



## BEEKEEPING AS A STRATEGY FOR RURAL DEVELOPMENT IN JOS NORTH AND JOS SOUTH LOCAL GOVERNMENT AREAS OF PLATEAU STATE, NIGERIA



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**Abstract:** This study was undertaken to determine the economic potential of beekeeping in Plateau state. Simple random sampling technique was used to select two (2) Local Government Areas (Jos North and Jos South) Forty-eight (48) structured questionnaires were purposively administered to each Local Government Area to elicit information from respondents giving a total of ninety-six (96) respondents. Data collected among others include the socio-economic characteristics of respondents, number and location of beehives owned by the beekeepers, amount of honey harvested from each hive, annual expenditure and income from beekeeping and problems associated with beekeeping in the study areas. Data obtained were analyzed using descriptive statistical tools such as frequency, mean, percentages, bar charts and pie charts. Chi-square was used to find out if there was any significant difference between income from bee keeping and educational level of beekeepers while One-way variance statistics was also employed to find out if the different methods of beekeeping had effect on the quantity of honey harvested. Results indicated that (88%) of the beekeepers were males. Most of them (38%) had tertiary education as their highest qualification and had between 1-5 years beekeeping experience. The results of Chi-square analysis showed that educational level of beekeepers has no significant effects on income from beekeeping. The results of one way analysis of variance on the best keeping method for more honey yield indicates that the different beekeeping methods considered (traditional hives and Top-bar hives) have no significant effect on honey yield,  $F(1, 6) = 2.85$ ,  $P = 0.143$ . Mean table on the contribution of bee products to household income indicates that beekeeping is a viable business as majority of respondents found it very profitable. Parasites, predators, absconding of bees and inadequate funding were some of the major problems militating against beekeeping in the study area. It was recommended that individuals in the study area should be encouraged and introduced into beekeeping as this can serve as a means of livelihood. The bee hunters should be discouraged on the use of fire for harvesting honey as this reduces bee population as well as their productivity. Inexperienced beekeepers should be supplied with adequate information on good beekeeping management techniques by the extension agents to boost their production and also enable them solve their beekeeping problems.

**Keywords:** Beekeeping, bee hives, bee products, economic importance, honey, productivity

### Introduction

Beekeeping is the practice of bee rearing which combines the knowledge of the biology and behavior of bees with that of the surrounding environment, and the use of sustainable equipment to produce honey and other beehive products for the benefit of man (Lynn, 2003). Historically, throughout the length and breadth of civilization, honeybees have provided source of honey for human consumption. It is on record that the first authenticated record of men pursuing bees is a cave painting in Spain which was dated to about 8,000 years before the present era (Ama-Ogbari, 2014). However, the formal management of honeybee colonies for the commercial honey production is a more recent innovation. In contemporary times, the keeping of bees in movable comb hives is a legacy of the innovativeness of the father of commercial beekeeping, Reverend Lorenzo I. Langstroth who patented a hive in 1852 which has remained widely used up till today (Gills, 2007).

Beekeeping is an economically viable activity that needs to be developed, as there is a great potential in broadening its base in rural and urban areas of Nigeria. Beekeeping can play a very vital role in increasing rural income as well as contributing to increased export earning, its role in biodiversity conservation, and the usefulness of its hive products as raw materials for local industries (Akosim *et al.*, 2007). Bakers buy large amount of honey to use in crackers, bread, cookies and other baked foods. They are also used for confectionary, cosmetics, pharmaceuticals etc. Interestingly, the venom of the bee sting is also useful. A collection of it is processed into liquid, built into ample of 5ml. each serves as a dose for arthritis (Ama-Ogbari, 2014). Similarly, the stings when collected are used to produce vaccine against the hemolytic, hemorrhagic and nervous disorder; and occasional sting experienced by a bee keeper stimulates anti-bodies that

prevent stroke or paralysis, internal hemorrhage and red blood cell ailments (Ama-Ogbari, 2014). According to Abubakar (2011), a number of developing countries including Nigeria found beekeeping for honey production as a profitable enterprise. It is also an important foreign exchange earner for those who export honey and beeswax. Much of the knowledge about honeybees is derived from managed colonies especially those kept in movable combination hives (Adjare, 1990). Beekeeping as an enterprise has a lot of potentials for the development of households, providing self-employment and employment for others (Anyaeagulam *et al.*, 2008). Beekeeping has been identified as a viable agricultural practice option that can alleviate poverty and sustain rural development in Nigeria.

The most commonly found honeybee in Nigeria is the *Apis mellifera adansonii* which lives in colonies throughout the year. Other species of honeybees include *Apis dorsata*, *Apis florea*, *Apis cerena*. The demand for bee honey in Nigeria is on the increase but organized beekeeping as an enterprise is low (Eluagu and Nwali, 1999). According to Onwubuya (2004), bee farming can help alleviate poverty in rural areas as it can be taken as a hobby, a social booster and can be practiced by those who are not conventional farmers. Traditional beekeeping involves providing hives at a level of care for bees, while honey hunting involves collecting honey from wild bee combs (Chah *et al.*, 2013). In recent times, modern beekeeping is becoming popular in Nigeria with the use of modern hives and beekeeping equipment such as smoker, bee dress, with veil and gloves which makes it possible to work in the day rather than at night (Okunola, 2014). Beekeeping needs a relative small investment. It uses unused resources like pollen and nectar and it can be combined with other investments because it is not labour intensive neither time consuming (Oladipo, 2011). It is the

only agricultural production that does not need much resource like large expanse of land, water, feed and fertilizer to thrive. It has also been discovered as a far more profitable and cost effective type of farming when compared to crop farming (Ja'afar-furo *et al.*, 2006). Beekeeping conveys many benefits. It provides not only direct job opportunities, cash income and food, but also assists the increased agricultural production of various crops. Hence, beekeeping could help not only enhancing rural development but save our scarce foreign exchange.

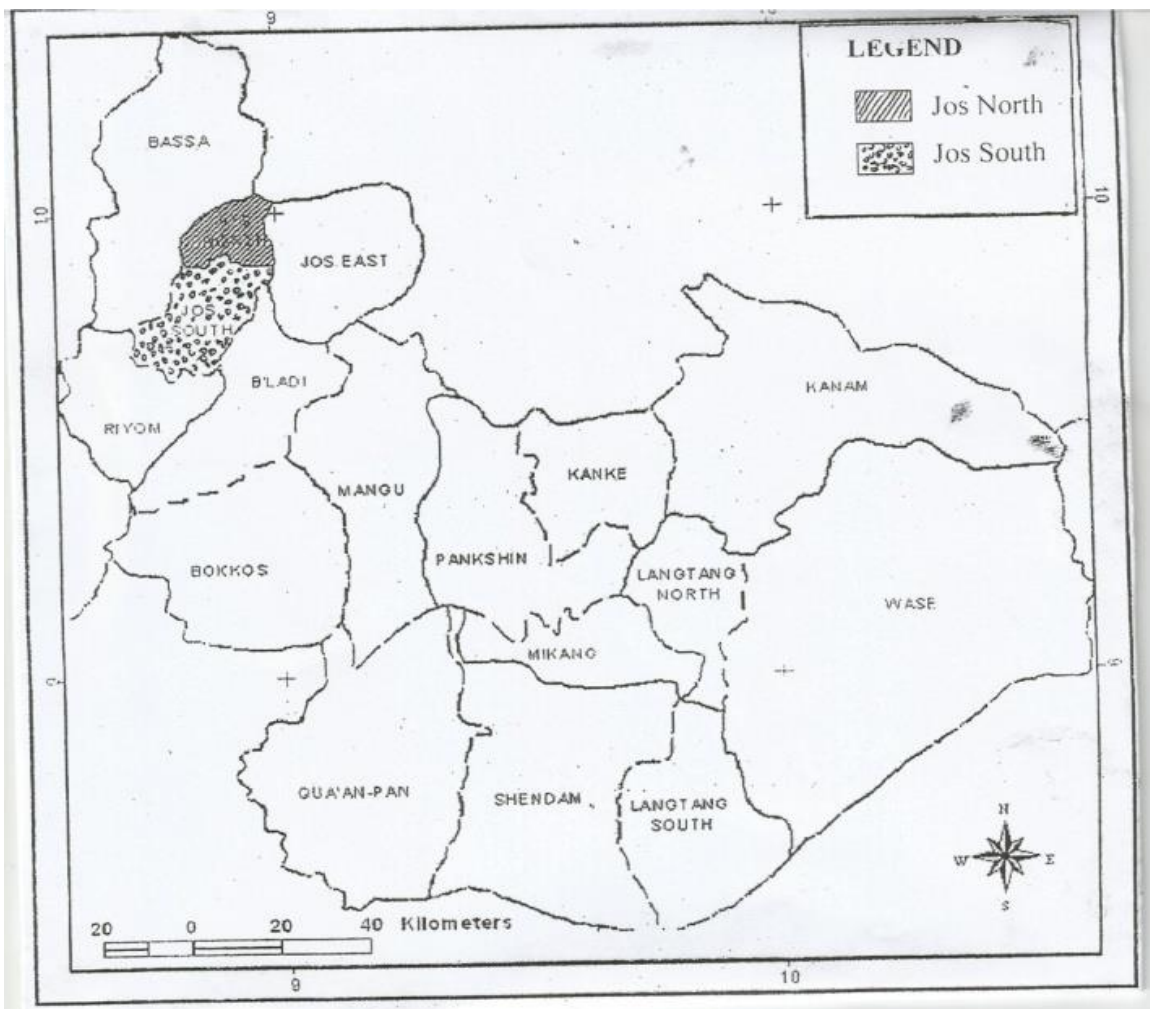
## Materials and Methods

### The study area

The study was conducted in Jos North and Jos South local government areas of Plateau state, Nigeria. Plateau state is located between latitude 08°24'N and longitude 008°32' and 010°38' E (Fig. 1). The state has a land area of 26,899 square kilometers and an estimated population of about three million people; the altitude ranges from around 1,200 meters (about

4000 feet) to a peak of 1,829 metres above sea level in the Shere Hills range near Jos with an average temperature of between 18 and 22°C. Harmattan winds cause the coldest weather between December and February. The warmest temperatures usually occur in the dry season months of March and April.

Plateau state consists of seventeen (17) local government areas with different ethnic groups. Jos North has an area of 291 km<sup>2</sup> and a population of 429,300 according to 2006 census. It is located between latitude 9° 56' 8" (9.9304°) North and longitude 8°54' 8" (8.9022°) East. The average elevation is 1,200 meters (3,937 feet) and contains fourteen (14) wards. Jos South has an area of 510km<sup>2</sup> and a population of 306,716 at the 2006 census and it contains twelve (12) wards. It is the second most populated local government area in the state after Jos-north. The people of the state are predominantly farmers, hunters, headsmen and some are business oriented with very few working class in various offices.



Source: [www.Researchgate.net](http://www.Researchgate.net)

Fig. 1: Map showing the Study Area

### Sampling procedure

Simple random sampling method was used to select the two (2) local government areas (Jos north and Jos south) and six (6) wards (Tafawa, Tudun-wada, Kabong, Ali Kazaure, Jenta Adamu, Naraguta A and Jos Jarawa) were selected in Jos North and six (6) wards (Bukuru, Gyel B, Kuru B, Zawan B, Turu and Kuru) were also selected in Jos South. Eight questionnaires (8) were distributed in each ward and a total number of ninety-six (96) questionnaires were administered

purposively to the respondents (beekeepers, bee traders, bee consumers, honey hunters) (Famuyide *et al.*, 2014). Structured questionnaires and personal interviews were used to collect data for the respondents. The questionnaires were designed to obtain information on socio-economic characteristics of respondents, number of beehives owned by the beekeepers, amount of honey harvested from each hive, annual expenditure and income from beekeeping and problems associated with beekeeping.

**Analytical technique**

The analytical tools employed for this study include descriptive statistics, mean, one-way analysis of variance and chi square test. Descriptive statistics using tables, percentage, frequency, mean, pie chart and bar charts were used to analyze the number of individual associated with beekeeping, the socio-economic characteristics of farmers, contribution of bee products to household income as well as the problems associated with beekeeping. A chi-square test was used to determine the effect of educational level to annual income from beekeeping. The model is expressed as follows:

$$X^2 = \sum \frac{(O - E)^2}{E}$$

**Where:** O = level of education; E = annual income from beekeeping, while

One-way analysis of variance was employed to determine the best beekeeping method for more honey yield production. The model is expressed as:

$$y_{ij} = \mu + t_j + \Sigma_{ij}$$

**Where:** y<sub>ij</sub> = Observation of honey yield by method of beekeeping; μ = Mean yield of honey based on beekeeping methods; t<sub>j</sub> = Beekeeping methods; Σ<sub>ij</sub> = Error term

**Result and Discussions**

**Socio-economic characteristics of beekeepers in the study area**  
Majority (88%) of the beekeepers were males while 12% were females (Table 1). This shows that beekeeping in the study area is dominated by males. This is in line with the findings of Okoye and Agwu, (2008) that beekeeping is traditionally gender specific involving male members of the household. The few numbers of females may be due to fear of bee sting and poor awareness by women, making them to erroneously believe that it is men's occupation. In the same vein, (88%) of the beekeepers were married with 12% being single. This may be due to the fact that the married respondents venture into beekeeping as an extra source income to cater for their families. Also majorities of beekeepers were within the age group of 51 and above hence young people are not much involved into beekeeping in the study area. This indicates danger for the future of the industry since beekeeping experience has to be transferred to the younger generation to ensure sustainability. In the same vein Table 1 shows that a reasonable income can be earned from beekeeping, helping in the much needed rural empowerment and development.

**Table 1: Socio-economic characteristics of beekeepers**

Attributes	Frequency	Percentage (%)
<b>Gender</b>		
Male	7	88
Female	1	12
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Marital status</b>		
Single	1	12
Married	7	88
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Age (years)</b>		
20-30	1	13
31-40	2	25
41-50	2	25
51 and above	3	37
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Annual income from beekeeping (N)</b>		
Less than 100,000	4	50
100,000-200,000	1	12
201,000-300,000	0	0
301,000-400,000	1	13
401,000 and above	2	25
<b>Total</b>	<b>8</b>	<b>100</b>

**Source:** Field survey (2017)

**Table 2: A chi-square test on the relationship between education level and annual income**

Test statistics	Level of education	Annual income from beekeeping
Chi-Square	1.750 <sup>a</sup>	.750 <sup>b</sup>
Df	2	6
Asymp. Sig.	.417	.993

**Source:** Field survey (2017)

Chi-square test carried out to determine the relationship between educational level and annual income from beekeeping is shown on Table 2 indicating that the annual income from beekeeping did not differ with education level, X (2, N=8) =0.99, P>0.05. This suggests that beekeeping greatly contributes to the annual income of beekeepers irrespective of their educational level.

**Identification of best beekeeping method for more honey yield production**

Productivity in beekeeping is the measure of honey yield per beehive which is influenced by various factors some of which are considered in Table 6, 7 and 8.

The survey on Table 3 shows that 50.0% of the respondents indicated the use of top bar hives while 50.0% made use of traditional hives (such as baskets, calabash, tree trunks and mud pots); none of the respondents seems to make use of the Langstroth hive probably due to its high cost.

During the survey it was observed that 100% of the beekeepers kept their hives in the bush. This shows that local domestication of bees has not been achieved in management of the bee, thus are located in the bush. The result also shows that 50% of the beekeepers place their hives on trees while the other 50% placed theirs on stands. It was also revealed that 12.5% of the respondents carried out routine inspection on their apiary weekly. Another 37.5% did routine inspection fortnightly, while the remaining 50% did inspect their hives once in a month.

The survey shows that 12.5% of the beekeepers get their stock by capturing of natural swarm, 37.5% got theirs by baiting i.e. using stimulant such as honey, sugar syrup, bee combs etc. to attract the bees into the hive while majority(50%) of the respondent got their stock by purchase of existing colony.

Table 4 reveals that significant number of the respondents (37.5%) claimed to have between one to five years' experience in beekeeping, 12.5% had 6-10 years' experience while the remaining respondents (50%) had eleven and above years of experience in beekeeping. This implies that most of the beekeepers have reasonable beekeeping experience in the study area. Years of experience to a large extend equips the beekeepers with the knowledge that enhances more production. The higher the numbers of years spend in beekeeping, the more he becomes aware of new production techniques (Iheanacho, 2000). With experience, beekeepers are able to make and take necessary decisions regarding risk and uncertainty that are inevitable in any business endeavors or enterprises. Beekeepers with long years of experience are able to adjust production to meet market demand and price fluctuation that may occur.

Table 4 also reveals that most of the beekeepers (75%) owned 11 hives and above while 25.0% of the respondents own between 1-10 hives. This shows that majority of the beekeepers in the study area are small scale farmers that is, bee products are generally produced on a small scale; this could be attributed to people's attitude of not really taking beekeeping as a form of vocation. On amount of honey obtained, 37.5% obtained 1-5litres of honey per hive, 12.5% obtain 6-10 litres per hive, 25.0% obtain 11 – 15 litres while

and another 25.0% of the beekeepers receive over 16 liters of honey per hive, hence more honey and increased income could be obtained if the beekeepers increased the number of hives.

**Table 3: Apiary characteristics in the study area**

Variables	Frequency	Percentages (%)
<b>Type of hive used</b>		
Top-bar hives	4	50.0
Langstroth hives	0	0
Local hives	4	50.0
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Location of hives</b>		
In the bush	8	100
In town	0	0
Both	0	0
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Position of hives</b>		
On the tree	4	50.0
On stand	4	50.0
On the ground	0	0
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Routine Inspection</b>		
Weekly	1	12.5
Fortnightly	3	37.5
Monthly	4	50.0
<b>Total</b>	<b>8</b>	<b>100</b>

Source: Field survey (2017)

**Table 4: Production characteristic of beekeepers in the study area**

Variables	Frequency	Percentage (%)
<b>Year of experience</b>		
1-5	3	37.5
6-10	1	12.5
11-15	2	25.0
16 and above	2	25.0
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Number of Hives</b>		
1-10	2	25.0
11-20	3	37.5
21 and above	3	37.5
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Litres of honey obtained per hive</b>		
1-5	6	75.0
6-10	1	12.5
11 and above	1	12.5
<b>Total</b>	<b>8</b>	<b>100</b>

Source: Field survey, 2017

According to the survey report Fig. 2, 37.5% of the respondent started the business with the sum of ₦1000 - ₦10,000; 25.0% started theirs with the sum of ₦11000- ₦20,000 while 37.5% of the beekeepers started with ₦21000 and above. These findings revealed that beekeeping does not require a large sum of capital to start.

From Table 5 majority (50.0%) of the respondents harvest their honey between February and April, while 37.5% harvest between May and July, and 12.5% harvest between August and October. The table further reveals that higher yield of honey were obtained by beekeepers who harvested between February and April, followed by those who harvested between the month of May and July whereas 3 litres were obtained between August and October. Therefore, the study shows that honey should be harvested between February and July as bees are busy converting pollen into honey.

A one way analysis of variance, shown in Table 6, was conducted to study the main effect of beekeeping method on honey yield. The beekeeping methods considered are the use

of Top-bar hives, Langstroth hives and Traditional hives. The one way analysis of variance showed that the different bee keeping methods have no significant effect on honey yield,  $F(1, 6) = 2.85, P = 0.143$ . Therefore, the null hypothesis is accepted and the alternative hypothesis rejected.

Specifically, the analysis of variance suggest that beekeepers should be encouraged to use any beekeeping method that is affordable to them as the method of beekeeping does not affect honey yield. However, good management of bees which involves routine and seasonal management which results to high honey products (Micheal, 2008) is required.

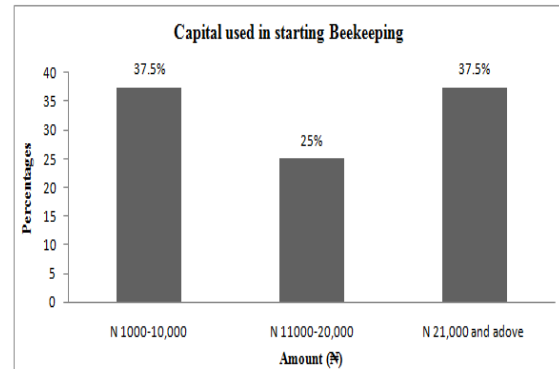


Fig. 2: Capital used in starting beekeeping

**Table 5: Harvest operations of beekeepers in the study area**

Variables	Frequency	%	Quantity harvested (litres)
<b>Harvest period</b>			
February-April	4	50.0	31
May-July	3	37.5	14
August-October	1	12.5	3
November-January	0	0	0
<b>Total</b>	<b>8</b>	<b>100</b>	<b>48</b>
<b>Method of harvest operation</b>			
Modern practice	5	62.5	35
Local practice (use of flame)	3	37.5	13
<b>Total</b>	<b>8</b>	<b>100</b>	<b>48</b>

Source: Field survey. 2017

**Table 6: Results of analysis of variance testing for best beekeeping methods for more honey yield**

Methods of Beekeeping	Sum of Squares	df	Mean Square	F	Sig.
Top-bar hives (modern method)	60.500	1	60.500	2.847	.143
Local hives (Local method)	127.500	6	21.250		
<b>Total</b>	<b>188.000</b>	<b>7</b>			

Source; Field survey, (2017)

**Contribution of bee products to household income**

The beekeepers in the study area produce honey solely for commercial purposes i.e. to generate income. 25.0% of the respondents sell their honey at rates between ₦1000 – ₦1200 per litre while 75% of the beekeepers sell their honey at rates between ₦1300-₦1800 per litre (Table 7).

Most of the respondents ignorantly waste the empty honey combs which is a valuable material for generating income while 50% convert the empty combs into beeswax used for the

manufacture of diverse products such as candles, hair and body cream, polish etc. Other bees' by-products such as propolis, royal jelly and bee bread are also valuable bee products which uses and importance are not well known as 50% of the beekeepers still waste such valuable product which could have served as an extra source of income when sold as raw material for the production of medicine, creams and other confectionaries or processed locally for domestic use.

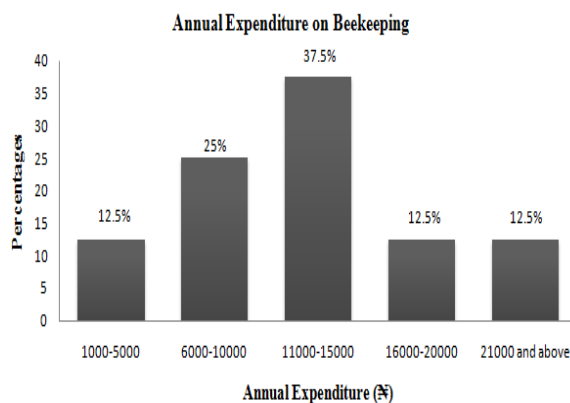
Costs of inputs used in beekeeping is shown in Fig. 3, most (37.5%) beekeepers in the study area spend 11,000-15,000 annually on beekeeping, while 25% spend 6000-10,000 and few other respondents (12%) spend 1000-5000, 16,000-20,000, 21,000 and above respectively. This result indicates that the practice of beekeeping is not capital intensive, therefore apiculture is an industry that can help develop rural areas of Nigeria through increased farm income (Bradbear, 1991; Oduntan, 1999).

Table 8 shows the contribution of bee products to household income. Average annual income from beekeeping (₦729,375) and that from other sources (₦518,125) were considered. The Table revealed that bee products contribute significantly to household income of the respondents in the study area with the difference of ₦211,250. Beekeeping, though not widely practiced in the country is another economic enterprise that has over the years improved the living conditions and livelihood of many in the study area.

**Table 7: Objectives of honey production**

Main objectives of honey production	Frequency	%
Consumption	0	0
Commercial	8	100
Both	0	0
<b>Total</b>	<b>8</b>	<b>100</b>
<b>Price of honey per litre (₦)</b>		
1000-1200	2	25.0
1300-1500	3	37.5
1600-1800	3	37.5
<b>Total</b>	<b>8</b>	<b>100</b>

Source: Field survey, 2017



**Fig. 3: Annual expenditure on beekeeping**

**Table 8: Mean table showing the contribution of bee products to household income**

Sources of Income	Average (₦)
Annual income from beekeeping	729,375
Annual income from other sources	518,125

Source: Field survey, 2017

**Problems associated with beekeeping in the study area**

The problems that are associated with beekeeping in the study area indicated inadequate finance and storage facilities, presence of predators and parasites. This agreed with the statement of Pokhrel (2008), which says that predators, parasites and diseases are some of other factors that affect beekeeping, thus decreasing the population hence lowering honey production. However, the major problems of beekeeping identified in the study area can be solved through workshops and extension services (Kwaga *et al.*, 2008). It was also observed that problems such as poor government assistance, lack of research funding, slow policy formulation, bush burning, and lack of modern techniques for bee production and absconding of bees.

**Conclusion**

The following conclusions were drawn based on the major findings of the study. The research revealed that beekeeping in Jos North and Jos South local government areas of Plateau state is practiced by few individuals, and a good number of the respondents are into honey hunting using fire to harvest the honey thereby killing the bees. Majority of the beekeepers producing honey were males over forty years and are married. Participation of women and young ones were very low. This study however, revealed that gender, age, level of education and marital status of beekeepers did not affect adoption of beekeeping as a business. The findings also revealed that beekeeping methods does not affect honey yield as long good beekeeping management is carried out. It has been found that a high number of the beekeepers do not have large number of hives which may affect their productivity. Most of the beekeepers have good knowledge of beekeeping with few who still use fire to harvest honey and ignorantly waste other bee products such as beeswax, propolis and royal jelly. The study also revealed that beekeeping is a profitable business as majority of the beekeepers engaged in it obtains good return. However, predators, parasites absconding of bees were the major problems encountered in beekeeping in the study area. Therefore with encouragement from the government and individuals, coupled with good management, beekeeping could effectively influence rural development of rural areas of Plateau State and Nigeria in general.

**Recommendations**

Based on the findings of this study, the following recommendations are made;

1. Individuals in both local government areas should be introduced into beekeeping since the percentage of beekeepers was low and as this can serve as a means of livelihood.
2. Bee hunters should be introduced into beekeeping and discourage the use of fire because that can reduce bee population as well as their productivity.
3. Females should be encouraged and trained into beekeeping.
4. Apiculture should be incorporated into the school curriculum for agricultural, forestry and zoological students in higher institutions of learning, in order to prepare them for self-employment after graduation.
5. Ignorant beekeepers should be supplied with adequate information on good beekeeping management techniques to boost their production, enable them solve their problems and to enlighten them about the importance of bees and their product, seasonal management of bees and also, the best time for honey harvest.

**Conflict of Interest**

The authors declare that there is no conflict of interest related to this study.

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