Determinants of Farmers' Preferences for Communal Spraying for Trypanosomiasis Control among Smallholder Dairy Cattle Farms in Busia County, Kenya

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Abstract

Trypanosomosis is the single most important disease constraining the expansion of livestock in Kenya. Several technologies have been developed to ameliorate the effects of the disease. However, the delivery of these technologies to farmers has been undertaken on trial and error basis without a proper strategy leading to more failures than success and wastage of scarce resources. The main objective of this study was to estimate determinants of preferences for communal spraying for trypanosomosis control among smallholder cattle farmers in Busia County, Kenya. Cross–sectional survey design was adopted and data collected from a sample of 217 respondents using structured questionnaires and analyzed using descriptive and inferential statistical analysis. Age, experience, and milk income were found to be significant determinants of preference for communal spraying among semi –zero grazers. Experience and expenditure on spraying were on the other hand significant factors determining preference for communal spraying among zero grazers. There is need to develop T&T technologies which are attractive to all age groups. Strategies to boost milk income should be pursued as this would encourage home spraying for T&T control. Kenya's policy of promoting farming as a business is supported by these findings. Home spraying requires knowledge and skills and therefore farmers need to be properly trained for effectiveness. Agricultural extension service is needed to augment farmers' experience.

Keywords: *Communal spraying, trypanosomiasis, preference, zero and semi-zero grazing.*

Introduction

Trypanosomiasis is a major constraint to the expansion and production of livestock and their products on approximately 10 million km^2 of land in Africa south of the Sahara (FAO, 2000). In Kenya, about 25% of the total land area is infested with tsetse flies and therefore endemic for tsetse-transmitted trypanosomiasis. Trypanosomiasis interferes with people's livelihoods through loss of subsistence, particularly proteins, and incomes. It also limits agriculture through under-utilization of agricultural land and loss of traction and manure; as infected animals are too weak to be used in draught ploughing. Mochabo et al. (2005) and Mugalla (2000) have noted that trypanosomiasis is one of the most researched diseases in Africa, and this has led to development of an array of technologies to ameliorate the effects of the disease. These technologies include the use of chemotherapeutic and chemoprophylactic drugs; tsetse control using targets, traps and insecticidal pour-ons and or sprays; and the rearing of livestock resistant to trypanosomiasis.

Currently, the promotion of various technologies for adoption by farmers is being undertaken on *ad hoc* basis. This has raised questions with regard to sustainability of several trypanosomiasis control programs initiated in various parts of the country. The current study hypothesizes that the low success rate in uptake communal spraying for trypanosomiasis control is due to the lack of a clearly formulated strategy to promote its uptake. There is limited information particularly on determinants of smallholder farmers' preferences for communal spraying for trypanosomiasis control in different dairy production systems in Kenya. This study aimed at estimating determinants of farmer preferences for communal spraying for trypanosomosis control.

Methodology

Study area

The study was conducted in Busia County which is located in Western Kenya. The County was purposively selected because it is a tsetse endemic zone and local communities have been engaged in education and tsetse and Trypanosomosis control programs including sensitization and promotion of the zero-grazing nets and community based crush pens for spraying cattle. The County falls in the sugarcane-belt, with maize and cotton production being important enterprises (Jaetzold and Schmidt, 1983). Cattle rearing is also undertaken with dairying gaining importance. Cattle breeds kept include local Zebu and improved dairy of various crosses (Friesian, Ayrshire, and Guernsey). The study area is located within the Lake Victoria basin tsetse belt. The highest points in this area are at about 1500m above sea level, located in Samia and Teso hills. This area receives between 1270 - 1790mm of rainfall annually with slight spatial variation (Jaetzold and Schmidt 1983). The rainfall amount generally decreases from north to south with a reliability of more than 66%. The maximum monthly rainfall falls between April and May.

This study employed a cross –sectional survey design. This was preferred because it is efficient in collecting large amounts of information within a short time.

Sampling of respondents and data collection

Sampling of farmers was based on dairy production system. The main production systems considered in this study are zero grazing and semi-zero grazing. A list of all zero grazing farmers in Busia County was constructed with the assistance of Ministry of Livestock Development Staff and local leaders. Based on this list, farmers were selected from each study locations using a random procedure. Overall, 106 households were selected for zero grazing. Selection of semi-zero grazing farmers was based on the communal spraying crush pens. A list of all the crush pens was obtained from the Veterinary Department from which respondents were randomly selected. The number of households sampled per crush pen was depends on their membership. Overall, 111 households were sampled. The main data collection instrument for the study was a questionnaire. The questionnaire included such details as personal characteristics of the household head (such as age, sex, education), farm-specific characteristics (such as number and class of livestock owned, major livestock diseases, types of crops grown and their acreage, among others) and the nature and sources of trypanosomosis control technologies in particular and veterinary services in general utilized in the area.

Econometric approach

The consumer theory postulates that individuals derive satisfaction or utility from the consumption of goods and services (Varian, 1992). However, Lancaster (1966) argued that it is the attributes or characteristics of goods and services from which such utility is derived. Consumers will therefore make consumption decisions based on their perceptions of the degree of provision of those attributes by a good or service (Louviere, 1988; Reed *et al.*, 1991). Due to observational deficiencies on the part of the analyst arising from unobserved attributes and measurement errors, the analysis of consumer choice is cast in a random utility framework (Maddala, 1983). This framework models the probability that a consumer will choose a particular good or service from the choice set as a function of differences in utilities among alternatives as well as the attributes of the consumer (Ben-Akiva and Lerman, 1985). Because the consumer is rational, s/he is assumed to choose the alternative that maximizes his/her utility (Greene, 1990). On this basis, the observed choice is deemed to be the option that confers the consumers the highest utility.

Following Maddala (1983), suppose that a consumer faces m alternative choices.

Let U_i^* denote an underlying latent variable representing the indirect utility associated with the ith choice. The observed variables Y_i are defined as

$$Y_i = 1 \; if \; U_i^* = Max(U_1^*, U_2^*, , U_m^*)$$

…… (1)

Y_i = 0 Otherwise

Assuming that there are no ties in the selection, the following random utility model can be specified:

$U_i^* = V_i(X_i) + \varepsilon_i$ ……..…… ……. (2)

Where V_i is the deterministic component of the indirect utility function, X_i is the vector of attributes for the *ith* choice and $\underline{\varepsilon_i}$ is a vector of stochastic errors that captures unobserved variations in tastes and in the attributes of alternatives and other measurement errors. Assuming that the error term is independently and identically distributed with a Weibull distribution, the probability of choosing the *ith* alternative given the vector of attributes is given by the logit model (Maddala, 1983):

$$\Pr(Y_i = 1 | X) = \frac{e^{V_i}}{\sum_{j=1}^{m} e^{V_j}} \quad \text{(3)}$$

The assumption of a Weibull distribution for the errors ensures independence from irrelevant alternatives (IIA).

In most cases we consider the effects of both alternative- and consumer-specific attributes on the choice probability. If U_{tj}^* is the level of indirect utility for the t^{th} consumer making the j^{th} choice and Y_{tj} = 1 if the t^{th} consumer makes the j^{th} choice and Y_{tj} = 0 otherwise, then

$$U_{tj}^* = \alpha_j' X_t + \beta' Z_{tj} + \varepsilon_{ij} \quad \text{…… (4)}$$

where X_t are consumer-specific variables and Z_{tj} is the vector of the attributes of the j^{th} choice as perceived by the t^{th} consumer. The probability that the t^{th} consumer selects the j^{th} out of m alternatives is given by the following mixed multinomial logit:

$$P_{tj} = \Pr(Y_{tj} = 1) = \exp(\beta_j' X_t + \alpha' Z_{tj})$$

$$\sum_{k=1}^{m} \exp(\beta_k X_t + \alpha_k Z_{tk}) \quad (5)$$

where $\beta_1, \ldots, \beta_m$ and $\alpha_1, \ldots, \alpha_m$ are alternative- and consumer-specific coefficients respectively.

Equation (5) was used to evaluate the impacts of both farmer and technology-specific attributes on the choice probability. A multinomial logit model was fitted using computer software. The variables in the model are given in table 1.

Table 1: Description of Variables in the Empirical Model

Variable	Description
Choice	Dependent variable representing farm-er's preference for a particular technology. CHOICE=1 if the channel is chosen and 2 oth-erwise
Age	Age (years) of the household head
Sex	Sex of the household head. Coded as a dum-my variable: 0=female; 1=male
Education	Highest level of formal education attained by the household head. Coded as a categorical variable: 0=no formal education, 2=primary level, 3=post primary education
Cattle number	Number of cattle owned
Household Income	Household income in ksh

Experience	Experience of most important decision maker
Off farm income	Amount of off-farm income (Kenya shillings)
Present farm size	Total land size owned (acres)
Milk income	Income from milk in Ksh
Present grazing area	Area under pasture/fodder
Method expenditure	Amount of money spent on the technology in 12 months prior to the survey

Source: Author, 2012

Results and Discussion

The determinants of preferences for communal spraying among semi zero grazing farms are presented in table 2

Results show that age, experience, and milk income are important factors explaining preference for communal spraying among semi –zero grazers. There was a positive and significant relationship between communal spraying and the age of the respondents at 1 percent. An increment in age of respondents is expected to lead to an increase of log of odds of preference for communal spraying.

Table 2: Determinants of Preference for Communal Spraying Among Semi-Zero Grazing Farmers

Variable	Coefficient	Std. Error	z value	Pr(>|z|)
Age	0.078	0.029	2.682	0.00732 **
Male	-22.310	3014	-0.007	0.99409
Female	-22.150	3014	-0.007	0.99414
Adult Literacy	3.555	4900	0.001	0.99942
Primary education	20.350	3014	0.007	0.99461
Secondary education	19.620	3014	0.007	0.99481
College education	18.260	3014	0.006	0.99517
University education	2.464	4080	0.001	0.99952

Cattle number	0.044	0.124	0.354	0.72355
Income household	0.000	0.000	1.298	0.19431
Experience	-0.091	0.040	-2.25	0.02443 *
Farm size	0.046	0.118	0.39	0.69677
Income milk	0.001	0.006	-2.131	0.03307 *
Grazing area	-0.499	0.407	-1.224	0.22091
Expenditure	0.000	0.000	-1.267	0.20526

Signif. Codes: '*' 0.05 Null deviance: 152.49 on 110 degrees of freedom

Residual deviance: 86.53 on 95 degrees of freedom

Source: Author's Survey Data, 2012

The positive relationship implies that older people were more likely to prefer communal spraying than young people. This could be explained by the fact that communal spraying is less tedious and requires less energy and is therefore more attractive to older people. The relationship between milk income and preference for communal spraying among smallholder cattle farmers was found to be negative and significant at the 5 percent. An increase in income from milk and experience would lead to a decrease in the log of odds of communal spraying. The coefficient was negative implying that farmers with large milk income would not prefer communal spraying as opposed to those with low levels of milk income. This may be because those endowed with higher income can afford other technologies such as home spraying. This implies that T&T control methods should be tailored to different income levels of farmers.

Experience was significant and negative at 5 percent level. The results indicated that an increase in the number of years in dairy farming would lead to a decrease in the likelihood of a farmer preferring communal spraying. That implies that farmers with experience were less likely to prefer communal spraying compared to other methods Communal crush pens should be retained for farmers with limited experience and low milk incomes.

Results in Table 3 show that, at five per cent level of significance, experience and expenditure on spraying were significant factors determining preference for communal spraying among zero grazers.

Table 3: Determinants of Preference for Communal Spraying among Zero Grazing Farmers

Variable	Coefficient	Std. Error	z value	Pr(>|z|)
Age	-0.131	0.108	-1.214	0.225
Male	-3.661	7.870	-0.465	0.642
Female	-3.245	7.404	-0.438	0.661
Adult literacy	-19.450	17810	-0.001	0.999
Primary education	-1.813	4.200	-0.432	0.666
Secondary education	-33.540	6824	-0.005	0.996
College education	-43.460	3968	-0.011	0.991
University education	3.415	5.569	-0.613	0.540
Cattle number	0.856	0.928	0.922	0.356
Income household	-0.002	0.002	-1.447	0.148
Experience	-0.528	0.260	-2.033	0.0420 *
Farm size	1.096	0.617	1.778	0.0755
Income milk	0.007	0.004	1.850	0.0643
Grazing area	-1.271	1.022	-1.244	0.214
Expenditure	-0.006	0.003	-2.017	0.0437 *

Signif. Codes: '*' indicate significant at 0.05 Null deviance: 140.016 on 101 degrees of freedom

Residual deviance: 18.274 on 86 degrees of freedom

Source: Author's Survey Data, 2012

Experience was significant and negative at 5 percent. The results indicated that an increase in the number of years in dairy farming would lead to a decrease in the likelihood of a farmer preferring communal spraying. That implies that experienced farmers were less likely to prefer communal spraying. Expenditure was significant and negative at 5 percent. The results indicated that an increase in the expenditure in communal spraying would

lead to a decrease in the likelihood of a farmer preferring communal spraying.
Farmers who practice zero grazing are expected to spray their cows at home. Those who are less experienced may use communal spraying which requires less expertise. As they become experienced and master the intricacies of dairying, they may adopt other T&T control methods. Expenditure on communal spraying has negative sign implying that expenditure/cost would lead to a decrease in the likelihood of a farmer preferring communal spraying as expected. This finding points to the necessity of developing affordable/low-cost T&T control methods for sustainable T&T control.

Conclusion

Age, experience, and milk income were found to be significant determinants of preference for communal spraying among semi –zero grazers. Experience and expenditure on spraying were on the other hand significant factors determining preference for communal spraying among zero grazers.

Recommendations

There is need to develop T&T technologies which are attractive to all age groups. Young people should be involved in T&T control. The results point to the need to promote dairying as a business where returns cover farmers' investment costs. Strategies to boost milk income should be pursued as this would encourage home spraying for T&T control. Kenya's policy of promoting farming as a business is supported by these findings. Home spraying requires knowledge and skills and therefore farmers need to be properly trained for effectiveness. Agricultural extension service is needed to augment farmers' experience.

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