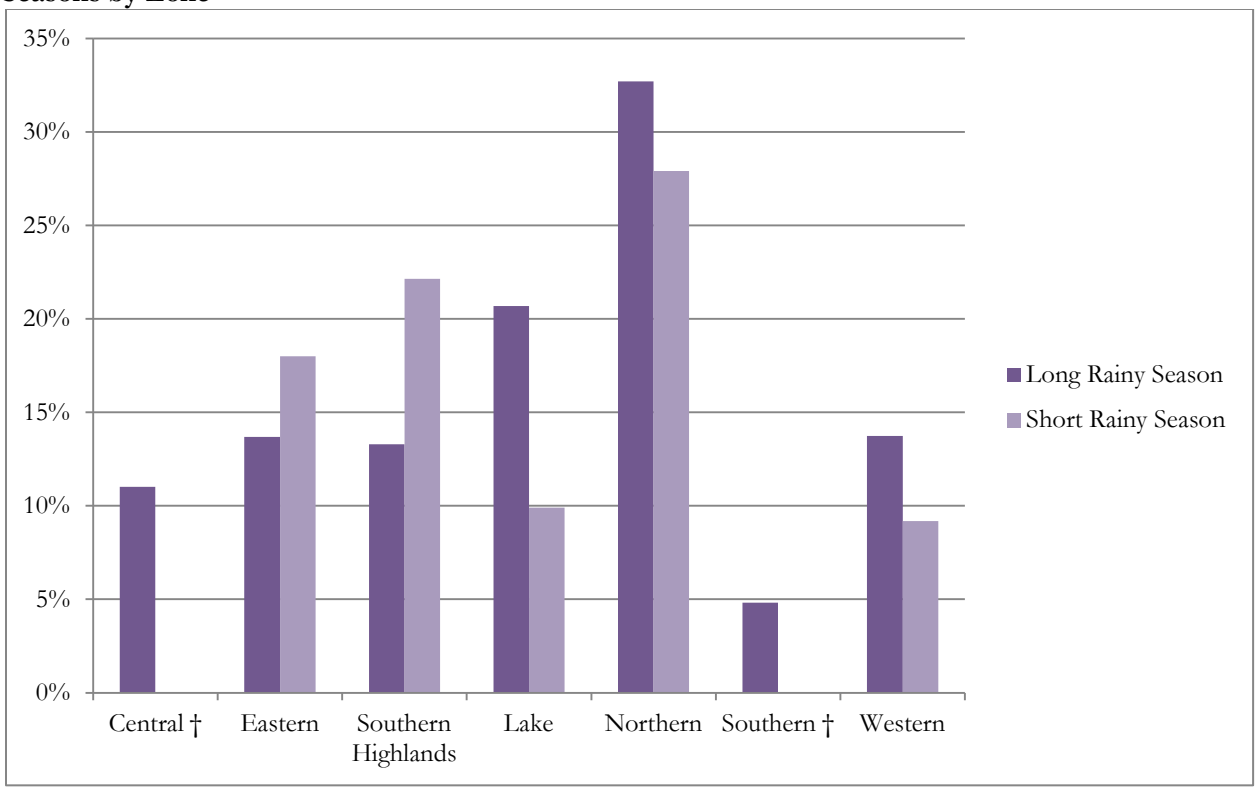
Figure 21: **Proportion of Plots Using Improved Variety Seeds for Maize, Paddy and Cassava in the Long and Short Rainy Seasons by Gender of Plot Decision-Maker**



** Statistically significant at the .10 level*
***Statistically significant at the .05 level*
****Statistically significant at the .01 level*

As shown in *Figure 22,* use of improved variety seeds varied by zone. About a third of maize plots were planted with improved variety seeds in the Northern zone during the long rainy season, while less than 5% of maize plots were planted with these seeds in the Southern zone.

Figure 22: **Proportion of Plots Using Improved Variety Seeds for Maize in the Long and Short Rainy Seasons by Zone**



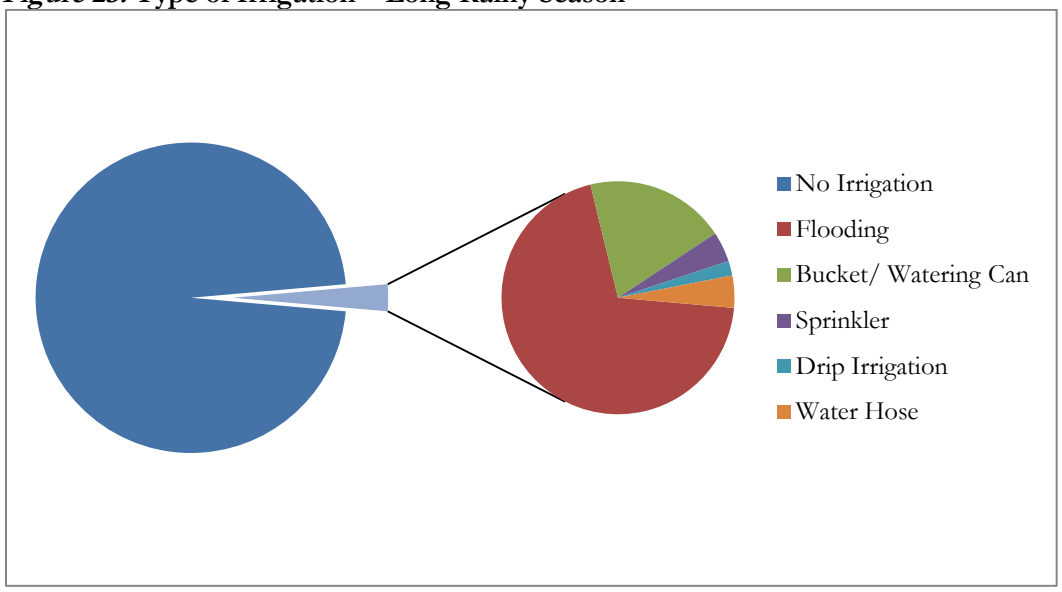
† *Insufficient observations to obtain reliable proportion for the short rainy season. Zanzibar had insufficient observations for both the long and short rainy seasons*

**Questions strataid, s4aq22 & s4bq22*

Water Management

Only 2.8% of plots were reported as having any irrigation during the long rainy season, and 4.4% during the short rainy season. Irrigation was used most frequently in the Northern zone. Of those reporting irrigation during the long rainy season, 70% reported using flooding (*What was the type of irrigation?*).

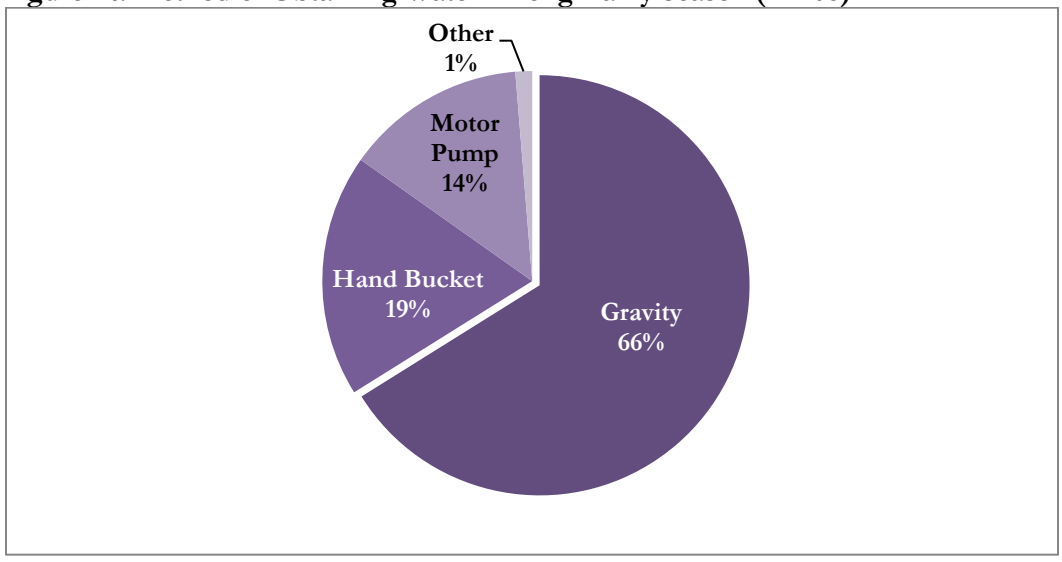
Figure 23: **Type of Irrigation – Long Rainy Season**



**Question s3aq16*

For those plots during the long rainy season that reported using irrigation, *Figure 24* shows the method used to obtain water (*What was the method of obtaining water?*). The majority reported the method as gravity (66%), followed by hand bucket (19%) and water pump (14%).

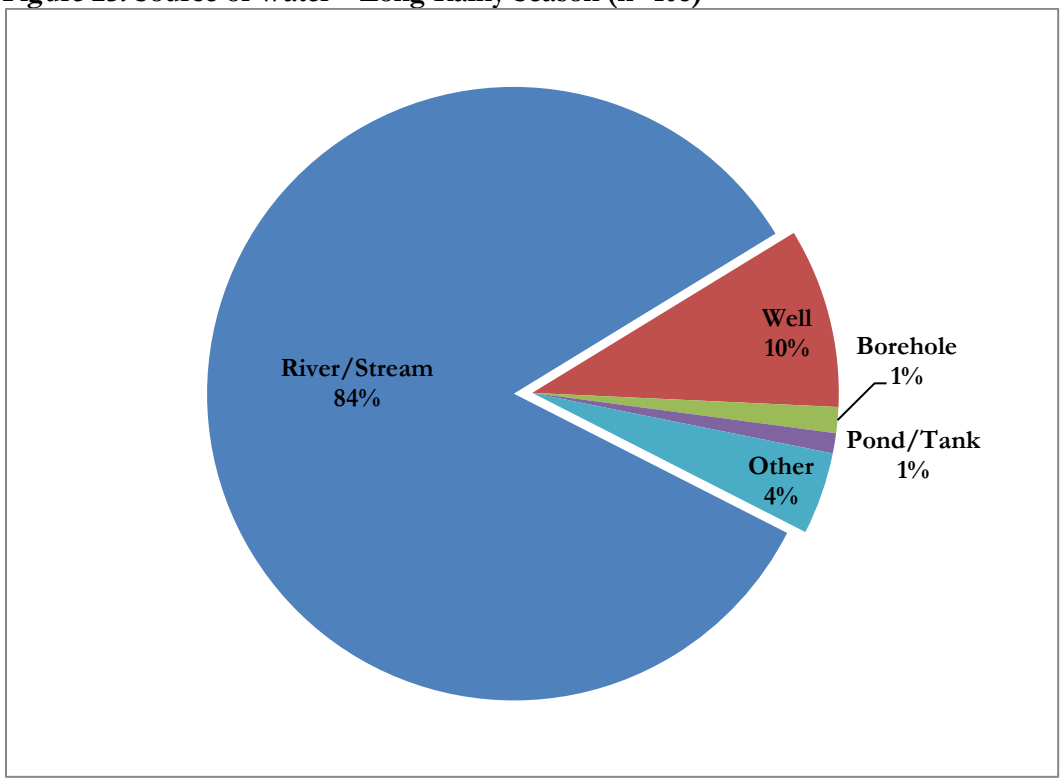
Figure 24: **Method of Obtaining Water – Long Rainy Season (n=108)**



**Question s3aq17*

Similarly, *Figure 25* shows the source of water reported on long rainy season plots using irrigation (*What was the source of water?*). The main source of water reported was river/stream (84%), with wells, boreholes, and ponds/tanks together accounting for just under 12%.

Figure 25: **Source of Water – Long Rainy Season (n=108)**



**Question s3aq18*

Appendix A Soil Characteristics

Long Rainy Season Proportion of Plots: Soil Type (n=4253)			
Soil Type	Proportion	95% C.I.	
Loam	64%		[61, 67]
Sandy	18%		[16, 21]
Clay	16%		[14, 17]
Other	2%		[1, 3]
Short Rainy Season Proportion of Plots: Soil Type (n=84)			
Soil Type	Proportion	95% C.I.	
Loam	55%		[41, 69]
Sandy	22%		[11, 33]
Clay	20%		[9, 32]
Other	2%		[-1, 6]

Long Rainy Season Proportion of Plots: Soil Quality (n=4253)			
Soil Type	Proportion	95% C.I.	
Good	49%		[46, 52]
Average	46%		[43, 48]
Bad	5%		[4, 6]
Short Rainy Season Proportion of Plots: Soil Quality (n=84)			
Soil Type	Proportion	95% C.I.	
Good	34%		[21, 47]
Average	65%		[52, 78]
Bad	1%		[-1, 2]

Long Rainy Season Proportion of Plots: Source of Information on Soil Quality (n=4253)			
Soil Type	Proportion	95% C.I.	
Own Experience	97.5%		[96, 99]
Other	2.1%		[1, 3]
Scientifically Tested	0.4%		[0, 1]
Short Rainy Season Proportion of Plots: Source of Information on Soil Quality (n=84)			
Soil Type	Proportion	95% C.I.	
Own Experience	92.0%		[85, 99]
Other	8.0%		[1, 15]
Scientifically Tested	-		-

Long Rainy Season Proportion of Plots: Slope Steepness (n=4251)		
Slope	Proportion	95% C.I.
Flat Bottom	48%	[44, 51]
Slightly Sloped	37%	[34, 40]
Flat Top	11%	[9, 12]
Very Steep	5%	[3, 6]
Short Rainy Season Proportion of Plots: Slope Steepness (n=84)		
Slope	Proportion	95% C.I.
Flat Bottom	50%	[39, 61]
Slightly Sloped	44%	[34, 54]
Flat Top	5%	[1, 10]
Very Steep	1%	[-1, 4]

Appendix B Soil Management

Proportion of Plots Experiencing Erosion Problems			
Season	Proportion	95% C.I.	Number of Observations
Long Rainy Season	15%	[14, 17]	4252
Short Rainy Season	21%	[13, 29]	84

Long Rainy Season Proportion of Plots Experiencing Erosion Problems (n=555)		
Cause of Erosion	Proportion	95% C.I.
Rain	93.9%	[91, 96]
Animals	3.2%	[1, 5]
Wind	1.8%	[1, 3]
Cultivation does not comply with soil conservation	0.9%	[0, 2]
Other	0.2%	[0, 1]
Short Rainy Season Proportion of Plots Experiencing Erosion Problems (n=17)		
Cause of Erosion	Proportion	95% C.I.
Rain	88.0%	[70, 106]
Animals	6.6%	[-7, 20]
Wind	5.4%	[-6, 17]

Proportion of Plots Implementing Erosion Control			
Season	Proportion	95% C.I.	Number of Observations
Long Rainy Season	19%	[17, 22]	4252
Short Rainy Season	15%	[7, 23]	84

Long Rainy Season Proportion of Plots Implementing Erosion Control (n=660)		
Main Cause of Erosion	Proportion	95% C.I.
Terraces	38%	[31, 45]
Erosion Control Bunds	26%	[20, 31]
Drainage Ditches	17%	[12, 21]
Water Harvest Bunds	10%	[7, 13]
Tree Belts	6%	[3, 8]
Vetiver Grass	4%	[1, 6]
Gabions/Sandbags	1%	[0, 2]
Long Rainy Season Proportion of Plots Implementing Erosion Control (n=660)		
Second Cause of Erosion	Proportion	95% C.I.
Drainage Ditches	12%	[8, 15]
Water Harvest Bunds	6%	[4, 8]
Erosion Control Bunds	4%	[2, 7]
Terraces	3%	[2, 5]
Vetiver Grass	2%	[0, 3]
Gabions/Sandbags	1%	[0, 2]
Tree Belts	1%	[0, 3]
Dams	1%	[0, 2]
Missing	70%	[64, 75]

Short Rainy Season Proportion of Plots Implementing Erosion Control (n=46)		
Cause of Erosion	Proportion	95% C.I.
Drainage Ditches	50%	[19, 81]
Water Harvest Bunds	15%	[-4, 34]
Terraces	10%	[-10, 29]
Tree Belts	9%	[-9, 28]
Vetiver Grass	8%	[-7, 24]
Erosion Control Bunds	7%	[-7, 22]
Short Rainy Season Proportion of Plots Implementing Erosion Control (n=46)		
Second Cause of Erosion	Proportion	95% C.I.
Erosion Control Bunds	11%	[-10, 33]
Drainage Ditches	8%	[-7, 24]
Missing	80%	[57, 104]

Appendix C Comparison of Input Use by Season (Proportion Using Input)

Organic Fertilizer		Estimated Proportion	Amount (kg /acre)	95% C. I.	Observations	Median
Plot Level	Ever	13%		[11%,15%]	540 out of 4607	
	if Yes, Purchased?	*16%*		*[12%,20%]*	*109 out of 540*	
	Long Rainy Season	12%		[10%,14%]	446 out of 4184	
	if Yes, Amount?		*703*	*[521,885]*	446	*278*
	Short Rainy Season	12%		[10%,15%]	179 out of 1406	
	if Yes, Amount?		*1026*	*[615,1438]*	*175*	*300*
Households	Ever	22%		[19%,25%]	431 out of 2216	
	if Yes, Purchased?	*16%*		*[12%,20%]*	*87 out of 431*	
	Long Rainy Season	19%		[17%,22%]	358 out of 2096	
	Short Rainy Season	19%		[15%,22%]	144 out of 797	
Inorganic Fertilizer						
Plot Level	Ever	10%		[8%,12%]	487 out of 4607	
	Long Rainy Season	11%		[8%,13%]	456 out of 4185	
	if Yes, Amount?		*47*	*[41,52]*	456	*33*
	Short Rainy Season	4%		[1%,6%]	59 out of 1406	
	if Yes, Amount?		*65*	*[42, 88]*	58	*40*
Households	Ever	13%		[10%,16%]	305 out of 2216	
	Long Rainy Season	13%		[10%,16%]	287 out of 2096	
	Short Rainy Season	4%		[2%,7%]	40 out of 797	
Pesticide OR Herbicide OR Fungicide						
Plot Level	Ever	11%		[8%,13%]	489 out of 4607	
	If yes, pesticide amount?		*0.83*	*83* *83*		*0.5*
	If yes, herbicide amount?		*3.33*	*329* *326*		*0.4*
	If yes, fungicide amount?		*3.69*	*24* *23*		*4.0*
	Long Rainy Season	11%		[9%,13%]	450 out of 4185	
	Short Rainy Season	5%		[3%, 7%]	68 out of 1406	
Households	Ever	15%		[12%,17%]	329 out of 2216	
	Long Rainy Season	14%		[12%,17%]	301 out of 2096	
	Short Rainy Season	7%		[4%, 10%]	53 out of 797	
Credit (Purchased Inputs on Credit)						
Plot Level	Ever	1%		[1%,2%]	48 out of 4607	
Households	Ever	2%		[1%,3%]	40 out of 2216	

Appendix D Application Rates of Inputs

Input	Season	Mean Application Rate (kg/acre)	Confidence Interval	Median Application Rate (kg/acre)	Observations
Organic Fertilizer	Long Rainy Season [1]	703	[521,885]	278	441
	Short Rainy Season [2]	1,159	[688,1629]	300	176
Inorganic Fertilizer	Long Rainy Season [1]	47	[41,52]	33	451
	Short Rainy Season	83	[43,123]	40	59
Pesticide	Long Rainy Season	0.83	[0.62,1.04]	0.5	83
	Short Rainy Season [3]	-	-	-	-
Herbicide	Long Rainy Season [1]	3.33	[1.80, 4.85]	0.4	326
	Short Rainy Season [3]	-	-	-	-
Fungicide	Long Rainy Season [2]	3.69	[3, 4.4]	4	23
	Short Rainy Season [3]	-	-	-	-

[1] Estimated mean excludes top 1% of observations.
[2] Estimated mean excludes top 2% of observations.
[3] Insufficient observations to calculate short rainy season means for pesticide, herbicide and fungicide application rates.

Appendix E Proportion of Input Use by Crop Cultivated (plot-level)

Maize - Organic Fertilizer		Estimated Proportion	95% Confidence Interval	Observations
Long Rainy Season	Primarily Maize	16%	[13%,18%]	238 out of 1607
	Maize	15%	[12%,17%]	277 out of 2017
Short Rainy Season	Primarily Maize	16%	[12%,20%]	95 out of 566
	Maize	14%	[11%,18%]	117 out of 784
Maize - Inorganic Fertilizer				
Long Rainy Season	Primarily Maize	16%	[12%,20%]	276 out of 1607
	Maize	14%	[10%,17%]	305 out of 2017
Short Rainy Season	Primarily Maize	4%	[1%,6%]	24 out of 566
	Maize	3%	[1%, 4%]	27 out of 784
Maize - Pesticides, Herbicides, Fungicides				
Long Rainy Season	Primarily Maize	11%	[7%,14%]	179 out of 1607
	Maize	11%	[8%,14%]	232 out of 2017
Short Rainy Season	Primarily Maize	4%	[2%,7%]	27 out of 566
	Maize	4%	[2%,6%]	34 out of 784
Paddy - Organic Fertilizer				
Long Rainy Season	Primarily Paddy	5%	[1%,8%]	20 out of 487
	Paddy	5%	[2%,8%]	24 out of 549
Paddy - Inorganic Fertilizer				
Long Rainy Season	Primarily Paddy	9%	[4%,14%]	53 out of 487
	Paddy	9%	[4%,14%]	59 out of 549
Paddy - Pesticides, Herbicides, Fungicides				
Long Rainy Season	Primarily Paddy	11%	[3%,19%]	38 out of 487
	Paddy	11%	[4%,18%]	45 out of 549
Cassava - Organic Fertilizer				
Long Rainy Season	Primarily Cassava	6%	[2%,9%]	26 out of 669
	Cassava	5%	[2%,9%]	26 out of 718
Cassava - Inorganic Fertilizer				
Long Rainy Season	Primarily Cassava	1%	[0%,2%]	10 out of 669
	Cassava	2%	[1%,3%]	13 out of 718
Cassava - Pesticide, Herbicide, Fungicide				
Long Rainy Season	Primarily Cassava	1%	[0%,3%]	9 out of 669
	Cassava	2%	[1%,3%]	16 out of 718

Appendix F Proportion of Input Use by Gender of Decision-Maker (plot-level)

Season	Decision-Making	Input users (percent of subgroup)	95% C.I.	Observations	Wald test P-value
Organic Fertilizer					
Any Season	Exclusively Male	14%	[11%,17%]	1,579	0.254
	Exclusively Female	11%	[8%,14%]	956	
	Shared	13%	[10%, 15%]	1,704	
Long Rainy Season	Exclusively Male	13%	[11%, 16%]	1,562	0.293
	Exclusively Female	11%	[7%, 14%]	934	
	Shared	12%	[10%, 14%]	1,656	
Short Rainy Season	Exclusively Male	16%	-	330	-
	Exclusively Female	10%	-	244	
	Shared	9%	-	491	
Inorganic Fertilizer					
Any Season	Exclusively Male	11%	[8%, 14%]	1,578	0.868
	Exclusively Female	10%	[7%, 14%]	956	
	Shared	11%	[8%, 14%]	1,704	
Long Rainy Season	Exclusively Male	11%	[7%, 14%]	1,563	0.883
	Exclusively Female	10%	[7%, 14%]	934	
	Shared	11%	[8%, 14%]	1,656	
Short Rainy Season	Exclusively Male	4%	-	330	-
	Exclusively Female	4%	-	244	
	Shared	3%	-	491	
Pesticides, Herbicides, or Fungicides					
Any Season	Exclusively Male	13%	[10%, 16%]	1,578	0.102
	Exclusively Female	9%	[6%, 13%]	956	
	Shared	11%	[8%, 13%]	1,704	
Long Rainy Season	Exclusively Male	12%	[9%, 16%]	1,563	0.130
	Exclusively Female	9%	[5%, 12%]	934	
	Shared	11%	[8%, 13%]	1,656	
Short Rainy Season	Exclusively Male	6%	-	330	-
	Exclusively Female	6%	-	244	
	Shared	4%	-	491	

Credit					
Any Season	Exclusively Male	1.8%	[0.8%, 2.8%]	1,578	0.232
	Exclusively Female	0.6%	[-0.2%, 1.5%]	956	
	Shared	0.1%	[0.4%, 2.1%]	1,704	

Appendix G Mean and Median Input Use by Gender of Decision-Maker (plot-level)

Season	Decision-Making	Mean Application Rate (kg/acre)	95% C.I.	Observations	Median Application Rate (kg/acre)
Organic Fertilizer					
Long Rainy Season	Exclusively Male	569	[400, 739]	171	250
	Exclusively Female	795	[410, 1180]	85	400
	Shared	779	[524, 1034]	183	270
Short Rainy Season	Exclusively Male	986	[368,1604]	46	233
	Exclusively Female	1014	[-138,2165]	23	300
	Shared	623	[192,1055]	47	200
Inorganic Fertilizer					
Long Rainy Season	Exclusively Male	50	[40, 59]	150	33
	Exclusively Female	42	[28, 56]	93	33
	Shared	47	[38, 56]	206	40
Short Rainy Season	Exclusively Male	73	[17,128]	15	30
	Exclusively Female	81	[23,140]	13	32
	Shared	49	[27,71]	16	50
Pesticides					
Any Season	Exclusively Male	1.11	[0.69, 1.54]	30	0.80
	Exclusively Female	0.66	[0.27, 1.05]	13	0.50
	Shared	0.69	[0.44, 0.93]	39	0.50
Herbicides					
Any Season	Exclusively Male	4.01	[1.46, 6.56]	138	0.50
	Exclusively Female	3.70	[-1.94,9.34]	53	0.30
	Shared	2.50	[1.41, 3.60]	133	0.38
Fungicides					
Any Season	Exclusively Male	4.76	[1.21, 8.30]	6	4.00
	Exclusively Female	3.58	[3.39, 3.76]	7	4.00
	Shared	3.04	[1.09, 5.00]	10	1.67

Appendix H Comparison of Input Use Across Zones (Proportion of Households Using Input)

Organic Fertilizer	Estimated Proportion	95% C.I.	Observations
Northern	34%	[24%,44%]	114 out of 400
Central	33%	[23%,44%]	44 out of 144
Southern Highlands	24%	[17%,32%]	78 out of 368
Lake	22%	[15%,28%]	52 out of 304
Western	22%	[17%,27%]	66 out of 352
Zanzibar	11%	[6%,16%]	26 out of 479
Southern	8%	[4%,11%]	34 out of 487
Eastern	5%	[2%,7%]	17 out of 731
Inorganic Fertilizer			
Southern Highlands	34%	[24%,43%]	118 out of 368
Southern	18%	[10%,25%]	73 out of 487
Northern	15%	[6%,23%]	46 out of 400
Zanzibar	8%	[4%,12%]	22 out of 479
Western	7%	[3%,12%]	25 out of 352
Central	6%	[-2%,13%]	8 out of 144
Eastern	5%	[0%,11%]	10 out of 731
Lake	1%	[0%,2%]	3 out of 304
Pesticide OR Herbicide OR Fungicide			
Southern Highlands	22%	[14%,29%]	74 out of 368
Northern	22%	[14%,29%]	70 out of 400
Southern	20%	[14%,26%]	88 out of 487
Western	13%	[8%,18%]	43 out of 352
Eastern	12%	[4%,20%]	19 out of 731
Lake	7%	[2%,12%]	18 out of 304
Central	5%	[-1%,12%]	8 out of 144
Zanzibar	4%	[1%,6%]	9 out of 479
Use of Any Input			
Southern Highlands	52%	[42%,62%]	175 out of 368
Northern	45%	[34%,56%]	147 out of 400
Central	38%	[26%,49%]	50 out of 144
Southern	36%	[28%,44%]	157 out of 487
Western	32%	[26%,39%]	103 out of 352
Lake	25%	[18%,32%]	60 out of 304
Zanzibar	19%	[13%,25%]	50 out of 479
Eastern	18%	[10%,25%]	36 out of 731

Purchased Organic Fertilizer			
Zanzibar	62%	[41%,82%]	16 out of 479
Eastern	41%	[12%,70%]	7 out of 731
Southern	41%	[25%,58%]	14 out of 487
Southern Highlands	18%	[9%,28%]	14 out of 368
Western	16%	[7%,26%]	10 out of 352
Northern	13%	[6%,21%]	15 out of 400
Lake	12%	[4%,20%]	7 out of 304
Central	8%	[-2%,18%]	4 out of 144

Inputs Purchased with Credit			
Central	7%	[0%,13%]	9 out of 144
Western	4%	[1%,7%]	14 out of 352
Southern Highlands	3%	[0%,6%]	12 out of 368
Northern	1%	[0%,1%]	2 out of 400
Southern	1%	[0%,1%]	3 out of 487
Eastern	0%	-	0 out of 731
Lake	0%	-	0 out of 304
Zanzibar	0%	-	0 out of 479

Appendix I Proportion of Plots Treated with Inorganic Fertilizer in the Long Rainy Season by Region

Region	Estimated Proportion	95% C.I.	Observations of maize plots using inorganic fertilizer	Observations of maize plots
Dodoma	0%	-	0	95
Arusha	6%	[-6%, 17%]	3	59
Kilimanjaro	23%	[9%, 37%]	27	116
Tanga	2%	[-1%, 4%]	2	117
Morogoro	2%	[-1%, 4%]	2	100
Pwani	3%	[-3%, 9%]	1	39
Dar es Salaam	10%	[-6%, 27%]	2	14
Lindi	0%	-	0	116
Mtwara	6%	[2%, 10%]	11	168
Ruvuma	34%	[17%, 51%]	66	186
Iringa	44%	[29%, 59%]	96	197
Mbeya	26%	[11%, 41%]	62	230
Singida	15%	[-7%, 38%]	7	46
Tabora	12%	[2%, 21%]	13	120
Rukwa	7%	[-2%, 16%]	9	107
Kigoma	3%	[-3%, 8%]	1	32
Shinyanga	3%	[-1%, 6%]	2	78
Kagera	0%	-	0	38
Mwanza	1%	[-1%, 4%]	1	60
Mara	0%	-	0	22
Manyara	0%	-	0	59
North Zanzibar	0%	-	0	3
South Zanzibar	0%	-	0	2
Urban/West Zanzibar	0%	-	0	2
North Pemba	0%	-	0	10
South Pemba	0%	-	0	1

Appendix J Input Use by Gender of Household Head (Proportion of Households Using Input)

Season	Gender of Head of Household	Input Users (percent of subgroup)	95% C.I.	Observations	Wald test P-value
Organic Fertilizer					
Any Season	Male	24%	[21%,27%]	1,678	0.003
	Female	16%	[12%,21%]	538	
Long Rainy Season	Male	21%	[18%, 24%]	1,586	0.006
	Female	14%	[10%, 18%]	510	
Short Rainy Season	Male	20%	[16%,25%]	625	0.019
	Female	13%	[7%,18%]	172	
Inorganic Fertilizer					
Any Season	Male	14%	[11%, 16%]	1,678	0.156
	Female	11%	[7%, 15%]	538	
Long Rainy Season	Male	14%	[11%, 17%]	1,586	0.150
	Female	11%	[7%, 15%]	510	
Short Rainy Season	Male	5%	[2%, 8%]	625	0.110
	Female	2%	[0%, 4%]	172	
Pesticides, Herbicides, or Fungicides					
Any Season	Male	16%	[13%, 19%]	1,678	0.001
	Female	10%	[7%, 13%]	538	
Long Rainy Season	Male	16%	[13%, 18%]	1,586	0.001
	Female	10%	[6%, 13%]	510	
Short Rainy Season	Male	8%	[5%, 11%]	625	0.095
	Female	4%	[1%, 8%]	172	
Any Input					
Any Season	Male	39%	[35%, 43%]	1,678	<0.001
	Female	28%	[23%, 33%]	538	
Credit					
Any Season	Male	2.2%	[1.2%, 3.3%]	1,678	0.417
	Female	1.5%	[0%, 3.1%]	538	

Appendix K Descriptive Statistics: Improved Variety Seeds

Proportion of Plots Planted with Improved Variety Seeds – Long Rainy Season			
Crop	Estimated Proportion	95% C.I.	Observations
Maize	16%	[13%, 19%]	299 out of 1995
Paddy	5%	[2%, 8%]	29 out of 532
Beans	2%	[1%, 3%]	11 out of 609
Sorghum	5%	[0%, 9%]	11 out of 297
Millet	3%	[-2%, 8%]	3 out of 116
Sweet Potatoes	1%	[0%, 3%]	3 out of 225
Yams	0%	-	0 out of 28
Cowpeas	5%	[1%, 9%]	9 out of 147
Groundnut	2%	[1%, 4%]	11 out of 363
Cassava	5%	[1%, 8%]	14 out of 305

Proportion of Plots Planted with Improved Variety Seeds – Short Rainy Season			
	Estimated Proportion	95% C.I.	Observations
Maize	15%	[11%, 19%]	119 out of 780
Paddy	7%	[0%, 15%]	14 out of 76
Beans	1%	[0%, 2%]	3 out of 347
Sorghum	3%	[-3%, 8%]	1 out of 41
Millet	11%	[-10%, 32%]	1 out of 9
Sweet Potatoes	1%	[-1%, 4%]	3 out of 123
Yams	0%	-	0 out of 8
Cowpeas	5%	[-1%, 11%]	4 out of 61
Groundnut	3%	[0%, 6%]	6 out of 147
Cassava	9%	[0%, 18%]	12 out of 82

Proportion of Households Using Improved Variety Seeds - Long Rainy Season			
Crop	Estimated Proportion	95% C.I.	Observations
Maize	18%	[15%, 21%]	235 out of 1393
Paddy	5%	[2%, 8%]	25 out of 435
Beans	2%	[1%, 4%]	11 out of 490
Sorghum	5%	[0%, 10%]	11 out of266
Millet	2%	[-2%, 6%]	2 out of 99
Sweet Potatoes	2%	[0%, 3%]	3 out of 214
Yams	0%	-	0 out of 21
Cowpeas	5%	[1%, 9%]	8 out of 137
Groundnut	2%	[1%, 4%]	10 out of 327
Cassava	4%	[1%, 8%]	9 out of 221

Proportion of Households Using Improved Variety Seeds - Short Rainy Season			
	Estimated Proportion	95% C.I.	Observations
Maize	17%	[13%, 21%]	91 out of 513
Paddy	6%	[0%, 12%]	11 out of 69
Beans	1%	[-1%, 3%]	3 out of 263
Sorghum	3%	[-3%, 8%]	1 out of 38
Millet	11%	[-10%, 32%]	1 out of 9
Sweet Potatoes	2%	[-1%, 4%]	2 out of 106
Yams	0%	-	0 out of 8
Cowpeas	5%	[-1%, 12%]	4 out of 56
Groundnut	4%	[0%, 7%]	6 out of 117
Cassava	7%	[0%, 13%]	8 out of 67

Types of Improved Variety Seeds Purchased – Long Rainy Season				
Crop	Type of Seed	Estimated Proportion	95% C.I.	Observations
Maize	Certified	88%	[82%, 93%]	299
	Quality Declared	12%	[7%, 18%]	
Paddy	Certified	49%	[22%, 75%]	29
	Quality Declared	51%	[25%, 78%]	
Beans	Certified	39%	[10%, 67%]	11
	Quality Declared	61%	[33%, 90%]	
Sorghum	Certified	78%	[62%, 95%]	11
	Quality Declared	22%	[5%, 38%]	
Millet	Certified	67%	-	3
	Quality Declared	33%	-	
Sweet Potatoes	Certified	100%	-	3
	Quality Declared	0%	-	
Yams	Certified	-	-	0
	Quality Declared	-	-	
Cowpeas	Certified	93%	[79%, 107%]	9
	Quality Declared	7%	[-7%, 21%]	
Groundnut	Certified	78%	[48%, 107%]	11
	Quality Declared	22%	[-7%, 52%]	
Cassava	Certified	32%	[-7%, 71%]	14
	Quality Declared	68%	[29%, 107%]	

Types of Improved Variety Seeds Purchased – Short Rainy Season				
Crop	Type of Seed	Estimated Proportion	95% C.I.	Observations
Maize	Certified	82%	[71%, 93%]	119
	Quality Declared	18%	[7%, 29%]	
Paddy	Certified	36%	[-1%, 73%]	14
	Quality Declared	64%	[27%, 101%]	
Beans	Certified	100%	-	3
	Quality Declared	0%	-	
Sorghum	Certified	100%	-	1
	Quality Declared	0%	-	
Millet	Certified	100%	-	1
	Quality Declared	0%	-	
Sweet Potatoes	Certified	84%	[45%, 122%]	3
	Quality Declared	16%	[-22%, 55%]	
Yams	Certified	0%	-	0
	Quality Declared	0%	-	
Cowpeas	Certified	87%	[65%, 110%]	4
	Quality Declared	13%	[-10%, 35%]	
Groundnut	Certified	93%	[80%, 107%]	6
	Quality Declared	7%	[-7%, 20%]	
Cassava	Certified	0%	-	12
	Quality Declared	100%	-	

Appendix L Improved Variety Seeds by Gender of Plot Decision-Maker

Proportion of Plots using Improved Variety Seeds by Gender of Plot Decision-Maker					
		Estimated Proportion	95% C.I.	Observations	Wald test P-value
Maize					
Long Rainy Season	Exclusively Male	18%	[13%, 22%]	102 out of 640	0.0481
	Exclusively Female	12%	[8%, 16%]	53 out of 451	
	Shared	17%	[13%, 21%]	141 out of 891	
Short Rainy Season	Exclusively Male	23%	[13%, 32%]	32 out of 128	0.088
	Exclusively Female	13%	[5%, 20%]	18 out of 136	
	Shared	11%	[7%, 16%]	32 out of 280	
Paddy					
Long Rainy Season	Exclusively Male	4%	[1%, 7%]	13 out of 227	0.4507
	Exclusively Female	3%	[0%, 7%]	5 out of 121	
	Shared	7%	[2%, 13%]	11 out of 175	
Short Rainy Season	Exclusively Male	23%	[0%, 45%]	10 out of 19	0.1401
	Exclusively Female	0%	-	0 out of 3	
	Shared	10%	[-5%, 24%]	3 out of 21	
Beans					
Long Rainy Season	Exclusively Male	3%	[0%, 5%]	5 out of 173	0.6265
	Exclusively Female	2%	[-1%, 5%]	2 out of 137	
	Shared	1%	[0%, 3%]	4 out of 296	
Short Rainy Season	Exclusively Male	0%	-	0 out of 49	0.3157
	Exclusively Female	0%	-	0 out of 63	
	Shared	1%	[-1%, 2%]	1 out of 140	
Sorghum					
Long Rainy Season	Exclusively Male	3%	[-1%, 6%]	3 out of 104	0.575
	Exclusively Female	11%	[-4%, 26%]	5 out of 66	
	Shared	3%	[-1%, 6%]	3 out of 121	
Short Rainy Season	Exclusively Male	0%	-	0 out of 3	0.3276
	Exclusively Female	0%	-	0 out of 63	
	Shared	7%	[-7%, 20%]	1 out of 16	
Millet					
Long Rainy Season	Exclusively Male	2%	[-2%, 5%]	1 out of 56	0.5917
	Exclusively Female	0%	-	0 out of 16	
	Shared	5%	[-5%, 16%]	2 out of 39	

Sweet Potatoes					
Long Rainy Season	Exclusively Male	1%	[-1%, 4%]	1 out of 63	0.985
	Exclusively Female	2%	[-2%, 5%]	1 out of 60	
	Shared	1%	[-1%, 4%]	1 out of 99	
Short Rainy Season	Exclusively Male	2%	[-2%, 7%]	2 out of 18	0.3293
	Exclusively Female	0%	-	0 out of 16	
	Shared	0%	-	0 out of 45	
Yams					
Long Rainy Season	Exclusively Male	0%	-	0 out of 15	-
	Exclusively Female	0%	-	0 out of 7	
	Shared	0%	-	0 out of 6	
Cowpeas					
Long Rainy Season	Exclusively Male	3%	[-3%, 9%]	1 out of 42	0.3013
	Exclusively Female	2%	[-1%, 6%]	2 out of 36	
	Shared	8%	[1%, 15%]	6 out of 68	
Short Rainy Season	Exclusively Male	3%	[-3%, 9%]	1 out of 13	0.3356
	Exclusively Female	1%	[-1%, 3%]	1 out of 19	
	Shared	14%	[-3%, 31%]	2 out of 17	
Groundnut					
Long Rainy Season	Exclusively Male	3%	[0%, 5%]	4 out of 128	0.1249
	Exclusively Female	0%	[0%, 1%]	1 out of 92	
	Shared	3%	[0%, 6%]	6 out of 139	
Short Rainy Season	Exclusively Male	7%	[-4%, 18%]	3 out of 24	0.6035
	Exclusively Female	6%	[-5%, 17%]	1 out of 18	
	Shared	2%	[-2%, 6%]	1 out of 49	
Cassava					
Long Rainy Season	Exclusively Male	7%	[1%, 12%]	12 out of 204	0.0333
	Exclusively Female	0%	-	0 out of 66	
	Shared	3%	[-3%, 10%]	1 out of 29	
Short Rainy Season	Exclusively Male	15%	[0%, 31%]	10 out of 52	0.0933
	Exclusively Female	0%	-	0 out of 13	
	Shared	6%	[-6%, 18%]	2 out of 8	

Appendix M Improved Variety Seeds by Zone

Proportion of Plots Using Improved Variety Seeds by Zone – Long Rainy Season			
	Estimated Proportion	95% C.I.	Observations
Maize			
Northern	33%	[24%, 41%]	114 out of 344
Lake	21%	[11%, 30%]	24 out of 119
Eastern	14%	[8%, 19%]	23 out of 152
Western	14%	[8%, 19%]	28 out of 229
Southern Highlands	13%	[7%, 20%]	68 out of 533
Central	11%	[4%, 18%]	16 out of 140
Zanzibar	8%	[-10%, 27%]	1 out of 15
Southern	5%	[2%, 7%]	25 out of 463
Paddy			
Northern	28%	[-3%, 58%]	4 out of 14
Eastern	9%	[0%, 18%]	6 out of 70
Zanzibar	7%	[2%, 12%]	12 out of 189
Lake	5%	[-3%, 13%]	1 out of 22
Southern	5%	[1%, 9%]	6 out of 131
Central	0%	-	0 out of 18
Southern Highlands	0%	-	0 out of 42
Western	0%	-	0 out of 46
Beans			
Central	5%	[-1%, 12%]	1 out of 18
Lake	2%	[-1%, 6%]	2 out of 95
Northern	2%	[0%, 5%]	3 out of 136
Western	2%	[-1%, 6%]	2 out of 73
Southern Highlands	1%	[0%, 3%]	3 out of 219
Eastern	0%	-	0 out of 24
Southern	0%	-	0 out of 44
Zanzibar	0%	-	0 out of 0
Sorghum			
Central	8%	[-2%, 18%]	5 out of 75
Western	8%	[-3%, 20%]	2 out of 32
Zanzibar	6%	[-3%, 14%]	1 out of 17
Southern	2%	[0%, 4%]	3 out of 126
Eastern	0%	-	0 out of 5
Southern Highlands	0%	-	0 out of 5
Lake	0%	-	0 out of 27
Northern	0%	-	0 out of 10

Millet			
Central	4%	[-3%, 11%]	3 out of 66
Southern Highlands	0%	-	0 out of 16
Lake	0%	-	0 out of 1
Northern	0%	-	0 out of 5
Southern	0%	-	0 out of 16
Western	0%	-	0 out of 10
Zanzibar	0%	-	0 out of 2
Eastern	-	[0%, 0%]	0 out of 0
Sweet Potatoes			
Central	21%	[-19%, 60%]	1 out of 5
Northern	6%	[-6%, 18%]	1 out of 16
Western	1%	[-1%, 4%]	1 out of 53
Eastern	0%	-	0 out of 13
Southern Highlands	0%	-	0 out of 18
Lake	0%	-	0 out of 74
Southern	0%	-	0 out of 24
Zanzibar	0%	-	0 out of 22
Yams			
Central	0%	-	0 out of 0
Eastern	0%	-	0 out of 1
Southern Highlands	0%	-	0 out of 0
Lake	0%	-	0 out of 1
Northern	0%	-	0 out of 0
Southern	0%	-	0 out of 5
Western	0%	-	0 out of 1
Zanzibar	0%	-	0 out of 20
Cowpeas			
Lake	11%	[0%, 22%]	4 out of 9
Eastern	10%	[-4%, 24%]	3 out of 27
Southern Highlands	9%	[-6%, 24%]	1 out of 13
Southern	8%	[0%, 16%]	4 out of 44
Central	0%	-	0 out of 17
Northern	0%	-	0 out of18
Western	0%	-	0 out of 14
Zanzibar	0%	-	0 out of 5

Groundnut			
Northern	15%	[-14%, 44%]	1 out of 7
Southern	9%	[1%, 17%]	7 out of 71
Central	1%	[-1%, 3%]	1 out of 85
Southern Highlands	1%	[-1%, 4%]	1 out of 82
Western	1%	[-1%, 4%]	1 out of 88
Eastern	0%	-	0 out of 5
Lake	0%	-	0 out of 14
Zanzibar	0%	-	0 out of 11
Cassava			
Western	20%	-	1 out of 5
Zanzibar	5%	[1%, 9%]	12 out of 249
Southern	2%	[-2%, 6%]	1 out of 46
Central	0%	-	0 out of 0
Eastern	0%	-	0 out of 1
Southern Highlands	0%	-	0 out of 1
Lake	0%	-	0 out of 3
Northern	0%	-	0 out of 0

Proportion of Plots Planted with Improved Variety Seeds – Short Rainy Season, (Maize, Paddy and Cassava			
	Estimated Proportion	95% C.I.	Observations
Maize			
Zanzibar	55%	[-14%, 124%]	1 out of 2
Southern	42%	[-26%, 111%]	2 out of 4
Northern	28%	[16%, 39%]	52 out of 193
Southern Highlands	22%	[9%, 36%]	11 out of 49
Eastern	18%	[3%, 33%]	11 out of 45
Lake	10%	[4%, 16%]	19 out of 205
Western	9%	[4%, 14%]	23 out of 282
Central	0%	-	0 out of 0
Paddy			
Zanzibar	81%	[55%, 107%]	10 out of 12
Northern	36%	[18%, 54%]	4 out of 11
Eastern	0%	-	0 out of 7
Southern Highlands	0%	-	0 out of 17
Lake	0%	-	0 out of 28
Western	0%	-	0 out of 17
Central	-	-	0 out of 0
Southern	-	-	0 out of 0
Cassava			
Zanzibar	16%	[2%, 30%]	12 out of 72
Eastern	0%	-	0 out of 1
Southern Highlands	0%	-	0 out of 4
Lake	0%	-	0 out of 2
Northern	0%	-	0 out of 1
Western	0%	-	0 out of 2
Central	-	-	0 out of 0
Southern	-	-	0 out of 0

Appendix N Water Management

Proportion of Plots Using Irrigation			
Season	Proportion	95% C.I.	Number of Observations
Long Rainy Season	3%	[2%, 4%]	4252
Short Rainy Season	4%	[-1%, 9%]	84

Long Rainy Season Proportion of Plots Using Irrigation (n=108)		
Type of Irrigation	Proportion	95% C.I.
Flooding	70%	[61%, 79%]
Bucket/ Watering Can	20%	[9%, 30%]
Sprinkler	4%	[0%, 9%]
Water Hose	4%	[-2%, 11%]
Drip Irrigation	2%	[0%, 4%]
Short Rainy Season Proportion of Plots Using Irrigation (n=6)		
Type of Irrigation	Proportion	95% C.I.
Flooding	77%	[38%, 116%]
Bucket/ Watering Can	17%	[-18%, 53%]
Drip Irrigation	5%	[-7%, 18%]

Long Rainy Season Proportion of Plots: Method of Obtaining Water (n=108)		
Method of Obtaining Water	Proportion	95% C.I.
Gravity	66%	[50%, 82%]
Hand Bucket	19%	[8%, 30%]
Motor Pump	14%	[-1%, 29%]
Other	1%	[-1%, 4%]
Short Rainy Season Proportion of Plots: Method of Obtaining Water (n=6)		
Method of Obtaining Water	Proportion	95% C.I.
Gravity	77%	[38%, 116%]
Hand Bucket	17%	[-18%, 53%]
Other	5%	[-7%, 18%]

Long Rainy Season Proportion of Plots: Source of Water (n=108)		
Source	Proportion	95% C.I.
River/Stream	84%	[75%, 93%]
Well	9%	[3%, 16%]
Borehole	1%	[-1%, 3%]
Pond/Tank	1%	[-1%, 3%]
Other	4%	[-1%, 9%]
Short Rainy Season Proportion of Plots: Source of Water (n=6)		
Source	Proportion	95% C.I.
River/Stream	68%	[37%, 100%]
Other	32%	[0%%, 63%%]