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Analysis of productivity of apiculture among ADP contact farmers in Ohafia agricultural zone of Abia State, Nigeria

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Abstract
This study was conducted in Ohafia Agricultural Zone of Abia State. The study assessed the productivity of ADP contact apiculturists and the constraints militating against the productivity of the apiculturists. The study used purposive and random sampling techniques to select 60 beekeepers. Data were collected from the apiculturists through primary source. The collected data were analysed using total factor productivity, multiple regression analysis and Likerty scale. The result of the findings showed that mean productivity of the apiculturists was 4.25kg/₦. The result further indicated that education, experience and number of bee hive positively and significantly influenced the productivity of the respondents while age was negatively signed and significant. The major constraints on the productivity were climate change, bush burning, deforestation, poor government intervention, poor extension contact etc. Policy should aim at full implementation of laws guiding bush burning and deforestation. The farmers should be advised to always clear the bushes around their beekeeping surroundings at the onset of dry seasons in order to ward off the bush being burned by fire. Also the few extension agents in the field should be encouraged to visit and teach the apiculturists the improved technologies on beekeeping so as to increase the knowledge of the beekeepers and enhance the productivity of the apiculturists.

Key Words: *Apiculture; Productivity; Constraints; ADP Contact Farmers*

Introduction

Agriculture in Nigeria is predominantly in the hands of rural small holder farmers. These people constitute the majority of producers of food consumed in the country. They have been adjudged to be poor. One of the causes of their poverty is that most of them are still into traditional farming practices. The outcomes of the practices are low productivity, production and low income. The low productivity of these farmers are attributed to the use of low input technologies, lack of knowledge of improved technologies and poor farm skills, poor extension services, unavailability and high cost of inputs (Anyanwu and Obasi, 2010). In order to address this issue and improve the performances of the Nigerian smallholder farmers and alleviate their poverty, the Nigerian government over the years introduced and implemented several policies and programmes among which is Agricultural Development Programme (ADP). The ADP was established to promote improved technologies for food crops, enhanced delivery systems of agricultural extension services, input supply and improved rural infrastructure. The ADP carries out this through its programmes. One of the ADP programmes is the training of smallholder farmers on apiculture. This is because apiculture is an aspect of agricultural sector that has not been given much attention particularly at the commercial level in Nigeria (ICTA, 2004).

Apiculture is the science of rearing and

managing bees for the sole reason of tapping bee honey and other by-products of bees for various economic, health, and social relevance (Keystone, 2001, https:// agriculturenigerian. com/farming-production/apiculture). In the early days and even in some communities these days, collection of honey was conventional bee hunting practice, where the entire bee colonies are killed. Bee hunters set hives and trees on fire in order to harvest the honey (Ijeomah, 2012). The honey obtained from this practice is of low quality. With the advent of ADP, modern beekeeping came into being and farmers started receiving training on modern beekeeping and thus beekeeping became an agro enterprise. Thus ADP started the promotion of improved box hive technology in the country in order to increase the quantity and quality of honey production and the capacity of beekeepers for better management of bees and hives for honey and other by-products. The ADP extension agents started assisting smallholder farmers in order to obtain higher honey production and overcome low productivity and low quality of honey. Then the enterprise became means of likelihood for farmers. The domestication of honey bees in a modern way does not only create a means of livelihood for the beekeepers but also ensures high productivity, time flexibility, social equity and environmental soundness (Yuusuph, 2017). Beekeeping does not require daily attention and mounts no gender barriers as both male and female of productive age can practice it. It is an activity that any one undertakes as it requires minimal time and effort. According to Usifo (2017), beekeeping is a profitable venture which one can start with small capital without additional cost. Bees do not require daily maintenance and would not need much labour until harvest and processing. The bees only need a place they can get nectar, pollen and water and a hive to live in. Similarly, Islam *et al.*, (2016) and Saha (2015) noted that beekeeping is very easy, acceptable, comparatively less expensive, and an income generating activity. They indicated that 1-5 bee colonies do not require extra land space and maintenance of the colonies were cheap and easy as 5 bee colonies require an average technical labour of 35 minutes/day for their maintenance.

In bee keeping, there are many benefits that are derived from the bees. Bees are one of the insects that produce food eaten by human beings in form of honey. Honey is the only food that includes all the substances necessary to sustain life, including enzymes, vitamins, minerals and water (htt://rodaleinstitue.org). Other products from bees are beewax (used for furniture polish, candles and crayon), pollen (used for food, cosmetics, preparation of medicine and pollination), propolis (used for repairs of honey combs), royal jelly (which is used as food for queen bees) etc (Usifo, 2017).The indirect benefits from bees are promotion and rehabilitation of nature, as well as increase in pollination and agricultural productivity (Brown, 2001; Bradbear, 2009). Beekeeping business is widely practiced in Nigeria and other countries of the world as a result of importance of honey in the areas of food and medicine (Ojeleye, 1990). In Nigeria, beekeeping is an all year round activity; it is not affected by seasonal variations (Akachukwu, 1995). In Nigeria, there are abundant forest, flowers and fantastic weather and two high seasons (dry and rainy seasons) that favour apiculture. Inspite of the abundant resources and potentials for beekeeping, the production of the honey and other products of bees are still low. In Africa, in which Nigeria is located has the lowest yield per colony when compared to other continents. For instance, the Oceania had an average yield of 37kg per colony, North America and USSR each had 24kg/colony while Africa had annual bee hive productivity of 7-13kg/colony (FAO, 2011). In the past years, Nigeria and Uganda targeted to produce 1000litres and 500litres of honey per

day but this could not be achieved due to low productivity of the farmers. This low productivity could be the reason why beekeeping business is often neglected and is not taken as major economic venture (Olagunju, 2000). The factors that could be attributed to this low productivity are forests that often serve as habitats for bees are continuously been cleared for other agricultural activities, some of the trees are been burned during dry season when bushes are set on fire thereby killing some of the bees, remaining ones escape as hive contents are destroyed and re-colonisation is hindered (Ijeoma, 2012). Also the farmers have low educational level, low income, low extension contact, lack of skill, needed inputs and inadequate information and technologies. Other attributes for the low productivity could be limited access to improved technologies, and low capital investment (Yemisi and Aisha, 2009). It is as a result of these and other attributes that very few farmers seem to be into apiculture in Ohafia Agricultural Zone of Abia State, hence honey and other bee products remained scarce and expensive in the state. Therefore, this study assessed the productivity level of ADP contact farmers, the factors that determined their productivity and then identified the constraints associated with apiculture production in Ohafia Agricultural Zone of Abia state.

Materials and Methods

Ohafia Agricultural Zone is one of the three agricultural zones of Abia State. Politically, the zone is known as Abia North Senatorial Zone. The zone is located within latitudes4^0 $40^/$ N and 6^0 $14^/$N of Equator and Longitudes7^0 $40^/$E and8^0 $00^/$E of Greenwich Meriden. The zone has an area of 2,349.70Km^2 with population of 1,161,700 people and population density of 580 persons per Km^2 (NGA 2016).

The climate of the area is tropical. The mean rainfall of the zone is 2000mm with mean temperature of 27^{oC}. There are two distinct seasons in the area in a year, namely; rainy and dry seasons. The rainy season ranges from March to October while dry season occurs from November to February. These two high seasons favour honey bee production (Bajow, 1998). The major arable crops grown in the area are cassava, rice, yam, sweet potato etc. Other crops include cash crops such as banana and plantain, cocoa, rubber, cashew, and oil palm. The farmers also rear sheep, goat and poultry.

Purposive and random sampling techniques were used for the selection of the apiculturists. For the purposive, the researchers obtained a list of the beekeepers from ADP office and this served as a sampling frame of the contact apiculturists from Ohafia agricultural zone. From the sampling frame, a random sampling technique was adopted to select 60 beekeepers. This formed the respondents that were used for the study.

Data were collected through primary source with structured questionnaire. Oral interview was also used to collect supplementary information from the respondents. The data collected from the respondents included honey bee colonies, holding size, average honey yield per hive per annum, quantity of inputs used in honey bee production, problems encountered in the beekeeping. In the collection of the data, ADP extension agents who had been working closely with the farmers assisted the researchers in the administration and collection of the questionnaire from the farmers.

The collected data were analysed with descriptive statistics, total factor productivity, multiple regression analysis and Likert scale. The productivity index was analysed by using total factor productivity. Therefore, the productivity of the apiculturists was analysed using Adgaba *et al*., (2014) and Ahmed *et al*., (2017) approach. They defined productivity of

beekeeping as a measure of honey yield per hive. In this study, the analysis of productivity level of the farmers was measured by the quantity of honey produced (Kg) per Naira cost of all inputs used in the production. It is expressed thus:Honey yield (kg)/Cost of inputs of a bee hive (₦)

In order to estimate the factors that influenced the productivity of the apiculturists, multiple regression analysis was used to achieve it. The function was fitted with four functional forms, namely; Linear, Semi-log, Double-log, and Exponential. The lead equation was selected based on statistical and econometric criteria and number of significant variables. Semi-log was selected as the lead equation. The implicit form of it is specified as follows:

$Y = Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8,)$,

While the explicit form of Semi-log is expressed thus:

$Y = \beta_{0+} \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + e$

Where

Y = Productivity (Measured as ratio of honey yield to value of bee hive), X_1 = Gender (Dummy, Male = 1, female = 0), X_2 = Educational level (Year), X_3 = Experience (Year), X_4 = Age (Year), X_5 = Labour (Manday), X_6 = Household size(Number), X_7 = Number of hive (Number), Income (₦), ln = Natural logarithm, β_0 = Coefficient, B_1-B_8 = Parameter estimates, e = Error term

Likert rating scale was used to establish the constraints militating against the productivity of apiculture in the study area. Likert of 5 points scale was used to identify the constraints militating against the productivity of the beekeepers. The scores of the respondents was based on the following points, Very serious (5), Serious (4), Minor (3), Unserious (2) and Do not know (1). The mean score was determined as follows: 5 + 4 + 3 + 2 + 1 =15/5 = 3.0. The decision rule followed thus: any response ≥ 3.0 was adjudged accepted as constrain while any mean responses < 3.0 was adjudged rejected

Results and Discussion

Productivity of the ADP Contact Apiculturists

Table 1 shows the distribution of productivity level of the respondents in the study area. From the Table, majority (38.33%) of the apiculturists had productivity of 4.1 - 5.0kg/₦. Thirty percent had between 3.1 - 4.0kg/₦, 21.6% 5.1- 6.0kg/₦ while 10% had 2.1- 3.1kg/₦ respectively. The analysis further showed that mean productivity of the beekeepers was 4.25kg/₦. The finding of this study is similar to the result obtained by Ahmed *et al*., (2017) who recorded 4.8kg/Colony. The mean productivity of 4.25kg/₦ realized in this study implies that beekeeping is productive in Ohafia agricultural zone of Abia state since it is not less than one, although the level of productivity obtained in this study was low. This suggests that there is need for the apiculturists to further increase their productivity because high productivity indicates high efficiency of beekeeping and an efficient apiculturist is assured of high profitability of his business.

Table 1: Distribution of the Respondents according to their Level of Productivity

Productivity Level (Kg/₦)	Frequency	Percentage
2.1 – 3.0	6	10
3.1 – 4.0	18	30
4.1 – 5.0	23	38
5.1 – 6.0	13	21
Total	**60**	**100**
Mean	**4.25**	

Source: Field Survey, 2019

Table 2: Multiple Regressions on Factors Influencing the Productivity of Apiculturists

Variable	Linear	Exponential	Double-log	Semi-log +
Intercept	0.003	0.001	0.029	0.145
	(0.247)	(0.466)	(0.344)	(-313)
Gender	-0.036	-0.011	0.013	0.040
	(-0.118)	(-0.168)	(0.247)	(0.130)
Education	-0.301	-0.030	-0.136	1.224
	(-2.355)**	(-1.065)	(-2.511)**	(4.018)***
Experience	0.013	-0.001	0.037	0.440
	(0.497)	(-0.159)	(0.935)	(1.983)*
Age	1.005	-13.492	-55.611	0.781
	(-1.128)	(-2.129)**	(-1.565)	(-4.009)***
Labour	-0.385	-0.046	-0.598	-0.907
	(-0.612)	(-0.336)	(-0.843)	(-0.228)
Household size	-0.001	0.011	-0.019	-0.401
	(-0.022)	(0.840)	(-0.288)	(-1.105)
Number of Hive	0.020	0.003	0.033	0.138
	(0.506)	(0.405)	(0.611)	(4.510)***
Income	0.000	2.992E-005	1.544	6.119
	(2.186)***	(1.580)	(2.193)**	(1.551)
R^2	0.855	0.779	0.854	0.858
F-ratio	37.667***	22.455***	37.651***	38.447***

+ Lead equation, *** Significant at 1%, ** Significant at 5%, * Significant at 10%
Source: Field Survey, 2019

Factors Influencing Productivity of the Apiculturists

The result of multiple regressions on factors that influence the productivity of the apiculturists is presented in Table 2. From the result, semi-log function was chosen as the lead equation based on the value of R^2, F-ratio, number of significant variables and conformity with *apriori* expectation. The value of R^2 was 0.858. This implies that 85.8% of the total variation in the productivity of the beekeepers was explained by the actions of independent variables included in the model while 14.2%was due to error of estimation and other factors outside the scope of the study. The F-value of 38.4 indicates that F-ratio was statistically significant at 1% level implying that the factors included in the model best explained the productivity and goodness of fit of the regression line. The Table shows that four variables out of eight were statistically significant at 1% and 10% levels respectively.

Educational attainment, beekeeping experience and number of hive were positive and significant at 1% level. The positive sign indicates increases in the apiculturists' productivity. The positive sign of education implies that as the farmers attain high level of education, their productivity increases in bee honey production. The implication of this is that high educational level gives the farmers the opportunity to read literatures and apply the knowledge to adopt new technologies on beekeeping and this enhances their productivities. Beekeeping experience and number of bee hive were positively signed and significant at 10% and 1% levels respectively. The positive sign and significance of beekeeping experience implies that as the experience of the farmers' increases, there will be more increase in the productivity of the farmers as highly experienced farmers are expected to adopt improved practices that would enhance the productivity of their

enterprises (Ebe *et al*., 2017). This result is in line with Ibeneme (2018) who observed that any increase in years of farming would lead to a corresponding increase in productivity of household bee farmers. Also the number of bee hive was positive and significant, implying that as the number of the beehive increases, there will be increase in the output and productivity of the apiculturists. The positive relationship of number of hive indicates higher productivity and output of honey. This is in tandem with *a priori* expectation and findings of Sekuniade *et al*., (2004).

On the other hand, the age of the apiculturists was negatively signed and significant at 1% level. This implies that productivity declines with advancement in age of the beekeepers. This is expected because as the farmer is aging, he begins to be weak, hence the productivity starts declining (Ebe *et al*., 2017).The negative coefficient of age indicates that young people who are agile and stronger are more productive than older people (Mbah, 2012). Similarly, Nwaru (2004) found out that the ability of a farmer to bear risk and be productive decreases with age.

Table 3: Constraints Associated with Apiculture Productivity in the Study Area

Constraint	5	4	3	2	1	Total	Mean	Remark	Ranking
Bee sting and absconding of bees	18	15	13	11	3	214	5.57	Accepted	8th
Scarcity of farm land	4	16	13	14	13	164	2.73	Rejected	12th
Poor access to road	16	11	12	15	6	196	3.27	Accepted	10th
Poor government intervention	20	18	12	8	2	226	3.77	Accepted	6th
Incidence of disease and pest	18	7	21	13	1	208	3.47	Accepted	9th
Poor extension contact	27	13	9	11	0	236	3.93	Accepted	4th
Inadequacy of technical knowledge	22	11	17	10	0	225	3.75	Accepted	7th
High incidence of bush burning	30	12	11	5	2	243	4.05	Accepted	2nd
Lack of capital	18	21	11	10	0	227	3.78	Accepted	5th
Poor market for bee products	5	22	20	12	11	1 68	2.80	Rejected	11th
Forests destruction	25	17	11	7	0	240	4.00	Accepted	3rd
Climate change	33	17	9	1	0	262	4.37	Accepted	1st

Source: Field Survey, 2019

Constraints Associated with Apiculture Productivity in the Study Area

Constraints associated with apiculture productivity in the study area are presented in Table 3. The constraints were ranked from 1st to 12th based on how serious the problem is in the beekeeping enterprise.The result depicts that all constraints except land scarcity and poor market for bee products were perceived as constraining factors as their mean values were greater than 3.0. The Table further shows that the major constraints were climate change (X = 4.37), this was followed by high incidence of bush burning (X = 4.05), forest destruction (X = 4.00). This implies that the first three constraints were taken as major

problems. The issue of climate change is global. With regards to apiculture, global warming mainly affects its production by altering the rainfall pattern and temperature of the area and these intensifies flood, drought or causes seasonal variation. Also bush burning and forest destruction were other serious problems. This is because the trees that bear flowers in which the bees depend on are being cleared and some are destroyed by fire during bush burning. The fires that destroy the trees even kill the bees and at times hinder re-colonisation of the hives. Even though the apiculturists were ADP contact farmers but poor extension contact was rated as a constraint. This was because there were few extension agents in the field due to retirement of most of the agents and government was yet to employ new ones. Therefore, the extension agents hardly visit them in order to know their problems as complained by the beekeepers.

Conclusion and Recommendations

The findings of the study indicated that the mean productivity of the apiculturists was 4.25kg/₦. The result further showed that educational attainment, beekeeping experience and number of bee hives positively and significantly influenced the productivity of the apiculturists while age negatively and significantly influenced the apiculturists' productivity. It was found that the major constraints militating against productivity of bee keeping were climate change, bush burning, deforestation, lack of government intervention, poor extension contact. The study therefore, recommends that government policy should aim at full implementation and enforcement of the laws guiding against bush burning and indiscriminate cutting of trees as these are the major cause of climate change in the area. The farmers should be advised to carry out fire tracing. Also, the few extension agents in the field should be encouraged to visit and teach apiculturists the improved technologies on beekeeping so as to increase the knowledge of the beekeepers and enhance the productivity of the apiculturists.

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