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Using Logistic Regression to Characterise Communal Cattle Farmers in Botswana

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ABSTRACT

This paper aims to characterise and profile subsistence cattle farmers according to selected attributes to establish their influence on the type of cattle breed kept by farmers in Botswana. The development of communal cattle production can be a sustainable way to improve the livelihoods of the rural population in Botswana. However, there needs to be more information or research conducted to characterise and profile communal cattle farmers with a precondition that the farmers can keep any of the three breeds (Tswana, Cross, or Exotic). A logistic regression model was fitted to determine the influence of 11 predictor variables on the type of cattle breed kept by the farmers. Results revealed that female-headed households were 50% more likely to have the Tswana breed of cattle than male-headed households. In contrast, female-headed households were 30% less likely to have cross-breed or exotic-breed cattle than male-headed households. Results further show that resource-poor farmers tend to keep Tswana breed cattle. These are holdings with no farm labour, no other economic activities, female-headed households, and their primary source of income specified as "other".

Keywords: Cross-breed, Exotic breed, Tswana breed, Odds ratio, Subsistence farming

1. INTRODUCTION

Botswana is a semi-arid and landlocked country located in southern Africa. It shares borders with Namibia, South Africa, Zambia, and Zimbabwe. Botswana's mean annual rainfall varies from a maximum of 650 mm in the Northern part (Kasane) to a minimum of less than 250mm

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in the Southern region (Tsabong) (Ministry of Environment, 2011). The semi-arid climate makes crop production risky. Therefore, most farmers practice livestock farming. About 36.1% of the population in Botswana lives in the rural parts of the country (Statistics Botswana, 2018), where agricultural production is the principal economic activity that sustains the livelihoods of rural households. About 70% of rural households derive their livelihoods from agriculture through subsistence farming (Seanama Conservation Consultancy, 2012). Thus, the need for rural development to improve agricultural productivity cannot be overemphasised. For instance, according to Garwi (2022), smallholder agriculture has been promoted as a key driver for rural development in Chipinge rural district in Zimbabwe. Livestock production is a significant component of rural agriculture in southern Africa (Moorosi *et al.*, 2001; Schwalbach *et al.*, 2002; Tavirimirwa *et al.*, 2013; Malusi *et al.*, 2022; Garwi, 2022). For generations, livestock has played a key role in rural subsistence farming in Botswana. In Botswana, the agricultural sector is dominated by subsistence farmers who make up 85% of the farming population (Mrema, 2004). Cattle farming dominates the agricultural sector's contribution to the Gross Domestic Product (GDP) (Mosalagae & Mogotsi, 2013; Statistics Botswana, 2019). The agricultural sector's contribution to the GDP has declined from 40% at the time of independence (1966) to 2.0% in 2018 (Statistics Botswana, 2019). This decrease is attributed to erratic rainfalls, recurring droughts, and the discovery of diamonds in 1967 (Debswana, 2007).

The livestock sector in Botswana is characterised by two land tenure systems: communal and commercial farming. Communal grazing (open-access grazing lands referred to as cattle posts) accounts for 86% of the national cattle herd, and 71% of Botswana farmers use open-access grazing lands for their herds. In comparison, private grazing in ranches (fenced system) accounts for 14% of the cattle, with 29% of farmers on private grazing fenced ranches (Mahabile *et al.*, 2005; Mosalagae & Mogotsi, 2013). This paper aims to characterise and profile subsistence cattle farmers according to various attributes to establish their influence on the type of cattle breed kept by farmers in Botswana. The development of communal cattle production can be a sustainable way to improve the livelihoods of the rural population in Botswana. However, there is little information or research conducted to characterise and profile communal cattle farmers with a precondition that the farmers can keep any of the three breeds. This is corroborated by Uchendu *et al.* (2021) research on demographic profiling and the characterisation of cattle and cattle farmers in Botswana. Uchendu *et al.* (2021) cited that most

published data on Botswana's cattle population neither represents the demographics of cattle and cattle ownership nor captures political or gender factors that affect cattle farming. These authors demonstrated the need to characterise and profile communal cattle farmers before any intervention, as the general perception that these farmers are similar is incorrect (Schwalbach *et al.*, 2002).

This paper is divided into four sections. The first section provides an introduction to the study. The second section presents the materials and methods, which covers and explains the sampling method and procedure. The third section provides the study results and discussion. This section is concerned with characterising the study's household heads and agricultural holders. A logistic regression model was fitted to determine the influence of 11 explanatory variables on the type of cattle breeds (Tswana, Cross, or Exotic) kept by the farmers. The last section is the conclusion which summarises the findings of the study. It entails how the farmers are characterised and profiled in the study.

2. MATERIALS AND METHODS

Agricultural surveys are conducted once a year in Botswana, where 255 enumeration areas (EAs) are selected from a total of 1202 EAs. This study focused on the 2012 annual agricultural survey data collected from 246 EAs that were enumerated. Approximately 94% of the farmers were sampled. A detailed questionnaire consisting of 65 questions was administered by trained personnel in face-to-face interviews. The questionnaire was made up of three forms: Form I was used to list all the dwellings in the rural areas of Botswana, including large villages. It contained information on agricultural activities. Agricultural holdings were identified from the listed dwelling units. Form II covered questions on demographic characteristics of household members, particulars of the holding and holder, and particulars about the ownership of land. Form III covered livestock owned, crop production, water supply, farm equipment, machinery inventory, and farm enterprise (Statistics Botswana, 2012).

The sampling frame was such that there was implicit stratification according to rural ecological zones, namely villages, lands, and cattle-post. Implicit stratification is a multi-stage geographic technique combining systematic and stratified sampling elements for each stratum to be represented. The implicit stratification was undertaken so that all agricultural districts became their own strata. The implicit stratification was expected to increase precision and improve data accuracy. The enumeration areas were listed in independent subgroups (i) village, (ii) lands,

and (iii) cattle posts in each agricultural district. Of the 255 EAs selected for the survey, 119 were allocated to the village stratum, while 83 and 53 were allocated to lands and cattle-post strata, respectively (Statistics Botswana, 2012).

A stratified two-stage probability sample design was used to select subsistence agricultural holdings for the sample. The first stage entailed selecting enumeration areas (EAs) as primary sampling units (PSUs). The EAs or PSUs were chosen with probability proportional to the measure of size (PPS) (Statistics Botswana, 2012).

The data set consists of 1904 agricultural holdings, four of which were not used when fitting a model because of missing values. The respondents did not provide information on some of the questions asked. The response variable is the type of cattle breed kept by farmers. The predictor variables are gender, educational level, age of the household head, household size, marital status, farming status, source of income for the holding, other economic activities undertaken, the awareness level of farming programs, beneficiation from farming programs, and use of farm labour. A unit of study was a holding, and the respondent was an agricultural holder or a person responsible for the day-to-day operations of the holding and may not necessarily be the holding owner. The data in this study were analysed using Statistical Analysis System (SAS) Version 9.3 (SAS Institute, 2002-2010).

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistics

TABLE 1: Personal Characteristics of Household Heads

Variable	**Frequency (%)**
Gender	
Male	1309 (68.75)
Female	595 (31.25)
Educational level (highest attained)	
Illiterate	749 (39.34)
Primary	706 (37.08)
Secondary	449 (23.58)
Variable	**Measures of location/dispersion**
Age	

Mean	51.89
Median	53.00
Mode	65.00
Household size	
Mean	3.54
Median	3.00
Mode	1.00
Standard deviation	2.72

From Table 1 above, 68.75% of the household heads were males, indicating male dominance in cattle farming. The results of this study concur with those of Uchendu *et al.* (2021), who stated that there was more male than female cattle farmers in Botswana. Similarly, Olbrich *et al.* (2014) found that most principal decision-makers on farms in Namibia were males (94.7%), which also shows male dominance in the agricultural sector in Namibia. The reasons why men dominate the cattle farming sector may be attributed to the fact that few women own land due to cultural norms and practices, as indicated by Kalabamu (2006). In Botswana, women were largely excluded from land ownership during the pre-colonial era (Kalabamu, 2006). Traditionally, women were responsible for producing food crops and looking after goats and sheep, while men were responsible for cattle management and hunting (Kalabamu, 2001; Larsson, 1989; Larsson, 1990). Women could only access land through men - a father, husband, son, or paternal uncle (Kalabamu, 2006).

Only male siblings had the right to be allocated land from their fathers' holding, the tribal reserve, or to inherit it from their fathers (Schapera, 1994). Schapera (1994) revealed that women were excluded from grazing areas, including visiting cattle posts. According to Fosbrooke (1971a, 1971b), the government encouraged arable farmers (mostly women) to migrate permanently to their ploughing fields to boost food production. Kalabamu and Morolong (2004) reported that land boards and the government tolerated and condoned the self-allocation of arable fields in Botswana. Nearly two-fifths (39.34%) of household heads were illiterate, while 37.08% and 23.58% had primary and secondary school education. These results are consistent with a survey conducted on livestock production by Kunene and Fossey (2006) in South Africa, where more than half of the farmers had never attended school. A study in the Vhembe district, South Africa, revealed that about 18.81% of participants in irrigated

smallholder agricultural enterprises were completely illiterate, 27.84% had primary education, and 39.86% had secondary school education (Mavhungu *et al.*, 2021).

The current study has revealed that more than half (54.41%) of the household heads were aged 50 years and above in Botswana. The mean age of the household heads was 51.89 years, with a standard deviation of 18.34 years. A study by Mmopelwa and Seleka (2011) reported an average age of the household head of 58 years for communal cattle farmers in Botswana. The results are similar to the findings of Olbrich *et al.* (2014), whose study revealed differences amongst the age of farmers, with a mean age of 55.4 years and 4.3% of the farmers aged 35 years or younger in Namibia. The mean household size was found to be 3.54 people per holding, with a standard deviation of 2.72. The slight standard deviation of 2.72 people means that the number of people in each holding in the data set is close to the mean, on average. There is less variation in the number of people per household. This result is consistent with Mmopelwa and Seleka (2011) findings, who reported an average household size of four individuals for such holdings. Olbrich *et al.* (2014) reported similar results in a survey in Namibia, with an average household size estimated to be 3.7 members, with 38.2% of the households having two members. Kunene and Fossey (2006) reported that most households were headed by males (89.5%), with 75% of the households headed by females being widowed, and the rest had husbands who were migrant workers.

TABLE 2: Personal Characteristics of Agricultural Holders

Variable	Number of holders (%)
Marital Status	
Never married	264 (13.87)
Married	1045 (54.88)
Living together	170 (8.93)
Separated	14 (0.74)
Divorced	36 (1.89)
Widowed	375 (19.70)
Farming Status	
Full-time	1481 (77.78)
Part-time	423 (22.22)

Table 2 shows that more than half (54.88%) of the holders were married, followed by 19.70% who were widowed, and 13.87% who never married, which is consistent with an earlier study by Mmopelwa and Seleka (2011), where about 59% of the household heads were married. Oladele and Moilwa (2010) reported that a little over half (50.8%) of the farmers in Mahalapye, Botswana, were married. Most of the farmers (77.78%) were full-time farmers. Agricultural holders further engaged in other economic activities for income generation. In 2012, almost one in every five (18.32%) holders reported being engaged in other economic activities. Schwalbach *et al.* (2002) said that 77% of farmers engaged in other economic activities for commercial gain. Cash income from cattle farming activities was generally low, with three-quarters (75.4%) of farmers having income less than or equal to R1000 from cattle farming activities (Schwalbach *et al.*, 2002).

There were several possible sources of income for the holdings. Almost one in every five (18.54%) holdings reported the sale of livestock as their primary source of income, compared to 81.46% who reported "other" as their primary source. Abeygunawardena *et al.* (1997) cited that more than two-fifths (45%) of the cattle farmer's income came from selling the animals for meat, followed by the sale of milk (34%), manure (12%), and draught (9%). Through the Ministry of Agricultural Development and Food Security, the Government of Botswana introduced several farming programs aimed at stimulating agricultural output. The majority (95.96%) of the farmers indicated they were aware of the farming programs, with 19% of the farmers being aware of one farming programme, 29% of the farmers were aware of two farming programs, 23% of the farmers were aware of three farming programs, 13% were aware of four farming programs, and 12% were aware of five farming programs. Half (50.32%) of the farmers had benefited from the farming programs.

Although the agricultural sector is labour-intensive, only two-fifths (39.13%) of the holdings employed someone, either on a full-time or temporary basis, to work on the holding. The reason why 39.13% of the holdings employed someone to work on the farm may be attributed to the fact that most holdings rely on family members to work on the farm. Mdiya and Mdoda (2021) reported that 70% of the households were married and played a key role in providing family labour for households. Uchendu *et al.* (2021) indicated that family size translates directly to the available family workforce, with an average family size of four. The mean household size for our study was found to be 3.54 people per holding; hence only 39.13% of the holdings employed someone to work on the farm. Most farmers (70.85%) keep the indigenous Tswana

breed of cattle because of the adaptation to the local environment. In comparison, 40.60% and 13.66% keep the cross and exotic breeds of cattle, respectively. The Tswana breed, cross breed, and exotic breed of cattle constitute 33.63%, 57.82%, and 8.55% of this study's total cattle population.

3.2. Statistical Modelling

A logistic regression model was fitted to determine the influence of 11 explanatory variables (gender, age, and educational level of household head, household size, marital status of the holder, farming status of the holder, source of income for the holding, other economic activities undertaken in the holding, awareness level of farming programs, benefiting from farming programs, and the use of farm labour) on the type of cattle breed (Tswana, Crosses or Exotic) kept by the farmers. A logistic regression model was chosen because the response variable is dichotomous. The farmers can keep any type of the three breeds: coded as one if the farmer owns the breed and zero otherwise. Three logistic regression models were fitted for each type of breed. Logistic regression is an optimal method for analysing dichotomous dependent variables (Allison, 2012). We were modelling for the probability that the farmer keeps a particular type of breed. A few farmers in the study had at least two types of breeds, with Tswana breed being indigenous to Botswana. The logistic regression model is

$$logit(\pi_i) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + - - - - - - + \beta_{11} x_{ik}$$
$$for\ k = 11\ explanatory\ variables\ and\ i = 1,2,3, \ldots . 1904\ farmers$$

The parameter β_i refers to the effect of x_i on the log odds that $y = 1$ (we were modelling for the probability that the i^{th} farmer keeps a particular breed) controlling the other x_j. For example, exp (β_i) is the multiplicative effect on the odds of a 1-unit increase in x_i, at fixed levels of other x_j (Peng *et al.*, 2002, Agresti, 2002, Allison, 2012, Mdiya & Mdoda, 2021). The assumptions of a binary logistic model are:

- The true conditional probabilities are a logistic function of the explanatory variables (Midi *et al.*, 2010). Logistic regression requires that the explanatory variables are linearly related to the log odds.
- The response variable should be measured on a dichotomous scale.
- One or more predictor variables can be either continuous or categorical variables.

- The predictor variables are not linear combinations of each other. Logistic regression requires little or no multicollinearity among the independent variables.
- The observations are independent of each other. In other words, the observations should not come from repeated measurements or matched data (Gregory-Scheiber, 2018).

TABLE 3: Explanatory Variables and Their Levels

Variable	Levels
Gender	Female; male
Educational level	Illiterate; primary; secondary
Age of household head in years	
Household size (number of people who spent the night in the holding)	
Marital status	Never married; married; living together; separated; divorced; widowed
Farming status	Full-time farmer; part-time farmer
Source of income for the holding	Sale of livestock; other
Other economic activities undertaken in the holding	Yes; no
Awareness level of farming program	0,1,2,3,4 and 5 depending on the number of farming programs the holder was aware of
Benefiting from farming programs	Yes; no
Use of farm labour in the holding	Yes; no

3.3. Logistic Regression Results

Several diagnostics were used to check the goodness of fit of the fitted models. The p-values for the Likelihood ratio, Score, and Wald tests for the three models fitted for the different types of breeds were all significant at 5% level, which indicated that there was at least one explanatory variable in the models that was statistically significant, with an impact on the type of breed. The Receiver Operating Characteristic (ROC) curve value was 0.738 for the Tswana breed, 0.749 for the cross-breed and 0.774 for the exotic breed, indicating the model fit was fair for all three breeds. The p-value for the Deviance was significant for the Tswana breed and cross-bred, which signified that the model did not fit the data. In contrast, the Pearson goodness

of fit had a p-value greater than 0.05 for both Tswana breed and cross-bred, which means the fitted models were appropriate. Conversely, the p-values for both the Deviance and Pearson goodness of fit tests were insignificant, indicating that the fitted model was adequate for the exotic breed. Similarly, the Hosmer-Lemeshow goodness of fit tests had p-values greater than 0.05 for all three models, indicating the adequacy of the fitted models.

Males were set as the reference category to test gender differences amongst household heads (see Appendix 1). The odds of a female household head having a Tswana breed of cattle were 1.5 times that of a male household head. In other words, female-headed households were 50% more likely to have Tswana cattle breed than male-headed households. In contrast, the odds of a female household head having a cross-breed or exotic breed cattle was 0.7 times what it was for an identical male household head having a cross-breed or exotic breed cattle, so we can conclude that the male-headed households were more likely to have a cross breed or exotic breed of cattle, compared to the female-headed households with the same background. Same background refers to farmers with the same characteristics concerning other variables (that is, holding other variables constant), the only difference between them being gender.

The odds of a full-time holder having the exotic breed of cattle was found to be 0.8 times the odds of a part-time holder. Compared with a full-time holder, a part-time holder was consequently more likely to have the exotic breed cattle. This may be due to costs associated with maintaining exotic breeds. There was no significant difference between full-time and part-time holders concerning having Tswana breed or cross-breed cattle on their holdings. The odds of having Tswana breed cattle with no other economic activities undertaken was 1.3 times the odds of a holding with other economic activities. In other words, in comparison to a holding with other economic activities, a holding with no other economic activities undertaken was more likely to have the Tswana breed cattle.

Kunene *et al.* (2006) reported that many farmers in northern KwaZulu Natal in South Africa kept the local Nguni breed because of its disease resistance. These results are consistent with the findings of Amimo *et al.* (2011) in Western Kenya, who revealed that most farmers kept the indigenous Zebu breed because of the adaptation to the local environment and disease resistance. In a study conducted in South Africa, Malusi *et al.* (2022) cited that one of the advantages of rearing indigenous cattle breeds by communal farmers is that they can survive drought and cope with natural forages.

Alternatively, a holding with no other economic activities was less likely to have the exotic breed cattle. That is, the odds of a holding with no other economic activities having the exotic breed was 0.8 times that of a holding with other economic activities. This may be due to costs associated with maintaining exotic breeds. The holdings with other economic activities undertaken or not were not statistically different concerning having cross-breed cattle. The p-value was 0.065, indicating no significant difference amongst the holdings with or without economic activities undertaken having cross-breed cattle. This may explain why cross-breed cattle constitute the largest percentage (57.82%) of the total cattle population in the study.

For holdings whose primary source of income was the sale of livestock, the odds of having a Tswana breed of cattle was 0.6 times what the similar odds were for a holding with the main source of income specified as "other". In other words, a holding with the main source of income as a livestock sale was less likely to have a Tswana cattle breed than for a holding where there were "other" sources of income. In contrast, holdings with the main source of income as sale of livestock were more likely to keep cross-breed and exotic cattle breeds compared to holdings whose main source of income was "other". The odds of a holding with the main source of income as the sale of livestock having cross-breed cattle was 1.8 times that of a holding whose main source of income was "other". Furthermore, the odds of a holding with the main source of income as the sale of livestock having an exotic breed of cattle was 1.4 times the odds of a holding whose main source of income was "other". Kunene *et al.* (2006) cited that farmers kept the Brahman breed for meat production because of its large body and Jersey breed for high milk production. Amimo *et al.* (2011) reported that some cattle farmers kept cross-breed cattle for increased milk production, and a few kept exotic dairy breeds for higher milk yields.

On awareness of farming programs and the influence thereof on the cattle breed type kept by the holder, the logistic regression model revealed that the odds of a holder who was aware of five farming programs, having cross-breed cattle, was 2.5 times the odds of a holder who was not aware of any farming program having cross-breed cattle. Conversely, the odds of a holder who was aware of at most three farming programs having an exotic breed of cattle was found to be 0.4 times the odds of a holder who was not aware of any farming program. A holder who was aware of at most three farming programs was less likely to have exotic breeds compared to a holder who was unaware of any farming program. This is counterintuitive as one would expect the farmers to utilise farming programs to increase production. The variable awareness

of farming programs was not related to Tswana breed cattle, as none of the p-values was significant.

Compared with holdings with farm labour, holdings with no farm labour were more likely to keep Tswana breed cattle but less likely to keep cross-breed and exotic cattle breeds. The odds of a holding with no farm labour having Tswana breed cattle was 1.7 times that of a holding with farm labour having Tswana breed cattle. On the other hand, the odds of a holding with no farm labour having cross breed and exotic breed of cattle was 0.58 and 0.55 times the odds of a holding with farm labour having cross and exotic breeds, respectively. Nsoso and Rabasima (2004) reported that about 86% of beef cattle farmers in southern Botswana farmed under an extensive management system. These farmers use small inputs of labour, fertilisers, and capital. Cattle farming brings a modest income since labour which accounts for 89.2% of the cost, is supplied by the family unit at no cost (Abeygunawardena *et al.,* 1997; Mdiya & Mdoda, 2021; Uchendu *et al.,* 2021). The age and education level of the household head, household size, marital status of the holder, and beneficiation from the farming programs appeared to have no statistically significant effect on the type of breed kept by the farmers.

4. CONCLUSION

The paper aimed to characterise and profile subsistence cattle farmers according to selected attributes to establish their influence on the type of cattle breed kept by farmers in Botswana. Almost one in every five (18.54%) holdings reported the sale of livestock as their primary source of income, compared to 81.46% who reported “other” as their main source. The low cattle off-take makes it difficult for farmers to sustain their lives by selling cattle. Full-time holders and holdings with no other economic activities undertaken were less likely to have exotic breed cattle. This may be due to costs associated with maintaining exotic breeds. The holdings with no farm labour were more likely to keep Tswana breed cattle and less likely to keep cross-breed and exotic cattle breeds. The findings that we have presented suggest that low-income holders tend to keep Tswana breed cattle. These are female-headed households and the holdings with the main income as “other”, no farm labour, and no other economic activities. On the other hand, affluent farmers keep cross-breeds and can sustain their lives by selling cattle as a source of income.

Since 70% of rural households derive their livelihoods from agriculture (Seanama Conservation Consultancy, 2012), developing the cattle farming sector is imperative.

Botswana's government has initiated programs meant to assist farmers, but the programs are underutilised due to the high contributions required before the grants can be disbursed. A little over three-quarters (77%) of farmers are full-time holders who may not be able to pay the required high contributions. However, half (50.32%) of the farmers have benefited from such farming programs. The study has demonstrated the need to characterise and profile the communal cattle farmers before any intervention, as the general perception that these farmers are similar is incorrect. The results of this study are important for strategic planning initiatives in a developing Botswana, where agriculture forms a large part of the economy.

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APPENDIX 1: ODDS RATIO AND P-VALUE BY THE BREED TYPE

	Tswana		**Cross**		**Exotic**	
	OR	**P-value**	**OR**	**P-value**	**OR**	**P-value**
Gender (Reference: Male)		**<.0001**		**<.0001**		**0.0017**
Female	1.510	**<.0001**	0.714	**<.0001**	0.716	**0.0017**
Age	0.998	0.6641	0.997	0.3461	0.992	0.0951
Educational level (Reference: Secondary)		0.1232		0.3853		0.6905
Illiterate	1.189	0.0412	0.896	0.1707	0.910	0.3923
Primary	0.938	0.4079	1.044	0.5588	1.027	0.7916
H/hold size	0.999	0.9721	0.989	0.5973	0.992	0.8041
Marital status (Reference: Widowed)		0.9206		0.1149		0.2784
Divorced	0.821	0.5686	0.734	0.3656	0.954	0.9250
Living together	0.938	0.7562	0.961	0.8356	1.305	0.3663
Married	0.981	0.9002	1.262	0.0955	1.350	0.1861
Never married	1.065	0.7386	0.904	0.5633	0.871	0.6261
Separated	1.084	0.8869	1.368	0.5259	0.806	0.8115
Farming status (Reference: Part-time)		0.5046		0.8980		**0.0465**
Full-time	1.048	0.5046	1.009	0.8980	0.843	0.0465
Economic activities (Reference: Yes)		**0.0005**		0.0655		**0.0016**
No	1.272	**0.0005**	0.883	0.0655	0.772	**0.0016**

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Source of income (Reference: Other)		**<.0001**		**<.0001**		**<.0001**
Livestock	0.634	**<.0001**	1.805	**<.0001**	1.448	**<.0001**
Farming programs awareness (Reference: 0)		**0.0205**		**<.0001**		**0.0011**
Aware of 5 farming programs	0.709	0.2636	2.477	**0.0034**	0.678	0.2776
Aware of 4 farming programs	1.026	0.9330	1.465	0.2113	0.807	0.5473
Aware of 3 farming programs	0.986	0.9603	1.585	0.1134	0.386	**0.0066**
Aware of 2 farming programs	1.130	0.6762	1.229	0.4766	0.396	**0.0080**
Aware of 1 farming program	1.427	0.2394	0.958	0.8840	0.473	**0.0362**
Benefited (Reference: Yes)		0.0641		0.8330		0.7572
No	0.897	0.0641	0.988	0.8330	0.976	0.7572
Farm labour (Reference: Yes)		**<.0001**		**<.0001**		**<.0001**
No	1.670	**<.0001**	0.588	**<.0001**	0.552	**<.0001**

Boldfaced p-values indicate that the explanatory variables are significant at 0.05. The baseline category for each predictor variable is stated in the brackets and all odds ratios will be interpreted with reference to the baseline category.