Perception and Control of the Fall Armyworm and its Impacts on Livelihoods in Eastern Africa

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Acknowledgements

Being in another country half way around the world can be difficult especially when you face problems such as language, cultural differences, and even new research methodology. Because of my translators and mentors, I was able to understand the sociological problems of local farmers. Since this was my first time ever doing a social science project, I was skeptical at first with the data collection methods, so I sculpted my questionnaire to produce not only qualitative data but quantitative data using very simple questions. My understanding of social research has grown exponentially because of this project and has made me appreciate the results you can get from just talking to people. Being obviously different had its drawbacks when talking to people because of their perception of foreigners, but because of this difference, I was able to experience the most extreme interactions. I experienced complete indifference to joyous praises because of how I looked. Everywhere I went I experienced a different reaction from people and I'm thankful for every single one because they helped me understand the people of Western Kenya and Tanzania. I'm Thankful for my experience and my project. It has opened my mind up to a whole new world of research and opportunities.

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Abstract

Since 2016, the invasive species *Spodeptera frugiperda* (Fall Armyworm) has ravished though Africa causing substantial damage to cereal crops. Since their arrival they have been reported in over 30 African countries and are majorly affecting the livelihoods of subsistence farmers. Because of the recent invasion, farmers are coming closer to the point of food insecurity. My task was to find out how much local farmers knew, how much they were losing, and how that was affecting their livelihoods. I also examined the perceptions on the effectivity of the control methods the farmers were using and disseminated knowledge.

By compiling a four-page questionnaire I was able to compare famer's yields, knowledge, control methods, and social standards. I cross tabulated factors such as country locale and if the participant was a push pull farmer or not. With the help of my mentors and translators, I administered my questionnaires and received information specific to each farmer. I conducted one focus group where I gathered information on yield loss since the arrival of the Fall Armyworm and their general knowledge of the pest. Do you know where the Fall Armyworm came from? Is there a less affected variety of maize? How do you think the Fall Armyworm came to your farm? How do you control the Fall Armyworm in your own farm? These were a few questions I asked and probed at to receive their ideas and perceptions on the new pest.

In the research I conducted, I gathered and compiled ideas of farmers from all around, finding that a majority of our respondents used chemical control even though it is very expensive. The reason for this was the level of effectivity compared to other methods such as ash or detergent. Knowledge and information of the Fall Armyworm is disseminated mostly from villager to villager or through radio broadcasts and about 60% of farmers are losing more than half of their yield every harvest due to this invasive species. We asked many farmers where these pests could have come from to test their knowledge and found out that they had many wild stories and that the dissemination of correct knowledge can insure better harvests for farmers.

Introduction

ICIPE

ICIPE was founded in 1970 by professor Thomas Risley Odhiambo with a vision to create a powerhouse for insect research. The International Centre of Insect Physiology and Ecology was born, with a mission to "alleviate poverty, ensure food security, and improve the overall health status of peoples of the tropics by developing and extending management tools and strategies for harmful and useful arthropods, while preserving the natural resource base through research and capacity building." The mission statement of ICIPE has encouraged the development and adoption of the 4H structure of human, plant, animal and environmental health. Over the years Icipe has gathered the attention of scientists' world over, with its ground-breaking research on teste fly, push pull technology, malaria and the environmental impact of bees.

Thomas Odhiambo Campus (IOTC)

Nestled on 60 acres on the peninsula, Mbita point lies the Thomas Odhiambo Campus. Named after the founder of ICIPE, the campus is home to a majority of the organizations: field research. Because of its location on the shores of Lake Victoria and its proximity to the equator the IOTC is a suitable and sought-after environment for research on crop pests and malaria carrying mosquitos. The campus is equipped with offices, a medical clinic, a primary school, guest housing, security greenhouses and many laboratories. During my time at the Thomas Odhiambo campus I was able to see the dedication of the laboratories to former director and World Food Prize laureate Hans Harran. Every year, researchers, graduate and doctorate students and interns come to the campus to research under the supervision of one of the six resident scientists on matters such as Malaria, Teste, or Push Pull technology.

Push Pull Technology

Push Pull technology was first developed in the late 1990s by Professor Zeyaur Khan, the father of push pull. This technology is based on the simplicity of natural pheromones secreted by plants. With the intercropping of a "push" plant such as the climate smart Greenleaf Desmodium, [*Desmodium Intortum (Mill.)*], or Silverleaf Desmodium, [*Desmodium Uncrinatrum (Jacq.)*], pests such as Stem Borer or Fall Armyworm are deterred from the maize or sorghum field. By using a "pull" plant such as Bracharia grass [*Brachiaria cv Mulato II*] or Napier Grass [*Pennisetum purpureum*] planted around the border of the field the pests are given an alternative host to feed and lay eggs on. (See Appendix 3) The goal of Push Pull as stated by Dr. Zeyaur Khan is "*To end hunger and poverty for 10 million people by extending Push-Pull technology to 1 million households in sub-Saharan Africa by 2020*". This goal is just within reach as the year twenty twenty fast approaches. Desmodium used in push pull technology is also an effective control method to the devastating parasitic Striga weed. Because of the research done by ICIPE and other organizations Push Pull has bettered the lives of millions of subsistence farmers all through sub-Saharan Africa. This new technology doesn't just stop at subsistence farmers however, it has reached a much bigger scale. One of my interviewees was a farmer owning over one hundred twenty acers of land with one tenth of it under Push pull. Push pull has grasped the attention of the world by effectively controlling Striga weed.

Spodeptera frugiperda: Fall Armyworm

Fall Army Worm (*Spodeptera frugiperda*) is a species in the order of Lepidoptera native to The Americas but has recently become invasive, and a threat to agriculture in Africa and Europe. Its common name, Fall Army Worm, comes from the fact that it will sweep through a field like an army destroying everything in its path. Due to its substantial migrational abilities it has easily spread through all of Africa leaving some parts of the continent with little to no food.

Methods and Procedure

I interviewed 50 farmers, 32 from Kenya and 18 from Tanzania. Of the 32 Kenyans 15 were male and the remaining 17 were female. In Tanzania of the 18 participants 12 were male and 6 were female. Due to the time constraints placed on women in agriculture, it was much harder to find women to interview. The average age of all my participants was 46 with an average of 22 years of experience. Thirty of the farmers that I interviewed had some type of land under push pull with the average being seven tenths of an acre. Seventy percent of my participants highest education level was primary, 11 attended secondary schooling, 3 attended college or university and one of the fifty had no formal education. Every respondent was aware of the Fall armyworm but only 18% had any information on lifecycle, origin, or could recognize early signs of the pest. All of my respondents were chosen with some regard to age, gender, push pull, and location. To collect and organize data, I formed a questionnaire that was administered to each of my 50 participants. See Appendix 1.

After the individual questionnaire process was finished I conducted a focus group to compile ideas as a group and complement the individual results. This group, unlike my original sample, was equal in both gender, push pull and non-push pull farmers. To create my focus group questions, I compiled questions from the individual questionnaire. To collect data, I created a questionnaire by forming broad questions such as, how the recent Fall Armyworm infestation is directly and indirectly affecting farmer's livelihoods. After creating my general questions, I began to formulate easier yes, no and simple short answer questions that could help answer the broader points. After my draft was created, we briefly reviewed the questionnaire for topographical errors and tested it on five random participants. Once the trial run was finished I continued to edit my questionnaire to create less complex and easier to answer questions. My questionnaire was then put through a final review and test run to create my final product that was used throughout the rest of the process. I then compiled a list of questions for a focus group to gather a collective response to complement my individual interviews and spark a discussion on Fall Army Worm.

To administer my questionnaire, we traveled to 6 different counties, three in Kenya and three in Tanzania, to meet groups of farmers where with the help of my translators we collected information. Before beginning questionnaires, we made sure that every farmer knew that there were no right or wrong answers, so we could avoid any obscured data. Once finished the 50 questionnaires were entered into a statistical analysis program, Statistical Package for Social Sciences (SPSS). After entry and coding, data was arranged to answer various questions and

determine statistical data. Data was then averaged and turned into an equal percent value to compare unequal values.

Results

Objectives and Findings

The goal of my research consisted of understanding how the livelihoods of East Africans was being affected due to the recent Fall Armyworm outbreak. On top of that, I was to gather information about the farmers yield loss and perception, so information on the Fall Armyworm and push pull could be more easily disseminated to local farmers. During my interviewing process I was to help disseminate knowledge to the participants in hopes to answer some of their questions about this new pest. I categorized my findings into 5 sections of farmer perception, yield loss, farmers knowledge, and methods of control.

Farmer Perception

In Kenya 93.75% of farmers reported that the Fall armyworm infestation compared to last year was low, while the remaining 6.25% said that it was a similar infestation. Results in Tanzania however, showed that 72.2% of participants believed the infestation was much higher compared to the previous year. Only one Tanzanian participant said the infestation was the same but four from northern Tanzania reported low infestation. Farmers believed that higher infestation rates were due to drought or insufficient rains.

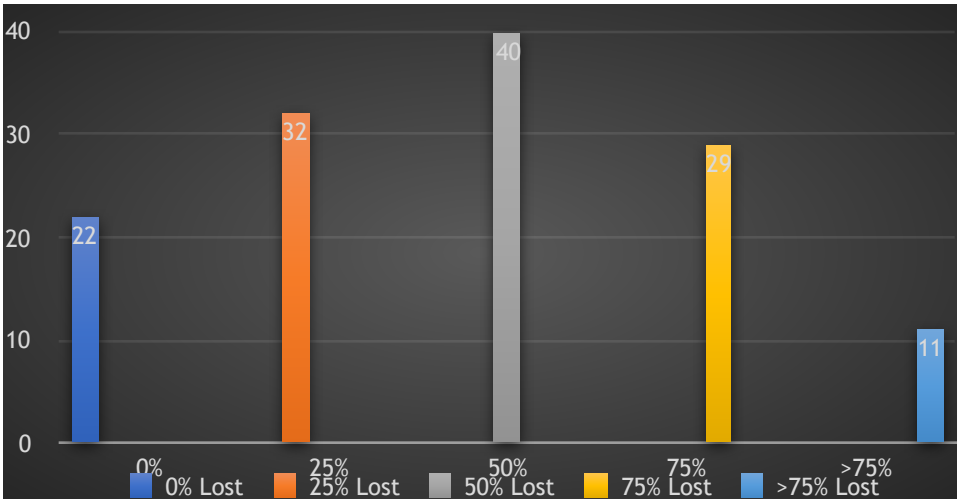
In Push Pull fields 70% of farmers reported a lower infestation in Tanzania while only 2 of 10 respondents reported high. In Kenya 13 of 17 push pull participants reported a lower infestation while three reported similar and one reported a high infestation in comparison to the previous

year. Each farmer gave a rating of damage on a 1-5 scale with one being least severe. In non-push pull fields, the average rating of damage was 4.3 while push pull fields rating of damage was a surprising low 1.6.

Yield Loss

Yield loss was reported in form of a percentage by all farmers. Each participant was asked their expected yield and then their actual harvest, the percentage was figured and then classified under 1, zero percent 2, twenty five percent 3, fifty percent 4, seventy five percent, or 5, greater than seventy five percent. Each farmer was asked to report a percent lost for push pull, if applicable, and non-push pull maize in both the long rain and short rain seasons. Between Both Tanzania and Kenya percent of yield loss was very similar with a variance of 1-7 percent in each category. 81.6% of cases reported that their loss due to drought and fall armyworm was 50% in their fields. Overall farmers reported that mostly maize was affected with sorghum only effected when infestation is high, other crops were not damaged even though the Fall Armyworm has the ability to feed on over 80 different crops. See Table 1 in Appendix 4

Percentage of Yield Loss



Graph 1

This table compares the percent of yield loss reported by farmers for all fields combined. As you can see above a majority of farmers estimated their yield loss at 50% or greater in their fields.

Comparing Yield Loss

REPORTED %	KENYA	COMPARATIVE %	TANZANIA	COMPARATIVE %	**TOTAL**
0%	14	16.1%	8	17.7%	22
25%	19	21.8%	13	28.8%	32
50%	26	29%	14	31%	40
75%	23	26.4%	4	8.8%	27
>75%	5	5.7%	6	13.3%	11
TOTAL	87		45		

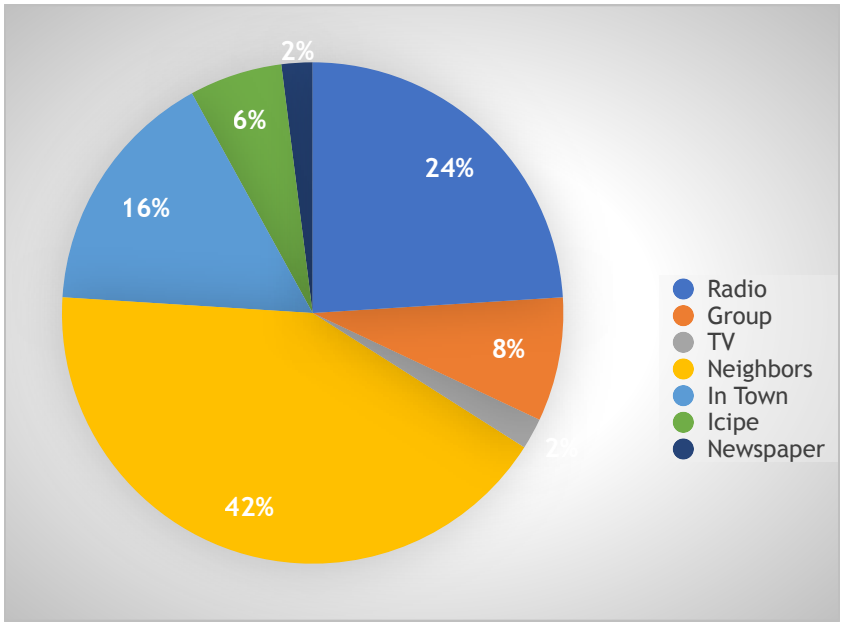
Table 2

In the table above Kenyans had a general lower percent of yield loss compared to those living in Tanzania. Each percent bracket was turned into a comparative percentage so that information from both countries could be easily cross tabulated and viewed together. The information above is very similar country to country except for those who fall in the loss of 75% bracket. In Kenya many more farmers reported a loss of three fourths of their harvest compared to the four who reported the same in Tanzania. In Tanzania however, more farmers reported losses greater than 75% suggesting severity of loss in Tanzania could be more substantial.

Farmers Knowledge

On average farmers who were practicing push pull had a better knowledge and understanding of Fall Armyworm compared to participants who practiced traditional methods only. Push pull farmers had an overall cumulative percentage much higher than Non-push pull farmers reflecting the knowledge gap between the two groups. The verbal transfer of knowledge on the Fall Armyworm was the most popular at 42% with radio broadcasts for farmers following at 24%. See Table 3 in Appendix 5

Methods of Disseminating Knowledge



Graph 2

This table shows specifically how each of my participants learned about the recent Fall Army Worm (*Spodeptera frugiperda).* Knowledge was primarily disseminated orally between neighbors, with 42% of respondents mentioning that they had heard about this new pest from the people living around them.

Specific Knowledge on *Spodeptera f.*

		PUSH PULL	%	NON-PUSH PULL	%	COMBINED KNOWLEGE	TOTAL %
LIFE CYCLE	Yes	11	57.8%	2	11.1%	13	35.1%
	No	19		18		37	
ORIGIN	Yes	7	30.4%	2	11.1%	9	21.9%
	No	23		28		41	
INVASION	Yes	8	36.4%	3	17.6%	11	28.2%
	No	22		17		39	
EGG RECONIZATION	Yes	5	20%	1	5.2%	6	13.6%
	No	25		19		44	

Table 4

By showing the percentages of farmers who knew about basic information on Fall Army Worm we can compare the knowledge of push pull farmers to non-push pull farmers. The table above shows how push pull farmers knew much more about the fall army worm than people practicing traditional methods. This is indicated by a substantially higher percentage of farmers with the knowledge in the fourth column than the sixth.

Methods of control

From the respondents I heard nine different answers with chemical control being present in 68% of cases. Some methods of control were obscure, but the farmers reasoning was understandable. One of the 50 respondents said he did nothing because “it couldn’t help, and it couldn’t hurt”. All farmers except one used some sort of control method ranging from spraying chemicals to pulling up the whole crop.

Methods of Control

METHOD	N	%	% OF CASES
CHEMICAL	34	48%	68%
PUSH PULL	14	20%	28%
ASH	10	14.3%	20%
HERBAL	3	4.3%	6%
SHAKE AND BURRY	3	4.3%	6%
SOAP	2	2.9%	4%
STAB WORM	2	2.9%	4%
NO CONTROL	1	1.4%	2%
PULL UP	1	1.4	2%

Table 5

Once the participants methods of control were recorded (Table 5) they were asked to rate the effectiveness of this control (Table 6). They were asked if the control method they were using was working and then asked to rate the effectiveness on a scale 1-3 with three being the most effective. No participant responded as No 3 meaning perception on control was relatively positive.

Effectiveness of Methods of Control

METHOD	*Y1*	*Y2*	Y3	N1	N2	TOTAL
CHEMICAL	6	16	8	2	2	34
PUSH PULL	2	7	5	0	0	14
ASH	1	2	3	2	2	10

HERBAL	0	0	1	1	1	3
SHAKE AND BURRY	0	1	0	2	0	2
SOAP	0	0	1	1	0	2
STAB	0	0	0	2	0	2
PULL UP CROP	1	0	0	0	0	1
NOTHING	1	0	0	0	0	1

Table 6

Push Pull

Push pull was an effective measure of control with all respondents reporting that it was working and that there was little to no infestation in their push pull fields. Not only push pull being an effective measure of control, it increased the farmers livelihood rating because of the increased yield per acreage. Push pull farmers also had a lower loss of yield and damage percent rating and push pull farmers on average had a much greater knowledge of Fall Armyworm. This greater knowledge of Fall Armyworm was normally due to their strong affiliations with Icipe or the ministry of Agriculture.

Focus Group

The focus group was conducted and the responses were compiled from the individual questionnaires. By bringing the ideas of the group together they decided that overall the hybrid crop was more effected than the local variety. Their ideas on origin were congruent with that of the individual results. Collectively they decided major groupings of Government funded programs that hadn't been mentioned in individuals such as, mass fumigation, allowing

genetically modified crops for farmers, and funding research on biological controls. Overall, answers given in the focus group complemented the individual portion of my project.

Discussion

Fall Armyworm has become a huge agricultural problem in Africa. With no natural predators and their main source of food easily accessible they are destroying the livelihoods of small share farmers all over the continent. Because no specific control for this pest exists, farmers have resulted to trying anything to stop any further damage by this pest. Desperately farmers have been searching for a control method but to no avail. Pesticides that currently exist are cost prohibitive and are out of reach of most subsistence farmers, some farmers sell their reserves just, so they can afford a liter of "medicine" for their crops. In its home continent of South America, Fall Armyworm is controlled by a combination of pesticides and genetically modified crops that can be ecologically damaging. Genetically modified crops have yet to be approved for use in Kenya or Tanzania, so this option is not viable currently. However, in research done by senior scientists of push pull (*A climate-adapted push-pull system effectively controls fall armyworm, Spodoptera frugiperda in maize in East Africa),* they reported that push pull is an adequate control for stemborer, striga and now Fall armyworm. Due to shortage of desmodium seed, and limited resources for dissemination, push pull has not yet been available to every farmer. Farmers have turned to picking off the worms and burying them as a control method and some have given up and view any control as futile. If an adequate control method is not found, farmers could adapt to the lesser of these two cases causing widespread famine and poverty

throughout Africa. Every farmer had ideas of government programs that could be implemented and enforced to prevent hardship to smallholder farmers, so all hope is not lost yet.

Most farmers had little to no correct knowledge on the Fall armyworm creating false accusation and fear. Some farmers suggested that organizations, like ICIPE and the Ministry of Agriculture, had brought this pest to gain favor for their technologies. Others thought that synthetic fertilizer was bringing Fall Armyworm because damage in Hybrid fields was slightly worse than the local variety. Farmers had already begun to plant local seed only in hopes of reducing the pest, but at the cost of a lower yield per acre. Incorrect knowledge can be decremental to small share farmers and could lead to food insecurity down the road. Important knowledge being passed is creating a distrust in organizations sworn to help the farmers and in turn slowing the progress of the dissemination of knowledge and closing the path for new technologies. Knowledge is the best tool for dissemination of technology and this can only be achieved with more field agents and technicians. To reach the goal of push pull by “extending push pull technology to 1 million households in Sub Saharan Africa by 2020” information must be shared with farmers to create a mutual trust between farmers and Icipe.

The livelihood of the small share farmer is a balancing act of feeding family and consistently producing adequate yield. Their perception of yield and loss due to Fall Armyworm varied region to region. In Kenya most farmers reported a low infestation while in Tanzania they saw a high infestation compared to previous years. Farmers in both regions mentioned that this infestation level could be because of the amount of rainfall in the current season. By first impression the soil

located in Kenya and on the border of Tanzania seemed to be dark rich soil while the dirt further inland appeared light, sandy, and problematic for the cultivation of crops. This soil quality could have been because of the drier climate or just a drought spell. The African Armyworm is known to thrive in drought-stricken areas and the invasive Fall Armyworm is suspected to behave in a similar manner even though research has not been implemented.

The fact that participants with push pull fields responded to have a lower infestation in their fields overall supports (*A climate-adapted push-pull system effectively controls fall armyworm, Spodoptera frugiperda (J E Smith), in maize in East Africa*). This could also be because of the fact that Push Pull fields constantly produce an average yield of 3.6 to 4.1 bags seasonally with very little variance compared to the seasonal variance of 5.3 to 8.7 in non-push pull fields. This variance can be perceived as "non -push pull is unreliable." This rating could also be lower due to the fact that there is a narrow success rate in push pull fields. These fields normally do not exceed more than four acres with the average size being .7 acres. Many farmers reported that push pull had no signs of damage both in their own plots but their neighbors as well, meaning their perception of push pull is positive. Push pull may not be to 10 million households yet, but it is changing the lives of most farmers practicing this new technology. Push pull seems to be the pathway out of poverty in Eastern Africa.

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Appendices

- ***Appendix 1***

Perception of Fall Armyworm and its impacts of livelihoods in Western Kenya

Objective: (1) To understand the farmers knowledge and perception of the Fall armyworm.

(2) Understand how the recent Fall armyworm infestation is affecting farmers crop production, and overall livelihoods.

Interviewer's name _____
Date of interview_____

Section A: Farmer Details
Name of Farmer _____ Cell Phone # _____
District _____ County _____ Village _____
Gender: Male____ Female ____ Age: _____
Level of Education: None ___ Primary ___ Secondary ___ College ____ Higher Education ____

Section B: Farmer Characteristics
1. How long have you been a farmer? Years _____
2. What is your total household size? _____
3. Are you a Push Pull Farmer? Yes_____ No_____
--- If no have you heard about Push Pull? Yes_____ No_____
4. Are you concerned with any new pests? Yes _____ No_____
5. If yes what pest? _____
6. Are you happy with your current farming methods? Yes_____ No_____
7. Do you have any source of income other than farming? Yes_____ No_____
-- If yes what is that source of income? _____
8. How much land did you plant this season in acres?
--- Non Push Pull: Acres___
--- Push Pull: Acres____
9. Which crops do you plant? Maize_____ Sorghum_____ Others____
(specify)_____
10. Which varieties of these cereals do you plant?
--- Non Push Pull Maize: Local_____ Hybrid_____
--- Push Pull Maize: Local____ Hybrid____
11. Do you apply farm yard manure to your field?
--- Non Push Pull: Yes____ No_____
--- Push Pull: Yes____ No_____
12. Do you apply any chemical fertilizers in your farm?
--- Non Push Pull: Yes ____ No____
--- Push Pull: Yes____ No____

13. Estimate on yield for the last four seasons (90 kg bags)

Crop	SR 2016	LR2016	SR2017	LR2017
Non Push Pull Maize				

Non Push Pull Sorghum				
Push Pull Maize				
Push Pull Sorghum				

Section C: Farmers Knowledge of Fall armyworm.

1. Do you know about the Fall armyworm? Yes_____ No_____
2. How did you hear about Fall armyworm? _____
3. Can you recognize the FAW eggs on the plant? Yes_____ No_____
4. Can you recognize the fall armyworm larvae? Yes ____ No_____
5. Has Fall armyworm attacked your farm?

--- This Season? (Non Push Pull) Yes____ No____
--- Last Season? (Non Push Pull) Yes____ No____
--- This Season? (Push Pull) Yes____ No_____
--- Last Season? (Push Pull) Yes____ No_____

6. If yes, when did you see Fall armyworm in your farm for the first time?

--- Non Push Pull: Year____ Season____
--- Push Pull: Year____ Season____

7. Do you know the life cycle of the Fall armyworm? Yes____ No_____
8. Have you ever seen Fall armyworm in your neighbor's farm?

--- Non Push Pull: Yes ____ No____
--- Push Pull: Yes____ No_____

9. Do you know where Fall armyworm came from? Yes____ No____
10. Do you know how they invade a farm? Yes____ No_____
11. Do you know how Fall armyworm causes damage to crops? Yes ____ No____

--- If yes please explain _____

12. What methods do you use to control Fall armyworm in your own farm?

_____

--- is it effective? Yes____ No____
--- How effective? (1= Not Effective 3= Very Effective) 1 2 3
13. Have you received any training on how to prevent Fall armyworm? Yes ____ No____
14. If yes who trained you? _____

--- What were you trained on? _____

15. What are its effects on your farm, and Kenya, in general?

_____

_____

Section D: Farmer's rating of crop damage

1a. Please rate the damage on each crop that was attacked by Fall armyworm in Non Push Pull fields. (1= Least Severe; 5= Most Severe)

--- Maize 1 2 3 4 5
--- Sorghum 1 2 3 4 5
--- Other Crops 1 2 3 4 5

1b. Please rate the damage on each crop that was attacked by Fall armyworm in push pull fields. (1= Least Severe; 5= Most Severe)

--- Maize 1 2 3 4 5
--- Sorghum 1 2 3 4 5
--- Other Crops 1 2 3 4 5

2. How is the infestation compared to last season (LR 2017)?

--Non Push Pull: Low___ Same___ High___
--Push Pull: Low___ Same___ High___

3. Please rate the damage by Fall armyworm during LR and SR 2017

	Low		Average		High
--- Long Rain 2017 (Non Push Pull)	1	2	3	4	5
--- Short Rain 2017 (Non Push Pull)	1	2	3	4	5
--- Long rain 2017 (Push Pull)		1	2	3	4 5
--- Short Rain 2017 (Push Pull)		1	2	3	4 5

4. Please rate the yield loss caused by Fall armyworm during LR and SR 2017 (What was lost?)

	0%	25%	50%	75%	>75%
--- Long Rain 2017 (Non Push Pull)	1	2	3	4	5
--- Short Rain 2017 (Non Push Pull)	1	2	3	4	5
--- Long Rain 2017 (Push Pull)		1	2	3	4 5
--- Short Rain 2017 (Push Pull)		1	2	3	4 5

Section E: Gender Issues

1. Are you a member of any social group? Yes____ No____
2. If yes to above, who are the majority of the group?

Women____ Men____ Youth _____ Equal____

3. Have you shared information on Fall armyworm in this group with your group members?

---Yes____ No____

4. Are you a part of field demonstrations and trainings? Yes____ No____
5. How many Males and Females are there in your household? Male_____ Female_____
6. Who makes the agricultural choices in the family?

(1= Father 2= Mother 3= Eldest Son 4= Eldest Daughter 5= Anyone in the family 6= Other)

1 2 3 4 5 6

7. Please mark the age category for the number of males and females in your family.

Gender	Age Category	0 – 6	7 -14	15 - 30	31 - 60	Over 60
M						
F						

8. Please provide information on household workforce

Gender	Number of who work full time on the farm	Number of who work part time on the farm	Number of who work off the farm	Number of able bodied but do not do anything	Number of children, elderly, physically impaired
M					
F					

9. What policy actions do you think should be taken to deal with the Fall armyworm invasion?

_____

_____

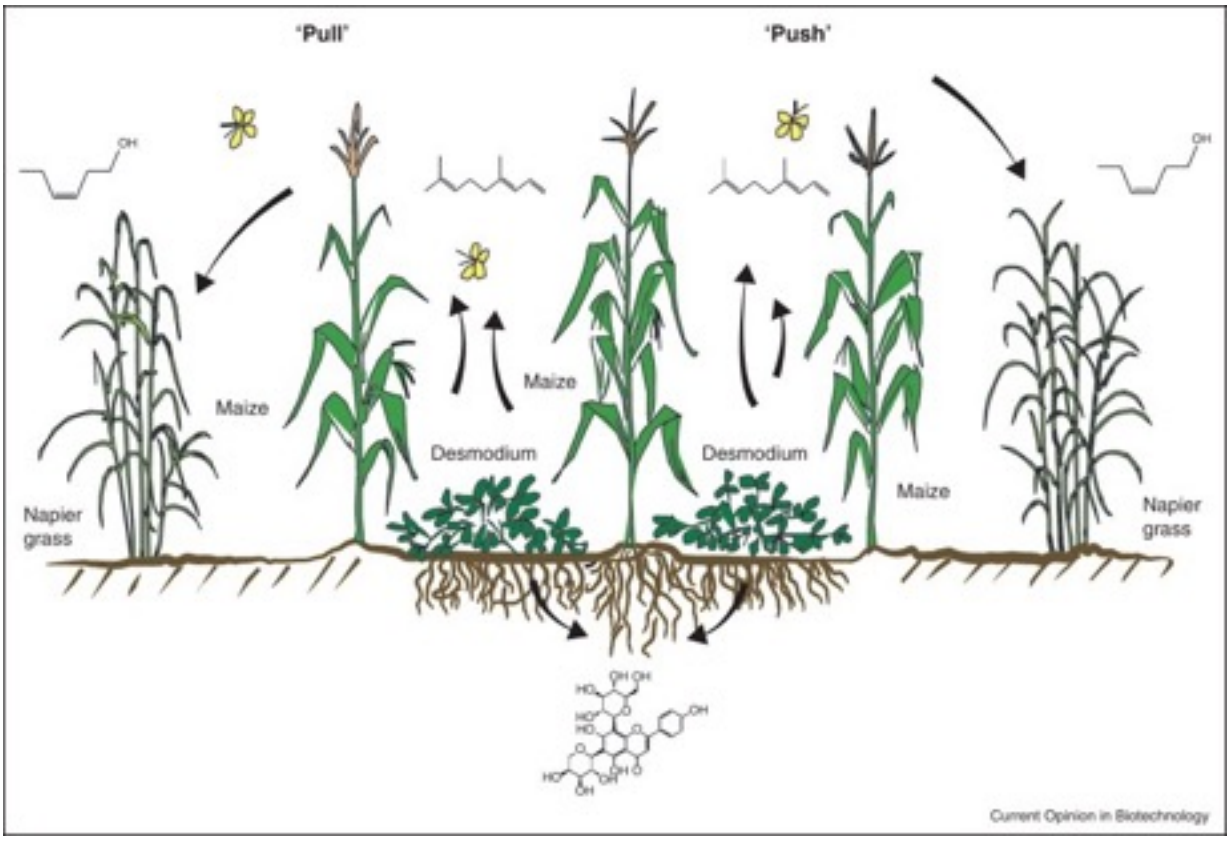
Thank You!

- ***Appendix 2***

Fall Armyworm Focus Group Questions

1. Do you know where the Fall Armyworm came from?
2. How many acres of land do you plant?
3. How much maize did you lose last year to FAW (SR and LR 2017 in % loss)
4. What methods do you use to control Fall Armyworm in your farm and is it working?
5. How many of you are push pull farmers? Are your Push Pull Fields damaged by FAW?
6. Do you plant Hybrid or Local? Does this affect the Fall armyworm damage? Why?
7. What do you think the Government should do to help with the Fall armyworm invasion?

- *Appendix 3*



- *Appendix 4 (Table 1)*

% REPORTED	N	%	% OF CASES
0%	22	16.7%	44.9%
25%	32	24.2%	65.3%

50%	40	30.3%	81.6%
75%	29	20.5%	55.1%
>75%	11	8.3%	22.4%

- *Appendix 5 (Table 3)*

METHOD	FREQUENCY	PERCENT
RADIO	12	24%
GROUP	4	8%
TV	1	2%
NEIGHBORS	21	42%
IN TOWN	8	16%
ICIPE	3	6%
NEWSPAPER	1	2%
TOTAL	50	100%