academicJournals

Vol. 9(22), pp. 1721-1728, 29 May, 2014
DOI: 10.5897/AJAR2014.8617
Article Number:E287F3B44997
ISSN 1991-637X

http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Choice of alternative crop enterprises among smallholder tobacco farmers in Teso District, Kenya: A multinomial logit analysis

D. K. Mbaye*, J. K. Lagat and H. Kelvin Mulungu

Department of Agricultural Economics and Business Management Egerton University, P. O. Box 536-20115, Egerton Kenya.

Received 16 February, 2014; Accepted 15 May, 2014

The study analysed the factors affecting the choice of alternative crop enterprises among smallholder tobacco farmers in Teso district, Kenya, using Multinomial logit model. Data used for the study were obtained from primary sources through structured questionnaires using a multistage sampling technique from 150 farmers selected randomly. The results indicate that farmers are indeed reducing the acreage under tobacco and venturing into other alternative crops. This shift and the choice of the alternative gone into was found to be influenced positively by factors such as land size, experience, access to extension services and distance to market. Total asset value however negatively influenced the shift to other crops. However demographic factors such as age, education, household size and gender had no role in influencing the farmers' decision to shift to alternative crops. There is therefore need for more awareness on the hazards of tobacco cultivation and facilitation to other alternative crops through support of extension services, credit, market and identification of alternatives suitable to the area for the farmers.

Key words: Multinomial logit regression, World Health Organization Framework Convention on Tobacco Control (WHO FCTC), tobacco, alternative enterprise.

INTRODUCTION

Tobacco is a widely grown non-food cash crop in the world and is cultivated in more than 120 countries owing to its ability to grow in a wide range of climatic and soil conditions (Chavez et al., 2010). In Kenya, it is grown in three regions namely South Nyanza (Migori, Kuria and Homa Bay districts), Western (Bungoma, Bumula, Malakisi, Sirisia, Busia, Teso and Mount Elgon districts) and Eastern (Meru, Embu and Kirinyaga districts) mainly under contract farming. Tobacco is a controversial crop not only because of negative impact on health from smoking but also due to its environmental issues; soil degradation, deforestation and water pollution (Ochola and Kosura, 2007; Geist et al., 2009), and social issues such as low returns/income, women and child labour (WHO, 2008; Kibwage et al., 2009).

Agriculture is the key source of food and employment for population in Teso District. Tobacco is the principal cash crop (GoK, 2008) and it is solely the only short season cash crop apart from tradable food crops like maize that dictate the economic position of full time

*Corresponding author. E-mail: mkwatulira@gmail.com

small-scale farmers in the district (Ekisa, 2010). Lagat et al. (2006) found that tobacco was the most cultivated crop as indicated through the share of all cultivated land with Teso district. This could be the reason for the high food poverty incidences in the district at 49.4% (GoK, 2008), making the area food insecure.

There is a worldwide effort against tobacco growing and consumption. The World Health Organisation Framework Convention on Tobacco Control (WHO FCTC) aims at reducing tobacco production and ultimately reducing the consumption (WHO, 2005). The WHO FCTC was developed in response to the globalization of the tobacco epidemic and Article 17[1] requires signatories to provide support for economically viable alternative activities to tobacco farming. Farmers who depend on tobacco production for their livelihood will therefore need to find other alternative crops to produce. Despite the negative economic, social and environmental impacts associated with tobacco production (Ochola and Kosura, 2007; Patel et al., 2007; WHO, 2008; Geist et al., 2009; Kibwage et al., 2009), evidence suggests that land under tobacco has rapidly grown with new areas like the Rift Valley adopting the crop (Kibwage et al., 2009). This rapid growth is at the expense of food crops whose role is vital to food security and in essence undermines WHO FCTC efforts. Most research carried out in tobacco growing regions reveal that switching from tobacco to other enterprises is profitable. Research has shown that there are abundant opportunities to shift from tobacco farming to other crops (Ochola and Kosura, 2007; Patel et al., 2007; Kibwage et al., 2009; Magati et al., 2012).

Since ratifying the WHO FCTC, Kenya has supported the current global lobby on the reduction of production and consumption of tobacco through national legislation. The legislation intends, in part, to reduce tobacco production and consequently cigarette manufacture and consumption. The response by farmers who depend on tobacco production for their livelihood would be reflected by switching to alternative farm enterprises. However, it has not been evaluated whether the passage of legislation has trickled down to the extent that changes have occurred in the farm enterprise mix. Therefore, this study was done to determine the alternative enterprises replacing tobacco among smallholder farmers along with the factors influencing their choice in Teso District.

MATERIALS AND METHODS

Description of study area

This study was done in Teso district, Busia country in Western Kenya between June and July 2013. The district covers a total area of approximately 559 km^2 with a population of 338,833 and population density average of 385 per km^2. The altitude ranges from 1000 to 1500 m above sea level with mean minimum and maximum temperatures of 15 and 30°C, respectively. The district experiences bi-modal rainfall with mean annual rainfall of 1000 to 1500 mm. Agriculture is the main source of livelihood with border trade and *bodaboda*[2] trade also accounting for livelihood sustenance. Land in most parts is suitable for crop production and major crops produced include cassava, maize, sorghum, finger millet, maize, groundnuts among others whilst sugarcane and tobacco are the dominant cash crops.

Data and sampling technique

A random sample of 150 tobacco farmers in the study area was selected, using multi-stage sampling procedure. The district was purposively selected as it is the poorest, especially food poverty, in the region and environmental degradation due to tobacco cultivation has been experienced. Amukura and Chakol divisions were selected as the tobacco grown in the area requires a lot of wood fuel for curing raising environmental concerns on deforestation. Simple random sampling was then used to select 14 sub-locations and systematic random sampling was used to select a sample of 150 farmers from a list obtained from British American Tobacco-Kenya-BAT(K) and Mastermind Tobacco Kenya-MTK. Data collection involved individual personal interviews with selected farmers using a standard structured questionnaire since most of the farmers had low educational status. Notable data collected included farm specific characteristics including socio-economic characteristics of the selected farmers, size of land acquisition, distance of farm to market, crops cultivated, production, credit, extension, inputs and output and many other data relevant to the scope of study. Stata version 12 was used to estimate the model.

Analytical technique

Theoretical framework

Economic choice theory suggests that individuals are rational, and if faced with the decision to choose between two or more alternatives, will prefer the option that provides the maximum level of utility. Therefore, tobacco farmers are expected, given a choice of alternative crop enterprises, including tobacco in the initial, to make a decision as to which enterprise to engage into so that they maximise their utility. Therefore, the choice of a crop alternative that a tobacco farmer chooses is a utility maximisation problem. However, with the campaigns and education targeted at the farmers for them to reduce tobacco production, it is expected that the farmers would have understood the negative effects and known that the utility from tobacco is less compared to other crops. The messages that enlighten them on the health, environmental and social ills of tobacco if received as measure by the awareness of the farmers, are expected to help them in making a decision. Producers' uncertainty about future income from tobacco may induce them to look for alternative crop/livestock enterprises to replace tobacco.

So generally, against this backdrop, the choice or the adoption of a given coping mechanism or moving away from tobacco by households can be considered a function of the expected utility derived from using that enterprise. The utility function (Allison and Christakis, 1994; Layton, 2000) can be stated as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad for\ j \epsilon J_i \tag{1}$$

where U_{ij} is household *i*' is utility for adopting a given alternative

[1]The WHO FCTC treaty has different tobacco demand and supply reduction strategies contained in different articles. Article 17 specifies the provision of support for economically viable alternative activities.

[2] A motorcycle or bicycle taxi common in Western Kenya

enterprise *'j'*, V_{ij} is the deterministic component of utility for household *i* associated with adopting the alternative enterprise, and ε_{ij} is the error term associated with choosing the alternative (Train, 2003). It captures the factors that affect utility but cannot be observed, e.g. moods and other hidden perspectives.

Nevertheless, before thinking of the alternatives, the tobacco farmer must consider the options and tobacco. The potential of alternatives to replace tobacco can be evaluated by the utility the farmer get from tobacco (U_{iT}) and the utility from the alternatives (U_{ij}), and they can only replace tobacco. The difference between the two utilities (ϑ_j) can be represented as:

$$U_{ij} > U_{iT} or\ \vartheta_j = U_{ij} - U_{iT} \quad (2)$$

Farmers are faced with several potential alternatives to replace tobacco with several factors that will influence this decision. Generally, they include the attributes of the alternative and the farmer characteristics. The economic aspects like size of the farm, access to credit and other inputs are also going to influence this decision. The institutional factors, since tobacco is a crop with ready market under contract farming, are also going to affect the decision as the farmer compares the utility from tobacco and other crops.

Multinomial logit model

A multinomial logit model, based on the above theoretical framework was used to analyse what affects tobacco farmers' choice of alternative enterprises. Let *A* be a random variable representing the alternative enterprise chosen by any farming household *i*. We assume that each farmer faces a set of discrete, mutually exclusive choices of alternative enterprises. These enterprises are assumed to depend on a number of climate attributes, socioeconomic characteristics and other factors *x*. The probability of choosing alternative A_i among the J number of alternative enterprises and the set of explanatory variables x (Greene, 2012) was presented as:

$$\text{Prob}\ (A_i=j) = \frac{e^{\beta_j' x_i}}{\sum_{k=0}^{j} e^{\beta_k' x_i}},\ j=0,1,\ldots J \quad (3)$$

Where j is the alternatives that range from none to J and β is a vector of coefficients on each of the independent variables x. k is the number of categories into which the responds may fall. Equation (3) above can be normalized to remove indeterminacy in the model by assuming that β = 0 and the probabilities can be estimated as:

$$\text{Prob}\ (A_i=j|x_i) = \frac{e^{\beta_j' x_i}}{1+\sum_{k=0}^{j} e^{\beta_k' x_i}},\ j=0,2\ldots J, B_0=0 \quad (4)$$

and according to Hassan and Nhemacena (2008), Equation (4) can yield the alternative enterprises (J) J-log odds ratio as:

$$\ln\left(\frac{P_{ij}}{P_{ik}}\right) = x'\left(\beta_j - \beta_k\right) = x'\beta_j,\ \text{if } k=0 \quad (5)$$

The dependent variable is therefore the log of one alternative enterprise relative to the base enterprise. However, interpreting the coefficients can be misleading, and instead we get the marginal effects or quasi-elasticities, which indicate the percentage point change in p upon a 1% increase in x. Over all states, the probabilities sum to 1, and the derivatives and quasi-elasticities to 0. Like the derivatives, quasi-elasticities are invariant to the choice of the reference state, and they may change in sign and size when they are evaluated at different points (Cramer, 2003).

The elasticities are computed as:

$$\delta_j = \frac{\delta P_j}{\delta x_i} = P_j\left[\beta_j - \sum_{k=0}^{J} P_k \beta_k\right] = P_j(\beta_j - \bar{\beta}) \quad (6)$$

Where δ_j is the elasticity associated with alternative j, that is the change from the base enterprise to enterprise j, it is simply the coefficient associated with enterprise j minus the average of the coefficient, multiplied by the probability associated with enterprise j.

It was hypothesised that the tobacco farmers who have reduced the area under tobacco cultivation have diversified into other enterprises, which were listed according to the share of total cultivated area they occupy, and the crop enterprise occupying the largest share of area used as the alternative enterprise chosen by the farmer/household.

The log-likelihood can be derived by defining, for each individual, d_{ij} = 1 if alternative j is chosen by individual i, and 0 if not, for the J + 1 possible outcomes. Then, for each i, one and only one of the d_{ij}'s is 1. The log-likelihood is a generalization of that for the binomial probit or logit model (Greene, 2012):

$$\ln L = \sum_{i=1}^{n} \sum_{j=0}^{J} d_{ij} \ln \text{Prob}\ (Y_i=j|x_i) \quad (7)$$

and the derivatives take the simple form as:

$$\frac{\delta \ln L}{\delta x_j} = \sum_{i=1}^{n} \left(d_{ij} - P_{ij}\right) x_i \text{ for } j=1,\ldots,J \quad (8)$$

n being sample size. Two models were estimated using multinomial logit. In the first model, we estimate the factors influencing the choice of an alternative including tobacco in the choice set. The idea is to determine the probabilities associated with choosing other alternatives away from tobacco. In the second model, we drop the farmers who have continued to grow or expanded the area under tobacco and only use a sub-sample of those who have abandoned tobacco. In this way, we have removed tobacco from the choice set and we are able to determine what affects the choice of an enterprise to replace tobacco after the decision to stop growing tobacco has been made.

Empirical model

The variables and empirical model was specified as:

$$\text{choice} = \beta_0 + \beta_1 \text{age} + \beta_2 \text{gender} + \beta_3 \text{hsize} + \beta_4 \text{fsize} + \beta_5 \text{totalassetval} + \beta_6 \text{exprience} + \beta_7 \text{distmkt} + \beta_8 \text{accextn} \quad (9)$$

Getting from the theoretical framework and literature, several factors are attributed to influence the choice a farmer makes as to what enterprises to engage in. The age and gender of the farmer influences choice of enterprise in that younger farmers are perceived to be liberal in experimenting and venturing into the possible alternatives facing them while older farmers are conservative. Age is also linked to experience (years engaging in a certain enterprise), that is, the older a farmer is the more experienced. The farm size (acres) also influences choice as the bigger the farm the more varied the choices facing a farmer and the same applies to household size especially in provision of labour. Distance to the market, access to extension services and total asset value especially in agricultural assets such as land, hoes, ox-ploughs, sprayer pumps and wheelbarrows; also contribute to the choice of enterprise a farmer engages in.

Table 1. Socio-economic characteristics of the farmers (Continuous).

Variable		Mean	t-value	p- value	Std Dev	Min	Max
Age	Reducers	44.7	-0.67	0.50	13.13	21	85
	Non-reducers	42.97			13.48	20	70
Household size	Reducers	5.59	0.13	0.90	1.45	1	9
	Non-reducers	5.63			2.14	1	10
Experience (Years)	Reducers	4.77	0.60	0.55	4.31	1	33
	Non-reducers	5.33			5.63	1	26
Land size	Reducers	2.77	0.89	0.37	1.94	0.5	10
	Non-reducers	2.88			1.65	0.5	7

Table 1. Socio-economic characteristics of the farmers (Discrete).

Characteristic	Reducers N=120		Non-reducers N=30		χ^2-value	Total 150	
	No.	Percent	No.	Percent		No.	Percent
Gender							
Male	116	96.67	30	100		146	97.33
Female	4	3.33	0	0	1.03	4	2.69
Division							
Amukura	60	50	20	66.67		80	53.33
Chakol	60	50	10	33.33	2.68	70	46.67
Education							
None	13	10.83	5	16.67		18	12
Primary	92	76.67	22	73.33		114	76
Secondary	14	11.67	3	10		17	11.33
Tertiary	1	0.83	0	0	1.03	1	0.67

RESULTS AND DISCUSSION

Socio-economic characteristics of the farmers

Since there were two groups, those who reduced or abandoned tobacco production to other alternative enterprises (reducers) and those who did not (non-reducers) a comparison of means was done in Table 1 using the student t-test for continuous variables at 5% confidence level.

The mean age of the reducers was approximately 45 years and that for the non-reducers was 43 years while the years of experience for both categories was 5 years with the least experience being 1 year since tobacco is an annual crop and farmers contracted may not renew the contract for the subsequent year. The average household size was approximately 6 persons whereas the average land size was approximately 3 acres indicating that majority of farmers are smallholder farmers with less than 5 acres of land. In some studies, large households and large farm sizes have been found to influence positively the uptake of more alternative agricultural practices through provision of factors of production (Ashenafi, 2007; Kibet et al., 2011).

In terms of gender (Table 2), male headed households were the majority with 97% while female headed households were only 3%. This difference can be attributed to the fact that women in the area, like in most of the Kenyan communities have neither rights to own agricultural production resources (especially land) nor power to make major decisions regarding agricultural production. The findings concur with that of

Table 3. Factors affecting enterprise chosen instead of tobacco.

Variables	Marginal effects (ME)				
	Maize	Cassava	Millet and sorghum	Vegetables	Rice and sugarcane
Log of total asset value	0.000**(0.000)	0.000*(0.000)	-0.000**(0.000)	0.000(0.000)	-0.000(0.000)
Household size	0.011(0.037)	-0.009(0.027)	-0.012(0.025)	-0.010(0.027)	0.011(0.027)
Distance to market for the alternative crop enterprise	0.009(0.010)	-0.015(0.012)	0.006**(0.003)	-0.010(0.010)	0.008***(0.003)
Access to extension services	-0.214(18.065)	0.061(3.551)	0.116(5.591)	0.184(2.366)	0.229(3.807)
Tobacco farming experience	0.013(0.015)	-0.016(0.016)	0.019**(0.007)	0.003(0.007)	-0.021(0.018)
Gender of household head	-0.144(0.341)	0.003(0.155)	0.038(0.222)	0.013(0.184)	0.062(0.526)
Age	-0.039(0.038)	0.030(0.024)	0.032(0.026)	0.031(0.024)	-0.050(0.031)
Land size	-0.143*(0.079)	-0.060(0.044)	0.249***(0.093)	-0.067(0.047)	0.045(0.062)
LR Chi (45) = 74.32					
P-value = 0.0039					

Standard errors in parentheses. *** ** * indicate significance at 99, 95 and 90% confidence level.

Kibet et al. (2011). The high labour requirement in tobacco production was also evidenced by the lack of any female among the non-reducers given that most female headed households were widowed.

The bulk of farmers having only attained primary or no education at all indicate the low levels of literacy in the district (Lagat et al., 2006; GoK, 2008) and also the inability of parents to take their children to secondary school which could be due to high poverty incidences of 59.5% according to GoK (2008). Education levels are said to influence choice to modern methods of production that need advanced skills unlike low levels of education which may leave the farmer with no choice than to practice traditional forms of production. The Chi square results revealed that there were no differences among the reducers and non-reducers in relation to gender, division and education level. This can be because of the homogeneity of the population which can be attributed to the fact that the farmers share same systems of production and are exposed to similar environment such as weather and institutional factors.

Econometric results

Table 3 shows the marginal effects results of the model. The reference for the model was the farmers who have not reduced tobacco production in the reference years. The model fits the data well as indicated by the Log-likelihood Ratio (LR) which is significant at $\alpha = 0.01$. This means that the model has strong explanatory power and variables included are jointly significant. The pseudo R-squared is also good though it may not be a very good measure of fit in multinomial cases (Greene, 2012).

Household size, age and gender of the household head, were not significant in determining what enterprise a farmer goes into. The sign of these coefficients are as expected and the fact that they are not significant seems to suggest that the household characteristics have little effect on the farmers' decision on the choice of enterprise (Kalineza et al., 1999). Distance to market was also positive for growing of rice and sugarcane with a slightly higher marginal effect significant at 99% confidence level. Given the bulkiness of sugarcane in marketing, the result is quite surprising. However, bearing in mind that the selling points for raw sugarcane are well distributed throughout the area through contracted farming that provides transportation to the millers, the likelihood of growing cane being positive is plausible as distance to market increased for other crops. The longer the distance to market for what a farmer considered an alternative, the higher was the probability of them growing sorghum and millet compared to continuing with tobacco. With an increase in distance to market of say 10%, the probability of growing millet and sorghum increases by 6%. Given millet and sorghum are like the second staple (Salasya et al., 2008; Gill, 2010) and they are less bulky crops, farmers far away from the market may resort to them after abandoning tobacco.

Land size was another major of the enterprise

Table 4. Factors that influence the choice of an enterprise.

Variables	Marginal effects (ME)			
	Maize	Millet and sorghum	Vegetables	Rice and sugarcane
Log of total asset value	0.285**(0.127)	-0.102(0.113)	0.167(0.109)	-0.143(0.113)
Household size	-0.014(0.028)	-0.024(0.026)	-0.008(0.028)	0.004(0.026)
Distance to market for alternative crop enterprise	-0.015(0.012)	0.007**(0.003)	-0.009(0.010)	0.008***(0.003)
Access to extension services	-0.004(0.084)	0.010(0.068)	0.145**(0.061)	0.204***(0.058)
Experience in tobacco farming	-0.018(0.016)	0.014*(0.007)	0.006(0.007)	-0.025(0.018)
Gender of household head	0.011(0.144)	0.013(0.206)	0.035(0.176)	0.068(0.480)
Age of household head	0.021(0.023)	0.045*(0.025)	0.022(0.024)	-0.028(0.028)
Farm size (in acres)	-0.106*(0.056)	0.047(0.038)	-0.071(0.051)	0.045(0.042)
LR = 68. 37				
P-value = 0.000				

Standard errors in parentheses. *** **, * indicate significance at 99, 95 and 90% confidence level, respectively.

that a farmer went into away from tobacco. For millet and sorghum, land size had a positive relationship that is significant at 1% significance level. With increase in land size by an acre, the probability of farmers preferring to grow millet and sorghum instead of tobacco increased by about 25%. This implies that large farm may enable households to allot their land to multiple cereal crops than small holders (Rehima et al., 2013). Previous studies indicated that land size positively affected type of crop, variety or agricultural enterprise that farmers engaged (Rahman, 2008; Hassan and Nhemacena, 2008; Ojo et al., 2013). The increased probability of growing millet and sorghum as land size increases could have more to do with the cultural attachment to the crops as they are favourite for *ugali*[3] and beer brewing among the Teso community (Salasya et al., 2008; Gill, 2010).

Choice of enterprise for reducers

A second estimation was done that used only the farmers that have reduced the area under tobacco production. In this model (Table 4), the reference or base category is the cassava, which is among the most common crop in the area. It also requires less investment with generally low management levels but can still do well. In estimating this model, the factors that influence the choice of an enterprise for farmers who have decided to reduce were determined. The difference with the first estimation is mainly in the exclusion of farmers who had not reduced the area under tobacco cultivation and hence the exclusion of tobacco among the alternatives. The Marginal effects are presented in Table 4.

Total asset value influenced positively the growing of maize away from cassava. With an increase in say 10% in the total asset value, the likelihood of a farmer who has reduced growing tobacco to opt for growing maize increased by about 28.5%. The assets that were measured included among them agricultural implements like ploughs. Similar findings with regards to asset position were also observed (Dilruba and Roy, 2012). Distance to market was another variable that was significantly influencing the choice of an enterprise after the farmer decides to reduce tobacco production. Millet and sorghum and rice and sugarcane were more likely to be the crops turned to after reducing area under tobacco as the distance to market increased for the farmer. Millet and sorghum could be benefiting due to them being not so bulky while for cane, it could be due to availability of market from the contracting millers operating in the area.

Advisory services through extension are very important in encouraging adoption of new technologies and encouraging farmers to diversify into other non-traditional crops (Kibet et al., 2011; Rehima et al., 2013). Farmers who had access to extension service were more likely to go into vegetables, rice, and sugarcane. It is therefore possible that the farmers who had no access to extension service did not consider growing them as they could have lacked the technical information needed in the management of these crops. Experience in tobacco growing, measured in years, had a significant influence on the choice of an enterprise at 90% confidence level. With a one-year increase in experience in growing tobacco, the preference for millet and sorghum compared to cassava increases by about 1.4%. This could still be explained by

[3] Dish of maize flour cooked with water to a dough like consistency

the importance of the cereals in the community.

In addition, experience is linked to age and thus the older farmers preferred the traditional crops that they are conversant with. The age of the farmer was also significant in influencing the choice of an enterprise. Aged farmers tended to prefer millet and sorghum to cassava, with an additional year increasing the probability of opting for cassava by about 4.5%. Dilruba and Roy (2012) indicated that aged farmers are less risky takers and hence after abandoning tobacco, prefer the more traditional millet and sorghum compared to these other crops.

CONCLUSION AND RECOMMENDATION

This study has shown that there is no significant difference in socio-economic characteristics and institutional characteristics between those who abandon tobacco production for other alternative enterprises and those who do not. That is, $p > 0.05$ for all the factors captured. Thus, tobacco reducers had no comparative advantage of taking up alternative enterprises other than tobacco over the non-reducers in terms of incentives and drivers of shifting to other alternatives facing them. The multinomial regression analysis suggests that farmers' years of experience, land size, access to extension, distance to market are statistically significant in determining the alternatives farmers go into after abandoning/reducing acreage under tobacco. It is therefore apparent that government should enforce legislation that will help farmers overtime to completely abandon tobacco production. Hence, suitable alternative crops should be identified according to the climate and soil type of the area. Provision of extension services is also paramount in equipping farmers with needed skills and so is making credit accessible to the farmers either in monetary terms or provision of inputs. Government should also facilitate the marketing of the farmers produce.

Conflict of Interests

The authors have not declared any conflict of interests.

ACKNOWLDEGEMENTS

This research was supported by the African Economic Research Consortium (AERC). The authors want to thank the anonymous reviewers and the journal editors for their valuable comments to improve the first version of the article.

REFERENCES

Allison PD, Christakis NA (1994). Logit Models for Sets of Ranked Items. Sociol. Methodol. 24:199-228. http://dx.doi.org/10.2307/270983

Ashenafi G (2007). Triticale crop and food security, and determinants influencing the adoption of triticale: Example from the Amhara Region, Ethiopia. Utilization of Diversity in Land Use Systems: Sustainable and Organic Approaches to Meet Human Needs, University of Kassel, Germany Tropentag, October 9-11, Witzenhausen.

Chavez MD, Berentsen PBM, Oude Lansink AGJM (2010). Creating a typology of tobacco farms according to determinants of diversification in Valle De Lerma (Salta-Argentina). Spanish J. Agric. Res. 8(2):460-471. http://dx.doi.org/10.5424/sjar/2010082-1201

Cramer JS (2003). Logit Models from Economics and Other Fields. Cambridge University Press, New York, pp. 106-125. http://dx.doi.org/10.1017/CBO9780511615412

Dilruba K, Roy BC (2012). Rural livelihood diversification in West Bengal: Determinants and constraints. Agric. Econ. Res. Rev. 25(1):115-124.

Ekisa GT (2010). Socio-economic and Cultural Aspects for Community Participation in Afforestation and Agroforestry Programmes: A Case Study of Teso District, Kenya. Available online at: www.forestrynepal.org/images/publication/ekisa_2010.pdf. Accessed on 16th November, 2012.

Geist H.J, Chang KT, Etges V, Abdallah JM (2009). Tobacco Growers at the Crossroads: Towards a Comparison of Diversification and Ecosystem Impacts. Land Use Policy, 26:1066-1079.http://dx.doi.org/10.1016/j.landusepol.2009.01.003

Gill TB (2010). Potential Adoption of Grain Amaranth Production in HIV/AIDS-Affected Rural Kenyan Communities. PhD Thesis, University of Florida. pp.109-112.

Government of Kenya (GoK)(2008). Teso District Development Plan 2008-2012. Government Printer, Nairobi.

Greene WH (2012). Econometric Analysis. Seventh edition. Prentice Hall, New Jersey. pp. 761-767. PMid: 22710466

Hassan R, Nhemacena C (2008). Determinants of African Farmers' Strategies for Adapting to Climate Change: Multinomial Choice Analysis. Afr. J. Agric. Res. 2(1):83-104.

Kalineza HM, Mdoe NS, Mlozi MR (1999). Factors Influencing Adoption of Soil Conservation Technologies in Tanzania: A Case Study of Gairo. Proceedings of FoA conference, 4:76-83.

Kibet N, Obare GA, Lagat JK (2011). The role of extraneous incentives and drivers in farm enterprise diversification: a study of passion-fruit (*Passiflora edulis*) Uptake in Uasin-Gishu County, Kenya. Asian J. Agric. Sci. 3(5):358-365.

Kibwage JK, Odondo AJ, Momanyi GM (2009). Assessment of livelihood assets and strategies among tobacco and non-tobacco growing households in South Nyanza region, Kenya. Afr. J. Agric. Res. 4(4):294-304.

Lagat JK, Wambua T, Owuor G (2006). An impact assessment of tobacco growing in Kenya. A Report Submitted to BAT Kenya.

Layton DF (2000). random coefficient models for stated preference Surveys. J. Environ. Econ. Manage. 40:21-36. http://dx.doi.org/10.1006/jeem.1999.1104

Magati OP, Kibwage JK, Omondi SG Ruigu G, Omwansa W (2012). A cost-benefit analysis of substituting bamboo for tobacco: A case study of smallholder tobacco farmers in South Nyanza, Kenya. Sci. J. Agric. Res. Manage. 2012: pp. 204-209.

Ochola S, Kosura W (2007). Case study on tobacco cultivation and possible alternative crops Kenya. Study conducted as a technical document for the first meeting of the ad hoc study group on alternative crops established by the conference of the parties to the WHO framework convention on tobacco control (February, 2007).

Ojo MA, Nmadu JN, Tanko L, Olaleye RS (2013). Multinomial logit analysis of factors affecting the choice of enterprise among small-holder yam and cassava farmers in Niger State, Nig. J. Agric. Sci. 4(1):7-12.

Patel P, Collin J, Gilmore AB (2007). The law was actually drafted by us but the government is to be congratulated on its actions": British American Tobacco and Public Policy in Kenya. Tobacco Control, 16(1):1-8. http://dx.doi.org/10.1136/tc.2006.016071

Rahman S (2008). Determinants of crop choices by Bangladeshi Farmers: A Bivariate Probit Analysis. Asian J. Agric. Develop.

5(1):29-42.
Rehima M, Belay K, Dawit A, Rashid S (2013). Factors affecting farmers' crops diversification: Evidence from SNNPR, Ethiopia. Int. J. Agric. Sci. 3(6):558-565.
Salasya B, Oduori C, Ambitsi N, Onyango E, Oucho P, Lumuli J (2008). A study on the status of finger millet production in Western Kenya paper presented for socio-economics, policy and Biometrics Session of the 11th KARI Biennial Scientific Conference, KARI headquarters, Nairobi, 10–14 November. pp: 1-11.
Train EK (2003). Discrete choice methods with simulation. Cambridge University Press, Cambridge, United Kingdom. http://dx.doi.org/10.1017/CBO9780511753930
World Health Organization (WHO) (2005). World Health Organization, WHO Framework Convention on Tobacco Control. WHO, Geneva.
World Health Organization (WHO) (2008). Study Group on Economically Sustainable Alternatives to Tobacco Growing (in Relation to Articles 17 And 18 of the Convention): Provisional Agenda Item 4.8 (FCTC/COP/3/11). WHO, Geneva.