

**ASSESSMENT OF HONEY PRODUCTION UNDER BOX HIVE TECHNOLOGY IN  
SELECTED LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA**

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**ABSTRACT**

*This study was undertaken to assess honey production under box hive technology in Kaduna state, Nigeria". The specific objectives were socio economic characteristics, profitability of honey production, the resource use efficiency of honey production. A purposive sampling technique was used to purposively select 139 bee farmers from three local government areas namely, Giwa, Kagarko and Kachia. The data were analysed using descriptive statistics, Farm budgeting techniques, Cobb Douglas regression model and resource use efficiency ratio. Result revealed that majority of the bee farmers in the study area were male and within the age bracket of 40-49 years with a mean age of 44. The average household size was 6. About 60.4% of the bee farmers had no formal education, indicating that they are largely illiterates. The average years of farming experience was 15years. About 52.5% of the farmers had contact with extension agents, about 61% had 13 beehives on their farm land. The calculated net farm income of beekeeping in the study area was ₦13020415, also the returns to naira invested of 2.46 implies that for every ₦ 1 invested in bee farming , a profit of ₦ 1.46 was generated. The regression model shows the fitness of the model with an R<sup>2</sup> value of 0.6338. The results showed that the number of breed (bees) used was significant at 1%. The resource use efficiency ratio result revealed that labor, box hive were over utilized, land was under- utilized while the number of larvae was optimally utilized in the study area. Some of the problems encountered by bee farmers in the study area include pesticide and insecticide application close to the apiary, poor road network, theft, problem of securing agricultural loans and excess smoking. From the findings it was concluded that beekeeping is profitable in the study area and can serve as source of income to households. It is recommended that more extension agent should be trained on modern beekeeping so that they can disseminate beekeeping information to the farmers.*

**INTRODUCTION**

Beekeeping tends to be perceived as ‘a hobby’, or as ‘a sideline activity. Rather than just a hobby beekeeping may be seen as a meaningful enterprise which serve as an important occupation and part of rural life worldwide. It is a non-farm business activity which is environmentally friendly taken over by the farmers and landless people. Meaning it does not occupy cultivated land, requires lower investment and provides rapid economic benefits, beside it is a nonpolluting intensive agricultural practice. Apiculture is the management of honey bee colonies for pollination of plants and other products (Kenesa, 2018). Honey is the natural sweet substance produced by honeybees from the secretion of living plants. Honey production through beekeeping has been classified as one of the most profitable enterprises in many part of the world.

Honey production through beekeeping is becoming popular among small farmers in the recent years. Beekeeping plays a vital role as essential food for human being and serve as source of employment to rural community of the world. Beekeeping is an encouraging off-farm enterprise, which indirectly or directly contributes to smallholder’s income in particular and nation economy at large. For better understanding of the status of production of honey, income generating power

of the activity and marketing of honey, there is a need for reviewing economic impact of beekeeping activity in the country.

In spite of the potentials and fully sufficient resources for honey production and increased demand for honey, bee farmers are still living in abject poverty in Nigeria. In Nigeria adequate attention has not been given to profitability study. Most of the work done in beekeeping was centered on method of beekeeping (the traditional and modern methods) and the honey marketing. Sufficient work has not yet been carried out to explore the economics, profitability or losses so as to find out the root causes of bee farmers problems, and propose solutions. For the rural people in times of famine honey is perceived as one of the most convenient coping strategies available due to its ability to provide immediate energy and easy storage and yet no quick interest is shown by policy makers and economic planners to harness the technology. In Nigeria particularly, there is no clear-cut policy directed at the Central Government, Local Government or even communal levels to assess the contribution of income from the beekeeping interventions. Beekeeping for wealth creation has practically remained untapped in the country.

However most beekeepers are still independent on traditional method of honey production with little attention to the profitability and ease of honey production under box hive or modern means. Honey production sector is facing many stumbling block such as poorly developed domestic and international marketing system which is due to maintaining the quality of honey production, lack of appropriate research on beekeeping technologies and equipment, loss of total bee population due to high mortality, deforestation which reduces the availability of nesting sites, diseases from rapidly spreading bee parasites. Very little income is gotten from the beekeeping activity despite the potential of honey production and benefits of beekeeping. In view of the above, the study seeks to assess honey production under box hive technology in selected local government areas of Kaduna state, Nigeria. To achieve this, the study seeks to achieve the following objectives: describe the socio economic characteristics of beekeepers; examine the profitability of honey production in the study area; determine the factors influencing honey production of the beekeepers; examine the resource use efficiency of box hive technology of honey production and identify the constraints associated with honey production.

## METHODOLOGY

The study was conducted in Kaduna State, Nigeria. The state occupies a major position in the agricultural economy of Northern Nigeria. The State is situated between Latitudes 9° N, 12° N and Longitudes 7°E, 9° E. The population of the State is 26,086,217 million people (projected from National Population Commission to 2017). Kaduna State has a cultivable land area of 4.5 million hectares, most of which is in the Guinea Savannah and enjoys mean annual rainfall of about 1525 mm. Other crops grown in the State include; guinea corn, millet, maize, soybean, acha, cocoyam, rice, groundnut, sorghum, beans, cassava, potatoes, beniseed and sugarcane (Ahmed *et al.*, 2015). Southern Kaduna is made up of about 12 local governments which include: Jemaá, Jaba, Kaura, Kauru, Zango-Kataf, Kagarko, Kachia, Sanga, Kajuru, Chikun, Kaduna-South and Lere. With the respective populations: Economically, over 60% of the people engage in farming, hunting and trading. Although of the three, farming dominates the occupation practiced by the people includes: livestock rearing, food and cash crops which includes; Ginger, Soya beans, Maize, guinea corn, Millet, Cassava, Yam tubers, and acha among others. The rainfall is evenly distributed from the months of April to October with an average of 1,524mm. There are two marked seasons in the State, the Dry windy season and the Rainy (wet) Seasons.

The wet season is usually from April through October with great variations as you move North-Wards. On the average, the State enjoys a rainy season of about five months (KADP, 2017).

In order to obtain a sample size for this study, a multistage sampling techniques was adopted to select respondents for the study. The first stage involved random selection of three (3) LGAs, namely Giwa, Kagarko and Kachia. While the second stage the second stage involved random selection of two communities from each of the selected LGAs, this give a total of 6 (Hayin gada, kaya, Yakadawa, zonzon, Samaru and Zango) communities. In the third stage, Yamane formula was used to determine the sample size base on the sample frame gotten from Kaduna Agricultural Development Agency (KADA) in each communities.

**Yamane formula**

$$n = N/1+N(e)^2$$

n = sample size N = sample frames e = degree of tolerance (0.05)

A total of 139 beekeepers was used for this study, 23 beekeepers from Giwa, 55 beekeepers from Kagarko and 51 beekeepers in Kachia local governments respectively. Data were collected using a structured questionnaire complimented with interview schedule and analyzed using frequency distribution, percentages, mean, farm budgeting tools, Cobb Douglas and resource use efficiency ratio. A three point likert rating scale of Very Severe Constraint (VSC), Severe Constraint (SC) and Not a Severe Constraint (NSV) was used to identify the constraint associated with beekeeping in the study area. The mean score was obtained by adding 1 + 2 + 3 = 6 and dividing it by 3. The decision rule is that any mean ( $\bar{X}$ ) scores  $\geq 2.0$ , indicate Constraint while scores  $< 2.0$  indicate Not Constraint. Resource use efficiency ratio was used to examine the resource use efficiency of box hive technology on honey production which was specify as follows:

**Resource-use efficiency ratio**

$$r = MVP/MFC \text{ -----(11)}$$

Where:

MVP = Marginal value product

MFC = Marginal factor cost

r = Efficiency ratio

The MVP will be estimated as follows

$$MVP = MPP*Py \text{ -----(12)}$$

Where:

MPP = Marginal Physical Product

Py= Price of Output

The MPP will be estimated as follows

$$MPP = \frac{b\check{y}}{x} \text{ -----(13)}$$

Where;

b = Regression coefficient,

$\check{y}$  = Mean of output

x = Mean of input

Decision rule for the resources-use efficiency ratio represents the following:

If r = 1.....resource is optimally utilized

If r <I .....resource is under-utilized

If r > I.....resource is over-utilized

## RESULT AND DISCUSSION

### Socio economic characteristics of the respondent

#### Age

Majority of the respondents (64%) were within the age group of 40 – 49 years with a mean age of 44 years. This implies that most of the respondents were in their active age and can therefore; participate actively in the day to day running of their beekeeping enterprise. And can readily adopt new and better technologies for enhancing their beekeeping productivity. This is in line with Beatrice (2016) who reported that the modal age of beekeepers in Ekiti State was 31 – 40 years as indicated by 50% of the beekeepers and this in contrast with Labe (2017) who found out that the modal class of the bee farmers in Chibok Local Government Area of Borno State was 31 – 35 as indicated by 38% of the beekeeping farmers. The next category was 20.7 % of the respondents within the 40 – 49 years age bracket and this is also an economically active age group. Very few (1.4%) of the respondents were above the age of 59 years.

#### Gender

The result of the socio-economic characteristics as revealed that most of the sampled respondents in the study area were males. This implies that beekeeping in the study area is a male dominated farming activity and this could be as a result of lack of technical know-how on beekeeping by women in the study area. This result is in line with Beatrice (2016) who reported that all the beekeepers in Ekiti State were males noting that women might be scared away from the business because of the age long fear of being stung by bees. Also, Tijani *et al.* (2011), reported of the dominance of males in beekeeping in Borno State, Nigeria.

#### Beekeeping experience

Increase in beekeeping experiences leads to a better assessment of the important and complexities of good farming decision-making including efficient use of input. Majority (39.2%) of the respondents had 10 years and below of bee farming experience as shown in Table 4.1. This was closely followed by a bee farming experience of 11-20 years as indicated by 37.4% of the respondents in the study area. (23.4%) had been beekeeping experience above 20 years. This implies that bee farming is an age long farming activity in the study area with a mean of 15 years. This result is in contrast with Beatrice (2016) who reported that 75% of the beekeepers in Ekiti State had 1 – 5 years beekeeping experience suggesting that the beekeepers were relatively new in the business. However, this result is in contrast with the findings of Tijani *et al.* (2011) who found out that majority (40%) of the bee farmers in Chibok Local Government Area of Borno State had 16 – 20 years of beekeeping experience.

#### Number of box hives

The result of the distribution of the respondents based on the number of box hive used shows that 61% of the respondents have 11-20 hives, this means that the respondents in the study area have a mean of 13 hives. This implies that the box hive technology is a modern method of beekeeping so most of the bee farmers in the study area are at the early stage of adopting this method. This result agree with (Babatunde *et al.*, 2011).

**Table 1: Socioeconomic characteristics table**

Variables	Frequency	Percentage (%)	Mean
<b>Age(years)</b>			
below 30 years	6	4.3	44.00
30-39years	16	11.5	
40-49years	89	64.0	
Above 49years	28	20.1	
<b>Gender</b>			
Male	126	90.6	
Female	13	9.4	
<b>Marital status</b>			
Married	105	75.5	
Single	6	4.3	
Divorce	20	14.4	
Widow	8	5.8	
<b>Household size</b>			
5 and below	106	47.7	6persons
6-10people	91	41.0	
11-15people	24	10.8	
Above 15 people	1	0.5	

Source: field survey, 2021

### **Profitability of Beekeeping in the Study Area**

The result presented in Table 2 shows the costs and returns of beekeeping using Top Bar hive in the study area. The cost of labour constituted a larger proportion (39.8%) of the total cost of production incurred by the bee farmers. This is in line with Babatunde *et al.* (2011) who found that labour cost accounted for the largest share of total cost of bee production in Oyo State. The least (0.45%) was the cost of uncapping knives. From the fixed inputs employed in bee farming in the study area, the honey extractor on beehive constituted a higher cost than the cost of other fixed inputs. From the two cost components of the total cost of beekeeping incurred, the fixed cost component constituted majority of the total cost incurred in the beekeeping. The total cost of production was ₦ 27779285 from a total variable cost of ₦ 2969300 and a total fixed cost of ₦ 24809985. Product obtained from beekeeping in the study area is honey. The average honey output was 106 liters per annum and the unit price was ₦ 3000. The total revenue generated was ₦ 40,799,700. The calculated net farm income was ₦13,020,415 and this implies that beekeeping is profitable in the study area and has the potential of contributing immensely to the financial base of the farmers. The returns to naira invested of 2.46 implies that beekeeping was profitability in the study area. This agrees with Labe (2017) who found that the gross return per naira invested in beekeeping was 1.68. The return to naira invested of 2.46 implies that for every one naira invested in beekeeping in the study area, a profit of ₦ 1.46 is generated. It can be say that beekeeping in the study area is a viable investment option that can be exploited for job creation and income generation coupled with the high demand for beekeeping products especially honey. This study is in line with (Labe, 2017).

**Table 2: Cost and returns analysis**

Variables	Cost (₺)	Percentage (%)
<b><u>Variable Inputs</u></b>		
Cost of labor	1,180,900	39.8
Cost of baiting materials	623900	21.0
Cost of transportation	397500	13.4
Cost of packaging container	767000	25.8
<b>Sub-total</b>	<b>2,969,300</b>	<b>100.00</b>
<b><u>Fixed cost</u></b>		
beehive	2813000	11.3
honey extractor	13209000	53.2
hive stand	153100	0.6
smoker	1280800	5.2
uncapping knives	639,300	2.6
uncapping tray	5000	0.01
bee garment	2,251,500	9.1
rent	1222200	4.9
Depreciation	2157390	8.7
interest	1078695	4.3
<b>Sub-total</b>	<b>24,809,985</b>	<b>100-00</b>
<b>Total Cost of production</b>	<b>27,779,285</b>	
<b><u>Returns</u></b>		
<b>Honey sales</b>	<b>40,799,700</b>	<b>100-00</b>
<b>Gross margin</b>	<b>37,830,400</b>	
<b>Net farm Income</b>	<b>13,020,415</b>	
<b>Return to naira invested (TR/TC)</b>	<b>2.46</b>	

Source: field survey 2021

### Factors influencing honey production

Cobb Douglass regression analysis was used to determine the factors influencing honey production in the study area. From the regression analysis in Table 2, the semi log function was the lead equation based on the number of significant of explanatory variables, R-square ( $R^2$ ) and F-value. The F- value was found to be 19.11 at 1% level of significance indicating the goodness of fit of the model. The  $R^2$  value was 0.6338 which implies that about 63.38% variation in the dependent variable (honey output) was explained by the independent variables included in the model, while unaccounted 36.62% could be due to non-inclusion of some important explanatory variables and errors in estimation. The result indicates that, other things being equal, the higher the number of breed used by beekeepers, the higher the honey output. A 1% increase in the number of breed used will increase output of honey by 7.72%. This makes sense and suggests that the scope for increasing honey production depends on increased number of bees. Increase in land size will not lead to an increase in the honey production, this is because honey production does not require large land size for its production.

**Table 3 Regression analysis: Factors influencing honey production**

Explanatory value	Coefficient	t-value
Land	0.0170482	0.21
Labor	0.061287	1.31
No of breed/ larvae	0.4390402	7.72***
No of box hive	0.1424705	2.40
Constant	4.80366	13.71***
R-square (R <sup>2</sup> )	0.6338	
F- value	19.11	

**Source: Field survey2021**

**Resource use efficiency**

Table 3 shows the allocative efficiency of bee farmers in the study area. The ratios of the marginal value product (MVP) to marginal factor cost (MFC) shows that the land, labor, larvae and box hive inputs had values of 126560.4, 10513.95, 32655.88 and 28494.1 respectively. This result implies that within the limits of statistical error, none of the inputs were efficiently allocated by the bee farmers. However, the ratio of the marginal value product (MVP) to marginal factor cost (MFC) of land had a value of 0.375 which implies that land input was underutilized by the beekeepers in the study area, bee farmers in study area need to increase the use of land by using more box hive on the land, this is because beekeeping require a small size of land. Based on the resource use efficiency, labor (2.5), box hive (1.071), were greater than 1. It implies that resources were over-utilized by the bee farmers, the bee farmers need to reduce the use labour and box hive in order to increase honey production. This result is in contast with (Ahmed *et al.*, 2015) who found out that box hives are underutilized in Kachia local government areas of Kaduna state. However, the resource use efficiency of land was 0.375, which implies that land input was under-utilized by the bee farmers in the study area. Larvae which is equal to 1 means the resources of the larvae is optimally utilization.

**Table 4: Resource use efficiency of Honey production under Box hive Technology**

Variable	Production elasticity	MVP	MFC	Ratio (r)	Remark
Land	0.017	126560.4	337494.3	0.375	Under Utilization
Labor	0.061	10513.95	4205.581	2.5	Over Utilization
Lava	0.439	32655.88	32655.88	1	Optimal Utilization
Box hive	0.142	28494.1	26594.49	1.071	Over Utilization
Estimate of return to scale= <b>0.659</b>					

**Source: field survey, 2021**

MPP = marginal physical product PY = price of output, MVP = marginal value product,

PX = price of input, MFC = marginal factor cost, r = efficiency Ratio,

Decision rule:

if r = 1: resource is optimally utilized, r > I: resource is under-utilized and r < I: resource is over-utilized.

**Constraints Encountered in Beekeeping in the Study Area**

A number of constraints were enumerated by the respondents as shown in Table 4.5. pesticide and insecticide application close to the apiary (2.66%) ranked as the first constraint encountered by the bee farmers and this constraint could led to the death of the bees which can lower the production of honey. poor road network (2.65) which is ranked as the second constraint by the bee farmers can hinder the timely arrival of input to the farm and slow movement of the honey form the producing area to the purchasing area. The problem of theft (2.64%) ranked third and this was equally reported by Tijani *et al.* (2011) as one of the problems of beekeeping in Chibok Local Government Area of Borno State. Since beekeeping is the means of livelihood to most of the beekeeping farmers, they have to develop means of securing their farms through keeping a close watch of their hives, fencing or hiring a security guard to watch over their hives so that the losses associated with theft can be avoided. Bottleneck in securing agricultural loan (2.45) ranked forth. The problem of excessive smoking (2.38) which changes the flavor of the honey is ranked as the fifth. Poor extension services (2.12) ranked as the sixth. Unconducive environment which lead to absconding of bees (1.99) ranked as the seventh. Inadequate modern equipment for efficient production and processing of honey (1.91) ranked as the eighth. Inadequate training on improved management practices (1.88) ranked as the ninth. Interference by red ant (1.87) which is ranked as the last constraint.

**Table 5 Constraint associated with honey production**

Constraints	Not severe constraint	Severe constraint	Very severe constraint	Mean	Rank
Pesticide and insecticide application close to apiary	12(8.6)	23(16.5)	104(74.8)	2.66	1 <sup>st</sup>
Poor road network	6(4.3)	36(4.3)	97(69.8)	2.65	2 <sup>nd</sup>
Theft	4(2.9)	41(29.9)	93(66.9)	2.64	3 <sup>rd</sup>
Bottleneck in securing agricultural loan for beekeeping	8(5.8)	60(43.2)	71(51.1)	2.45	4 <sup>th</sup>
Excess smoking which change the flavor of honey	31(22.3)	23(16.5)	87(59.7)	2.38	5 <sup>th</sup>
Poor extension services	6(4.3)	111(79.9)	22(15.8)	2.12	6 <sup>th</sup>
Unconducive environment which lead to absconding of bees	52(37.4)	51(36.7)	36(25.9)	1.99	7 <sup>th</sup>
Inadequate modern equipment for efficient production and processing of honey	37(26.6)	77(55.4)	25(18.0)	1.91	8 <sup>th</sup>
Inadequate training on improved management practices	23(16.5)	95(68.3)	21(15.1)	1.88	9 <sup>th</sup>
Interference by red ant	61(43.9)	35(25.2)	43(30.9)	1.87	10 <sup>th</sup>

**Source: field survey 2021**

**CONCLUSION AND RECOMMENDATION**

From the findings of the study on the assess of honey production under box hive technology in selected local government areas of Kaduna state, Nigeria, the result revealed that honey production is a profitable enterprise in the study area which contribute to high income of the bee farmers The type of hive used is the box hive with more than half of the beekeepers having between 1 and 13 hives. it could also be concluded that bee farmers over utilized labour and box hive assests, addition of these input will lead to a decrease in the production which could lead to low production, optimum utilization of this resources can lead to high profitability.

Therefore it was recommended that beekeeping is a viable income generating activity that can create jobs for the teeming unemployed youths it is recommended that more extension agents should be trained on modern beekeeping so that they can effectively disseminate beekeeping information to the farmers.

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