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5th International Conference of AAAE

23 - 26 September 2016, United Nations Conference Centre,
Addis Ababa - Ethiopia

Transforming Smallholder Agriculture in Africa:
The Role of Policy and Governance

Gender appropriateness of field days in knowledge generation and adoption of push-pull technology in eastern Africa

***Murage A. W, Pittchar J.O, Midega C.A.O., Onyango C.O.,
Pickett, J.A., and Khan Z. R.***

***Invited paper presented at the 5th International Conference of the African Association
of Agricultural Economists, September 23-26, 2016, Addis Ababa, Ethiopia***

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Gender appropriateness of field days in knowledge generation and adoption of push-pull technology in eastern Africa

Murage A. W^{1*}, Pittchar J.O¹, Midega C.A.O¹., Onyango C.O.,¹ Pickett, J.A.,² and Khan Z. R.¹

¹International Centre of Insect Physiology and Ecology (ICIPE), P.O. Box, 30772-00100

Nairobi, Kenya

²Rothamsted Research, Harpenden, Herts AL5 2JQ, United Kingdom

Abstract (244 words)

Women are taking over the Agriculture sector in sub-Saharan Africa and policies that enhance their empowerment in farming would have positive gains in enhancing food security and transforming lives. Adoption studies have identified gender as one of the factors that determine technology uptake, and this has been linked to women's access to farming information or lack of it. Technology scaling up systems should utilize pathways that are compatible with the needs of rural women who have to juggle farming with other household chores. Unfortunately, there has been limited effort to evaluate the suitability of the information pathways used to specific gender. This study evaluates the appropriateness of field days with respect to gender of the participants. A total of 2,615 participants were interviewed out of 6,221 who attended field days in Kenya, Uganda and Tanzania. The determinants of level knowledge level gained and willingness to adopt was evaluated using an ordered probit and logit model. Our findings shows that majority of the participants were women (51.3%), middle aged (40-45 years) and with primary level education (54.1% women). The model results shows that women farmers understood more about push-pull (coefficient of ordered probit = -0.112) and were more willing to adopt push-pull (coefficient of logit = -0.367). Age, education, being a push-pull farmer, perception of *Striga* severity and having a mobile phone were also significant. Our findings demonstrate that field days are appropriate for training farmers especially women who are often disadvantaged in information access.

Key words: Gender-appropriateness, Field days, Knowledge accumulation, Adoption

* Corresponding author: amurage@icipe.org

Introduction

Research addressing food insecurity in Africa has mainly focused on the main staple crops; specifically maize, millet and sorghum, which accounts for 40% of the calories consumed mainly by the poor most of whom are women and children (Pingali, 2001; Nyoro, 2002; De Groote, 2002). The production of these crops is faced with numerous challenges whose ripple effect has been chronic food shortages affecting many households in the rural areas. Efforts by many research organizations both national and international have come up with scientific breakthroughs such as the ‘push-pull’ technology, a productivity-enhancing innovation, developed and promoted by the International Centre of Insect Physiology and Ecology (ICIPE) in collaboration with other research organizations (www.push-pull.net) for the control of controlling stemborers, *Striga* weed (*Striga* spp.), and improving soil fertility. While the main objective of ICIPEs’ push-pull programme, as that of many other research organizations is to improve food security and incomes among farming households, potential food security impact would only occur when adoption of a new innovation is attained at scale (Murage et al., 2015).

Thus, despite the existence of such modern agricultural technologies as push-pull, agricultural productivity in Africa continue to be rated low and this has partly been attributed to the increased presence of female managed farms whose socio-economic circumstances are indicative of poverty and dependence other than authority and autonomy (United Nations, 1981). This is coupled by historical bias where agricultural development planners, deliberately targeted men for agricultural training, assuming that being household heads, they were the major decision makers for productive resources (Staudt, 1977). However, with the increasing number of women in farming deliberate efforts should be made to strengthen equitable access to information about technological innovations. Doss (2001) noted that although adopting a new technology may increase household income, some threshold of information may need to be achieved before a farmer decides to adopt. One of the main determinants of technology adoption has been recognized as the use of effective information dissemination pathways especially for ‘knowledge-based’ innovations (Padel, 2001). Several studies have provided evidence on the importance of information access and particularly on the role of informal information sources in influencing technology adoption (Burton et al., 1999; Genius et al., 2006; Morone et al., 2006). Of great importance is the ability of these information sources to promote gender equity in access and utilization (Feldstein and Poats, 1989). Some past studies have shown that indeed gender plays a major role in influencing adoption of new innovations and this has partly been ascribed to women’s access to farming information or lack of it (Burton et al., 2003; Murage et al., 2011a). Doss (2001) noted that access to information and farmers’ knowledge is correlated to gender and thus has an impact on technology adoption. For example, Rees et al. (2004) reported that men preferred radio and extension sources of information that led to their adoption of new innovations than women. However, gender preferences may not necessarily imply different

levels of access meaning that even though women could equally have access to radio, it may be unsuitable for them since they may lack of time to listen.

Therefore, while emphasis has been laid in developing technologies that are tailored to the roles of men and women in society, equitable access to information about such innovations has been lacking (Austin et al., 2001). Rural women especially face more difficulties than men in gaining access to agricultural information since they have less contact with extension services sometimes occasioned by socio-cultural restrictions or simply because they lack of time to participate in extension activities due to their heavier workload (World Bank, 2000; Winrock, 2001). Given that women are overtaking men in the farming sector, mainstreaming gender in existing dissemination methods is essential for the success of technology adoption (Deere and León, 2003). Unfortunately, many agricultural training programmes have largely been skewed to benefit men with limited efforts to evaluate their gender appropriateness. For the case of push-pull technology, a number of approaches have been used (Khan et al. 2008b), among them the field days which have been identified as one of the most effective and economic pathway in increasing its adoption. A previous study by Amudavi et al. (2008) found that farmers' propensity to seek new agricultural knowledge motivated them to attend field days and in the overall, they favourably rated its effectiveness in information dissemination. Farmers who attended field days in Western Kenya were able to start and manage push-pull gardens without getting further on-farm demonstration (Amudavi et al., 2008). In other studies by Murage et al. (2011a, b) and Murage et al. (2012), field days were also found to be the most preferred dissemination pathway, and their use led to quicker and higher adoption. Although the studies by Amudavi et al. (2008) and Murage et al. (2011a, b; 2012) provided useful insights into the relevance of use of field days in push-pull up-scaling, they are geographically limited to western Kenya where push-pull was promoted at the time. However, with the adaptation and expansion of push-pull technology to other areas in eastern Africa, there is likelihood of socio-cultural diversity which limits the generalization of the findings by these two authors in the new areas. In addition, the previous studies are also limited in discerning the gender-appropriateness of field days among a diverse range of socio-cultural and geographical settings. The current study therefore evaluates the appropriateness of field days in the greater eastern African region, while giving focus to its relevance to gender. We further evaluated the determinants of farmers' knowledge and understanding of the messages delivered during the training sessions and their willingness to adopt push-pull. The findings of this study will elicit farmer's feedback and help in guiding gender-related policies.

Methodology

Sampling and data collection

The study used data collected during farmers' field days trainings conducted in the year 2014 in Kenya, Uganda and Tanzania. During these open days, participants were required to register as

they entered the sites. Using the attendance list, an average of 30 farmers per field day were randomly selected and were requested to fill a semi-structured questionnaire covering different aspects of the field day training with help of trained enumerators. Out of a total of 6,221 registered participants 2,615 were sampled during different field days and interviewed (in Kenya, out of 4,067 participants, 1,863 were interviewed; in Tanzania out of 137 participants 73 were interviewed; in Uganda, out of 2,017 participants, 679 were interviewed). It is worth noting that in Tanzania, the dissemination efforts using field days was still at the initial stages, hence the small sample. However, since the dissemination process is continuous, it was necessary to elicit whether the field days were appropriate to the community in Tanzania or not, hence the inclusion of the sample. The interviews were done immediately after the field demonstrations at the field day site. The main information taken from respondents was on age, gender, education level, land size, and main sources of livelihoods. We also solicited information on knowledge gained by participants after attending field days by answering several questions about push-pull operations (See Table 3). Further, participants who had not taken up push-pull were asked if they were willing to try it later on after the field day training. Farmers' perceptions on the effectiveness of the push-pull technology were also evaluated.

Model specification and data analysis

All the variables in the dataset were summarized using descriptive analysis and cross-tabulations while disaggregating by gender. To evaluate the appropriateness of field days on knowledge generation, farmers were asked a series of eight (8) questions regarding their understanding of push-pull operations; and for which they were to respond as 1 = Yes and 0 = No. The responses obtained from these questions were used to generate a knowledge score on how farmers understood push-pull technology after the trainings. This overall score was re-coded as 0 = Not understood, 1 = Fairly understood, 2 = understood and 3 = well understood, depending on the score obtained. To evaluate the appropriateness of field days in catalyzing adoption, participants who were non push-pull farmers were further asked if they were willing to try push-pull technology after what they learnt from the field days for which they were to responded 1 = Yes, 0 = No. The generated variables were used for econometric analysis to evaluate the determinants of farmers' knowledge on push-pull and the willingness to adopt.

In the first scenario, the dependent variable of interest (farmers' knowledge and understanding of push-pull during the field day training and their perception on its effectiveness) was ordinal and categorical in nature and an ordered probit model was used. In the second scenario, a logit model was run to analyze the participants' willingness to adopt push-pull after learning from a field day since the dependent variable was discrete (0,1). In both cases, the underlying latent variable (Y^*) that indexes the level farmers knowledge and their willingness to adopt, is modeled as a function of unknown parameters which are estimated in the model (β), the vector of farmer characteristics (X_i) and a stochastic error term (ϵ) as follows:

$$Y^* = \beta' X_i + \varepsilon$$

For the ordered probit model, the latent variable Y^* takes exhibits itself in ordinal categories (coded as 0, 1, 2, 3); while in the logit model, Y^* is discrete in nature (0,1).

Results and discussions

Field days participation by gender

Figure 1 presents results on the overall field day attendance by gender in each country. There was variation across countries in terms of number of participants by different gender. In Kenya, there were more female farmers attending field days (53.2%) compared to men (46.8%). However, in Uganda and Tanzania, a higher percentage of the field day participants were men (57.4% and 62.6% respectively). The results were not surprising because recent observations made by World Bank (2000) indicates that women in Kenya have indeed overtaken the farming sector and constitute 80% of the farmers, whereas in Uganda and Tanzania, there is still male bias in agricultural extension programmes which has discouraged women from going out to access agricultural knowledge (Jiggins et al., 1998). In deed Nambuya et al. (2005) noted that although women in Uganda were the main users of improved sorghum varieties, majority of participants who turned up for the extension trainings were men. Dominance of men in controlling agricultural resources including access to extension services is still being witnessed in some African countries (Jiggins et al., 1998), with the assumption that the information will trickle down to women in the household. This unfortunately has negatively affected women farmers' ability to maximize their productivity. There is need for more emphases on raising productivity of women farmers through enabling them have access to efficient, effective, and appropriate technology, training, and information, this can be an effective engine for social change in sub-Saharan Africa (Jiggins et al., 1998). Since the role of women in African agriculture is already large and growing, they have a key role to play in revitalizing agriculture, especially food production (Saito and Weidemann, 1990).

Figure 1 approximately here

In Table 1, the socio-economic characteristics of field day participants are listed. At least 54.1% of women had attained primary level education, and 29.1% had secondary level education in the whole sample. Similarly, 41% and 40.1% of men had attained primary level and secondary level of education respectively. The percentage of farmers with no formal education was higher for women (10.2%) than for men (4.5%). Education is believed to be an instrument of enhancing people's general understanding of new concepts and this will determine how quick a person can assimilate new knowledge. Our results clearly indicates that rural women in Africa are still left behind in terms of education levels and this is likely to affect their ability to understand complex messages that come with new innovations particularly if such messages are packaged in a complex channel. This limitation makes the women farmer even more vulnerable in development and exacerbates their inability to use new innovations especially those that are knowledge

intensive. In view, the use of field days might be the most appropriate channel since it combines visual and hands-on training on the technology in question and this is likely to benefit women farmers more. Field days give farmers an opportunity to learn by seeing the performance of recommended practices adopted by other successful farmers and is thus likely to be effective in knowledge transfer to populations with low literacy rates, especially women, since farmers are able to discuss with fellow farmers and with facilitators (Rolling and Pretty, 1997; Akinsorotan, 2009). Indeed the results from the study by Murage et al. (2011b) indicate that less educated farmers preferred learning about push-pull from field days and Baraza[†] compared to more the educated farmers who preferred print materials and radio.

It's been shown that 38.9% of women and 32.1% of men who attended the field days were push-pull farmers. This represents about a third of the sample population implying that there is still many more new farmers attending field days to learn about the push-pull technology presenting a great potential for the program to up-scale the innovation intensively. The results further depicts that women will be the greatest beneficiaries of new innovations such as push-pull to improve their productivity since they were the majority participants. Previous studies have shown that women farmers were the main beneficiaries of push-pull technology given that they were the worst hit by the *Striga* menace, spending many hours weeding their crop (Khan et al., 2008a). Our results further shows that most of the respondents were within the ages of 40-45 years implying that most of the participating farmers are middle aged, and age group that is considered the most economically active and versatile and can lead to a positive effect on crop production (Akinsorotan, 2009; Ogungbile et al., 2002).

Table 1 approximately here

In the overall sample, 78.3% of the women and 76.3% of men who participated in the field days had mobile phone (Figure 2). The mobile phone revolution has been a unique development in agriculture sector presenting an opportunity for growth by lowering information costs, reducing transport costs, and providing a platform to deliver services and innovations. For example, farmers who owned mobile phones in Bangladesh acknowledged that their use had made it easy to overcome barriers of time and location and improved agricultural productivity (Islam, 2011). In another study by Nyamba and Mlozi (2012), farmers in Tanzania asserted that mobile phones conferred diverse advantages as a communication link in isolated circumstances because of its distinct feature of mobility. In addition, it helped them (farmers) to easily obtain agricultural information they needed such as market opportunities, better prices, input supply, management practices and weather. It can be deduced that exhibits an easy way to mobilize farmers for training and this has positive implications in reducing advertisement costs such as for field days. Besides, ownership of mobile phones has also made it easy for farmers to access information and

[†] Baraza: public gatherings of people usually in the village to listen to the chief, village elders, politicians or government officials

is seen as a move to revolutionize agriculture. In Kenya, 84.5% of women and 83.1% of men owned mobile phones, while in Uganda ownership of mobile phones was lowest with 54.7% of women and 60% of men had mobile telephones, and in Tanzania, 61.5% of women and 90% of men owned the mobile telephones. Further research would elicit information on how different gender utilized mobile phones particularly for agricultural purposes.

Figure 2 approximately here

Farmers' perception on constraints

Most of the field day participants in the three countries perceived *Striga* as a major problem and this was rated almost in equal measure by both men and women (see Table 2). Overall, 98.9% of women and 98.3% of men responded to having *Striga* as major problem. In Uganda and Tanzania, all the respondents (100%) stated *Striga* to be a major problem. Majority of the respondents rated its severity as very severe (46.6% of women and 45.5% of men). Similarly, stemborer infestation was stated to be a problem by 83.8% of women and 84.6% of men, with majority rating its severity as moderately severe (30.2% of women and 31.9% of men). Severity of stemborers and *Striga* weed has been commonly rated by farmers in most major districts and this has been the main motivation in adoption of push-pull (Khan et al. 2008a; Amudavi et al., 2008).

Table 3 approximately here

Perception and knowledge of push-pull technology benefits

Push-pull was rated as very effective by 86.3% of the female participants and 80.5% of the male participants in the overall sample (Table 3). In Kenya, 94% of female and 89.4% of male participants rated the technology as very effective, this was followed by Uganda where 58.2% of female and 62.2% of males rated push-pull as very effective, while in Tanzania, majority of the female participants (61.5%) rated the technology as moderately effective and 75% of the male participants rated it as very effective. This variation may be attributable to gender differences and which influences how women and men perceive certain attributes of the technology.

Table 3 approximately here

Majority of participants expressed having well understood the contents trained during field days. The understanding was higher amongst the women participants with 73.5% saying they 'well understood' while 70.4% of the men said the 'well understood'. The percentage of women who 'well understood' was higher in Uganda (51.3% vs 43.2%), as opposed to Kenya and Tanzania where the percentage of men was higher (79.4% for female vs 83.9% males in Kenya and 53.8% for female vs 61.7% for male in Tanzania). The percentage of women who did not understand was highest in Tanzania where 30.8% of female expressed having not understood the field day contents (Table 3). Among the non-push pull farmers who attended the field days, 91.3% of the women and 88.1% of the men were willing to adopt the technology after the training. Willingness to adopt was highest in Kenya, followed by Tanzania.

Determinants of field day participants' knowledge generation

Farmers' levels of knowledge generated by participating in field days can be influenced by their socio-economic characteristics. In our case, gender, age, education, being push-pull farmers, their perceptions on *Striga* severity were the main significant factors of knowledge level (Table 4). Age and gender were inversely related to the knowledge level (Coefficients = -0.112 for gender and -0.003 for age). The marginal effects for gender were 0.005 for 'not understood', 0.006 for 'fairly understood' and 0.026 for 'understood' as compared to 'well understood' which was dropped as the reference variable, implying that women exhibited higher level of understanding of the contents taught during field days as opposed to their male counterparts. Traditionally, women are more involved in farming than men and this puts them on a higher platform to keenly follow the proceeding in any agricultural training as it is bound to benefit them more in their activities. Particularly in field days where simplified messages are offered, women farmers are more likely to benefit due to such limitations of low education status which would make them not to understand complex messages. Furthermore, field days gives farmers an opportunity to share experiences with each other which is more beneficial especially to women who prefer learning from their neighbours and early adopters (Rolling and Pretty, 1997; Akinsorotan, 2009; Murage et al., 2011b). Elsewhere, in Ethiopia, it has been shown that one of the strategies for improving productivity and market access was to encourage women farmers to participate in field days and promotional efforts (ILRI, 2013).

Table 4 approximately here

The coefficient and marginal effect values for age shows an inverse relationship between the level of understanding and farmers age. This means that younger farmers had a better understanding of all the topics covered during the field days than the older farmers. This was not surprising given that most of the participants were within the range of 40-45 years which is relatively a young age set. On one hand, it can be argued that modern technologies are adopted by younger farmers since they are more likely to possess higher levels of education compared to the relatively older ones giving them (young farmers) an edge in understanding complex messages (Murage et al., 2015). Or, alternatively, these young farmers are viewed to have a long planning horizon and are more commercially oriented and thus would pay keen interest in agricultural training since they would benefit more if they applied this training in their future farming roles. Although older farmers are said to have authority or decision making autonomy thus giving them advantage with respect to technology adoption (Rees et al., 2004), younger farmers have access to education and exposure thus making them receptive to information and subsequent change (Nkonya, 1997). Njoku (1991) asserted that having formal education enhanced farmers' levels of knowledge and adoption of innovations.

The variables representing farmers with secondary education and tertiary education were positive and significant (coeff = 0.141 for secondary education and 0.180 for tertiary education). The marginal effects were negative in all the three outcome levels (See Table 4) compared to the base category of 'well understood'. This implies that compared to the farmers who had primary

education (dropped for reference) farmers with higher level of education expressed more understanding of the topics taught during the field days. Exposure to education increases farmers' ability to obtain process and use information relevant to the adoption new technologies. Field day trainings allow farmers to learn by doing and can therefore be suitable even for farmers who have low education levels. However, for knowledge intensive technologies such as push-pull, farmers with low or no education may find it challenging to understand some complex topics in a one days' training. This explains why majority of farmers with low level of education exhibited low understanding of most of the topics taught. This corroborates the study by Nkonya (1997) who acknowledged that literate farmers were more likely to understand new ideas and concepts provided by extension agents and other informants as opposed to the illiterate farmers.

Farmers' perceptions on severity of *Striga* weed was also a positive determinant of level of knowledge of push-pull. Our results shows a coefficient of 0.151 and marginal effects -0.007 (for outcome 0), -0.009 (for outcome 1) and -0.035 (for outcome 2) implying that farmers who perceived the severity of *Striga* as 'very severe' understood more on all the topics as opposed to those who perceived the *Striga* weed as less severe. It can be argued that farmers who perceived *Striga* as a very severe problem had a higher desire to learn more about the push-pull technology which could assist them to control this problem. In view, those farmers are likely to be keen during the training sessions with the desire to go and implement the knowledge they acquire on their farms. In our case, majority of that farmers who expressed *Striga* to be a very severe problem were women (Table 3), and this probably explains why they had a higher level of understanding about the technology. Indeed, Amudavi et al. (2008) acknowledged that farming constraints were among the key forces that stimulate farmer participation in field days. A more recent study by Murage et al. (2015) observed that farmers who perceived *Striga* infestation as a serious problem on their farms were more willing to adopt climate-smart push-pull as opposed to those who perceived it as not a problem. This probably explains why such farmers would pay more attention and therefore exhibit higher understanding levels after a day's training in a field day.

As would be expected, participants who were already push-pull farmers expressed higher knowledge of the technology after the training, compared to those who were not (coeff = 0.173). The corresponding marginal effects were negative for the 3 outcome variables. This would obviously be attributed to their experience in handling the technology in their farms prior to coming to the field days. An interesting thing to note is that those farmers with mobile phones were also more understating than those without (Coeff = 0.240). A possible argument here would be the attribution of such farmers to exposure either through education or their wider social contact which would be assumed to have better social capital than those without phones. In view, such farmers are expected to be more knowledgeable and therefore can easily grasp the information offered during agricultural trainings.

Determinants of willingness to adopt push-pull after the field day training

The willing to adopt by non push-pull farmers who participated in the field day is presented in Table 5. The variables representing gender of the participant, their perception on stemborers and *Striga* weed severity, and having mobile phones were the significant determinants of willingness to adopt. The negative coefficient (coeff = -0.367) for gender variable implies that women farmers were more willing to adopt push-pull compared to male farmers. Similarly the positive coefficient (coeff = 0.218 and 0.136 respectively) for farmers who perceived *Striga* and stemborers infestations as very severe indicates that these farmers were more willing to adopt push-pull after receiving training from the field day. This corroborates the results from a recent study by Murage et al. (2015) on the *ex ante* study on climate-smart push-pull. The scenario reflects the high desire for women to access new innovations in farming which has the potential to improve their productivity, a fact that may result into higher adoption rates by women. This is also consistent with adopter perception paradigm (Adesina and Zinnah, 1993) which explains that there is a significant association between farmers' perceptions of a problem or a technology and their decision to adopt. *Striga* and stemborers are perceived major constraints and by particularly women in sub-Saharan Africa who bear the direct effect of inability to feed their families due to low cereal yield. The existing cultural control measures of *Striga* such as hand weeding and uprooting present a high socio-economic opportunity cost for the women who have to spend long hours in the farm uprooting the weed (Berner et al., 1995; Woomer et al., 2004). This explains why women are more likely to express a willingness to adopt new innovations faster since they are the ones receiving the direct benefits of the technology. In fact, more women perceived *Striga* as either severe (31.2%) or very severe problem (46.6%) compared to men (see Table 2). This finding is consistent with that by Burton et al. (2003) and Murage et al. (2011a) who observed gender to be a strong predictor of speed of uptake of new innovations.

Table 5 approximately here

As in the case of knowledge accumulation above, farmers who had mobile phones were also positively linked to willingness to adopt (Coeff = 0.838). It can be argued that farmers who owned mobile phones are likely to have high self drive to want to be compatible with adopting a new technology over time by exerting the required efforts, probably due to spatial influence from the neighboring community. Although literature on this is lacking in developing countries, there is increasing evidence on the role of neighborhood effects in the adoption of agricultural technologies (Holloway et al., 2002; Staal et al., 2002; Bandiera and Rasul, 2006; Conley and Udry, 2010). Indeed, the Alliance for a Green Revolution in Africa (AGRA) has proposed use of proven ICT-enabled extension services such as mobile phone applications to increase adoption rates for technologies. However, ICT-enabled extension services still need to be backed by locally demonstrative and interactive dissemination strategies like field days.

Conclusion

Access to farming information via effective dissemination pathways can determine the adoption of the new innovation or not. Being male or female has a strong correlation to information access

and technology adoption. While many dissemination methods exist, the eventual usefulness of the information delivered may be determined by the socio cultural aspects of the recipients. The objective of this study was motivated by an interest in know how men and women benefit from field day trainings as one method of technology dissemination, using push-pull technology as an example. Our results demonstrate field days as an appropriate dissemination method for farmers particularly women who were the majority participants. It's further been shown that women in Kenya have indeed overtaken men in the farming sector, and therefore the access to information especially from field days. However, in other countries such as Uganda and Tanzania, there is still male dominance in agricultural trainings, probably due to the assumption of patriarchal unitary household decision making, where information is expected to flow into the household through the male household head. Given that our study showed a higher knowledge and understanding potential of women compared to men, then this assumption would definitely disadvantage the women farmers by not receiving information directly from the extension agents. The willingness to adopt also shows that women are likely to make quick decisions in taking up new technologies which have direct benefits to their farming constraints. This would otherwise take longer if they had to wait to receive information from the male household heads if they did not attend agricultural trainings themselves. Therefore, there is need for a paradigm shift and indeed more emphasis by any organization planning to disseminate new innovations to deliberately offer women farmers opportunities to directly access information via their preferred methods in order to enhance their knowledge and speed up adoption. Failure to enhance gender equity in information access will lead to inability of women to realize their full economic potential and consequent independence. One assumption of technology dissemination is that the trained farmers would assist in the diffusion of the technology information to their neighbors. Knowing that men and women have very distinct networks of social contacts, with different underlying factors that shape these network linkages, it would be appropriate for extension agents to exploit those pathways that benefit women more. This is because their (women) networks of sharing information are as large as for men or, in the cases, substantially larger especially in poor household. Ripple effects in adoption of technologies especially among the poor households are likely to be greater if women are trained more.

Acknowledgements

The authors acknowledge the support of the European Union (EU) and Biovision Foundation for financial support in dissemination and scaling-up of push-pull, all the farmers who participated in the field days, partners and field day facilitators.

Conflict of interest

The authors declare that we have no conflict of interest with the organization that sponsored the research work.

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Table 1: Characteristics of farmers who attended field days in the three countries

	Kenya		Tanzania		Uganda		All countries	
	Female N = 921	Male N = 942	Female N = 13	Male N = 60	Female N = 232	Male N = 447	Female N = 1166	Male N = 1449
Level of education (%)								
None	9.7	4.8	7.7	5.0	12.5	3.8	10.2	4.5
Primary	52.8	41.7	76.9	58.3	58.2	37.1	54.1	41.0
Secondary	30.9	40.1	7.7	25.0	22.8	42.1	29.1	40.1
Tertiary	6.6	13.4	7.7	11.7	6.5	17.0	6.6	14.4
Age of the farmer (Years)	43.13 (0.432)	45.67 (0.461)	40.38 (5.188)	49.82 (1.7)	39.03 (0.72)	42.95 (0.63)	42.29 (0.377)	45.0 (0.366)
If push-pull farmer (% Yes)	41.6	31.7	7.7	45.0	30.2	31.1	38.9	32.1

Table 2: Farmers' perception of *Striga* and stemborers in their fields

	Kenya		Tanzania		Uganda		All countries	
	Female N = 921	Male N = 942	Female N = 13	Male N = 60	Female N = 232	Male N = 447	Female N = 1166	Male N = 1449
If <i>Striga</i> a problem (% Yes)	98.6	97.5	100.0	100.0	100.0	100.0	98.9	98.3
<i>Striga</i> severity								
Not severe	2.2	3.0	0	0	0	0	1.7	1.9
Moderately severe	18.7	21.2	7.7	25.0	28.4	29.1	20.5	23.8
Severe	32.0	26.5	61.5	25.0	26.3	34.0	31.2	28.8
Very severe	47.1	49.3	30.8	50.0	45.3	36.9	46.6	45.5
If stemborer is a problem (% Yes)	82.1	81.7	84.6	91.7	90.5	89.7	83.8	84.6
Level of stemborer severity								
Not severe	16.8	17.1	15.4	5.0	9.5	9.6	15.4	14.3
Moderately severe	31.9	35.1	15.4	31.7	24.1	25.1	30.2	31.9
Severe	26.3	26.0	23.1	35.0	26.3	33.3	26.2	28.6
Very severe	25.0	21.8	46.2	28.3	40.1	32.0	28.2	25.2

Table 3: Farmers' perception and knowledge of push-pull technology after attending field days

	Kenya		Tanzania		Uganda		All countries	
	Female N = 921	Male N = 942	Female N = 13	Male N = 60	Female N = 232	Male N = 447	Female N = 1166	Male N = 1449
¹ Perception on effectiveness of push-pull (%)								
Not effective	1.0	2.0	0.0	1.7	2.6	8.1	1.3	3.9
Effective	5.0	8.4	61.5	23.3	39.2	29.8	12.4	15.6
Very effective	94.0	89.6	38.5	75.0	58.2	62.2	86.3	80.5
² Level of understanding push-pull from the field day (%)								
Not understood	1.1	1.3	30.8	8.3	4.3	4.0	2.1	2.4
Fairly understood	2.3	1.8	7.7	8.3	5.2	6.7	2.9	3.6
Understood	17.3	13.1	7.7	21.7	39.2	46.1	21.5	23.6
Well understood	79.4	83.9	53.8	61.7	51.3	43.2	73.5	70.4
Willingness to adopt Push pull technology after the field day (%)	96.5	95.4	84.6	96.7	71.1	71.4	91.3	88.1
Yes)								

¹Effectiveness of push-pull measure by answering the following

- From what you have learnt today, how effective is push pull technology in *Striga* control
- From what you have learnt today, how effective is push pull technology in stemborers control
- From what you have learnt today, how effective is push pull technology in improving soil fertility
- From what you have learnt today, how effective is push pull technology in providing fodder
- From what you have learnt today, how effective is push pull technology in improving cereal yields

²Understanding score was measure by farmers answering the following:

- During this field day have you clearly understood how *Striga* affects your cereals crops?
- During this field day have you clearly understood how stemborer affects your cereals crops?
- During this field day have you clearly understood how *Striga* and stemborers affects your cereals crops?
- During this field day have you clearly understood how to harvest desmodium seeds?
- During this field day have you clearly understood how to process desmodium seeds?
- During this field day have you clearly understood Utilisation of push-pull fodder
- During this field day have you clearly understood Silage making (fodder preservation)
- During this field day have you clearly understood Desmodium hay making (fodder preservation)

Table 4: Factors determining level of understanding of push-pull during field day trainings

Model variables	Coefficients		Marginal effects ¹					
			Outcome 0		Outcome 1		Outcome 2	
	Coef.	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Gender of participants (0= Female, 1 = Male)	-0.112***	0.053	0.005***	0.003	0.006***	0.003	0.026***	0.012
Age of the participants (years)	-0.003***	0.002	0.000***	0.000	0.000***	0.000	0.001***	0.000
² Participants with No education (0 = No, 1 = Yes)	0.033	0.101	-0.002	0.005	-0.002	0.005	-0.007	0.023
Participants with Secondary education (0 = No, 1 = Yes)	0.141***	0.057	-0.007***	0.003	-0.008***	0.003	-0.032***	0.013
Participants with Tertiary education (0 = No, 1 = Yes)	0.180***	0.087	-0.008***	0.003	-0.009***	0.004	-0.041***	0.019
<i>Striga</i> severity (0 = not severe, 1 = severe, 2= very severe)	0.151***	0.030	-0.007***	0.002	-0.009***	0.002	-0.035***	0.007
Stemborer severity (0 = not severe, 1 = severe, 2= very severe)	-0.005	0.025	0.000	0.001	0.000	0.001	0.001	0.006
Participants who is a Push-pull farmer (0 = No, 1 = Yes)	0.173***	0.054	-0.008***	0.003	-0.009***	0.003	-0.039***	0.012
Participants has a phone (0 = No, 1 = Yes)	0.240***	0.056	-0.013***	0.004	-0.014***	0.004	-0.055***	0.013
/cut1	-1.628	0.134						
/cut2	-1.212	0.129						
/cut3	-0.172	0.126						
Number of observations	2615							
LR chi2(9)	70.24							
Prob > chi2	0.000							
Pseudo R2	0.017							
Log likelihood	-1984.539							

¹ Outcome 3 (Well understood) used as the base category for comparison² Primary level education used as reference variable

Table 5: Determinants of farmers' willingness to adopt push-pull technology after learning from a field day

	Coefficients		Marginal effects	
	Coef.	Std. Err.	dy/dx	Std. Err.
Gender of participants (0= Female, 1 = Male)	-0.367***	0.138	-0.032***	0.012
Age of the participants (years)	0.004	0.005	0.000	0.000
² Participants with No education (0 = No, 1 = Yes)	0.157	0.289	0.013	0.022
Participants with Secondary education (0 = No, 1 = Yes)	-0.406	0.145	-0.037	0.014
Participants with Tertiary education (0 = No, 1 = Yes)	-0.230	0.216	-0.022	0.022
<i>Striga</i> severity (0 = Not severe, 1 = severe, 2= very severe)	0.218***	0.076	0.019***	0.007
Stemborer severity (0 = Not severe, 1 = severe, 2= very severe)	0.136***	0.064	0.012***	0.006
Participants has a phone (0 = No, 1 = Yes)	0.838***	0.137	0.086***	0.016
_cons	1.101	0.313		
Number of observations	2615			
LR chi2(8)	60.07			
Prob > chi2	0.000			
Pseudo R2	0.034			
Log likelihood	-847.195

Figure 1: Field days attendance disaggregated by gender

Figure 2: Percentage of field day participants with mobile phones disaggregated by gender