

**LSMS - INTEGRATED SURVEYS ON AGRICULTURE
UNITED REPUBLIC OF TANZANIA: MAIZE APPENDIX**

Professor Leigh Anderson, *Principal Investigator*

Associate Professor Mary Kay Gugerty, *Principal Investigator*

*Katie Stahley, Elysia Slakie, Karina Derksen-Schrock, Mary Kay Gugerty, & C. Leigh Anderson
Prepared for the Agricultural Policy Team of the Bill & Melinda Gates Foundation*



Appendix: LSMS-ISA: Maize

The tables below provide the details for analysis done in EPAR Brief #187, including 95% confidence intervals, the number of observations, and p-values where available.

Table of Contents

Maize Cultivation Frequency 2

Maize Consumption 3

Maize Inputs 4

Pesticides, Herbicides, Fungicides 4

Maize Yields 5

Maize Constraints and Pre-Harvest Losses 7

High and Low Producing Plot Differences 9

Maize Plot Intercropping and Productivity 10

Maize Sales and Value 11

Maize Cultivation Frequency

Estimated Proportion of Agricultural Households Cultivating Maize by Zone (Long and Short Rainy Seasons combined)				
Zone	Estimated Proportion	95% C.I.	Observations	Wald test P-value
Tanzania	83%	[80%, 85%]	1694 of 2298	
Western	95%	[92%, 98%]	304 of 320	<0.0001
Southern Highlands	93%	[89%, 96%]	332 of 343	
Northern	88%	[83%, 93%]	299 of 340	
Lake	80%	[72%, 88%]	199 of 246	
Central	79%	[69%, 89%]	107 of 136	
Southern	74%	[68%, 81%]	332 of 456	
Eastern	69%	[57%, 80%]	121 of 195	
Zanzibar	6%	[0%, 12%]	15 of 262	

Estimated Proportion of Agricultural Households Cultivating Maize by Gender of Household Head (Long Rainy Season)				
Household Head	Estimated Proportion	95% C.I.	Observations	Wald test P-value
Male	82%	[80%, 85%]	1047 of 1740	0.9506
Female	83%	[79%, 86%]	346 of 558	

Maize Consumption

Estimated Proportion of Agricultural Households Reporting Consumption Over Last 7 Days			
Food Item	Estimated Proportion	95% C.I.	Observations (of n= 2474)
Maize (flour)	82%	[79%, 84%]	1,969
Maize (grain)	24%	[21%, 27%]	508
Maize (green, cob)	18%	[15%, 21%]	383

Estimated Proportion of Agricultural Households that Produced a Portion of Priority Foods Consumed Over the Last Seven Days			
Food Item	Estimated Proportion	95% C.I.	Observations
Maize (grain)	63%	[58%, 68%]	316 of 508
Maize (flour)	49%	[46%, 53%]	838 of 1969

Maize Inputs

Estimated Proportion of Maize Plots Planted with Improved Variety Seeds (Long Rainy Season)			
Crop	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	16%	[13%, 19%]	299 of 1995
Short Rainy Season	15%	[11%, 19%]	119 of 780

Estimated Proportion of Maize Plots Planted with Improved Variety Seeds by Zone (Long Rainy Season)			
	Estimated Proportion	95% C.I.	Observations
Northern	33%	[24%, 41%]	114 of 344
Lake	21%	[11%, 30%]	24 of 119
Eastern	14%	[8%, 19%]	23 of 152
Western	14%	[8%, 19%]	28 of 229
Southern Highlands	13%	[7%, 20%]	68 of 533
Central	11%	[4%, 18%]	16 of 140
Zanzibar	8%	[-10%, 27%]	1 of 15
Southern	5%	[2%, 7%]	25 of 463

Estimated Proportion of Input Use on Plots				
		Estimated Proportion	95% Confidence Interval	Observations
Organic Fertilizer				
Long Rainy Season	Primarily Maize	16%	[13%,18%]	238 of 1607
	Maize	15%	[12%,17%]	277 of 2017
Short Rainy Season	Primarily Maize	16%	[12%,20%]	95 of 566
	Maize	14%	[11%,18%]	117 of 784
Inorganic Fertilizer				
Long Rainy Season	Primarily Maize	16%	[12%,20%]	276 of 1607
	Maize	14%	[10%,17%]	305 of 2017
Short Rainy Season	Primarily Maize	4%	[1%,6%]	24 of 566
	Maize	3%	[1%, 4%]	27 of 784
Pesticides, Herbicides, Fungicides				
Long Rainy Season	Primarily Maize	11%	[7%,14%]	179 of 1607
	Maize	11%	[8%,14%]	232 of 2017
Short Rainy Season	Primarily Maize	4%	[2%,7%]	27 of 566
	Maize	4%	[2%,6%]	34 of 784

Maize Yields

Plot Maize Yields by Zone in the Long Rainy Season (Area Harvested)			
Zone	Median Yield (t/ha)	90 th Percntile Yield (t/ha)	Observations
Tanzania	0.66	2.00	1811
Southern Highlands	0.94	2.67	507
Northern	0.74	2.47	287
Western	0.59	1.78	221
Central	0.59	1.48	137
Eastern	0.49	1.78	126
Southern	0.49	1.48	409
Lake	0.41	1.37	110

*Insufficient observations to calculate yields for Zanzibar (less than 30).

Maize Yields for Plots of Male and Female Headed Households (Area Harvested)						
Season	Head of Household	Median Yield (t/ha)	Average Yield (t/ha)	95% C.I.	Observations	Wald test P-value
Long Rainy Season	Male	0.71	0.94	[0.88, 1.01]	1413	0.0553
	Female	0.59	0.84	[0.73, 0.94]	398	
Short Rainy Season	Male	0.49	0.72	[0.63, 0.94]	302	0.0783
	Female	0.36	0.54	[0.36, 0.75]	94	

Maize Yields				
Long Rainy Season				
		Mean Yield (t/ha)	Confidence Interval	Observations
Country	Harvested	0.80		1811
	Planted	0.56		1888
Household	Harvested	0.91	[0.85, 0.96]	1284
	Planted	0.72	[0.67, 0.77]	1324
Plot	Harvested	0.92	[0.86, 0.98]	1811
	Planted	0.75	[0.70, 0.81]	1888
Short Rainy Season				
Country	Harvested	0.60		396
	Planted	0.35		440
Household	Harvested	0.70	[0.59, 0.81]	311
	Planted	0.50	[0.41, 0.60]	339
Plot	Harvested	0.67	[0.58, 0.77]	396
	Planted	0.49	[0.41, 0.57]	440

Average and Median Plot Yields by Input Use (Long Rainy Season)					
	Median Yield (t/ha)	Mean Yield (t/ha)	95% Confidence Interval	Observations	Wald test P-value*
No Fertilizer or IV Seed	0.59	0.80	[0.74, 0.85]	1184	
Organic Fertilizer Only	0.95	1.20	[1.02, 1.37]	153	.0000
Inorganic Fertilizer Only	0.91	1.16	[0.94, 1.38]	167	.0019
IV Seed Only	0.62	0.89	[0.71, 1.07]	145	.3227
Organic Fertilizer and IV Seed	0.49	0.78	[0.51, 1.06]	40	.9291
Inorganic Fertilizer and IV Seed	1.42	1.71	[1.12, 2.30]	55	.0019

*Compared to plots with neither fertilizer nor IV seed in the same sample.

Correlation Between Maize Plot size and Plot Yield for Area Harvested Yield Calculations			
Season	Correlation Coefficient	Significance	Observations
Long Rainy Season	-0.0634	0.007	1809
Short Rainy Season	0.0032	0.95	396

Correlation Between Maize Plot size and Plot Yield for Area Harvested Yield Calculations				
Plot Size	Mean Yield (t/ha)	95% C.I.	Observations	Wald test P-value
< 0.81 acres (2 acres)	0.98	[0.89, 1.07]	959	0.0078
≥0.81 ha	0.84	[0.77, 0.91]	598	

Maize Constraints and Pre-Harvest Losses

Estimated Proportion of Agricultural Households that Own Farm Implements			
	Estimated Proportion who Own Implement	Mean Number Owned	Observations (of n=2297)
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 & threshing machine	0.0%	-	
Fertilizer distributor	0.0%	-	

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

Estimated Proportion of Maize Plots Not Fully Planted Due to Constraints			
	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	12.3%	[10.2%, 14.4%]	215 of 1770
Short Rainy Season	11.4%	[7.7%, 15.1%]	39 of 368

Constraints Impeding Planting of Entire Plot of Maize Plots that were not Fully Planted, Long Rainy Season			
Causes	Estimated Proportion	95% C.I.	Observations (of n=215)
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

Estimated Proportion of Maize Plots with Area Harvested Less than Area Planted			
	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	30%	[26%, 33%]	522 of 1862
Short Rainy Season	48%	[40%, 55%]	188 of 400

Reasons for Harvesting a Smaller Area of Plot than the Area Planted, Maize (Long Rainy Season)			
Causes	Estimated Proportion	95% C.I.	Observations (of n= 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%	-	

Estimated Proportion of Maize Plots with Pre-Harvest Losses			
	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	34%	[30%, 37%]	656 of 1864
Short Rainy Season	39%	[32%, 45%]	153 of 400

Causes of Pre-Harvest Losses, Maize (Long Rainy Season)			
Causes	Estimated Proportion	95% C.I.	Observations (of n=656)
Animals	50%	[44%, 55%]	330
Theft	25%	[20%, 30%]	160
Insects	18%	[14%, 22%]	116
Other	3%	[2%, 5%]	23
Birds	3%	[2%, 5%]	19
Diseases	1%	[0%, 2%]	8

High and Low Producing Plot Differences

Input Use for Plots Yielding Below and Above the 90 th Percentile, Long Rainy Season					
Input	Plot Yield	Estimated Proportion	95% C.I.	Observations	Wald test P-value
Any Input	< 90 th Percentile	37%	[32%, 41%]	589 of 1625	.0000
	≥ 90 th Percentile	59%	[49%, 70%]	107 of 181	
Any Fertilizer	< 90 th Percentile	24%	[20%, 28%]	388 of 1625	.0000
	≥ 90 th Percentile	49%	[38%, 60%]	89 of 181	
Inorganic Fertilizer	< 90 th Percentile	13%	[10%, 16%]	231 of 1625	.0068
	≥ 90 th Percentile	27%	[16%, 38%]	53 of 181	
Organic Fertilizer	< 90 th Percentile	14%	[11%, 16%]	207 of 1625	.0001
	≥ 90 th Percentile	28%	[21%, 35%]	48 of 181	
IV Seed	< 90 th Percentile	14%	[12%, 17%]	218 of 1630	.0265
	≥ 90 th Percentile	24%	[15%, 33%]	41 of 181	
Pesticide/Herbicide	< 90 th Percentile	9%	[7%, 12%]	162 of 1625	.0021
	≥ 90 th Percentile	22%	[14%, 30%]	42 of 181	

Loam Soil for Plots Yielding Below and Above the 90 th Percentile, Long Rainy Season				
Plot Yield	Estimated Proportion	95% C.I.	Observations	Wald test P-value
< 90 th Percentile	68%	[64%, 71%]	1086 of 1626	.0001
≥ 90 th Percentile	81%	[74%, 88%]	145 of 181	

Average Plot Size for Plots Yielding Below and Above the 90 th Percentile, Long Rainy Season				
Plot Yield	Average Plot Size (ha)	95% C.I.	Observations	Wald test P-value
< 90 th Percentile	1.35	[0.97, 1.73]	1630	.0116
≥ 90 th Percentile	0.83	[0.68, 0.99]	181	

Maize Plot Intercropping and Productivity

Estimated Proportion of Maize Plots Intercropped			
	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	65%	[61%, 68%]	617 of 1864
Short Rainy Season	74%	[68%, 80%]	291 of 400

Reasons for Intercropping Plots (for all crops)			
	Estimated Proportion	95% C.I.	Observations (of n=2733)
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

Maize Yields for Not Intercropped and Intercropped Plots (area harvested)					
Season		Average Yield (t/ha)	95% C.I.	Observations	Wald test P-value
Long Rainy Season	Not Intercropped	1.06	[0.96, 1.17]	581	0.0000
	Intercropped	0.84	[0.78, 0.90]	1230	
Short Rainy Season	Not Intercropped	0.74	[0.60, 0.87]	106	0.2579
	Intercropped	0.65	[0.55, 0.76]	290	

Estimated Proportion of Plots Intercropped by Crop Planted (Long Rainy Season)			
Crop	Estimated Proportion	95% C.I.	Observations
Cowpeas	91%	[86%, 96%]	119 of 129
Beans	84%	[78%, 89%]	92 of 557
Groundnut	72%	[66%, 78%]	254 of 346
Yams	71%	[44%, 99%]	15 of 22
Maize	65%	[61%, 68%]	617 of 1864
Sorghum	63%	[55%, 71%]	185 of 273
Sweet potatoes	62%	[53%, 72%]	130 of 213
Cassava	46%	[36%, 57%]	84 of 207
Millet	45%	[32%, 58%]	51 of 110
Paddy	20%	[14%, 26%]	82 of 502

Maize Land Productivity (Long Rainy Season)				
	Mean Land Productivity (USD/ha)	95% C.I.	Observations	Wald test P-value
Not Intercropped	\$151.82	[\$133.29, \$170.33]	572	0.2169
Intercropped	\$165.51	[\$152.88, \$178.11]	955	

Maize Labor Productivity (Long Rainy Season)				
	Mean Labor Productivity (USD/day)	95% C.I.	Observations	Wald test P-value
Not Intercropped	\$1.72	[\$1.47, \$1.98]	572	0.1122
Intercropped	\$1.94	[\$1.75, \$2.14]	954	

Maize Sales and Value

Estimated Proportion of Households that Sold Priority Crops (Long and Short Rainy Seasons)			
	Estimated Proportion	95% C.I.	Observations
Long Rainy Season	28%	[25%, 31%]	374 out of 1337
Short Rainy Season	17%	[12%, 22%]	55 out of 322

Maize Sales by Zone (Long and Short Rainy Seasons)			
	Estimated Proportion	95% C.I.	Observations
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

Mean Value of Maize Sales by Gender of Household Head (Long Rainy Season)				
Head of Household	Mean (\$US)	95% C.I.	Observations	Wald test P-value
Male	\$96.73	[\$78.21, \$115.25]	305	0.0062
Female	\$55.64	[\$32.62, \$78.66]	69	

Estimated Proportion of Households Selling Maize Produced by Gender of Household Head					
Season	Head of Household	Estimated Proportion	95% C.I.	Observations	Wald test P-value
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	

Estimated Value of Maize as a Estimated Proportion of Seasonal Crops			
Season	Crop	Estimated Proportion of Total Value	Value (millions of \$USD)
Long Rainy Season	Maize	34%	391
	Other	66%	769
Short Rainy Season	Maize	25%	64
	Other	75%	194

Average Price per Kilogram of Sales of Maize				
	Mean (\$USD/Kg)	Median	95% C.I.	Observations
Long Rainy Season	\$0.19	\$0.19	[\$0.18, \$0.21]	373
Short Rainy Season	\$0.17	\$0.18	[\$0.12, \$0.21]	54