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Drying Survey in Kenya: North Rift

AflaSTOP: Storage and Drying For Aflatoxin Prevention

March 2013

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North Rift Drying Survey for AflaSTOP

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I. Executive Summary

AflaSTOP commissioned a survey to investigate maize drying practises in Rift Valley Province (North Rift) amongst 48 farmers in January 2013. The survey was carried out after the long rains harvest in November/December 2012. Information from this survey will help inform the contractor working on developing appropriate drying technology for smallholder farmers the level of effort smallholders are currently undertaking to drying down their crop. PARS (Pan African Research Services Ltd) undertook the field work and AflaSTOP analyzed the data collected. Key findings in this report include the following:

- The majority of households in this survey are male-led with crop production being the main source of income, the median farm size is 4.75 acres, maize and beans are the main crops cultivated.
- After cutting the maize stalks, farmers pile them in the field for around 3 days (often on tarpaulins) before de cobbing and moving the cobs back to the homestead.
- 85% of farmers dry their maize in cob form for a period of time. Generally the cobs are laid for 8 hours per day on tarpaulins ankle deep, turning it 2 - 3 times per day for around 4 days. 58% of the farmers bring the cobs in and out each day.
- 46% of farmers then place their cobs into a crib-like structure where it continues to slowly dry out for approximately 3 weeks.
- 100% of farmers shell their maize by bringing in a paid for mechanical service which takes less than one day to shell over 100 bags per day and includes 6 - 8 sheller laborers, and generally 3 - 4 people on the farm to bag the cobs.
- 88% of farmers then dry the shelled maize again on tarpaulins, ankle deep for 7.5 hours per day, turning it 4 times a day for around 4 days. 69% of farmers bring the grain in at night.
- Most farmers who do not bring their cobs or grains in cover it with an additional tarpaulin.
- 100% of farmers have someone stay with the cobs/pods when they are drying during the day compared to 67% of farmers who stay with the maize grains. The main reasons are to prevent theft, livestock eating it, and to protect it from rain by bringing it in when rain threatens.
- 15 bags of maize can be dried on a tarpaulin, when farmers do not have enough tarpaulins they dry their grain in batches. Tarpaulin ownership per acre is much higher among small farmers than large farmers.
- Farmers judge the maize on the cobs dry when it is hard to bite, and or changes colour. They judge shelled maize is dry by shaking, dropping and listening to the sound as it hits a surface, or biting it.
- The imperative to shell is split between the grain being dry and the need for cash; major cash needs are for inputs and school fees.
- 21% of farmers reported that rain affected their ability to dry the maize in some years. They estimated that less that 10% of their crop suffered some consequence, these consequences being rot, discoloration, and/or mold. The effected grain, for the most part, was fed to livestock.
- Only 35% of farmers had heard of aflatoxin but a majority of those would pay for drying services to reduce loss and aflatoxin at a median cost of 20 KES per bag.

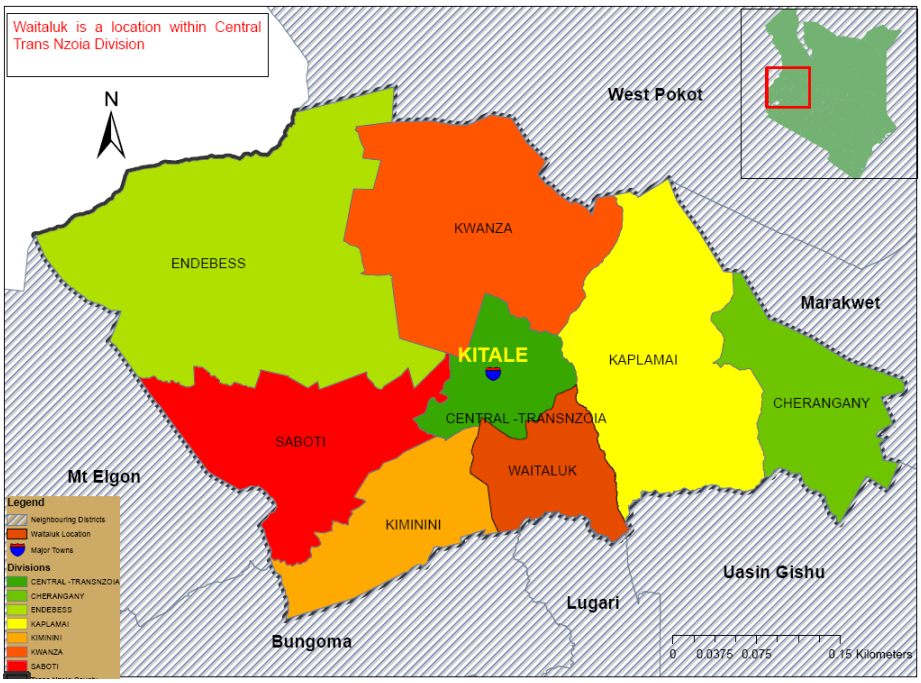
- Farmers used the following mechanical solutions to laborious time consuming work; tractor for ploughing[1]; mechanical sheller to remove maize grain from cob; posho mill to grind maize into flour. They also hired in outside labor to help when family members were not enough to manage the farm labour needs.
- Radio is the best way to pass general information to large numbers of farmers, while mobile phones may offer a more targeted approach.
- Based on farmer attitudes in North Rift, any new drying technology should be first marketed at farmers with small to medium sized plots who are over 36 years age

In summary, farmers spend 8 days actively drying their maize and 6 and a half days drying their beans. The crops are dried by placing the crop ankle deep on a tarpaulin and letting the sun drying it. In North Rift what the farmers consider dry and ready for storage as grain in bags is generally around 15 - 16% moisture (this finding is from KMDP work and was not able to be tested in this survey). However, although the grain goes into the store at levels considered higher than the advised level of maximum 13.5% moisture generally, the grain remains in relatively good condition. Again, other work has found aflatoxin levels in this region are generally low - possibly reflected the colder temperatures in the region.

[1] Surveys from KMDP work in Kenya

II. Respondents' characteristics

The household sample includes 48 households selected from four divisions (Kwanza, Endebess, Central-Trans Nzoia, and Central-Trans Nzoia (Waitaluk).



The map above shows their relative proximity to Kitale town, which is important when considering the age demographics of the respondents. The majority of those in Endebess are over 50 years old, while respondents in Central-Trans Nzoia (Waitaluk) reflect a higher incidence of younger farmers. This may reflect a tendency of younger farmers to locate themselves closer to urban centers.

Age by Division	Endebess	Kwanza	Central – Trans Nzoia	Central-Trans Nzoia (Waitaluk)
15-25 years	10%	0%	10%	**33%**
26-35 years	10%	13%	**29%**	11%
36-50 years	**20%**	**63%**	**29%**	**22%**
Over 50 years	**60%**	**25%**	**33%**	**33%**

The majority of the respondents are male, 28 out of 48 respondents. Crop production (as stated by 94% of the respondents) is the main economic activity of these households.

All respondents are the household head or the spouse of the household head, except for six cases where adult children and a manager were interviewed in place of the household head or spouse of the household head. Out of all 48 households, only 2 had women as the head of household. The maximum household size included 14 people however the median household size was 7 people.

In terms of education, the majority of the respondents (83%) have at least eight years of education, with an equal number of men and women achieving this level of education. Most of the respondents are married (83%) and over one-third (38%) are over 50 years old. That said, age does not appear to be a deciding factor with regard to land utilization, reflecting that older farmers hire labor or use family labor to accomplish the tasks they can no longer do themselves. Although a majority of land is used for crop production, approximately 27 to 19 percent of it appears to be unutilized or used for livestock fodder.

Avg. Land Utilization by Age	
15-25 years	81%
26-35 years	76%
36-50 years	73%
Over 50 years	78%

A tiny proportion or farmers (6%) are members of a farmers group. However, one third of farmers (35%) have heard of aflatoxin

Almost all farmers (90%) see crop production as a business and almost half of the respondents surveyed also rear livestock and sell livestock products to supplement their farm incomes.

RESPONDENT DEMOGRAPHICS	
Number of respondents	48
Household head	52%
Male respondent	58%
Self-employed in crop production	94%
Male household head	92%
Median household size	7
Age: 15-25 years	13%
Age: 26-35 years	19%
Age: 36-50 years	31%
Age: over 50 years	38%
Married	83%
At least 8 years of education	83%
Member of a farmers group	3 farmers (6%)
See crop production as a business	90%
Have heard of aflatoxin	35%

III. Crop Production

Land Ownership

The median farm size is 4.75 acres. More than one-third (40%) are smallholder farmers owning three acres or less. The largest farm surveyed is 45 acres with the smallest being 1.5 acres. In this report, farm sizes are referred to as small, medium, and large as defined in the table below. Age does not seem to be a determinant of the size of farm that a farmer possesses, with a majority of farmers across all three farm sizes being 36 years of age or older.

Farm Size	
Small: 1–3 acres	40%
Medium: 3.25 – 8 acres	42%
Large: 9 – 45 acres	19%

Farm Size by Age group	Small	Medium	Large
15-25 years	16%	11%	11%
26-35 years	21%	16%	22%
36-50 years	**37%**	**21%**	**44%**
Over 50 years	**26%**	**58%**	**22%**

Grain Production

All the farmers surveyed grow maize, 83% grow beans, 6% grow sorghum, and 4% grow millet. Only 3 farmers (6%) dedicate all their land to maize production and do not grow any other crops. The remaining respondents reserve some land for livestock fodder and grazing. Farmers who grow more than one crop practice intercropping, or grow two crops simultaneously on separate parcels of land. All the respondents list themselves as the main person who is involved with drying maize and other crops.

Other Crops and Income Sources

While many of the farmers surveyed grow a variety of grains, vegetables and fruits comprise a significant piece of farmer production and income.[2] Of those surveyed, over eighty percent reported that they did engage in any other income generation activities besides crop production. These respondents indicated that they kept livestock and sold livestock products, such as milk (44%), or owned their own businesses outside the farm (20%) as a way of supplementing their farm income and reducing dependency on income from crop harvests. Of those who kept livestock, 68% were men and an equal number of men and women owned non-farm businesses.

[2] This includes cabbage/sukuma wiki, followed by bananas, and Irish & sweet potatoes.

Farm Size & Crop Production	
Median farm size (acres)	4.75
Range of farm size (acres)	1.5 – 45
All cultivated land dedicated to maize production	21%
Respondent main person who dries maize & other crops	100%
Other major crops: beans/legumes	83%
Supplement farm income with other activities	82%
Ratio of land dedicated to maize production to total acreage	73%

Maize & Bean Productivity

In this survey, farmers differentiated good and bad production seasons by the number of bags they had after harvest. For maize, yields decreased by over one-third on average when comparing a good and bad season, while bean yields decrease by almost two-thirds.

Yield – MAIZE	Maximum	Minimum	Median	% change
Good Season	700 bags	14 bags	41.5 bags	-33%*
Bad Season	450 bags	1 bag	28 bags	
Yield – BEANS	**Maximum**	**Minimum**	**Median**	
Good Season	150 bags	1 bag	4 bags	-63%*
Bad Season	50 bags	0.5 bags	1.5 bags	

*this refers to the % change from a good to bad season for the median farmer

Breaking this down by yield per acre, farms produced a median yield of 1575kg of maize per acre in a good harvest, experiencing a 44% decrease in a bad harvest. Similarly, respondents produced a median yield of 165kg of beans per acre in a good harvest, but only 60kg in a bad harvest, resulting in a 64% decrease.

Yield per acre – MAIZE	Maximum	Minimum	Median	% change
Good Season	3480kg	450kg	1575kg	-44%*
Bad Season	2460kg	90kg	878kg	
Yield per acre – BEANS	**Maximum**	**Minimum**	**Median**	
Good Season	788kg	45kg	165kg	-64%*
Bad Season	225kg	18kg	60kg	

*this refers to the % change from a good to bad season for the median farmer

Looking at yields per acre by farm size, there is a substantial variance between yields of maize in a good harvest, with small to medium-sized farms having a much higher level of productivity than larger ones.

This may reflect that small farmers, who have most likely been trained in some format, plant optimally and harvest optimally. Small and medium sized farms are also keen to care for every grain, larger farms may have to balance the labor costs of recovering every grain versus what they deem an acceptable loss of grain. Furthermore, respondents with large farms are more likely to be mechanized, but mechanization may not give such a degree of efficiency. For example; the plant population and fertilizer delivery may be below par per acre on these larger farms, reducing yields per acre. This poorer level of productivity may also be a consequence of the higher upfront costs in terms of labor, inputs, and machinery for larger farms.

When respondents experience a bad maize harvest, small and large farms are disproportionately affected in comparison to medium-sized farms that experience a lesser decrease in yields. Medium-sized farms seem to have developed an ability to adjust their production habits when faced with a bad growing season, possibly demonstrating better coping mechanisms than their peers. Meanwhile, large farms, which could be presumed to have better access to resources, are actually worse off than small farms.

In both good and bad seasons, bean yields appear to remain around 5 to 13 percent of that of maize, which is significant for the family of the farmer in terms of nutrition and protein, and for income generation. Large farms do better than medium-sized farms in a good harvest, and better than both small and medium-sized farms in a bad harvest.

Yield – MAIZE (kg/acre)	**Median Good Season**	**% change**	**Median Bad Season**	**% change**
Small: 1 – 3 acres	1800	0%^	720	-37%*
Medium: 3.25 – 8 acres	1800		1140	
Large: 9 – 45 acres	1440	-20%^	675	-41%*
Yield – BEANS (kg/acre)	**Median Good Season**		**Median Bad Season**	
Small: 1 – 3 acres	180		45	0%*
Medium: 3.25 – 8 acres	90	-50%^	45	-46%*
Large: 9 – 45 acres	180	+50%^	84	

^ This refers to the % change in a good season between farm sizes

*This refers to the % change in a bad season between farm sizes

IV. Seasons

Overview

There seems to be consensus among the majority of respondents concerning the key determinants of maize planting, which is also referred to as the long rains crop. It is generally agreed among farmers that they begin to prepare the land to plant maize in January to February; they then plant their crop in February to March; the long rains start in March to April; and they later harvest the long rains crops in October to November. However, the data reflects a high degree of uncertainty among respondents when it comes to factors influencing a short rains/2nd season crop.

SEASONS	1	2	3	4	5	6	7	8	9	10	11	12
Long rains start	2%	4%	**29%**	**63%**	0%	0%	0%	1%	0%	0%	0%	0%
Long rains stop	0%	0%	0%	0%	4%	**29%**	**33%**	**10%**	**10%**	8%	2%	2%
Short rains start	0%	2%	6%	2%	0%	0%	**10%**	**48%**	**21%**	4%	4%	2%
Short rains stop	2%	0%	2%	2%	2%	2%	2%	8%	**21%**	**19%**	**29%**	**10%**
Prep land	**47%**	**33%**	**20%**	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plant main crop	0%	**46%**	**50%**	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plant 2nd season*	0%	0%	4%	0%	0%	4%	**11%**	**52%**	**11%**	7%	**11%**	0%
2nd season rains	0%	0%	4%	0%	0%	4%	2%	**56%**	**15%**	8%	8%	2%
Harvest long rains crop	0%	0%	0%	0%	0%	0%	0%	0%	**10%**	**35%**	**46%**	8%
Harvest short rains crop	2%	0%	0%	0%	4%	2%	**13%**	**13%**	2%	0%	6%	**27%**
***only 27 responded**												

Short Rains/2nd Season crop

Although 27 farmers responded in this section with their thoughts about the main seasonal determinants of short rains/2nd season, only 18 of them actually grow a 2nd crop. Isolating the responses of these 18 farmers with regard to the short rains/2nd season planting, there is a similar level of still uncertainly regarding when the short rains start and stop, as well as when the 2nd season crop is planted. Despite this, a majority of these same 18 farmers do agree that the 2nd season rains are in August (72%) and that they harvest the short rains crop in December (65%), which does match the growing season for beans.

SEASONS	1	2	3	4	5	6	7	8	9	10	11	12
Short rains start (18)	0%	6%	6%	0%	0%	0%	17%	44%	11%	11%	6%	0%
Short rains start	0%	2%	6%	2%	0%	0%	10%	48%	21%	4%	4%	2%
Short rains stop (18)	6%	0%	6%	6%	0%	0%	0%	17%	17%	17%	22%	11%
Short rains stop	2%	0%	2%	2%	2%	2%	2%	8%	21%	19%	29%	10%
Plant 2nd Season (18)	0%	0%	0%	0%	0%	0%	**11%**	**56%**	**11%**	**11%**	**11%**	0%
Plant 2nd season*	0%	0%	4%	0%	0%	4%	11%	52%	11%	7%	11%	0%
2nd season rains (18)	0%	0%	0%	0%	0%	6%	6%	**72%**	0%	11%	6%	0%
2nd season rains	0%	0%	4%	0%	0%	4%	2%	56%	15%	8%	8%	2%
Harvest short rains crop (18)	6%	0%	0%	0%	12%	0%	0%	6%	0%	0%	12%	**65%**
Harvest short rains crop	2%	0%	0%	0%	4%	2%	13%	13%	2%	0%	6%	27%

The lack of agreement on seasonal variables also reflects the fact that farmers in North Rift do not have a clear 2nd/short rains season due to the unpredictable rains schedule, which means that those farmers that do plant a 2nd/short rains crop, do so based local conditions which vary every year. That said, age does seem to be a factor among respondents over 50 years old, as these farmers provided answers that fell outside the general consensus of their peers more often, especially with the short rains/2nd season crop. This may indicate that since older farmers have more experience with the erratic nature of a 2nd season/short rains season in North Rift and how unreliable it is, while younger farmers do not as they have been more affected by climate change. In addition, it is important to note that no farmer in the age group from 15-25 years grows a 2nd season crop.

Farm size also seems to be an influencing factor, as small and medium sized farms record more answers outside the dominant months than do larger farms, especially when it comes to the short rains. This is indicative of the wide range of practices in the field when it comes to the 2nd/short rains season and that larger farms may be better able to react quickly to favourable conditions that warrant the planting of a 2nd season/short rains crop than smaller farms.

V. Crop Harvesting in the field

Rainfall & the Cutting of Crops in the Field

While weather patterns fluctuate from season to season, 2012 was wetter and cloudier year for farmers in North Rift compared to 2011. Nevertheless, this does not seem to impact when farmers harvested, as a majority of farmers do not delay cutting maize or beans if it is raining (60% & 75% respectively). This may be a contributing factor to the significant occurrence of spoilage experienced by farms of all sizes, as discussed in Section XII. High levels of rainfall continuing throughout the drying process may exacerbate the higher levels of moisture already present in grain if it was also raining at the time of harvest and may impact the effectiveness of sun drying. The minority of farmers that do delay cutting their maize wait up to 7 days, but only wait up to 2.5 days to cut their beans.

Weather during Harvest	2012	2011
Rain during harvest of maize	69%	42%
- Rained a small number of hours in a day	71%	85%
Rain during harvest of beans	48%	35%
- Rained a small number of hours in a day	74%	79%
Cloudy half the day	48%	27%
Cloudy all day	25%	13%
Sunny half the day	13%	23%
Sunny all day	15%	38%

While not statistically significant, it is interesting to note that 3 farmers (6%) did report that they have sold their maize and bean crops in the field, 2 of these being small farms and 1 a medium sized farm. Two sold their maize in the field to pay for school fees and the other used their maize proceeds to buy fertilizer –all three used their bean crop to pay for school fees.

Harvesting in the Field

After cutting the stalks, almost all farmers (96%) say that they cut their maize stalks and leave them stacked in the field (stooking). They all agree that it is important to stack the maize well to reduce loss, wastage, and rotting, and half say that they stook their maize on tarpaulins in the field. That said, forty-six out of 48 farmers (96%) report that it does rain while the maize is stooking in the field, and over two-thirds (65%) report that maize does fall from the pile when it rains.

Harvesting takes the median farmer 2 days for maize and one for beans. In terms of days per acre, all farm sizes spend the same amount of time per acre, while medium and large farms spend slightly less time per acre harvesting beans. After harvesting, the median farmer leaves their maize to dry in the field stooking for two weeks. Almost all farmers then remove the cob from the stalk in the field in order

to make their harvest easier to carry home to their storage facility. Conversely, a majority of farmers (78%) remove the bean pods from the stalks at home in order to avoid wastage.

Harvesting time	Maximum	Minimum	Median	Median days per acre*
Stalks cut & left in field (weeks)	5	1	2	
Maize – Days spent harvesting	30	1	2	
Small farm	10	1	1	0.5
Medium farm	30	1	2	0.5
Large farm	30	1	7	0.5
Beans – Days spent harvesting	10	1	1	
Small farm	10	1	1	0.5
Medium farm	7	1	1	0.33
Large farm	7	1	2.5	0.38

*Using median farm size per category

Tarpaulin ownership is important starting at this stage of harvesting - Close to half of farmers (46%) admit that their entire crop does not fit on their tarpaulins. When this happens, 45% say that their dry their crop in bits, while the remainder borrow and/or hire more tarpaulins from their neighbors and friends. However, this may be an unreliable practice, especially when neighbors and friends happen to be harvesting at the same time. Tarpaulin ownership does increase between small farms and medium-sized farms, and again between medium-sized and large farms. Despite this, small farmers have more tarpaulins per acre planted than medium and large farms, indicating a dramatic reduction of equipment available to handle the volumes being produced as farm size increases.

Tarpaulin Ownership	Maximum	Minimum	Median	Per Median Acreage
Overall	17	1	3	
—small farm: 1-3 acres	4	1	3	1.5
—medium farm: 3.25-8 acres	10	1	4	1
—large farm: 9-45 acres	17	4	6	0.40

When using tarpaulins in the field to dry their crop, the median farmer tends to leave the crop to dry for 3 days before moving the crop back to their house to continue the drying process, mainly due to the fact that it is easier to look after the maize and family labor is more readily available at home. When the crop is in the field on the tarpaulin, farmers generally do not cover it at night (92%).

Drying in the field & transport	Maximum	Minimum	Median
Days leave crop on tarpaulin to dry in field	14	1	3
Transport cost from field to compound per bag (KES)	70	10	20
Transport cost from field to compound per load (KES)	6000	500	1000

*Using good harvest numbers/farmers who said they have enough tarpaulins

When preparing to transport crops from the field, a bit more than half of farmers bag it in the field (54%) while others transport it loose. A similar amount of farmers transport the crop by truck, while the other half (42%) carry it on their back. Not surprisingly, small and medium-sized farmers are more likely to carry on their backs, as opposed to the majority of large farms (78%) who transport it by truck.

VI. Drying Practices at Home

Drying in cobs/pods

Almost all farmers (85%) dry their crop in cob or pod form at home. Maize and beans are dried in the crib or on tarpaulin mats with no farmers citing use of mechanical driers at this stage in the drying process.[3] Most farmers admit that they do not have enough tarpaulin mats and when this happens they dry their beans first due to spoilage and to the fact that beans are usually harvested earlier. The maize and beans are placed on the mats ankle deep at the center and 84% of farmers turn the crop over during the day. Cobs and pods are dried for a median of 8 hours per day for 4 days and the crop is turned over 2.5 times per day. Those farmers that have enough tarpaulins dry a median of 15 bags of maize per tarpaulin.

Drying in cobs/pods	Maximum	Minimum	Median
Size of lot (# of bags of maize) left on tarpaulin to dry*	75	3.75	15
Time drying (hours per day)	10	6.5	8
Days drying	30	2	4
Times turned over per day (maize)	5	1	2.5
Number people needed to turn over	1	10	4
Times brought in early in 2012 due to rain^	5	1	2
Times not put out in morning in 2012 because it looks like it's going to rain*	6	1	4
Number people help moving in & out	10	2	4

^14 farmers answered

*11 farmers answered

Just over half of farmers (58%) bring their crop that is drying as pods or cobs in each night, and almost all of those that do not bring the crop in cover it with a tarpaulin (85%). Weather does appear to be a factor for all farmers in North Rift, however, respondents in Kwanza division do report more rainfall than other divisions. When it starts to rains farmers stop what they are doing and bring the crop inside with family member help.

Rainfall & Drying of Cobs/Pods	
Times brought in early due to rain^	
ENDEBESS	30%
KWANZA	50%
CENTRAL – TRANS NZOIA	24%
CENTRAL – TRANS NZOIA (WAITALUK)	22%
Times not put out in morning because it looks like it's going to rain*	
ENDEBESS	20%

[3] 1 farmer answered that she dried her millet on a tarpaulin

KWANZA	63%
CENTRAL – TRANS NZOIA	10%
CENTRAL – TRANS NZOIA (WAITALUK)	22%

^14 farmers answered, *11 farmers answered

Crop Security

In general, farmers have four people helping them move the crop in and out of the night time storage point every day. A combination of family members and hired help assist in this activity with the median casual laborer being paid 150KES per day just to move the grain in and out each day – they do not help with any other work on the farm during the day 82% of the time.

Crop Security	
Someone stays with the grain during the day	100%
- To prevent theft	44%
- To prevent livestock from eating	35%
- In case of rain – they are there to cover	6%
What family member stays with the grain?	
- Husband	27%
- Wife	27%
- Daughters	23%
- Sons	13%

Moreover, farmers always have someone stay with the grain during the day to prevent theft and livestock from eating the crop. The person watching the grain is usually the husband or wife, followed by the daughters. After a median amount of 4 days, farmers then begin to check the grain for the below characteristics to see if the crop is dry enough to thresh/shell.

How tell crop is dry enough to thresh/shell	
Shaking the grain	41%
When it is dropped, it makes a cracking noise	20%
When the grain is hard to bite	12%
By use of a moisture meter	7% (3 farmers)

Often farmers will use more than one method to determine whether the grain is ready (shaking combined with dropping).

VII. Crib Details

Crib Ownership & Use

Nearly half (46%) of the farmers surveyed dry their crops in a crib, with small and medium sized farms being more likely to have a crib than large farms. The main crop dried in the crib is maize, followed by beans, and millet. The median crib holds approximately 75 bags and holds the entire harvest most of the time (86%). Those who cannot fit their entire crop in the crib tend to store it elsewhere.

Crib Details	Maximum	Minimum	Median
Capacity (bags)	200	4	75
Time left in crib (weeks)	12	1	3

The median farmer leaves their crop in the crib for approximately 3 weeks and they check on the grain on a weekly basis by touching or looking at it (86%). Very few farmers appear to do any sort of testing of dryness (shaking, dropping cobs) during those checks, however all the farmers surveyed describe how they know the maize is dry with one large farmer citing use of a moisture meter. In addition, 3 farmers answered that they know their beans are dry by when "the pods start to crack, spilling the beans out."

How tell maize is dry enough to come out of crib	
When the grain is hard to bite	27%
When the grain changes color	23%
When it is dropped, it makes a cracking noise	18%
When it's light and comes off the cob easily	18%
When you can't see any wetness on the grains	9%
By use of a moisture meter	5% (1 farmer)

*22 respondents

Crib Cost

Almost all farmers built their cribs themselves with one farmer indicating that he bought his crib. The majority of cribs were more than four years ago (before 2009) and the median farmer spent about 14,000KES on materials and the fundi to build the crib in 7 days.

Crib Cost	Maximum	Minimum	Median
Materials to build(KES)	25,000	4,000	10,000
Fundi cost (KES)	7,000	400	3,500
Time to build(Days)	14	2	7

Removing Crops from Crib

Of the farmers that own a crib, 68% take cobs out every week to eat. They decide to shell the maize that has been in the crib when the grain is completely dry and there is no sign of wetness (32%), when the price of maize goes up (14%), or after a certain period of time. They cite similar reasons as to ***why*** they shell it at this point, with additional answers including the need to buy farm inputs (18%), to pay for school fees (14%), and to reduce chance of spoilage (14%).

VIII. Threshing & Shelling

Threshing & Shelling Process

The median farmer in North Rift who does not store their maize in cob form waits 16 days to shell his/her cobs from the day of harvest to last day of drying the maize cobs at their home. The majority of farmers hire 6 laborers to help them thresh/shell (83%) for 1 day. Nearly all farmers hire labor to help them shell their maize (83%) all at once, while fewer farmers hire help to thresh their beans (48%).

Farm size does influence the amount of labor hired versus family help employed. Small farms are slightly more reliant on household labor than large farms. Conversely, large farms do not have the same pool of family labor to draw upon, so they hire more outside labor than small farms, 10 people versus 5 people.

Threshing & Shelling	Maximum	Minimum	Median
How long before shell, if do not store in cob form (days)	40	1	14
Number of Family who help	8	1	3
—small farm: 1-3 acres	6	1	4
—medium farm: 3.25-8 acres	8	1	2.5
—large farm: 9-45 acres	8	1	3
Number of outside help hired	30	2	6
—small farm: 1-3 acres	8	3	5
—medium farm: 3.25-8 acres	20	2	6
—large farm: 9-45 acres	30	2	10
- Number of labor days hired	90^	1	2
- Rate paid per day (KES)~	250	100	150
- Rate paid per bag (KES)**	60	50	55
Hours to thresh/shell entire crop	16	0.5	4.5
Days to thresh/shell entire crop	7	1	1

^A 40 acre farmer hired 30 people for 3 days, hence 90 days
~37 respondents
**2 farmers answered

In terms of labor, all large farms hire labor to help with threshing and shelling, as opposed to 82% of small farms. Labor also appears to be available most of the time (85%), with those that could not find any labor having to wait 1.5 days. This shows that farmers have more flexibility when threshing and shelling, as opposed to when everyone is harvesting or there is rain and labor is harder to find. Furthermore, all farms seem to take a median of 1 day to thresh/shell their crop which demonstrates that despite the varying levels of labor hired, farmers across the spectrum use the exact amount of labor they need to complete threshing and shelling in the course of one, eight hour day.

Days to thresh/shell entire crop~	Maximum	Minimum	Median
—small farm: 1-3 acres	2	.06 (30 minutes)	1
—medium farm: 3.25-8 acres	3	1	1
—large farm: 9-45 acres	7	0.38 (3 hours)	1

~8 hours used as standard for 1 working day

Finally, almost all farmers state that they shell their maize mechanically, and bean farmers hit the pods with a stick. In order to better understand what farmers meant by "mechanically," several farmers were contacted who detailed that they pay for a shelling machine to be brought to their farms to shell the main "mechanically." Farmers pay 50KES per bag, plus labor costs, which explains the short time recorded for shelling/threshing the entire crop across all farm sizes – 1 day. A more detailed analysis of the costs associated with this will be discussed in Section X.

It is interesting to note that only six farmers knew what a hand sheller was and these farmers estimate that a hand sheller cost anywhere from 50KES to 3000KES. Two-thirds of the farmers who answered were small farmers, but they costed the sheller the lowest, from 50KES to 150KES, while only 1 medium and 1 large farm responded, with the large farmer quoting 3000KES.

IX. Drying After Threshing & Shelling

Drying Grain

After their crop is shelled, 88% of farmers dry maize again on tarpaulin mats (94%) with some farmers drying beans on the ground because they do not have enough tarpaulin mats. Mirroring the data in Sections IV and V, farmers who do not have enough tarpaulins dry their beans first then their maize, since it takes a shorter time to dry, is usually ready first, and to avoid rotting.

Farmers continue to dry their maize and beans ankle deep at the center in grain form and over two-thirds (69%) bring their crop in at night. Those farmers that do not bring the crop in at night are mainly medium and large farms - Only 11% of small farms do not bring their maize in at night. Finally, most of the farmers who do not bring their maize in at night do, however, report covering the grain with tarpaulins.

In terms of time spent drying, maize grain dries for approximately 4 days and beans for 5 days, 7.5 hours per day. From the data, it seems that farms of all sizes generally dry their maize grain for the same amount of time (4 days), however, large farms dry their beans for 1.5 days less than the median small and medium-sized farm. That difference aside, nearly all farmers (96%) turn their grain over during the day approximately 4 times with the help of 4 people.

Drying AFTER threshing & shelling	Maximum	Minimum	Median
Days MAIZE sitting on ground/tarpaulin drying	18	2	4
—small farm: 1-3 acres*	14	3	4
—medium farm: 3.25-8 acres*	18	2	4
—large farm: 9-45 acres*	14	2	4
Days BEANS sitting on ground/tarpaulin drying	14	1	5
—small farm: 1-3 acres*	14	3	5
—medium farm: 3.25-8 acres*	14	1	5
—large farm: 9-45 acres*	7	2	3.5
Time drying per day (hours)	11	5	7.5
Times turned over per day	10	2	4
Number people needed to turn over	1	10	4
Times brought in early due to rain~	6	1	2
Times not put out in morning because it looks like rain`	4	1	2
Number people help moving in/out of store/house	2	12	5
—small farm: 1-3 acres*	8	3	4.5
—medium farm: 3.25-8 acres*	7	2	6
—large farm: 9-45 acres*	12	2	6
Rate outside labor paid per day (KES)	200	100	150

~22 respondents
`16 respondents

Rainfall

Only a minority of farmers report having to return their maize to their store before it had dried long enough due to rain (21%), which implies that while rains delays drying, it does not stop the drying process. Of these farmers, 90% report an effect on the grain, especially respondents with large farms. Nevertheless, most farmers (69%) indicate that they stop what they are doing and bring the crop inside when it starts to rain with a similar number reporting that family members also help with this (67%).

Rain during drying of threshed/shelled grain	
Yes, the grain was effected~	
—small farm: 1-3 acres*	21%
—medium farm: 3.25-8 acres*	15%
—large farm: 9-45 acres*	33%

~10 respondents
* Proportion of farmers within each subgroup

Most put the grain into their store or into their home when it is raining and use the outside labor they have hired to help as well. This hired labor does not do any other work on the farm during the day besides helping move the grain in and out when required, and ensuring the security of the grain. Curiously, this survey found that farmers are more likely to have someone stay with their cobs/pods than with their grain.

Crop Security	**Grain**	**Cob/Pod**
Someone stays with the grain during the day	67%	100%
- To prevent theft	50%	44%
- To prevent livestock from eating	38%	35%
- In case of rain – they are there to cover	8%	6%
Someone stays with the grain		
—small farm: 1-3 acres*	68%	
—medium farm: 3.25-8 acres*	60%	
—large farm: 9-45 acres*	78%	

* Proportion of farmers within each subgroup

Farmers verify that their maize has been dried long enough by shaking it, or dropping it to see if it makes a noise. Likewise, for beans they drop the grain and bite it to make sure it is hard.

How tell maize is dry	
By shaking the grain	31%
When it is dropped, it makes a cracking noise	25%
Grain is hard when you bite it	23%
By use of a moisture meter	6% (3 farmers)
How tell beans are dry	
When it is dropped, it makes a cracking noise	46%
Grain is hard when you bite it	25%
Put hand in bag	14%

Lastly, only one medium sized farm reported that they had used a mechanical drier. To dry their grain cost 50KES per bag and they had to pay 5000KES to transport the grain to the drier, which was 10KM away. This cost will be discussed in more detail in Section X.

X. Moisture Testing

Farm Size & Crops

Only 10% of the surveyed sample (5 farmers) conducted any mechanical moisture testing on their crop, and the only crop they did this for was maize. Of these 5 farmers, four are large farms with 9 acres or more and one is a small farm. The small farm had their maize tested twice - once after it had been shelled and dried, and once after it came out of the store. The median large farms also had it tested twice, once before going into the store and then again after coming out of the store. The maize of all five respondents had a lower moisture level after the second test than they did after the first test. The moisture level lost during storage was around 1 percent, which is a fairly standard expectation reflected in large scale industrial store operators in similar environmental conditions.

Moisture Testing – MAIZE	Yes	Moisture level
Tested on the field	0%	
Tested before going into crib or store	20%	14.8%
Tested before shelling & drying	0%	
Tested after drying after threshing & shelling	60%	13.50 – 14.60%
Tested before putting into store	60%	13.50 – 14.50%
Tested after coming out of store	80%	12.50 – 13.40%

A majority of the farms that did ~~do~~ moisture testing are located in Central Trans-Nzoia (60%), which may indicate that the availability of testing services are more widely available in peri-urban areas. Large farmers closer to town may also have a better awareness of the value of moisture testing as opposed to those with farms further away in Endebess division, or they may be more likely to find a buyer in the market who values this testing and will pay a higher price per bag. The median cost for testing was 50kes per bag and this was paid in cash by all farmers.

Moisture Testing	Maximum	Minimum	Median
Cost per bag*	100	25	50

*Only 3 answered

XI. Costs

Types of Labor

With regard to labor used on the farm for crop harvesting, farmers do display a preference for casual laborers and family members when it comes to helping on the farm, using neighbors almost as a last resort. Given that family members are paid in other ways (food, housing, school fees, etc.), it is not surprising that they are the form of labor used most often and that they are often not remunerated for their work in cash (83% of farmers do not pay their family members a daily wage for working on the farm however they are fed, housed and looked after).

Looking at the table below, the median farmer might breakdown the days he/she hires labor in the following way:

2 days for harvesting x 3 family members = 6 days
4 days for drying in cob form x 2 family members = 8 days
1 days for threshing/shelling x 2 family members = 2 days
4 days for drying after threshing/shelling x 1 family member = 4 days
TOTAL = 20 days labor hired for farm activities

Days help/hired for farm activities	% that hire	Maximum	Minimum	Median
Family Members*	81%	178	2	20
Neighbors^	27%	28	3	10
Casual Laborers	90%	120	2	19

*40 respondents, ^13 respondents, ~43 respondents

While some farmers do pay family members a daily wage, it is interesting to note that 2 farmers did indicate that they made an in-kind payment of grain. However, it appears that casual laborers and neighbors are not paid in-kind in North Rift. Overall, the median wage for family members, casual laborers, and neighbors was fairly similar, with neighbors receiving KES 25 less per day.

Rate paid	Max per day (KES)	Max per day (in-kind)	Min per day (KES)	Min per day (in-kind)	Median per day (KES)	Median per day (in-kind)
Family Members^	200	3 bags	100	0.125 (1/8 bag)	150	1.56 bags
Neighbors	300	NA	100	NA	125	NA
Casual Laborers	300	NA	100	NA	150	NA

^Only 8 farmers pay family members in cash or in-kind

Labor Used by Activity

Respondents tend to hire labor to help them with the more tedious and time consuming activities, such as cutting the stalks in the field, removing the cobs/pods from the stalks, and threshing/shelling the crop. That said, the data seems to indicate that they hire less labor for the drying process conducted at home, which probably indicates a higher use of family member labor for moving the grain from the field to the house and for moving the grain in and out to dry. It may also be illustrative of the degree of urgency a farmer feels during the harvesting and drying process – when they need to get something done quickly in order to avoid spoilage – they hire labor.

When do you hire labor?	
To cut stalks in the field	81%
To pile stalks in the field	71%
To remove cobs/pods from stalks	81%
To move grain from field to house/store	58%
To move grain in/out to dry	54%
To shell/thresh crop	81%

With this in mind, cutting stalks in the field and moving the grain from the field to the house attract the highest daily rate, followed by removing cobs/pods from the stalks. Small farms paid the lowest median rate with medium sized farms paying the highest. Large farms, on the other hand, tended to pay less than medium sized farms, which can be attributed to the fact that large farms hire much more labor at once. Their need for a greater amount of labor due to their size increases their outgoing expenses prior to harvest, straining household/farm resources. Thus, large farms may be trying to economize on their labor expenses, while medium farms hire less labor and can possibly afford a higher wage rate or need to offer a better rate to attract labourers away from larger farms.

Labor Costs (KES)^	**Maximum per day per person**	**Minimum per day per person**	**Median per day per PERSON**	**Median per day per ACRE**	**Median per day per BAG**
Cut stalks in the field	200	100	200	500	
—small farm: 1-3 acres*	200	100	100		
—medium farm: 3.25-8 acres*	200	150	**200**	450	
—large farm: 9-45 acres*	200	100	190		
Pile stalks in the field	200	100	150	500	
—small farm: 1-3 acres*	200	100	100	500*	
—medium farm: 3.25-8 acres*	200	150	**200**	500	
—large farm: 9-45 acres*	200	100	165		
Remove cobs/pods from	250	100	175		

stalks					
—small farm: 1-3 acres*	250	100	125		50
—medium farm: 3.25-8 acres*	200	100	**200**		
—large farm: 9-45 acres*	200	100	178		
Move grain from field to house/store	250	100	200		35
—small farm: 1-3 acres*	250	100	100		20*
—medium farm: 3.25-8 acres*	200	100	**200**		50*
—large farm: 9-45 acres*	100~	100~	100~		
Move grain in/out to dry (15 respondents)	200	100	150		
—small farm: 1-3 acres*	200	100	150		
—medium farm: 3.25-8 acres*	200	100	**200**		
—large farm: 9-45 acres*	100*	100*	100*		
Shell/thresh crop	250	100	150		
—small farm: 1-3 acres*	150	100	150		
—medium farm: 3.25-8 acres*	250	100	**180**		
—large farm: 9-45 acres*	200	100	150		

^Due to data quality 15-22 farmers used for this analysis, other responses disqualified
~2 respondents
*1 respondent

Labor Availability

A majority of respondents answered that it is always possible to hire labor (65%). Nevertheless, a third of farmers do have trouble hiring labor at the peak of harvest when there is a higher demand for labor. When they cannot get enough labor to help them harvest, farmers indicate that they have a greater level of wastage due to spoilage and rotting of maize in the field.

Technology Costs by Bag

When asking farmers about what they pay per bag, it appears that there is a maximum price of 60KES per bag per individual technology.[4] While larger farms are more likely to spend their resources on a higher number of these services, especially moisture testing and transport, farms of all sizes are paying for mechanized shelling. Interestingly, only one farmer had used a mechanized drier, but fourteen additional farmers would pay for drying services that reduced their loss and aflatoxins in their maize.

[4] The Storages surveys conducted in North Rift and Eastern indicated that 25% of farmers and about 50% of farmers respectively would be willing to pay 225KES per 90-kg bag for a drying machine service.

Thus, the marketing of any new drying technology should include reference to the resulting reduction in loss and prevention of increasing levels of aflatoxin.

Cost Breakdown	Bags	Labor Cost	Transport Cost	Cost per bag	TOTAL SPENT PER BAG (if using service)
Transport from the field`				20KES per bag	20KES
Moisture Testing~				50KES per bag	50KES
Mechanized Sheller*	56	1576KES	Comes to farm	60KES per bag	88KES
Mechanized Drier^	250		5000KES	50KES per bag	70KES
Drying services to reduce loss & aflatoxins+				20KES per bag	20KES
Make Posho (Ugali flour)				10KES per bag	10KES
AGGREGATE TECHNOLOGY COSTS PER BAG					**257 KES per bag (if all technology used)**

`17 farms, median cost, ~5 farms, median cost, *5 respondents contacted for follow-up, ^1 medium farm responded, +14 respondents

Labor Costs by Bag

From the data below, it appears that small and medium farmers spend similar amounts moving grain and shelling/threshing their crop. In comparison, large farms spend much more on cutting stalks and harvesting, and less on moving grain in and out to dry as compared to their peers. Labor hired to take maize in and out of the store to dry is paid a flat rate to do this - and they do nothing else during the day, therefore a smallholder with limited bags has a higher cost per bag than a farmer with many more bags to be moved in and out each day. This shows that while larger farms may have lower yields per acre, they economize on the total cost of labor they have to pay for, when possible, given their much higher labor demands.[5]

[5] To be taken with a grain of salt, since the data set does not display costs and labor used for entire harvesting process

Labor Cost Breakdown	# Bags*	Cut Stalks	Move grain in/out to dry	Shell/Thresh Crop^	TOTAL SPENT~
Median Small Farm	30				
- Days of labor used by activity		1	4	9	
- Labor cost per day (KES)		100KES	150KES	150KES	
TOTAL COST		**100**	**600**	**1350**	**2050KES**
Median Medium Farm	65				
- Days of labor used by activity		2	3	8.5	
- Labor cost per day (KES)		200	200	180	
TOTAL COST		**400**	**600**	**1530**	**2530KES**
Median Large Farm	250				
- Days of labor used by activity		7	3.5	13	
- Labor cost per day (KES)		190	100	150	
TOTAL COST		**1330**	**350**	**1950**	**3630KES**

*Using good harvest numbers, ^includes family & outside help

~ Data did not say how many people were hired per acre for each activity

XII. Spoilage & Mold

Spoilage

Over three-quarters (79%) farmers reported that they experienced spoilage during periods when there are rains. Of these, a similar level of farmers across all farm sizes reported spoilage with the main indicators of being discoloration, rotting, and a bad smell.

Reported spoilage by farm size	
—small farm: 1-3 acres*	84%
—medium farm: 3.25-8 acres*	75%
—large farm: 9-45 acres*	78%

The data on the number of bags affected by farm size reflects that the median small farm actually had fewer bags affected by spoilage (3) than the median large farm who reported 8.5 bags being affected. Nevertheless, as a percentage of the overall crop, large farms had a negligible portion of their total yield being affected by spoilage, while small and medium sized farms have slightly higher levels of spoilage. This may be due to small and medium sized having poorer quality storage facilities, and utilizing less labor to assist them in the drying process.

Stored crop affected (bags)	Maximum	Minimum	Median	%of total crop*
Overall	61	0.50	4	9.6%
—small farm: 1-3 acres*	6	0.50	3	10%
—medium farm: 3.25-8 acres*	61	1	5	7.7%
—large farm: 9-45 acres*	31	4	8.5	3.4%

*Using good harvest numbers

Rotting, Odor, Discoloration

A similar level of farmers reported problems with rotting, odor, and discoloration of crops (83%), with the main causal factor cited as there being a lot of rain when the maize was piled and being transported back to the store. Despite farmer awareness of the harm that rotting and discoloured maize can cause, which will be discussed in the next section, 90% fed rotten, smelly, and discoloured maize to their livestock, 8% sold it to the local brewer, and curiously, 3% (1 small farmer) buried it in the ground.

Mold

The reported incidence of mold was much lower among respondents (46%) but the main cause of mold cited was rain which made the crops damp. Farms also used the moldy grain as livestock fodder (77%), while the remainder threw it away, used it as fertilizer for the field, or attempted to dry it again in the sun. Most farmers acknowledge that consuming moldy crops is harmful to human health, but almost all of them would feed moldy, discoloured, and smelly grain to animals. Furthermore, 98% would not use their own crop that was moldy and 94% would not use their neighbor's crop if it was moldy.

XIII. Aflatoxin Awareness

Farmer Knowledge

When asking farmers directly about their aflatoxin awareness, only a third of them (35%) had heard of aflatoxin and about one-third (35%) of those answered that aflatoxin is a "poison" found in spoiled maize due to poor storage that could kill you. Despite this, 98% of all farmers were afraid to use wet or discoloured maize, which indicates that although some farmers are not familiar with the formal term, they do believe that eating wet and discoloured maize is bad for them. Almost all the farmers who had heard of aflatoxin did agree that it harmful and named varying attributes associated with the mycotoxin, but only 18% thought that it was a disease of maize or a maize infection. That aside, over half (53%) did answer that the main cause of aflatoxin was poorly dried, wet maize.

Aflatoxin Awareness	
Heard of aflatoxins	
—small farm: 1-3 acres*	42%
—medium farm: 3.25-8 acres*	25%
—large farm: 9-45 acres*	44%
Can cause death	94%
#1 Information source about aflatoxin	Radio/tv/newspaper
Would pay for drying services to avoid loss & aflatoxin	82%
Afraid to use wet/discoloured maize	98%

Out of the 17 farmers who knew of aflatoxin, only 7 (41%) said that they "knew how to tell if their crop was affected by aflatoxin," with the main indicator being if the maize had become "discoloured" by the maize heart turning "black" or grey. However, when prompted with other indicators, wetness and moldiness were also agreed to be the main symptoms of aflatoxin. In actuality, aflatoxin cannot be seen or tasted, but the presence of mold indicates that the grain was stored when it was too wet, which creates a higher level of humidity. Combining this with warm weather creates a more conducive environment for aflatoxin to grow in.

With regard to their crops, 82% of farmers who were aware of aflatoxin would pay for drying services for maize, beans, and sorghum.

Drying – Willingness to pay per bag (KES)	**Maximum**	**Minimum**	**Median**
Overall	100	2	20
—small farm: 1-3 acres	100	20	20
—medium farm: 3.25-8 acres	40	2	20
—large farm: 9-45 acres	50	10	25

*14 respondents

XIV. Information Sources

In the North Rift Valley, information dissemination mainly occurs through the radio, as a negligible portion of farmers are members of farmers groups or are visited by extension workers.

Radio

In the last year, a majority of respondents indicated that they listen to the radio every day or every other day. On the whole, most turn on the radio to hear the news, followed by discussion programs, and music. Almost half of those who listen to the radio (45%) remember getting information on farming practices from the radio in the last year, and 40% reported that this information influenced them ***a lot***. Not surprisingly, respondents also indicated that radio would be the best way for them to learn about a new drying technology, followed by receiving this information on their mobile phone.

Extension Workers

Approximately 77% of all farmers surveyed reported that they had **not** been visited once by extension workers. The few farmers that were visited reported that extension workers stopped by 1 to 3 times per year with the median farmer receiving 1 visit per year. In addition, extension workers also were in touch with 21% of farmers via mobile phone, with the median farmer receiving one phone call per year. Of the few farmers that extension workers did speak with in some format, 60% said that the information they received from them influenced their farming practices, which shows that receiving information from extension workers does have more traction and credibility with farmers than receiving that information over the radio.

With regard to geography, 73% of those visited had farms in Central-Trans Nzoia, which is the division in which Kitale town is located. This indicates that the further you live from Kitale town, the main urban center, the less likely you are to receive a visit from an extension worker. Of those who were visited, large farms were slightly more likely to have extension workers stop by their farm, but this may have to do more with the scope of their influence rather than the farms being larger.

Farmers Groups

Of the 48 farmers surveyed, only 3 (6%) belonged to some kind of a farmers group or network, which reveals a surprisingly low rate of membership among farmers in North Rift. It is important to note that two of the 3 were farms over 25 acres located in Central Trans Nzoia, and only these two farms reported that they discussed new farming practices in this group. Both reported that the information from this group did influence their farming practices but disagreed on the extent to which it had an influence. This data begs the question which was not asked of why farmers about why they are not part of groups, whether active farmer groups exist outside Central Trans Nzoia division, or if farmers are uninterested or do not see the value of membership in such type of groups and had forgone membership?

Information Dissemination Channels	
Via Radio	
Listen to radio every day	69%
- male respondent	52%
- female respondent	48%
Listen to radio & remember getting info on farm practices from the radio	45%
- This information on farming practices influenced them A LOT	40%
Best way to learn about new products	#1 – Radio, #2 – Mobile Phone
Via Extension Workers	
Information from extension workers influences them A LOT	60%
Extension worker visited village at least once	23%
Spoke to extension worker or received information via mobile phone at least once in last year	29%
—small farm: 1-3 acres*	21%
—medium farm: 3.25-8 acres*	25%
—large farm: 9-45 acres*	56%
No village visit and no communication with extension worker	71%
At least one village visit and communication with extension worker at least once	15%

*Proportion of farmers within each subgroup

XV. Scaled Questions

General Attitudes of farmers

As the last part of the survey, farmers were asked a set of questions borrowed from a study funded by the Bill and Melinda Gates Foundation that sought to assess farmers' attitudes in Africa. This information about their wants and motivations was then used to divide the farmers into segments in order to better target those farmers that would be more likely take up new technology and innovations that increased their productivity.

With regard to the farms surveyed in the North Rift, the majority seem to have a positive outlook on farming and believe that there is scope for them to improve their farming practices. Fifty-percent of respondents do not feel trapped, but are proud to be farmers and would be willing to invest in time-saving technology. Most respondents also believe that they were meant to be farmers, which demonstrates the satisfaction they get from farming.

DRYING SURVEY	Disagree Strongly	Disagree Somewhat	Neither Agree or Disagree	Agree Somewhat	Agree Strongly
I would prefer if my children do not end up working as farmers	**69%**	13%	4%	6%	8%
There is no hope for poor farmers to improve	**60%**	15%	13%	8%	4%
If I had a choice I would not be a full-time farmer	**35%**	17%	25%	13%	10%
There is no better investment than farming	**29%**	15%	27%	13%	17%
God meant me to be a farmer/it is my destiny to be a farmer	8%	8%	29%	27%	**27%**
I am proud to be a farmer	4%	0%	17%	29%	**50%**
Any farm method that saves me time is worth paying for	4%	10%	23%	27%	**35%**

Nevertheless, there seems to be some hesitation by 25 – 29% of respondents who are on the fence and seem ambivalent towards farming. This group is unsure if they would remain full-time farmers if they had a choice. They also may think that better investments exist, but are not the type of person who is going to make the effort to seek them out or take the risks required to embark on a new endeavour. Likewise, farming may have been the only career path available to them, which would explain why 29% seemed unsure of their destiny as farmers – they are trying to make the best out of farming, but possibly feel frustrated or mildly trapped. This group of respondents would be slightly less likely to take up new technology as they are not excited about farming.

Age

When reviewing the attitudes of farmers in comparison to their ages, it is generally the farmers over 36 years of age who are happy to be farmers, displaying a hopeful attitude with regard to the future and the prospects of farming for their children. This segment of respondents is more likely to take up new technology that saves them time and would generally be more excited about acquiring new farming skills or techniques.

Despite this, when considering a lifetime of farming behind them farmers over 50, and even some over 36, seem to have similar attitudes to the youngest farmers when it comes to the choice of being a farmer and the investment potential of farming. Perhaps older respondents do regret some of the decisions they made and wish they had had the chance to take up a different profession. It is also possible that older farmers have seen so much wealth accumulated by other non-farmers over the course of their lifetime, while they have experienced the high and lows of agriculture, that they are unsure if farming is really the best investment.

DRYING SURVEY	15-25 years	26-35 years	36-50 years	Over 50 years
I would prefer if my children do not end up working as farmers – Disagree Strongly (69%)	6%	18%	**39%**	**36%**
There is no hope for poor farmers to improve - Disagree Strongly (60%)	7%	24%	**34%**	**34%**
If I had a choice I would not be a full-time farmer - Disagree Strongly (35%)	6%	24%	**35%**	**35%**
If I had a choice I would not be a full-time farmer - Neither Agree or Disagree (25%)	25%	17%	8%	**50%**
There is no better investment than farming - Disagree Strongly (29%)	14%	**36%**	14%	**36%**
There is no better investment than farming - Neither Agree or Disagree (27%)	23%	8%	**46%**	23%
God meant me to be a farmer/it is my destiny to be a farmer – Agree Strongly (27%)	0%	23%	31%	**46%**
God meant me to be a farmer/it is my destiny to be a farmer – Agree Somewhat (27%)	15%	15%	15%	**54%**
God meant me to be a farmer/it is my destiny to be a farmer – Neither Agree or Disagree (29%)	14%	21%	**50%**	14%
I am proud to be a farmer - Agree Strongly (50%)	4%	13%	33%	**50%**
Any farm method that saves me time is worth paying for - Agree Strongly (35%)	6%	18%	41%	35%
Any farm method that saves me time is worth paying for - Agree Somewhat (27%)	15%	23%	31%	31%
Any farm method that saves me time is worth paying for - Neither Agree or Disagree (23%)	18%	18%	18%	**45%**

Farm Size

Lastly, respondents classified as farmers with small farms appear to be more hopeful. They are proud to be farmers and believe it was what they were meant to be. They think farming is a good investment, but are less likely than respondents with medium sized farm to take up technology that saves them time, perhaps due to a lack of resources or due the size of their plots.

In comparison, only 8% of those farmers with large farms agree strongly that they are proud to be farmers and only 21% disagree strongly that there is no better investment than farming. These larger farmers seem less likely to take up time saving technology, compared to medium and small farms, and they are much less passionate about farming. So, surprisingly, it is the smaller farmers who are more optimistic for the future, while farmers with larger holding are more pessimistic.

DRYING SURVEY	Small	Medium	Large
I would prefer if my children do not end up working as farmers – Disagree Strongly (69%)	**45%**	33%	21%
There is no hope for poor farmers to improve - Disagree Strongly (60%)	**55%**	31%	14%
If I had a choice I would not be a full-time farmer - Disagree Strongly (35%)	41%	29%	29%
If I had a choice I would not be a full-time farmer - Neither Agree or Disagree (25%)	42%	42%	17%
There is no better investment than farming - Disagree Strongly (29%)	**57%**	21%	21%
There is no better investment than farming - Neither Agree or Disagree (27%)	23%	46%	31%
God meant me to be a farmer/it is my destiny to be a farmer – Agree Strongly (27%)	**54%**	31%	15%
God meant me to be a farmer/it is my destiny to be a farmer – Agree Somewhat (27%)	**46%**	38%	15%
God meant me to be a farmer/it is my destiny to be a farmer – Neither Agree or Disagree (29%)	14%	**64%**	21%
I am proud to be a farmer - Agree Strongly (50%)	**50%**	42%	8%
Any farm method that saves me time is worth paying for - Agree Strongly (35%)	35%	**41%**	24%
Any farm method that saves me time is worth paying for - Agree Somewhat (27%)	38%	31%	31%
Any farm method that saves me time is worth paying for - Neither Agree or Disagree (23%)	27%	**64%**	9%

Therefore, considering this data on farmer attitudes, it can be suggested that any new drying technology should be marketed at farmers with small to medium sized plots who are over 36 years age.

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