WOMEN GROUPS IN THE DISSEMINATION OF PUSH PULL TECHNOLOGY IN WESTERN KENYA

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Background Information

ICIPE

The International Centre of Insect Physiology and Ecology (ICIPE) is a Kenyan-based institution founded in 1970 by Professor Thomas R. Odhiambo. Odhiambo was a Kenyan-born graduate of Cambridge University with a PhD in insect physiology and an MA in natural science who became the first Africa Prize Laureate in 1987. Due to his strong support for African-based scientific strategies, Odhiambo claimed Africa needed an establishment to develop not only young African scientists, but African scientific capabilities, as well. Thus, ICIPE was founded with the initial focus to improve the knowledge and control of tropical pests in developing countries in Africa. Currently, ICIPE's Director General is Professor Christian Borgemeister, who was a full-time professor at Hannover University, Germany. The objectives of ICIPE revolve around what are known as the "4-Hs:" human health, animal health, plant health, and environmental health. Through research and development, ICIPE has begun and will persist to ensure food security and better health for humans and livestock, protect the environment, and conserve and effectively utilize available natural resources. ICIPE's endeavors include developing, introducing, and adapting new technologies for insect control, and improving knowledge, building ability, developing courses of action, and reducing poverty through extensive research and collaboration with over eighty other institutions.

Thomas R. Odhiambo Campus: Mbita Point Field Station (MPFS)

The Thomas R. Odhiambo Campus of ICIPE, located in Mbita Point, in Western Kenya on the eastern shoreline of Lake Victoria, was established in October of 1977. Contained within approximately 60 acres of land, the station has the capacity to serve not only the people of Kenya's most economically destitute district, Suba District, but regions far beyond Suba's boundaries, as well. According to the Kenyan Census of 1999, Suba District itself has a population of approximately 156,000 people living on the mainland, the two major islands of Rusinga and Mfangano, and fourteen minor islands. Odhiambo was aware of the dire situation the farmers residing in Nyanza Province were faced to endure; to have an ICIPE station in the heart of the problem to assist in finding solutions for those most greatly affected was his dream. The station is presently supporting research on the management of crop and horticultural pests, malaria, tick and tsetse flies, and commercial insects including bees and silkworms. In addition, the station is used as a demonstration site for area farmers on the various technologies ICIPE has developed. Because of the surrounding high-potential production area, MPFS is ensured with profuse amounts of research opportunities. The warm climate unfortunately encourages a wide variety of crop and livestock pests in addition to human and livestock disease vectors. Thus, the station is placed in an ideal region for research purposes. With the quantity of expertly trained scientists, top research facilities, and research opportunities both ecologically and socio-economically, the station has and continues to make a positive impact on individuals universally affected by arthropods in the region.

The Gatsby Project/The Habitat Management Program

As the population of Kenya steadily continues to increase, Nyanza Province, already considered one of the most densely populated regions in the world, continues to become more densely populated. As a result, land available for agricultural production decreases, and, thus, current agricultural production is not fully capable of feeding the people it once used to sufficiently support. In addition, various constraints on the major food crops (maize, beans, and sorghum), including pests, parasitic weeds, and erratic weather patterns, have negatively impacted the already inadequate yield. In order to help maximize agricultural production for the local farmers, Dr. Zeyaur Khan, an entomologist at MPFS, has led the Habitat Management Program. Funded by the Gatsby Charitable Foundation of the United Kingdom, the program is attempting to improve production in Western Kenya. This has been done through focused research on biologically-based methods to help control constraints which are believed to be the major causes to low yields.

As previously mentioned, maize is one of the staple crops in eastern Africa. Western Kenya, an agriculturally high-potential region, is known for its production of cereal crops, especially maize. Most farmers in Western Kenya grow plots of maize as a subsistence crop, yet, unfortunately, it is not produced to the levels expected from a high-potential region. This is due in part to a cereal crop pest known as the stemborer, or stalkborer. Affecting much of East and southern Africa, the stemborer, whose moth feeds on the leaves of maize, also has worm-like larvae which cause the main damage to the crop. Larvae bore into and feed on the stalk of the maize plant, weakening and inhibiting full development of the plant. Crop losses commonly average 20-40 %, but can reach up to 80 %! Two of the most common varieties of the stemborer are *Busseola fusca*, an indigenous species, and *Chilo partellus*, introduced from Asia in the 1930's. The former affects mostly higher altitude regions, while the latter is destructive at low- and mid-altitude regions.

In addition to the stemborer, another paramount force of destruction is the striga weed, also known as "witch weed." A parasite, this weed latches itself onto the roots of the young maize plant, stunting its growth and causing severe underdevelopment. *Striga hermonthica,* as is its scientific name, is deceiving as it produces a purple flower before creating thousands upon thousands of seeds that remain dormant in the soil for up to two decades until a suitable host germinates. After infestation, yield losses range between 30 and 100 %, or the approximate loss equivalency of US$ 7 to 13 billion; in some cases, invasions reach such soaring levels that farmers are forced to abandon their land. Besides ruining current crops, striga has the potential to ruin subsequent crops as well, as they consume most of the nutrients out of the soil.

Because the traditional methods used to control these crop pests are relatively ineffective, commercial pesticides and herbicides were introduced as a remedy. However, the apparent majority of farmers in Western Kenya and East Africa are subsistence farmers who do not have the capital to afford the typical chemicals used to avoid such crop losses. In addition, the chemicals are not only too expensive for the local farmer, but hazardous to the environment, as well. Consequently, the necessity for other methods to control the infestations was very apparent. To manage the pests, Dr. Khan's project, the

Gatsby Project, developed a biological—environmental-friendly—procedure to minimize the occurrence of such crop-destroyers: the 'Push Pull' strategy.

The Push Pull strategy applies a unique, but biological approach in order to suppress striga weeds and stemborer infestations. To suppress striga, a legume is intercropped among the rows of maize. The legume, most commonly silverleaf or greenleaf desmodium, produces a chemical that weakens the growth of the weed, and, in effect, diminishes the effects of striga to the crop. In addition, the legume replenishes the soil with nitrogen, becoming a natural fertilizer. This also helps to reduce striga. After just two seasons of intercropping, striga is commonly found to be non-existent in the plot.

The desmodium is also part of the biological control method for the stemborer. Various desmodium varieties and other leguminous plants secrete chemicals that act as repellants to the stemborer moths, in effect, 'pushing' them away from the plot. The other half of the name Push Pull comes from the effect of various indigenous grasses. These grasses, most commonly Napier Grass and Sudan Grass, are planted to border the crop affected by the stemborer. They emit a chemical which the adult stemborers are attracted to, and, therefore, it 'pulls' the stemborer away from the maize crop. After the moth has chosen to lay its eggs on the grass as opposed to the maize, the grass then reveals another weapon; the grass discharges a tacky substance which operates to disable the movement of the larvae. They soon die at a rate of approximately 80 %, preventing them from giving birth to another generation.

The Push Pull strategy not only greatly reduces the damage caused by striga and stemborer, but has numerous supplementary effects, as well. The additional crops of desmodium and Napier grass provide a source of fodder for livestock. Desmodium especially adds protein to the diets of the livestock, increasing their milk output. If the farmer doesn't own any livestock, the extra products from the Push Pull strategy can be sold as extra income. The intercropping of desmodium has a mulching effect on the soil, working to keep the soil moist for a longer period of time. Bordering Napier grass around the maize plot binds the soil together to fight erosion and acts as a windbreak to shield the maize from strong winds. Perhaps the most important benefit to the Push Pull strategy, however, is that it does not involve the use of harmful pesticides, herbicides, and fertilizers, and is much less expensive than these chemicals, as well, proving to be a practical method which should be made available to all farmers.

Availability of the Push Pull strategy to farmers who can greatly profit from its benefits is precisely what the Gatsby Project is attempting to improve. As the project researches more techniques and additions to the current strategy, they realize it will be to no avail if farmers have limited access to the information.

Homa Bay District

Homa Bay District is directly to the east of Suba District. The 1,160 sq. km. district is home to approximately 288,540 residents. Like Suba District, the people of Homa Bay District are predominantly descendants of the Luo. Their ancestors were a Nilotic group who migrated from the presently southern half of Egypt beginning in the sixteenth century. The Luo are the third-largest tribal group in Kenya, accounting for 13% of the population. Education is an important aspect of Luo life; parents will take whatever actions necessary to ensure their children have the opportunity to attend school.

As a result, the Luo are represented well by political leaders and have a large influence in the Kenyan government.

The Luo are supporters of large families. Traditionally, polygamy was practiced and all of a man's wives lived on his farmstead along with the rest of his extended family. Currently, however, this tradition has been generally abandoned, as younger Luo men have only one wife. Formerly herders, the Luo are now stationary crop-cultivators who raise cattle, sheep, and goats in addition to their farm. As in many African tribes, the Luo women are responsible for virtually all of the house and yard work, including raising the children, cleaning the farmstead, tending to the garden and fields, and raising the livestock.

Vihiga District

Vihiga District lies within the borders of the Western Province, north of Kisumu. With boundaries circling only 563 sq. km., Vihiga is considered one of the most densely populated regions of the Kenya, with a population of roughly 498,883. Therefore, Vihiga is considered a more urban region than Homa Bay. Vihiga is populated by a different tribe than Homa Bay; the Luhya are the dominant habitants. The Luhya are, like the Luo, a Nilotic group whose origins are uncertain. They are, however, believed to have migrated from areas in the North such as present-day Sudan and Ethiopia. The Luhya are the second-largest tribe in Kenya, and comprise a total of 14 % of the population. As for education and intellect, the Luhya rank averagely in comparison to the rest of Kenya.

Like the Luo, the Luhya's culture revolves around the extended family. Polygamy is a traditional practice of the Luhya, and, although it is not as commonly practiced today, it is still allowed. The Luhya people are agriculturalists who depend on a productive crop in order to survive. While the men generally tend to the cattle and goatherds, women are depended on for ensuring work in the field and work around the house is completed.

Introduction

Women Groups in the Dissemination of Push-Pull Technology in Western Kenya

Push Pull is a relatively new technology, developed in 1994. Since then, it has slowly been introduced to the farmers in the area. Great efforts have been made to ensure these farmers have food security, which in turn will result in good health, followed by higher income and, eventually, financial stability. Numerous channels have been utilized to pass information about new technologies, especially Push Pull, which can assist in improving the economic situation of local farmers.

Vihiga was the first of the two districts used in this comparison to be introduced to Push Pull. Since the initial introduction in 2002, Vihiga's number of project farmers rose to over 200 project farmers by the year 2005, with the largest increase present during the most recent year. Farmers residing in Homa Bay, however, were initially introduced to the technology in 2003, only one season after the initiation in Vihiga. By the year 2005, Homa Bay had less than 100 project farmers. This is a significant difference in need of investigation.

To determine what is causing this dramatic difference, it is necessary to analyze through comparison the performance and effects of the many channels used to disseminate the Push Pull information. In order to do so, a questionnaire was developed to survey farmers in both Homa Bay District and Vihiga District. The study analyzed the socioeconomic and sociocultural aspects of farmers in relation to the impact of various intervention strategies utilized in each district with relation to the gender.

Objectives

1. *To determine the current levels of adoption and diffusion of Push Pull technology in Western Kenya among women farmers.*
2. *To determine whether differences exist between Homa Bay and Vihiga Districts in the rate of technology adoption and diffusion.*
3. *To determine the influence of socio-cultural factors, institutional factors, group participation, and intervention strategies on the rate of adoption of Push Pull.*
4. *To compare the relative efficiency of these intervention strategies in disseminating agricultural technology information.*
5. *To determine the rate of information flow necessary for the uptake of Push Pull technology*

Procedures and Methodology

I was given a basic background of the situation in each district through reading materials and counseling from Dr. Khan and Jimmy Pittchar. From this, I developed a questionnaire, which was tested through the surveying of farmers in Suba District. The questionnaire was then revised with the assistance of Dr. Khan, Jimmy Pittchar, and Matilda Ouma. The final questionnaire (Appendix……..) consisted of questions relating to the socioeconomic and sociocultural aspects of farmers and the impact of dissemination channels in each district with relation to gender.

The questionnaire was then utilized to interview a large number of farmers in the two districts to be compared. In order to compare the channels' performance effectively, the number of farmers involved in Push-Pull technology (project farmers), was equivalent to the number of farmers not involved (non-project farmers). Because the study was focused on the effects the channels have specifically on women farmers, an effort was made to interview more women farmers than men farmers, making use of the men's answers as a control.

In total, eighty farmers were interviewed through a random sampling selection. Of the forty farmers from each district, twenty were project farmers and twenty were non project farmers. Approximately seventy-five percent of the interviewees were female, and twenty-five percent were male. After the interviews were complete, the data was entered, analyzed, and compiled into the following charts.

In addition to the data taken from interviews, a focused group discussion was administered in both districts. The discussions followed specific guidelines (Appendix….) relating closely to the individual questionnaires. These group discussions were not only used for supplementary information, but for validation of the individual responses. The validations from the focused group discussions were combined with the data resulting from individual questionnaire and data previously taken to form recommendations and conclusions.

Results

Part 1: Fundamental Characteristics of Respondents

Table 1: Age of Homa Bay Respondents

Age (in years)	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
<25	1	16.7	1	7.1	1	20	2	13.3
25-35	1	16.7	4	28.6	0	0	8	53.3
36-45	1	16.7	5	35.7	1	20	5	33.3
46-55	1	16.7	2	14.3	1	20	0	0
>55	2	33.3	2	14.3	2	40	0	0

Table 2: Age of Vihiga Respondents

Age (in years)	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
<25	0	0	0	0	0	0	1	7.1
25-35	0	0	4	28.6	1	16.7	4	28.6
36-45	2	33.3	5	35.7	3	50	3	21.4
46-55	1	16.7	3	21.4	1	16.7	1	7.1
>55	3	50	2	14.3	1	16.7	5	35.7

In Homa Bay District, the age distribution was quite even among the male project and non-project farmers and an expected bell distribution was discovered in the female project farmers. The female non-project farmers of Homa Bay, however, were overwhelmingly young, with 66.6% under age 35. In Vihiga District, the male project farmers were all aged over 36 years, while the female project farmers were slightly younger on average, with approximately 65% between the ages of 25 and 45. All non-project farmers in Vihiga were scattered in range, although, again, a bell curve is generally described by the figures.

Table 3: Marital Status of Homa Bay Respondents

Marital Status	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Single, Never Married	0	0	0	0	1	20	0	0
Married	6	100	10	71.4	3	60	11	73.3
Separated or Divorced	0	0	0	0	0	0	0	0
Widowed	0	0	4	28.6	1	20	4	26.7

Table 4: Marital Status of Vihiga Respondents

Marital Status	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Single, Never Married	0	0	0	0	0	0	0	0
Married	5	83.3	11	78.6	5	83.3	12	85.7
Separated or Divorced	1	16.7	0	0	1	16.7	0	0
Widowed	0	0	3	21.4	0	0	2	14.3

Among all farmers, marriage was most prevalent. However, in Homa Bay, just over 25% of all females interviewed were widows. Of the non-project males, 40% were either never married or widowers. In Vihiga, the percentage of widows was much less, yet the number of project females who were widows was greater than the number of non-project females who were widows. Also in Vihiga, 16.7% of the men were found to be separated with their wives.

Table 5: Number of Children of Homa Bay Respondents

Number of	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Children	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	0	0	1	20	1	6.7
1-3	2	33.3	6	42.9	0	0	5	33.3
4-6	3	50	5	35.7	3	60	6	40
7-9	0	0	3	21.4	1	20	2	13.3
>9	1	16.7	0	0	0	0	1	6.7

Table 6: Number of Children of Vihiga Respondents

Number of	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Children	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	0	0	0	0	0	0
1-3	1	16.7	3	21.4	3	50	3	21.4
4-6	2	33.3	7	50	2	33.3	7	50
7-9	3	50	3	21.4	1	16.7	4	28.6
>9	0	0	1	7.1	0	0	0	0

The number of children per household was very scattered among the interviewees. It should be noted that only two of the eighty interviewed reported no children and these two were both non-project farmers in Homa Bay District. It is apparent families have a range of between one and nine children, with generally a bell curved distribution for most categories, project or non-project, female or male, Vihiga or Homa Bay.

Table 7: Types of Crops Grown for Food in Homa Bay

Crop Type	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Maize	6	100	14	100	5	100	15	100
Beans	6	100	14	100	5	100	13	86.7
Sorghum	5	83.3	9	64.3	3	60	6	40
Millet	0	0	3	21.4	0	0	6	40
Sweet Potatoes	3	50	2	14.3	2	40	3	20
Vegetables	2	33.3	3	21.4	1	20	5	33.3
Peanuts	3	50	12	85.7	5	100	11	73.3
Bananas	1	16.7	0	0	2	40	1	6.7
Other Crops	1	16.7	5	35.7	1	20	3	20

Table 8: Types of Crops Grown for Food in Vihiga

Crop Type	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Maize	6	100	14	100	6	100	14	100
Beans	6	100	12	85.7	4	66.7	11	73.3
Sorghum	0	0	1	7.1	0	0	4	26.7
Millet	0	0	3	21.4	1	16.7	2	13.3
Sweet Potatoes	4	66.7	8	57.1	3	50	3	20
Vegetables	1	16.7	6	42.9	2	33.3	7	46.7
Peanuts	2	33.3	2	14.3	0	0	6	40
Bananas	3	50	8	57.1	4	66.7	5	33.3
Other Crops	5	83.3	9	64.3	4	66.7	5	33.3

Maize can be easily held as the staple crop of this region, as 100% of the farmers interviewed, regardless of participation or gender, reported maize as one of their food crops. Another major crop grown was beans. All but two farmers interviewed in Homa Bay grew beans. Beans are frequently grown in Vihiga, as well; 100% of the male project farmers, 85.7% of the female project farmers, 66.7% of the male non-project farmers, and 73.3% of the female non-project farmers reported growing beans. Other major crops in Homa Bay included peanuts and sorghum. As for Vihiga, various fruits and vegetables were frequently grown.

Table 9: Total Number of Crops of Homa Bay Respondents

Total Number of Crops	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
1-3	1	16.7	1	7.1	0	0	3	20
4-6	5	83.3	13	92.9	5	100	12	80
7-9	0	0	0	0	0	0	0	0

Table 10: Total Number of Crops of Vihiga Respondents

Total Number of Crops	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
1-3	1	16.7	2	14.3	2	33.3	4	28.6
4-6	4	66.7	12	85.7	4	66.7	8	57.1
7-9	1	16.7	0	0	0	0	2	14.3

The majority of all Homa Bay respondents produced between four and six different types of crops. None of the respondents produced more than six types of crops, and less than 20% produced less than four. Of these, the female non-project farmers had the highest percentage of farmers who produced less than four types of crops, with 20%. All male non-project farmers farmed between four and six different types of crops. The majority of farmers farmed between four and six types of crops. The female non-project farmers again had a fair percentage of farmers who produced less than four types of crops with 28.6%, but the male project farmers had the highest percentage, with 33.3%. Vihiga also supports a larger number of farmers with more than six types of crops, with 14.3% of female non-project farmers and 16.7% of male project farmers. The average number of crops in Homa Bay and Vihiga were 4.48 and 4.60, respectively.

Table 11: Constraints in Crop Production in Homa Bay

Crop Constraints	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Weeds	6	100	14	100	5	100	15	100
Pests	5	83.3	8	57.1	3	60	3	20
Diseases	2	33.3	0	0	1	20	6	40
Lack of Capital	3	50	3	21.4	3	60	6	40
Lack of Implements	2	33.3	3	21.4	3	60	7	46.7
Lack of Labor	3	50	12	85.7	3	60	3	20
Soil Problems	1	16.7	5	35.7	1	20	3	20
Wildlife	1	16.7	0	0	1	20	0	0
Erratic Weather	2	33.3	2	14.3	1	20	7	46.7
Other (Lack of Farm Inputs, Markets, etc.)	1	16.7	6	42.9	2	40	3	20

Table 12: Constraints in Crop Production in Vihiga

Crop	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Constraints	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Weeds	6	100	14	100	6	100	14	100
Pests	4	66.7	10	71.4	2	33.3	9	64.3
Diseases	2	33.3	0	0	1	16.7	0	0
Lack of Capital	3	50	2	14.3	4	66.7	5	35.7
Lack of Implements	0	0	1	7.1	1	16.7	1	7.1
Lack of Labor	1	16.7	8	57.1	2	33.3	3	21.4
Soil Problems	3	50	3	21.4	2	33.3	5	35.7
Wildlife	1	16.7	5	35.7	2	33.3	6	42.9
Erratic Weather	0	0	1	7.1	0	0	1	7.1
Other (Lack of Farm Inputs, Markets, etc.)	1	16.7	6	42.9	4	66.7	5	35.7

The biggest constraint in crop production was overwhelmingly weed infestations. All farmers cited weeds (particularly striga) as a constraint in their crop production. Other major problems in Homa Bay were pest infestations (47.5% overall), lack of labor (52.5% overall), erratic weather patterns (30% overall), and lack of implements (37.5% overall). In Vihiga, weather seemed to be less of a problem, but lack of inputs (40% overall) replaced this issue in the list of major constraints in crop production. Other problems in Vihiga included pest infestations (62.5% overall) and lack of capital for farm use (35% overall).

Table 13: Remedies to Biological Crop Constraints—Homa Bay

Solutions	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Uprooting/ Weeding	3	50	1	7.1	4	80	4	26.7
Cow Dung	0	0	4	28.6	1	20	9	60
Chemicals	1	16.7	2	14.3	1	20	5	33.3
Push Pull	6	100	14	100	0	0	0	0
Hired Labor	2	33.3	12	85.7	1	20	11	73.3
Other	1	16.7	1	7.1	1	20	4	26.7

Table 14: Remedies to Biological Crop Constraints—Vihiga

Solutions	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Uprooting/ Weeding	0	0	2	14.3	3	50	9	64.3
Cow Dung	1	16.7	3	21.4	2	33.3	5	35.7
Chemicals	1	16.7	1	7.1	1	16.7	2	14.3
Push Pull	6	100	14	100	0	0	0	0
Hired Labor	2	33.3	10	71.4	2	33.3	2	14.3
Other	1	16.7	1	7.1	3	50	2	14.3

Various remedies to biological crop constraints were used by the farmers in both regions. Among the project farmers, the next most used solution after the Push Pull strategy was hired labor. This included a third of the men and 85.7% of the women in Homa Bay, and a third of the men and 71.4% of the women in Vihiga. For the non-practicing farmers, the major solution in Homa Bay was uprooting and weeding for the men (80%) and hired labor and farmyard manure (73.3% and 60%, respectively) for the women. In Vihiga, the majority of the non-project farmers used weeding and uprooting as a solution to biological crop constraints. This included 50% of the men and 64.3% of the women.

Table 15: Cattle Ownership in Homa Bay

Number of Cattle	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	2	14.3	1	20	4	26.7
1-3	1	16.7	7	50	3	60	5	33.3
4-6	4	66.7	4	28.6	0	0	5	33.3
7-9	1	16.7	1	7.1	1	20	1	6.7
>9	0	0	0	0	0	0	0	0

Table 16: Cattle Ownership in Vihiga

Number of Cattle	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	2	33.3	2	14.3	1	16.7	4	28.6
1-3	3	50	12	85.7	4	66.7	9	64.3
4-6	0	0	0	0	1	16.7	1	7.1
7-9	0	0	0	0	0	0	0	0
>9	1	16.7	0	0	0	0	0	0

Most of the farmers in Homa Bay owned at least a few cattle. Two thirds of the male project farmers owned between four and six cattle, while half of the female project farmers owned between one and three. Of the project farmers in Homa Bay, only two didn't own any cattle and they were both female. Of the non-project farmers, however,

60% of the males and 33.3% of the females owned between one and three cattle. In Vihiga, most farmers owned between one and three cattle (50% of male project farmers, 85.7% of female project farmers, 66.7% of male non-project farmers, and 64.3% of female non-project farmers). Only a few farmers owned more than three cattle. In both districts, the general trend was that female non-project farmers were less likely to own any cattle.

Table 17: Goat Ownership in Homa Bay

Number of	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Goats	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	3	50	8	57.1	4	80	6	40
1-3	3	50	5	35.7	0	0	8	53.3
4-6	0	0	1	7.1	1	20	1	6.7
7-9	0	0	0	0	0	0	0	0
>9	0	0	0	0	0	0	0	0

Table 18: Goat Ownership in Vihiga

Number of	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Cattle	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	5	83.3	11	78.6	6	100	13	92.9
1-3	1	16.7	3	21.4	0	0	1	7.1
4-6	0	0	0	0	0	0	0	0
7-9	0	0	0	0	0	0	0	0
>9	0	0	0	0	0	0	0	0

The majority of farmers did not own any goats. In Homa Bay, this amounted to 50% of the male project farmers, 57.1% of the female project farmers, 80% of the male non-project farmers, and 40% of the female non-project farmers. Those in Homa Bay who did own any goats owned between one and three goats. In Homa Bay, 50% of male project farmers, 35.7% of female project farmers, and 53.3% of female non-project farmers, owned between one and three goats. In Vihiga, 83.3% of male project farmers, 78.6% of female project farmers, 100% of male non-project farmers, and 92.9% of female project farmers did not own any goats. Zero farmers in Vihiga owned more than three goats.

When asked why they didn't own any cattle, most farmers in Homa Bay replied that there was no particular reason. Only two respondents replied that they couldn't afford any cattle. When asked their main reason for owning zero goats, the majority answered that goats required far too much labor which was not available to the farmers. In Vihiga, however, all but one of the respondents who were asked why they didn't own any cattle replied that they couldn't afford cattle. As for goats, the number one answer was that they couldn't afford goats. Another popular answer was that labor constraints kept the farmers from owning any goats.

Part 2: Research Findings

Objective 1: Current Levels of Adoption and Diffusion of Push Pull Technology

Table 1: Awareness of Push Pull

Aware of Push Pull	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	6/6	100	14/14	100	3/5	60	8/15	53.3
Vihiga	6/6	100	14/14	100	5/6	83.3	10/14	71.4

Awareness levels of Push Pull technology resulted as expected. Of the non-project farmers—both male and female—in Homa Bay, approximately half had heard of Push Pull. In Vihiga, however, the percentage was much higher. Of the male non-project farmers, 83.3% were aware of Push Pull, and 71.4% of the female non-project farmers had heard of the technology.

Table 2: Years of Participation/Plans for Adoption of Homa Bay Respondents

Years of Participation	MPF out of 6		FPF out of 14		MNPF out of 3		FNPF out of 8	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
1 Year	2	33.3	5	35.7	0	0	0	0
2 Years	2	33.3	5	35.7	0	0	0	0
3 or more Years	2	33.3	4	28.6	0	0	0	0
Wants to Adopt	0	0	0	0	3	100	8	100

Table 3: Years of Participation/Plans for Adoption of Vihiga Respondents

Years of Participation	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 10	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
1 Year	1	16.7	5	35.7	0	0	0	0
2 Years	2	33.3	5	35.7	0	0	0	0
3 or more Years	3	50	4	28.6	0	0	0	0
Wants to Adopt	0	0	0	0	5	100	8	80

The only differences between the Homa Bay and Vihiga project farmer respondents when asked how many years they'd been practicing appears in the males. In Vihiga, 50% of the males had been practicing Push Pull for three or more years, and only 16.7% reported that they began their plot just this year. In Homa Bay, however, the ratio was divided evenly—33.3%—among those who had practiced one year, two years, or three or more years. All but two of the non-project farmers who had heard about Push Pull expressed a desire to own a Push Pull plot. These two who had no desire to own a Push Pull plot were both farmers over 65 years of age in the Vihiga district who believed that the strategy required too much work. The majority of the others who did express a desire to own a plot reported that they had learned about the technology too recently to implement it just yet. Other common constraints in attaining a Push Pull plot included

poor access to seeds and other inputs required to begin a plot and lack of information on the technology.

Objective 2: Differences between Homa Bay and Vihiga Districts in the Rate of Technology Adoption and Diffusion

Table 1: Number of Project Farmers by Year

	2002	2003	2004	2005	2006
Homa Bay	0	10	30	75	100
Vihiga	25	100	125	230	620

It is necessary to take into account the fact that Homa Bay District was not introduced to Push Pull until 2003, yet the lack of high uptake rates in comparison to Vihiga is still visible. In the four years since Homa Bay was introduced to the technology, its number of participating farms has only reached 100, whereas in Vihiga, within only five years past the initial introduction, 620 farms are now participants.

Table 2: Controlling Stemborer and Striga According to Non-Project Farmers Who are Aware of the Push Pull Strategy

Constraint	Control	Homa Bay (out of 11)		Vihiga (out of 15)	
		Ratio	%	Ratio	%
Stemborer	Push Pull	3	27.3	2	13.3
	Pesticides	1	9.1	0	0
	Other	2	18.2	1	6.7
	None	5	45.5	12	80
Striga	Push Pull	5	45.5	4	26.7
	Weeding/ Uprooting	3	27.3	4	26.7
	Manure	0	0	3	20
	Other	1	9.1	0	0
	None	2	18.2	4	26.7

Of the eleven farmers in Homa Bay and fifteen farmers in Vihiga who were aware of the Push Pull strategy, only 27.3% of those in Homa Bay and 13.3% of those in Vihiga were aware that Push Pull is used to control the stemborer. Most farmers who were aware of Push Pull but hadn't implemented it reported that they didn't have any method of controlling stemborer (45.5% in Homa Bay and 80% in Vihiga).

Knowledge about the Push Pull's use against striga was slightly higher than the knowledge of the strategy's use against stemborer; 45.5% of those in Homa Bay and 26.7% of those in Vihiga were aware of Push Pull as a control for striga. In Vihiga, this method tied with one other method—weeding/uprooting—for use against striga. The same percentage (26.7%) of people in Vihiga, however, said they were not aware of any controls against striga, even though they were aware of the Push Pull strategy.

Objective 3: Influence of Socio-cultural factors, Institutional Factors, Group Participation, and Intervention Strategies

Table 1: Gender of Household Heads of All Respondents

Household Head		Project Farmers		Non-Project Farmers	
		Ratio	%	Ratio	%
Homa Bay	Male	10	71.4	11	73.3
	Female	4	28.6	4	26.7
Vihiga	Male	11	78.6	12	85.7
	Female	3	21.4	2	14.3

In both Vihiga and Homa Bay Districts, the percentage of male-headed households regardless of participation in Push Pull was over 70%. Male-headed households were especially more prevalent among the Vihiga non-project farmers, however, with less than 15% of the non-project Vihiga farmers with a female-headed household.

Table 2: Number of Assets for Homa Bay Residents

Number of Assets[1]	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Zero	1	16.7	0	0	0	0	0	0
One	0	0	2	14.3	2	40	3	20
Two	1	16.7	6	42.9	1	20	6	40
Three	4	66.7	6	42.9	2	40	6	40
Four	0	0	0	0	0	0	0	0

Table 3: Number of Assets for Vihiga Residents

Number of Assets[2]	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Zero	0	0	0	0	0	0	0	0
One	0	0	1	7.1	2	33.3	4	28.6
Two	4	66.7	10	71.4	4	66.7	6	42.9
Three	2	33.3	2	14.3	0	0	4	28.6
Four	0	0	1	7.1	0	0	0	0

Of the assets in measurement, zero farmers in Homa Bay owned more than the most frequent answer of three, and one farmer didn't own any. In Vihiga, all interviewees in Vihiga owned at least one of these articles, and one project female even had four items in her possession.

[1] Assets in measurement were as follows (estimated costs): bicycle ($85); iron roof ($575) versus grass-thatched roof ($70 per year); radio ($15); and vehicle ($3,000 to $5,000). No regard was taken as to which assets were owned, just the number of assets owned.

[2] Same as Table 2

Table 4: Level of Education of Homa Bay Respondents

Level of	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Education	Ratio	%	Ratio	%	Ratio	%	Ratio	%
None	0	0	0	0	0	0	0	0
Grades 1-4	1	16.7	4	28.6	0	0	1	6.7
Grades 5-8	4	66.7	6	42.9	3	60	5	33.3
Grades 9-12	1	16.7	4	28.6	2	40	9	60
College/University	0	0	0	0	0	0	0	0

Table 5: Level of Education of Vihiga Respondents

Level of	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Education	Ratio	%	Ratio	%	Ratio	%	Ratio	%
None	0	0	0	0	0	0	1	7.1
Grades 1-4	2	33.3	3	21.4	1	16.7	7	50
Grades 5-8	0	0	9	64.3	2	33.3	4	28.6
Grades 9-12	4	66.7	1	7.1	3	50	2	14.3
College/University	0	0	1	7.1	0	0	0	0

Generally, the levels of education of the interviewees followed a bell curve pattern. Non-project women in Homa Bay seemed to have received more education, as 60% of respondents in this category had completed between nine and twelve grades of education. Non-project women in Vihiga differed from non-project women in Homa Bay in that the majority had hardly received any education at all; 57.1% did not pass grade four!

Table 6: Level of Education vs. Extent of Project Participation—Homa Bay

Years of Part.	*1 Year*		*2 Years*		*≥ 3 Years*		*N/A*	
Years of Ed.	Ratio	%	Ratio	%	Ratio	%	Ratio	%
None out of 0	0	n/a	0	n/a	0	n/a	0	n/a
1-4 out of 6	1	16.7	3	50	1	16.7	1	16.7
5-8 out of 18	3	16.7	4	22.2	3	16.7	8	44.4
9-12 out of 16	3	18.8	0	0	2	12.5	11	68.8
University out of 0	0	n/a	0	n/a	0	n/a	0	n/a

Table 7: Level of Education vs. Extent of Project Participation—Vihiga

Years of Part.	*1 Year*		*2 Years*		*≥ 3 Years*		*N/A*	
Years of Ed.	Ratio	%	Ratio	%	Ratio	%	Ratio	%
None out of 1	0	0	0	0	0	0	1	100
1-4 out of 13	1	7.8	3	23.1	1	7.7	8	61.5
5-8 out of 15	3	20	3	20	3	20	6	40
9-12 out of 10	2	20	1	10	2	20	5	50
University out of 1	0	0	0	0	1	100	0	0

The correlation between years of project participation and years of education did not follow a specific pattern. The project interviewees in both districts who had reached a higher level of education had practiced the strategy a fairly evenly distributed number of years. The non-project farmers of Homa Bay appeared to have more education than not. In Vihiga, non-project farmers were more likely to have less education than project farmers.

Table 8: Land Ownership and Cultivation

District	Average Land Owned (In acres)	Average Land Cultivated (In acres)	Percent of Average Land Utilized for Crops
Homa Bay	3.58	2.03	56.7 %
Vihiga	1.86	1.82	97.8%

As you can see, the average amount of land owned by farmers living in Homa Bay surpassed the average amount of land owned by farmers living in Vihiga by almost two acres. The average amount of land utilized for crop production in Homa Bay was roughly two acres, or 56.7% of the average amount. In Vihiga, 1.82 acres were used for crops. This calculates to almost 98% of the land being used for crop production.

Table 9: Number of Males Who Work on Farmland in Homa Bay

Men Worked	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	10	71.4	0	0	12	80
1	5	83.3	4	28.6	4	80	2	13.3
2	1	16.7	0	0	1	20	1	6.7

Table 10: Number of Males Who Work on Farmland in Vihiga

Men Worked	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	7	50	0	0	8	57.1
1	5	83.3	7	50	6	100	6	42.9
3	1	16.7	0	0	0	0	0	0

When asked how many males from the family worked in the fields, the responses varied greatly by gender. All male farmers interviewed reported that at least one man of their family worked in the fields. The women tended to report, however, that zero men worked in the fields. This is particularly true in Homa Bay, where 71.4% of the project females and 80% of the non project females reported that no men worked in the fields. In Vihiga, only 50% of the project females and 57.1% of the non-project females reported that zero men worked in the fields. Of those women whose response was that men from their homestead do work in the fields, only one of these women, a non project farmer from Homa Bay, reported that more than one man worked.

Table 11: Number of Females Who Work on Farmland in Homa Bay

Women	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Worked	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	0	0	2	40	0	0
1	4	66.7	14	100	2	40	14	93.3
2	2	33.3	0	0	1	20	1	6.7

Table 12: Number of Females Who Work on Farmland in Vihiga

Women	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Worked	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	1	16.7	0	0	1	16.7	2	14.3
1	4	66.7	13	92.9	4	66.7	10	71.4
2	1	16.7	1	7.1	1	16.7	2	14.3

It is apparent that women make up an indispensable portion of the labor in crop production. Most women who were interviewed (100% of project and 93.3% of non-project women in Homa Bay, and 92.9% of project and 71.4 % of non-project females in Vihiga) reported that they were the only female worker in their fields. Most men (66.7% of project and 40% of non-project males in Homa Bay, and 66.7% of all males in Vihiga) agreed with this response, as well. A very select few of the men, however, reported that no women worked in the fields. This included 40% of the non-project males in Homa Bay and 16.7% of all of the males in Vihiga.

Table 13: Mean Number of Men and Women Who Worked

District	Project Status	Men	Women
Homa Bay	Project	.55	1.10
	Non-Project	.50	1.00
Vihiga	Project	.75	1.05
	Non-Project	.60	1.00

After viewing the average number of men and women who worked (according to all respondents), it is apparent that not as many men work in the fields as women. It is also noticeable that all project farmers tend to have more workers in the field than non-project farmers. In addition, Vihiga seems to have a higher number of men who work in the fields than Homa Bay.

Table 14: Activities According to Gender in Homa Bay

Activity	Labor Group	MPF (of 6)		FPF (of 14)		MNPF (of 5)		FNPF (of 15)	
		Ratio	%	Ratio	%	Ratio	%	Ratio	%
	Male	2	33.3	0	0	4	80	2	13.3
Plowing/	Female	0	0	5	35.7	0	0	7	46.7
Tilling	Both (M/F)	4	66.7	4	28.6	0	0	1	6.7
	Hired Labor	0	0	7	50	1	20	8	53.3
	Male	1	16.7	0	0	2	40	0	0
Planting	Female	2	33.3	10	71.4	0	0	14	93.3
	Both (M/F)	3	50	4	28.6	3	60	1	6.7
	Hired Labor	0	0	2	14.3	0	0	2	13.3
	Male	0	0	0	0	2	40	0	0
Weeding/	Female	1	16.7	10	71.4	0	0	14	93.3
Uprooting	Both (M/F)	5	83.3	4	28.6	3	60	1	6.7
	Hired Labor	0	0	3	21.4	0	0	2	13.3
	Male	0	0	0	0	2	40	0	0
Harvesting	Female	2	33.3	11	78.6	0	0	14	93.3
	Both (M/F)	4	66.7	3	21.4	3	60	0	0
	Hired Labor	0	0	2	14.3	0	0	3	20
	Male	0	0	0	0	2	40	0	0
Processing	Female	4	66.7	12	85.7	1	20	14	93.3
	Both (M/F)	2	33.3	2	14.3	2	40	0	0
	Hired Labor	0	0	2	14.3	0	0	3	20

Table 15: Activities According to Gender in Vihiga

Activity	Labor Group	MPF (of 6)		FPF (of 14)		MNPF (of 6)		FNPF (of 14)	
		Ratio	%	Ratio	%	Ratio	%	Ratio	%
	Male	3	50	2	14.3	4	66.7	1	7.1
Plowing/	Female	0	0	5	35.7	1	16.7	7	50
Tilling	Both (M/F)	3	50	5	35.7	1	16.7	4	28.6
	Hired Labor	0	0	8	57.1	1	16.7	5	35.7
	Male	1	16.7	1	7.1	1	16.7	0	0
Planting	Female	2	33.3	6	42.9	1	16.7	7	50
	Both (M/F)	3	50	6	42.9	4	66.7	5	35.7
	Hired Labor	0	0	8	57.1	1	16.7	5	35.7
	Male	1	16.7	1	7.1	1	16.7	0	0
Weeding/	Female	2	33.3	7	50	1	16.7	7	50
Uprooting	Both (M/F)	3	50	5	35.7	4	66.7	5	35.7
	Hired Labor	0	0	8	57.1	1	16.7	5	35.7
	Male	1	16.7	1	7.1	1	16.7	0	0
Harvesting	Female	2	33.3	6	42.9	3	50	7	50
	Both (M/F)	3	50	6	42.9	2	33.3	5	35.7
	Hired Labor	0	0	8	57.1	1	16.7	5	35.7
	Male	1	16.7	1	7.1	1	16.7	0	0
Processing	Female	3	50	7	50	4	66.7	8	57.1
	Both (M/F)	2	33.3	5	35.7	1	16.7	4	28.6
	Hired Labor	0	0	8	57.1	1	16.7	5	35.7

In both regions, the general response from the males was that men from the household performed the land preparation tasks. Responses varied greatly between genders, however. For instance, where 80% of the male non-project farmers in Homa Bay reported performing the plowing and tilling, the women non-project farmers only gave this credit to the men 13.3% of the time. Instead, 46.7% reported that the task was performed by the women, and 53.3% reported that they hired labor to finish the land preparation. This ratio was similar among the non-project farmers in Vihiga, as well. According to the project farmers in both regions, however, a compromise was reached in that the majority of the male project farmers reported that most tasks were completed by both men and women of the household. Women were said to perform most tasks after land preparation, including planting, weeding, harvesting, and processing. Generally, weeding, harvesting, and processing tasks were left solely to the women to complete, especially among the non-project farmers.

Table 16: Initial Sources of Information on the Push Pull Strategy—Homa Bay

Source	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
ICIPE	5	83.3	10	71.4	1	20	3	20
Neighbor	0	0	2	14.3	2	40	2	13.3
Farmer-Teacher	0	0	0	0	0	0	3	20
Radio	0	0	1	7.1	0	0	0	0
Group	0	0	1	7.1	0	0	0	0
School	1	16.7	0	0	0	0	0	0
Unaware of P-P	0	0	0	0	2	40	7	46.7

Table 17: Initial Sources of Information on the Push Pull Strategy—Vihiga

Source	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
ICIPE	2	33.3	6	42.9	2	33.3	1	7.1
Neighbor	4	66.7	6	42.9	3	60	6	42.9
Radio	0	0	2	14.3	0	0	2	14.3
Group	0	0	0	0	0	0	1	7.1
Unaware of P-P	0	0	0	0	1	16.7	4	28.6

In Homa Bay, ICIPE was clearly the most frequent initial source of information about the Push Pull strategy. Among the project farmers in that region, 83.3% of the males and 71.4% of the females cited ICIPE as their initial source of information on the technology. Of the approximate half of the non-project farmers who were aware of the strategy, the majority of them stated they initially learned about Push Pull from ICIPE, as well. In Vihiga, Push Pull was predominantly learned through neighbors who had a Push Pull plot. 66.7% of the project males, 60% of the project males, and 42.9% of the project and non-project females first heard about the technology from their neighbors. ICIPE, however, was the most common source of information about the technology after neighbors.

Table 18: Respondents Who Listen to the Radio in Homa Bay

Amount of	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Time	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Never	1	16.7	2	14.3	0	0	2	13.3
Rarely	1	16.7	8	57.1	1	20	9	60
Some	2	33.3	2	14.3	3	60	3	20
Often	2	33.3	2	14.3	1	20	1	6.7

Table 19: Respondents Who Listen to the Radio in Vihiga

Amount of	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Time	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Never	0	0	2	14.3	2	33.3	6	42.9
Rarely	0	0	4	28.6	0	0	5	35.7
Some	1	16.7	7	50	3	50	1	7.1
Often	5	83.3	1	7.1	1	16.7	2	14.3

As shown in the table, women generally do not listen to the radio on a regular basis. Of the females, approximately 71.4% of project farmers and 73.3% of non-project farmers in Homa Bay and 42.9% of project farmers and 78.6% of the non-project farmers in Vihiga admitted that if they ever did listen to the radio, it was on very rare occasions (more or less one program a week). In Homa Bay, project farmers and non-project farmers alike were less likely to listen to the radio than farmers in Vihiga, where most project farmers listened to the radio often (a few programs a day) or on some occasions (a few programs a week). In both regions, the trend for non-project farmers was that they were most likely to not listen to the radio on a regular basis.

Table 20: Awareness of ICIPE or Agricultural Extension Staff—Homa Bay

Awareness of	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Staff	Ratio	%	Ratio	%	Ratio	%	Ratio	%
ICIPE Only	0	0	7	50	2	40	5	33.3
Ministry of Ag. Only	0	0	0	0	0	0	4	26.7
Both (ICIPE and Ministry)	5	83.3	7	50	0	0	2	13.3
Neither	1	16.7	0	0	3	60	4	26.7

Table 21: Awareness of ICIPE or Agricultural Extension Staff—Vihiga

Awareness of	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Staff	Ratio	%	Ratio	%	Ratio	%	Ratio	%
ICIPE Only	2	33.3	12	85.7	2	33.3	7	50
Ministry of Ag. Only	0	0	0	0	0	0	0	0
Both (ICIPE and Ministry)	4	66.6	2	14.3	3	50	0	0
Neither	0	0	0	0	1	16.7	7	50

In general, project farmers of both districts were aware of extension staff in their regions. In Homa Bay, 50% of the women project farmers knew only ICIPE agents, but the other 50% knew both ICIPE and Ministry of Agriculture agents. Of the non-project farmers, 60% of the males and 26.7% of the females were unaware of both ICIPE and Ministry of Agriculture agents, but 33.3% of the females knew of an ICIPE agent. In

Vihiga, all project farmers knew an ICIPE agent in their region. The non-project farmers lacked this advantage; 50% of the women and 16.7% of the men were unaware of any agents, ICIPE or Ministry of Agriculture, in their region.

Table 22: Consultation of Extension Staff

Consultation of Agents	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	5/5	100	12/14	85.7	2/2	100	3/15	20
Vihiga	5/6	83.3	13/14	92.9	3/5	60	3/7	42.9

Consultation of the extension staff from both ICIPE and governmental agencies occurred more among the project farmers in both districts. In Homa Bay, 100% of the male and 85.7% of the female project farmers had consulted any of the staff, where only 20% of the female non-project had consulted the staff. Among the project farmers of Vihiga, 83.3% of the men and 92.9% of the women consulted the staff, where only 42.9% of the non-project women had consulted the agents. Of the farmers who stated they hadn't consulted the staff, the main reasons for this in Homa Bay were that the farmers believed the agents were never available, or the farmers didn't have time. In Vihiga, the dominant answer was that there was no reason they had never consulted the staff.

Table 23: Awareness of Farmer-Teachers

Farmers Aware of Farmer- teachers	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	6/6	100	9/14	64.3	0/5	0	8/15	53.3
Vihiga	6/6	100	14/14	100	5/6	83.3	8/14	57.1

When asked whether or not the interviewees knew any farmer-teachers in their area, Vihiga proved to be more aware. All of the project farmers in Vihiga knew of a farmer-teacher, whereas in Homa Bay, only 64.3% of the women project farmers knew any farmer-teachers. Of the non-project farmers, in Homa Bay, 0 of the men and 53.3% of the women knew of farmer-teachers. In Vihiga, however, 83.3% of the men and 57.1% of the women stated they knew a farmer-teacher.

Table 24: Attendance of Field Days

Attended Field Days	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	5/6	83.3	9/14	64.3	2/5	40	7/15	46.7
Vihiga	5/6	83.3	13/14	92.9	3/6	50	5/14	35.7

Field day attendance among project farmers was much higher in Vihiga than in Homa Bay. In Vihiga, 83.3% of the males and 92.9% of the females had attended field days. In Homa Bay, however, only 64.3% of the females had attended field days. Among non-project farmers, Homa Bay had a higher attendance. Almost half of the non-project

women had attended field days, whereas only 35.7% of the women in Vihiga had attended a field day.

Major reasons cited for not attending field days in Homa Bay included unawareness of scheduling of field days (9 farmers) and no time available to attend field days (5 farmers). In Vihiga, the major reasons were, again, unawareness of when the field days were scheduled (7 farmers) and no time to attend (5 farmers).

Table 25: Printed and/or Reading Materials for Information

Attained Print-ed Materials	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	1/6	16.7	7/14	50	2/5	40	7/15	46.7
Vihiga	4/6	66.7	6/14	42.9	1/6	16.7	3/14	21.4

When it came to receiving printed reading materials about information on new technologies, Homa Bay had the advantage. Of the non-project farmers, 40% of the men and 46.7% of the women stated they had received printed materials. In Vihiga, however, only 16.7% of the men and 21.4% of the women reported they had received such materials.

Table 26: Attendance of Barazas—Homa Bay

Attended Barazas	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	2/6	33.3	4/14	28.6	0/5	0	8/15	53.3
Vihiga	3/6	50	10/14	71.4	4/6	66.6	5/14	35.7

Barazas or public meetings were not regularly attended by the farmers in Homa Bay, with only about a third of the project farmers attending, 0 of the non-project males, and about 50% of the non-project females. In Vihiga, however, attendance was a little bit higher, with 50% of the project males, 71.4% of the project females, two thirds of the non-project males, and one third of the project females.

When the farmers who didn't regularly attend barazas were asked what the reason for this was, the strongest answers were that the barazas didn't normally focus on agricultural topics (8 farmers) or the farmer didn't have time to leave his or her shamba (farm) to attend the barazas (17 farmers).

Table 27: Spontaneous Diffusion: Discussions with Neighbors in Homa Bay

Speak with Neighbors	MPF Ratio	%	FPF Ratio	%	MNPF Ratio	%	FNPF Ratio	%
Homa Bay	6/6	100	14/14	100	5/5	100	15/15	100
Vihiga	4/6	66.6	12/14	85.7	6/6	100	14/14	100

Many farmers discuss agricultural topics with neighboring farmers. It was very common in Homa Bay; 100% of those interviewed reported agricultural discussion with

their neighbors. In Vihiga, however, it was less common; a third of the male project farmers and almost 15% of the female project farmers stated they didn't speak with their neighbors about new agricultural technologies. A discussion rate of 100% was present among the non-project farmers of Vihiga, however.

Table 28: Number of Groups Involved In—Homa Bay

Total Number	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
of Groups	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	1	7.1	0	0	1	6.7
1-2	5	83.3	9	64.3	4	80	9	60
3-4	1	16.7	3	21.4	1	20	5	33.3
5 or More	0	0	1	7.1	0	0	0	0

Table 29: Number of Groups Involved In—Vihiga

Total Number	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
of Groups	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0	0	0	1	7.1	0	0	1	7.1
1-2	4	66.7	12	85.7	5	83.3	11	78.6
3-4	2	33.3	1	7.1	0	0	2	14.3
5 or More	0	0	0	0	1	16.7	0	0

Group membership is a common occurrence in both districts. The majority of all farmers were a member of between one and two groups. In Homa Bay, this includes 83.3% of male project farmers, 64.3% of the female project farmers, and 80% and 60% of the male and female non-project farmers, respectively. In Vihiga, among the project farmers, this includes 66.7% of the males and 85.7% of the females, and among the non-project farmers, 83.3% of the males and 78.6% of the females were involved in one or two groups. A fair number of farmers were members of three or more groups, with approximately 15-20% in both districts. Those who weren't involved in any groups were all women; one project and one non-project in each district, to make a total of four women who weren't group members.

Table 30: Groups that Discussed Push Pull—Homa Bay

Groups	MPF out of 0		FPF out of 8		MNPF out of 3		FNPF out of 2	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Clan	n/a	n/a	1	12.5	0	0	0	0
Farming	n/a	n/a	1	12.5	0	0	0	0
Merry go round	n/a	n/a	1	12.5	0	0	0	0
Women	n/a	n/a	5	62.5	3	100	2	100

Table 31: Groups that Discussed Push Pull—Vihiga

Groups	MPF out of 2		FPF out of 4		MNPF out of 3		FNPF out of 7	
	Ratio	%	Ratio	%	Ratio	%	Ratio	%
Clan	0	0	1	25	0	0	0	0
Farming	2	100	2	50	2	66.7	7	100
Merry go round	0	0	0	0	0	0	0	0
Women	0	0	1	25	1	33.3	0	0

The farmers who stated they had learned about Push Pull during group meetings were asked in which groups this had occurred. In Homa Bay, the response was overwhelmingly women groups. This included 62.5% of the female project farmers and 100% of the non-project farmers. In Vihiga, farming groups performed the best in informing their members of Push Pull. This included 100% of the male project farmers, 50% of the female project farmers, two thirds of the male non-project farmers, and all of the female non-project farmers. The next prevailing answer was that Push Pull had been discussed during the meetings of women groups.

Table 32: Summary on Various Sources for Learning about Push Pull

	MPF	%	FPF	%	MNPF	%	FNPF	%
Heard of Push Pull from the Radio								
Homa Bay	2/5	60	8/11	72.7	0/5	0	3/13	23.1
Vihiga	6/6	100	12/13	92.3	2/4	50	4/8	50
Heard of Push Pull from Extension Agents								
Homa Bay	5/5	100	14/14	100	2/2	100	0/15	0
Vihiga	5/6	83.3	12/13	92.3	1/2	50	1/4	25
Heard of Push Pull from Farmer-Teachers								
Homa Bay	5/6	83.3	8/14	57.1	0/5	0	2/15	13.3
Vihiga	5/6	83.3	14/14	100	2/6	33.3	5/14	35.7
Heard of Push Pull from Field Days								
Homa Bay	3/5	60	8/9	88.9	0/2	0	1/7	14.3
Vihiga	5/5	100	13/13	100	1/3	33.3	2/5	40
Heard of Push Pull from Barazas								
Homa Bay	1/2	50	0/4	0	0/0	n/a	1/8	12.5
Vihiga	1/3	33.3	3/10	30	2/4	50	1/6	16.7
Heard of Push Pull from Neighbors								
Homa Bay	2/6	33.3	5/14	35.7	5/5	100	11/15	73.3
Vihiga	2/4	50	8/12	66.7	6/6	100	7/14	50
Heard of Push Pull from Groups								
Homa Bay	0/6	0	8/14	57.1	3/5	60	2/15	13.1
Vihiga	2/6	33.3	4/14	28.6	3/6	50	7/14	50

Those interviewed were asked, of the sources they had access to, which they had learned about Push Pull from. The radio had been a source of Push Pull information significantly more in Vihiga than in Homa Bay. The percentages of project and non-

project farmers who had heard about Push Pull were higher in Vihiga than both categories in Homa Bay.

In reference to extension agents, while the majority of project farmers in Vihiga had heard about Push Pull from extension agents, all of the project farmers in Homa Bay who were aware of these agents had learned about Push Pull from them. As for non-project farmers, the women in both districts had a significant amount of percentage drop from the men.

The farmer-teachers had an excellent impact on farmers in Vihiga, but in Homa Bay, the transfer of information from farmer-teachers to farmers was a fair amount less. Comparing project farmers to non-project farmers, a noteworthy drop occurs; the clear majority of project farmers versus less than a third of non-project farmers had heard about the technology from farmer-teachers.

Field days were extremely effective in Vihiga as all of the project farmers had learned Push Pull from field days. Although they were not as effective in Homa Bay, they still achieved some impact; the majority of project farmers had learned Push Pull from a field day. Less than half of non-project farmers from both districts had learned any information on Push Pull from field days.

Barazas were relatively ineffective in both districts; only 1 project farmer in Homa Bay and 4 in Vihiga had learned about Push Pull from barazas. A lower percentage than that was present among non-project farmers from both districts.

Push Pull as a topic during neighborly discussions among project farmers proved to be more common in Vihiga than in Homa Bay; among non-project farmers, however, the opposite is true.

Lastly, groups were generally an uncommon source for information about Push Pull. Less than a third of project farmers in Vihiga and only 8 project farmers in Homa Bay had heard of Push Pull through groups. Among non-project farmers, however, only 5 farmers in Homa bay and 10 in Vihiga had heard about Push Pull through groups.

Table 33: Number of Outlets during Which Push Pull was Discussed—Homa Bay

Number of	MPF out of 6		FPF out of 14		MNPF out of 5		FNPF out of 15	
Channels	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0-1	0	0	0	0	1	20	7	46.7
2-3	3	50	7	50	4	80	8	53.3
4-5	3	50	5	35.7	0	0	0	0
6-8	0	0	2	14.3	0	0	0	0

Table 34: Number of Outlets during Which Push Pull was Discussed—Vihiga

Number of	MPF out of 6		FPF out of 14		MNPF out of 6		FNPF out of 14	
Channels	Ratio	%	Ratio	%	Ratio	%	Ratio	%
0-1	0	0	0	0	0	0	5	35.7
2-3	0	0	2	14.3	4	66.7	6	42.9
4-5	5	83.3	7	50	2	33.3	3	21.4
6-8	1	16.7	5	35.7	0	0	0	0

Table 35: Mean Number of Outlets during Which Push Pull was Discussed

	All Farmers	MPF	FPF	**Total Project**	MNPF	FNPF	**Total Non-project**
Homa Bay	**2.75**	3.17	4.00	**3.75**	2.20	1.60	**1.75**
Vihiga	**3.60**	4.67	5.00	**4.90**	2.83	2.30	**2.30**

When the number of channels through which farmers had learned about the Push Pull technology was analyzed, it became apparent that, in both regions, reiteration and reinforcement are necessary for the uptake of Push Pull strategy. As you can see, project farmers have heard about Push Pull through various different channels, where non-project farmers had rarely discussed Push Pull in more than three different channels. This is heavily demonstrated in Vihiga District, where 100% of male project farmers and 85.7% of female project farmers remembered discussion of Push Pull through at least four channels, but 66.7% of male non-project farmers and 78.6% of female non-project farmers had not heard any discussion on Push Pull in more than three channels. Overall, the farmers in Vihiga had heard about Push Pull through more channels than the farmers in Homa Bay. The mean number of channels through which the technology was heard in Homa Bay was 2.75, whereas in Vihiga, the total average was 3.60 channels. Between project and non-project farmers, the number of channels through which the farmer had heard about the technology made a large difference as to whether or not the farmer had adopted the technology. Project farmers had heard about the technology through more than twice as many channels than non-project farmers. There is an obvious variance between men and women farmers, as well. In both regions, the women project farmers had heard about the strategy through more channels than the men project farmers, but the women non-project farmers had not heard about Push Pull discussions through as many channels as the men non-project farmers. This shows the necessity of reaching especially the women through as many of these channels as possible in order for the most efficient uptake and diffusion of Push Pull and other technologies.

Table 36: Number of Channels vs. Years of Participation—Homa Bay

Years of Part. Number of Channels	*Wants to Adopt (out of 11)*		*1 Year (out of 7)*		*2 Years (out of 7)*		*≥ 3 Years (out of 6)*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
0-1	4	36.4	1	14.3	0	0	0	0
2-3	7	63.6	4	57.1	1	14.3	4	66.7
4-5	0	0	2	28.6	4	57.1	2	33.3
6-8	0	0	0	0	2	28.6	0	0

Table 37: Number of Channels vs. Years of Participation—Vihiga

Years of Part. Number of Channels	*Wants to Adopt (out of 13)*		*1 Year (out of 6)*		*2 Years (out of 7)*		*≥ 3 Years (out of 7)*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
0-1	1	7.7	0	0	0	0	0	0
2-3	8	61.5	1	16.7	1	14.3	0	0
4-5	4	30.8	3	50	4	57.1	5	71.4
6-8	0	0	2	33.3	2	28.6	2	28.6

The number of channels through which Push Pull was heard by each farmer varied in conjunction with the duration of practice of the technology. In Homa Bay, 100% of the farmers who weren't practicing Push Pull but wanted to adopt had heard about the technology through only three or less channels. In Vihiga, the majority of farmers (83.3%) who had been practicing Push Pull for one year had heard discussions about the technology through between two and five channels. The majority of farmers (92.9%) who had been practicing Push Pull for two or more years mentioned between four and eight channels through which they had heard about Push Pull. Similar results were acquired for Homa Bay.

Objective 4: Comparison of Relative Efficiency of Intervention Strategies

Table 1: Mean Intervention Strategy Rankings for Homa Bay Respondents

Strategy	MPF out of 6	FPF out of 14	MNPF out of 5	FNPF out of 15
Neighbors	4.33	5.86	4.20	5.47
Printed Materials	6.00	5.57	6.00	5.73
Farmer-Teachers	2.17	1.93	2.40	1.60
Field Days	3.00	3.57	2.80	2.73
Barazas	5.33	4.79	6.00	5.33
Groups	1.83	2.29	1.20	1.73
Radio	5.33	4.00	5.00	4.87

Table 2: Homa Bay Summary

Rank	MPF	FPF	MNPF	FNPF
1	Groups	Farmer-Teachers	Groups	Farmer-Teachers
2	Farmer-Teachers	Groups	Farmer-Teachers	Groups
3	Field Days	Field Days	Field Days	Field Days
4	Neighbors	Radio	Neighbors	Radio
5	Barazas & Radio	Barazas	Radio	Barazas
6	(Tied)	Printed Materials	Printed Materials	Neighbors
7	Printed Materials	Neighbors	& Barazas (Tied)	Printed Materials

Homa Bay respondents ranked the intervention strategies very similarly between the non-project farmers and the project farmers. All males listed groups first, farmer-

teachers second, field days third, and neighbors fourth for efficiency of reaching the most farmers with the most amount of information in the least amount of time. There was a toss up, however, between the barazas, radio, and printed materials. The women all listed farmer-teachers first, groups second, field days third, radio fourth, and barazas fifth in their preferences for strategies to be used. The women project farmers listed printed materials before the neighbors, when the non-project women listed those last two oppositely from the project farming women.

Table 3: Mean Intervention Strategy Rankings for Vihiga Respondents

Strategy	MPF out of 6	FPF out of 14	MNPF out of 6	FNPF out of 14
Neighbors	6.50	5.07	4.50	5.21
Printed Materials	6.17	6.21	6.00	5.43
Farmer-Teachers	2.00	2.57	2.50	2.50
Field Days	2.83	3.50	4.17	3.21
Barazas	4.83	5.07	5.67	4.86
Groups	2.00	1.64	1.17	1.93
Radio	3.67	4.21	5.00	4.86

Table 4: Vihiga Summary

Rank	MPF	FPF	MNPF	FNPF
1	Farmer-Teachers & Groups (Tied)	Groups	Groups	Groups
2		Farmer-Teachers	Farmer-Teachers	Farmer-Teachers
3	Field Days	Field Days	Field Days	Field Days
4	Radio	Radio	Neighbors	Barazas & Radio (Tied)
5	Barazas	Barazas & Neighbors (Tied)	Radio	
6	Printed Materials		Barazas	Neighbors
7	Neighbors	Printed Materials	Printed Materials	Printed Materials

In Vihiga, the general consensus was that groups are the most efficient in reaching the most farmers with the most information in the least amount of time, and this was closely followed by farmer-teachers. Field Days followed at number three among all types of farmers. Numbers four through seven, however, were comparable among the project farmers, with radio as four, barazas as five, and neighbors and printed materials as six and seven. Relating the non-project farmers, however, is not as easy a task. The men believed neighbors to be fourth, radio to be fifth, barazas to be sixth and printed materials last, whereas the women preferred barazas and radio to neighbors and printed materials.

Analysis of Results

The Gatsby Project has made proficient advancements for approximately a decade in suppressing hunger and ensuring food security throughout Western Kenya. Its team of scientists, field workers, and other associates has attempted and succeeded at increasing knowledge and spreading awareness on amazingly useful yet relatively simple techniques all farmers can indulge in to improve their crop yields and general farm practices. Diffusion of these technologies, however, is not totally complete, as many farmers still do not partake in many of the strategies. Thus, this study was conducted in order to reflect and compare three main differences to determine why diffusion is not to a satisfactory level. These comparisons include the differences of diffusion between farmers who have adopted the technologies versus farmers who have yet to adopt, diffusion between men and women, and diffusion between two districts in Western Kenya, Homa Bay District and Vihiga District. This study also analyzes the influences of intervention strategies, socioeconomic factors, group participation, and institutional factors in the adoption of these technologies.

All of the farmers interviewed in both districts were subsistence farmers. Respondents of both districts reported typically the same major crops: maize and beans. After this is where the first difference lies, however; the average amount of land owned by the farmers in Homa Bay was approximately 3.58 acres, but only 56.7% of that was utilized for crop production. In Vihiga, the average amount of land owned by the farmers was approximately 1.86 acres, and almost all of it—97.8%—was utilized for crop production. Not only did the farmers in Vihiga use most of their land for crops, but the majority was still able to have enough space left over for cattle, goats, or other livestock. They proved to be extremely efficient in exploiting as much of their land as possible.

All Vihiga and Homa Bay residents, regardless of amount of land utilized for crops, encounter constraints in producing a crop. The biggest constraint in both districts is most definitely the striga weed, also locally known as “kayongo.” This parasitic weed was cited by all farmers interviewed as a constraint in their maize production. In addition, it affects and proves to be equally as damaging to millet and sorghum, two other staple cereal crops in the region. The second leading maize crop constriction quoted was the stemborer. The larvae of this moth tended to be more of an obvious problem in Homa Bay District, though, as a fair number of the farmers in Vihiga District noted the stemborer to only be abundant and damaging in times of drought. This leads to another difference in crop constraints between the two districts; Homa Bay is plagued with erratic weather patterns. Most of the time, there is not enough precipitation to produce sufficient yields. When the precipitation is present, however, it tends to be in excess. While Homa Bay is enduring this unpredictable restriction, Vihiga usually enjoys adequate rainfall.

It is also necessary to read between the lines with the answers from the residents of Homa Bay and the residents of Vihiga. Homa Bay residents commonly cited shortages of labor, drought, and lack of implements as major constraints to their crop production, whereas Vihiga residents commonly cited lack of fertilizer and credit as the major constraints in crop production. This implies that there is more commercial awareness in Vihiga; they are thinking of input costs versus output gains and see new technologies as cost savers. They think financially and with a lot of foresight. In addition, because the average income in Homa Bay is so low, the residents live from day to day with

substandard saving habits; they are unsure what tomorrow will bring. If their income were to be raised, they would actively save more. Basically, those in Vihiga are attempting to boost themselves while those in Homa Bay are waiting to be boosted by an outside aid.

Many other factors are responsible for the lack of uptake in Homa Bay. These include the ratio between land and labor, education, and income of the farmers, institutional factors, participation in women groups, and other intervention strategies such as the radio, field days, farmer-teachers, barazas, and printed materials, and the effects of spontaneous diffusion.

The first to be investigated is the ratio between land and labor. The discovery of the average amount of men who work in the fields in Vihiga and Homa Bay defines this ratio very well. Because the average number of women working in the fields is comparable in both districts, and the average number of men is higher in Vihiga (.75 for project farmers and .60 for non-project farmers) than in Homa Bay (.55 for project farmers and .50 for non-project farmers), the conclusion can be made that there is generally more labor available for farmers residing in Vihiga District. After the averages for number of women and number of men are added together, the final average number of workers is approximately 1.57 in Homa Bay and 1.71 in Vihiga. As for amount of land, farmers in Homa Bay cultivated more land on average (2.03 acres) than farmers in Vihiga (1.82 acres). Combining the average amount of workers with the average amount of cultivated land, the resulting land versus labor ratios are 1.29 for Homa Bay and 1.06 for Vihiga. This follows that in Homa Bay, the average amount of acres each person works is 1.29 acres, and in Vihiga, the average farmer works only 1.06 acres of land. That's almost 22% more land for each worker to nurture in Homa Bay than in Vihiga!

The second group of factors responsible for the difference of technology diffusion between the two districts is socio-economic factors. Education appeared to not affect the rate of adoption in either district, as the distribution of grade completion was relatively even. The income was measured using how many assets a farmer owned. The farmers were asked whether or not they owned a bicycle or an automobile, and also whether their home had a grass-thatched roof or an iron roof. The interviewees were then categorized by their answers into four different groups which correspond with approximated income groups. On the whole, Vihiga residents had a higher average income than Homa Bay residents.

The cultural restrictions involving women and gender equality are another major factor in need of investigation. When asked who the head of the household was, interviewees from both regions always said the husband was the head unless the interviewee was a widow, in which case, she made all of the decisions. This proves to be a foremost limitation in the uptake of new technologies, as women are the main workers in the fields and operate most other agricultural work, as well. Women plant the crop, tend to the crop during development, harvest and process the yield, and sell the final produce, yet they are not allowed to make the decisions relating to agriculture.

Thus, women are the focus of this study. Interviewees were asked various questions pertaining to where they receive information and whether or not they implement new technologies they learn about. Men and women alike were interviewed in order to compare responses from men about learning new technologies with responses

from women. Institutional factors, participation in women groups, and the efficiency of other intervention strategies were all topics discussed with the farmers.

When asked if they knew of extension staff from either ICIPE or the Ministry of Agriculture, almost all project farmers from both regions stated that they knew of extension staff from at least one of these departments. Knowledge of extension staff among non-project farmers was not as prevalent. Almost half of all non-project farmers were unaware of any extension staff, especially ICIPE agents. Yet, in Vihiga, a larger number of non-project farmers than in Homa Bay knew of at least the ICIPE agent in their area. All of the project farmers in both districts who said they had consulted these agents said they had also learned about Push Pull from the agents. A majority of the non-project farmers hadn't consulted the agents. Those who had, however, had learned about Push Pull from the staff. Thus, it is safe to conclude that the agents are performing their tasks well; the farmers are plainly just unaware of the services they offer.

Groups are a key source of information for many of the farmers in both districts. All farmers interviewed except four women (two in Homa Bay and two in Vihiga) were members of at least one group, and most were involved in more than one. Additionally, it appeared that most groups people in Homa Bay were involved in were women groups, whereas in Vihiga, the most common groups were farming groups. Although not all groups were reported to have discussed the Push Pull Strategy, a fair share did offer information on Push Pull. The majority of farmers did state that they had learned about new agricultural technologies, regardless. Lastly, when the farmers were asked whether or not they believed groups better enabled the learning of new technologies, all farmers replied gave the affirmative, except one woman, a project farmer from Vihiga who claimed she knew everything about farming she deemed necessary to know.

Other intervention strategies have been used in the past in efforts to distribute information on the Push Pull Strategy. These include radio broadcasts, field days, farmer-teachers, barazas, printed materials, and spontaneous diffusion through neighboring farmers. Radio programs commonly speak of better agricultural practices and often give information about new technologies. Of these programs, Sokomoko and Tembea na Majira were commonly cited by the farmers as broadcasts from which they heard about Push Pull. However, most farmers generally do not listen to the radio; this is especially true for women farmers. In Homa Bay, where two thirds of male project farmers and 80% of male non-project farmers listened to the radio more than a few times a week, only 28.6% of female project farmers and 26.7% of female non-project farmers listened to the radio as much as the men. Vihiga's results varied a bit from Homa Bay's; the majority of project farmers listened to the radio more than non-project farmers. In Homa Bay, only one farmer said they had initially learned of Push Pull from the radio, whereas in Vihiga, four farmers stated this. Although four is only a tenth of all farmers interviewed in Vihiga, it still shows that radio broadcasts are reaching farmers a little better in that region than in Homa Bay.

Field days are all-day workshops where farmers gather to learn about new technologies and then see the demonstrated technology in a neighboring plot. They are a fantastic hands-on experience for farmers who need visual aides. Regardless, farmers tend to not take advantage of these opportune learning experiences. This is especially true for Homa Bay, where the majority of non-project farmers did not attend field days, and approximately a third of project farmers did not attend field days. Field days give the

impression to have an efficient learning technique, though, as the vast majority of farmers who did attend field days and learned about Push Pull had adopted the technology. Mainly non-project farmers reported not learning any information about Push Pull during field days.

Farmer-teachers are farming individuals who have expressed the desire and have the capabilities to assist fellow farmers in learning new technologies. They are trained by professionals, yet are not considered professionals themselves. Although farmer-teachers were not the initial source of information on the Push Pull technology, many farmer-teachers provided some details about the strategy for the farmers, although more so in Vihiga than in Homa Bay.

Barazas, or public meetings, were reported as commonly believed to be attended only by persons of higher authority in the area. This discourages both women and farmers to attend. The percentage of farmers that reported learning of Push Pull in Barazas (about 25% of those who regularly attended) indicates that barazas were not a very effective transmitter for information on Push Pull. It was also signified by the farmers that barazas do not commonly focus on agricultural topics.

Printed materials were not distributed to the extent necessary to achieve any improvement. About half of the farmers in Homa Bay and only about a third of the farmers in Vihiga had received printed materials. Of these, only a scant few had learned about Push Pull from printed materials.

Neighboring plots are seen by many farmers walking into town or to visit friends. Commonly, farmers stop to ask what new technologies are being implemented. This was a major source of information on Push Pull for many of the farmers interviewed. Virtually all of the farmers said they speak to their neighbors about agricultural technologies, and the vast majority of them said they had learned information about Push Pull from their neighbors. Neighbors were also one of the major initial sources of information about Push Pull in both regions. However, Vihiga's percentage was higher than Homa Bay's; almost half of all farmers in Vihiga initially heard of Push Pull from their neighbors, whereas less than a fourth of all farmers in Homa Bay initially heard of Push Pull from their neighbors.

The initial sources of information are the first step in implementing new agricultural technologies. It appears that much of this initial step in Homa Bay happened with ICIPE, whereas in Vihiga, spontaneous diffusion proved to be the leading information originator. The results also showed that more channels through which a farmer had heard about Push Pull increased the likelihood of his or her participation in the strategy.

Finally, when the respondents were asked to give their recommendations on which outlets to use in which sequence in order to reach the most farmers most efficiently, the ideas were typically similar. The general consensus was that groups and farmer-teachers should be used first and second and field days should be third. After that, the answers for the most efficient outlets varied between each district, between both genders, and between both participation statuses. Residents of Vihiga commonly recommended using the radio as a fourth outlet and printed materials were suggested to be the last outlet to be used. In Homa Bay, men reported spontaneous diffusion to be the fourth most efficient outlet, whereas women declared the radio as fourth. It was generally decided that printed materials should be last in Homa Bay.

Recommendations and Conclusions

After identifying the causes of this rift present between the rates of adoption in both districts, concentration upon how to improve the situation is necessary. The questions that must be addressed are as follows: 1) In which ways and through which channels do women farmers acquire the most amount of information on new technologies recommended for implementation, and 2) how can we ensure these women farmers receive the information necessary to adopt new technologies? Several steps can be taken to answer these two questions and, in turn, assist in assuring food security to the local farming families. The course of action should be as follows:

- **Female Empowerment/Male Sensitization:** Most women left the tasks of attending barazas, field days, and meetings with extension staff to their husbands. On the other hand, they exclaimed that they were more so not allowed by their husbands to attend these functions and discuss issues with governmental and non-governmental agencies. In addition, most women farmers stated they had no part in making agricultural decisions in the household; this was up to their husband. Furthermore, the women were the chief workers on the farm. Therefore, it is absolutely necessary to empower the women and educate their husbands about the importance and benefits of this empowerment. In order to achieve both of these, required tasks include the following:
  - *Women Education*: Because women bear the brunt of most of the agricultural work, they need to be educated just as much as the men, if not more so. In doing so, information which can be used to improve the farm is obtained by those who have the most influence over the outcome and production of the farm.
  - *Male Sensitization*: It is imperative that the husbands of farming women understand the benefits of educating their wives. As it is, most men believe having an educated wife means risking losing their household control to their spouse. Of course, this is not entirely true. It has been shown that in Western Kenya, women who are highly educated are able to better utilize all of their assets, and, in return, bring a higher income to the family. This is not a commonly known fact among male farmers in the area, however. Therefore, the men need to be sensitized to benefits their wives can bring in being higher educated.
  - *Gender Equality in Agriculture*: This applies not only to working agricultural tasks, but to major decisions, as well. It is apparent that the women are overburdened with agricultural tasks; to help free some time and to involve the men at a higher level, men should be encouraged to spend more time helping their wives complete tasks in the fields. As for decision-making, no improvement will be achieved in educating the women about new technologies if they have no power to make the decision to implement these technologies. Therefore, it is necessary to attempt to equalize the genders in this aspect, as well.

Accomplishing the afore mentioned goals will be the most difficult task in reaching financial stability and food security, as it is an issue within the culture. It is, nevertheless, the most important task at hand though, as problems cannot be overcome if the means of overcoming them are blocked by cultural and traditional issues.

- **Education of Work Simplification Strategies:** Most of those interviewed who had not heard of Push Pull (3 in Vihiga, 9 in Homa Bay) hadn't gone to any field days or barazas, didn't know of any farmer-teachers or extension staff, and didn't listen to the radio on a regular basis. When asked why they didn't attend any of these functions, meet with any of the staff, or listen to the radio, the most common answer was that they were over occupied with farm work and didn't have time to travel to these events. It would be beneficial for women farmers to free up some of their time so they can attend workshops or meet with extension staff. The first step in achieving this is education for the women, even if it is in the form of tips from neighboring farmers, focusing on effortless techniques which can be utilized to simplify the daily work women must tend to.

- **Information Transmittance Through Groups:** When asked to give their recommendations for improving the rate of transmittance of information, the number one answer suggested by farmers was to spread information through groups. This could incorporate a number of aspects and channels through which information could be diffused. Groups can therefore be considered a sort of "melting pot" for methods of transmitting information. First, it is necessary to keep in mind that nearly all farmers are involved in some sort of community-based group. By combining the teaching skills of farmer-teachers and ICIPE extension staff, the visual aids of field days and workshops, and ideas of fortification imparted by reading materials, virtually all local farmers can be reached with new information about new technologies in an extremely efficient manner. In addition, members of groups can support and aid each other when questions or problems arise. Therefore, reaching farmers with new information through community-based groups is an ideal method for efficient technology diffusion.

- **Reiteration and Reinforcement:** As the results show, as the number of channels a person had been involved with increased, the probability that they had learned of Push Pull, the strategy's benefits, and had implemented the strategy increased, as well. Furthermore, there were a fair amount of farmers who had heard of Push Pull, but stated they did not know any techniques of controlling striga or stemborer. This implies that even though they may have been told of Push Pull, they haven't been exposed to the idea for the period necessary to begin associating the strategy with its benefits. Therefore, it is obligatory to attempt to reach farmers through as many methods as possible to ensure they associate Push Pull with controlling striga and stemborer and implement the practice. This also includes making certain farmers are aware

of when events such as workshops, field days, and group meetings are scheduled to maximize the amount in attendance. Reiteration and reinforcement of technology ideas is an essential step in obtaining food security for the local farmers.

- **Improved Access to Seeds:** Many farmers from both districts had not begun Push Pull because they didn't have access to seeds necessary for the initiation of the strategy. This is because the seeds are not only expensive, but many times unavailable, as well. Therefore, improved availability both in the physical sense and the financial sense is essential. In making seeds more available for the farmers to purchase, they will be more inclined to begin new technologies such as Push Pull, increasing their income and, thus, increasing food security.

- **Improvement of Initial Investment Availability:** When asked whether or not they would buy and implement Desmodium and Napier grass were the seeds available, some farmers said no. Their main reason for this was that they had not enough capital to buy the means of propagation for these extra crops. This financial deficiency does not only apply to certified seeds; much farm equipment is required to begin and maintain a successful Push Pull plot—proper tools, adequate labor, and a sufficient supply of inputs—and most farmers explained that they were unable to afford this equipment. Although there are community-based groups focusing on credit and savings for farmers, the services provided by these groups are not adequate to reach the level of farmers' need. The farmers also cited a need for a better availability of initial investment funds. Therefore, services relating to this aspect of agriculture need to be strengthened. In implementing supportive credit facilities which can be utilized to assist farmers in obtaining essential funds for their farm, the number of farmers who are not adopting new technologies due to lack of capital will decrease.

The Luo farmers who generally live south of the Kenyan partition of Lake Victoria, in Suba and Homa Bay districts, have developed a dependency on both governmental and volunteer support and assistance. This is due in large part to the fact that this region is heavily affected by the worst situations present in Kenya: erratic weather, drought, unutilized high-potential land, and prominent and destructive health issues including but not limited to HIV/AIDS and malaria. Because the region is so afflicted by these sorts of problems, it is many times the focus for aid given to the country. Thus, the dependency needs to be broken in order for a major improvement to take place. The farmers in this area need to realize they will not always have assistance; only then can they begin to become fully self-sufficient, improve their financial stability, and maintain food security.

PERSONAL PERSPECTIVE

Two days after I flew into Nairobi, I embarked on a journey to my station, Mbita Point, with a day-long stop in Kisumu. While in Kisumu, Mr. Mokaya took me to lunch on the Imperial Terrace. Afterwards, he took his daughter, Emily, and I to the Nakumatt in town where I bought many of my necessities for the next two months. While leaving the store, I dropped all of my American coins on the floor after I bought my items. After helping me pick them up, Emily said "One rolled under that furniture." There was furniture on display next to where I dropped the coins. I told her "Oh, it's ok, it doesn't matter." In Kenya, one coin probably *would* matter. I felt so spoiled.

During the last two hours of day in Kisumu, Mr. Mokaya and I sat in the Land Rover waiting for the doctors to arrive. During this period of time, as Mr. Mokaya and I discussed issues such as drug abuse laws, school uniforms, and outrageously cheap prices, I became an avid people-watcher. The people in Kenya interested me immediately; the way they dressed and acted was so similar yet so different from the American way.

Gratefully, the flight from Nairobi to Kisumu was short; the next four hours of travel after arriving in Kisumu would be some of the longest hours I've ever spent. The road between Kisumu and Mbita Point went around the east side of Lake Victoria. The first half was paved, the second was not. Comparing the two, however, I would have to say that the second half was a more comfortable ride; even when the road was paved, it was filled with potholes and was impossible to travel over without slowing to ease the jolt every 30 seconds. Yet, during the most comfortable times, when the road was not paved, mud caked the wheels and the road was almost impassable. I was so appalled that I videotaped the trip in order to show the severity of the situation.

Between Kisumu and Mbita point, there were many tiny villages full of mud huts, tin-sided shops, and roadside stands. We arrived in Olare in the Homabay district and saw a fair amount of people with pineapples set up at their market on the roadside. Jimmy Pittchar and Dr. Charles Midega asked to pull over. As soon as the villagers noticed our

vehicle slowing down, they grabbed their pineapples and about ten or twelve of them surrounded the vehicle, sticking their pineapples and fresh pineapple sticks in the windows. They were selling four pineapples for about $1.50. Out of the ten or twelve vendors swarming our car, only one was a man. That was more evidence that women do all the work in Kenya.

Developing my questionnaire was most definitely the part of the internship with which I was most mentally capable. Conducting interviews, however, was a different story. On my first day of testing the questionnaire, Matilda Ouma and I traveled to Ogongo, a village located about 30 minutes away from Mbita Point. There, I interviewed six farmers for practice and testing. As this was my first real experience out in a Kenyan community, I experienced quite a shock. The farmers I interviewed lived in conditions I couldn't even imagine; thatched-roof mud huts, holes in the ground for outhouses, cows, goats, and chickens roaming wildly, and children everywhere, yelling "Mzuuungu!" meaning 'white face' after we show up. After speaking with them for fifteen minutes, however, I became even more surprised. These farmers own hardly anything to their name, yet are completely happy and satisfied. This is especially true for those who were doing well in comparison. Their spirits were amazingly high given the circumstances.

During the interviews, I found out that even though these farmers own or farm only half an acre of land, they still are farmers. This is so different from the way of life in America; when people farm half an acre of land in Iowa, they're considered gardeners, not farmers. I was also appalled to find that many of the women farmers are so young! The woman pictured on the right has three children and manages her farm entirely by herself; she is only 18 years old! It was difficult for me to conceive that she was my same age yet has accomplished so much and come so far in life given her dire situation. As you can see, she's very happy and satisfied, as well.

One of the interview days was also a market day for a particular region. Matilda requested to stop at the market to buy her necessities for the next week. At the market, hundreds of stands were set up, selling all types of produce, including millet, corn, soybeans, other legumes, bananas, pineapples, potatoes, cassava, and lemons. Matilda bought a few lemons and I asked her how much a typical lemon would cost. She said, "They are more expensive because you're standing with me. When they see a mzungu, they assume they can get a higher price out of the consumer because mzungus generally do not know the going rate for produce. I keep telling her, 'I'm no tourist, I'm a local. Give me a local price,' but she still charges me more. Typically, the price is one shilling per lemon." I was expecting a lower price for lemons in Kenya than in America, but I was definitely not expecting that outrageously low price!

One shilling is just a bit more than $0.01. I was wondering how they could expect to make a living off of prices like this, considering the producer maybe sold about 30 lemons that day, *if* she was lucky.

During the month of July, I volunteered a portion of my extra time at a community-based organization called Kageno. On Rusinga Island, across from Mbita, a tiny village has been plagued with AIDS, reaching a 42% prevalence rate. This is due mainly to a practice called 'Fish-For-Sex' in which the women literally sell their bodies to the fishermen in order to pay for the fish brought in each morning. The organization is attempting to slow the growth of the disease by using income-generating activities, such as selling crafts, to acquire a base for income for the women to pay the fishermen.

While I was working with Kageno, a group of medical students was also volunteering, by giving their services to make sure all of the children were immunized. I took part in this process by spending a day with the children in the area; I weighed them, took their height, and measured their arm's circumference. Although the task sounds relatively easy, this was assuredly the most difficult task I performed all summer. The children, who only speak the language of the Luo, had never stood on a scale or stood up straight next to a wall; I had difficulty attempting to get them to do so. Measuring their arm circumference was a more difficult task, yet, as many of them assumed I was going to hurt them in some way. Seeing all of these sickly children did not help my spirits, either. I broke down and cried when I arrived back in my room that evening.

Overall, my experience in Kenya this past summer was one of the best experiences I have ever taken part in. As an international intern, I learned so much about the culture and situation, more than I could have ever dreamed of. Despite the difficulties, such as driving to the emergency room in Kisumu, I achieved so much more than I thought myself capable of and am entirely indebted to the World Food Prize Youth Foundation, Dr. Khan and the rest of ICIPE, and the people of Kenya.

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Glossary

Baraza- A public meeting held by local administrators, usually the chief; an informal meeting addressing various types of topics. When held with the District Commissioner, a larger, more formal level is reached.

Shamba- Kiswahili for 'farm'.

Appendix 1

Focus Group Discussion, Homa Bay District, 15 June 2006

Focus Group Questions

1. Are there cultural practices that hinder the adoption of new agricultural technologies? Discuss them, if any.

2. Effects of household factors:
   - Do you think the amount of Land or labour are important issues in adopting new farm technologies?
   - Gender: What limitations or advantages do female-headed households (widows) have in adopting new farm technologies?
   - Socio-economic factors: Are education, income, family size important factors in the way farmers adopt new farm technologies ?

3. Institutional factors: How has the extension system performed in transmitting technology information?

   3.1 How are women farmers fairing in comparison to male farmers in accessing farm extension services ?

4. Participation in women groups:
   - On average, how many groups does a farmer belong to?
   - What is the utility/relevance of group membership with respect to technology adoption?
   - What kind of information do you get from the groups you belong to?
   - How useful are the groups in transmitting technology information?

5. Please compare the performance of the following in transmitting new farm technology information?
   - Radio?
   - Field days?
   - Farmer-teachers?

- Barazas?
- Printed material?
- Groups
- Direct learning from neighbours (spontaneous diffusion).

6. Among these which are the best channels for disseminating new technology information to **women farmers** ? Please explain why.

Appendix 2

Questionnaire
Women Groups in the Dissemination of Push-Pull Technology in Western Kenya

Name: _____ Age: _____ Gender: _____

Village: _____ District: _____

Project Farmer/Non-Project Farmer: _____ Date: _____

Note of financial status:

1. a) Are you married? _____

   b) Who is the head of your household? M__ F __

   c) How many children do you have? _____

2. a) Up to what grade level of education do you have? _____

   b) Up to what grade level of education does your spouse have? _____

3. a) Do you own a bicycle? _____

   b) What type of roof does your house have? _____

4. a) How much land do you own (in acres)? _____

   b) How much land do you use for crops? _____

   c) In the last two seasons, how many members worked on the farmland?

   Men_____ Women _____ Children _____

   d) On average, how many hours did each group spend on the following activities:

Activity	Men	Women	Children
1) Plowing/Tilling			
2) Planting			
3) Weeding			

4) Harvesting

5) Processing

5. a) What food crops do you grow? _____

_____

b) What are the major constraints in your crop production? _____

_____

c) What methods do you use as a remedy to these constraints? _____

6. a) How many cattle do you own? _____

b) If none, give reasons why. _____

_____

c) What forage do you feed your cows? _____

7. a) How many goats do you own? _____

b) If none, give reasons why._____

_____

c) What forage do you feed your goats? _____

8. a) Have you heard of the Stemborer? _____

b) Have you heard any information regarding how to control stemborers? _____

c) Where or how did you get that information? _____

9. a) Have you heard of the Striga weed? _____

b) Have you heard any information regarding how to control Striga? _____

c) Where or how did you get that information? _____

10. a) Are you aware of the Push-Pull strategy? _____

b) Where did you hear about it? _____

c) Do you practice the Push-Pull strategy? _____

d) How long ago did you begin your Push-Pull plot? _____

e) Do you use Napier and/or Desmodium from your plot to feed your animals?___

f) Since then, has milk output from your cows and/or goats increased?_____

g) If you don't have a Push-Pull plot, give reasons why. _____

_____

h) Do you have the desire to own a Push-Pull plot? _____

11. a) From which NGO's do you get information about any pest and weed control?

_____

12. a) Do you own a radio? _____

b) How often do you listen to the radio? _____

c) Which types of agricultural programs do you commonly listen to? _____

_____

d) If you don't listen to the radio, give reasons why. _____

_____

e) Which other family members listen to the radio? _____

f) Which agricultural programs do they commonly listen to? _____

_____

g) Have you learned any information about Push-Pull farming on the radio?_____

13. a) Are you aware of any ICIPE agents or other agricultural extension agents in your area? _____

b) Do you consult these agents for information and help regarding crop technologies? _____

c) If so, have you learned about Push-Pull technologies from them? _____

d) If you haven't consulted these agents, give reasons why._____

_____

14. a) Do you know any farmer-teachers in your area? _____

b) Which technologies have you learned from them? _____

_____

15. a) Have you attended any Farmer Field Days in the past two years? _____

b) Did you learn about Push-Pull technologies during these field days? _____

c) What other technologies did you learn about through field days? _____

_____

d) If you haven't attended Farmer Field Days, give reasons why. _____

16. a) Have you received any bulletins, brochures, or other printed material in the past two years? _____

b) Which technologies have you learned about through this material? _____

_____

17. a) Have you attended any public meetings (barazas) in the past two years? _____

b) Did you learn about Push-Pull farming during these meetings? _____

c) What other technologies did you learn about through barazas? _____

_____

d) If you haven't attended any of these meetings, give reasons why. _____

_____

18. a) Have you talked to your neighbors about agricultural technologies? _____

b) Did you learn about Push-Pull farming from your neighbors? _____

c) What other technologies have you learned about from neighbors?

_____

19. a) Are you involved in any groups? _____

b) If so, which ones are you involved in and what benefits do they provide?

Name	Benefits
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

c) Do you learn about any agricultural technologies from these groups? _____

d) Have you learned any information on the Push-Pull strategy from any of these groups? _____ From which groups? _____

e) Do you believe belonging to a group enables you to learn agricultural technologies better? _____

20. Please rank the following in terms of usefulness in learning agricultural technologies (in particular Push-Pull technology):

___ Radio ___Field Days ___Farmer-Teachers __ Neighbors

___ Groups ___ Barazas ___Printed Material