

Seed Traceability Study Report

Program for Africa's Seed System



Ipsos, Kenya. January 26, 2015

Burkina Faso



Ghana



Kenya,



Malawi



Mozambique



Uganda





Acknowledgement

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The report was a culmination of a rigorous data collection and analyzing process, in which all the persons named above and others in the Ipsos fraternity contributed immensely in leadership, coordination and stimulating inspiration, and whom we recognize for their efforts.

We would like to express our deepest appreciation to all those who provided IPSOS the possibility to complete this report. A special gratitude to the PASS program team; Director Joe DeVries, Director of M&E Dr. David Ameyaw, Program Officer Samuel Amanquah, Josephine Njau & Mary Muthama.

We would also like to acknowledge with much appreciation all the breeders from the six countries who participated in this study, who despite their busy schedules gave us time to interview them and permission to use information and the necessary materials to complete the task. We would also like to thank the various regulatory authorities we visited: KEPHIS in Kenya, NARO in Uganda, INERA in Burkina Faso, Chidetse Research Station in Malawi and IIAM in Mozambique.

We wish to acknowledge PASS project partners in these countries for their efforts in directing us to the small holder farmers that they work with in the various regions.

Last but not least, many thanks go to the people who took part in the study (the seed companies, the agro dealers, and the farmers).

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Acronyms

ADP	Agro-Dealer Development Programme
AGRA	Alliance for a Green Revolution in Africa
CBOs	Community Based Organizations
	Distinct Uniformity and Stability Testing
DUS	
EACI	Education for African Crop Improvement, PASS
FBO	Faith Based Organization
FO	Farmer Organizations
FGD	Focus Group Discussion
FIAAC	Fund for the Improvement of and Adoption of African Crops
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
	KARI Seed Unit
KSU	Small holder farmer
SHF	
KIIs	Key Informant Interviews
Ksh	Kenya shillings
MoA	Ministry of Agriculture
PASS	Program for Africa's Seed Systems
SEPA	Seed Production for Africa Initiative
	International Potato Centre
CIP	Non-Governmental Organization
NGO	
KEPHIS	Kenya Plant Health Inspectorate Services
NARO	National Agricultural Research Organization
IIAM	Instituto de InvestigaçãO Agrária de Moçambique
INERA	Institut de l'Environnement et Recherches Agricoles

EXECUTIVE SUMMARY

i. Brief study description and context

Food security in Africa is a major challenge to governments and other development partners. Among other factors, the journey to sustainable food security is determined by such factors as availability of improved seed varieties, farm level management and market access. Africa's food security is very much depended on food production by the small holder farmers. There is therefore need to build capacity to these farmers to produce more through access to improved seed varieties and better agricultural management practices. It is in this context that partners such Alliance for Green Revolution in Africa (AGRA) are operating to revolutionize agriculture in Africa through development of new improved seed varieties.

AGRA's Program for Africa's Seed Systems (PASS) as one of its four core programs has the key objective to improve household food security and income by promoting the development of seed systems that delivers improved, locally-adapted crop varieties to smallholder farmers in an efficient, equitable and sustainable manner.

The Program's objectives are organized in terms of the major results that are expected from each of its four subprograms. The SEPA sub-program helps ensure that improved crop varieties are produced and distributed through private and public channels (including seed companies, publicly-supported seed programs, and public extension) so that farmers can adopt these varieties.

Under phase 1 (2007-2011) of the PASS implementation, \$150 million was invested in 13 sub-Saharan African countries in an effort to build human and technical capacities, develop improved varieties and ensure the availability and accessibility of improved seed varieties to smallholder farmers in the often harsh conditions of sub-Saharan Africa. PASS supported the development of over 300 high yielding varieties of 11 crop species during the initial 5 years of its operation. These improved varieties are expected to be multiplied by seed companies and adopted by smallholder farmers in the PASS target countries.

ii. Objectives of the study

The first phase of the study was to establish;

- The number of varieties released by PASS through partner breeders and breeding institutions
- The proportion of the released varieties that has been commercialized
- The proportion of the commercialized varieties that is at the bulking stage (by seed companies) and the quantity that have reached the input market,

The second phase and the objective of the study were to;

- Identify the seed companies and agro-dealers that received the sampled PASS supported certified varieties
- Identify the intended catchment areas (agro-ecological zones) of the sampled varieties
- Assess the proportion of farmers using these certified varieties within these catchment areas
- Establish how farmers accessed (channels of distribution) these released varieties
- Assess farmer satisfaction levels of these sampled varieties and
- Assess the yield (and other intended qualities/traits) performance of these certified varieties at the household level

iii. Summary of the study methodology

Figure 1: Summary seed traceability methodology



1. A list of PASS funded breeders was provided by AGRA and formed the first contact
2. Multipliers/Seed Companies, NGOs, FOs and farmers were the second point of contact, information about them was provided by the breeders
3. Agro dealers are the contact points with farmers, information about them was provided by the multipliers/seed companies, NGOs, FOs and farmers

4. Finally the farmers were selected based on the information provided by the agro dealers and in areas where the breeders mentioned that the crops have been adapted.

iv. Summary of main findings

Breeders

All breeders interviewed are experts and specialists in plant breeding ranging between 10 to 25 years with a PhD as the minimum level of education attained. All are based in main breeding centres in the six counties

- Kenya – KARI (HQ, Kakamega, Mtwapa, Kitale)
- Uganda – NARO (Kampala)
- Mozambique – IIAM (Nampula, Maputo)
- Malawi – Chidetze Research Centre (Lilongwe)
- Burkina Faso – INERA (Ouagadougou)
- Ghana – CSIR (Accra)

Breeding Process

Breeding objective is primarily very significant, the breeder identify constraint/challenges such as diseases, drought or early maturity, they then get the right germplasm or make crosses between different varieties with the favourable attributes they are looking for. Crosses are made with local materials/crops that are adapted to the local ecological zones. Germplasm is usually the male parent and local material as the female parent. Germplasm is one of the key fundamental prerequisite in seed development and most of them are acquired from international sources;

- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for Finger millet
- West Africa Rice Development Association (WARDA) for Rice
- International Centre for Tropical Agriculture (CIAT) for Beans
- International Sweet Potato Centre (CIP) for sweet potato
- Others are cross-breeds of local varieties

Farmer's involvement in Seed breeding

Farmers are of paramount importance in seed breeding. They contribute vastly through Participatory Variety Selection before breeders recommend the material for National performance. Farmers' participation is largely involved during the adaptation trials and in the selections.

“Of course the breeding process begins with the farmer. The farmer knows what traits are desirable in seeds depending on the ecological and climatic conditions” **Finger millet breeder**

“Farmers’ participation is crucial during the breeding process. We have to make sure that the varieties that we are breeding meet their preferences. Therefore a bit of participatory breeding is involved”
Cassava breeder

“The first thing I did even before I collected my germplasm was to have a participatory rural appraisal. This is like a question and answer session with farmers so that you know what problems they are facing”
Maize breeder “..... we conduct what we call, participatory variety selection, with farmers because we want to involve the farmer, before we recommend the material for national performance trial.”, **Rice breeder.**

Participatory breeding is therefore a crucial step in the variety development process. The next step is variety testing that happens in the breeding institution so that the seeds can be tested in a higher level within a controlled environment.

“...If you are lucky to stumble upon a variety there that has got the desirable traits that you want then you advance it. Advancing means that you test it in higher level kind of trials because you start off with a wide range of germplasm. At this point you don’t even measure yield but you look at the general performance just through visual course and biometric data. They then undergo rigorous training where you get a few shortlisted varieties which you test in given conditions and then again make selections. If you are lucky to get varieties that have got the characteristics of the traits that the farmers want then you can advance that variety to the highest level which is the National Performance Trials...” **Finger millet breeder**

“...happens you don’t just take the product and say this is my final product, you have to take it through what we call generations of testing and in breeding, you know when you harvest a maize cob it has like 500 grains. Each grain is a potential of becoming a variety. You get 1000 of seeds, you go through what we call advancing your generations, you use research station, you do irrigation, at a certain point maybe at about like the 1st two years you actually can’t involve farmers, you start involving farmers when you start doing field trial...” **Maize breeder**

Before commercialization any seed variety developed has to be submitted to the national body in charge of seed standards that carry out the national performance trial. Upon passing the DUS test it is then released through Ministry of Agriculture.

Summary of seed Varieties traced

Table 1: Summary of seed varieties traced

Country	Number of varieties traced	Number of varieties that have moved to seed companies	Number of varieties that have reached the farmer through the formal process	Number of varieties that have reached the farmer through the informal process
Kenya	10	3 (30%)	3 (30%)	7 (70%)
Uganda	9	8 (88%)	9 (100%)	0
Mozambique	8	1 (13%)	1 (13%)	7 (87%)
Malawi	9	5 (56%)	5 (56%)	2
Ghana	17	13 (76%)	9 (53%)	0
Burkina Faso	6	6 (100%)	6 (100%)	0

NB: Seeds varieties in the form of cuttings like cassava and sweet potatoes may not go through seed companies.

Multipliers

Multipliers consist of private seed companies, some NGOs and seed unit at breeding institution (KARI-Kenya) who gets the foundation seed either from the breeders themselves or the breeding institutions and multiply them.

For multipliers, that took part in the survey, they have been in the multiplying business spanning between 4 to 30 years. There were three types of multipliers that the survey identified; seed companies, Seed Unit and NGOs. Seed companies are the most preferred multipliers by the breeders then followed by the Non- governmental organizations. In terms of education level of staff in multiplying organizations, almost all of them had qualifications in agriculture related field. Annex 1 is a summary of breeders, multipliers, quantities of seed multiplied and yield potential.

Communication & Marketing

Communication channels to multipliers about PASS improved seeds are multivariate with no official preferred communication modality. Breeders too do not have a specific communication modality with multipliers pertaining the new varieties that they develop

Improved seeds are packaged in in units ranging from 1kg to 25 Kgs. Smallholder farmers mainly prefer the 2 kg pack. . Cuttings are normally packed in bands of 20 cuttings. Apart from the agro dealers; multipliers also work with NGOs, Farmers, CBOs, and institutions like churches.

Summary of yields

Even though yields for small holder farmers in most cases are lower than breeder estimates for varied reasons, there was consensus among all small holder farmers that use of improved seed varieties had improved yields. More importantly, better farming practices such mono-cropping and use of manure and fertilizers across all countries produced higher yields. A summary table of the yield calculation for each country is given bellow.

Table 2: Kenya Yields

	Average Harvest / Hectare (Tonnes)								
	Beans	Cassava		Finger millet	Maize		Rice		Sweet potato
Varieties	KK8 (51)	Tajirika (36)	Karemba (3**)	U-15 (3**)	KH500-22A (147)	KH500-43A (25)	Nerica 1 (34)	Nerica 10 (14)	Kenspot-4 (4**)
Mean Acreage	0.34ha	0.51ha	1.21ha	0.24ha	0.62ha	0.42ha	0.24ha	0.30ha	0.15ha
Breeder estimate	1.8	63.3	68.2	2.5	7.5	6.5	3	3	10
Average Harvest / Hectare	1.53	40.31	31.13	.67	4.83	4.49	2.38	1.99	1.90
Mono-Cropping	1.74	54.96	46.02	-	5.38	5.35	3.04	1.93	1.80
Mixed-Cropping	1.33	36.38	1.36	.67	3.37	1.06	1.42	2.78	2.22
Uses fertilizer/manure	1.58	58.64	46.02	.67	5.00	5.56	2.38	1.99	2.03
Does not Use fertilizer/manure	1.23	17.85	1.36	-	1.40	1.10	-	.-	1.78

Study regions: *Coast, Eastern, Rift Valley, Central, Nyanza and Western Kenya*

With an exception of Karemba, U-15 and Kenspot-4 which did not have many farmers growing them for robust analyses, all other varieties are performing well.

Table 3: Uganda yields

	Average Harvest / Hectare (Tonnes)						
	Beans		Cassava		Maize		
Varieties	Nabe 15 (122)	Nabe 16 (56)	Nase 13 (17)	Nase 14 (22)	Longe 9H (14**)	Longe 10H (109)	Longe 5D (5**)
Mean Acreage	0.30ha	0.50ha	0.66ha	0.80ha	0.59ha	0.50ha	0.81ha
Breeder estimate	1.8-2	2-2.5	20-30	23-33	8-9	9-10	3-4
Average Harvest / Hectare	1.13	.95	11.44	14.91	9.21	8.43	3.07
Mono-Cropping	1.97	1.52	13.17	15.65	9.51	9.98	3.07
Mixed-Cropping	0.48	.61	7.28	13.84	9.04	7.43	-
Uses fertilizer/manure	1.97	1.10	13.17	16.05	9.43	9.05	3.07
Does not Use fertilizer/manure	0.55	.91	7.28	11.86	8.25	8.13	-

Study regions:

Central: Wakiso, Mityana, Mubende, Nakaseke, Luwero, Mukono, Wakiso, Rakai, Masaka;

Eastern: Bugiri, Iganga, Soroti, Kamuli, Mbale, Iganga, Kaberamaido

Northern: Lira, Gulu, Yumbe, Arua, Adjumani, Nebbi

Western: Masindi, Kasese, Fort Portal, Kyenjojo, Bushenyi, Ishaka, Rukungiri, Hoima

Table 4: Mozambique

	Average Harvest / Hectare (Tonnes)						
	Cassava			Maize	Sweet potato		
Varieties	Orera (20)	Eyope (14)	Mokhalana (9*)	ZM523 (29)	Delvia (20)	Ininda (14)	Irene (25)
Mean Acreage	0.35ha	0.54ha	0.45ha	0.25ha	0.30ha	0.38ha	0.27ha
Breeder estimate	18-23	17-25	31	3 – 7	23	22	19.6
Average Harvest / Hectare	12.38	.95	10.36	2.25	11.12	9.43	10.25
Mono-Cropping	14.38	1.52	10.36	2.25	12.99	11.46	12.03
Mixed-Cropping	10.37	.61	-	1.78	4.13	3.86	4.68
Uses fertilizer/manure	12.88	1.10	12.42	2.51	15.87	13.36	12.17
Does not Use fertilizer/manure	12.08	.91	7.90	-	7.28	4.94	9.08

Regions: Manica, Gaza, Tete, Zambezia, Nampula

Table 5: Malawi

	Average Harvest / Hectare (Tonnes)						
	Beans		Cassava			Pigeon peas	Sweet potato
Varieties	Mal/KK25 /9/S-F (15)	Namtupa (Nag/KK25/168/S-F(47)	Sauti (63)	Mpale (5**)	Sangonja (4)	Mwaiwathualima (102)	Chipika (LU06/0527) (99)
Mean acreage	0.63ha	0.63ha	0.46ha	0.77ha	0.48ha	0.55ha	0.42ha
Breeder estimate	2	2	35	35	35	2.0-3.0	25
Average Harvest / Hectare	1.05	1.36	16.99	1.05	4.05	1.45	20.19
Mono-Cropping	1.09	1.36	17.35	1.05	3.16	1.46	20.36
Mixed-Cropping	.49		5.56	—	6.72	1.44	3.09
Uses fertilizer/manure	1.23	2.07	20.69	1.05		1.81	24.15
Does not Use fertilizer/manure	0.84	1.10	14.38	1.05	4.05	1.38	19.37

Study regions: Lilongwe, Balaka, Dedza, Mulanje, Phalombe

All varieties seem to have performed well except two cassava varieties, which were mentioned as having undesirable traits by the very few farmers who had grown them.

Table 6: Ghana

	Average Harvest / Hectare (Tonnes)								
	Cassava	Groundnut			Maize				
Varieties	Ampong (2**)	Obolo (5**)	Yenyawoso	Oboshie	Sanzal-sima (27)	Ewul-boyu (10)	Wang-dataa (20)	Tigli (9)	Bihilifa (11)
Mean Acreage	0.81ha	0.93ha	1.62ha	0.78ha	0.88ha	0.93ha	1.02ha	0.70ha	1.11ha
Breeder estimate	59	2.7	2.7	2.6	5.4	5.4	4.7	5.2	4.6
Average Harvest / Hectare	24.71	1.14	1.07	.74	1.83	2.37	1.38	2.95	.92
Mono-Cropping	24.71	–		.62	9.57	1.46	1.34	–	.31
Mixed-Cropping	–	1.14	1.07	.76	1.16	2.57	1.45	–	.98
Uses fertilizer/manure	–	1.25	1.48	.10	2.71	0.62	3.56	4.96	.95
Does not Use fertilizer/manure	24.71	1.00	.66	.86	1.14	–	0.78	2.75	.77

Regions: Northern, Upper East, Upper West, Ashanti, Brong Ahafo and Volta Regions

Table 7: Burkina Faso

	Average Harvest / Hectare (Tonnes)					
	Maize			Cowpeas		
Varieties	Wari (115)	Komsaya (76)	Tiligre (69)	Kom-Calle (3)	Gourgou (1**)	Nafi (28)
Mean Acreage	0.60ha	0.71ha	0.41ha	0.40ha	0.20ha	0.48ha
Breeder estimate	8.3	8.9	2	1.8	2	2
Average Harvest / Hectare	3.57	3.29	1.92	0.66	1.48	.44

Mono-Cropping	3.95	10.24	.2.20	0.66	1.48	.61
Mixed-Cropping	2.72	5.50	1.66	–		0.35
Uses fertilizer/manure	3.80	7.37	1.92	.74	1.48	.48
Does not Use fertilizer/manure	2.88	2.47	-	.74	–	.21

On overall and across the countries, small scale farmers rely heavily on traditional farming methods in farm preparation, planting and soil fertility management. Over half of the farmers practice intercropping. Incidence of manure and fertilizer use is low. The research teams observed that most farmers practiced planting by digging holes using hands, not using manure or fertilizer, not weeding regularly, using fertilizer only during planting time and not top dressing. From the yield calculations, it is apparent that intercropping and non-use of manure and fertilizer produces lower yields.

Various crop diseases are also reported such as Stringa for Maize. There was high incidence of recycling of seeds from own harvest. Rainfall patterns during the seasons under investigation had its effects, where some varieties are affected by higher (such as the drought resistant maize varieties), while others suffer from low rainfall. Overall we conclude that the use of improved seed varieties with good farming practices produces better yields. However, owing to rampant poor farming practices, there is a need to advocate for use of improved seeds accompanied by improved farming practices in order to obtain greater impacts on yields and farmers' incomes.

v. Policy Recommendations

AGRA's Program for Africa's Seed Systems (PASS) has one of its objectives the improvement of household food security and income by promoting the development of seed systems that deliver improved, locally-adapted crop varieties to smallholder farmers in an efficient, equitable and sustainable manner. This study was a comprehensive tracking exercise of improved seeds varieties that have been developed with AGRA support. The tracking begun from breeders, to certifiers, multipliers, dealers and finally to smallholder farmers.

The study revealed that PASS work has had a great impact in the quantity of improved seed varieties available to farmers. Further, PASS work has had great impact in capacity building for breeders through the scholarship and other funding programs. Even though infrastructural and human resource challenges still remain in the breeding context, PASS has had significant impact in improving the work environment for breeders through the various funding and scholarship opportunities

Much as there is improved access and use of improved seed varieties by smallholder farmers, coverage is low, and recycling is rampant (though this is not necessarily a disadvantage). There have been efforts to educate farmers on the importance of good farming practices including usage of complimentary farm inputs. Low incomes and to some extent ignorance have been cited as contributing factors to retrogressive farming practices noted among some farmers.

In order to improve the demand and supply for improved seeds varieties as well as an overall improvement of smallholder productivity and incomes the following are the policy recommendations emanating from this study.

Address delays emanating from the certification process

Breeders expressed concern on the length of time it takes the Standards Bodies to complete the certification process. Delays meant that many seeds varieties developed could not be availed for multiplication and commercialization. The implications of such delays are that many investments in breeding are locked up from utilization despite the huge resources invested in developing such varieties. Much as there is need to control for quality in seed breeding there is also need to establish an efficient quality control system.

Address Credit constrains faced by smallholder farmers

Uptake of improved seeds by smallholder farmers has been constrained by the high costs of such seeds compared to other traditional alternatives like recycling seeds from previous harvests. This study revealed that there are credit constrains that hinder access and utilization of improved seeds varieties by smallholder farmers. Credit constrains also affected access to other inputs like fertilizers and appropriate farming tools. Lack of fertilizers and appropriate farming tools undermine productivity even when improved seeds have been used. Innovative credit facilities to cater for the various needs of smallholder farmers will go a long way in improving productivity. Public interventions in access to farm inputs by smallholder farmers will also complement AGRA efforts in increasing smallholder farmers' productivity.

Take advantage of high mobile phone and radio penetration to build the capacity of farmers

From this study, 88% of smallholder farmers interviewed owned mobile phones while another 80% had access to radio services. The mobile phone has provided opportunities not only for improved communications and money transfers but also for increasing the depth of banking services and hence access to credit. There is need to encourage mobile phone based technologies and innovations to build smallholder farmers' capacity. The high penetration of the radio among smallholder farmers is also a good opportunity to disseminate information on good farming practices. In many countries there are vernacular radio stations that could be utilized to provide specific targeted information pertaining crops husbandry to communities living in different agro ecological zones. These two tools, the radio and the mobile phone provide a good platform for capacity building and mobilization of smallholder farms in to action for improved productivity.

Improve extension services to deliver quality services to farmers

The survey revealed that a majority of smallholder farmers still relied on extension services for their crops husbandry. Capacity building and resources for efficient extension services would go

a long way in ensuring that farmers received good advice and that there was adequate networking and dissemination of information through adequate extension services.

Address the significant usage of recycled seeds from last harvest

The study established that a significant proportion of farmers still relied on seeds from last harvest for planting. These seeds are not certified and may compromise productivity through compromises on resistance to pests and diseases as well as lack of proper adaptation to other climatic related conditions. Many of the farmers that used recycled seeds from previous harvests either pledged ignorance or low incomes to purchase the improved varieties. Targeted support through provision of certified seeds to poor farmers is just one part of the solution. Most of the solution may lie in spirited campaigns through media and extension services to educate farmers on the advantages of using improved seeds varieties. Efforts to lower the costs of certified and improved seeds will also encourage uptake by smallholder farmers.

Increase the pool of qualified breeders

As already noted PASS has had a great impact in increasing the pool of qualified breeders. However we are yet to reach a critical mass of well-trained breeders in all the countries visited for the study. Some crops had very few breeders including some that had only one. PASS should keep up the efforts and put in more resources towards the training of more breeders. Besides the human capital development, PASS may need to put in more resources towards the improvement of the technical infrastructure.

Many breeders especially in Kenya testified that before the AGRA support they were poorly funded and lacked essential infrastructure and hence they could not pursue their key mandate of breeding for adapted seeds varieties for their countries. Hence PASS work has been appreciated by scientists on the ground. The remaining challenges could be overcome by more concerted efforts from other players and forming synergy partnerships with PASS and other institutions with similar mandates.

Form partnerships with other players in the smallholder sector to increase the synergy for productivity and welfare improvement

As already pointed, PASS is doing a commendable job in the smallholder sector in terms of improvements in productivity. However the resource requirements (both financial and otherwise) to transform the sub-Saharan smallholder agriculture sector are huge. This is an opportunity for PASS to increase resources in the smallholder sector while at the same time forming partnership with other like-minded organizations to improve results. Organizations that may help with farmer capacity building and communication would go a long way to increase the successes of the PASS program.

vi. Limitations of studies

As with all methodologies, there are limitations. In the process of developing the harmonized approaches and methodologies, the final approach entailed a revision of Ipsos Technical Proposal to include agro dealer and household surveys in vast areas from the initial proposed ecological zones as the project documents indicated.

Both agro dealer and household surveys were carried out at a much higher cost than budgeted and the process of mobilizing these additional resources, recruiting national teams for the expanded geographical scope of the agro dealer and quantitative household surveys delayed commencement of the farm level data collection phase in all the countries as information had to be obtained first from the breeders then seed multipliers the agro dealers in a snowballing manner, on where they target, whom they work with.

The sampling framework selected provided a sound basis to capture different requirements of the study – particularly to cover all crop types and varieties (maize, beans, finger millet, rice cassava) in each country (Kenya, Uganda, Ghana, Malawi, Mozambique, and Burkina Faso).

However, the sample size was not sufficient to generalize at the village level – with larger villages (with more than 150 farmers each) potentially requiring even larger sample sizes. This is not a major concern, as the ability to compare village data is seen as a secondary concern, less important than say the comparison between crops and different supply chains.

Also, the absence of baseline information means that the household survey has had to rely on recall information. This inevitably introduces the possibility that the recall period for area planted, fertilizer application, quantity of seed used, harvests, etc. might have been too long for some farmers. In many cases, it may not even be possible to verify the farmer's information, particularly where evidence of harvest may not be available for example where the harvest have already been consumed or sold.

CHAPTER ONE: INTRODUCTION

1.1. Study background

The Program for Africa's Seed Systems (PASS) is one of the four core programs of AGRA. The key objective of PASS is to improve household food security and income by promoting the development of seed systems that delivers improved, locally-adapted crop varieties to smallholder farmers in an efficient, equitable and sustainable manner.

PASS consists of four sub-programs that focus on different elements of the input supply chain. These are;

- Education for African Crop Improvement (EACI),
- Fund for the Improvement and Adoption of African Crops (FIAAC),
- Seed Production for Africa Initiative (SEPA) and the
- Agro-Dealer Development Program (ADP)

PASS objectives are organized in terms of the major results that are expected from each of its four subprograms:

1. EACI provides training for a new generation of crop breeders and agricultural scientists upon which seed systems depend for growth and productivity
2. FIAAC funds crop breeding in Africa to improve African crop varieties and promote their adoption by small holder farmers.
3. SEPA helps ensure that improved crop varieties are produced and distributed through private and public channels (including seed companies, publicly-supported seed programs, and public extension) so that farmers can adopt these varieties.
4. ADP provides training and credit to establish and support the growth of small agro-dealers, who are a primary conduit of seeds, fertilizers, and knowledge of their proper use, to smallholder farmers to increase their productivity and incomes.

Under phase 1 (2007-2011) of the PASS implementation, \$150 million was invested in 13 sub-Saharan African countries in an effort to build human and technical capacities, develop improved varieties and ensure the availability and accessibility of improved seed varieties to smallholder farmers in the often harsh conditions of sub-Saharan Africa. PASS supported the development of over 300 high yielding varieties of 11 crop species during the initial 5 years of its operation. These improved varieties are expected to be multiplied by seed companies and adopted by smallholder farmers in the PASS target countries.

Assessments (PASS Mid-Term Review, End of PASS Phase 1 evaluation, PASS Projects Assessments, PASS Value Chain Analysis) of PASS at various stages of its implementation

pointed to the gradual uptake of improved varieties by farmers in the target countries, however no critical assessment has been done to establish

- a) the number of the PASS supported released varieties that have been commercialized
- b) which seed companies, agro-dealers (and others) received these varieties
- c) the number taken up by seed companies
- d) the quantity that have reached agro-dealers in the targeted catchment areas and
- e) the yield (and other intended qualities/traits) levels of these varieties at the household level

The need to determine/establish the above parameters has come to the fore of discussions among PASS key stakeholders.

This study (which built on the phase 1 of the PASS programme) critically assess the proportion of the PASS supported commercialized varieties that has been multiplied by seed companies (and others), which seed companies, agro-dealers (& others) received these commercialized varieties, the demand levels for these varieties and how these multiplied varieties have impacted on yields and incomes of smallholder farmers in the 6 targeted countries of Kenya, Uganda, Malawi, Mozambique, Ghana and Burkina Faso.

Seed is a major investment by smallholder farmers but across Africa there are multiple supply chain pathways, within which it is important to understand the different actors (breeders, seed companies, agro-input traders, etc.) and the farmers that underpin more sustainable models of seed production, distribution and related impacts in farmers' fields. There are also some challenging questions around the fact that farmers sometimes adopt varieties and capture the benefits in terms of livelihoods gains, but in other instances they may not sustain their adoption of new and improved varieties. It is important to understand why this is so.

It is against this background the AGRA has sought to procure the services of Ipsos to undertake a seed variety traceability study in 6 PASS target countries - Ghana, Kenya, Uganda, Malawi, Burkina Faso & Mozambique.

1.2. Objectives of the Study

The objectives of this phase of the study were to:

- Identify the seed companies and agro-dealers that received the sampled PASS supported certified varieties in the selected 6 countries of Kenya, Uganda, Mozambique, Ghana, Malawi and Burkina Faso
- Identify the intended catchment areas (agro-ecological zones) of the sampled varieties
- Assess the proportion of farmers using these certified varieties within these catchment areas
- Establish how farmers accessed (channels of distribution) these released varieties

- Assess farmer satisfaction levels of these sampled varieties and
- Assess the yield (and other intended qualities/traits) performance of these certified varieties at the household level

1.3. Study methodology

The study was designed to a multi-prong methodological approach as indicated below;

Figure 2: Summary study methodology



The **Improved Seed Traceability** Study was preceded by an Inception Phase, during which Ipsos was invited to AGRA office in Nairobi for a briefing by the client. Terms of Reference for the study as well as the conceptual approach and methodology were discussed and harmonized during the meeting held with AGRA in May 2014.

The following section outlines the sampling frame, the data collection tools, as well as the challenges and limitations of the study.

1.3.1. Desk Research

The desk research phase included a review of historical data to cover all dimensions of PASS (including reports of previous assessments, the supply chain information from the stakeholders involved in the seed multiplication and distribution and other development partners as well as conducting interviews to gather relevant information on a need basis).

1.3.2. Qualitative Research (Key Informant Interviews)

Key informant interviews (KIs) targeted the following; breeders who developed the improved seed varieties, the multipliers who included private seed companies, and the government agencies concerned with policy and legal issues in agriculture and plant science.

Face to face interviews were carried out with the target respondents and were audio-recorded for analysis. On average the interview took between 45 minutes & 1 hour. A trained and experience moderators facilitated the discussions in a non-structured and natural manner using the predetermined discussion guide. Appointments were booked in advance with the targeted respondents prior to the interviewing process as appropriate.

1.3.3. Quantitative Research

Method of selection

Quantitative research methodology was used to collect information from the agro dealers and small holder farmers. Small holder farmers were defined as those that had up to 5 acres of land under food crop cultivation.

There was no sampling framework that could have been used to draw a sample for both agro dealers and small holder farmers. The list of the agro dealers was based on the information provided by the multipliers and the seed companies while that of the farmers was based on the target ecological zones where the crops were adapted and the market information provided by the agro dealers and breeders. Therefore there was no scientific method used in the selection of the agro dealers and small holder farmers.

Agro dealers' names and contacts were given by the multipliers and seed companies. The number of agro dealers interviewed in each of the countries depended on the names and contacts given by the multipliers and seed companies. Initially the survey targeted to interview between 30 and 50 agro dealers in each of the survey countries.

Since this was a seed traceability study that focused on targeted seed varieties, purpose sampling was done and snowballing was used to get the SHF who had planted the targeted seed varieties in each of the 6 survey countries.

After considering these possible sampling options (purposive, snowballing), the survey team settled on a sampling approach that best permitted an analysis at many levels;

- An analysis of the adoption patterns;
- A minimum sample size of 30 farmers per variety - sufficient observations to permit statistically valid conclusions;
- A sufficient sample size to explore yield variations under several scenarios; and,
- A random sample to adequately represent male and female farmers

The process of selecting the respondents was as follows:

1. AGRA provided the list of breeders who were the first contact in the traceability study. The breeders provided information about the varieties they have developed and the names and contacts of the multipliers. These multipliers were either seed companies, breeding institutions, NGOs, farmer organizations or individual farmers. The breeders also provided information about the ecological zones and physical areas where the developed varieties have been adapted.
2. The second point of contact was the multipliers (seed companies, breeding institutions, NGOs, farmer organizations or individual farmers). From the multipliers we were able to get information about commercialization, quantities produced and information about agro dealers.
3. The quantitative phase of the data collection started from the agro dealers. Information about the names, locations and contacts details of the agro dealers was obtained from

the multipliers. The teams moved to the locations and centres where the agro dealers operate and interviewed only agro dealers that stocked and sold PASS targeted seed varieties. Agro dealers are the contact points where farmers got the PASS seeds. Some NGOs like the One Acre Fund in Kenya and FOs are also involved in the distribution of seeds to the farmers. In this case these were interviewed using the agro dealer data collection tools. The NGOs and the FOs provided the contacts or the locations where their customers (small holder farmers) came from.

4. Information about small holder farmers provided by the agro dealers, the NGOs, FOs and the breeders guided our sampling points for the small holder farmers. Since there was no sampling framework, snowballing was the most common method that was used to get to these small holder farmers. It is important to note that we only talked to the SHF that had planted the PASS target seed varieties. Household interviews were conducted with the small holder farmers and the head of the household was the target respondent or the person who makes the most decisions on which seed variety to purchase and other household decisions.

We made a deliberate attempt to have a minimum of 30 small holder farmers for each variety to allow for a statistical inference on the data collected. The key advantage of this approach was that the random sample of farmers enables analysis of adoption patterns in areas where the seeds have been distributed.

1.3.4 Yield Calculation

The yield calculation was based on the Sociologists yield concept. Gross yield is obtained before any losses occur during and after harvest.

The acreage question as framed to Farmers was in Acres – from 1/8 acre to 5 acres, whereas the yield question was in Kilograms.

A recoding process was carried out on the data to make it usable with SI Units for area and weight:

- 1Acre = 4046.86 m².
- 1 Hectare = 10,000 m².
- 1 Ton = 1,000 Kg.

After recoding all acreage in M², we calculated all the measures of central tendency and dispersion – Mean, Mode, Median and Range and Standard Deviation. We have only used the mean for the analysis below. We have also looked at some other indicators that could explain the yield figures.

All seed varieties that in our opinion are doing well are highlighted in yellow below:

1.3.5 Data collection

The (5) Five main data collection instruments were used as developed by Ipsos in consultation with AGRA PASS team. These included:

- Discussion Guide for Breeders;
- Discussion Guide for Government agency in charge of policy and regulatory issues regarding improved seed development
- Discussion Guide for Multipliers/Seed companies
- Structured questionnaire for Agro-dealers;
- Household survey questionnaire for Smallholder Farmers

The final data collection tools are annexed to this report

1.3.4. Study areas

Table 8: Seed traceability Study Zones

Country	Ecological zones/study areas	Administrative Areas
Kenya	Coastal region, low to high altitudes, lake basin and the highlands	Coast, Eastern, Rift Valley, Central, Nyanza and Western regions
Ghana	Guinea Savannah, Sudan Savannah, Forest Savannah zones	Northern, Upper East, Upper West, Ashanti, Brong Ahafo and Volta Regions
Mozambique	Central, South and Northern regions	Manica, Gaza, Tete, Zambezia, Nampula
Uganda	Southern, Central, Eastern, Western and Northern regions	Central: Wakiso, Mityana, Mubende, Nakaseke, Luwero, Mukono, Wakiso, Rakai, Masaka Eastern-Bugiri, Iganga, Soroti, Kamuli, Mbale, Iganga, Kaberamaido Northern-Lira, Gulu, Yumbe, Arua, Adjumani, Nebbi Western- Masindi, Kasese, Fort Portal, Kyenjojo, Bushenyi, Ishaka, Rukungiri, Hoima
Malawi	Southern, Central	Lilongwe, Balaka, Dedza, Mulanje, Phalombe
Burkina Faso	Bobo, Ouagadougou	Bama, Nasso, Samaga, Sapone, Pissi, Kombisirri

1.4. Challenges

Getting the target small holder farmers in some areas;

Some farmers in Meru county Tigania East constituency, Kiorimba location had large pieces of land which were all under cultivation with our target crop variety. In the field, some varieties were devoted to larger farm areas such as Nerica 1 in Kenya

Poor information

In areas where the seeds have been adapted we found during snowballing that most of the farmers did not have information about improved seed varieties. Some agro dealers also claimed that they didn't know where to get the certified seed varieties especially the ones that we were tracing.

Improved seed availability

Farmers we visited in some areas stated that their local agro dealers didn't stock the improved seed varieties that we were tracing. We confirmed this when we visited the agro dealers in the local shopping centers.

Information about improved seed customers

We had expected that we will find that the agro dealers kept some information about their customers who purchase improved seed varieties. We found out that they didn't keep records of their customers of improved seed varieties we were looking for. We had to rely on purposive sampling in villages and look for the farmers. Documentation both in government agricultural office and local organization were not clear and in some places missed completely.

CHAPTER TWO: PUBLIC SECTOR VARIETY DEVELOPMENT

2.1. Multipliers: Improved variety development and release

2.1.1. Kenya

In Kenya the study traced 10 varieties from 5 crops;

- Beans-KK8
- Cassava-Tajirika & Karembo
- Finger millet-U15
- Maize-KH500-22A & KH500-43A
- Rice-Nerica 1 & Nerica 10
- Sweet Potato-Kenspot 1 & Kenspot 4

Out of the 10 varieties, 7 of them have been commercialized/released and are available on the agro dealer shops with the exception of Finger Millet (U-15) and Rice (Nerica 1 & 10). The following table shows the breeders for each of the varieties and seed companies that received the varieties.

Table 9: Breeders and seed companies traced in Kenya

Breeder	Crop	Variety	Multiplier/Seed Company	Quantity multiplied/distributed	Yield Potential/Ha
Dr. Reuben Otsyula	Beans	KK8	Bubai Seed Company	7 tons to a local agro dealer in Kitale	1.8 ton
Dr. Joseph Kamau	Cassava	Tajirika	KARI Seed Unit	Cannot Estimate	Tajirika 63.3 ton

		Karemba			Karemba 68.2 ton
Chrispus Oduori	Finger Millet	U-15	KARI Kitale	Has not been commercialized	2.5 ton
Dr. Jane Ininda	Maize	KH500-22A	Olerai Seed Company	140 tons	7.5 ton
	Maize	KH500-43A	East Africa Seed	280 tons	6.5 ton
Dr. John Kimani	Rice	Nerica 1 & 10	Farmers	Has not been commercialized	3 ton
Dr. Laura Karanja	Sweet potato	Kenspot 1 & 4	Kasambara Sweet Potato Growers	Cannot estimate	3-10 ton

2.1.2. Uganda

In Uganda, a total of 9 varieties were traced from 4 crops;

- Beans-Nabe 15 & 16
- Cassava-Nase 13 & 14
- Maize-Longe 9H, 10H & 5D
- Soybean-Maksoy 2N & 3N

During our study we picked other varieties of Soybean that the breeders had developed besides the target varieties;

- Soybean-Maksoy 1N, Maksoy 4N and Maksoy 5N

All the varieties developed in Uganda have moved down the chain to the farmers through the retailers or distribution points (agro dealers, farmer groups, NGOs).

Initially the survey team had a list of 4 breeders in Uganda but on conducting the interviews with the identified breeders, they later linked the team to other breeders that they had developed the varieties together.

Table 10: Breeders and seed companies traced in Uganda

Breeder	Crop	Variety	Multiplier/Seed Company	Quantity Multiplied	Yield Potential/Ha
Dr. Stanley Nkalubo	Beans	Nabe 15 & 16	Supa Seeds	>200 tons	1.8-2.5 ton
Kessime Eunice Vasiter	Beans	Nabe 15 & 16	Masindi Seed Company Limited	100 tons	
DR Richard Edema	Cassava	Nase 13	Fica seeds	3000 tons	20-30 ton
Liri Charles	Cassava	Nase 13 & 14	Grow more seeds and chemicals Ltd	2200 tons	20-33 ton
Dr Asea	Maize	Longe 9H	Pearl seeds	over 500 tons	8-10 ton

		&10 H			
Kwemoi Daniel	Maize	Longe 5D	Dr. Kiwemba	Cannot estimate	3-4 ton
Namazzi Sylvia Birabwa	Maize	Longe 9H	Otis seed company	180 tons	8-10 ton
			Equator seeds Gulu	1000 tons	
			Rwenzori Seeds	> 200 tons	
			SIMLAW Seed Company	100 tons	
			CAII Seeds	30,000 tons	
			Rrial Seeds	20 tons	
			Aera Seeds,	7 tons	
			Bakusekamaja Womens Seeds Association	200 tons	
			Simba Seeds	3 tons	
			Victoria Seed Company	1,000 tons	
			Gerald Owachi	400 tons	
Tony Obua	Soybean	Maksoy 2N	Equator Seeds	500 tons	2-3 ton
Prof. Phenahas Tukamuhabwa	Soybean	Maksoy 3N	NASECO	2,500 tons	4-7 ton

2.1.3. Malawi

A total of 6 varieties were traced in Malawi for the 4 crops: sweet potatoes, cassava, pigeon peas and beans with the breeders and seed companies stationed in Lilongwe at the Ministry of Agriculture & Food Security and in Blantyre

Breeder	Crop	Variety	Multiplier	Quantity Multiplied	Yield potential/Ha
Dr Ibrahim Benesi	Cassava	Mpale, Sangoja	Ministry of Agriculture & Food Security (Agriculture research station at Chidetze)	Not provided	35-40 ton
Dr. GAD Kananji	Beans	Mwaluwa	EXAGRIS, CPM, PEACOCK, IITA	Not provided	2.5 ton

2.1.4. Mozambique

A total of 10 varieties were traced in Mozambique from 3 crops, all of the varieties have been released and commercialized and have gone through the chain from the breeders to the

farmers. The team did not however identify any farmer with the cassava variety Varuiya in the surveyed area.

Breeder	Crop	Variety	Multiplier	Quantity Multiplied	Yield potential/Ha
Pedro Fato	Maize	ZM523	Associação Mulanguene	351 ton	5-7 ton
Constantino Cuambe	Cassava	Orera	Corridor Agro	850 ton	18-23 ton
		Eyope			17-25 ton
		Mokhalana			31 ton
		Varuiaya			22 ton
Jose Ricardo	Sweet Potato	Delvia	Xavier Muthemba	200 ton	23 ton
	Sweet Potato	Ininda	Arcanjo Cossa	240 ton	22 ton
	Sweet Potato	Irene	Associação 25 de Setembro	300 ton	19 ton
Jose Ricardo	Sweet Potato	Delvia, Ininda, Irene	Bernardo Armando	200 ton	
	Sweet Potato	Delvia, Ininda, Irene	Jair de Oliveira	350 ton	
	Sweet Potato	Delvia, Ininda, Irene	Isabel Mondlane	450 ton	

2.1.5. Ghana

Traced 17 varieties from 5 crops, out of these 17 varieties only 9 could be traced to the farmers.

Breeder	Crop	Variety	Multiplier	Quantity Multiplied	Yield potential/Ha
Dr Joe Manu Aduaening	Cassava	Ampong	JOSMA company	44,620 bundles	56 ton
		Sika Bankye			56 ton
		Otuhia			65 ton
		Broni Bankye			40 ton
Dr Amoah	Cowpea	Videz	Emmanuel Agyei Asamoah	400kg	3.5 ton
		Hewale		800kg	3 ton
		Asomdwee		800kg	2.9 ton
		Hewale, Asomdwe, Videza	M & B Seeds	New	
		Videz	Antika Seeds	Cannot estimate	
		Asomdwe		Cannot estimate	
Dr James Asibuo	Ground nut	Obolo	M & B Seeds	Cannot estimate	2.7 ton

		Yenyawoso		Cannot estimate	2.7 ton
		Oboshie		Cannot estimate	
		Oboshie	Heritage Seeds	1 ton	2.6 ton
		Otuhia		1 ton	2.4 ton
		Obolo		250 kg	
		Yenyawoso		1 ton	
Dr Obeng Antwi	Maize	Sazal Sima	Lexborg Investments Company Ltd	New varieties	5.4 ton
		Wandata		New varieties	4.7 ton
Dr Maxwel Darko Asante	Rice	Agra Rice	Heritage Seeds	New	9.4 ton

2.1.6. Burkina Faso

Breeder	Crop	Variety	Seed Company/Multiplier	Quantity Multiplied	Potential Yield/Ha
Mr. Zongo Hamidou, Joseph Batiste Batieno	Cowpea	Nafi	FAGRI	200-220 ton	1.5 ton
		Tiligre			1.5 ton
		Gourgou			1.8 ton
		Kom-calle			1.2 ton
Dr. Jacob Sanou	Maize	Wari	NAFASO	0.45-1.2 ton	8-10 ton
		Komsaya			8-10.9 ton

2.2. Policy and Legal Framework

2.2.1. Overview breeding sector in Kenya

In the Kenyan context, Kenya Agricultural & Livestock Research Organization (KALRO) formerly KARI (Kenya Agricultural Research Institute) is the institution responsible for breeding in Kenya and ensuring quality seed breeding, analysis of the product and the recommendation for certification. This process involves working with stakeholder committees including the breeders, the seed companies, KALRO, and the farmers.

The new seed variety policy issues that govern improved variety development and release are hinged on standards, both local and international which Kenya is a party to. The new seed variety management also relies on Acts of Parliament with associations to Seed Variety Act, Seed Policy Act and KEPHIS (Kenya Plant Health Inspectorate Services) Act. Besides, Kenya is

a signatory of a number of treaties and international systems that are relevant to quality assurance in agriculture and seed testing such as the International Seed Testing Association with the KEPHIS liaison office.

These standards are aligned to the Organization of Economic Co-operation and Development (O.E.C.D). There are the seed schemes subscribed to enforce the new seed variety implementation of those standards. The International Union for the Protection of New Variety of Plants is a reward scheme for the breeders for their efforts when they develop new variety of plants. The varieties are protected against exploitation by other persons. In the Kenyan case, KEPHIS is the inventory agency in terms of seed quality matters and assurance which can be traced an Act of Parliament, the seed and plan variety research. The Seed Variety Act is the basic guideline and it is the one that implements what is in the Seed Policy.

Farm level performance of the developed varieties is usually ascertained through wide network of the KARLO and KEPHIS countrywide field offices and various activities such as farm field days. Regular feedback is provided by the farmers through such interactions to give information on what the issues the farmers may have on the developed varieties, whether positive or negative regarding the seed varieties that they are working with at the moment.

Regulatory framework in Kenya

For the breeder and foundation seed production and management, KEPHIS as the agency in charge does not do this alone; actually there are stakeholder committees comprising of the partners concerned. KEPHIS does the actual evaluation and gives a report to the committees and the committees make a decision on release and certification.

New seed variety agronomic performance and quality assessment is only traced from product submitted to KEPHIS for evaluation. There is a database for all the products submitted for evaluation but what is mainly focused on is what released. The new developed varieties are monitored through joint observations by the relevant stakeholders. These are implemented through various regulations as specified for the different crop types for the seed, national farmers' trials, evaluations, field inspection protocols and the seed company specific standards.

Regarding the capacity of the country to address the issue of food security, the country has enough breeders and what is needed is only facilitation of the existing breeders to get to full potential through resource mobilization, capacity building and capital injection into their programs.

2.2.2. Overview breeding sector and legal framework in Uganda

In Uganda, the National Agricultural Research Organization (NARO), which was established by an Act of Parliament in 2005, is mandated to undertake research on crop, animal, fisheries, livestock and environment resources. As such, the organization takes a lead role in the seed breeding process (with active participation in this process from other competent private institutions- such as leading universities) as well as offering training to plant breeders. The

Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) (through an Inspectorate Directorate) in turn undertakes to check for purity of the prototypes given out as seed by NARO and other leading private institutions while organizations such as the National Agricultural Advisory Services (NAADS) facilitate the dissemination process through providing advisory services (extension services/ agricultural training) to farmers

Uganda's food production and security is guided by the Development Strategy and Investment Plan (DSIP) whose key objectives include increasing rural incomes and livelihood and improving household food and nutrition security. Uganda's Vision 2040 is also instrumental in transiting the country's agricultural sector from the subsistence level to modern agriculture able to sustain the country's growing economy. The country currently has a good breeding program for most key national crops such as beans, soya beans, sorghum, millet, sweet potatoes, bananas, cassava and coffee among others. Systems to enhance seed performance tracking are however weak/non-existence in some cases.

2.2.3. Overview breeding sector and legal framework in Mozambique

The model of seed breeding, multiplication, commercialization and overall monitoring in Mozambique largely conforms to internally established processes. The Agrarian Research Institute of Mozambique (IIAM) is responsible for the seed breeding process in the country and works closely with the Seed Department (government owned) which oversees the process of registration of all proposed new varieties by interested parties. This department largely checks for duplications of proposed varieties, their adaptability to the environment as well as capacity to ensure quality outputs during harvesting. The seed multiplication/ commercialization process follows a rigorous process of field inspections and checking of seed performance before approval of the multiplication process.

The National Directorate of Agrarian Services in turn checks the marketing and distribution of all approved seeds in the market as one of the strategies to strengthen the seed chain. Seed distributors for instance must produce the government granted certification for distribution of all varieties present in their outlets. The process of development of new and improved seed varieties in the country is still weak as only few breeders are available/ certified.

2.2.4. Overview breeding sector and legal framework in Malawi

With the country having faced significant changes in the agricultural sector in the past- among them including low rainfall patterns, increased acidity levels in the soil and subsequent low crop production including from the country's main currency earner; tobacco- the country has made efforts to improve the agricultural sector in order to safeguard its future.

Through the Ministry of Agriculture, the government provides support to authorized research stations mandated to breed quality seed varieties as well as ensure their multiplication and distribution. Currently there are about 20 qualified breeders in the country which constitute of government agencies- Chitedze, Bvumwe, Runyangwa, Ruwawa and Rufuwu- as well as other private players- such as Monsanto, Pannar, Seedco among others- which operate under laid out policies by the government. Funding hiccups however limit the extent of coverage made by

these breeders during seed tracing and performance monitoring (the breeding to actual harvest cycle).

The government has also implemented the Agriculture Sector Wide Approach (ASWAp) whose key goal is to have a harmonized agricultural sector with a wide sectoral approach involving as many stakeholders as possible to enhance increased and sustainable agricultural production and growth. The ASWAp approach advocates for multi-disciplinary participatory approach with all stakeholders including farmers, the private sector and non-governmental organizations.

2.2.5. Overview breeding sector and legal framework in Ghana

The Ministry of Food and Agriculture (MOFA) is the lead agency and focal point of the Government of Ghana, responsible for developing and executing policies and strategies for the agriculture sector within the context of a coordinated national socio-economic growth and development agenda. By means of a sector-wide approach, the Ministry's plans and programmes are developed, coordinated and implemented through policy and strategy frameworks. In this regard, MOFA facilitated the preparation of the Food and Agriculture Sector Development Policy (FASDEP II)¹.

Ghana is currently working on a bill on crop breeding and development; the bill which is before cabinet would provide the legal framework for breeders' investment and efforts to be recognized and necessary royalties paid to them.

"The Bill, when passed into law will provide an incentive to stimulate new breeding initiatives that will focus on national development, provide a basis for innovative and effective breeding work at domestic level and foster partnerships between the private and public breeding sectors," *Dr. Stephen Amoah, a research scientist of the Crop Research Institute (CRI) of the Council for Scientific and Industrial Research (CSIR)*²

The bill, called the Plant Breeders' Rights Bill was first published in 2013 to strong opposition by activist groups such as Food Sovereignty Ghana. The Bill is modelled on UPOV (International Union for the Protection of New Varieties of Plants) 1991, which is viewed by opponents as rigid and inflexible compared to the previous UPOV convention, UPOV 1978. UPOV 1991 has not been acceded to by a number of developing countries such as China, Brazil and Kenya. Opponents of the bill are concerned that the Bill will result in the rights of multinationals being favoured at the expense of local farmers and breeders³.

¹ Source: Ministry of Food and Agriculture website: http://mofa.gov.gh/site/?page_id=319

² Source: <http://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=12629>

³ Source: <http://www.mondaq.com/x/345242/Life+Sciences+Biotechnology/Controversy+Over+Plant+Breeders+Rights+Bill+In+Ghana+Continues>

CHAPTER THREE: AGRO-DEALERS

3.1. Agro Dealer Summary Findings – Kenya

3.1.1. Outlet composition and stocking & price

Different quantities of seed varieties were in stock at the time of the survey. It was observed that maize variety KH500-22A had very low stocks compared to the other maize variety (KH500-43A). Quantities purchased or received from the suppliers by agro dealers were low with the highest being 100kg of seed in the last season. This could be an issue of low demand at that particular time. .

Nerica 1 was reported to have the highest selling price per kilo at Ksh 277 while Nerica 10 was reported to be sold at 255. A kilo of KK8 was reported to be sold at Ksh 240 while that of KH500-22A was reportedly sold at Ksh 175.

Overall improved maize seeds (KH500-22A) sold most in the agro dealers at an average 1,000kg per outlet compared to other improved seeds. The other variety of maize (KH500-43A) sold at an average 800kg in an agro dealer outlet.

3.1.2. Credit facilities

Majority of customers at the agro dealer ask for credit on improved seeds; with 70% of our sample of agro dealers revealing such demand for credit. Only 34 % of our sample of agro dealers could advance seeds on credit to farmers, but mainly for maize seeds. Seeds on credit are advanced with no interest at all.

This survey did not ask about the duration of payment. However it was reported that about 90% of farmers that received seeds on credit did pay back. .

3.1.3. Sales

Out of all the improved seed varieties sweet potato and cassava accounted for most sales in Kenya, these two crops are not measured/sold in kg like the rest of the seed varieties; they are measured in cuttings. Of the seeds that are sold in kg, rice and beans accounted the most sales according to the agro dealers that took part in the survey.

Most agro dealers purchase improved seeds from seed companies, a good number of them also get the seeds from the breeders.

3.1.4. Access

The distance travelled by the agro dealers to purchase the improved seed varieties vary depending on the source and type of crop. For example Nerica 1 is bred in Mwea and planted in Kisumu, Nerica 10 is bred in Mwea and planted in Meru while Tajirika is bred in Mtwapa and planted in Kilifi.

Most agro dealers said that they purchase their improved seeds in cash although some also purchase on credit for example 25 agro dealers said that they have purchased maize on credit.

On the mode of access of the stock, majority of the agro dealers get the improved seeds brought to their premises by the sellers. However, some of the agro dealers go and get the seeds from the source-seed companies, distributors.

3.1.5. Communication

As reported by the agro dealers, the best communication method that farmers get to know about the improved seed varieties is through field demonstrations and from other farmers. Agricultural extension officers, field days and radio also play a significant role in passing on information about improved seed varieties to the farmers.

Asked whether the farmers ask for advice from them, majority of the agro dealers reported that farmers ask for advice from them on how to plant the improved seed varieties. This was reported by agro dealers across all crops. However the survey did not ask the agro dealers whether these farmers ask this advice after the agro dealers introduce the improved varieties to them or even when the farmer had a prior knowledge of the seed variety.

3.1.6. Demographics

On education, majority of the agro dealers have completed secondary education with the highest segment having completed college education.

Age distribution among the surveyed agro dealers is almost even between the ages of 21 to 55 years with the highest number between 26 to 30 years.

Most of the agro dealer do agro business as a full time career job but 5 out of the 50 agro dealers survey do not do this business full time.

3.2. Agro Dealer Summary Findings - Uganda

3.2.1. Outlet composition and stocking & price

The average number of people working in an agro dealer outlet in Uganda was 3. A total of 46 agro dealers were surveyed in Uganda, out of these 67% said they sell improved seeds all year round while only 33% said they only sell improved seeds during planting time.

All of the agro-dealers traced confirmed to be currently selling improved seed varieties. All of those surveyed sell maize, more than half of them (63%) sell beans, 24% sell soybeans whereas 11% sell cassava.

In terms of quantity in kilograms stocked, Longe 10H seed variety had the highest stock quantities among those surveyed with an average of just approximately 2 tons (1901.1 Kg) whereas the least stocked is Maksoy 3N Soybean seed variety.

3.2.2. Credit facilities

The most preferred mode of payment by sellers (seed companies, multipliers and breeders) of PASS to agro dealers is cash.

Only about 20% of agro dealers selling maize said that they got the seeds on credit. Majority of agro dealers that offer credit reported that they ask the farmers to pay back in cash without interest. This survey did not ask about the duration of payment. Ninety three percent of agro dealers revealed that there was demand for credit by farmers. Only 59% of agro dealers could extend credit facilities to farmers.

The average repayment rate by farmers was at about 82% in Uganda.

3.2.3. Sales

On average agro-dealers bought 1,223 kilograms of PASS seed varieties for distribution to farmers. Approximately five times more of Nabe 16 seed variety (1761 Kgs) was sourced than Nabe 15 (360Kgs). As for the maize Longe 10H was sourced more than 9H and 5D varieties whereas for Soybeans on average 512 Kgs of Maksoy 2N was sourced compared to 3N where 282.5 Kgs were sourced

On the other hand agro-dealers in Uganda sold on average 1,093 kgs of PASS seed varieties in the last season. When the data is stratified by staple crop, Nabe 16 accounts for the highest quantity sold for beans, Longe 10H was the highest quantity of maize sold whereas Maksoy 2N was the highest quantity of soybean sold.

3.2.4. Access

The distance travelled by the agro dealers to purchase the improved seed varieties vary depending on the source and type of crop. Agro dealers for beans and soybean seem to travel farther to get the seeds with a mean distance of more than 200km while those of maize travel nearer with a mean distance not more than 150km for Uganda.

On the mode of access of the stock, majority of the agro dealers get the improved seeds brought to their premises by the sellers. However, some of the agro dealers go and get the seeds from the source-seed companies, distributors.

3.2.5. Communication

As reported by the agro dealers, the best communication method that farmers get to know about the improved seed varieties is through word of mouth and learnings from other farmers. Agricultural extension officers, field days and radio also play a significant role in passing on information about improved seed varieties to the farmers.

Majority of the agro dealers reported that farmers ask for advice from them on how to plant the improved seed varieties. This was reported by agro dealers across all crops.

3.2.6. Demographics

On education, majority of the agro dealers have college and university education with 12 out of the 46 having some secondary education. None of the agro dealers had informal education.

Age distribution among the surveyed agro dealers the majority (16 out of 46) were between 26-30 years. Most of the agro dealer do agro business as a full time career job only 13% of agro dealers surveyed are not on full time basis.

3.3. Agro Dealer Summary Findings - Mozambique

3.3.1. Outlet composition and stocking & price

The minimum number of employees in the agro dealer outlets in Mozambique is 2 while the maximum was 14. The mean was seven employees per outlet. .

Ten agro dealers were traced in Mozambique nine of which said they sell improved seeds all year round. All ten agro dealers said that they sell seeds varieties of staple foods such as beans, maize, sweet potato and cassava. Seven varieties were being traced in Mozambique but only 4 of the seed varieties were found with agro dealers.

3.3.2. Credit facilities

Majority of the agro dealers buy seed varieties in cash while a few get them on credit, for maize, 2 out of 7 agro dealers said that they get the seeds on credit while 1 for each of the three sweet potato varieties also get the cuttings on credit.

On repayment terms, the two maize variety agro dealers said they repaid in cash without interest while those for sweet potato said they repaid through other means other than cash with or without interest.

About 60% of the agro dealers surveyed in Mozambique revealed that there was demand for credit by farmers to buy seeds. Only 20% of agro dealers were able to avail such credit to farmers. *Sales*

On average maize sold 1.6MT while for the sweet potato varieties the sales exceeded 2MT; Delvia sold 2.6MT, Ininda was sold 2.2MT and Irene 5.07MT.

3.3.3. Access

The mean average distance travelled by agro dealers to purchase maize was 20km, while the maximum was 200km. For the sweet potato varieties, the mean distance was less than 5km.

On delivery, most agro dealers reported that they fetched the seed varieties from the seed company. Four out of the seven agro dealers selling maize said they went for seeds while 3 said it was delivered at their premises.

3.3.4. Communication

The most used marketing channel used by agro dealers is field demonstration; 60 % of the agro dealers surveyed said they market through field demonstration, 5 out ten said farmer field days and also through word of mouth.

3.3.5. Demographics

On education, majority of the agro dealers have more than primary education, eight out of ten agro dealers have some secondary education or more. None of the agro dealers had informal education.

Age was fairly distributed among the ten agro dealers with the lowest band being 21-25 year which had 2 agro dealers. One agro dealer was above 55 years.

3.4. Agro Dealer Summary Findings – Malawi

3.4.1. Outlet composition and stocking & price

Most of the agro dealer outlets surveyed had an average of 5 employees.

Almost all the agro-dealers surveyed had stocks of all the varieties we were tracing for Cassava : Chipika (LU06/0527); Sagonja & Mpale, Pigeon peas: Mwaiwathualima (ICEAP00557) and Beans Maluwa Mal/KK25/9/S-F and Namtupa.

Improved cassava and pigeon peas sold most in the agro dealers compared to other improved seeds. This could be explained by the favorable attributes that have enhanced demand by the farmers for the developed varieties of these 2 crops.

3.4.2. Credit facilities

Majority of customers at the agro dealer do not ask for credit on improved seeds. Seventy five percent of agro dealers said that farmers did not ask for credit in order to purchase improved seeds.

Majority of agro dealers that offer credit reported that they ask the farmers to pay back in cash without interest.

3.4.3. Sales

Out of all the improved seed varieties pigeon peas and cassava accounted for most sales in Malawi. This can be attributed to the network of the distributorship of the Root and Tubers Farmers Association. This is a network of farmers that works with the breeders at the research stations. The Association has a membership of about 110 farmers who farm the improved varieties of Cassava we were tracking. For the pigeon peas agro dealer, there's presence of groups of farmers in each area with varying number of farmers as members hence the high number of sales reported from the surveyed agro-dealers.

3.4.4. Access

The distance travelled by the agro dealers to source the improved seed varieties varies depending on the source and type of crop. For instance a pigeon peas agro dealer has a wide network of pigeon farmers in the Balaka area, a total of about 10 shops covering a radius of about 70 kilometers. Major agro dealers have local farmers' groups' mobilisers/contact people/ mini-agro dealers who work directly with communities and to re distribute seeds. The arrangement resembles some "sub dealership". These groups also work with government with the government which provides seed vouchers to farmers who in turn use them to buy the improved variety seed.

Most agro dealers' purchase improved seeds from the seed multipliers directly or the seed companies double up as the agro-dealership. A good number of them also get the seeds from the breeders from the Chidetze Research Station. Few agro-dealers are being used by the seed companies.

3.4.5. Communication

The best communications method that farmers get to know about the improved seed varieties is through posters, radios and farmer field days and word of mouth from other farmers.

3.4.6. Demographics

It was observed that a good number of the agro dealers have post-secondary education with the highest segment having completed university education with all of them above the age of 26 years. Most of the agro dealers do agro business as a full time career job (92%).

3.5. Agro Dealer Summary Findings - Ghana

3.5.1. Outlet composition and stocking & price

A total of 36 agro dealers were surveyed in Ghana out of which only 32 said they sell/stock improved seed varieties. Twenty five of the agro dealers that sell/stock improved seeds said that they do so all year round. The mean number of employees or people working in the agro dealer outlet was 3 people.

3.5.2. Credit facilities

Most of the agro dealers do not seek credit to purchase improved seed varieties. Only three agro dealers said that they sought seed varieties on credit and paid back in cash without interest.

3.5.3. Sales

While sales depended on the number of agro dealers selling a particular variety, overall maize contributed to the bulk of the sales for the agro dealers interviewed. Maize variety Sanzal-sima contributed to the highest sales. The total value of the best performing seed variety was 73%.

3.5.4. Access

The mean distance travelled by the agro dealers to get the seed varieties vary from 3km for Otuhia (cassava) to 440 for Asomdwee (groundnut).

On delivery, most agro dealers reported that they go for the seed varieties at the seed company or seed distributor. A very small number of agro dealers said that the seeds are delivered at their premises

3.5.5. Communication

Farmers know about the improved seed varieties stocked by agro dealers from other farmers (probably those that have bought the seeds). Twenty two agro dealers reported this while 21 agro dealers reported that farmers know about the improved seeds through word of mouth. Radios also play a significant role because 19 of the agro dealers said that farmers get this information through the radio.

3.5.6. Demographics

On education, majority of the agro dealers have completed secondary education (14 out of 32) while seven agro dealers had college/university education. Three of the agro dealers said they have no formal education.

There was a fair distribution of age among the agro dealers, although a slightly higher number of them were aged between 26 and 35 years old.

Only 2 out of 32 agro dealers said they don't do it as a fulltime job.

3.6. Agro Dealer Summary Findings – Burkina Faso

3.6.1. Outlet composition and stocking & price

The average number of people working in an agro dealer outlet ranged from 2 to 4 persons depending on the size of the outlet. All the outlets sold improved seeds. About a third of those interviewed cited that they only stocked/sold the improved seeds during planting season only.

All the improved seeds varieties we were tracking were available at the time of the survey. Maize variety Wari had the highest stocks compared to the other maize variety Komsaya, cow pea's varieties Kom-calle and Gourgou had very low stocks.

Seed companies were the main purchase points of all the improved seed varieties.

Nafi was reported to have the highest selling price per kilo while Komsaya was reported to be lowest selling price.

Overall improved maize seed varieties accounted for most sales in the agro dealers compared to other seeds.

3.6.2. Credit facilities

Majority of customers at the agro dealer ask for credit on improved seeds; 19 out of 23 agro dealers said that farmers ask for credit. About 89% of the agro dealers surveyed gave credit facilities to farmers. Maize seeds varieties had the most demand on credit. Most of the credit was paid back with no interest.

Majority of farmers that get improved seeds on credit actually pay back. Overall there was 64.43% credit recovery as reported by the agro dealers in Burkina Faso.

3.6.3. Sales

Out of all the improved seed varieties Maize accounted for most sales.

Almost all agro dealers purchase improved seeds from seed companies, none of them purchase from the breeders.

3.6.4. Access

The distance travelled by the agro dealers to purchase the improved seed varieties vary depending on the source and type of crop. For instance, the distance in kilometers travelled from the main source to the agro dealer is 14 and 21 kilometers for Wari and Komsaya maize varieties respectively.

3.6.5. Communication

Radio emerged as the best communication channel that farmers prefer when they want to know about improved seed varieties in Burkina Faso. Word of mouth followed closely as the second most preferred method. Posters, field days, TV programs and other farmers also play a significant role in passing on information about improved seed varieties to the farmers

When the agro dealers were asked whether the farmers ask for advice from them, majority reported that farmers ask for advice from them on how to plant the improved seed varieties. This was reported by agro dealers across all crops. Only 2 out of the 23 agro dealers reported to have never been approached by farmers for advice.

3.6.6. Demographics

On education, on average, the agro dealers have completed secondary and college education with the highest segment having completed primary education.

Age distribution among the surveyed agro dealers is almost even with the highest number between 36 to 40 years.

Nearly all of the agro dealer do agro business as a full time career job but only 1 agro dealer out of the 23 agro dealers surveyed do not do this business full time.



CHAPTER FOUR: FARMER LEVEL PERFORMANCE

This chapter is divided in two: In the first part, we have summary findings for each country. In the second part, we have detailed findings, which include tabulated data and charts.

PART 1: SUMMARY FINDINGS

4.1. Farm Level Performance Summary findings - Kenya

4.1.1. Household socio-economic characteristics

A total of 352 small holder farmers were interviewed with their age distributed between the ages of 26 to 55 years. Majority (45%) of the respondents were between the ages of 31-45 years.

Eighty nine percent of the farmers said that they owned common farming tools like digging hoes and implements and only 11% said they don't own. A plough and oxen are also mostly used in small scale farming but only 24% said they owned a plough and 23% owned a pair of oxen.

For the purpose of communication and information dissemination it is important to note that 88% of the small holder farmers owned a mobile phone and 80% owned a radio. Colour TV ownership was low at 24%.

The average number of household members is 5 which consist of 3 children and 2 adults with two of the children below the age of 13 years.

Farming was reported as the main source of income for the farmers surveyed, crop farming accounted for 82% of the household income and 5% animal husbandry. Income from business and employment accounted for 6% and 5% respectively.

On the household dwelling, the main household dwelling floor is made of earth or mud floor while the roofing is of iron sheet, 35% of the farmers had their main household dwelling floor cemented while only 1% had their floor tiled.

More than three quarters (78%) of the small holder farmers reported that they own the land that they use for cultivation. Eleven per cent of them hire the land they use for cultivation while 3% reported that they are given the land.

4.1.2. Source of information

More than half of the small holder farmers interviewed reported that they receive information on improved seed varieties through word of mouth. Slightly more than a quarter of the farmers reported that they receive information through extension officers and 10% through local administration.

4.1.3. Crops & cropping patterns

Almost all the farmers interviewed plant maize (99%), about three quarters plant beans and only 13% plant finger millet. Finger millet has however not been officially released.

Farm size for cultivation is fairly distributed across all the crop varieties but most common acreage is between a quarters of an acre to 1 acre. Few farmers reported to having planted the various crops in more than an acre.

Most of the crops are planted in mixed plots, i.e. they are planted with other crops. Nerica 10 however is 93% planted alone (separate plot), same applies to Kenspot-4 that is planted (75%) in separate plot.

All of the target crops were planted during the two previous seasons but most farmers reported having planted more beans and maize. For the current season, 61% of farmers reported that they have planted beans while 78% said that have planted maize.

Most of the farmers interviewed reported that they plant by digging holes by hand for all the crops asked about. About a third of them for Karemba and 39% for KH500-22A use animal drawn mechanism as a planting method.

Majority of the farmers use manure and fertilizer during planting and only a few use manure and fertilizer before planting. Forty six percent of farmers planting beans reported that they top dress while only 11% do the same for both KH500-22A and Nerica 1.

All farmers interviewed reported that they use pesticides and insecticides. Farmers planting KK8 and both maize varieties reported that they also fumigate the crops. More than half of maize and rice farmers said that they use pesticides.

All the farmers reported to use extension services but the lowest was reported in both maize varieties; KH500-22A and KH500-43A at 13% and 33% respectively.

4.1.4. Awareness, traits, cost and use

Farmers that reported to have participated in seed selection with breeders were 21% while those that reported to have participated in field education days were 47%.

Top among the sources of seeds were the agro dealer while other included the local shop and own previous harvest. Maize topped the percentage that is sourced from the agro dealer at 74% while rice had the lowest at 12%.

Normally seeds are packed in 1kg, 2kg and 5kg pack sizes and out of these pack sizes and most farmers purchased seeds in a 2kg pack size. Sixty per cent of maize farmers reported to have bought seeds in the 2kg pack size while only 10% of rice farmers said they purchased in

the same size. Other pack sizes varied depending of the crop and variety and included grams. Sweet potato and cassava planting materials are not measured in kg.

The average price for a kilogram of KK8 cost 230 Kenya shillings while that of KH500-22A cost 190 Kenya shillings. U-15 cost 60 per kilogram. Please also not that the variety U-15 has not been released and this price could be between farmers. Farmers in Kilifi were given the cassava cuttings for free by a local NGO.

Most farmers reported paying for seeds in cash for maize (KH500-22A-95%, KH500-43A-94%) and rice (Nerica 1-60%) while for bean (KK8) it was 30% in cash and 52% on credit. Cassava and sweet potato was mostly given for free.

More than half of farmers that acquired seeds for beans on credit paid back in cash without interest (54%); those that acquired maize (KH500-22A) seeds on credit half paid back in cash without interest. Those that acquired Nerica 1 paid back all with harvest.

High yielding, early maturity and resistant to drought and pests are some of the most favourable attributes for the majority of the crops. U-15 is said to be resistant to Striga while both varieties of maize are tolerant to drought.

4.1.5. Farm Production, Yields & Satisfaction

Apart from finger millet farmers reported that their yields from the improved seeds have either increased by half or the yields have doubled According to the breeder, finger millet seeds have not yet been released by the Ministry of Agriculture and could be that farmers are “recycling” the seeds from the time of field trials.

Satisfaction is high for all improved seed varieties apart from the cassava variety Karembo which is at a scale of 2.5 out of 5 where 5 means “totally satisfied” and 1 means “totally dissatisfied”. This is attributed to what the multiplier said was reported by the consumers that Karembo is bitter and has killed a consumer sometimes back. This is however an allegation that was never proved. On the other hand, Tajirika which is the other cassava variety scored the highest at 4.5 out of 5. Nerica 1 also scored 3 out of 5 compared to Nerica 10 which scored 3.6 out of 5. Nerica 10 is more preferred because it is high yielding and matures early.

4.2. Farm Level Performance Summary findings - Uganda

4.2.1. Household socio-economic characteristics

A total of 378 farmers were surveyed in Uganda, out of these 61% were male while 39% were female. All of them said that they had been farming for the last three seasons.

All the farmers surveyed are small holder farmers planting crops in areas less than 5 acres. The plots they crop is either one piece of land or separate plots in different areas but all combined amount to less than or 5 acres

4.2.2. Source of seeds and information

On the source of seeds most farmers reported that they buy them from the agro dealers, the local shop and from other farmers. A majority of the farmers said that their source of seeds is their own from previous harvest. This is highest for cassava at 35% and for beans at 32%. Forty one percent of the farmers (n=253) said they purchased their seeds from the agro dealers.

Majority of the farmers reported that they pay in cash, for cassava Nase 14 more than half of the farmers said they get from other means (free), probably from relatives, neighbours, etc. only 1% for maize (Longe 10H and Beans Nabe 15) said they get the seeds on credit

Majority of the farmers said they get information on improved seed varieties from other farmers (68%) and from the radio (56%). Other important sources include; word of mouth and local administration

4.2.3. Crops & cropping patterns

A total of 9 varieties were being traced in Uganda and all of them were traced at the farm level. The crops and varieties were;

- Beans-Nabe 15 and 16
- Cassava-Nase 13 and 14
- Maize-Longe 9H, 10H and 5D
- Soybean-Maksoy 2N and 3N

Maize and beans comprised the highest percentages of the crops that the small holder farmer's plant, soybean was the least mentioned amounting to 8% of the crops they grow.

During the previous two complete seasons, maize, beans and cassava formed the bulk of their crops

4.2.4. Awareness, traits, cost and use

Farmers in Uganda plant most of their crops in mixed plots, however for maize, more than half said that they plant in separate plots. Majority of the farmers do not use extension services, less

than a third of the farmers reported to have used extension services. For maize it was 25% and 26% for Longe 5D and Longe 10H respectively that reported to have used extension services.

On planting methods, poor practices are used by most of the farmers. More than three quarters of the farmers for all crops reported that they had planted during the current season by digging holes by hand. Sixteen percent of maize farmers (Longe 10H) said that they had used animal drawn ploughs to plant during the current season. Very few of the farmers reported to use or apply manure and fertilizer to their farms. More than 2 thirds reported not to have applied or used manure and fertilizer.

Most of the farmers reported to apply manure/fertilizer before or during planting. Only a small percentage top dress or apply manure/fertilizer after planting. The crops during which manure/fertilizer is applied after planting are maize and beans

Although just a few farmers said they treat their crops, the majority within this category applies pesticides and also fumigate.

4.2.5. Farm Production, Yields & Satisfaction

High yields, early maturing and disease and drought resistance are the most common desired traits that the farmers reported for the improved seed varieties. Most farmers reported that their yield increased by 50% or doubled with the improved seeds compared to the other seeds they have used before. The biggest percentage of cassava and soybean farmers said their yield doubled. Most farmers do not participate in farm demonstration activities, 63% reported that they have not participated in either farm demonstrations or farm field days. Ownership (farm, equipment)-70% of the farmers said they own the land on which they farm while 21% said they hire, the rest have been given by relatives or by the government. On asset ownership, most of the farmers own the basic households assets like radio, mobile phones and farming tools such as digging holes. Only 7% own oxen and 9% own a plough.

4.3. Farm Level Performance Summary findings - Mozambique

4.3.1. Household socio-economic characteristics

In Mozambique a total of 158 farmers were interviewed of whom 33% were female. Eighty seven percent of these farmers said that their main source of income was crop farming

4.3.2. Source of seeds and information

The target PASS seed varieties that the survey was tracing were 8 seeds but only 7 varieties were found at the farm level. The cassava variety Varuiaya was not traced at the farm level. The other seed varieties were;

- Cassava-Orera, Eyope and Mokhalana
- Maize-ZM523
- Sweet Potato-Delvia, Ininda and Irene

The purchase point for most of the farmers was Seed Company (57%) for cassava, agro dealers for maize (45%) and sweet potato is given free (55%). The mean distance travelled by farmers to purchase improved seed varieties are below 50km for all varieties apart from Mokhalana which is 73.1km. The lowest distances are for the sweet potato that is below 12km.

The main source of information is through field demonstrations 45%, word of mouth (39%) and through marketing campaigns & agricultural shows at 28% for each of them

4.3.3. Crops & cropping patterns

The majority of farmers (54%) in Mozambique said they own the land on which they plant the improved seed varieties. Four percent said that they have hired the land and 3% said that they have been given by relatives. Thirty six of the respondents did not answer the question on ownership of the land on which they plant the seed varieties. All the farmers reported to have digging hoes, only 22% said they have a plough and 11% have oxen. Eight percent have an ox-drawn cart.

Cassava is mostly grown on mixed plots although for Orera half of the farmers said that they have grown it on a separate plot; maize was wholly reported as having been grown on a separate plot. More than three quarters of farmers that have planted sweet potato said that they had grown in separate plots. More than half of the farmers that have grown sweet potato said that they have used extension services. Less than half of farmers that had grown the other varieties said that they haven't used extension services. More than three quarters of the farmers reported that they plant by digging holes using hands, for cassava and sweet potato more than 77% reported using hands for digging. For maize it was 72% that reported using hands to dig holes for planting Cassava (Eyope and Mokhalana, it was 100% use of hands).

On manure and fertilizer application more than half (55%) of the farmers that planted Sweet potato (Delvia) said that they have applied manure and fertilizer. For the other crop varieties, manure and fertilizer usage was a third or less. It was lowest (8%) for cassava variety Mokhalana.

Most of the farmers that had grown Orera, ZM523, Delvia and Irene reported that they applied manure/fertilizer before planting while most farmers that had grown Eyope reported that they applied manure/fertilizer during planting. Only 38% of the farmers reported to have used pesticides on their crops. Targeted crops varieties for which pesticide, insecticide and fumigation were done; for Delvia and Irene all the three processes were carried out.

4.3.4. Farm Production, Yields & Satisfaction

Overall satisfaction with the improved seeds was above average with the highest satisfaction being that of cassava variety Orera which was 3.5 out of 5 where 5 meant extremely satisfied and 1 was extremely dissatisfied. Cassava variety Eyope had the lowest satisfaction mean score of 3.1. More than half of the farmers said that they have participated in demonstration farms (63%), farm field days (39%) in the last 3 seasons, only 9% said they have not participated in any of the farm activities.

Most farmers that grew maize and cassava said that their yield remained the same compared to other seed varieties. However 43% of farmers that had grown Eyope said that the yield had increased by half while 16% of farmers that had grown maize (ZM523) said that their yield has doubled.

4.4. Farm Level Performance Summary findings - Malawi

4.4.1. Household socio-economic characteristics

In Malawi a total of 371 farmers were traced 44% of whom were female, ninety four percent of the small holder farmers traced reported that they are the heads of the household. All of the farmers said that farming is their main source of income.

Most farmers said they own the basic hand digging hoes (94%), 10% own oxen and only 1% own a plough. Those that own a radio are 70% and those with mobile phones were 62%.

Majority of the farmers have some primary education (45%) while those that have completed secondary education were 7%. Sixteen percent had no formal education.

4.4.2. Source of seeds and information

Most of the farmers said they get the seeds from the agro dealers; 93% of the farmers that planted pigeon peas and 74% for farmers who planted sweet potato. Other sources included breeder and multipliers. Most farmers paid cash for the seed varieties they have planted during the current season. However 96% of farmers that planted Namtupa said that they had gotten the seeds on credit.

Terms of payment for the farmers who got the seeds on credit was pay back with their harvest. Most of the farmers said that they planted the crops in separate plots. Forty percent of the farmers that planted pigeon peas said that they planted in mixed plots.

The most common means that the farmers reported to have received information about improved seed varieties was through radio (59%). Those that reported to have received from other farmers were 50% and only 27% through word of mouth

4.4.3. Crops & cropping patterns

A total of 9 varieties were being traced in Malawi but only 7 were found at the farmer level. The varieties that were traced at the farmer level were;

- Beans-Mal, Namtupa
- Cassava-Sauti, Mpale and Sagonja
- Pigeon pea-Mwaiwathualima
- Sweet potato-Chipika

For the farmers that planted beans and one variety of maize (Sauti), pigeon peas and sweet potato more than half said that they don't use extension services. Majority farmers use hands for digging holes; however farmers who planted maize (Sauti) reported to have used both mechanized and hand digging.

Most of the farmers have not used manure or fertilizer for the crops they planted during the current season. About a quarter (25%) of farmers that planted beans (Namtupa) said that they used manure/fertilizer.

Farmers reported that they have participated in a number of activities; 59% said they have participated in farm field days but 80% said they haven't participated in seed selection. Thirty nine percent said they have attended farm education days. On land ownership most of the farmers said that they owned the land that they have planted (89%), 7% said they have hired while the remaining 4% said they have been given by relatives.

4.4.4. Awareness, traits, cost and use

High yields, tolerance to pests, quality and resistance to disease was the most desired characteristics of the crops grown from the improved seed varieties. Ninety five percent of the farmers who planted Chipika said that it is high yielding while 95% of farmers that planted pigeon peas said it was high yielding.

4.4.5. Farm Production, Yields & Satisfaction

On performance most farmers said that their yield has increased by half or it has doubled however 33% of the farmers that planted Mpale said that the yield has remained the same. Satisfaction level is above average for all crops, Mpale has a mean score on satisfaction of 3.0 out of 5 where 5 is the highest and means extremely satisfied. Score 1 is the lowest which means extremely dissatisfied. Namtupa has the highest score of 4.0.

4.5. Farm Level Performance Summary findings - Ghana

4.5.1. Household socio-economic characteristics

In Ghana, a total of 338 farmers were surveyed 27% of which was female farmers. Out of the 338 farmers traced, 94% said that they were the heads of the household. Seventy five percent of these farmers said that their main source of income is crop farming. Only 100 farmers out of the total 338 were found to plant the targeted PASS varieties.

On land ownership, more than half (51%) of the farmers said that they own the land on which they plant the improved seed varieties, 25% said they hire while 20% said they have been given by relatives.

About a third of the farmers surveyed have no formal education while only 2% have university education.

4.5.2. Source of seed and information

The PASS programme targeted seed varieties that were traced at the farm level were;

- Cassava-Ampong, Buroni Bankye, Otuhia
- Cowpea-Obolo, Yenyawoso, Oboshie
- Maize-Sanzal-sima, Ewul-boyu, Wang-dataa, Bihilifa, Tigli
- Rice-AgraRice

On purchase, only one farmer who planted cassava (Ampong) said they purchased the seeds on credit.

Most of the farmers reported that their sources of seeds planted during the current season are own seeds from previous harvest. Most of the farmers do not use extension services.

Three quarters of the farmers said that they have not participated in either farm demonstrations, farm field days. Ninety percent said that they never participated in seed selection process with breeders and 73% said they have not attended farm education days in the last 3 seasons.

The most common source of information was reported to be from other farmers, 72% of the farmers said that they got information about improved seed varieties from other farmers, 62% from radio and 43% from word of mouth.

4.5.3. Crops & cropping patterns

The most common method of farming for the farmers surveyed was digging using hands except for the maize variety Ewul-boyu of which 20% of the farmers reported using animal drawn plough while 70% reported using motor driven method of farming.

Application of pesticide, insecticide and fumigation-more than half (59%) of the farmers reported to have used pesticide, insecticide or fumigated their crops.

4.5.4. Awareness, traits, cost and use

On desirable attributes; colour of the seed, early maturity and high yield were the most common desirable characteristics that the farmers reported.

Most farmers said they did not see any much difference between yields of the improved varieties with other seed varieties. However about a quarter of the farmers said that the yield has doubled.

4.5.5. Farm Production, Yields & Satisfaction

The satisfaction score for the improved seeds was above 2.5 out of 5 where 5 being the highest score meant that the farmers was extremely satisfied and 1 meant the farmer was extremely dissatisfied. The crop with the highest satisfaction level was maize-Ewul-boyu at 4.5 while the lowest was groundnut-Yenyawoso at 2.5.

4.6. Farm Level Performance Summary findings – Burkina Faso

4.6.1. Household socio-economic characteristics

In Burkina Faso, a total of 315 farmer were surveyed of which 58% were male and 42% were female. All the farmers have been growing crops in the last three seasons or more. All farmers grow crops in either a mixed plot or in separate plots which accounts for less than 5 acres. The main crop grown is maize (85%).

On land ownership, majority of the farmers (82%) said they own the land on which they plant the improved seed varieties. On asset ownership, 96% of the farmers said that they own a bicycle, 82% own oxen while 58% own a plough.

4.6.2. Source of seeds and information

On acquisition of seeds most farmers surveyed in Burkina Faso said they get their improved seeds from charity. The crop varieties that were traced to the farmers include;

- Cowpea-Tiligre, Kom-calle, Gourgou and Nafi
- Maize-Wari and Komsaya

Most of the farmers reported that they paid cash for the seed varieties they planted during the current season, a small number of maize farmers said they paid by other means (got it free or worked for the seeds-labour). A very small number (1%) for maize Komsaya and Wari said they got on credit.

More than half of the farmers said that they have participated in farm field days in the last 3 seasons. The main source of information is through the radio at 57%, word of mouth (54%) and from other farmers at 35%.

4.6.3. Crops & cropping patterns

On the planting approach, most of the farmers grow their crops on mixed plots apart from Kom-calle and Gourgou that are planted on separate plots. On the use of extension services, most of the farmers interviewed said that they use extension services.

Mechanized (animal drawn) planting method is the most common method of planting in Burkina Faso according to the farmers surveyed apart from farmers who have grown Kom-Calle and Nafi who reported using hands for digging holes for planting.

4.6.4. Awareness, traits, cost and use

High yield, early maturing and drought resistant are the most common favourable attributes reported by the farmers. Most of the farmers said that the performance of the improved seed varieties has increased their yield by 50%.

4.6.5. Farm Production, Yields & Satisfaction

On satisfaction, most of the farmers are satisfied with the improved seed varieties, satisfaction is between 3 and 3.6 where 1 means extremely dissatisfied and 5 means extremely satisfied. Gourgou has the lowest satisfaction at 3.0 while Kom-Calle, Nafi and Komsaya has the highest satisfaction at 3.6.

vii.

PART 2: DETAILED FINDINGS

viii.

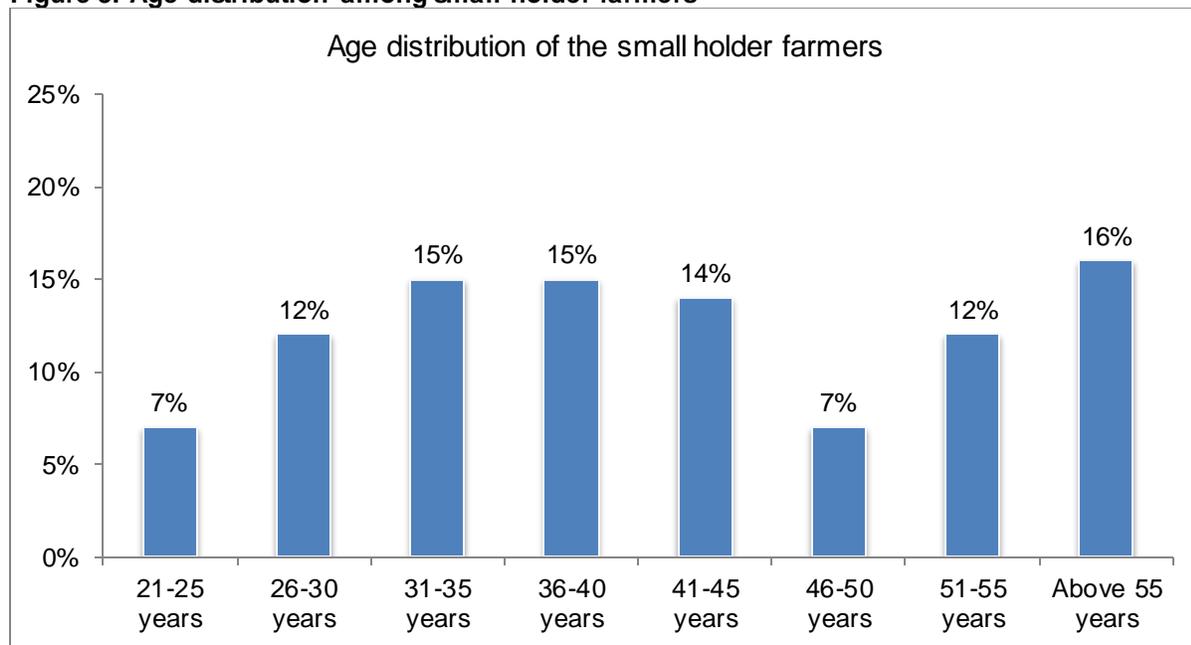
4.7. Farm Level Performance Detailed findings: Kenya

Household socio-economic characteristics

Demographics-Age distribution

A total of 352 small holder farmers were interviewed; their age was distributed between the ages of 26 to 55 years with the majority (45%) between the ages of 31-45 years.

Figure 3: Age distribution among small holder farmers



Household assets – land and physical assets

Asset ownership

Small holder farming is labour intensive and the use of common farming tools like digging hoes and implements was expected. Eighty nine percent of the farmers said that they owned these tools and only 11% said they don't own. A plough and oxen are also mostly used in small scale farming but only 24% said they owned a plough and 23% owned a pair of oxen. For the purpose of communication and information dissemination it is important to note that 88% of the small holder farmers owned a mobile phone and 80% owned a radio. Colour TV ownership was low at 24%.

Table 11: Household asset ownership

Household asset Ownership (352)	Own	Have but don't own	Don't have
Digging hoes/implements	89%	0%	11%
Mobile phone	88%	2%	10%
Radio	80%	2%	18%
Store	50%	1%	49%
Bicycle	43%	3%	54%
Granary	25%	2%	73%
Plough	24%	8%	69%
Colour TV	24%	2%	74%
Oxen	23%	8%	68%
Motor cycle	18%	5%	76%
Access to electricity	16%	1%	83%
Ox drawn cart	9%	2%	89%
Tractor	1%	16%	83%
Pick-up	1%	2%	97%

Household size and composition and age distribution, education

Average household composition

Average number of household members is 5 which consist of three children and 2 adults with two of the children below the age of 13 years. The other children aged between 13 and 17 years is assumed to be in school. This means that there is limited labour for small holder farmers since on average only two adults are available to provide labour in the farm.

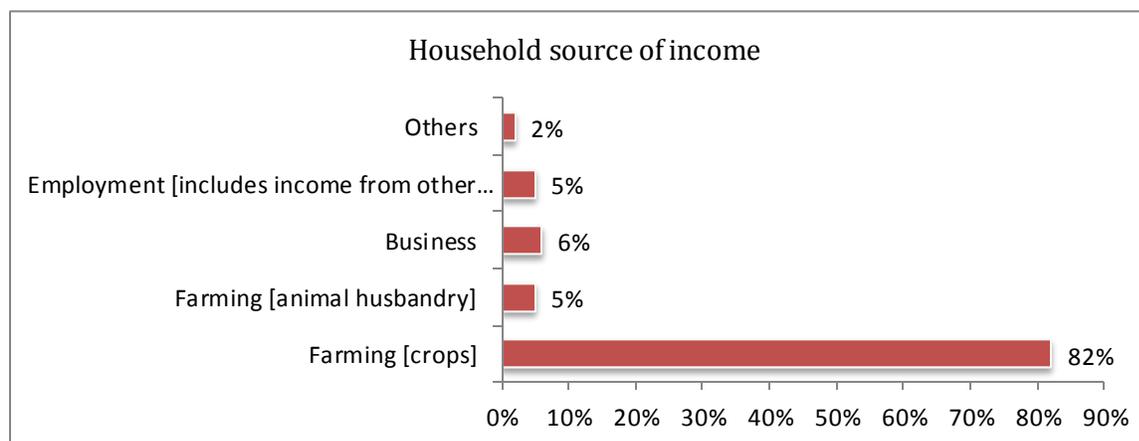
Table 12: Household composition

	Number
Children below 5 yrs of age	1.2
Children 5 - 12 yrs of age	1.5
Teenagers (13 - 17 years)	1.1
Adults (18+)	2.8

Main source of household income

Farming, especially crop farming was the main source of income for the farmers surveyed, crop farming accounted for 82% of the household income and 5% animal husbandry. Income from business and employment accounted for 6% and 5% respectively.

Figure 4: Household main source of income



Floor and roofing material

Main household dwelling floor is made of earth or mud floor while the roofing is of iron sheet, 35% of the farmers had their main household dwelling floor cemented while only 1% had their floor tiled.

Table 13: Household dwelling composition

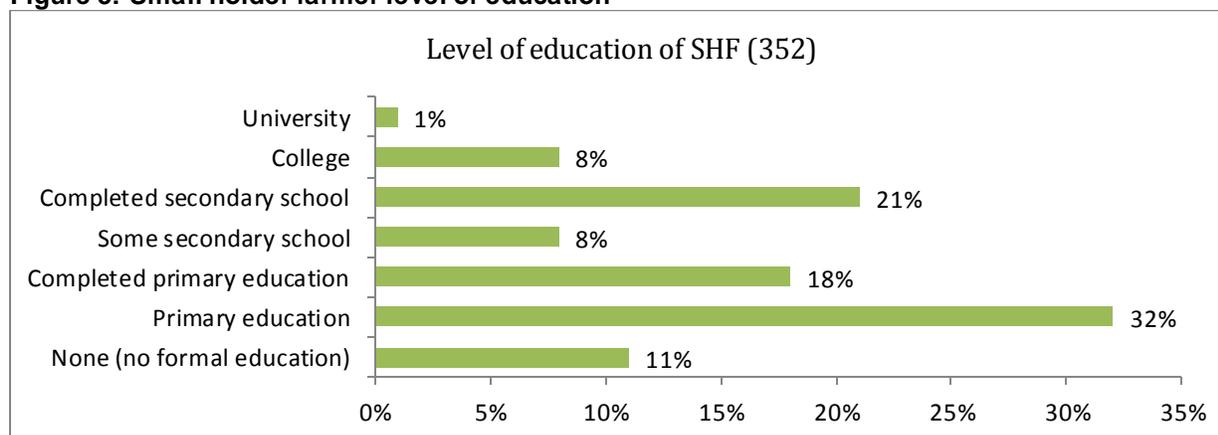
Floor	Base (352)	Roofing	Base (352)
Cement	35%	Iron sheets	88%
Mug/earth	64%	Tin	1%
Tiles	1%	Grass	7%
		Other materials	4%

Education of the respondent

The highest percentage of small holder farmers interviewed had attained primary education and above but the highest single percentage; 32% had only some primary education. Eleven per

cent of the small holder farmers interviewed had no formal education while 1% had university education.

Figure 5: Small holder farmer level of education



Source of information about improved seeds

More than half of the small holder farmers interviewed reported that they receive information on improved seed varieties through word of mouth. Thirty five percent of the farmers receive information through the radio and only 9% receive through the TV. Slightly more than a quarter of the farmers reported that they receive information through extension officers and 10% through local administration.

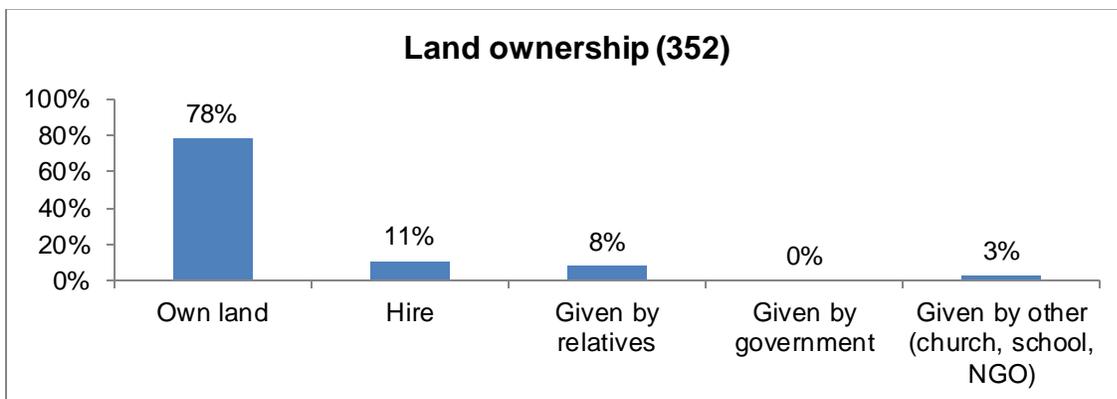
Table 14: Source of information about improved seed varieties

Source of information about improved seed varieties	Base (352)
Through word of mouth	51%
Radio	39%
Through agricultural extension officers	27%
Field Demonstrations	23%
Farmer field days	22%
Posters	11%
Agricultural shows	11%
Through local administration	10%
TV programs	9%
Pamphlets	5%
Through marketing campaign	4%

Household land ownership

More than three quarters (78%) of the small holder farmers reported that they own the land that they use for cultivation. Eleven per cent of them hire the land they use for cultivation while 3% reported that they are given the land.

Figure 6: Land ownership

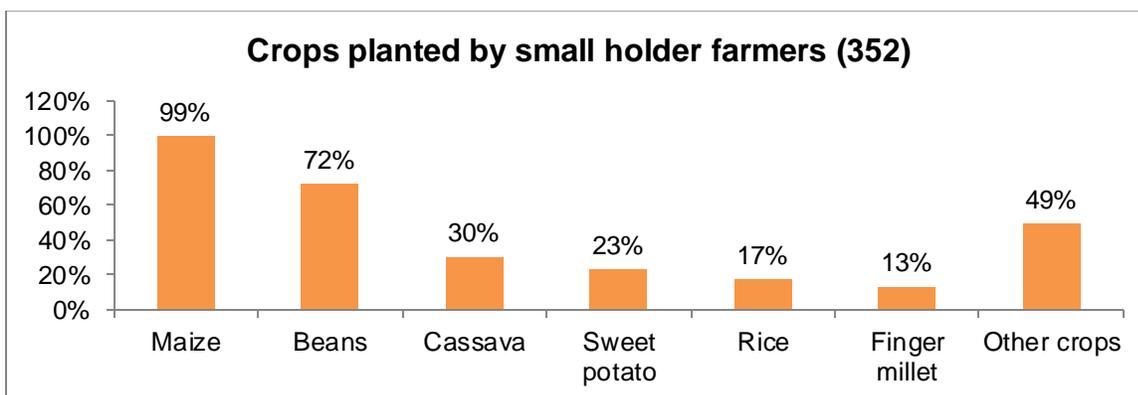


Crops and cropping patterns

Crops planted

Almost all the farmers interviewed plant maize (99%), about three quarters plant beans and only 13% plant finger millet. Other crops outside the interest crops are 49%.

Figure 7: Crops planted



Average farm size in use for various crops

Farm size for cultivation is fairly distributed across all the crop varieties but most common acreage is between a quarters of an acre to 1 acre. Few farmers reported to having planted the various crops in more than an acre. This is a true indication that the selected farmers are small holder farmers where the definition of a small holder farmer is one that has only 5 acres or less land under food crop cultivation.

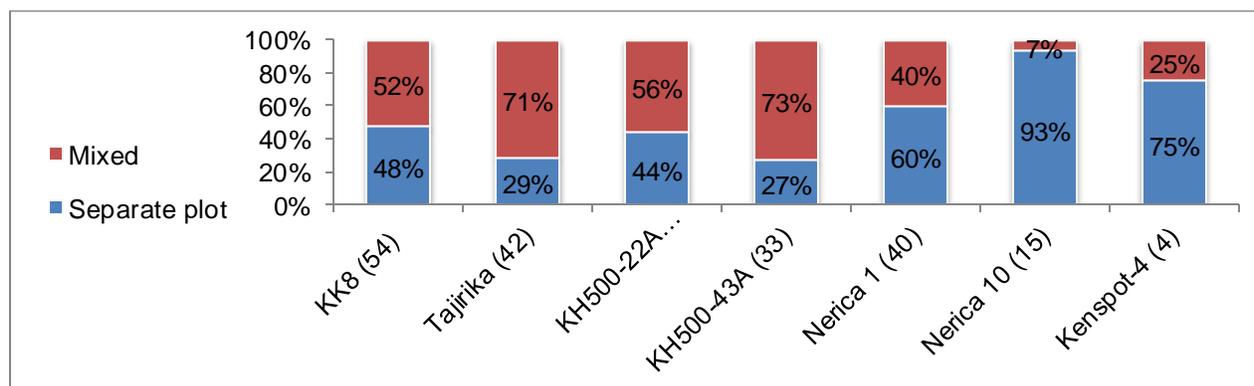
Table 15: Average farm size for crop varieties

	Beans (252)	Cassava (106)	Finder millet (45)	Maize (348)	Rice (60)	Sweet Potato (81)
¼ acre	19%	26%	40%	12%	35%	38%
½ acre	23%	13%	13%	17%	22%	22%
¾ acre	8%	4%	7%	9%	3%	2%
1 acre	25%	22%	4%	24%	17%	2%
2 acres	10%	7%	2%	16%	5%	1%
3 acres	2%	3%	-	4%	2%	2%
4 acres	*	2%	-	3%	3%	-
5 acres	1%	-	-	2%	-	-

Farm acreage type for seed varieties

Most of the crops are planted in mixed plots, i.e. they are planted with other crops. Nerica 10 however is 93% planted alone (separate plot), same applies to Kenspot-4 that is planted 75% in separate plot. Tajirika and KH500-43A have highest percentages for being planted in mixed plots at 71% and 73% respectively.

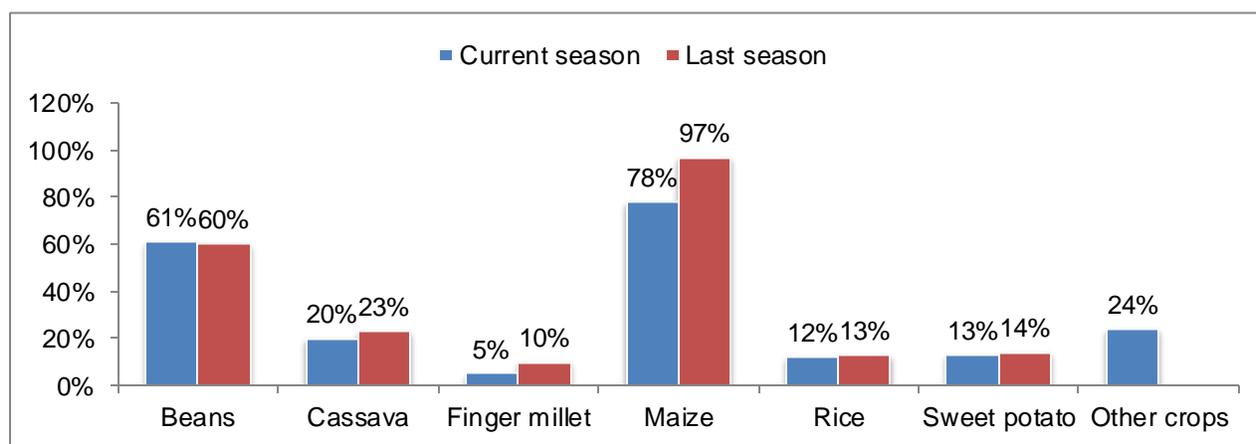
Figure 8: Farming pattern



Crops grown during current and last seasons

All of the target crops were planted during the two previous seasons but most farmers reported about both beans and maize. For the current season, 61% of farmers reported that they have planted beans while 78% said that have planted maize. Seventy nine percent reported that they had planted maize during the last planting season.

Figure 9: Crops planted during current and last season



Planting method

Most of the farmers interviewed reported that they plant by digging holes by hand for all the crops asked about. About a third of them for Karemba and 39% for KH500-22A use animal drawn mechanism as a planting method.

Table 16: Planting method

	KK8	Tajirika	Karemba	U-15	KH500-22A	KH500-43A	Nerica 1	Nerica 10	Kenspot-4
Base	54	42	3	4	171	33	40	15	4
Mechanized (animal drawn)	19%	2%	33%	-	39%	12%	2%	-	-
Mechanized (motor driven)	-	57%	33%	-	11%	3%	-	7%	-
By hand (digging holes)	81%	40%	33%	100%	50%	85%	98%	93%	100%

Use of manure and fertilizer

Majority of the farmers use manure and fertilizer during planting and only a few use manure and fertilizer before planting. Forty six percent of farmers planting beans reported that they top dress while 11% do the same for both KH500-22A and Nerica 1.

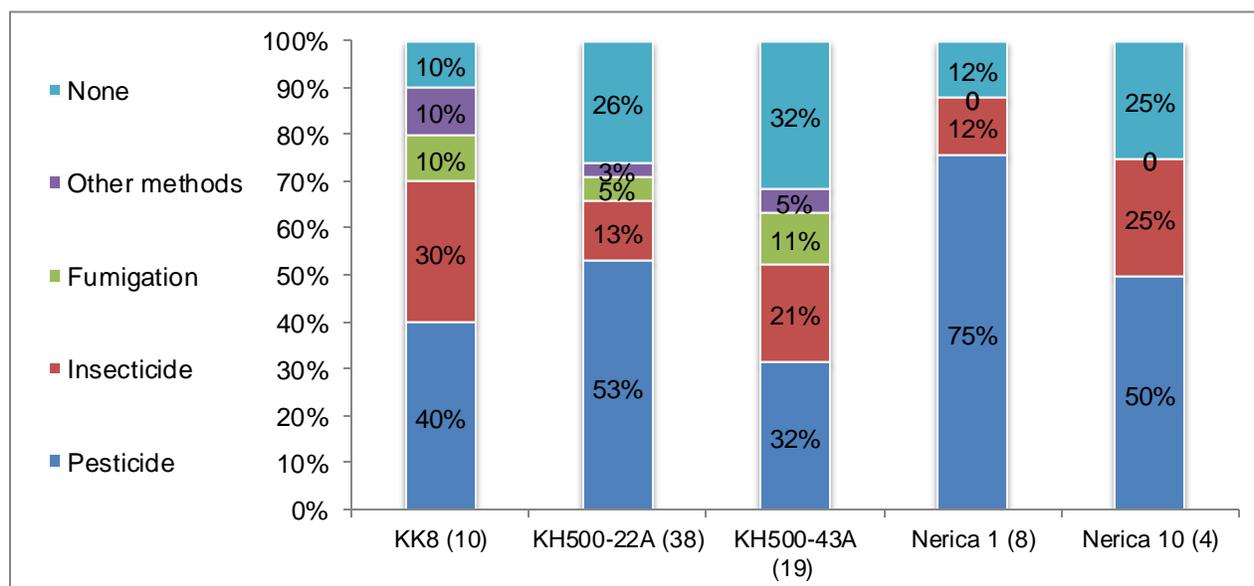
Table 17: Use of manure and fertilizer

	KK8 (54)	U-15 (4)	KH500-22A (171)	KH500-43A (33)	Nerica 1 (40)	Nerica 10 (15)
Before planting	19%	-	7%	3%	1%	1%
During planting	74%	100%	30%	5%	4%	4%
After planting/top dressing	46%	-	11%	5%	11%	4%

Use of pesticides

All farmers interviewed reported that they use pesticides and insecticides. Farmers planting KK8 and both maize varieties reported that they also fumigate the crops. More than half for maize and rice farmers said that they use pesticides and a quite a significant percentage also don't apply anything to the crops.

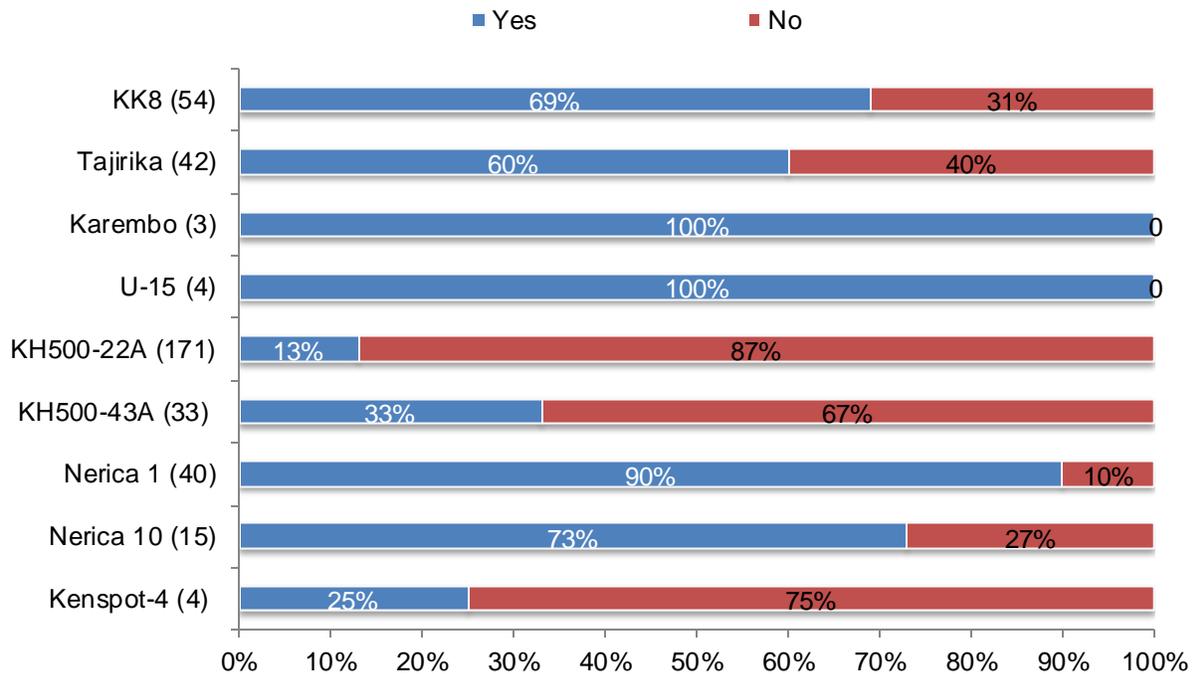
Figure 10: Use of pesticides



Extension services

All the farmers reported to use extension services but the lowest was in both maize varieties; KH500-22A and KH500-43A reported as 13% and 33% respectively. Crops that reported the highest percentage are Karembo and U-15 at 100% for both. Ninety per cent of farmers planting Nerica 1 reported to use extension services.

Figure 11: Farmers using extension services

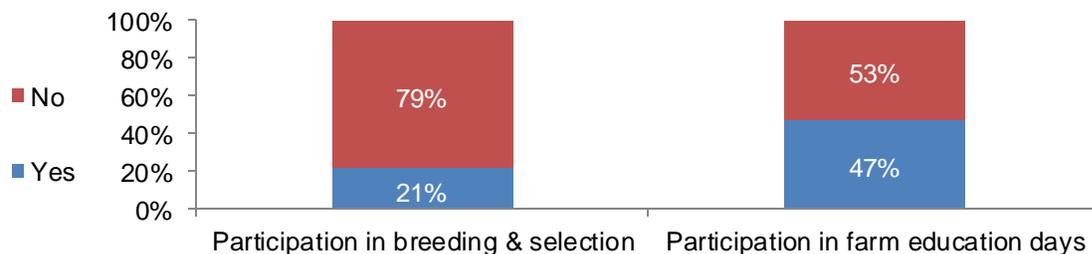


Awareness, traits, cost and use

Participation in seed selection with breeders & field demonstrations

Farmers that reported to have participated in seed selection with breeders were 21% while those that reported to have participated in field demonstration and education days were 47%. For the field day education the percentage is impressive considering that it is almost half.

Figure 12: Farmers participation in breeding and field demonstration



Source of seeds crops

Farmers have a multiple sources of seeds for planting but top among them was the agro dealer while other included the local shop and own previous harvest. Maize topped the percentage that is sourced from the agro dealer at 74% while rice had the lowest at 12%. This survey did not ascertain whether the seeds bought were certified and sealed. It is likely that the seeds bought/received from the local shop, own harvest, other farmers and sources was not sealed and certified.

Table 18: Sources of seeds

	Beans: (216)	Cassava: (71)	Finger millet: (18)	Maize: (273)	Rice: (43)	Sweet Potato: (45)
Agro dealers	42%	42%	50%	74%	12%	22%
Seed company	3%	11%	6%	6%	5%	2%
Local shop	22%	-	6%	10%	-	2%
Charity (government/NGO/Church)	4%	23%	17%	4%	86%	11%
Own previous harvest	25%	21%	17%	10%	5%	40%
Other farmer(s)	9%	30%	6%	3%	2%	44%
Other sources	17%	4%	-	2%	44%	2%

Pack sizes of seeds bought

Normally seeds are packed in 1kg, 2kg and 5kg pack sizes and out of these pack sizes and most farmers purchased seeds in a 2kg pack size. Sixty per cent of maize farmers reported to have bought seeds in the 2kg pack size while only 10% of rice farmers said they purchased in the same size. Other pack sizes varied depending of the crop and variety and included grams. Sweet potato and cassava planting materials are not measured in kg.

Table 19: Pack sizes of seeds purchased

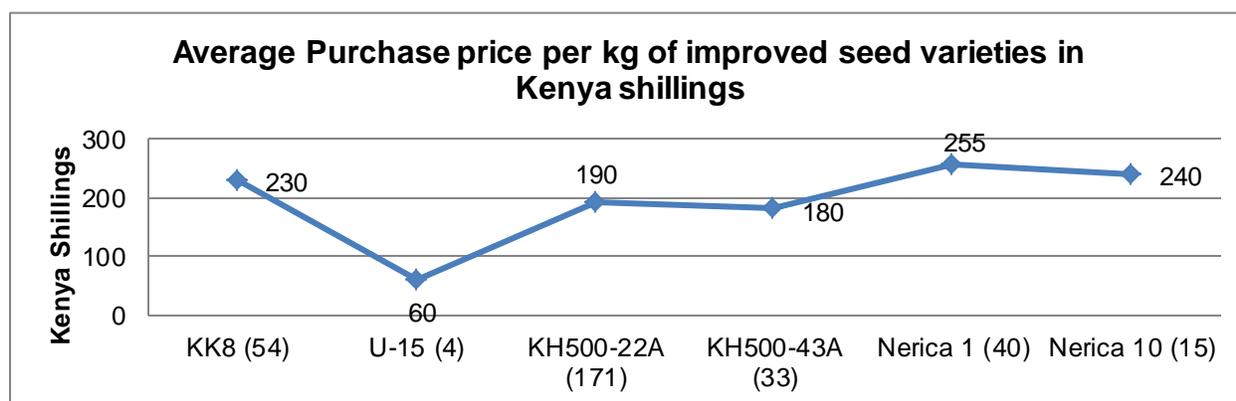
	KK8 (54)	U-15 (4)	KH500-22A (171)	Nerica 1 (40)	Nerica 10 (15)
1kg	2%	50%	3%	40%	7%
2kg	20%	25%	60%	10%	13%

5kg	17%	-	5%	8%	27%
Other pack sizes	61%	25%	32%	42%	53%

Average price per kg of improved seed varieties

The average price for a kilogram of KK8 cost 230 Kenya shillings while that of KH500-22A cost 190 Kenya shillings. U-15 cost 60 per kilogram. The variety U-15 has not been released and this price could be between farmers.

Figure 13: Average buying price



Mode of payment for improved seeds

Most farmers reported paying for seeds in cash for maize (KH500-22A-95%, KH500-43A-94%) and rice (Nerica 1-60%) while for bean (KK8) it was 30% in cash and 52% on credit. Cassava and sweet potato was mostly given for free.

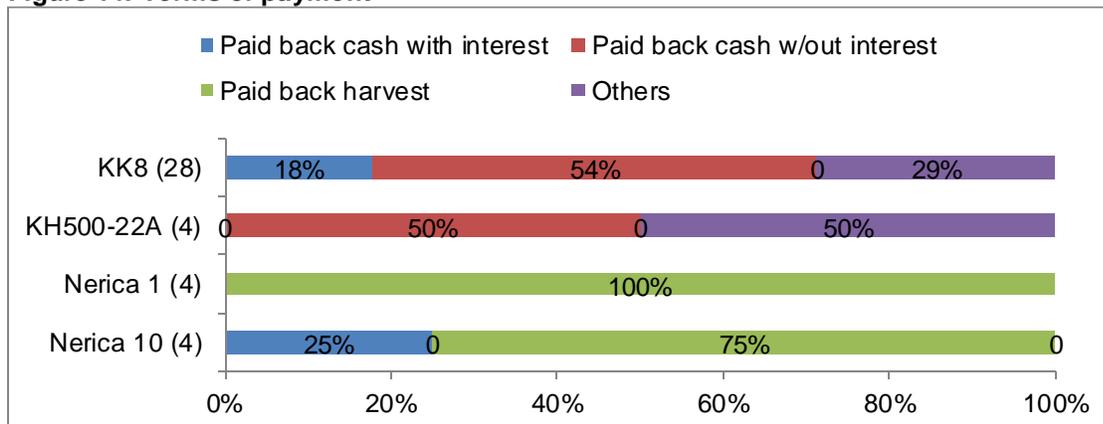
Table 20: Mode of payment

Mode of payment	KK8 (54)	Tajirika (42)	U-15 (4)	KH500-22A (171)	KH500-43A (33)	Nerica 1 (40)	Nerica 10 (15)	Kenspot-4 (4)
Paid cash	30%	21%	50%	95%	94%	60%	40%	25%
Got on credit	52%	2%	-	2%	3%	10%	27%	-
Other (did not pay, instalments, from harvest)	19%	76%	50%	3%	3%	30%	33%	75%

Terms of payment for seeds obtained on credit

More than half of farmers that acquired seeds for beans on credit paid back in cash without interest (54%); those that acquired maize (KH500-22A) seeds on credit half paid back in cash without interest. Those that acquired Nerica 1 paid back all with harvest.

Figure 14: Terms of payment



Favourable attributes

High yielding, early maturity and resistant to drought and pests are some of the most favourable attributes for the majority of the crops. U-15 is said to be resistant to Striga while both varieties of maize are tolerant to drought. See tables below;

Figure 15: Beans: KK8 (54)

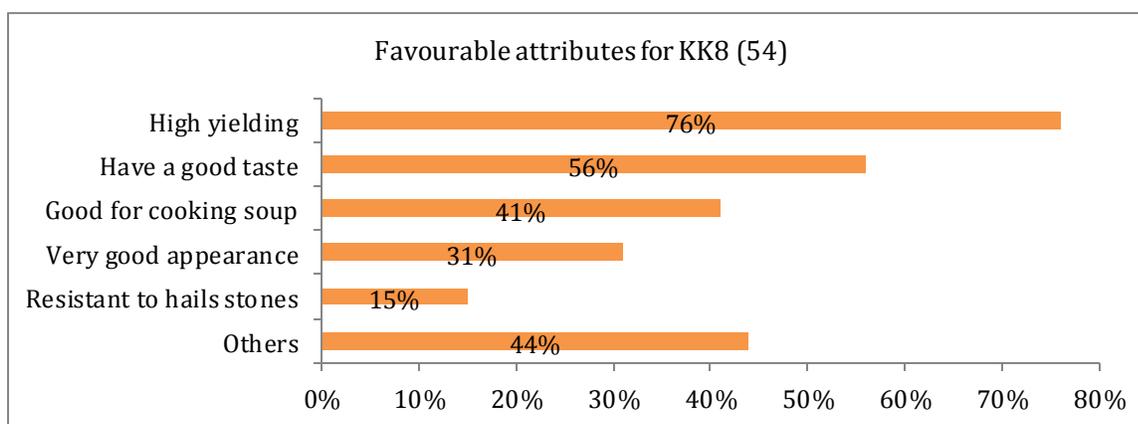


Figure 16: Cassava: Tajirika (42)

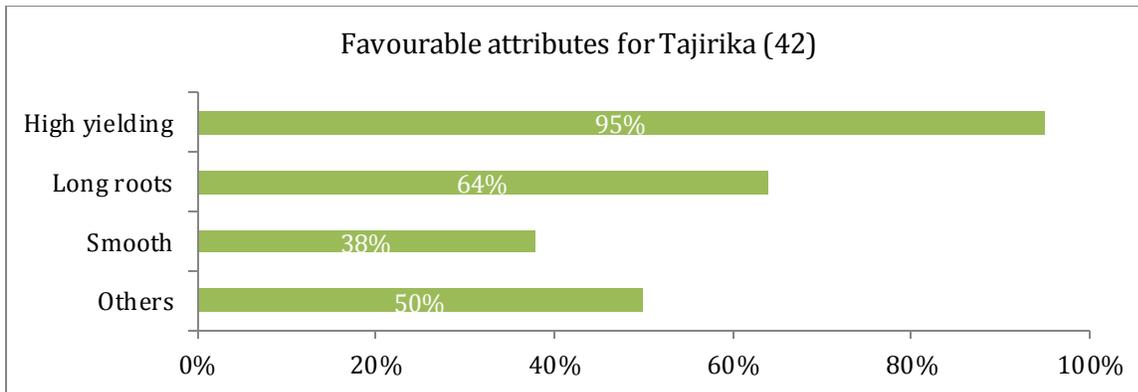


Figure 17: Finger millet: U-15 (4)

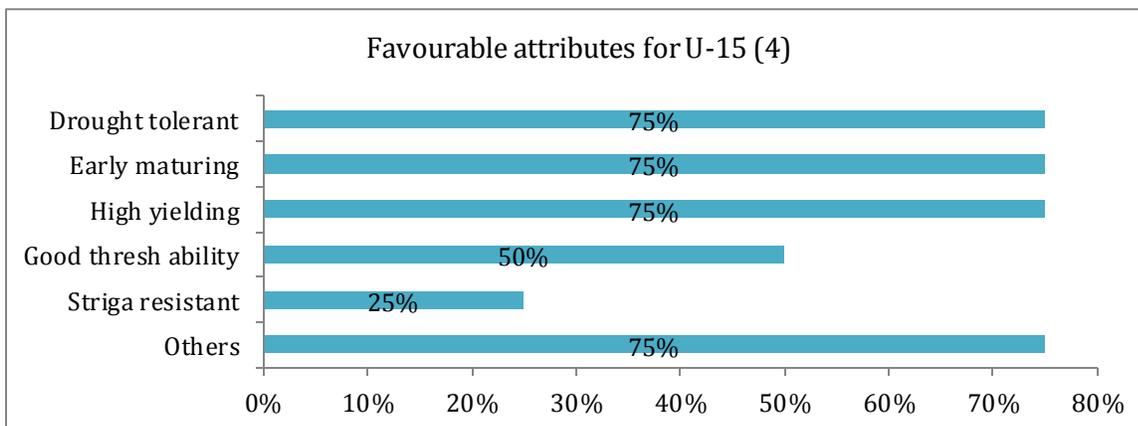


Figure 18: Maize; KH500-22A, KH500-43A

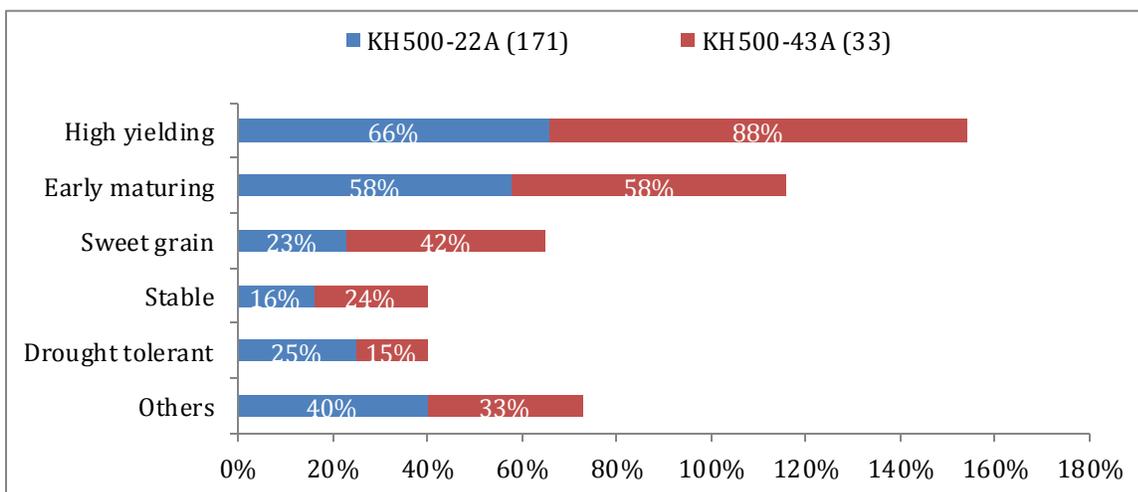


Figure 19: Nerica 1 (40) & Nerica 10 (40)

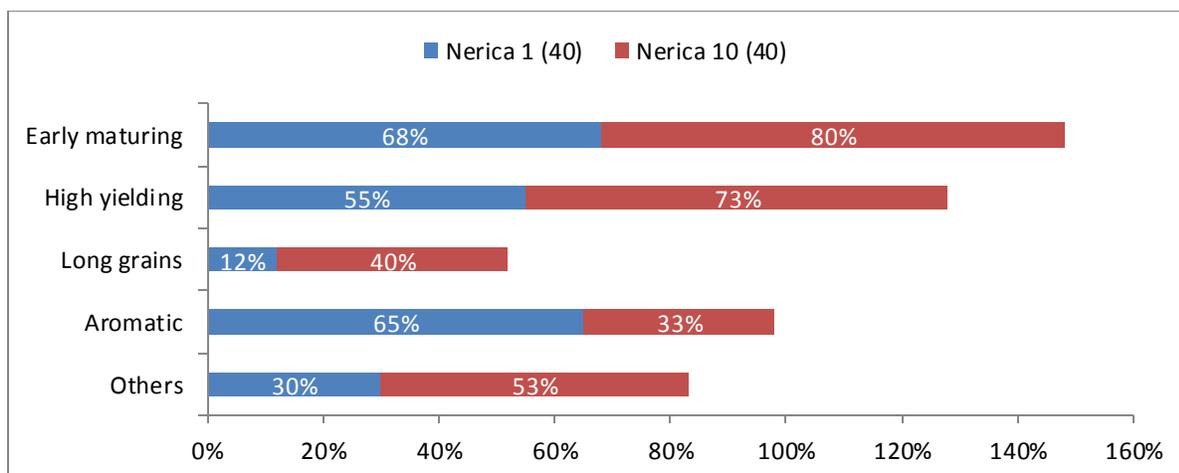
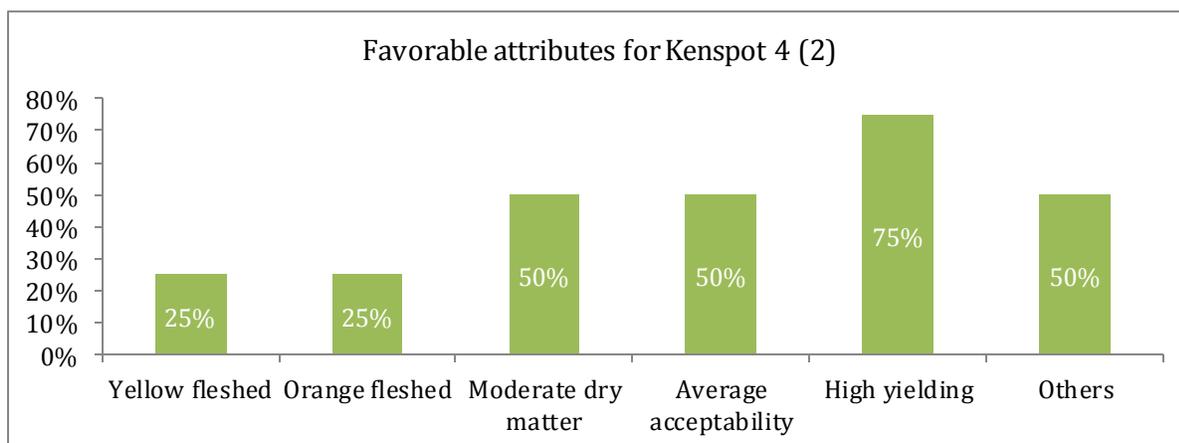


Figure 20: Sweet Potato: Kenspot-4 (2)



Farm Production, Yields & Satisfaction

Yield from improved seeds compared to other varieties

Apart from finger millet farmers reported that their yields from the improved seeds have either increased by half or it has doubled. According to the breeder, finger millet seeds had not been released by the Ministry of Agriculture and it is likely that farmers are “recycling” the seed from the time of field trials.

Table 21: Yield improvement

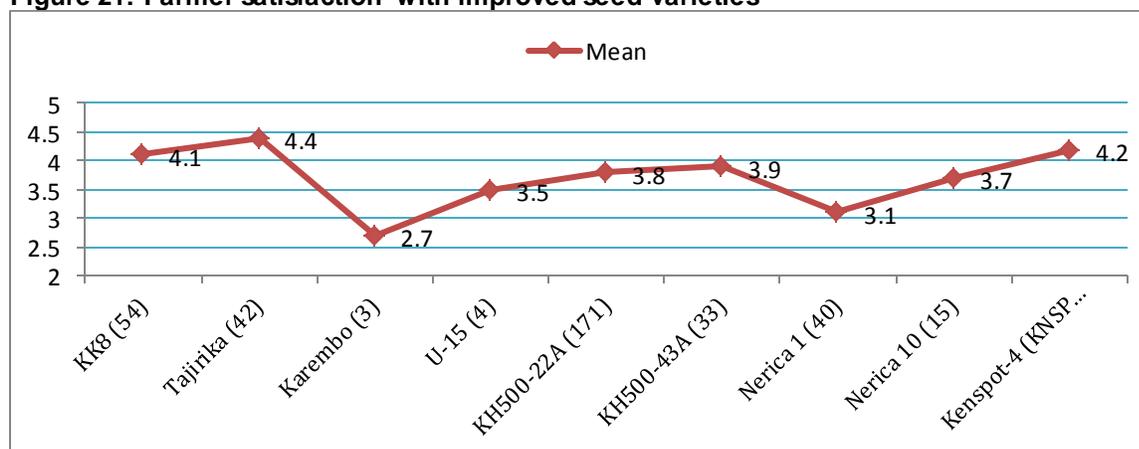
Yield of improved seeds	KK8 (54)	Tajirika (42)	Kare mbo (3)	U-15 (4)	KH50 0-22A (171)	KH50 0-43A (33)	Nerica 1 (40)	Nerica 10 (15)	Kenspot -4 (KNSP (4)
Got same yield	30%	21%	-	50%	37%	21%	45%	47%	25%

compared to other varieties									
Yield increased by 50%	35%	21%	67%	25%	43%	45%	30%	13%	50%
Double yield	35%	57%	33%	25%	20%	33%	25%	40%	25%

Satisfaction

Satisfaction is high for all improved seed varieties apart from the cassava variety Karembu which is at a scale of 2.5 out of 5 where 5 means “totally satisfied” and 1 means “totally dissatisfied”. This is attributed to what the multiplier said was reported by the consumers that Karembu is bitter and has killed a consumer sometimes back. This is however an allegation that was never proved. On the other hand, Tajirika which is the other cassava variety scored the highest at 4.5 out of 5. Nerica 1 also scored 3 out of 5 compared to Nerica 10 which scored 3.6 out of 5. Nerica 10 is more preferred because it is high yielding and matures early.

Figure 21: Farmer satisfaction with improved seed varieties



4.7. Farm Level Performance Detailed findings: Uganda

Distribution of the crops that the farmers plant

Maize and beans comprise the highest percentages of the crops that the small holder farmer's plant, soybean was the less mention amounting to 8% of the crops they grow.

Table 22: Crops planted

Base	378
Beans	64%
Cassava	34%
Maize	89%
Soybean	8%

Other crops	31%
-------------	-----

During the previous two complete seasons, maize, beans and cassava formed the bulk of their crops.

Table 23: Crops grown during the previous two seasons

		Current Season [378]	Last season [378]
Crops grown in the most two recent complete seasons	Beans	48%	44%
	Cassava	21%	21%
	Maize	67%	71%
	Soybean	3%	4%
	Other crops	17%	-

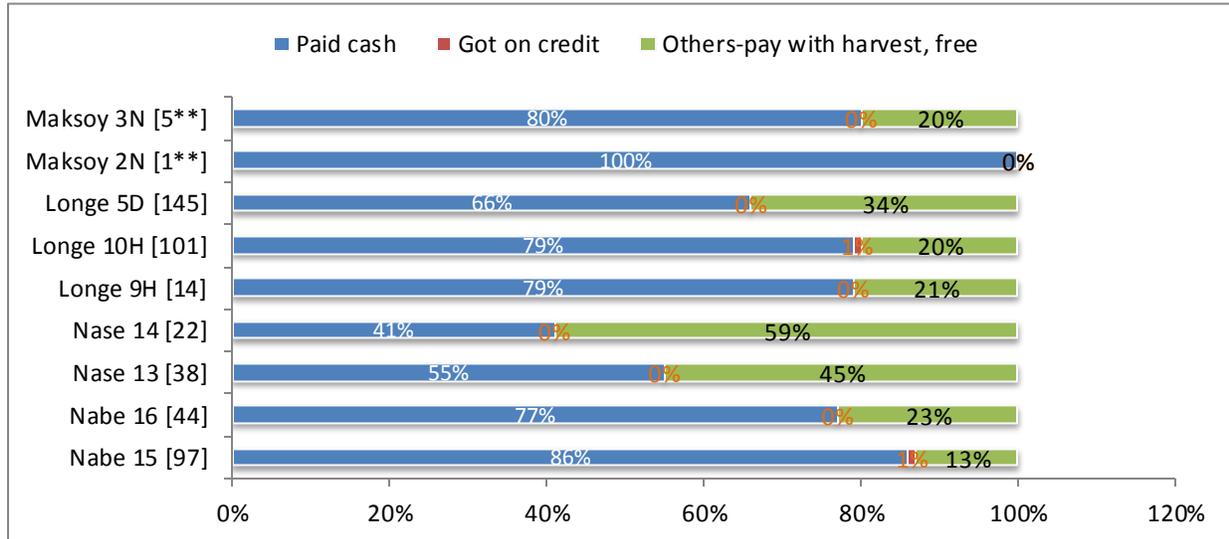
On the source of seeds most farmers reported that they buy them from the agro dealers, the local shop and from other farmers. A majority of the farmers said that their source of seeds is their own from previous harvest. This is highest for cassava at 35% and for beans at 32%. Forty one percent of the farmers (n=253) said they purchased their seeds from the agro dealers.

Table 24: Purchase point for seeds

		Beans [183]	Cassava [79]	Maize [253]	Soybean [12*]
Purchase point of seed planted in current season	Agro dealers	37%	20%	41%	50%
	Seed company	2%	1%	2%	-
	Local shop	23%	1%	13%	8%
	Charity (government/NGO/Church)	3%	27%	10%	-
	Own previous harvest	32%	35%	27%	17%
	Other farmer(s)	5%	16%	6%	33%
	Other sources	2%	3%	2%	-
	Not applicable	-	-	1%	-

Methods of payment for improved seeds, majority of the farmers reported that they pay in cash, for cassava Nase 14 more than half of the farmers said they get from other means (free), probably from relatives, neighbours, etc. only 1% for maize (Longe 10H and Beans Nabe 15) said they get the seeds on credit.

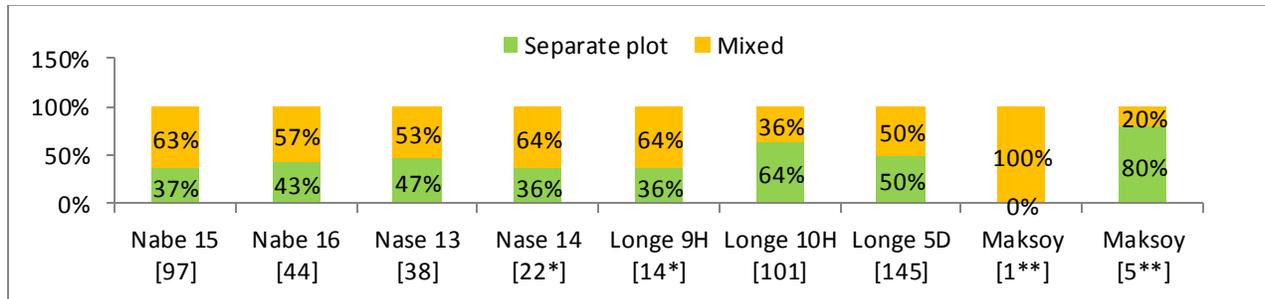
Chart 1: Method of payment



Method of planting

Most of the farmers reported that they plant most of their crops in mixed plots, however for maize, more than half said that they plant in separate plots.

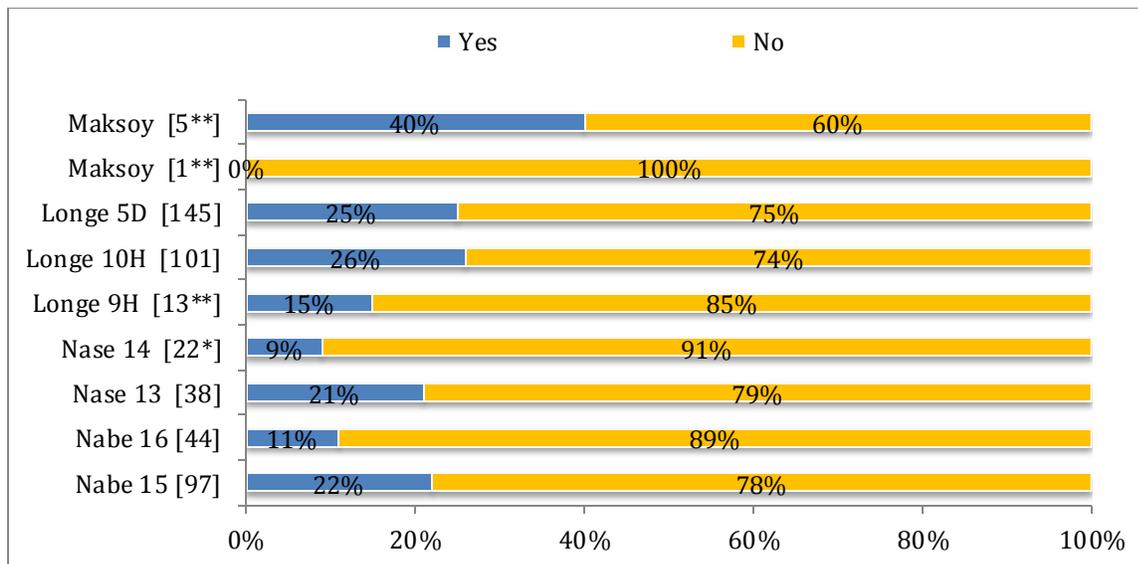
Chart 2: Planting method



Use of extension services;

Majority of the farmers do not use extension services, less than a third of the farmers reported to have used extension services. For maize it was 25% and 26% for Longe 5D and Longe 10H respectively that reported to have used extension services.

Chart 3: Extension services



Method used for planting

Very poor planting methods are used by most of the farmers. More than three quarters of the farmers for all crops said reported that they have planted during the current season using hands (digging holes by hand). Sixteen percent of maize farmers (Longe 10H) said that they have used animal drawn ploughs to plant during the current season.

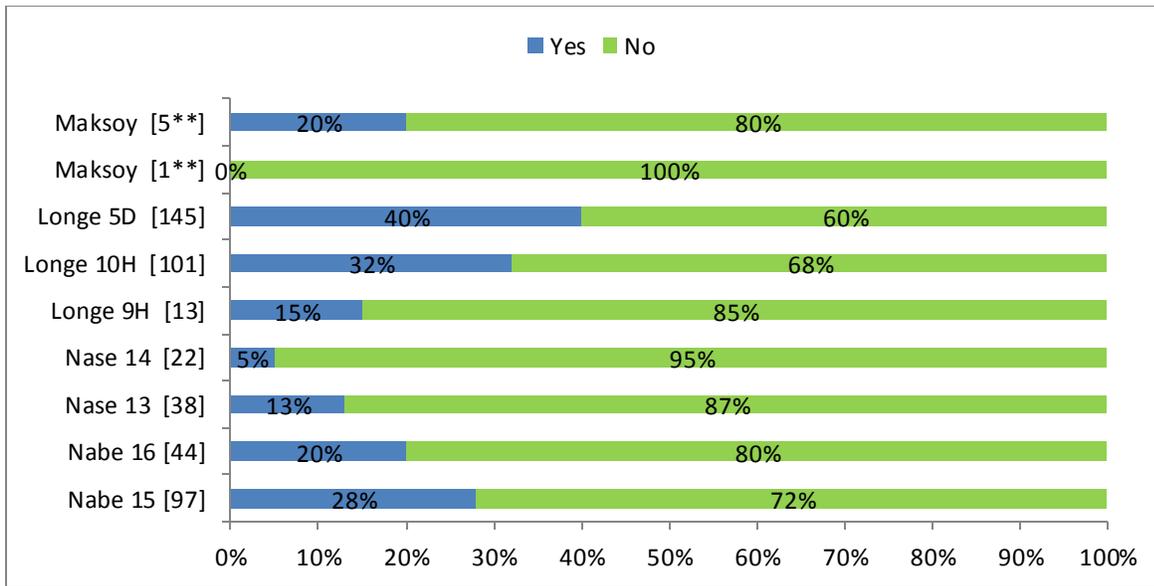
Table 25: Methods used in planting

What method did you use to plant seeds in the current season		Mechanized (animal drawn)	Mechanized (motor driven)	By hand (digging holes)
Beans	Nabe 15 [97]	-	2%	98%
	Nabe 16 [44]	5%	11%	84%
Cassava	Nase 13 [38]	13%	3%	84%
	Nase 14 [22*]	14%	-	86%
Maize	Longe 10H [101]	16%	1%	83%
	Longe 5D [145]	5%	3%	92%
Soya beans	Maksoy [1**]	-	-	100%
	Maksoy [5**]	20%	-	80%

Manure and fertilizer application

Very few of the farmers reported to use or apply manure and fertilizer to their farms. More than 2 thirds reported not to have applied or used manure and fertilizer.

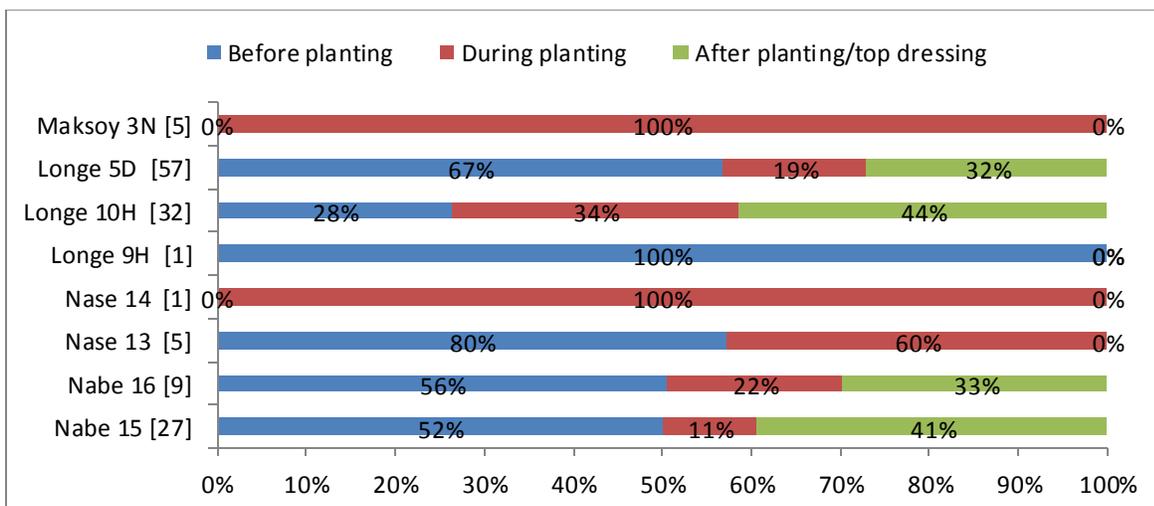
Chart 4: Manure & fertilizer application



Time of manure and fertilizer application

Most of the farmers reported to apply manure/fertilizer before or during planting. Only a small percentage top dress or apply manure/fertilizer after planting. The crops during which manure/fertilizer is applied after planting are maize and beans.

Chart 5: Time of manure application



Use of pesticides

Although just a few farmers said they treat their crops, the majority within this category applies pesticides and also fumigate.

Table 26: Pesticides use

	Pesticide	Insecticide	Fumigation	Others	None
Nabe 15 [44]	34%	27%	36%	-	2%
Nabe 16 [11*]	64%	27%	9%	-	-
Nase 13 [20]	20%	5%	40%	-	35%
Nase 14 [11*]	64%	-	27%	-	9%
Longe 9H [8**]	62%	-	25%	-	12%
Longe 10H [26]	35%	4%	58%	4%	-
Longe 5D [53]	55%	4%	34%	2%	6%
Maksoy 2N [2**]	50%	-	50%	-	-
Maksoy 3N [2**]	50%	-	50%	-	-

Farmer desired traits

High yields, early maturing and disease and drought resistance are the most common desired traits that the farmers reported for the improved seed varieties.

Table 27: Farmers desired traits

Beans	High yielding	Early maturing	Market class
Nabe 15 [96]	77%	62%	50%
Nabe 16 [43]	86%	35%	9%
Cassava	High yielding	Early maturing	Desirable culinary qualities
Nase 13 [36]	61%	14%	31%
Nase 14 [21]	76%	14%	
Maize	High yielding	Drought Tolerant	Disease resistance
Longe 10H [101]	92%	50%	41%
Longe 5D [140]	81%	31%	20%
Soybean	Large seeds that easy to sort	Very resistance to pod shattering	Excellent seed appeal
Maksoy 3N [4]	50%	25%	50%

Crop yields comparison with other varieties

Most farmers reported that their yield increased by 50% or doubled with the improved seeds compared to the other seeds they have used before. The biggest percentage of cassava and soybean farmers said their yield doubled.

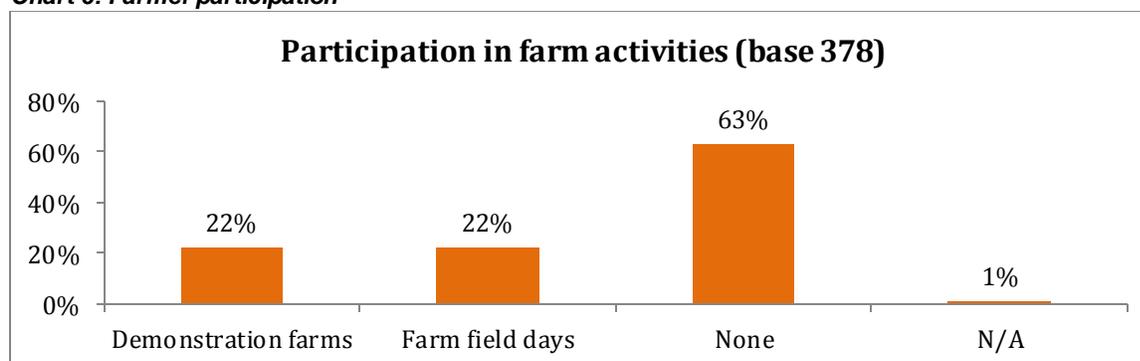
Table 28: Crop yield comparison

	Got same yield compared to other varieties	Yield increased by 50%	Double yield
Nabe 15 [107]	32%	38%	30%
Nabe 16 [54]	26%	35%	39%
Nase 13 [42]	31%	29%	40%
Nase 14 [28]	7%	25%	68%
Longe 9H [11**]	27%	36%	36%
Longe 10H [102]	17%	32%	51%
Longe 5D [4**]	50%	25%	25%
Maksoy 2N [3**]	-	33%	67%
Maksoy 3N [6**]	-	33%	67%

Participation in farm demonstration, farmer field days:

Most farmers do not participate in farm activities, 63% reported that they have not participated in either farm demonstrations or farm field days.

Chart 6: Farmer participation



Demographics

Ownership (farm, equipment)-70% of the farmers said they own the land on which they farm while 21% said they hire, the rest have been given by relatives or by the government. On asset ownership, most of the farmers own the basic households assets like radio, mobile phones and farming tools such as digging holes. Only 7% own oxen and 9% own a plough.

Table 29: Demographics-Uganda

	Own	Have but don't own	Don't have
Digging hoes/implements [378]	96%	-	4%
Radio [378]	91%	-	9%
Mobile phones [378]	81%	1%	18%
Bicycle [378]	68%	*	32%
Store [378]	61%	1%	39%
Motorbike [378]	22%	1%	77%
Colour TV[378]	22%	1%	77%
Electricity [378]	21%	*	78%

Granary [378]	14%	1%	85%
Plough [378]	9%	3%	88%
Oxen [378]	7%	3%	90%
Pickup [378]	3%	2%	95%
Tractor [378]	1%	4%	95%
Ox-drawn Cart [378]	1%	1%	99%

Source of information

Majority of the farmers said they get information on improved seed varieties from other farmers (68%) and from the radio (56%). Other important sources include; word of mouth and local administration.

Table 30: Source of information

Sources of information about improved seed varieties?	Base	378
		Other farmers
	Radio	56%
	Through word of mouth	49%
	Farmer field days	21%
	Through local administration	16%
	Field Demonstrations	13%
	Posters	11%
	Agricultural shows	10%
	Through agricultural extension officers	10%
	TV programs	9%
	Through marketing campaign	5%
	Daily / weekly Print	4%
	Other sources	4%
	Pamphlets	1%

ix.

4.8. Farm Level Performance Detailed findings: Mozambique

Purchase point for seeds

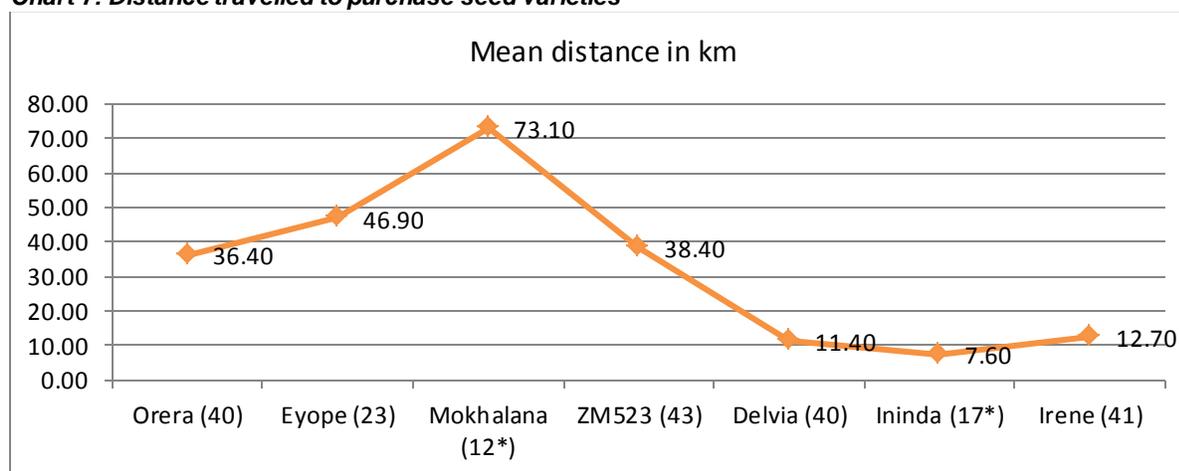
Table 31: Purchase point for improved seeds

Purchase point of seed planted in current season		Cassava	Maize	Sweet potato
	Base	69	85	65
	Agro dealers	20%	45%	15%
	Seed company	57%	14%	8%
	Local shop	10%	20%	8%
	Charity (government/NGO/Church)	3%	2%	55%
	Own previous harvest	14%	41%	17%
	Other farmer(s)	3%	5%	6%

Mean distance to purchase of seed varieties: the mean distance travelled by farmers to purchase the improved seed varieties are below 50km for all varieties apart from Mokhalana which is 73.1km. The lowest distances are for the sweet potato that is below 12km

Mean distance to purchase point

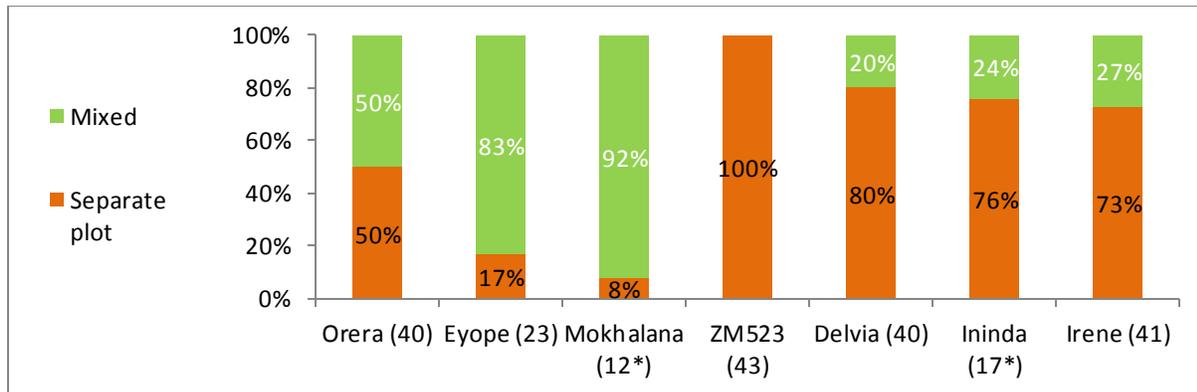
Chart 7: Distance travelled to purchase seed varieties



Cropping approach

On the planting approach, cassava is mostly grown on mixed plots although Orera half of the farmers said that they have grown it on a separate plot; maize was wholly reported as having been grown on a separate plot. More than three quarters of farmers that have planted sweet potato said that they had grown in separate plots.

Chart 8: Cropping approach



Use of extension services

More than half of the farmers that have grown sweet potato said that they have used extension services less than half of farmers that had grown the other varieties said that they haven't used extension services.

Table 32: Use of extension services

Do you use extension services?	Orera (40)	Eyope (23)	Mokhalana (12*)	ZM523 (43)	Delvia (40)	Ininda (17*)	Irene (41)
Yes	20%	26%	8%	35%	72%	88%	63%
No	80%	74%	92%	65%	28%	12%	37%

Method of planting

More than three quarters of the farmers reported that they plant by digging holes using hands, for cassava and sweet potato more than 77% reported using hands for digging. For maize it was 72% that reported using hands to dig holes for planting Cassava (Eyope and Mokhalana, it was 100% use of hands.

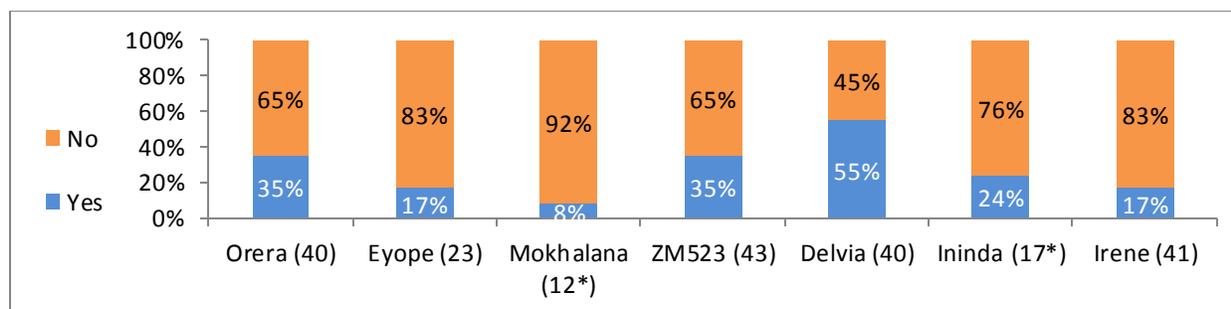
Table 33: Planting methods

	Mechanized (animal drawn)	Mechanized (motor driven)	By hand (digging holes)
Orera (40)	8%	2%	90%
Eyope (23)	-	-	100%
Mokhalana (12*)	-	-	100%
ZM523 (43)	28%	-	72%
Delvia (40)	18%	5%	78%
Ininda (17*)	6%	6%	88%
Irene (41)	2%	-	98%

Soil fertility management:

On manure and fertilizer application more than half (55%) of the farmers that planted Sweet potato (Delvia) said that they have applied manure and fertilizer. For the other crop varieties, manure and fertilizer usage was a third or less. It was lowest (8%) for cassava variety Mokhalana.

Chart 9: Soil fertility management



Period of manure application:

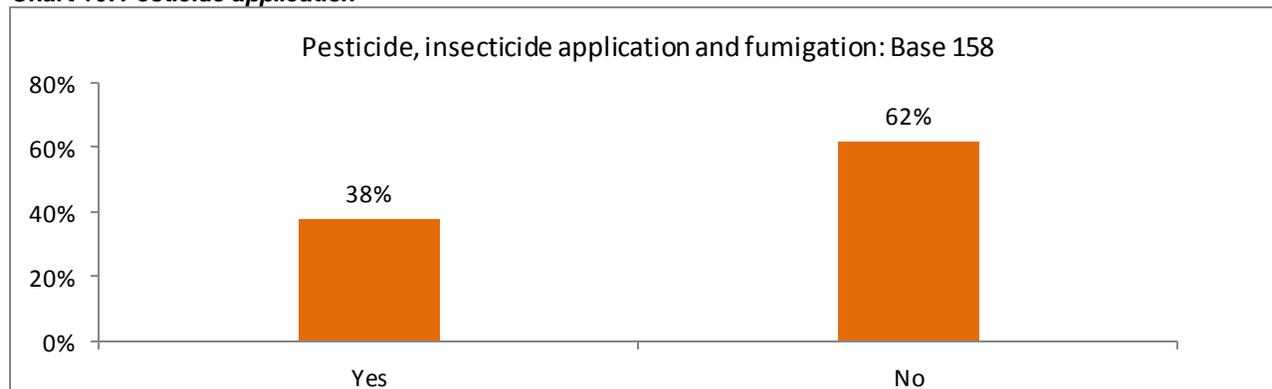
Most of the farmers that had grown Orera, ZM523, Delvia and Irene reported that they applied manure/fertilizer before planting while most farmers that had grown Eyope reported that they applied manure/fertilizer during planting.

Table 34: Period of manure application

	Orera	Eyope	Mokhalana	ZM523	Delvia	Ininda	Irene
Base	14	4	1	15	22	4	7
Before planting	7	2	-	14	16	3	7
During planting	6	4	1	-	5	2	-
After planting/top dressing	1	2	-	1	4	1	2

Pesticide application: Only 38% of the farmers reported to have used pesticides on their crops.

Chart 10: Pesticide application



Targeted crops varieties for which pesticide, insecticide and fumigation were done; for Delvia and Irene all the three processes were carried out.

Table 35: Pesticide insecticide and fumigation

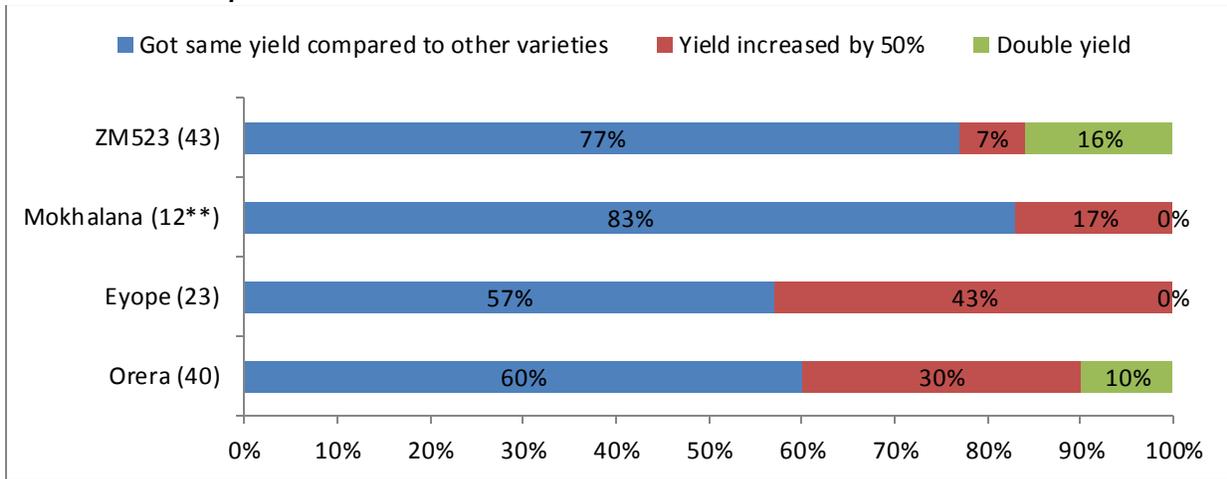
		Orera	Eyope	Mokhalana	ZM523	Delvia	Ininda	Irene
For which of the seed varieties did you apply pesticide, insecticide or fumigation?	Base	10	3	15	1	17	5	9
	Pesticide	8	-	15	-	11	-	1
	Insecticide	-	-	-	-	1	-	1
	Fumigation	-	-	-	-	3	4	5
	None	2	3	-	1	2	1	2

Yield comparison

Most farmers that grew maize and cassava said that their yield remained the same compared to other seed varieties. However 43% of farmers that had grown Eyope said that the yield had

increased by half while 16% of farmers that had grown maize (ZM523) said that their yields have doubled.

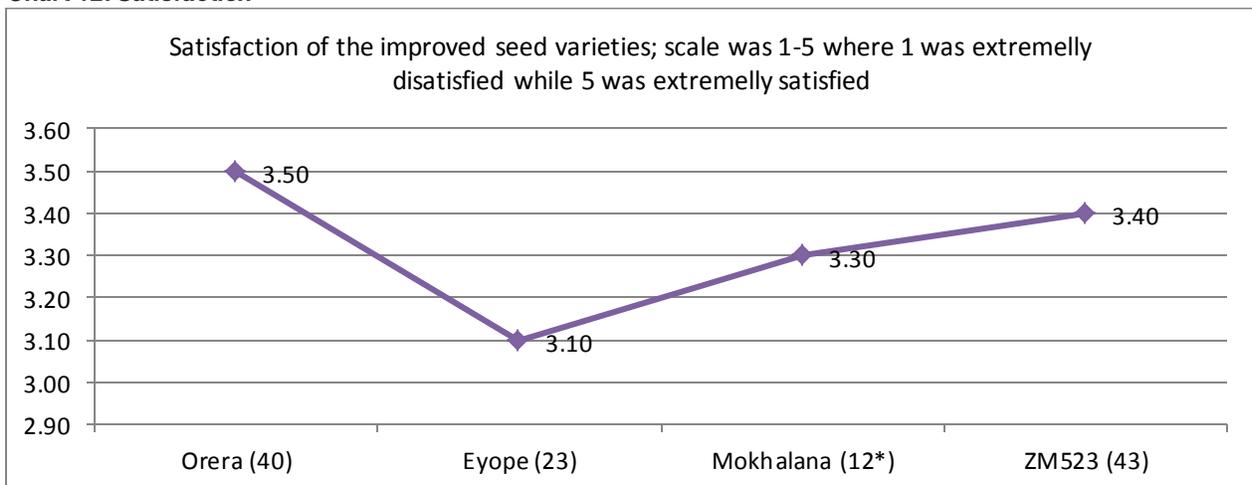
Chart 11: Yield comparison



Satisfaction:

Overall satisfaction with the improved seeds was above average with the highest satisfaction being that of cassava variety Orera which was 3.5 out of 5 where 5 meant extremely satisfied and 1 was extremely dissatisfied. Cassava variety Eyope had the lowest satisfaction mean score of 3.1

Chart 12: Satisfaction



Participation in farm activities

More than half of the farmers said that they have participated in demonstration farms (63%), farm field days (39%) in the last 3 seasons, only 9% said they have not participated in any of the farm activities.

Table 36: Farmer participation in field activities

Did you participate in farm	Base	Yes: Base 158
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demonstrations and farmer field days in the last 3 seasons?	Demonstration farms	63%
	Farm field days	39%
	None	9%

Land ownership

The majority of the farmers (54%) said they own the land on which they plant the improved seed varieties. Four percent said that they have hired the land and 3% said that they have been given by relatives. Thirty six of the respondents did not answer the question on ownership of the land on which they plant the seed varieties.

Table 37: Land ownership

Do you own the farm you grow the improved seed varieties?	Base	158
	Own land	54%
	Hire	4%
	Given by relatives	3%
	Given by government	1%
	Given by others	3%
	No response	36%

Asset ownership

All the farmers reported to have digging hoes, only 22% said they have a plough and 11% have oxen. Eight percent have an ox-drawn cart.

Table 38: Asset ownership

Base: 158	Own	Have but don't own	Don't have
Digging hoes/implements	100%	-	-
Radio	87%	2%	11%
Bicycle	65%	3%	33%
Granary	61%	6%	33%
Mobile phones	56%	3%	41%
Store	36%	7%	57%
Electricity	31%	1%	68%
Colour TV	28%	3%	68%
Plough	22%	4%	73%
Motorbike	21%	3%	76%
Oxen	11%	1%	87%
Tractor	11%	10%	79%
Ox-drawn Cart	8%	3%	89%
Pickup	8%	3%	90%

Source of information

The main source of information is through field demonstrations 45%, word of mouth (39%) and through marketing campaigns & agricultural shows at 28% for each of them.

Table 39: Source of information

	Base	315
Where did you get information about improved seed varieties?	Field Demonstrations	45%
	Through word of mouth	39%
	Through marketing campaign	28%
	Agricultural shows	28%
	Radio	26%
	Farmer field days	23%
	Other farmers	11%
	Through local administration	6%
	Through agricultural extension officers	6%
	TV programs	3%
	Pamphlets	2%
	Daily / weekly Print	1%

4.9. Farm Level Performance detailed findings - Malawi

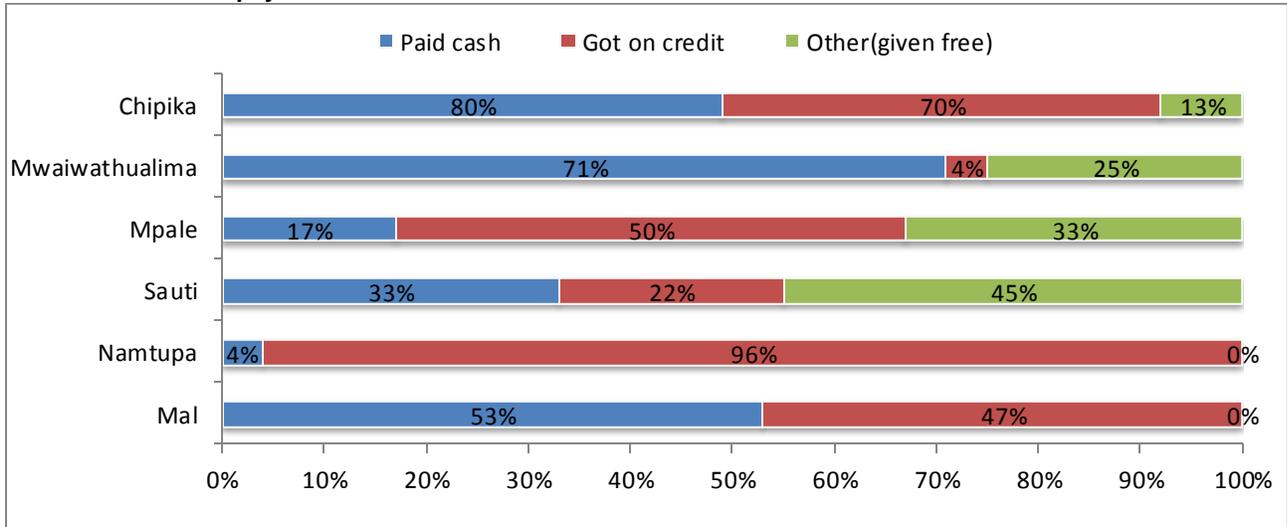
Most farmers said that they get the seeds from the agro dealers; 93% of the farmers that planted pigeon peas and 74% for farmers who planted sweet potato. Other sources included breeder and multipliers.

Table 40: Point of purchase

	Beans [72]	Cassava [77]	Pigeon peas [112]	Sweet potato(110)
Purchase point of seed planted in current season				
Agro dealers	97%	77%	93%	74%
Seed company	-	21%	-	14%
Local shop	1%	-	3%	-
Charity (Government/NGO/Church)	-	1%	3%	6%
Own previous harvest	-	2%	2%	2%
Other farmer(s)	-	-	-	2%
Breeder	1%	1%	1%	2%
Decentralised vine multiplier	-	-	-	1%
Bwumbwe research	-	-	-	1%

-most farmers paid cash for the seed varieties they have planted during the current season. However 96% of farmers that planted Namtupa said that they had gotten the seeds on credit. While 45% of farmers that planted Sauti said they got the seeds for free.

Chart 13: Method of payment



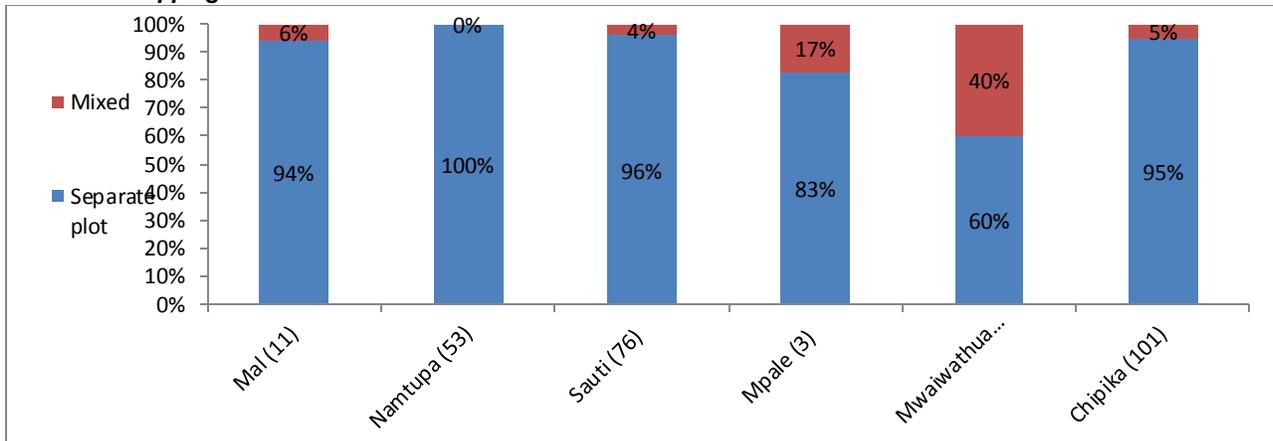
Most of the farmers that got seeds on credit paid back with their harvest.

Table 41: Terms of payment

	Paid back cash with interest	Paid back cash w/out interest	Paid back harvest
Mal (11)	-	9%	91%
Namtupa (51)	4%	33%	63%
Sauti (17)	-	35%	65%
Mpale (3)	14%	29%	57%
Mwaiwathualima	25%	-	75%
Chipika	14%	29%	57%

Cropping method-most of the farmers said that they planted the crops in separate plots. Forty percent of the farmers that planted pigeon peas said that they planted in mixed plots.

Chart 14: Cropping method



Use of extension services-for the farmers that planted beans and one variety of maize (Sauti), pigeon peas and sweet potato more than half said that they don't use extension services.

Table 42: Use of Extension services

	Yes	No
Mal (11)	47%	53%
Namtupa (53)	38%	62%
Sauti (76)	36%	64%
Mpale (3)	67%	33%
Mwaiwathualima	5%	95%
Chipika	18%	82%

Method used for planting-the most used method of planting is the use of hands for digging holes, farmers who planted maize (Sauti) reported to have used both mechanized and hand digging.

Table 43: Planting method

	Mechanized (animal drawn)	Mechanized (motor driven)	By hand (digging holes)
Mal (11)	-	-	100%
Namtupa(53)	-	-	100%
Sauti (76)	36%	64%	84%
Mpale (3)	67%	33%	86%
Mwaiwathualima	1%	-	99%
Chipika	0%	0%	100%

Use of manure and fertilizer-most of the farmers have not used manure or fertilizer for the crops they planted during the current season. About a quarter (25%) of farmers that planted beans (Namtupa) said that they used manure/fertilizer.

Table 44: Use of manure and fertilizer

	Yes	No
Mal (11)	12%	88%
Namtupa (53)	25%	75%
Sauti (76)	9%	91%
Mpale (3)	-	100%
Mwaiwathualima	16%	84%
Chipika	17%	83%

High yields, tolerance to pests, quality and resistance to disease was the most desired characteristics of the crops grown from the improved seed varieties. Ninety five percent of the farmers who planted Chipika said that it is high yielding while 95% of farmers that planted pigeon peas said it was high yielding.

On performance most farmers said that their yield has increased by half or it has doubled however 33% of the farmers that planted Mpale said that the yield has remained the same.

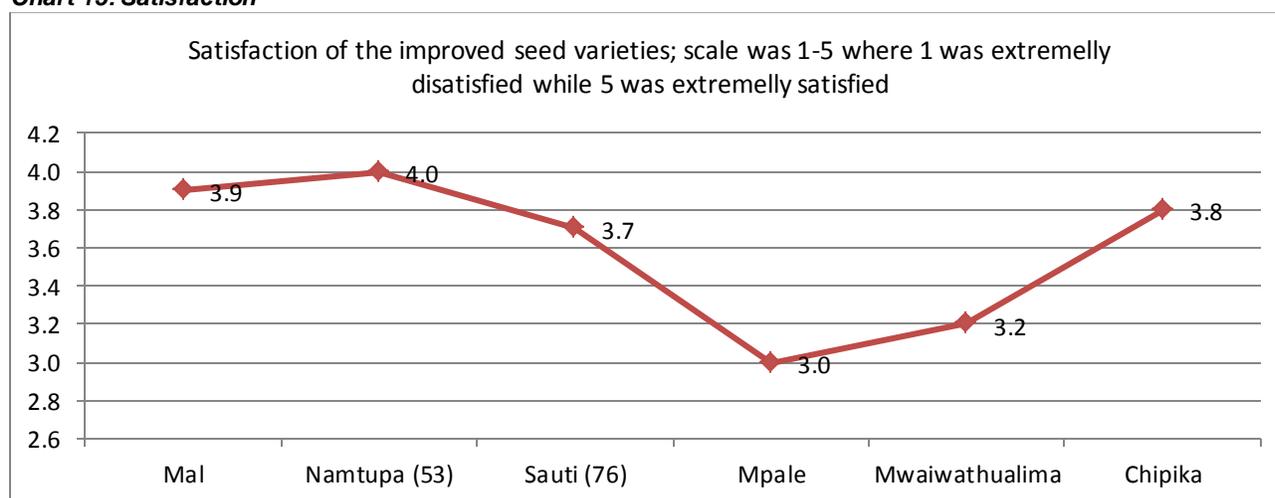
Table 45: Yield comparison

	Got same yield compared to other varieties	Yield increased by 50%	Double yield
Mal	-	29%	71%
Namtupa	15%	45%	40%
Sauti	13%	47%	39%
Mpale	33%	50%	17%
Mwaiwathualima	17%	63%	20%
Chipika	19%	49%	33%

Satisfaction:

Satisfaction level is above average for all crops, Mpale has a mean score on satisfaction of 3.0 out of 5 where 5 is the highest and means extremely satisfied. Score 1 is the lowest which means extremely dissatisfied. Namtupa has the highest score of 4.0

Chart 15: Satisfaction



Participation

Farmers reported that they have participated in a number of activities; 59% said they have participated in farm field days but 80% said they haven't participated in seed selection. Thirty nine percent said they have attended farm education days.

Table 46: Farmer participation in field activities

Participation in farm demonstrations and farmer field days in the last 3 seasons?	Base	371
	Demonstration farms	41%
	Farm field days	59%
Participation in seed variety selection with a breeder	Base	371
	Yes	20%
	No	80%
Attendance in farm education days in the last 3	Base	371

seasons	Yes	39%
	No	61%

Land ownership-most of the farmers said that they owned the land that they have planted (89%), 7% said they have hired while the remaining 4% said they have been given by relatives.

Table 47: Land ownership

Land tenure system	Base	371
	Own land	89%
	Hire	7%
	Given by relatives	4%

Asset ownership:

Most farmers said they own the basic hand digging hoes (94%), 10% own oxen and only 1% own a plough. Those that own a radio are 70% and those with mobile phones were 62%.

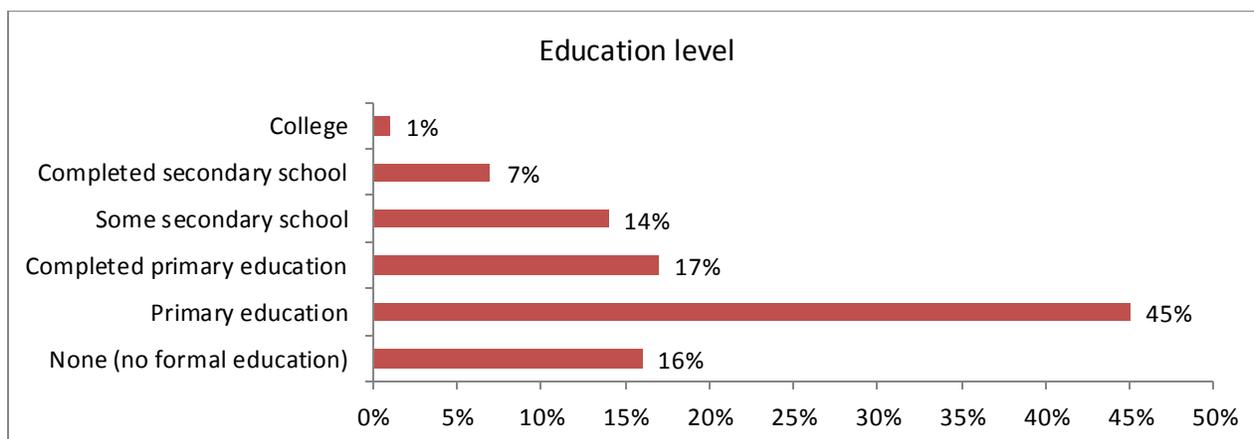
Table 48: Asset ownership

Base: 371	Own	Have but don't own	Don't have
Digging hoes/implements	94%	0%	6%
Radio	70%	1%	29%
Mobile phones	62%	1%	36%
Granary	24%	0%	76%
Store	18%	0%	81%
Oxen	10%	0%	90%
Colour TV	10%	0%	90%
Access to Electricity	5%	2%	93%
Pickup	3%	1%	97%
Plough	1%	1%	99%
Tractor	1%	-	99%

Education

Majority of the farmers have some primary education (45%) while those that have completed secondary education were 7%. Sixteen percent had no formal education.

Chart 16: Demographics-education



Source of information

The most common means that the farmers reported to have received information about improved seed varieties was through radio (59%). Those that reported to have received from other farmers were 50% and only 27% through word of mouth.

Table 49: Source of information

Where did you get information about improved seed varieties?	Radio	59%
	Other farmers	50%
	Field Demonstrations	39%
	Through agricultural extension officers	35%
	Agricultural shows	32%
	Farmer field days	29%
	Through word of mouth	27%
	Through local administration	16%
	Through marketing campaign	12%
	Posters	3%
	TV programs	2%
	Pamphlets	1%

4.10. Farm Level Performance detailed findings: Ghana

Purchase point for seeds planted during the current season

Most of the farmers reported that their sources of seeds planted during the current season are own seeds from previous harvest and from other farmers

Table 50: Point of purchase

Purchase point of seed planted in current season	Beans	Cowpea	Groundnut	Maize	Rice
	[169]	[21]	[54]	[295]	[46]
Agro dealers	3%	24%	7%	13%	9%
Local shop	1%	19%	19%	10%	15%
Charity (government/NGO/Church)	1%	0%	0%	2%	2%
Own previous harvest	86%	57%	69%	79%	70%
Other farmer(s)	32%	19%	13%	20%	22%
Agra office	1%	0%	0%	0%	0%

Use of extension services; most of the farmers do not use extension services.

Table 51: Use of extension services

Do you use extension services?	Yes	No
Ampong [1**]	100%	0%
Buroni Bankye [2**]	0%	100%
Otuhia [2**]	50%	50%
Obolo [7**]	0%	100%
Yenyawoso [2**]	0%	100%
Oboshie [6**]	17%	83%
Sanzal-sima [25]	8%	92%
Ewul-boyu [10*]	20%	80%
Wang-dataa [20]	35%	65%
Bihilifa [11]	9%	91%
Tigli [8*]	0%	100%
AgraRice [6**]	17%	83%

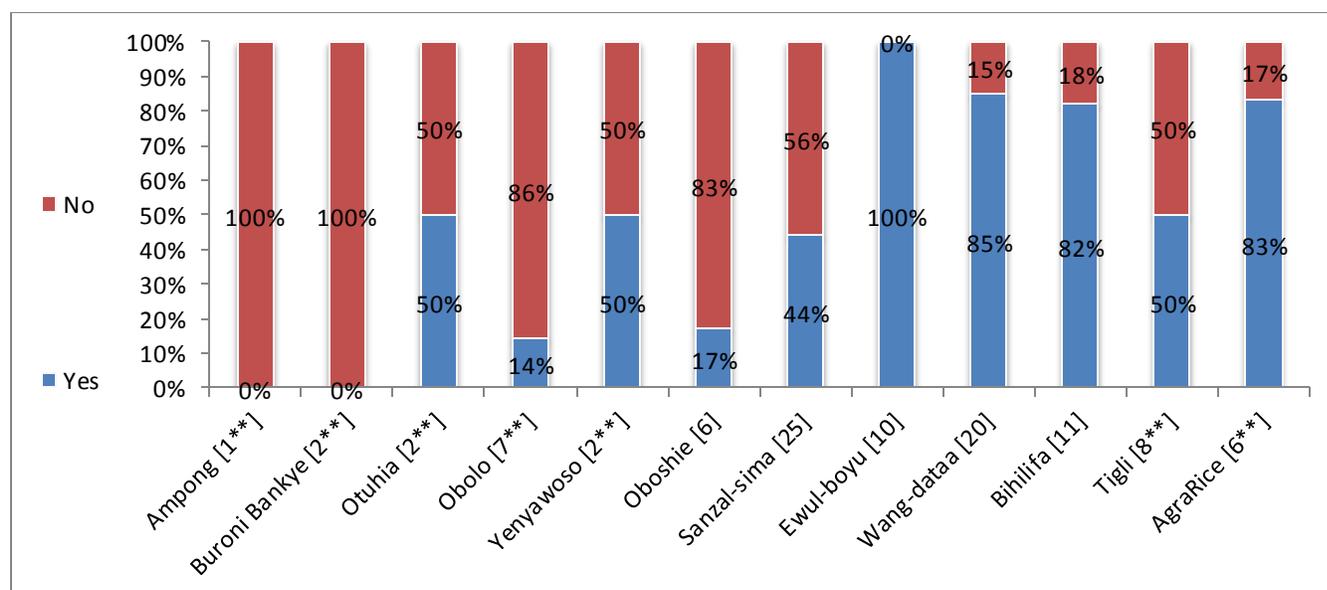
Farming methods: the most common method of farming for the farmers surveyed was digging using hands except for the maize variety Ewul-boyu of which 20% of the farmers reported using animal drawn plough while 70% reported using motor driven method of farming.

Table 52: Farming methods

	By hand (digging holes)	Mechanized (animal drawn)	Mechanized (motor driven)
Ampong [1**]	100%	0%	0%
Buroni Bankye [2**]	50%	0%	50%
Otuhia [2**]	100%	0%	0%
Obolo [7**]	86%	14%	0%
Yenyawoso [2**]	100%	0%	0%
Oboshie [6]	50%	33%	17%
Sanzal-sima [25]	56%	0%	44%
Ewul-boyu [10]	10%	20%	70%
Wang-dataa [20]	30%	25%	45%
Bihilifa [11]	82%	9%	9%
Tigli [8**]	63%	25%	13%
AgraRice [6**]	17%	33%	50%

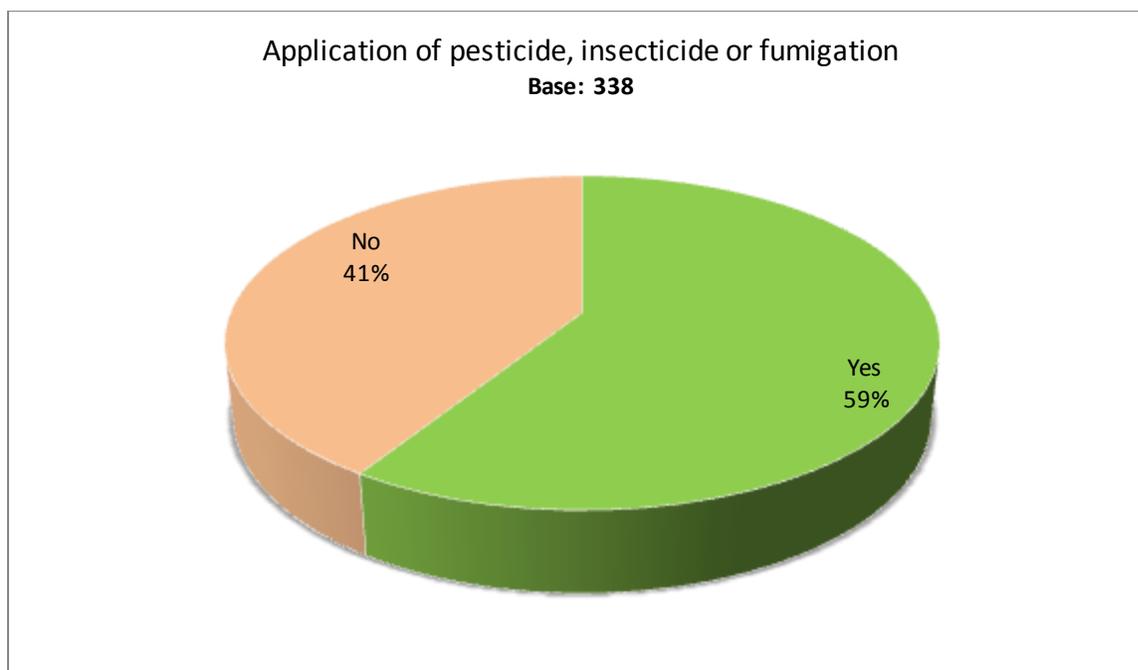
-The number of farmers using manure and fertilizer was almost non-existent for some varieties. But for other varieties there was a good percentage of farmers that reported to have used manure and fertilizer in their farms.

Chart 17: Use of manure and fertilizer



Application of pesticide, insecticide and fumigation: more than half (59%) of the farmers reported to have used pesticide, insecticide or fumigated their crops.

Chart 18: Pesticide, insecticide and fumigation



On desirable attributes; colour of the seed, early maturity and high yield were the most common desirable characteristics that the farmers reported.

Yield comparison with other varieties

Most farmers said they did not see any much difference between yields of the improved varieties with other seed varieties. However about a quarter of the farmers said that the yield has doubled.

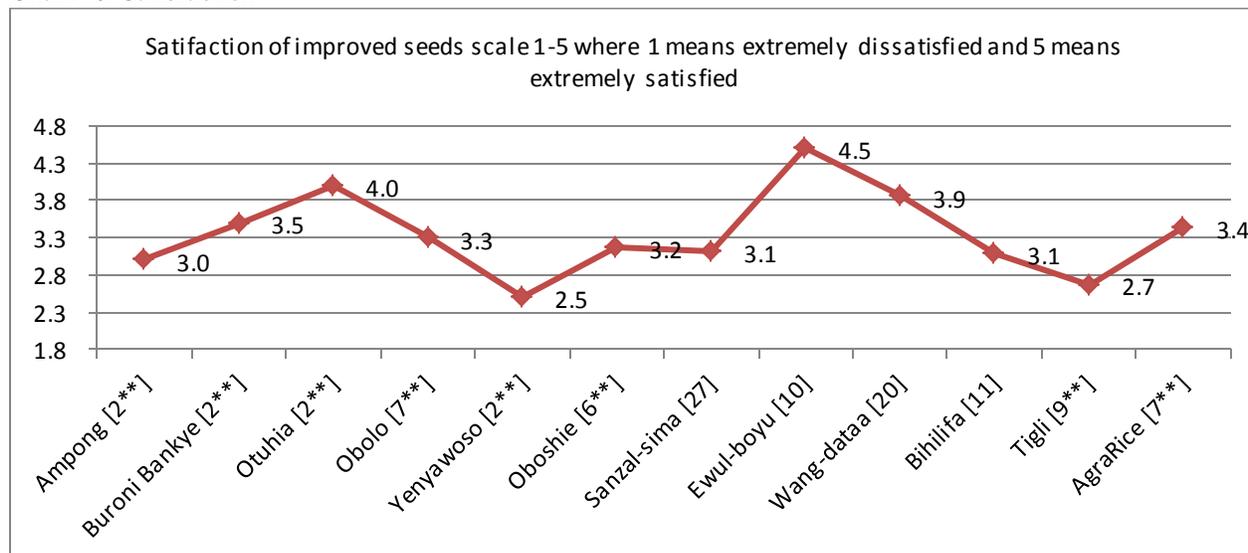
Table 53: Yield comparison

	Got same yield compared to other varieties	Yield increased by 50%	Double yield
Ampong [2**]	0%	50%	50%
Buroni Bankye [2**]	0%	100%	0%
Obolo [7]	71%	29%	0%
Yenyawoso [2**]	100%	0%	0%
Oboshie [6**]	100%	0%	0%
Sanzal-sima [27]	67%	33%	0%
Ewul-boyu [10]	50%	50%	0%
Wang-dataa [20]	75%	25%	0%
Bihilifa [11]	64%	36%	0%
Tigli [9**]	78%	22%	0%
AgraRice [7**]	43%	43%	14%

Satisfaction

The satisfaction score for the improved seeds was above 2.5 out of 5 where 5 being the highest score meant that the farmers was extremely satisfied and 1 meant the farmer was extremely dissatisfied. The crop with the highest satisfaction level was maize-Ewul-boyu at 4.5 while the lowest was groundnut-Yenyawoso at 2.5

Chart 19: Satisfaction



Participation

Three quarters of the farmers said that they have not participated in either farm demonstrations, farm field days. Ninety percent said that they never participated in seed selection process with breeders and 73% said they have not attended farm education days in the last 3 seasons.

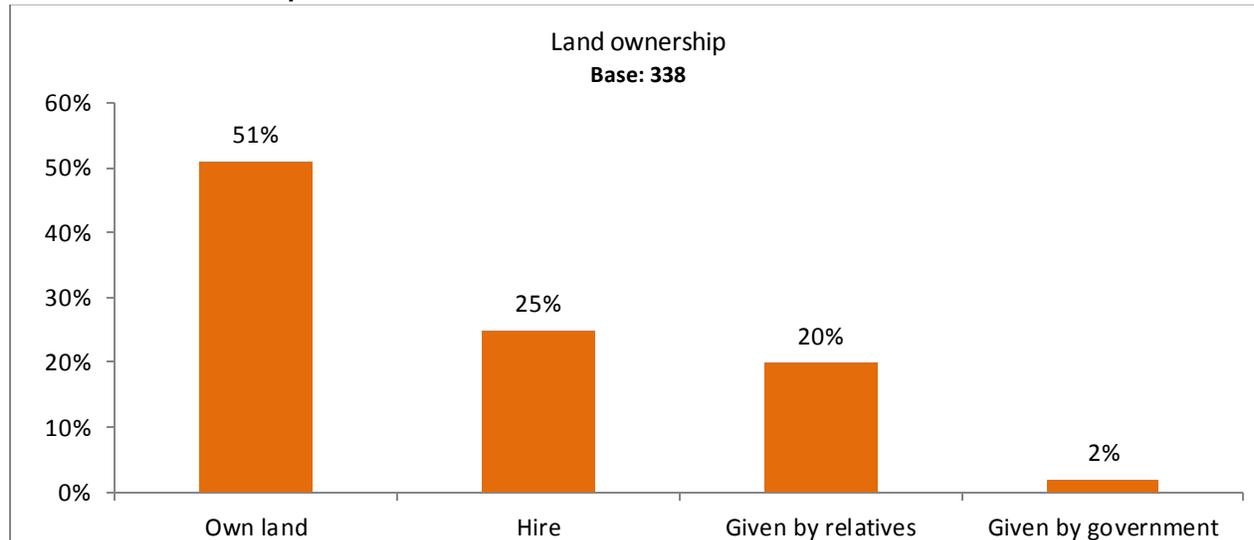
Table 54: Farmer participation in field activities

Participation in farm demonstrations and farmer field days in the last 3 seasons?	Base	338
	Demonstration farms	16%
	Farm field days	17%
	None	75%
Participation in seed variety selection with a breeder	Base	338
	Yes	10%
	No	90%
Attendance in farm education days in the last 3 seasons	Base	338
	Yes	27%
	No	73%

Land ownership

On land ownership, more than half (51%) Of the farmers said that they own the land on which they plant the improved seed varieties, 25% said they hire while 20% said they have been given by relatives.

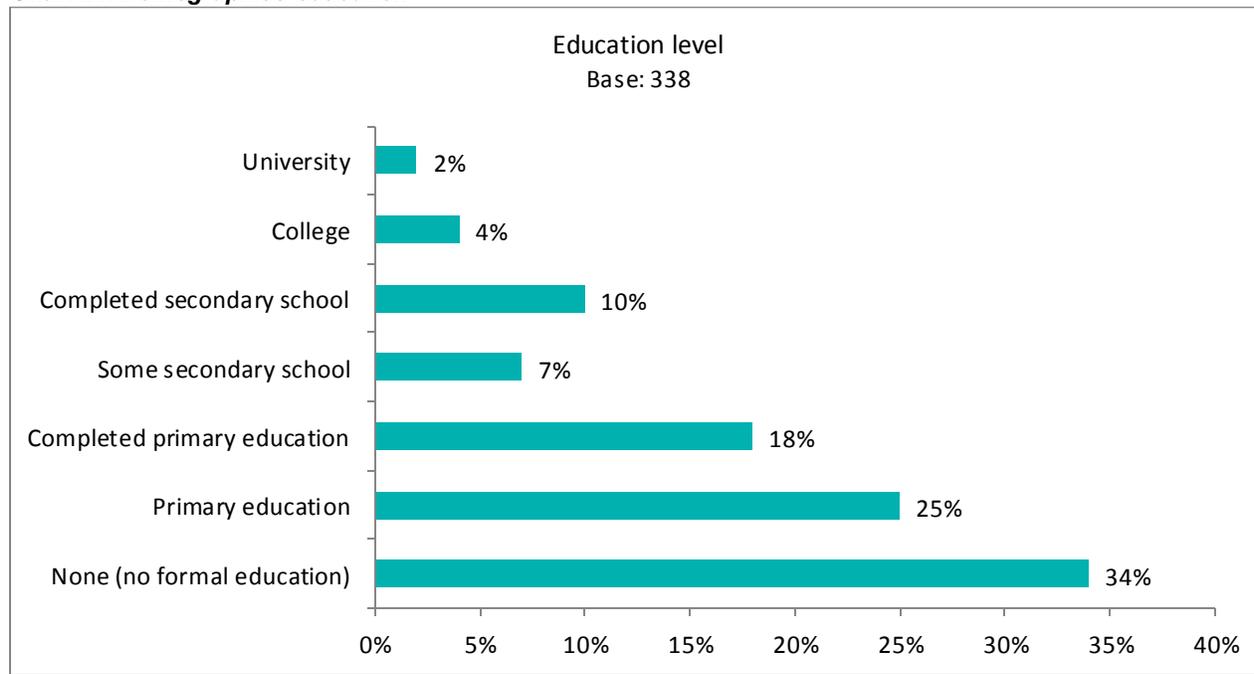
Chart 20: Land ownership



Education level

About a third of the farmers surveyed have no formal education while only 2% have university education.

Chart 21: Demographics-education



Source of information

The most common source of information was reported to be from other farmers, 72% of the farmers said that they got information about improved seed varieties from other farmers, 62% from radio and 43% from word of mouth.

Table 55: Source of information

	Total	338
Where did you get information about improved seed varieties?	Other farmers	72%
	Radio	62%
	Through word of mouth	43%
	TV programs	25%
	Through agricultural extension officers	11%
	Field Demonstrations	10%
	Posters	9%
	Farmer field days	7%
	Agricultural shows	6%
	Through marketing campaign	5%
	Through local administration	4%
	Pamphlets	1%
	None	1%
	Daily / weekly Print	0%

4.11. Farm Level Performance detailed findings: Burkina Faso

Point of purchase for crops planted during the current season

Most farmers surveyed said they get their improved seeds from charity; 62% for maize, 59% for cowpea and 67% other crops.

Table 56: Point of sale

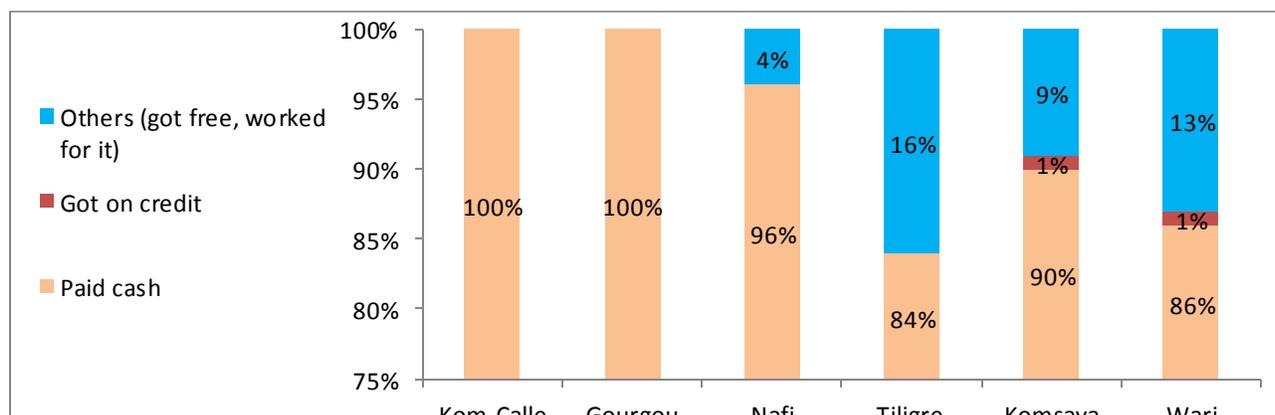
Purchase point of seed planted in current season		Maize [293]	Cowpeas [111]	Other crops [30]
	Agro dealers	5%	7%	7%
	Seed company	5%	2%	10%
	Local shop	6%	5%	37%
	Charity (government/NGO/Church)	62%	59%	67%
	Own previous harvest	30%	35%	50%
	Other farmer(s)	19%	28%	7%
	Other sources	2%	3%	2%

The crop varieties that were traced to the farmers include;

- Cowpea-Tiligre, Kom-calle, Gourgou and Nafi
- Maize-Wari and Komsaya

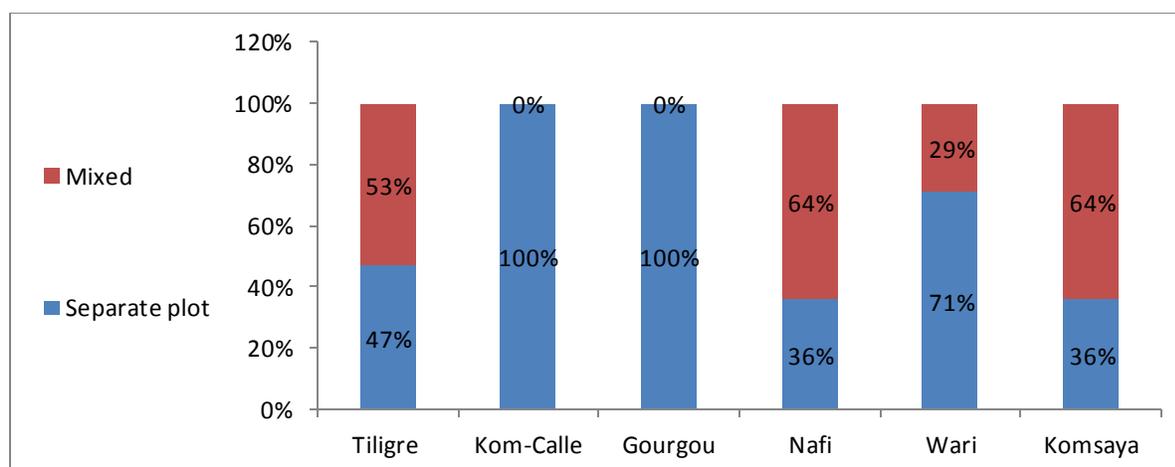
Mode of payment for varieties purchased: most farmers reported that they paid cash for the seed varieties they planted during the current season, a small number of maize farmers said they paid by other means (got it free or worked for the seeds). A very small number (1%) for maize Komsaya and Wari said they got on credit.

Chart 22: Mode of payment



On the planting approach, most of the farmers grow their crops on mixed plots apart from Kom-calle and Gourgou that are planted on separate plots.

Chart 23: Planting method



Use of extension services

Most of the farmers interviewed said that they use extension services; more farmers with cowpea varieties use extension services than farmers of maize varieties.

Table 57: Use of extension services

Do you use extension services?	Maize		Cowpeas			
	Wari	Komsaya	Tiligre	Kom-Calle	Gourgou	Nafi
Yes	83%	88%	74%	67%	100%	82%
No	17%	12%	26%	33%	0%	18%

Method of planting

Most farmers used mechanized (animal drawn) planting method apart from farmers who have grown Kom-Calle and Nafi. Most of the farmers who have grown Kom-Calle and Nafi plant by digging holes with hands.

Table 58: Planting method

Base: n=xx	Mechanized (animal drawn)	Mechanized (motor driven)	By hand (digging holes)
Tiligre	85%	5%	10%
Kom-Calle	14%	-	86%
Gourgou	100%	0%	0%
Nafi	16%	1%	83%
Wari	95%	4%	1%
Komsaya	90%	10%	0%

Favourable attributes for cowpea

Table 59: Farmer favourable attributes for cowpea

	Cowpeas
--	---------

	Tiligre	Kom-Calle	Gourgou	Nafi
High yielding	76%	100%	89%	100%
Large-sized	60%	67%	57%	
White-coloured grain	66%	33%	54%	
Rough grain texture	10%		68%	
Striga resistant	60%	67%	4%	
Others	1%			

Favourable attributes for maize

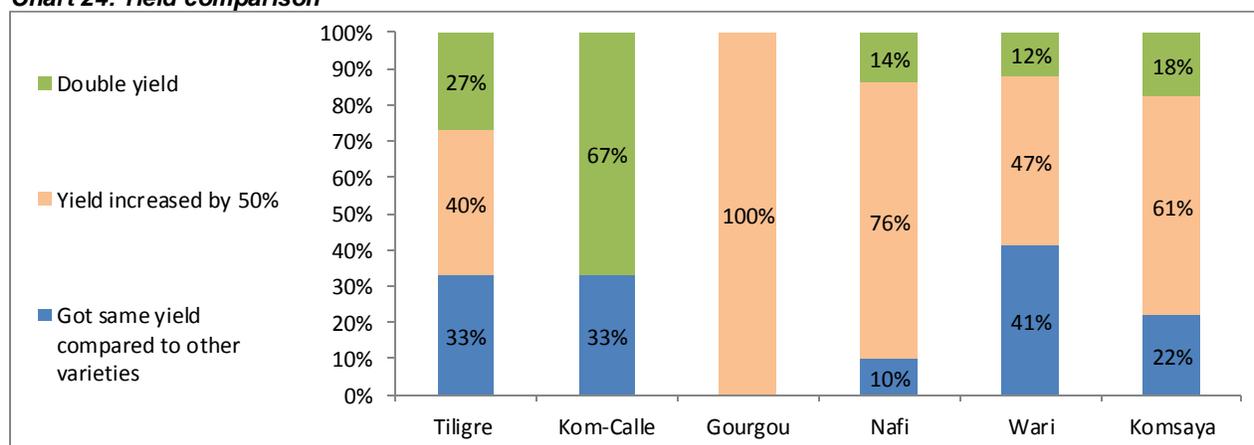
Table 60: Farmer favourable attributes for maize

	Maize	
	Wari	Komsaya
High yielding	79%	83%
Improved grain quality	68%	82%
Drought resistant	65%	60%
Good processing ability	44%	59%
Yellow	15%	24%
Stays green	37%	33%

Yield comparison

Most of the farmers said that the performance of the improved seed varieties has increased their yield 50%; 67% of Kom-Calle farmers said that the yield has doubled. However 41% of Wari farmers said that the yield has remained the same.

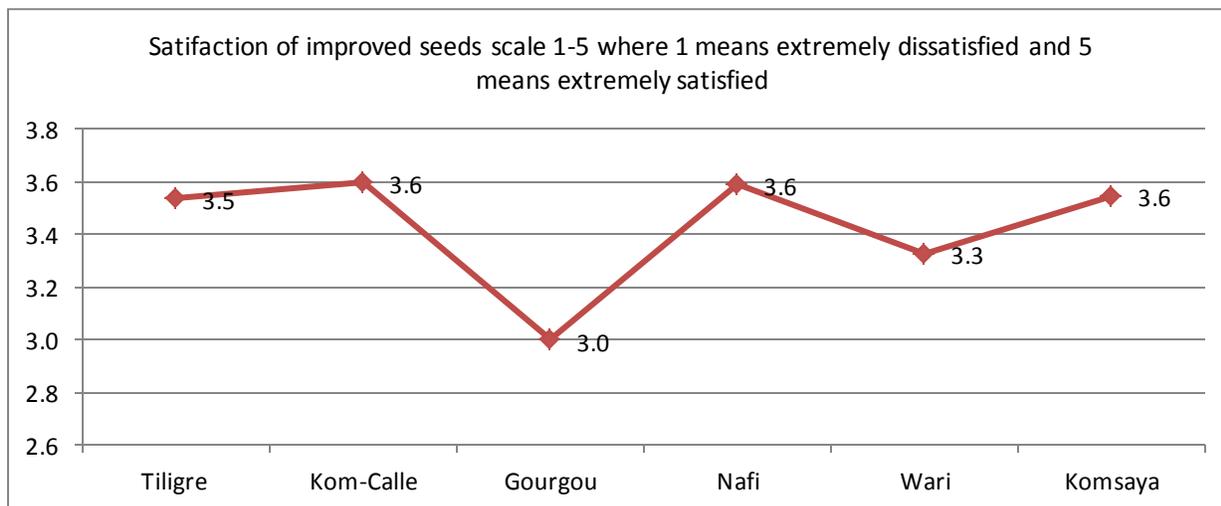
Chart 24: Yield comparison



Satisfaction:

Most of the farmers are satisfied with the improved seed varieties, satisfaction is between 3 and 3.6 where 1 means extremely dissatisfied and 5 means extremely satisfied. Gourgou has the lowest satisfaction at 3.0 while Kom-Calle, Nafi and Komsaya has the highest satisfaction at 3.6

Chart 25: Satisfaction



Participation in farm activities

More than half of the farmers said that they have participated in farm field days in the last 3 seasons, 31% said they have participated in demonstration farms and 41% said they haven't.

Table 61: Farmer participation in farm activities

Did you participate in farm demonstrations and farmer field days in the last 3 seasons?	Base	315
	Demonstration farms	31%
	Farm field days	51%
	None	41%

Land ownership

The majority of the farmers (82%) said they own the land on which they plant the improved seed varieties. Seven percent said that they have hired the land and 9% said that they have been given by relatives.

Table 62: Land ownership

Do you own the farm you grow the improved seed varieties?	Base	315
	Own land	82%
	Hire	7%
	Given by relatives	9%
	Given by others	2%

Asset ownership

Ninety six percent of the farmers said that they own a bicycle, 82% own oxen while 58% own a plough.

Table 63: Asset ownership

	Own	Have but don't own	Don't have
Bicycle [315]	96%	1%	3%
Radio [315]	93%	0%	7%
Mobile phones [315]	83%	3%	13%
Oxen [315]	82%	5%	13%
Plough [315]	58%	3%	39%
Digging hoes/implements [315]	34%	5%	61%
Granary [315]	30%	1%	69%
Ox-drawn Cart [315]	21%	16%	63%
Store [315]	10%	2%	88%
Pickup [315]	9%	14%	77%
Colour TV[315]	7%	3%	90%
Access to Electricity [315]	6%	1%	93%
Motorbike [315]	5%	1%	94%
Tractor [315]	2%	3%	94%

Source of information

The main source of information is through the radio at 57%, word of mouth (54%) and from other farmers at 35%.

Table 64: Source Information

	Base	315
Where did you get information about improved seed varieties?	Radio	57%
	Through word of mouth	54%
	Other farmers	35%
	Farmer field days	27%
	Field Demonstrations	25%
	Through marketing campaign	24%
	Posters	22%
	Agricultural shows	9%
	Pamphlets	5%
	TV programs	3%
	Through local administration	3%
	Daily / weekly Print	2%
	Through agricultural extension officers	2%

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

5.1. Breeders

The main challenge identified in the breeding process is on seed verification and certification by the various regulatory bodies. There is a need for this process to be shortened, and AGRA could engage various government ministries in championing the cause of PASS programme.

There are quite a number of seeds that have not yet been commercialized, but they are in the system – courtesy of farmers who participated in the breeding system. AGRA needs to engage breeders on this, as there are seeds in the system, which have not yet been released for commercialization.

5.2. Seed Companies

PASS funded breeders work within government breeding facilities. Some few breed privately. However, there is a feeling among seed companies that they do not want to depend on 'government breeders', but would rather have their own.

There could be an opportunity for AGRA to engage seed companies to fund / support breeders. This will enhance sustainability, as all seed companies operate on a business model.

Cassava and Sweet potatoes varieties do not go through the value chain (Agro-dealers) due to their perishability nature. In their case, multipliers are not necessarily seed companies, but farmer organizations and Church organizations and NGOs that pass the varieties directly to farmers. This also provides an avenue for partnerships, which can also be used to distribute farm enhancers such as manure and fertilizer

5.3. Agro dealers

In the whole study, we did not come across a seeds only stockiest. Agro-dealers main challenge is having seed varieties that are not well supported by information for farmers to enquire about or purchase. Another challenge is constrained access to credit (from seed companies) hence they are unable to stock beyond their working capital. This presents an opportunity for advocacy on all PASS improved seed varieties at the grassroots level to improve uptake.

Demand for seed varieties needs to be created at the farmers level, rather than from Agro-dealers.

5.4. Small holder farmers

Poor farming methods seem to dampen prescribed harvests. The greatest opportunity that is urgent is provision of fertilizer as an accompaniment for improved seeds. AGRA can champion and advocate for push of fertilizer as a boost to agricultural production.

Some activities set out in the program seem not to have taken place particularly communication on best practices of planting the improved seed varieties to ensure maximum yield returns (e.g. through field demonstrations)

There is need for more advocacies on use of improved seed varieties for every new planting season. Some farmers reused seeds from the previous planting season rather than buying new seeds and this led to decline in yields. In addition, innovative ways should be developed to ensure that farmers acquire new seeds for every planting season. E.g. creating a credit vehicle for poor farmers to enable them purchase new seeds/farm inputs in every new planting season

There is need to strengthen the internal control systems of the program. There is an information gap between the breeders and the farmers for example in Kenya Nerica 4 was developed out of the scope of the terms of reference given to the breeders and this has never been realized.

5.5. Policy Recommendations

AGRA's Program for Africa's Seed Systems (PASS) has one of its objectives the improvement of household food security and income by promoting the development of seed systems that deliver improved, locally-adapted crop varieties to smallholder farmers in an efficient, equitable and sustainable manner. This study was a comprehensive tracking exercise of improved seeds varieties that have been developed with AGRA support. The tracking begun from breeders, to certifiers, multipliers, dealers and finally to smallholder farmers.

The main message from this study is that farmers are satisfied with improved seed varieties and majority reported improvement of yields from using such seeds. That said it is noteworthy that there are challenges from both supply (breeders) and demand (smallholder farmers) side. PASS is doing a good job to address some of the challenges but still a lot remains to be done. Breeders experienced challenges ranging from infrastructural and other resource constrains including human resources. Infrastructural constraints in this case include certifications processes as well as facilities. These challenges impacted on the quantity of varieties developed within a given time period as well as the length of time it took to release a variety to the market. On the other hand smallholder farmers faced various challenges that impacted on their capacity to access and utilize improved seeds varieties. Low incomes coupled with credit constraints were hindrances when it came to access to improved seeds varieties by smallholder

farmers. Furthermore, the study revealed that a significant portion of smallholder farmers were ignorant of the benefits of using improved seeds varieties as opposed to using recycled seeds from previous harvests. Yet despite these challenges several improved seeds varieties have been developed through AGRA support and released for commercial multiplication while others are still awaiting official release. There is also an increasing uptake of improved seed varieties by smallholder farmers. Improved seeds varieties have the potential to improve yields and livelihoods for smallholder farmers through improved productivity. In order to improve the demand and supply for improved seeds varieties the following are the policy recommendations emanating from this study.

Address delays emanating from the certification process

Breeders expressed concern on the length of time it takes the Standards Bodies to complete the certification process. Delays meant that many seeds varieties developed could not be availed for multiplication and commercialization. The implications of such delays are that many investments in breeding are locked up from utilization despite the huge resources invested in developing such varieties. Much as there is need to control for quality in seed breeding there is also need to establish an efficient quality control system.

Address Credit constrains faced by smallholder farmers

Uptake of improved seeds by smallholder farmers has been constrained by the high costs of such seeds compared to other traditional alternatives like recycling seeds from previous harvests. This study revealed that there are credit constrains that hinder access and utilization of improved seeds varieties by smallholder farmers. Credit constrains also affected access to other inputs like fertilizers and appropriate farming tools. Lack of fertilizers and appropriate farming tools undermine productivity even when improved seeds have been used. Innovative credit facilities to cater for the various needs of smallholder farmers will go a long way in improving productivity. Public interventions in access to farm inputs by smallholder farmers will also complement AGRA efforts in increasing smallholder farmers' productivity.

Take advantage of high mobile phone and radio penetration to build the capacity of farmers

From this study, 88% of smallholder farmers interviewed owned mobile phones while another 80% had access to radio services. The mobile phone has provided opportunities not only for improved communications and money transfers but also for increasing the depth of banking services and hence access to credit. There is need to encourage mobile phone based technologies and innovations to build smallholder farmers' capacity. The high penetration of the radio among smallholder farmers is also a good opportunity to disseminate information on good farming practices. In many countries there are vernacular radio stations that could be utilized to provide specific targeted information pertaining crops husbandry to communities living in different agro ecological zones. These two tools, the radio and the mobile phone provide a good

platform for capacity building and mobilization of smallholder farms in to action for improved productivity.

Improve extension services to deliver quality services to farmers

The survey revealed that a majority of smallholder farmers still relied on extension services for their crops husbandry. Capacity building and resources for efficient extension services would go a long way in ensuring that farmers received good advice and that there was adequate networking and dissemination of information through adequate extension services.

Address the significant usage of recycled seeds from last harvest

The study established that a significant proportion of farmers still relied on seeds from last harvest for planting. These seeds are not certified and may compromise productivity through compromises on resistance to pests and diseases as well as lack of proper adaptation to other climatic related conditions. Many of the farmers that used recycled seeds from previous harvests either pledged ignorance or low incomes to purchase the improved varieties. Targeted support through provision of certified seeds to poor farmers is just one part of the solution. Most of the solution may lie in spirited campaigns through media and extension services to educate farmers on the advantages of using improved seeds varieties. Efforts to lower the costs of certified and improved seeds will also encourage uptake by smallholder farmers.

Increase the pool of qualified breeders

From the study we can conclude that we are yet to reach a critical mass of well-trained breeders in all the countries visited for the study. Some crops had very few breeders including some that had only one. There is therefore need for resources to train more breeders. Besides the human capital development there is need to improve the technical infrastructure. Many breeders especially in Kenya testified that before the AGRA support they were poorly funded and lacked essential infrastructure and hence they could not pursue their key mandate of breeding for adapted seeds varieties for their countries.

Form partnerships with other players in the smallholder sector to increase the synergy for productivity and welfare improvement

As already pointed, PASS is doing a commendable job in the smallholder sector in terms of improvements in productivity. However the resource requirements (both financial and otherwise) to transform the sub-Saharan smallholder agriculture sector are huge. This is an opportunity for PASS to increase resources in the smallholder sector while at the same time forming partnership with other like-minded organizations to improve results. Organizations that may help with farmer capacity building and communication would go a long way to increase the successes of the PASS program.

ANNEXES

ANNEX 1: Breeders, multipliers and yield potential

Breeder	Crop	Variety	Multiplier/Seed Company	Quantity multiplied/distributed	Yield Potential/Ha
Kenya					
Dr. Reuben Otsyula	Beans	KK8	Bubai Seed Company	7 tons to a local agro dealer in Kitale	1.8 ton
Dr. Joseph Kamau	Cassava	Tajirika	KARI Seed Unit	Cannot Estimate	Tajirika 63.3 ton
		Karemba			Karemba 68.2 ton
Chrispus Oduori	Finger Millet	U-15	KARI Kitale	Has not been commercialized	2.5 ton
Dr. Jane Ininda	Maize	KH500-22A	Olerai Seed Company	140 tons	7.5 ton
	Maize	KH500-43A	East Africa Seed	280 tons	6.5 ton
Dr. John Kimani	Rice	Nerica 1 & 10	Farmers	Has not been commercialized	3 ton
Dr. Laura Karanja	Sweet potato	Kenspot 1 & 4	Kasambara Sweet Potato Growers	Cannot estimate	3-10 ton
Uganda					
Dr. Stanley Nkalubo	Beans	Nabe 15 & 16	Supa Seeds	>200 tons	1.8-2.5 ton
Kessime Eunice Vasiter	Beans	Nabe 15 & 16	Masindi Seed Company Limited	100 tons	
DR Richard Edema	Cassava	Nase 13	Fica seeds	3000 tons	20-30 ton
Liri Charles	Cassava	Nase 13 & 14	Grow more seeds and chemicals Ltd	2200 tons	20-33 ton
Dr Asea	Maize	Longe 9H & 10 H	Pearl seeds	over 500 tons	8-10 ton
Kwemoi Daniel	Maize	Longe 5D	Dr. Kiwemba	Cannot estimate	3-4 ton
Namazzi Sylvia Birabwa	Maize	Longe 9H	Otis seed company	180 tons	8-10 ton
			Equator seeds Gulu	1000 tons	
			Rwenzori Seeds	> 200 tons	
			SIMLAW Seed Company	100 tons	
			CAII Seeds	30,000 tons	
			Rrial Seeds	20 tons	
			Aera Seeds,	7 tons	
			Bakusekamaja Womens Seeds Association	200 tons	
			Simba Seeds	3 tons	
			Victoria Seed Company	1,000 tons	
Gerald Owachi	400 tons				

Tony Obua	Soybean	Maksoy 2N	Equator Seeds	500 tons	2-3 ton
Prof. Phenahas Tukamuhabwa	Soybean	Maksoy 3N	NASECO	2,500 tons	4-7 ton
Mozambique					
Breeder	Crop	Variety	Multiplier/Seed Company	Quantity multiplied/distributed	Yield Potential/Ha
Breeder	Crop	Variety	Multiplier	Quantity Multiplied	Location of Multiplier
Pedro Fato	Maize	ZM523	Associação Mulanguene	351 ton	5-7 ton
Constantino Cuambe	Cassava	Orera	Corridor Agro	850 ton	18-23 ton
		Eyope			17-25 ton
		Mokhalana			31 ton
		Varuiaya			22 ton
Jose Ricardo	Sweet Potato	Delvia	Xavier Muthemba	200 ton	23 ton
	Sweet Potato	Ininda	Arcanjo Cossa	240 ton	22 ton
	Sweet Potato	Irene	Associação 25 de Setembro	300 ton	19 ton
Jose Ricardo	Sweet Potato	Delvia, Ininda, Irene	Bernardo Armando	200 ton	
	Sweet Potato	Delvia, Ininda, Irene	Jair de Oliveira	350 ton	
	Sweet Potato	Delvia, Ininda, Irene	Isabel Mondlane	450 ton	
Ghana					
Breeder	Crop	Variety	Multiplier/Seed Company	Quantity multiplied/distributed	Yield Potential/Ha
Dr Joe Manu Aduaening	Cassava	Ampong	JOSMA company	44,620 bundles	56 ton
		Sika Bankye			56 ton
		Otuhia			65 ton
		Broni Bankye			40 ton
Dr Amoah	Cowpea	Videza	Emmanuel Agyei Asamoah	400kg	3.5 ton
		Hewale		800kg	3 ton
		Asomdwee		800kg	2.9 ton
		Hewale, Asomdwe, Videza	M & B Seeds	New	
		Videza	Antika Seeds	Cannot estimate	
		Asomdwe		Cannot estimate	
Dr James Asibuo	Groundnut	Obolo	M & B Seeds	Cannot estimate	2.7 ton
		Yenyawoso		Cannot estimate	2.7 ton
		Oboshie		Cannot estimate	
		Oboshie	Heritage Seeds	1 ton	2.6 ton
		Otuhia		1 ton	2.4 ton

		Obolo		250 kg	
		Yenyawoso		1 ton	
Dr Obeng Antwi	Maize	Sazal Sima	Lexborg Investments Company Ltd	New varieties	5.4 ton
		Wandata		New varieties	4.7 ton
Dr Maxwell Darko Asante	Rice	Agra Rice	Heritage Seeds	New	9.4 ton
Burkina Faso					
Breeder	Crop	Variety	Multiplier/Seed Company	Quantity multiplied/distributed	Yield Potential/Ha
Mr. Zongo Hamidou, Joseph Batiste Batiemo	Cowpea	Nafi	FAGRI	200-220 ton	1.5 ton
		Tiligre			1.5 ton
		Gourgou			1.8 ton
		Kom-calle			1.2 ton
Dr. Jacob Sanou	Maize	Wari	NAFASO	Cannot estimate	
		Komsaya			
Malawi					
Breeder	Crop	Variety	Multiplier/Seed Company	Quantity multiplied/distributed	Yield Potential/Ha
Dr Ibrahim Benesi	Cassava	Mpale, Sangoja	Ministry of Agriculture & Food Security (Agriculture research station at Chidetze)	Not provided	35-40 ton
Dr. GAD Kananji	Beans	Mwaluwa	EXAGRIS, CPM, PEACOCK, IITA	Not provided	2.5 ton

x. Annex : 2: Yield Calculation graphical charts



Yield calculations.pptx

xi. Annex 3 Data collection tools



KE_PASS_Breeder
DG_PA_v4.docx



KE_PASS_Govt
Agency DG_PA_v3.docx



KE_PASS_Seed Co
DG_PA_v4.docx



KE_PASS_AGD
Kenya Questionnaire_



KE_PASS SHF Kenya
Questionnaire_PA_v2

xii. Some of the varieties traced in pictures

Maize: KH 500-43 A



Maize: KH500-22A



Sweet Potato Farm in Maputo, Mozambique



Field Interviewer at a Sangoja Cassava variety Farm in Lilongwe region, Malawi



Maize variety at multiplication stage in Ghana



Nerica 10 rice in field in Meru, Kenya

