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Livelihood Strategies of Resource-Poor Farmers in Striga-Infested Areas of Western Kenya.

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Abstract

Striga hermonthica (del) Benth is threatening rural livelihoods in western Kenya where maize is the major food and cash crop. Vulnerability analysis was conducted on a sample of 802 households in eight districts of Nyanza and Western provinces. Farmers perceived Striga as the major cause of poverty and food insecurity. Both household income and child nutrition indicators showed alarming conditions for the majority of households. The coping strategies and informal safety nets were not capable of addressing the vulnerability issue successfully. A logistic regression model of determinants of poverty was estimated to examine the determinants and correlates of poverty. Results revealed certain characteristics of households that were more likely to be poor: poor access to land and farm assets; high dependency ratio; headed by older farmer with low education attainment; no off-farm work, no cash crops; depend on credit; Striga has been on the farm for long, high perceived yield loss to Striga given high dependency on maize for livelihoods; adopt no integrated Striga control options; and live in Bondo and Vihiga districts. The paper concludes with implications for policy to improve the livelihoods of small-scale farmers in the Striga-affected areas of western Kenya.

Key words: livelihoods, maize, Striga, Kenya, Logit

Introduction

Striga hermonthica (del) Benth is a root parasite that infests cereal and legume crops in sub-Saharan Africa. It constitutes the most important biological constraint to cereal production and it accounts for more than 50% yield losses in the region. This yield loss affects the livelihood of about 300 million people in sub-Saharan Africa (Lagoke et al., 1991; Parker, 1991).

Maize is by far the major crop in western Kenya. It is a staple and source of cash for many smallholders. It is grown by at least 95% of the 1.6 million farm families of the two provinces (Ministry of agriculture, 2004a and 2004b). The main constraints to maize production are Striga, poor soil fertility, and drought. By far, Striga is perceived to be the major issue threatening livelihoods of rural households. The parasitic weed is found in about 75,000 hectares of farmland and results in crop losses estimated at about US$10-38 million per annum (Woomer et al., 2004). The objective of this paper was therefore to analyze livelihood strategies of small-scale farmers in an environment characterized by a paucity of resources (scarcity of land, recurrent droughts, and low education level) and hard hit by Striga on maize, the most important economic enterprise.

Study area, sample size, and data collection

A combination of systematic and random sampling was applied to select 802 households for this study in western Kenya (402 for Nyanza Province and 400 for Western Province). Two factors guided the sampling strategy: the importance of maize and the severity of Striga in maize production. Data were collected between June and October 2005 by means of structured questionnaires on household demographics; Striga and Striga control technologies; access to land, vulnerability; capital assets; etc. In addition to survey questionnaires, each enumerator received a GPS handset to take geographic coordinates of households and equipment to take anthropometric measurements of children aged six years and below.

Analytical methods

Vulnerability analysis and econometric models were used for data analysis.

In this paper, the concept of food sufficiency was captured through food shortage and frequency of food shortage experienced by households (FAO, 2000). About the concept of quality of diets, we considered the nutritional status of children aged six years and below. Results on nutritional indicators from the survey were compared to international standards.

Poverty analysis related to the classification of the sample households into poor and non-poor based on whether they are below or above a poverty line of two-third of mean household income following the World Bank's approach to local poverty assessment (World Bank, 1996). Total household income was computed as the sum of farm income, off-farm income, and transfer incomes. A logistic regression model of determinants of poverty was estimated and the marginal effects derived to simulate the effects of alternative measures to enable the poor households to come out of poverty.

The econometric models such as probit, logit, and tobit have been used extensively in studies explaining different socioeconomic phenomena (e.g. Adesina and Chianu, 2002; Kristjanson et al., 2005; Manyong et al., 2006; Chianu et al., 2007). In constructing the logit model (Greene, 2000), it was assumed that the probability of being poor is determined by an underlying response variable that captures the true economic status of an individual household. Let T be the observed poverty status of a household, which equals one if household is poor and zero otherwise, and T^* be a latent variable reflecting the combined effect of the explanatory variables inducing or reducing poverty. However, T^* is not observable and is related to the observed poverty status, T, as follows:

$$\begin{aligned} T^* &= \beta' X + \varepsilon \\ T &= T^* \text{ if } T^* > 0 \\ &= 0 \text{ if } T^* \le 0 \end{aligned} \qquad (1)$$

where X is a vector of explanatory variables, β is a vector of unknown parameters to be estimated, and ε is independently and normally distributed random error term. The probability that a given rural household is poor ($P(T=1)$) can be defined as:

$$\text{Prob}(T=1) = \Phi = \text{Prob}(\beta' X + \varepsilon > 0) = \frac{\exp(\beta' X)}{1+\exp(\beta' X)} \qquad (2)$$

The logistic regression model of poverty, in the form of the ratio of natural logarithm of the probability of being poor to the probability of being non-poor (i.e. log odds ratio), can thus be given as

$$\ln\left(\frac{\Phi}{1-\Phi}\right) = \beta' X + \varepsilon \qquad (3)$$

where Φ is the conditional probability of being poor. Finally, the marginal effect of a given explanatory variable j on the probability of being poor for household i is given by:

$$\frac{\partial \Phi_i}{\partial X_{ij}} = \Phi_i (1-\Phi_i)\beta_j \qquad (4)$$

The choice of variables that induce or reduce poverty was made based on theoretical and empirical work in this area.

Results and Discussion

Socioeconomic and farm characteristics of households

The demographic and farm characteristics play a key role in determining the livelihoods of rural people. On average the household had a low number of years of schooling (lower for female-headed households -3.5 years- compared to male-headed households -7 years); high dependency ratio (0.92); and very small landholdings (1.3 ha/household for 5.8 persons). Maize was grown by most of households (> 96%). Others were beans, sorghum, cassava, groundnut, cowpea, millet, and soybean. The common types of livestock assets were poultry (>87% of households) and small ruminants (>50%) that households can rely on in periods of scarcity. In summary the above characteristics are features of resource-poor households.

Perceived importance of Striga

Farmers ranked Striga as the first main constraint in the production of maize (93% of households). Others were stalk borer, storage insects, low and erratic rainfall, low soil fertility, and inadequate input supply. The importance of Striga was quantified through its perceived negative effect on maize productivity. The farmers would expect an average yield up to 1.8 tons/ha in a Striga-free field, 0.9 ton/ha in a

moderately infested field, and only 0.4 ton/ha in a highly infested field.

Food insecurity

A large proportion of households (>91%) declared experiencing food shortages. The proportion of food insecure households was highest in Bondo district (96%) for Nyanza and in Busia district (76%) for Western. Food shortage occurred every year. The duration of food shortage, another indicator of food insecurity was beyond a quarter, from February to June. This long period of food shortage projects the extent to which households are exposed to other risks such as the need to dispose assets as a coping strategy or stunting for children. Coping strategies to mitigate the negative effects for food shortage included to engage in petty trading (62% of households for Nyanza and 39% for Western), seek short-term off-farm employment (43.5% and 41%), rely on informal safety nets such as remittances from relatives (41% and 33%), dispose of household assets such as livestock (10% and 9.3%), and many other minor. However, most of households considered that these coping strategies were not effective.

Nutritional status of vulnerable groups

The above-perceived vulnerability from a qualitative analysis was confirmed by results from quantitative anthropometric measurements on children. The nutritional indicators for Nyanza indicated that many children (almost half) were underweight, were suffering from a chronic exposure to food shortages, and were experiencing wasting (Table 1). The similar results were found for Western province albeit at a lower level for prevalence of malnutrition. However, the proportion of children who experienced severe malnutrition was higher in Western compared to Nyanza.

Household income and determinants of poverty

The results showed that about 58% of the sample farmers were poor (Figure 1). Poverty was slightly higher in Western than in Nyanza and was more pervasive among female-headed households than male-headed households. Poverty differentials across provinces masked a lot of variation across districts (results not shown in this paper), even within the same province. The results confirm how inappropriate it would be to make generalizations about poverty based on broader geographical classifications. This is because poverty is a result of complex socio-economic, agro-ecological, and institutional and policy variables (Alene et al., 2007). The results from the logistic regression indicated that the model fitted the data well because chi-squared model test statistics were highly significant (Table 2). All the coefficients of the variables had the expected signs. Any additional child to a household, holding other factors constant, would raise the probability of being poor by 12%. The probability of being poor would increase with age at the rate of 0.3% per year and would be reduced by 1.3% for an additional year of schooling for the household head. Young farmers are open to new innovations and so for educated farmers (Adesina and Chianu, 2002; Manyong et al., 2006). Therefore, the above two factors could exert a positive effect on poverty reduction.

An additional hectare of land per capita would reduce the household's probability of being poor by 45%. In a low-capital intensive agriculture, land is the major factor of production (Bamire and Manyong, 2003). Therefore, household poverty is associated with little endowment in land. Further fragmentation of land due to increasing population pressure like that in western Kenya will worsen poverty, in the absence of agricultural intensification. The results show households owning more farm assets have lower probability of being poor, probably because assets contribute to the efficiency of farming systems (Okike et al., 2004).

A 10% increase in the share of off-farm income in total income would reduce the household's probability of being poor by about 34%. This implies that poverty reduction strategies must consider income-earning opportunities for rural households beyond farming. Each additional hectare of land under cash crops also would reduce the household's probability of being poor by over 28%. The result relating to the positive relationship between credit and poverty confirms that the poor depend on credit and, in essence, means that causality runs from poverty to credit.

The results show that adopters of hybrid maize have a 24% lower probability of being poor than non-adopter households. Agricultural technologies such as hybrid varieties and other yield-enhancing technologies improve the efficiency of the system, increase its productivity, and therefore would play a key role in poverty reduction.

Table 1. Nutritional status of children in Nyanza and Western provinces (n=number of children)

	Weight-for-height		Weight-for-age		Height-for-age	
	Nyanza	Western	Nyanza	Western	Nyanza	Western
n	327	404	346	413	338	408
Normal (%)	70.3	65.1	50.6	40.9	52.1	41.7
Mild malnutrition (%)	11.9	13.1	18.5	16.5	18.9	17.2
Moderate malnutrition (%)	7.0	7.7	10.4	15.5	10.7	15.7
Severe malnutrition (%)	10.7	14.1	20.5	27.1	17.8	25.5

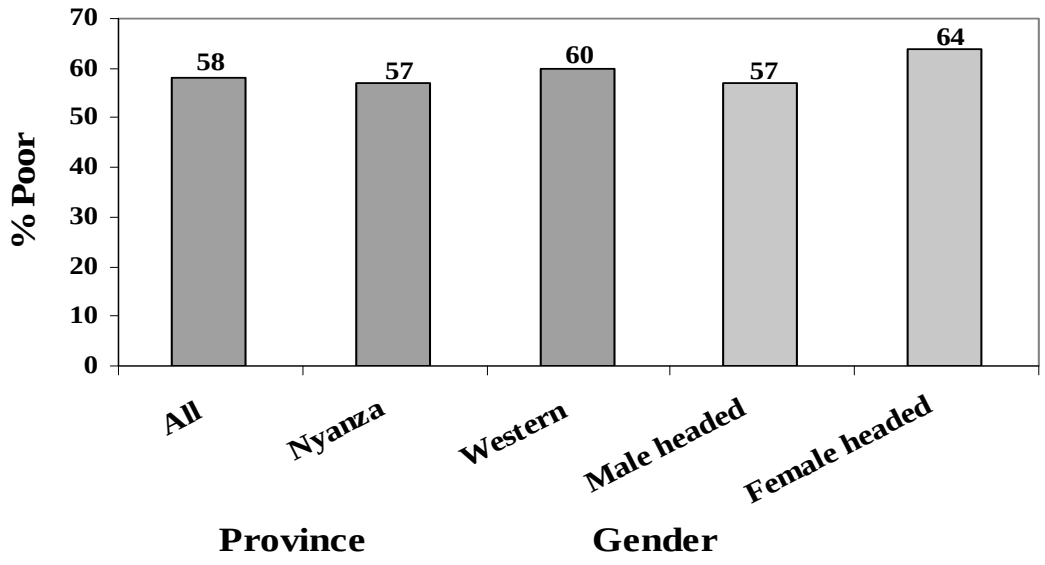

Figure 1. Poverty by province and by gender in western Kenya

Striga infestation has a significant influence on household poverty, implying that the longer Striga stays on a maize farm, the more likely the household is to be poor.

The result on Striga damage on maize yields, weighted by the share of maize in total household income, indicates that Striga damage has been more severe among households who derive much of their income from maize production. On the other hand, households who adopt integrated Striga control methods tend to have 15% lower probability of being poor.

In summary, results from the logistic model revealed characteristics of households that are more likely to be poor: poor access to land and farm assets; high dependency ratio; headed by older farmer with low education attainment; no off-farm work, no cash crops; depend on credit;.

Striga has been on the farm for long, high perceived yield loss to Striga given high dependency on maize for livelihoods; adopt no integrated Striga control options; and live in Bondo and Vihiga districts.

Table 2. Logit model estimates of the determinants of poverty in western Kenya(significant variables only)

Variables	Expected sign	Estimate	Marginal effect	% change in prob. of being poor
Constant		2.245**		
Human and social capital				
Dependency ratio (child/adult)	+	0.498***	0.120	12.0
Age (years)	+	0.012*	0.003	0.3
Education of household head (years)	-	-0.054**	-0.013	-1.3
Natural capital				
Land per capita (ha)	-	-1.862***	-0.447	-45.0
Physical capital				
Log of value of farm assets (Ksh)		-0.300*	-0.0722	-7.2
Financial capital				
Off-farm income share in total income	-	-1.395**	-0.335	-33.5
Land under cash crop (ha)	-	-1.168**	-0.280	-28.0
Credit (Yes=1, No=0)	+	0.862**	0.197	19.7
Technology				
Hybrid maize (adopter=1)	-	-0.987***	-0.241	-24.0
Striga damage (Risk)				
Years since Striga infested the maize farm	+	0.018**	0.004	0.4
Yield loss (%) × maize share in household income	+	0.065***	0.016	1.6
Striga control (Mitigation)				
Uprooting and burning (Yes=1)	-	-0.552*	-0.136	13.6
Location (relative to Bondo)				
Bungoma	-	-0.624*	-0.154	15.4
Goodness of fit tests:				
Hosmer-Lemeshow chi-squared (765)=880***				
Likelihood Ratio chi-squared (20)=244***				
Pseudo *R*-squared=0.23				
% of correct prediction=74				

Note: ***, significant at 0.01 level; **, significant at 0.05 level.

Conclusions and implications

Farmers in western Kenya are resource-poor and their livelihoods depend mostly on maize, which is being threatened by Striga. Through qualitative and quantitative assessments, this study revealed that households were highly vulnerable. Existing technological solutions to control Striga and farmers' coping strategies have not been capable of addressing the vulnerability issue successfully. Interventions to reduce poverty should address its root causes as derived from this study. Improving the education level of household members would allow the family unit to make the right choices about their livelihoods, including access to new technologies to control Striga, adoption of new varieties to enhance crop productivity, family planning to reduce the pressure on limited resources, etc. Creating opportunities for rural non-farm employment would absorb a big share of landless, thereby fostering diversification of income sources for the households. Diversification of the rural economy of western Kenya with high value and cash crops and modern fishing activities (proximity to Lake Victoria) can also contribute to poverty reduction. High priority should be given to interventions targeting Striga. There is a new Striga control technology, IR-Maize, that holds high potentials and that needs to be promoted massively. At the same time, it is important to increase the adoption of other existing modern Striga control technologies. The best approach would be to promote a package of integrated Striga control technologies from which smallholders

could choose on the basis of their particular circumstances.

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