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THE SOCIO-ECONOMIC FACTORS INFLUENCING HONEY PRODUCTION IN UGANDA

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ABSTRACT: *The study was conducted in Uganda in five districts of Lira, Kole, Nakasongola, Tororo, and Kabarole. A survey was conducted to establish the different socio-economic characteristics of bee-keeping farmers that influence the production of honey. A structured questionnaire was administered randomly to 218 beekeepers from the five districts and data analyzed using STATA 11. The results of STATA indicated four explanatory variables with P-values of <0.05 influencing honey production namely; bee keeping in income generation (P = 0.00, F = 6.6), types of hives kept per farmer (P = 0.00, F= 29.5), total number of hives kept per farmer (P = 0.00, F = 29.7) and number of hives colonized (P = 0.00, F = 13.2). Level of education, gender, age, beekeeping experience, market availability and training of bee keepers were not significant. Our results show that management of number of colonies corresponds to increase in honey production. These findings can support policy makers and beekeepers on honey production increase. We recommend bee keepers to match colony numbers to the resources available in their environment and maintain a minimum of 80 colonised bee hives. The country should promote the use of traditional bee hives and boost their production by making improvements on traditional bee hive construction.*

KEYWORDS: Bee Hives Type, Beekeeper, Environment, Honeybee Colony Management

INTRODUCTION

Bee keeping has been promoted worldwide as a major rural development engine with the bee products; honey, bees wax, propolis, pollen bee venom and royal jelly being of high socio-economic value (Krell, 1996). In Uganda, beekeeping has a substantial contribution towards employment and economy. It is easy and less expensive to operate than any other income generating activity. There is no need to purchase bee feeds as bees collect nectar and pollen from available sources of existing natural bee plants.

The bee hives used range from traditional to modern. The traditional/fixed comb bee hives are of various types depending on the location with locally available materials used for hive construction ranging from bamboo, palm tree logs, twigs to sticks. Two types of modern hives made from timber in use are: Kenya Top bar hive (KTB) and the Langstroth hive. The local bee hive usage is higher than modern bee hive usage and the local hives tend to be more colonized than modern hives (Kugonza and Nabakabya, 2008; Ndyomugyenyi et al., 2015).

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Only 2.7% of the total households in Uganda have been reported to own bee hives, with an estimated annual production of 2,600 tones (MAAIF/UBOS, 2010). The Northern sub region has the highest production while the Central sub region has the least production (MAAIF/UBOS, 2010). The colonization of hives is highest in Eastern (72.1%) and lowest in Karamoja Sub region (60%) (MAAIF/UBOS, 2010).

Apiculture contributes more to household income in Lira District in Northern Uganda compared to other livestock species (Mujuni et al., 2012). In Turkey where honey production has an important place, beekeeping is the main source of income for beekeepers who have more than 160 colonies (Vural and Karaman, 2010). Findings of Abere and Lameed, (2012) in Nigeria show that; beekeeping is the main occupation among 20% of the apiculturists while for 80% of the apiculturists beekeeping is a secondary occupation.

In turkey there was a parallel honey production increase between years 1936-2005 with increase in new type hive numbers; by 2005 the old type hives were 3.42% and new type hives 96.58% (Vural and Karaman, 2010). 1% increase in old type hives caused a decrease of 0.29% honey production and 1% increase in new type hives caused a 0.47% increase in honey production (Vural and Karaman, 2010). Beekeepers with less than 50 hives earn up to 34% of total income from beekeeping, whereas those with more than 100 bee hives earned up to 87.63% of total income from honey production (Vural and Karaman, 2010).

Most farmers in Western Uganda have a bee keeping experience of less than 6 years, with only 15% having a bee-keeping experience of over 16 years (Mujuni et al., 2012). The findings of Masuku (2013) in Swaziland, explain honey production by bee-keeping experience and colony size; an increase in beekeeping experience increases production of honey, 1% increase in beekeeping experience results in 0.41% increase in honey production. While 1% increase in colony size increases production of honey by 0.57%.

Lack of knowledge and skills and poor harvesting methods are reported as the major limitations to honey production (Ndyomugyenyi et al., 2015). Honey extraction methods such as boiling of honey combs, sun heating of combed honey were seen as result of a weak extension in Uganda (Kugonza and Nabakabya, 2008). In Kenya Musimba et al., (2001) reports that lack of extension contributes to low levels of production; only 5.2% of the respondents had been trained in modern beekeeping and traditional harvesting methods were the indicators.

Honey in Uganda has two markets; international and local. Uganda is one of the African countries exporting honey to the European Union (EU) market (CBI Market survey, 2009). The local market provides the largest market for honey in Uganda's shops and supermarkets, (Kugonza and Nabakabya, 2008). A national residue monitoring plan is implemented every year in Uganda by the department of livestock health and entomology so as to meet the export markets' requirements of a guaranteed supply of a certain quantity and quality (AAA business bulletin, 2015).

Despite the country's potential in beekeeping with her rich flora and ecological conditions, efforts to up-scale production levels through promotion of traditional bee hives that are cheaper; have not satisfied the growing international market for flavoured and organic honeys (CBI Market survey, 2009; TUNADO, 2012). It is estimated that Uganda has the capacity to produce 500,000 tons of honey per year (MAAIF/UBOS, 2010). The country's honey production has been increasing though at very low levels according to FAO statistics. The

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factors affecting honey quality and constraints of beekeepers in Uganda have been reported (Kajobe et al., 2009; Kalanzi et al., 2015; Kugonza and Nabakabya, 2008). A number of socio-economic characteristics of beekeepers influencing adoption of modern hives have been documented in other countries (Adgaba et al., 2014; Gebiso, 2015; Kalanzi et al., 2015). In Uganda, the socio-economic characteristics of the beekeepers affecting honey production remain fragmentary and needs to be understood. The goal of this study was therefore to determine the different socioeconomic factors of bee keepers under pinning honey production in Uganda and suggest solutions under which policy makers and bee keepers should operate in order to increase honey production.

MATERIALS AND METHODS

Study sites

Six cross-sectional surveys with both quantitative and qualitative parameter were conducted in five districts; Kabarole ($00^0$36'N, $30^0$18'E), Nakasongola ($01^0$18'N, $32^0$30'E), Tororo ($00^0$45'N, $34^0$05E), Lira ($2^0$20'N, $33^0$06') and Kole ($2^0$24'N, $32^0$48'E) in four agro ecological zones of Uganda. Kabarole represents the western highlands, Nakasongola the Lake Victoria crescent, Tororo the Kyoga plains while Lira and Kole represent the north eastern savannah grassland. The study districts were selected basing on the fact that they were good honey producing areas in their agro-ecological zones.

Study design

Two hundred and eighteen (218) beekeepers were randomly selected from the five districts in Uganda. A structured questionnaire was administered in an interview to determine the factors influencing the low production of honey. The instrument was pretested for validity on farmers of Usukuru Sub County to ensure that the questions answered the study objective.

Sample size and sampling strategy

$$s = \frac{x^2 N\rho(1-\rho)}{d^2(N-1) + x^2\rho(1-\rho)}$$

The sample size was determined using the mathematical tables and calculated using the formula by Krejcie and Morgan, (1970) and adopted by Kenya Projects Organization, (KENPRO 2015).

Where;

s = required sample size

x = z value (1.96 for 95% confidence level)

N= population size

ρ = Population proportion (expressed as a decimal) (assumed to be 0.5 (50%)

d = Degree of accuracy 5% expressed as a proportion (0.05) It is margin of error.

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Statistical analysis

Data was entered and analysed using STATA 11 (STATA corp USA). Descriptive statistical analysis and Analysis of Variance was done to measure the association of the socio-economic factors with honey production of bees.

RESULTS

Characteristics of the bee keepers

Results of analysis on the characteristics of the bee keepers show that across all the districts, 80.3% of the bee keepers were men and 19.7% women (Table 1). 61.4% of the sampled bee keepers were over 40 years of age. Majority of the sampled beekeepers (57.9%) kept two or more types of bee hives, 27.3% of the beekeepers had only traditional bee hives, 11.1% of the beekeepers had only top bar hives while 3.2% kept only langstroth bee hives. 64.8% of the bee keepers owned between 1-20 bee hives with the majority (82.9%) of the bee keepers having hives colonized (Table 1).

The demographics on the education level show that only 1.4% of the bee keepers had not undergone any formal education. 79.7% of the beekeepers had undergone trainings on aspects of honey production. 52.5% of the bee keepers had a bee keeping experience of between 1-5 years, while 19.6% had an experience of more than 10 years. 64.7% of the beekeepers had available markets for their honey, while 11.6% of the beekeepers did not know where to find markets. The ranking of beekeeping as an income generating activity was first in 15.3% of the beekeepers.

Factors that influence honey production

Out of the twelve explanatory variables compared, only four variables significantly influence honey production with P-values of <0.05 as shown in Table 2. These four variables included; ranking bee keeping in income generation, types of hives kept per farmer, total number of hives kept per farmer and number of hives colonized. Honey production was highest among farmers with honey production ranking as first position among the bee keeper's income generating activities. It's important to note that honey production was high among farmers keeping only traditional hives and those who kept more than one hive type as compared to modern bee hives. The production of honey increased with increasing number of hives kept and colonized per farmer up to 80 bee hives above which the production decreased. The following variables were not significant in influencing honey production: gender, age, education level, beekeeping experience, training in aspects of honey production and keeping records of the beekeeping enterprise (see Table 2).

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Table 1: A summary of the socio-economic characteristics of respondents

Explanatory Variable	Category	Frequency	Percentage
Education level	None	3	1.4
	Primary school	80	37.2
	Secondary school	87	40.5
	Tertiary institutions	45	20.9
Gender	Male	175	80.3
	Female	43	19.7
Age	15-30	30	13.9
	31-40	45	20.8
	41-60	98	45.4
	above 60	43	19.9
District of origin	Nakasongola	70	32.1
	Lira	20	9.2
	Tororo	49	22.5
	Kabarole	39	17.9
	Kole	40	18.3
Ranking of honey production in income generation	1st position	18	15.3
	2nd position	33	28
	3rd position	36	30.5
	4th position	18	15.3
	5th position	13	11
Beekeeping Experience in Years	1-5 years	94	52.5
	6-10 years	50	27.9
	more than 10 years	35	19.6
Types of hives kept per farmer	Traditional hives only	59	27.3
	Top bar hives only	24	11.1
	Langstroth beehives only	7	3.2
	More than one hive type	125	57.9
Total number of hives kept per farmer	1-20	140	64.8
	21-40	49	22.7
	41-60	11	5.1
	60-80	6	2.8
	81-100	5	2.3
	>100	5	2.3
Number of colonised hives per farmer	1-20	179	82.9
	21-40	25	11.6
	41-60	4	1.9
	60-80	4	1.9
	81-100	2	0.9
	>100	2	0.9
Trained on aspects of honey production	Trained	173	79.7
	Not trained	44	20.3
Market Availability	Yes	134	64.7
	No	49	23.7
	Don't know	24	11.6

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Table 2: Potential factors that influence honey production. (P = P values; F = F values)

Explanatory variable	Category	Means of Quantity of honey produced (Kg)	F	P
Education level	None	44.3	1.6	0.18
	Primary	88.6		
	Secondary	82.7		
	Tertiary	393		
Gender	Male	176	1.14	0.29
	Female	43.4		
Age	15-30	55.3	1.12	0.35
	31-40	342		
	41-60	82.9		
	> 60	173		
District	Nakasongola	263	1.06	0.38
	Lira	158		
	Tororo	12.2		
	Kabarole	209		
	Kole	60.4		
Ranking of bee keeping in income generation	1st position	1041	6.64	**0.00**
	2nd position	120		
	3rd position	92.6		
	4th position	40.1		
	5th position	91.2		
Beekeeping Experience in Years	≤ 5 years	49.2	2.38	0.07
	6-10 years	304		
	> 10 years	328		
Types of hives kept per farmer	Traditional hives only	138	29.5	**0.00**
	Top bar hives only	14.0		
	Langstroth beehives only	77.6		
	2 or more hive types	104		
Total number of hives kept per farmer	1-20	53.2	29.7	**0.00**
	21-40	76.6		
	41-60	158		
	60-80	960		
	81-100	299		
	>100	504		
Number of hives colonised	1-20	54.3	13.2	**0.00**
	21-40	143		
	41-60	465		
	60-80	1345		
	81-100	340		
	>100	750		
Trained on aspects of honey production	Trained	173	0.45	0.64
	Not trained	56.8		
Market Availability	Yes	218	1.02	0.38
	No	56.1		
	Don't Know	2.54		
Beekeepers with Records	Yes	266	2.22	0.11
	No	56.1		

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DISCUSSION

This was the first study to report socio-economic factors that could be influencing production of honey in Uganda. In this study, only four of the eleven potential factors assessed were observed to be significantly associated with honey production. These included; ranking of bee keeping in income generation, types of hives kept per farmer, total number of hives kept per farmer and number of hives colonized. Similar findings have been reported in other studies (Masuku, 2013; Musimba, 2001; Vural and Karaman, 2010). In Swaziland, Masaku (2013) reported an increase in honey production with increased bee-keeping experience and colony size. This agrees with our findings that show increase in the number of colonies corresponding to increase in honey production when the numbers of bee hives are up to 80. This could be due to the carrying capacity or the maximum number of honeybee colonies that can be supported by the flowering plants in a given area without affecting the production potential of individual honeybee colonies. The increase in honey production could have been due to plenty of nectar sources available to fewer colonies and the decline in honey yield that was observed when a bee keeper had more than 80 bee colonies can be attributed to scarcity of bee forages and over stocking of the bee colonies above the carrying capacity of the available bee forages.

Our findings on bee keeping experience disagree with Masaku, (2013) who reported that increased beekeeping experience increased honey production. This was probably because in this study, a small number of colonised hives were kept by the experienced beekeepers unlike in the case of (Masaku, 2013).

Our results suggest that beekeepers with only traditional hives produce more honey than those keeping the modern hives either Kenya Top Bar or langstroth bee hives only this agrees with Kalanzi et al., (2015) studies that reported on honey production in western Uganda being highly dependent on the use of traditional bee hives. This could be explained by the continued use of traditional beekeeping methods in the management of modern hives. These findings are not in agreement with studies in Ethiopia where the average honey productivity of modern hives was higher than local hives and Kenya top bar hives (Beyene and Verschuur, 2014; Gebiso, 2015; Haftom and Awet, 2013). Vural and Karaman, (2010) in Turkey reported a parallel honey production increase between years 1936-2005 with increase in new type of hive numbers.

The ranking of beekeeping in income generation of a farmer strongly influencing honey production agrees with studies of Vural and Karaman, (2010). The explanation to this could be that farmers whose main occupation is bee keeping have more colonized beehives and spend more time managing their apiaries.

The findings of this study have revealed that beekeeping trainings received by farmers in Uganda are not translated to honey production. This could be probably due to laxity by the farmers in applying the knowledge they received during training since 79.7% of the beekeepers had been trained on aspects of honey production. This finding does not concur with a similar study in Kenya by Musimba et al., (2001) where lack of extension contributed to low levels of production. The number of male farmers was predominantly high compared to the females. This finding concurs with the findings reported in studies by Mujuni et al., (2012) and Ndyomugyenyi et al., (2015), however the differences in gender did not significantly influence production of honey as previously reported in (Masuku, 2013).

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CONCLUSION

The country should up-scale honey production levels through efficient colony management; beekeepers should match the colony numbers to the resources available in their environment and maintain a minimum of 80 colonised bee hives; above which calls for establishment of perennial bee forage and need for alternative dry season feeds for the bees. Promotion of the use and improvement on traditional bee hive construction that are cheaper can increase honey yields.

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