

EMPIRICAL STUDIES OF APICULTURE POTENTIAL IN NORTHERN GUINEA SAVANNAH ECO-REGION: A CASE STUDY OF ZARIA LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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Abstract

*Apiculture is the act of rearing, breeding and managing honeybee colonies in artificial hives for economic gains which leads to the production of valuable materials such as honey, bee wax, propolis, bee pollen, bee venom and royal jelly. Interest in bees started with the hunting of wild colonies in hollow cavities of trees or rocks. Purposive Sampling Technique was used in the selection of the respondents from the seven districts (Birni da Kwaye (Zaria town and its environs) Dutsen Abba; Gyallesu; Tudun Wada; Tukar Tukur; Wuchiri and Zaria city) in Zaria Local Government area of Kaduna State. A total of one hundred and forty (140) questionnaires were administered out of which eighty (80) were retrieved from the study area. The data collected were analyzed using descriptive statistics such as frequency distribution tables, percentages and bar chart. The results revealed that 87.5% of the respondents were males and 55% of the respondents were between the ages of 31 – 40 years. Most of the farmers (73.8%) make use of locally made hives. Perfume (Danduwalla) is the most effective baiting material in the study area. Inadequate fund was ranked 1st as the major (21.4%) constraints facing the bee keepers in the study area. Majority of the respondents (35%) generates between N11,000 – N15,000 per season. Major species of bee found in the study areas was *Apis mellifera*. It can be concluded that beekeeping is a profitable enterprise with huge potentials in the local government for contributing immensely to household income and poverty reduction and local perfume (Danduwalla) should be inserted in the bee hives as baiting materials. Thus, it can further be exploited for job creation, income generation and enhancement of well-being of the farmers coupled with the high demand for beekeeping products in Nigeria especially honey. Sustainable production of honey and other bee products can be enhanced by the use of modern method as these will reduce the rate of deforestation in the study area. It is recommended that bee farmers should form a genuine association and influence such association as an avenue to access finance, inputs, technical information, market and also, organize capacity building on the technical know-how of beekeeping so that they can improve their apiary and apiary products.*

Key Words: *Beekeeping, Sustainable Production, Deforestation, Modern Method, Species*

Introduction

Apiculture is the art of rearing, breeding and managing honeybee colonies in artificial hives for economic gains (Shu'aib *et al.*, 2009), which leads to the production of valuable materials such as honey, bee wax, propolis, bee pollen, bee venom and royal jelly (Oladimeji *et al.*, 2017a). Globally, there is a growing consumption of honey and other bee products because of its high values in maintaining good health and in treatment of various diseases (Onwubuya *et al.*, 2013; Ajao *et al.*, 2014b). Modern beekeeping as distinct from honey hunting is not new in Nigeria. Honey can be said to be one of the most valuable products of the forest produced by honeybees. Interest in bees started with the hunting of wild colonies in hollow cavities of trees rocks (Wageningen, 1991; Sodimu *et al.*, 2010). According to Omonale (2005), the Ngamo practice beekeeping in planted hives and a more remarkable practice was recorded in Apiary in 1942 about Sarkin Zuma and the system of keeping bees in cylinder hives. These systems accommodate the queen excluder, which made it possible to divide one chamber hive into two chambers namely; the broad chamber and honey storage area. The Sarkin Zuma practice also involves the skilful introduction of gentle smoke to the hive to induce the beekeeper to harvest his honey.

Apart from honey and other by-products derived from honey bee, estimates suggest that between 35 percent and 73 percent of the world's cultivated crops are pollinated by some varieties of bees indicating that most of the plant species rely on bee insects for pollination (Klein *et al.*, 2007; Harshwardhan *et al.*, 2012; Oladimeji *et al.*, 2017b). Honeybees also provide numerous benefits to the natural environment and capable of

providing pollination services to a wide variety of crop species with an estimated annual contribution valued at \$3.1 billion (Morse *et al.*, 2000; Oladimeji *et al.*, 2017b). The significance of beekeeping cannot be overemphasized. Honey production is highly favoured among the Yorubas. It is used traditionally for ceremonies such as the completion of in-training apprenticeship, funerals, weddings, child naming and so on. Other products from the apiary include bee wax, which serves as raw materials in the manufacture of cosmetics, foundation sheep for hives, medicine, polishes and so on. Pollen and propolis which possesses therapeutic and antibiotic characteristics. Pollen can contain up to 35 percent protein, it can be eaten dry or added to other food. Pollen is sold to the perfume industry and nowadays also for consumption (Sergeen, 1997).

Apiary is a place where bee and bee hives are kept while hives is a hollow used to house bees. In spite of the favourable climatic and socio-economic environment, low-cost and sufficient availability of flowering plants and manpower in tropical countries, most developing countries including Nigeria have not tapped the available apicultural potential optimally. With the current growth in domestic consumption of honey in Nigeria and growing demand in the international market, the future of apicultural enterprise is very bright as the demand for honey is bound to increase, it could provide food, nutritional, and livelihood security to the rural work force on an ecologically sustainable basis. Ojo (2004) opined that apicultural practices need relatively small investment capital and most of the equipment needed for modern beekeeping can be sourced locally. In beekeeping, the quality of land required is less important

because hives are placed either on the trees or on the ground. It is also not competing with other enterprises for resources as the bees use nectar and pollen grains of plants.

Baiting materials are any materials put in beehives as an attractant for the bee to colonize the hive, such baits include cow dung, pineapples, palm wine, honey, citrus, locust bean (dadawa) and so on (Ayeeni, 2002). Bee usually develops instinct to propagate themselves when there is a sudden increase in favourable condition in the hives. The scout, queen and drone which made up the colony are easily attracted by the attractant (bait) placed in or around the new hives. Over the years, various baiting materials have been put to use even with the use of computers but effective bee keeping is yet to be addressed (Alcock, 1993). The goal of honey bee colony management is to aid the colony to build up to its maximum during the main nectar flow and to survive the dearth. Well managed colonies assure the greatest possible return for the beekeeper (Ayeeni, 2003; Sodimu *et al.*, 2010). It suffices to note that bees are renewable resources whose stock can be replenished. However, their renewability critically depends on the quality of management they are subjected, to maintain maximum sustainable yield (Oladimeji *et al.*, 2014a). Proper management of natural resources particularly flora and water resources are critical for bee sustainability as they can be a driver for sufficient food and achievement of global Sustainable

Development Goals (SDGs) (Oladimeji *et al.*, 2014b). According to FAO 1987, selection of baiting materials is one of the major problems faced by beekeepers. There is scanty data in beekeeping related research in this area especially in Northern Guinea Savanna eco-zone of Nigeria. This paper therefore, examines the species of bees available in the study area, determines the effective baiting materials and also determines the income generated by the beekeepers.

Materials and Methods

Study Area

The study was conducted in Zaria Local Government Area of Kaduna State. The local government was located at latitude 10°04' N and longitude 7°42' E. It has a total land area of 563 km² (217 Sqmi) and a projected population of 408,198 (NPC, 2006). Zaria has a tropical savanna climate with warm weather year-round, a wet season lasting from April to September and drier season from October to March. The vegetation in the local government area is Northern Guinea Savannah with annual mean rainfall of 1000 mm – 1500 mm, temperature of 25.6°C (78.1°F), precipitation of 1,117.6 mm and humidity of 69%. (NPC, 2006) It comprises of seven (7) traditional districts which include Birni da Kwaye (Zaria town and its environs) Dutsen Abba; Gyallesu; Tudun Wada; Tukar Tukur; Wuchiri and Zaria city. The main ethnic groups are Hausa and Fulani and they are predominantly Muslims.

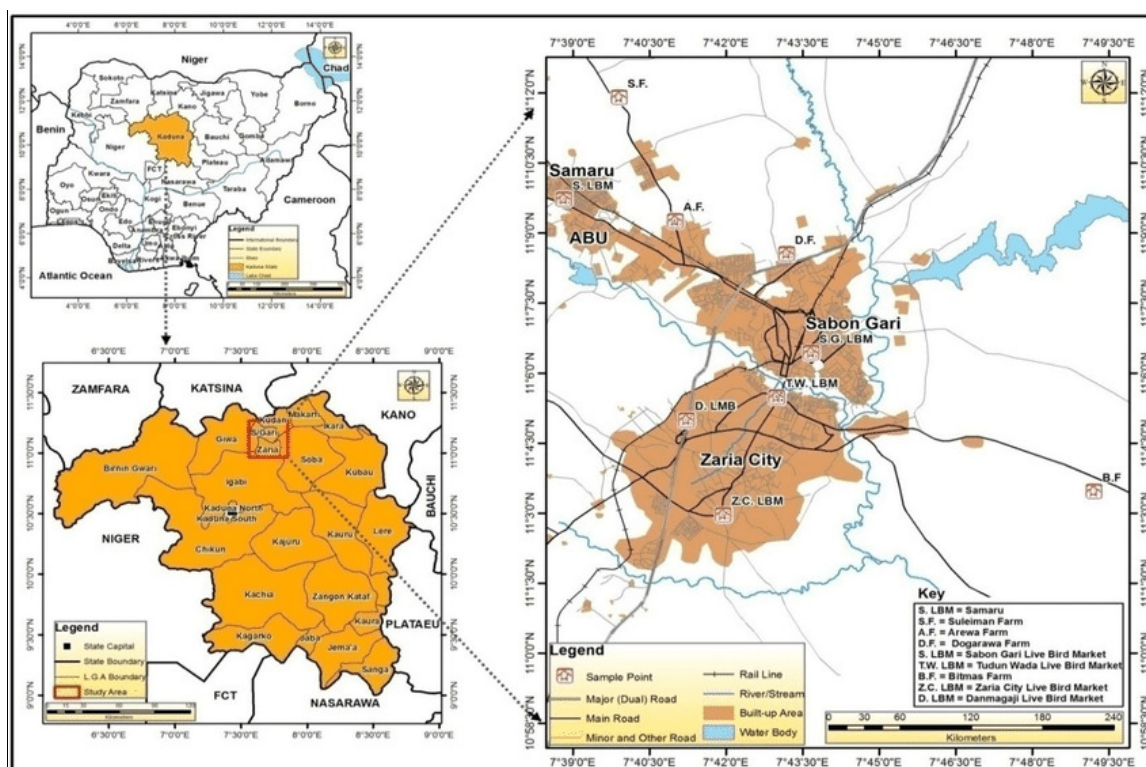


Fig. 1: Showing Map of the Study Area
Source: Hamisu *et al.* (2016).

Data Collection and Source

Primary data was used for the study. The primary data was collected using structured questionnaire. The questionnaire was designed to collect the following types of information

- Demographic Characteristics of the sample respondents such as sex; age; marital status and so on
- Different types of local/ indigenous baiting materials in use in their apiary
- Constraints confronting bee keeping activities in the local government and so on

Sampling Techniques

A purposive sampling technique were used in selection of the respondents. Twenty (20) questionnaires was distributed in each of the 7 districts (Birni da Kewaye; Dutsen Abba; Gyallesu;

Tudun Wada; Tukar Tukur; Wuchiri and Zaria city to make a sum total of sample size to be 140 and eighty questionnaires (80%) were retrieved from the respondents.

Statistical Tools

Descriptive statistics such as percentages, frequency distribution, tables and bar chart were used for the analysis.

Results and Discussion

Demographic Characteristics of Respondents

Some demographic characteristics are known to influence apiculture potentials in Zaria Local Government Area of Kaduna State. The variable employed in this study includes: age, sex, marital status, house hold sizes and level of education.

Table 1: Demographic Characteristics of the Respondents

Social-Economic Variables	Frequency	% Total
Gender		
Male	70	87.5
Female	10	12.5
Age		
<20	2	2.5
21 – 30	15	18.8
31 – 40	44	55
41 – 50	14	17.5
51 – 60	2	2.5
>60	3	3.8
Marital Status		
Single	22	22.5
Married	58	72.5
Educational Qualification		
Primary	11	13.8
Secondary	27	33.8
Tertiary	17	21.3
Adult Education	17	21.3
None of the above	8	1
Occupation		
Student	14	17.5
Farmer	45	56.2
Beekeeper	5	6.3
Researcher	3	13.8
Extension Worker	10	12.5
Others	3	3.8
Former training in beekeeping		
Yes	42	52.5
No	38	47.5
Years of Experience		
0 – 5	44	55
6 – 10	30	37.5
11 – 15	4	5
>15	2	2.5
Why Beekeeping?		
Hobby	7	8.8
Extra source of income	65	81.3
Main source of income	6	7.5
For research purpose	2	2.5
Type of Hive used		
Local	59	73.8
Modern	14	17.6
Both	7	8.8
Where do you place the hives?		
On the tree	41	51.3
On the ground	20	25
Near the river / stream	20	12.5
On the rock	9	11.3

Table 1 revealed that 55% of the respondents fall within the age range of 31 – 40 years. This means that these group of people are highly involved in bee keeping and they are active, hale and hearty. The results are in agreement with that of Oluwatosin (2008) and Tijani *et al.* (2011) who reported the modal age of beekeepers in Ekiti State was 31 – 40 years and 31-35 years in Chibok Local Government Area of Borno State respectively. The least (2.5%) age brackets corresponds to ages below 20 years and 51 – 60 years. This category probably has family to support them. The table further revealed that male dominates beekeeping in Zaria local government with 87.5% while 2.5% corresponds to female respondents. This is in consonance with the work of Ajao and Oladimeji, (2013), Oladimeji *et al.* (2017b) who reported dominance of males in honey hunting and beekeeping in Kwara State, Nigeria. The fewer number of female's involvement could be attributed to the notion that female is generally fearful of bee stings than male. 72.5% of the respondents who are married are more involved in bee keeping than the singles (27.5%). Perhaps, married people are looking for additional income to supplement their main income to take care of their family. This is in line with the observations of Famuyide *et al.* (2014) and Oladimeji *et al.* (2017a) that found 79.4% and 92.2% of the bee farmers married in Oyo and Kwara State respectively. The table also revealed that majority of the respondents is literate. This implies that new development and ideas can easily be diffused among them by agricultural bee extension workers. The table also further revealed that most of the respondents keeping bees in the study areas are farmers

(56.2%) that used it as an extra source of income. Closely followed are students who are using bee keeping to support their schooling. The least (3.8%) are the researchers who keep bees for research purpose. Majority (52.5%) of the respondents undergo formal training in apiculture. This is of paramount importance since modern apiculture requires little skill to be practiced efficiently. This is similar to the findings of Ezekiel *et al.* (2013) and Oladimeji *et al.* (2017a) that reported majority 90% and 68% respectively of the bee farmers in Oyo and Kwara States had educational background. 53% of the respondents have 0 – 5 years of experience in beekeeping while respondents that have more than 15 years' experience constitute 2.5%. Majority of the respondents (81.3%) keep bees for extra income while the least (2.5%) is for research. 73.8% of the respondents in Zaria Local Government make use of locally made hives, while 17.5% make use of modern hives and 8.8% use both. Locally made hives have the highest percentage because they are easy to come by and inexpensive; the respondents using both are those that have formal training about beekeeping and those that make use of modern hives are the literate respondents. The table also showed that 51.3% of the respondents keep their hives on the tree which is mostly conducive for bees.

Respondents Use of Bee Hives Baiting Materials

Various baiting materials were being put to use by the respondents in the study area as shown in table 2 below. The list of baiting materials used in the study area is inexhaustible but the most common and generalized materials are presented.

Table 2: Distribution of Different kinds of Baiting Materials

Districts	Baiting Materials								Total
	PW	CD	P	LB	H	TL	U	PA	
* Birni da	2	1	2	2	1	1	1	1	11
Kewaye	-	1	5	-	3	-		1	10
* Dusten Abba									
* Gyallesu	-	1	5	1	2	1	-	1	11
* Tudun Wada	-	1	7	1	-	2	1	1	13
* Tukar, Tukur	-	2	7	1	1	2	-	2	15
* Whuchiri	2	2	6	2	2	-	1	1	16
* Zaria City	-	5	4	1	-	1	1	-	12
Total	4	13	36	8	9	7	4	7	88

Note: PW – Palm wine, CD – Cow Dung, LB – Locust Beans, PA – Pineapple, P – Perfume (Danduwalla), H – Honey and U – Urine. * The total frequency exceeded the sample size due to multiple responses.

It is unequivocally clear in table 2 above that the traditional perfume (Danduwalla) is the most effective baiting material for beehives in Zaria Local Government area of Kaduna State. Perhaps this might be a result of composition of many plant extracts used in manufacturing the perfume. This results were in accordance with the work of Ayansola, (2003), Omonale (2005), and Sodimu *et al.* (2010). This is closely followed by the use of cow dung, while palm wine and urine are least used.

Respondents Placement of Bee Hives Bait in Apiary

Baiting of bee hives is of paramount importance in setting out new apiary especially in an area where bees are scarce due to climate and geo-positioning of the area. Baiting encouraged fast colonization of the bee hives however, natural colonization of bee hives is usually better than artificial moving of bees to the hives. Table 3 below shows various areas where beekeepers place baiting materials in the study area.

Table 3: Distribution of Respondents according to where the baits are placed when applying it to the hives

Where placed	Frequency	Percentage (%)
Inside the hive	36	45
On the hive	8	10
Beside the hive	10	12.5
Around the hive	26	32.5
Others (Specify)	-	-
Total	80	100

Forty-five percent of the respondents placed their baits inside the hives to attract bees. This is to enhance quick colonization of hives by the bees. This results were in agreement with the work Ayeni (2003) and

Sodimu (2010). Where it was demonstrated that placing bees baiting materials in the hive is more beneficiary, and advantageous than placing it elsewhere apart from fast colonization it

also encouraged quick settlement of the bees. Placement on the hive as the least (10%).

Respondents Based on the constraints in Apiary

A number of constraints were enumerated by the respondents as shown in Table 4. The constraints were ranked from most critical (Inadequate Fund

(21.4%)) to the least high cost of labour (10.7%). The above results are in accordance with the works of Sodimu *et al.* (2010); Onwumere *et al.* (2012); Ajao *et al.* (2014a) and Oladimeji *et al.* (2017b) who observed similar results among bee farmers in Oyo and Kwara State of Nigeria respectively.

Table 4: Distribution of the Respondents Based on the constraints in Apiary

Constraints	Frequency	Percentage (%)	Rank
Access to improve Technology	20	14.3	5 th
Inadequate Fund	30	21.4	1 st
High cost of Labour	15	10.7	6 th
Absconding of bees	25	17.9	3 rd
Inadequate Extension	23	16.4	4 th
Theft	27	19.3	2 nd
Total	140	100	

The total frequency exceeded the sample size due to multiple responses

Respondents based on Income Generated in Apiary

The result presented in Table 4 shows that majority (35%) of the beekeeping farmers had an income generated per season of N11, 000 – 15,000 from their beekeeping enterprise which is an indication that the beekeeping is a good income generating enterprise. This is closely followed by 23.8% of the respondents with an income of N16,000 – 20,000. The least proportion of the farmers

(5%) had annual income of N1000 – 5000 (Figure 1). This suggests that bee keeping activities possess the potential for generating high income in the study area if resources are properly managed.

Table 4 showed that 35% of the respondents generate between N11,000 – N15,000 per season followed by 23% who generate N16,000 – N20,000; 16.2% of the respondents generate more than N20,000 per season.

Table 4: Distribution of Respondents based on Income Generated in Apiary per season

Income generated per person	Frequency	Percentage (%)
N1,000 – N5,000	4	5
N6,000 – N10,000	16	20
N11,000 – N15,000	28	35
N16,000 – N20,000	19	23.8
Above N20,000	13	16.2
Total	80	100

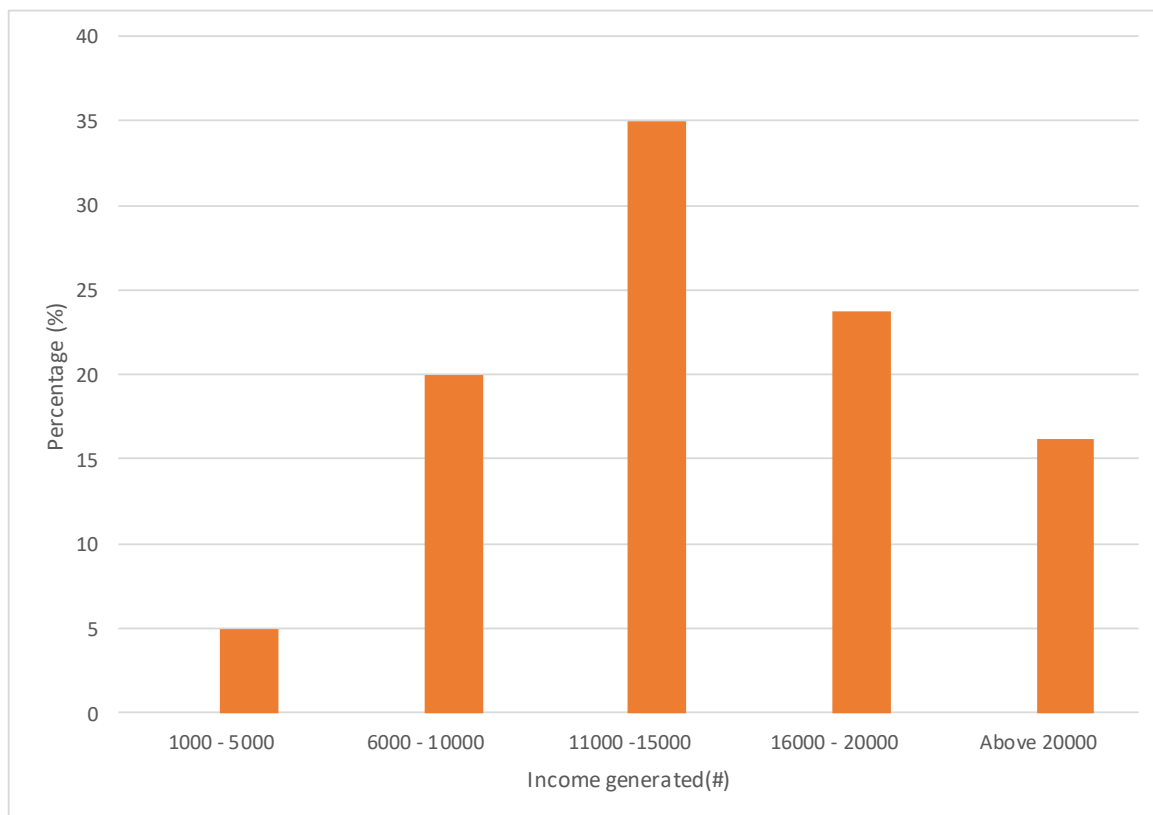


Fig. 2: Respondents based on Income Generated in Apiary per season

Identification of Species of Bees Collected

The bees collected at the various apiary visited within the local government were identified at the Savanna Forestry Research Station, Forestry Research Institute of Nigeria as: *Apis mellifera*

Family	-	<i>Apidae</i>
Order	-	<i>Hymenoptera</i>
Class	-	<i>Insecta</i>
Genus	-	<i>Apis</i>
Species	-	<i>mellifera</i>

Distinctive characteristics of the body structure are having a hairy skin, light brown / yellowish abdomen, an extended proboscis, a pollen basket at the rear legs, a soft looking head with strong labial palm holding out sideways; also have maxillae

lying close to the proboscis. This species identifies agreed with that of Ayansola, (2003); Sodimu *et al.* (2010) and Ajao *et al.* (2014a)

Conclusion

Based on above findings, it can be concluded that beekeeping activities is a profitable enterprise with huge potentials in the local government for contributing immensely to household income and poverty reduction and local perfume (Danduwalla) should be inserted in the bee hives as baiting materials. Thus, it can further be exploited for job creation, income generation and enhancement of well-being of the farmers coupled with the high demand for beekeeping products in Nigeria especially honey.

Recommendation

Based on the above results, it is recommended that perfumes which is the most effective baiting method in the study areas should be subsidized and easily made available to beekeepers. It is also, strongly recommended that women should be sensitized on the opportunities in bee farming has the results established that beekeeping is a male dominated farming activity.

Modern beekeeping should be encouraged as this will reduce the rate of deforestation. Furthermore, bee farmers should form a genuine association and influence such association as an avenue to access finance, inputs, technical information, market and also, organize capacity building on the technical know-how of beekeeping so that they can improve their apiary and apiary products.

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