PUSH-PULL TECHNOLOGY

International Center of Insect Physiology and Ecology, Mbita Kenya,

PUSH-PULL FARMING SYSTEMS: KNOWLEDGE AND PERCEPTIONS OF KENYAN AND UGANDAN FARMERS

icipe

African Insect Science for Food and Health

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World Food Prize

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Introduction

Abstract

Push-pull technology was invented at The International Center for Insect Physiology and Ecology (ICIPE) to help African farmers. It uses the desmodium legume intercropped with maize or sorghum, along with a row of Napier/Brachiaria grass around the outside of the plot. It not only prevents weeds and kills pests, but also improves soil fertility and provides food for animals. The methodology of this study consisted of field interviews of active farmers regarding their knowledge of pests, weeds, and aspects of push-pull. The study seeks to know if farmers are better understanding the technologies they are using and pests they are killing. This aligns with the research ICIPE does during field days. They teach farmers about the methods and then conduct surveys to see what the farmers retained.

Hundreds of thousands of farmers use push-pull technology all over Africa. The technology is knowledge intensive, meaning to use it correctly farmers need to know why they are implementing. Do male and female farmers perceive push-pull differently? Do farmers know about stemborer? Have they learned about the Fall Armyworm? Are they aware of the striga weed? Is there a difference in the level of knowledge about push-pull in push-pull farmers compared to non-push-pull farmers? The questionnaire that was developed asked in-depth questions on behavior and biology of weeds and pests, as well as specific questions on push-pull. Then, the surveys were analyzed and different groups were compared to one another. When analyzing the data, we found many farmers remember basic farming information they learned in school. The data reveals a knowledge gap between push-pull technology (PPT) and non-push-pull technology (NPPT) farmers, but also between regions and genders. With the research, the scientists at the ICIPE will be able to address key knowledge areas and target farmers who can most benefit from further education.

An Iowa Farmer

My name is Jacob Schultz and I grew up in a small town called Melvin IA. I have grown up on a 7th generation family farm that I hope to have the honor of taking over someday. We have mostly row crop of corn and soybeans, with two hog finishers. FFA is one of my favorite things I have been in and the lessons I learned there really made an impact on me. People being food insecure was something that I heard about in school but didn't really think would ever affect me.

That all changed when I went on the Monsanto Trip. This is a two-day trip where a regional seed dealer from Monsanto, Bruce Weller, takes kids from all over North West Iowa down to Des Moines. There he takes kids to different Monsanto facilities to show the kids what they are doing. The part that impacted me was showing everyone the World Food Prize, a building dedicated to fighting hunger around the world. When we were there he told us about all the great things they do, and an opportunity to write a paper about a developing country and their food security problem.

I didn't write the paper that year, but it got me thinking. Then in 2016after some convincing and help from my dad I wrote about the developing country of Sierra Leone, and their Rural Infrastructure problems. That brought me to the Iowa Youth Institute where I got to hear from

people all around the world about problems people were facing and solutions they were implementing. At that point, I thought it was the end of my journey until they talked about the Global youth institute and I knew that was something I wanted to do.

Once I fixed my paper and submitted it again, I was one in about 300 kids that got to the Global Youth Institute. There we got to see panels of people talking about food security, heads of huge agricultural companies, and hear stories from people who struggled to get food at home. This experience really opened my eyes to the world when I realized it wasn't all big family owned farms in Iowa.

About a month later I received an email that I could apply for an internship that would take me to a developing country to help. After everything I had herd I knew that I could go and try to make a difference. That brings me to where I was this summer. After applying and rounds of interviews I got accepted to go to Kenya to research and try to help towards the goals that farmers and researchers all over the world have, food security.

Acknowledgments

Doing this internship was one of the best experiences of my life. There are many people and organizations that were influential in getting me to Kenya and helped me while I was away. My experience would not have been the same without the help of any of these people.

I want to start off by thanking the World Food Prize. Without the amazing work that Norman Borlaug did, none of this would be possible. That, along with the work that Ambassador Kenneth Quinn, Lisa Fleming, and the wonderful staff at the world food prize makes everything they do run smoothly.

A huge thanks to the people at The International Center for Insect Physiology and Ecology (ICIPE) Research Center for their continued support for the World Food Prize Interns. Professor Z. R. Khan and Professor Charles Midega's work on the push pull program is already helping hundreds of thousands of people as it continues to grow. All of the workers at their Nairobi and Mbita stations have been more than nice, and helped make it feel more like home. Their drivers including Polycarp and Aloice, have been more than nice with Aloice saying he is out father for trip. Other people I would like to include are Matilda, for going around for interviews with us and Silas, for taking us out of the center.

There are also some people from home that have made my first trip out of the U.S. a lot easier. My parents have been very supportive throughout everything and they are always there when I need them. I have many friends who made the trip seem like it was going by quicker. A special thanks to my friend Joselin Tapia for everything she did while I was gone. Lastly, thanks to all my family who was interested in what I was doing and sent me their best wishes.

I would not be where I am today If it wasn't for my teachers and community. My Ag teach Brian Gottlob has pushed me to take every opportunity, and helped me every step of the way. Jacob Fox may have only been at my school for a year but he still influenced me to get where I am today. One last special thanks for all of the help that Bruce Weller does. He introduced me to the program and has been interested in my progress the whole way.

Background

ICIPE Research Center

ICIPE Is a Kenyan research institute founded in 1970. Their founder, Prof. Thomas Risley Odhiambo, was a graduate at Cambridge university. He went on to return to Kenya and become a respected lecturer. Odhiambo realized that there was very few native people in science and the continent was falling behind in key economic aspects. He saw the benefit that would come out of a research center that was designed to address these issues and train young African scientists.

That led to the founding of ICIPE, with the goal of improving the life of Africans, with African scientist. He wanted ICIPE to be a global leader in managing both harmful and helpful insects to improve the livelihood of others. The center started out as nothing more than a garage, and had very little money. However, with the help of another world-renowned scientist and a few donners the center was able to work towards it goals. The center works towards improving the 4Hs, human, animal, plant, and environmental health. ICIPE has been growing for more than forty-five years now trying to help sustain Africa. Every year they get hundreds of students and scientists coming to study and make the next step in the fight to improve the livelihood of others.

Thomas R. Odhiambo Field Station, Mbita Point

The field station for ICIPE in Mbita Kenya was named after the founder Prof. Thomas Risley Odhiambo. ICIPE Thomas Odhiambo Campus (IOTC) was founded in 1977 in order to have more room for research as well as being able to collect data from other areas of Kenya. The center has lab equipment, teaching facilities, and conference rooms. All of that attracts scientists and scholars from many fields to contribute to IOTC research in the area.

There are projects from all four focuses at Mbita, Human, Animal, Plant, and Environmental health. Some of their main projects include the fruit fly, malaria, and push-pull. At IOTC almost half of their land is used for experimental farming. This makes the center perfect for being the center of all push-pull research in the country. Every year many college students and interns come from all around the world to do research or work towards their degree.

Knowledge Intensive Push-Pull

Push-pull technology is a very knowledge intensive process. That means that there is a lot of things that the farmer needs to know to do it properly. Also, if they know what the technology is doing they will better understand why they are doing it. Push-pull technology was created at ICIPE in the early 90's by Prof. Z.R. Khan. It was created to help stop the pest stemborer. However, it ended up having many more benefits.

Push-pull technology is an entirely different farming practice than what the farmers are used to. It uses the desmodium legume in-between the rows of crops. Also, there are rows of a grass around the outside of the plot. There is maintenance, but in the end the farmers spend less time weeding and gets more bushels in return.

One thing that is important to know is what push-pull fights against. The first thing it stops is stemborers, a moth that lays eggs on maize. As the eggs grow they make their way down the leaf

and into the stem where they bore through it and live until their adult stage. The technology repels them in two different ways. First of all, desmodium gives off a scent that repels the insects away from the crop which is the push. Also, Napier grass gives off a scent that pulls in the moth which is the pull. The Napier then kills the larva at different stages making it harder for the moths to reproduce.

Push-pull also fights against the striga weed. Striga is a parasitic weed that attaches itself to the roots of cereals and takes away all it nutrients. The desmodium legume prevents the weed by giving off chemicals in their roots that makes them germinate and die. Just those reasons can already improve yields 5 times what it was producing before.

Push-pull not only stops pests, it also has many other money saving benefits. For instance, both the grasses and desmodium can be used as a fodder for animals. If the farmer doesn't have animals they can then use it as a source of income. The technology even helps with drought, the plants always shade the ground to keep the moisture in. A few other benefits include less erosion, better soil fertility, and improves income of the farmer.

The goal of this research is to help self-sustaining farmers to be able to feed their family and produce a livable income. For more than 20 years the team at ICIPE has been improving on the project to try and combat new problem people face every day. For instance, drought is becoming a worse problem in this region of Africa every day. This means some plants have a harder time growing. To try and combat the problem researchers analyzed a number of native grass species to test for drought resistance and insect control. It was found that bracharia excelled in both aspect and is now used instead of Napier in climate smart push-pull. This shows that push-pull is an evolving technology that will continue helping sustain farmers for generations to come.

Research

Methodology

The type of research used in this study was qualitative and quantitative. Qualitative research was aimed at gaining in depth information on knowledge of farmers and their habits. Besides that, questions were analyzed numerically to show a statistical representation of the study. This dual method approach was used to be able to compare different types of farmers in the region.

The methods used include interviewing farmers and conducting focus group discussions. The farmer teacher or extension officer in the area went out to organize farmers. The extension officer was to find a certain number of farmers to make the research even, and give us a better understanding of what push-pull farmers thought vs non-push-pull. For the individual interviews, there was a goal of having equal push-pull to non-push-pull, and men to women. This way they could be compared to one another. As for the focus group discussions, the data was used to see what people say in a group setting. With the information from both methods the data was triangulated to see if people said the same thing in a group as well as alone.

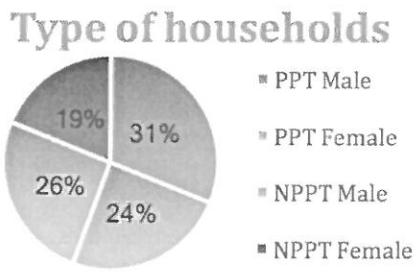
The reach of this survey included 2 counties in Kenya and 2 in Uganda. In Kenya, the counties were in the western region and included Miguri and Homa Bay. Bukedea and Bukoli North are the counties studied in eastern Uganda. These counties were chosen to get a wide variety of farmers with a different environment and community.

As long as time allowed and the farmers were available the goal was to even out the demographics in each area. This was not always possible due to shortened time and farmers working during the day. When conducting the surveys very few farmers spoke English so there was a need for translators. When surveying in Kenya the technicians at ICIPE we able to translate from Kiswahili. However, in Uganda there is no one language that cuts across everyone so it was harder to rely on the technicians. In that case farmer teachers and even English speakers in the community were asked to help translate.

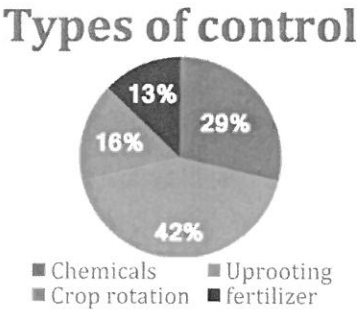
After all the data was collected it was analyzed to determine patterns and find correlations. When looking at the data different aspects were cross analyzed with one another to bring out the importance of the information. This information will lead us to a better understanding of what groups of farmers are more knowledgeable and allow extension officer to more efficiently conduct field days.

Analysis

Demographics: For the interviews, there was a total of 89 farmers. Out of those farmers there were 17 NPPT females, 23 NPPT males, 22 PPT females, and 28 PPT males. The farmers came from two different countries and in each country, there was two counties that I interviewed in. A majority of farmers only completing primary school. These farmers were selected from areas with a large number of PPT farmers as well as trying to get a balance between men and women. Out of all the farmers 66% of them had been farming for more than 13 years. Also 54% of farmers had a family of 6 to 10 people, and 23.5% of them had more than 10 people they were taking care of.



A question was asked to gain a better understanding of what the farms are currently doing for control of pests and weeds. The number one answer was to uproot weeds in their fields with 42% of all the farmers. Uprooting was followed by chemicals then crop rotation. When comparing push-pull farmers to non-push-pull farmers there was a large difference in the number of farmers that reported uprooting weeds. With the sufficient ground cover and killing of the striga weed, only 32% of push-pull farmers uprooted in their fields. As for non-push-pull farmers, there was more than double with 69% of them uprooting weeds. This is just one example of how there is less labor involved after establishing a push-pull field.

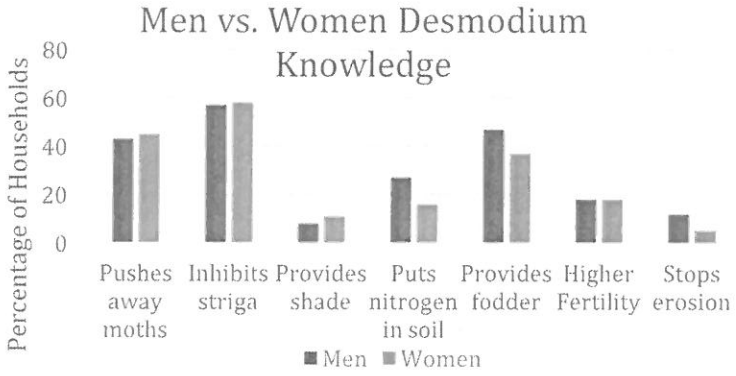


Objective one: This objective focuses on differences in the perception of male and female farmers. For this aspect, we asked all of the farmers in what way desmodium and Napier/bracharia helped on a farm. Then all of the different aspects they recalled were recorded. The graph below shows

the percentages of men and women that recalled each benefit for desmodium. The findings were similar for Napier/bracharia with percentages varying by less than 5% between male and female farmers. Both men and women were ahead in 3 of the 7 categories with one being a tie. This shows that while men and women may be knowledgeable on different aspects their overall perception is quite similar.

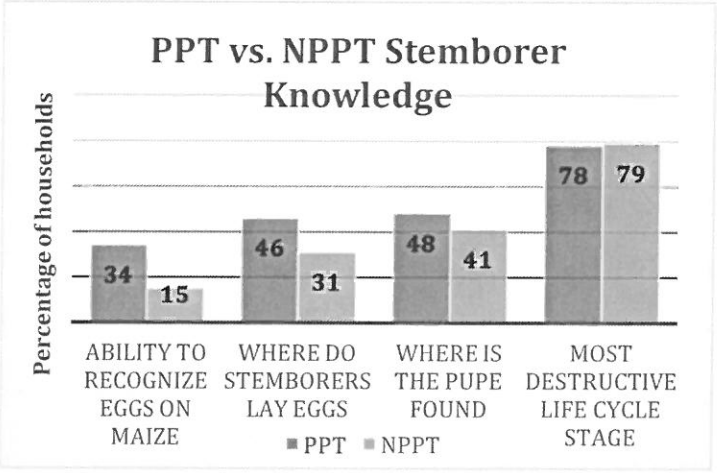
A number of aspects were low in both men and women. For desmodium very few farmers recalled that it provided shade to keep in moisture and that it helped stop erosion. For Napier/bracharia there was only 13.5% of farmers that knew the grasses were able to kill the pests at different stages of development.

In each focus group discussion, there was a larger number of males than females. It was clear than men where the first to answer questions and women were not usually the first ones to raise their hands. Without doing separate focus group discussions with males and females it can be very difficult to determine the difference in perception of the two groups. The women may not want to speak up in a group setting. One question asked gave insight into what the farmers were thinking as a whole. The farmers were asked who in the family was more aware of the damage caused by stemborer. In both countries, a large majority of farmers stated that both men and women were aware because they "Both work together in the garden". In Kenya, there was one vote for women and zero for men. In Uganda, it was different with 30% saying men and only 11.6% saying females.



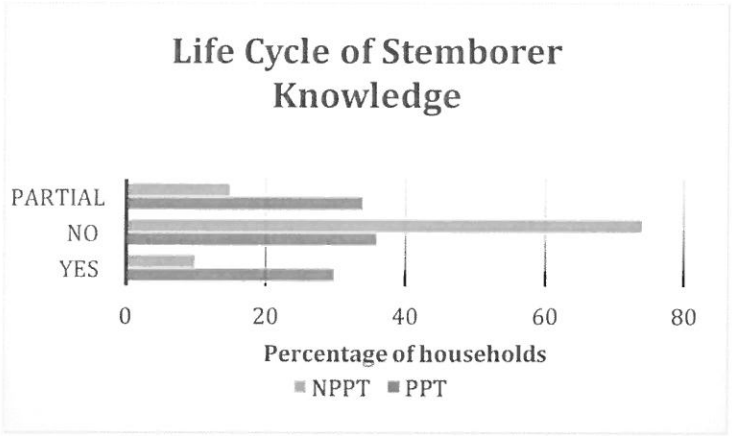
Objective two: The next objective was to determine how much knowledge farmers had on stemborer. For this we asked the farmers a series of specific questions about stemborers like, life cycle, location of eggs, and most destructive stage. For four out of the 5 aspects of the stemborers life the survey asked questions about there was a clear difference in the level of perception between push-pull and non-push-pull farmers. The greatest difference was in the farmers ability to recite

the life cycle of stemborers. For the push pull farmers 30% were able to remember the whole cycle. Also 34% partially knew, by missing only one stage or confusing the order. That is compared to the only 10% that knew the whole cycle and 15% that partially knew for the non-push-pull farmers.



One of the other questions asked was about their ability to recognize eggs laid on maize with 19% more push-pull farmers saying they did. Also, more push-pull farmers knew where the stemborer lays eggs by 15% and where the pupa is found by 7%. The only question that was similar between the two groups was about the most destructive life cycle stage nearly 80% of both groups knowing that larva was the most dangerous. However, push-pull farmers are also low on some aspects with only 34 able to recognize eggs. In addition, less than 50 percent of push-pull farmers know where stemborers lay eggs, and where the Pupe is found.

In the focus group discussion, there when we were taking stemborer there was a group of farmers that agreed that they only knew what they could see. In Kenya when asked about the stemborer the first person to step up and say what he thought was incorrect. There was another farmer that stood up said the options. There was 3 agreeing with the incorrect version and the rest recognizing the correct cycle. One farmer thought that the adult was the most destructive life cycle stage until the others corrected him and said that it was really the larva. In Uganda, there was a volunteer who got the life cycle correct. When the entire group was asked if they thought it was correct a majority thought it was with around a quarter of farmers claiming they didn't know.



Objective three: A very important pest right now is the fall armyworm. Fall armyworm is a new pest this year that has been devastating crops all around Africa. I was looking for basic information on awareness and behavior of the insects in my survey. First off, the farmers were asked if they were aware that fall armyworm was affecting their crops. The information showed that all but 2 farmers knew that the new pest was on their crops. For the question of whether or not they could

differentiate between stemborer and fall armyworm damage there was similar results. There was only 11.2% of farmers who could not give any examples.

If the farmers answered yes then they were asked two open ended questions to follow up. Throughout all of the interviews many farmers gave similar answers. The first question was what differences they see between the stemborer and the fall armyworm damage. The number one answer was that the fall armyworm does a larger amount of damage. Similar answers included that they ate faster and destroyed a greater percentage of yield. A number of farmers even noticed that there was a larger amount of larva feeding on the plant, which is due to the feeding habits and the amount of eggs laid by the moth.

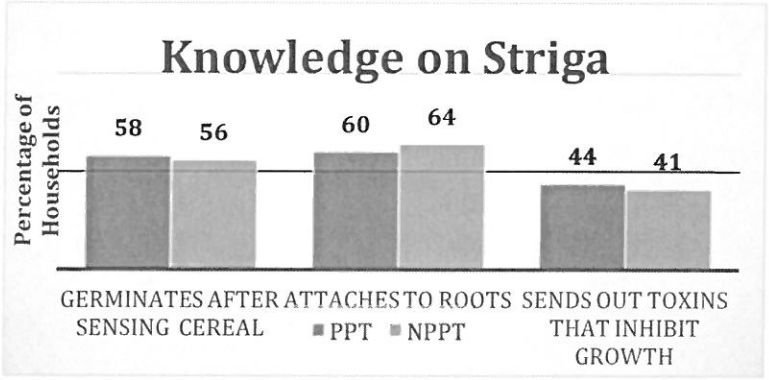
The second open ended question was on the control method that the farmers were using against the fall armyworm. The number one answer was to spray for the insect. 47% of the farmers reported spraying chemicals as one of their controls. There was a spray that came out this year which was advertised by organizations as a control method for the new pest. However, 15 of the farmers that used spray added without further questioning that the spray was not effective. The second most popular answer with 27% of the farmers was to do nothing. With this being a very new pest some farmers heard about controls to late or thought they might be ineffective. Other farmers reported using Indigenous farming technologies like ash, by hand, and herbal concoctions.

When the focus group discussion was asked about the fall armyworm they both agreed that it was one of the worst problems right now. In both countries, there was farmers that tried to spray, and nobody said that the spray was effective. Both countries also agreed that the fall armyworm was worse and caused a much larger percentage of damage.

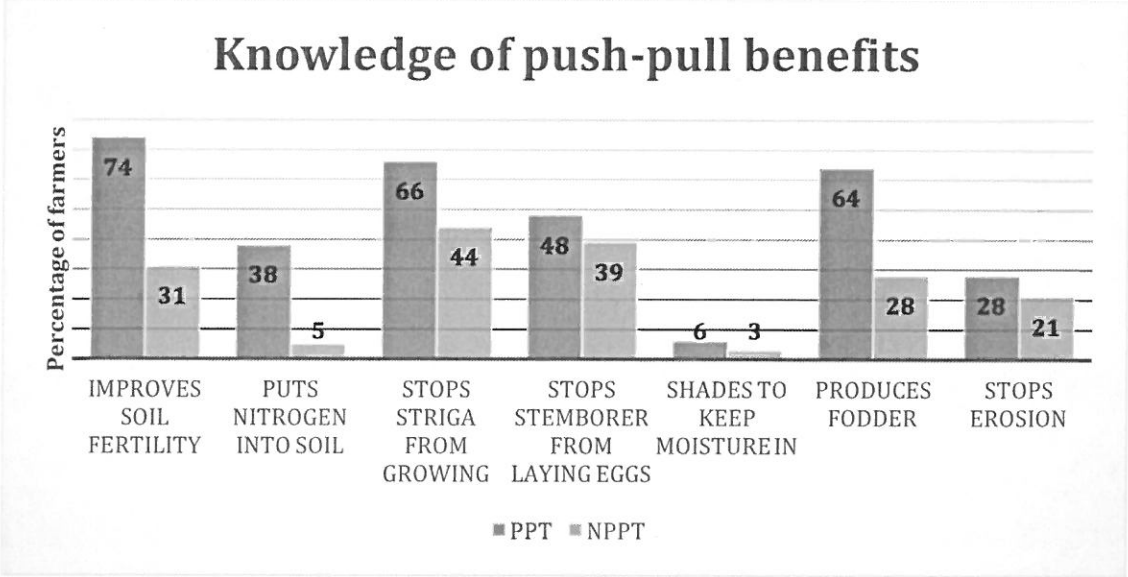
Objective four: One aspect of the experiment was to focus on farmers knowledge of striga. Push-pull is able to almost completely get rid of striga infestation. Non-push-pull fields can very easily become devastated by a large number of striga seeds in the soil. The striga weed is able to produce 20,000 to 50,000 seeds, and the seed can lay dormant for up to 20 years(push-pull.net). When talking about the knowledge intensive aspects of push-pull it is beneficial to know how the plants are affecting your crops. The farmers were asked how the striga grows in relation to the maize plant.

The findings were surprising that the numbers of farmers from all demographics reported the same aspects of the weeds growth. It didn't matter if the farmer was using push-pull or not. On all of the aspects of striga growth both groups were within 4% of one another. When asked about how long striga seeds can stay in the soil 51.7% of farmers said that striga could stay in the soil for greater than 15 years. 17% said 11 to 15 years, with the rest believing it was lower than that. Therefore, the numbers show that more than 50% of farmers are correct when it comes to that aspect of striga knowledge.

The focus group discussion conclusions for striga was very similar to that of the individual data. When it came to how striga grows there all aspects were brought out at the beginning and everyone was in agreement. In Kenya, a majority of the farmers believed that striga seeds lasted between 7-10 years in the soil. One thing that did stand out was the fact that Ugandan farmers agreed that striga seeds "never die".



Objective five: The last objective focused on the overall perception of push-pull. Like stated previously push-pull is knowledge intensive. Knowing more about the technology can change how much benefit farmers get out of the technology. One way the technology is thought to be spread it by farmer to farmer. This means that one farmer convinces another farmer to convert over to push-pull. In that method of dissemination, it is necessary to know more about the technology so the farmer can properly translate the benefits.



The farmers were asked to list all of the ways that push-pull technology improves a farm. The results showed that push-pull farmers reflected all benefits at a higher percentage than non-push-pull farmers.

Even though push-pull farmers were more aware of the benefits, there was still certain aspects that neither group were cognizant of. For instance, only 6% of push pull farmers reported that push-pull shades the ground to keep moisture in. Also for push-pull farmers, 28% reported that push-pull stopped erosion and 38% reported it putting nitrogen back into the soil.

The information that came out of the focus group discussion about push-pull benefits was very interesting. The scientific benefits that are present in the field where the first topics to be discussed. After that there was very many farmers that chipped in to tell how push-pull was helping them.

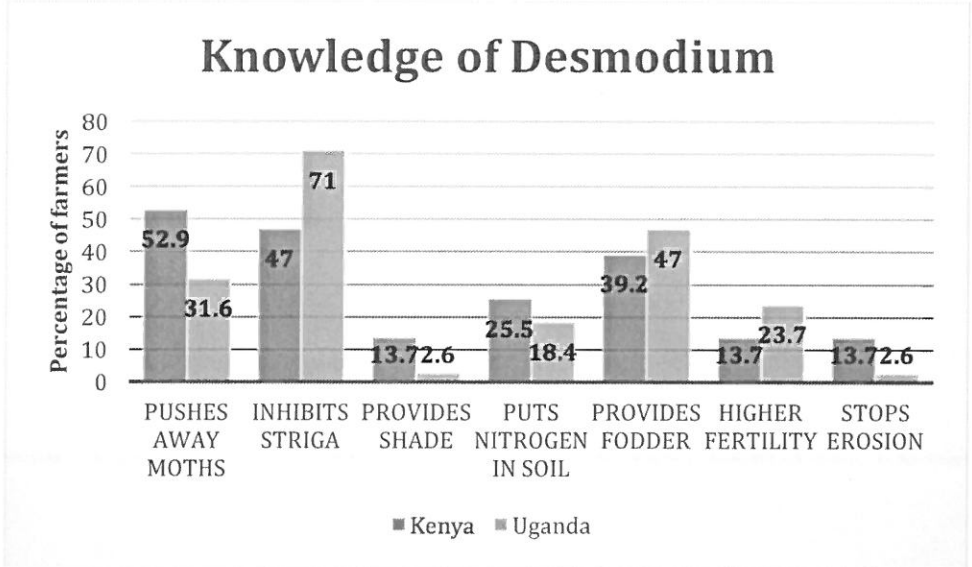
Some of the extra benefits they listed were improved household nutrition, reduces labor, and even creating personal business from selling fodder.

Additional data: An overlapping theme in this project was to be involved with farmers in both Kenya and Uganda. To see the level of perception in push-pull the same question that was analyzed for males and females was looked at for Kenya vs Uganda. Farmers in different areas may be taught completely different aspects of the same technology, that showed very clearly with push pull.

Neither group stood out as having a better overall perception of push-pull. Both groups excelled in different areas. For example, 71% of Ugandans compared to 47% of Kenyans relayed that desmodium inhibits striga growth. On the other side of the spectrum more than 50% of Kenyans and only 31.6% of Ugandans reported desmodium pushing away stemborer moths. In all seven aspects Kenyans were significantly higher in 4 categories compared to Ugandans being higher in 3.

One of main thing that stood out was that there seemed to be a few things in Uganda that almost no farmers were aware of. In Uganda only 2.6% of farmers reported desmodium helping with stopping erosion and providing shade to keep in moisture. In terms of Napier/bracharia no farmers said that it helped stop erosion. Also, only 2.6% knew that it killed stemborer larva at different stages of development.

When comparing the focus group discussion side by side there was some significant differences. When solely looking at push-pull benefits both countries gave similar answer for the most part. However, Kenyan farmers listed more in-depth answers related to the long-term effects of push-pull usage. The Kenyans seemed to continue being more descriptive when they gave 5 signs of stemborer damage compared to Ugandans 2. Both countries conveyed similar understandings of the workings of the ways push-pull helps their farms.



Conclusion

This study was aimed to address different topics relating to the overall perception on push-pull technologies of farmers. The information will be used by ICIPE to better target farmers in the field and decide what information is most relevant to their target audience. There were five specific objectives that questions were asked about as well as some more general overlapping themes. The demographics were fairly even with slightly more men than women, and slightly more Kenyans than Ugandans. This was due to time constrains and the ability to gather people to interview.

For the difference between men and women there was not a clear difference in their level of understanding. Both men and women had their strengths and perceived different topics differently. For instance, more men demonstrated that desmodium inhibits striga, but more females said that desmodium pushes away moths. The next step was trying to determine how many farmers knew general information about the stemborer. Almost 80% knew the most destructive life cycle stage, but less than 50% knew things like life cycle and where the insect lays eggs. With the new pest, the fall armyworm, questions were asked to see if farmers noticed the different pest in their field. It was clear farmers noticed the new infestation with only 2 saying they did not know what the fall army worm was. On top of that, all but 11.2% of farmers were able to explain the difference in the way that the fall armyworm destroyed crops compared to the stemborer. When talking about striga many farmers had basic knowledge on how it grows. 57% of farmers knew that it germinated after the cereal was planted, 62% knew that the roots of the plant attached to the cereal roots, and approximately 43% knew that the plant sent out toxins that inhibits growth.

Push-pull farmers vs. non-push pull-farmers was a big portion of what was being studied. As expect push pull farmers knew more about every aspect of push-pull. However, when it came to the pests push-pull controls they had very similar levels of perception. That is possibly due to the fact that push-pull has eliminated the pests so less people are worried about them. Lastly, there was surveys given in Kenya and Uganda. The two countries data was compared and showed that neither country excelled ahead. Kenyans were more likely to know that desmodium pushes away moths and puts nitrogen back in the soil. In Uganda, they were more likely to say desmodium inhibits striga and provides fodder. All groups seemed to have their strong suit, as well as an area that they could benefit from learning more about.

Contribution to Food Security

With growing populations and weather extremes food insecurity is going to continue to be a problem. This study is aimed at improving the lives of farmers in western Kenya and eastern Uganda. If subsistence farms are able to make money for themselves using push-pull then their lives will improve greatly. While push-pull is already being spread the study will help determine who is receiving the information better. That way field technicians can target those farmers and teach them the topics that were shown to be low. Not only that but if farmers are more aware of the technology then they will be able to teach other farmers how to use it so hopefully push-pull can spread faster impacting more farmers.

Personal Experience

I could have never fully expected what I was getting myself into. Going to Kenya for 8 weeks was my first time ever out of the United States. Not only did I get to participate in a once in a lifetime research opportunity, but also to experience a country and a culture that was absolutely eye opening. This trip is something I will never forget, the people I saw and the things I did were absolutely amazing. Saying that I got out of my comfort zone would be an understatement, everything made the trip that much better

Just from the guest center where I stayed there was plenty to experience. I got to try native foods for the first time, and even eat a fresh coconut right off the tree. Throughout the summer I met researchers and workers from all over the world. There was people from France, Germany, and different corners of The United States. We all had one goal in common, to try and positively impact the lives of people in the area.

During the exploring was one of my favorite pastimes. Going to the market was one of my favorite things to do. After a long day of work the marked was only a short walk away, and I knew I was bound to find something new to look at every day. There I was able to find handmade trinkets and tools to buy as gifts. We went to several National parks including Ruma and Impala. At Ruma national Park we were able to do a safari and see things like giraffes, zebras, and baboons. Then at Impala National Park there was Impalas, leopards, and lions. There were many other things we got to do including climbing Gambe Hill and even going on a ferry ride.

Working took up a majority of my day and it was also the most rewarding. I found that one of the best ways to experience a culture is to work in it and work alongside people that will help you connect. Seeing the children was fun and always seemed to put a smile on my face. In some one of the rural communities one of the children was so surprised to see me they even screamed and ran away. However, most of the time I was greeted with handshakes, name calling, and groups of them talking about us as we waked by. As for the people, I think Kenyans and Ugandans are some of the nicest people I have ever met. They were always happy to great us give us all they could. It was customary for the family that was hosting the field day to feed everyone who came to help. There we got native home cooked meals. It was delicious plates of ugali and chapatti usually with chicken or beef. I loved hearing about their culture, and I even took part in a native dance once. Then at the end of each meeting I had to say thank you in the farmers language, which may sound easy, but with the number of tribes in the area it proved to be difficult. At one time, I think I could say thank you in 6 or more languages including erokamano in Luo and asante Asante.

Along the way I saw things that will change me forever. This trip brought with it a lot of personal growth. I had never flown by myself let alone to a different continent. I had to learn to grow up very fast. A big one was that I had to wake myself up, instead of my mom. That may not sound that impressive, but that was just one of many things that I realized was going to be a lot different, not only in Kenya, but for the rest of my life out of high school. I had never lived by myself before, which sounds like a lot of fun, but comes with its own set of challenges.

Photos

Feeding Giraffes at Impala National Park

Interviewing a farmer in Western Kenya

Hiking to the top of Gambe Hill

Safari at Ruma National Park

Conducting Focus group with Farmers in Uganda

Helping pick up corn with Farmer in Uganda

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