

A STUDY OF THE EFFECTS OF HONEY THEFT AND BUSH BURNING ON APIARIES IN ADAMAWA STATE, NIGERIA

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ABSTRACT

This study determined the effects of honey theft and bush burning on apiaries in Adamawa State, Nigeria, using regression analysis on data collected from 80 apiaries in the year 2006. Eight explanatory variables (Number of beehives, Experience of apiarist, Level of education, Age of apiarist, Size of household, Type of beehives, Case of bush burning, and Case of honey theft) were fitted into the regression model to estimate the effects on income of apiarists as the dependent variable (Expected benefits of apiarists). Of the three functional forms estimated, double-log function was selected as the lead equation based on strength of the coefficient of determination (R^2), level of significance of the explanatory variables, and standard error of estimate and the signs of the coefficients. About 4.16% (N34, 377.82 or US\$ 264.44) and 8.55% (N70656.35 or US\$ 543.51) of the gross revenues of apiaries were approximated losses incurred from bush burning and honey theft, respectively, from the estimated model. While descriptive statistics showed that up to 40.64% of the total beehives used were vandalized through theft, bush burning affected about 21.84%. Apiarists suggested re-introduction of regular patrol by equipped forest guards (27.5%), enforcing bye-laws and stiff punitive measures for offenders (25.0%) and conducting awareness campaigns in the rural areas (21.3%), among others, as measures for checking the menace in the study area.

KEYWORDS: apiarists, burning, bush, honey, theft.

INTRODUCTION

Tackling global poverty in the context of the developing countries means improving the small-scale, and to a larger extent the medium scale, agricultural production through improved practices to reduce the tremendous reduction of yield losses. As these are multi-faceted problems, previous reports [1,2,3,4,5,6,7] indicated by successive studies, a several policies have been conducted and implemented by numerous experts and governments, respectively, towards addressing these agricultural issues with little effects.

In agriculture, losses could be encountered as a result of diseases, pests and parasites and natural factors like soil erosion, flood, drought and desertification, among many others. The extent of these constraints differs from crop to crop and locality to locality. However in recent years, beekeeping losses from honey theft and bush burning are severe in the tropical world, and Nigeria in particular.

Although honey hunting and bush burning have been in practice for ages, and reasonable efforts were put in place by the various governments both past and present to check these nefarious acts, these destructive actions still persist. Primarily, bush burning is for scouting for rats and other rodents, obtaining game by the locals, or farm clearing. Eventually the fire ends up in the apiaries. These incidences cause huge economic losses for the apiarists. It was reported [8, 9] that theft of honey and bush burning are now of global concern. Further, they are experienced more in developing nations where honey and bush meat hunting are prevalent. The practices are of significant economic importance because huge production losses may be involved. The practices also decrease the income of apiarists. Furthermore, quite a number of beehives may be lost and deforestation occurs as a result of continual removal of bee-flora, which in turn has a devastating effect on the honey flow. A recent survey [10] sought the opinions of both the rural and urban community farmers of Adamawa State in Nigeria as to their perceived constraints for adopting beekeeping as source of income. It was reported that about 56% of the respondents feared honey theft and vandalized beehives and/or their products. Due to these losses from honey theft and bush burning in Adamawa State, Nigeria, this study attempted to analyze the economic effects on beekeeping enterprises using regression analysis, hoping that ample information would be made available to policy makers in order to proffer some sustainable remedies taking account the apiarists' views.

MATERIALS AND METHODS

The study area was Adamawa State of Nigeria located between Latitudes 7° and 11° E of the Equator and between Longitudes 11° and 14° of the Greenwich Meridian. The State has an area of 42,159 square kilometers with a population of 3,194,781 [11].

Data Collection

Data for the study were collected from 80 apiarists in eight Local Government Areas (LGAs) in the State, through a stratified random sampling method. Ten apiarists were obtained from each LGA. The first stratum was made up of hobbyists i.e., apiarists owning 1-10 beehives in their apiaries, whereas the second stratum composed of apiarists owning from 11 and above beehives, also regarded as the commercial apiarists. This was done in order to provide a wide spread of data both from small-scale and large-scale apiaries. Five apiaries were drawn from each stratum. An interview schedule using a questionnaire was adopted in collecting primary data from apiarists in the 2006 production period by the forestry officers in charge of the respective LGAs in the area surveyed.

The Analytical Technique

The use of descriptive statistics and regression analysis were made in realizing the objectives. The choice of these tools of analyses was informed by the nature the cases of honey theft and bush burning take in the study area. For instance, the majority of the beehives were kept up in the trees with few pot/clay beehives placed on or beneath the ground. In event the fire in these apiaries, the excessive heat and smoke may compel the bees to abscond thereby leaving the beehives with only empty combs. The beehives rarely get burnt. Similarly, the honeybees may abscond as a result of the activities of honey theft which destroy both honeycombs and empty

combs. Few honeybees may get killed as the vandals use fire in most cases. However, these beehives may be re-occupied by another swarm of honeybees just immediately after the prior one absconds. The honeybees rebuild the combs and may store adequate honey depending on the period of the year and bee flora within the vicinity. This aspect therefore, makes it difficult to use investment analysis to appropriately capture the actual loss incurred. The use of a regression model in this case therefore, becomes relevant.

The function/model was specified implicitly as follows:

$$C = aX + U \dots\dots\dots (1)$$

Where:

C = the expected benefits of an apiarist personally
 derived from being on a hobbyist or commercial scale.

X = the included variables influencing the expected benefits

a = The vector of parameters

U = Random disturbance normally distributed

The C and X is substituted for convenience as below:

$$EBA = a_0 + a_1NOB + a_2EOA + a_3LOE + a_4AOA + a_5SOH + a_6TOB + a_7COB + a_8COT + U \dots\dots (2)$$

Where:

EBA = expected benefits from apiaries (Naira)

NOB = number of beehives (number)

EOA = Experience of apiarist (years)

LOE = Level of education: acquired formal education =1, otherwise = 0

AOA = Age of apiarist (years)

SOH = Size of household (number)

TOB = Type of beehives: modern (langstroth or top-bar) = 1, otherwise (traditional: log, straw etc.) = 0

COB = Case of bush burning: if yes = 1, otherwise = 0

COT = Case of honey theft: if yes = 1, otherwise = 0

a = Vector of parameter

U = Random disturbances normally distributed

RESULTS

Table 1: Cumulative Proceeds Accrued to the two Categories of Apiaries, Number of Apiaries Affected and those not Affected by Honey Theft and Bush Burning in Adamawa State, Nigeria.

Category of Apiaries	Accrued Proceeds	Frequency of Affected Apiaries		Frequency of Apiaries not Affected.	Total
		Apiaries Affected by Honey Theft	Apiaries Affected by Bush Burning		
	(₦)*	Apiaries Affected by Honey Theft	Apiaries Affected by Bush Burning	Apiaries Affected by Honey Theft and Bush burning	
• Large Scale /Commercial (11 and above beehives)	731,970.00 (88.57)	11(36.67)	8(66.67)	11(68.75)	45(56.25)
• Small Scale/Hobbyists (1-10 beehives)	94,420.00 (11.43)	19(63.33)	4(33.33)	5(31.25)	35(43.75)
TOTAL	826,390.00 (100)	30(100)	12(100)	16(100)	80(100)

Note: Values in parentheses are percentage of the total in each category.

Naira(₦)* 130 = US\$1

Source: Field survey, (2006).

Table II: Types of Beehives Used Between the two Categories of Apiarists in Adamawa State, Nigeria.

Type of Beehive	Category of Apiaries		Total
	Large scale/commercial (11 and above beehives)	Small scale /Hobbyist (1-10 beehives)	
• Tree-trunk/log	215(53.88)	596(67.50)	811(63.26)
• Waived straw	135(33.83)	179(20.27)	314(24.49)
• Clay/pot	25(6.27)	84(9.51)	105(8.51)
• Gourd/calabash	24(6.02)	20(2.27)	44(3.43)
• Kenya top-bar	-	4(0.45)	4(0.31)
TOTAL	399(100)	883(100)	1282(100)

Note: Values in Parentheses are Percentage of the total in each category

Source: Field survey, (2006).

Table III: Number of Beehives Affected and Those not Affected by Honey Theft/Vandalism and Bush Burning in Apiaries in Adamawa State, Nigeria.

Types of Beehives	Number of Beehives Affected by Honey Theft/Vandalism	Number of Beehives Affected by Bush burning	Number of Beehives Affected by Honey theft and Bush burning	Number of Beehives not Affected at all.
Tree trunk/Log				
Waived Straw	394(75.62)	108(38.57)	113(66.86)	196(62.82)
Clay/Pot	89(17.08)	125(44.64)	37(21.89)	63(20.19)
Gourd/Calabash	24(4.61)	29(10.36)	16(9.47)	40(12.83)
Kenya top-bar	14(2.69)	18(6.43)	3(1.78)	9(2.88)
TOTAL	521(100)	280(100)	169(100)	312(100)

Note: Values in parentheses are percentage of the total
Source: Field survey, (2006).

Table IV: Regression Coefficients showing the Effects of Honey Theft and Bush Burning in Adamawa State, Nigeria.

Functional Form	Constant	NOB	EOA	LOE	AOA	SOH	TOB	COB	COT	R ²	R ² (Adj)	Std Err.	F-ratio
Linear	4009.66	641.47*** (21.96)	-277.89 (-0.91)	-2.63 (-0.02)	-132.75 (-1.63)	324 (0.02)	21.07 (.462)	-264.43** (-3.39)	-4692.73*** (-6.42)	.915	.905	2938.50	95.37***
Exponential	3.623	2.768E-02*** (15.66)	6.598E-02 (.354)	-2.159E-03 (-.845)	5.103E-02 (1.03)	9.051E-03 (1.10)	-4.142E-03 (-1.49)	-5.029E-02 (-1.10)	-.212*** (-4.80)	.832	.814	.17901	44.11***
Double-log / Cobb Douglas	3.046	1.006*** (40.15)	.121** (3.16)	-8.743E-02 (-.944)	6.287E-03 (.643)	3.874E-02 (.917)	-1.120E-02 (-.314)	-4.169E-02*** (-4.35)	-8.553E-02*** (-4.35)	.971	.968	.07385	302.40***

Note: Values in Parentheses are t-ratios

** : Significant at P<0.01

***: Significant at P<0.001

Source: Field Survey, (2006).

Table V*: Suggestions by Apiarists on How to check Honey Theft and Bush Burning in Adamawa State, Nigeria.

Suggestion/Opinion	Frequency of Apiarists	Percentage of Total Apiarists
• Effective Bye-Laws/Stiff Punitive Measures for offenders	20	25.00
• Equip Forest Guards to perform regular Patrol	22	27.50
• Government Should conduct Awareness campaign on the Effects of Honey Theft and Bush Burning on Rural Economy	17	21.25
• Formation of Vigilante Groups to complement the efforts of forest Guards	13	16.25
• Government should introduce modern methods of Beekeeping	10	12.50
• Beekeepers should form Associations to pursue a common course	9	11.25
• No suggestion Offered	8	10.00

Note*: Multiple Responses were recorded
Source: Field Survey, (2006).

DISCUSSION

• Gross Revenue to Apiaries, Apiaries Affected and those not Affected by Honey Theft and Bush Burning in Adamawa State, Nigeria

It could be observed from Table I that about 56.25% of the apiaries fell within the large scale category and 43.75% accounting for the small-scale apiaries. Table I also shows that N826,390.00 was the gross revenue accrued to the two categories of apiaries in the 2006 cropping season. Of this amount, 88.57% was for the large-scale category, whereas only 11.43% accrued to the small-scale apiaries. Also indicated in Table I are apiaries affected by honey theft or vandalism, bush burning, the combination of the two incidences and those not affected at all in the study area. About 37.5% of all apiaries surveyed were affected through theft or vandalism of beehive crops. Out of this figure, 66.33% were in the small-scale apiaries, and 36.67% fell within the large-scale producers. Bush burning was said to have affected 15.0% of the total apiaries studied. While the large-scale category accounted for 66.67% of this value, 33.33% were found in the small-scale apiaries. The combined effects of honey theft and bush burning affected 20.0% of the total apiaries surveyed. Values of 68.75% and 31.25% of these combined incidences were for large and small-scales apiaries, respectively. Apiaries that were neither affected by honey theft nor bush burning accounted for 27.5%. About 68.18% and 31.82% of this value were estimates for large and small-scales apiaries, respectively.

From the above findings, it could be seen that honey theft or vandalism of beehive crops were more common in the apiaries of the study area. This further confirmed reports of two separate studies in Adamawa State [10, 12] where about 20.77% and 4.15% of the apiarists surveyed in 2002/2003 cropping season complained of bush burning and honey theft, respectively, and 35.0% of the respondents interviewed in 2005 could not adopt beekeeping for fear of vandalism of beehive crops.

• The Types of Beehives Used by Apiarists in the Study Area

There were five different types of beehives used in various apiaries by respondents in the area surveyed. These include tree-trunk or log, waived straw, clay or pot, gourds or calabash and Kenya top-bar beehives. The tree-trunk or log beehive was the most (63.26%) utilized. This was followed by the waived straw beehive with 24.49%. Clay or pot (8.51%), gourd or calabash (3.48%) and Kenya top-bar (0.31%) trailed in descending order (Table II). Similar finding was reported earlier in the study area [13]. However, the latest finding differs slightly in that a Kenya top-bar beehive was recorded. This improvement could be attributed to campaigns embark upon, although recently, towards embracing the use of low-technology method of beekeeping in the State.

• Number of Beehives Affected and those not Affected by Honey theft and Bush burning in the Area Surveyed

Given the gross number of 1282 beehives used among the 80 respondents surveyed, the mean of 16 beehives was said to be owned by an individual apiarist in the area. A larger proportion (40.64%) of these beehives was affected by honey theft alone. While about 21.84% and 13.18% were those beehives invaded by bush burning and the combined incidences of honey theft and bush burning, respectively, 24.34% of these beehives were those not affected by any of the two incidences at all. Tree-trunk or log beehives accounted for the majority (75.62%) affected by honey theft. Similarly, about 66.86% were the log beehives affected through the combined effects of honey theft and bush burning. The waived straw had the highest ((44.64%) proportion of the beehives affected by bush burning in the apiaries in Adamawa State; these are indicated in Table III. The highest percentage as affected beehives experienced in tree-trunk and waived straw stemmed from the fact they were the most populated in the area.

• **The Estimates of Effects of Honey theft and Bush burning on Apiaries in the Area Studied**

Table IV shows the regression coefficients indicating the effects of honey theft and bush burning on apiaries in Adamawa State. Three functional forms (linear, exponential, double-log) were applied. Of the three, the double-log or Cobb Douglas was selected as the lead equation based on the strength of the coefficient of determination (R^2), level of significance of the independent variables and the value (least) of standard error of estimate.

The R^2 value of .971 shows that 97.1% of the variation in income (gross revenue: expected benefits from apiaries-EBA) of apiaries in Adamawa State was jointly explained by the included variables namely number of beehives owned (NOB), experience Of apiarist (EOA), level of education of apiarist (LOE), age of apiarist (AOA), size of household (SOH), type of beehives owned (TOB), case of bush burning (COB) and case of honey theft (COT). Although eight variables were fitted into this model, the honey theft and bush burning coefficients worth more stressing in this analysis. However, the remaining six variables were adequately captured in studies earlier conducted in the area [14,15]. The coefficients of honey theft and bush burning were negative and both significant at $P < 0.001$, implying that the more these two activities in apiaries, the more the reduction in the benefits accruable to the apiarists. By implication, coefficients of – 4.163 and – 8.553 for case of bush burning and honey theft, respectively, indicate that 4.16% (N34,377.82) and 8.55% (N70,656.35) of the total benefits (N826,390.00) in the surveyed area were losses incurred as the result of bush burning and honey theft, respectively. It could be conveniently be stated that about N105, 034.17 was the cumulative loss experienced in Adamawa State due to these incidences. This magnitude of loss was considered quite enormous especially in a State where poverty has been so pronounced and the government is putting several policies towards empowering the less privileged in which the farmers constitute the majority.

Although coefficients of LOE and TOB also show negative signs, the variables were insignificant. However, coefficients of AOA, SOH, LOE and NOB have positive signs, with only NOB and EOA showing significant level of $P < 0.001$ and

$P < 0.01$, respectively. In other words, as the NOB and EOA increase, the EBA also increases. Also, similar finding was earlier reported by some scholars in the study area [14].

• **Suggestions by Apiarists towards Curtailing/Minimizing Bush burning and Honey theft in Adamawa State, Nigeria**

Apiarists were asked to suggest in their opinions how best these problems could be curtailed or eradicated in the area. These opinions are documented in Table V. The largest proportion (27.50%) of apiarists suggested equipping the forest guards to perform regular patrol in forests as what they consider the most viable remedy to bush burning and honey theft. Further investigations by the researchers showed that at the period of this study, forest guards were not on regular patrol. Also there were no vehicles given to them to ease movements. Above all, the forest guards were unauthorized to carry firearms. Collectively, these inadequacies made it absolutely difficult to effect arrest of culprits by the officers for sanctions, thereby increasing these nefarious activities in the area.

About 25.0% of the apiarists were of the view that making effective bye-laws and stiff punitive measures for offenders could drastically reduce bush burning and honey theft in Adamawa State. This was followed by 21.25% of the apiarists who felt that the government should massively embark upon conducting awareness campaigns on the effects of bush burning and honey theft on rural economy. Similarly, 16.25%, 12.50% and 11.25% suggested formation of vigilante groups to complement the efforts of forest guards, government should introduce modern methods of keeping bees, and formation of associations by apiarists to pursue a common course, respectively, as possible solutions to these unproductive practices in the surveyed area. Only about 10.0% of the apiarists could not offer any suggestion or opinion.

In addition to the various suitable suggestions put forward by the apiarists towards checking the practices of bush burning and honey theft, the researchers strongly endorsed the idea of empowerment of apiarists in the area through provision of soft or interest-free loans to enable them establish modern apiaries using low-technology beehives like the Kenya top-bar.

CONCLUSIONS

The incidences of bush burning and honey theft significantly reduced the benefits accruable to apiarists in Adamawa State, Nigeria. Although majority of the beehives used were of traditional make, there was a slight shift towards adoption of low-technology methods through the use of Kenya top-bar. Collectively, the government and the apiarists have vital roles to play in reducing bush burning and honey theft through proper legislative intervention and enforcement of laws of the land and economic empowerment of apiarists by the authorities concerned.

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