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Classification and influence of agricultural information on striga and stemborer control in Suba and Vihiga Districts, Kenya

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Abstract

This paper reports on findings of a study to examine the sources used by farmers in search of agricultural information on striga and/or stemborers control technologies and factors that influence acquisition of such information in Western Kenya region. A random sample of 476 households in Suba and Vihiga districts were interviewed and 15 information pathways were identified. Using principle component analysis (PCA) to derive few latent variables that encapsulate maximum variance in the pathways, two components (latent variables) proxying for 'agricultural knowledge' were extracted. Type I-knowledge (first component) loaded heavily with sources that had 'group' information searching. Type II-knowledge (second component) loaded heavily with sources requiring individual farmer search. Both types of knowledge positively and significantly influenced the likelihood of households using improved technology to control stemborer, while only Type-II knowledge and social economic factors were important in influencing the farmers' likelihood of using an improved technology to control striga. This study shows that information is an important factor in the households' likelihood of using improved technologies in the control of striga and stem borer in Vihiga and Suba, Kenya. Methods of individual interaction are important to striga control.

Key words: Agricultural information, improved technology, striga, stemborers, control technologies, Kenya

Introduction

Maize crop is an important part of the food security equation in East Africa where per capita consumption is about 81 kg/year (FAO, 2002). However, production levels per hectare remain below the optimum potential for most available varieties. The low yields are attributable to biotic and abiotic production constraints, among others. Striga weeds and stemborer in particular are biotic constraints that farmers struggle to control. Maize yield losses due to stemborers range from 20-80% depending on the severity of the infestation and the growth stage of the crop (Khan et al, 1997). On the other hand, striga related maize yield losses are estimated at 5% loss per every striga plant per m^2 (Parker and Riches, 1993), implying an almost complete loss. Striga and stemborer have been a menace to maize production in western Kenya. Several research efforts by different institutions have targeted western Kenya for intervention in the management of striga and/or stemborer. In the process, technologies such as imidazolinone-resistant (IR) maize (Kanampiu et al., 2003), improved fallows, soil fertility improvement (use of manure and fertilizers) and use of trap crops have been developed and disseminated to the farmers for the control of striga (see a review by Oswald, 2005). Early planting, applications of bull-dock (betacyfluthrin) and bio-pesticides have targeted the management of stemborers. Push pull technology (PPT) has also been recently developed for the management of both striga and stemborer in smallholder cereal production systems (Khan et al., 2002, Cook et al., 2007). In spite of the advances made, adoption of striga and stemborer control technologies is still low among most pest-constrained farmers.

Studies documenting factors that influence choice of technology, adoption decision and intensity of use of the chosen technologies in the control of striga and stemborer are very few. This lacuna motivated this study to evaluate factors that influence farmers' choice and adoption of striga/stemborer control technologies in Vihiga and Suba districts of western Kenya in order to inform research programmes and policy makers on how to enhance effective diffusion and adoption of the technologies. This paper reports on sources of information used by farmers by classifying type of knowledge gained through them and the factors that influence the acquisition of the information in the two districts.

Methodology

A random sample of 476 households in Suba and Vihiga districts were interviewed in March-April 2007 by trained enumerators using a semi-structured questionnaire. Vihiga is a high potential with high population density (over 1100 persons per km^2) while Suba is of low potential with low population (about 150 persons per km^2). Data collected included farm and farmers' socioeconomic characteristics and information sources accessed to learn about stemborer and striga control.

Farmers sources of information on striga and stemborer control methods

Fifteen sources of information considered to provide agricultural knowledge on striga and stemborer control were identified. These were: 1. Farmer groups, 2. On-farm demonstrations. 3. Contact farmer. 4. Community leaders. 5. Visits to agricultural organization. 6. Radio agricultural programs. 7. Agricultural extension. 8. Pamphlets and brochures 9. Agricultural shows. 10. Attending local meetings (*Baraza's*). 11. Agricultural field days. 12. Neighbours and friends. 13. Posters on agricultural information, 14. Farmer teachers. 15. Self (farming experience).

Data were obtained on the households' access to these 15 information sources (coded 1 if accessed the pathway, 0 otherwise); whether the source provided information on striga and/or stemborer control for the household (coded 1, 0 otherwise). Further, the household members' judgement of effectiveness of such a pathway in disseminating striga and/or stemborer control information coded as 0 if not effective, 1 if effective, and 2 if very effective. The effectiveness variable was rescaled to binary variable with 0 if the pathway was considered ineffective and 1 if effective or very effective. Farming experience was recorded as the number of years a household had been farming independently. A mean of the farming experience was obtained and the variable was re-scaled to 1 if the farming experience was equal or greater than the mean and 0 otherwise. This was done to obtain binary variables to be analysed by the principle component analysis (PCA) technique. Using the 'effectiveness' of a variable for the fourteen sources of information and binary variable for farming experience, a 'knowledge index' was generated for each household.

Generating knowledge index

It was assumed that interaction of farm households with various sources of information on striga and stemborer control leads to 'agricultural knowledge' on practices of management and control of striga and stemborer control. The more a household learned from many sources of information and judged them as effective, the higher the 'agricultural knowledge' such a household accumulated on the control of striga and/or stemborer. However, it is not easy to measure 'agricultural knowledge' accumulated by the households directly from the many sources of information. By using the principle component analysis (PCA) (Amudavi, 2005) approach, components extracted capturing maximum variance in the 15 sources of information identified by the sample farmers were assumed to measure the underlying bundle of agricultural knowledge for each farmer. The resultant two principle components were viewed as 'knowledge indices' for each farmer. Data on the knowledge indices were fitted to a linear regression model (Dallal, 2000) to identify socio-economic factors that influence the farmers' ability to accumulate the two types of knowledge. To find out if the knowledge indices influenced farmers' likelihood of using improved striga and stemborer control technologies, the data were fitted onto logistic regression model (Agresti, 1996).

Results

Types of agricultural knowledge

Four principle components, each with eigenvalue greater than one, were considered. The first component explained 24.3% of the variance in the farmers' perception of effectiveness of the sources of information. The second component explained 10.3% of the variance in the data. The third and the fourth components accounted for 7.4% and 7.2% of the

Table 1. Principal component analysis of sources of information about striga and stemborer control used by farmers in Suba and Vihiga districts, western Kenya

Information Source	Principal component			
	1	2	3	4
1. Community leaders	.691	-.174	.182	-.055
2. Field days	.674	.391	.014	.006
3. Agricultural Show	.670	.064	-.036	.017
4. Chief's Baraza	.644	-.052	-.177	.266
5. Farmer groups	.585	.045	-.083	-.302
6. Radio	.566	.248	.257	-.033
7. On farm demonstrations	.479	.442	.189	-.097
8. Neighbors and friends	.391	.262	-.214	.075
9. Pamphlets and brochures	.133	.658	-.057	-.106
10. Agricultural extension agent	.076	.645	-.094	.008
11. Organizational visits	.051	.588	.309	.213
12. Posters	-.042	.506	-.075	-.004
13. Farmer teachers	.375	.421	.236	-.144
14. Contact farmers	-.003	-.076	.862	.017
15. Farming experience	-.007	-.014	.008	.914
Eigenvalue (7.39)	3.64	1.55	1.11	1.09
% of variance explained (49.25)	24.28	10.34	7.39	7.23

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

variance, respectively. When the components were rotated using varimax rotation with Kaiser normalization (Wuensch, 2006), thirteen of the information sources loaded heavily (r coefficient ≥ |±0.4|) on the first and second principle components while the third and fourth components had only one information source loading heavily with each. (Table 1).

All the components are orthogonally independent. Hence, the first two components were observed to represent two distinct types of agricultural knowledge on striga and stemborer control that farmers had accumulated through their own experience and from interactions with the fourteen sources identified. In this study, principle component 1 was named Type I-knowledge and principle component 2 named Type II-knowledge.

Factors influencing knowledge among farmers

Type I-knowledge was significantly influenced by attainment of primary level of education, wealth(proxied by total livestock units), perception of minor and moderate stemborer infestation, moderate and major striga infestation levels, a household being located in villages hosting on-farm research activities or neighboring villages, market access and smaller farm sizes. On the other hand, Type II-knowledge was significantly influenced by the education level of the head of household (primary, secondary and post secondary), security of land tenure, wealth, and being located in villages hosting on-farm research activities and age of the head of household.

Influence of the farmers' knowledge on their likelihood to use improved technologies in the control of striga and stemborer

A logistic model (with 70.2% correct prediction, R^2 = 30.5%) shows that Type I-knowledge did not have significant influence on the farmers' likelihood to control striga (Table 2). However, Type II knowledge improved the farmers' likelihood to use an improved technology to control striga by about 7.5 times, holding all the other factors constant. Also, farmers' probability to use an improved technology to control striga was about 14 times higher if a household was in

Discussions and conclusion

Information is an important factor of production (Antholt, 1995, Sumberg, 2004) like the classic land, labour and capital. This study demonstrates information is important in pest and weed control in maize farming in western Kenya. Type I-knowledge was closely related with group activities in sourcing information. This knowledge did not significantly

Table 2. Socio economic and agricultural knowledge factors influencing technology adoption decisions

Predictors	Model 1 Striga control		Model 2 Stemborer control	
	Odds ratio	Probability	Odds ratio	Probability
Size of the household (Numbers)	1.27***	0.56	ns	
District of study (Suba=0, Vihiga 1)	2.63***	0.72	ns	
Total livestock units (unit less)	1.11**	0.53	ns	
Type I knowledge	ns		1.69***	0.63
Type II knowledge	2.02***	0.67	1.96***	0.66
Household location in a research village	2.13**	0.68	ns	

***p<0.01, **p<0.05, *p<0.10, ns=not significant

increase the farmers' likelihood to use an improved technology in the control of striga, but rather increased the farmers' likelihood to use an improved technology in stemborer.

Type II-knowledge was closely related with individual activities in sourcing information. This knowledge type positively influenced a farmer's likelihood of using improved technology in both striga and stemborer. Only the two agricultural knowledge variables were found to be significant in influencing the farmers' likelihood to use improved technology in controlling stemborers. This suggests that farmers are mostly not aware that stem borer can be controlled, so that even those farmers that have the resources to do so do not. Among the factors that positively influence farmers' accumulation of Type II-knowledge are higher education levels and participation in on-farm research. However, the farmers in rural areas are of low education levels. Among households used in this study, 17% had no education while 58% had only primary level education. It is hard to change education status of the farmers in the short run. The challenge then is to simplify agricultural messages so that the more than 70% of the population can also benefit from Type-II knowledge, which has significant impact on the control of striga and stemborer. Simplification can happen through more interactive methods, which contribute, to Type II knowledge. Due to logistical constraints only few farmers participate in on-farm research activities while this is identified as one important factor in influencing Type II-knowledge. Farmer field schools would be a recommended avenue where more and more farmers participate in on-farm research activities and they provide more interactive learning opportunities. Vihiga district compared to Suba; 8.4 times higher if the household was located in village hosting on-farm research activities; 3 times higher if the household was wealthier and 3.6 times higher if the household had more household labour. A logistic model (92.6% correct prediction, R^2 =29.8%) shows that only Type I and Type-II knowledge had positive partial effects on the farmer's likelihood to use an improved technology to control stemborers. Marginal increases in the farmer's Type I and Type II-knowledge, holding all other factors constant, increases farmer's likelihood to use an improved technology against stemborer by 5.4 and 7.1 times respectively.

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