

Factors Influencing Beekeeping Adaptation Strategy to Climate Change in Ondo State, Nigeria

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ABSTRACT

The study was carried out to examine the factors influencing beekeeping 'adaptation strategies to climate change in Ondo state, Nigeria. Multi-stage sampling technique was used in the selection of respondents. One hundred and twenty (120) respondents were used for the study. Frequency counts, percentage, mean and regression analysis was used in analyzing the data for the study. Primary data for the study were collected with the aid of structured questionnaire coupled with interview schedule, the mean age of the respondents was 55 years. 10.0% of the respondents had no formal education, while majority, 46.7% of the respondents, had tertiary education. The mean annual income was ₦215, 143. The result of Regression Analysis between socio-economic characteristics of beekeepers and their perception towards adaptation strategies to climatic change at 0.05 level of significance, revealed that Age (X_1) (0.000), Sex (X_2) (0.001), Marital Status (X_3) (0.004), Number of Household (X_6) (0.002), Method of Farming (X_8) (0.000), Annual Income (X_9) (0.000) had significant relationship on their perception towards respondents' adaptation strategies to climatic change. This suggests that age, sex, marital status, number of household method of farming and annual income could enhance their perception. The study concludes that beekeeping farmers' adaptation strategies were mostly affected by Inadequate funding, Scarcity of land resources and Negative effect on culture among others. The study recommends that there is an urgent need for government to assist farmers in searching a potential market for honey, so that farmers who involved in honey production are not discouraged by poor marketability of the products.

Keywords: Adaptation, Beekeeping, Climate

INTRODUCTION

Background to the study

Climate change is a global observable fact and one of the biggest challenges before us today. According to Collier and Dercon (2014), climate change refers to the variation in the earth's global climate or in regional climates over a period of time. It describes changes in the state of the atmosphere over time scales ranging from decades to millions of year (Collier and Dercon 2014).

Climate change is majorly characterized by prevalence of severe weather and temperature events, and varying rainfall pattern (Voccia, 2012). Efforts to deal with the current impacts of climate change, will require adaptation and mitigation responses (IPCC, 2014; Spires *et al.*, 2014), Climate adaptation refers to a system's capacity to accommodate changes in the climate, together with variability and extremes, to limit possible damage, to exploit the opportunities, and or deal with the outcomes (Bockel *et al.*, 2016).

The honey bee, *Apis mellifera*, along with many other native pollinators, provide pollination services of critical importance for agriculture and food security (Gallai *et al.*, 2009; Wratten *et al.*, 2012). In addition, honey bees sustain honey production, which can complement other socioeconomic activities within traditional agriculture (Potts *et al.*, 2016; Gajardo, 2022). Honey bees and honey production maybe directly and indirectly affected by

climate variability such as an increase in temperature, changes in precipitation patterns, as well as changes in the abundance and population dynamics of flowering plants and the availability of pollen and nectar, which are the main food resources for honey bees (Conte and Navajas, 2008; Delgado *et al.*, 2012).

According to Ajao and Oladimeji (2013), beekeeping offers an unexploited succor capable of salvaging people from abject hunger and poverty. Ayansola, (2012) observed that beekeeping will help to reduce the endemic poverty problem in Nigeria, especially in the rural communities. Beekeeping has a wonderful potential to boost Nigeria's export base. There is an increasing demand for honey and other bee products because of its great values in maintaining good health and in the treatment of various diseases.

According to data from the Food and Agriculture Organization of the United Nations (FAO 2020), annual worldwide production of honey and beeswax continues to increase, yet demand remains substantially in excess of supply. Furthermore, Sub-Saharan Africa produces only 9.8% of the world's honey and 23.5% of the world's beeswax. An export from Sub-Saharan Africa is considerably less than imports (Owuor, 2012). It has the potential to produce 500,000 tons of honey and 50,000 tons of beeswax per annum, but currently production is limited to 43,000 tons of honey and 3,000 tons of beeswax.

Honeybees are of great economic importance because they do not only produce honey and bees wax but also act as primary pollinating agents of many agricultural and forest crops, it is due to pollination that crop yield increases, quality of seed and fruit improves (Moniruzzaman and Rahman, 2009).

Beekeeping is increasingly becoming an important activity in the world as it provides opportunity for pollination of flowering plants (both wild and cultivated), increasing crop yields, honey products and ensuring maintenance of habitat and biodiversity in developing countries, especially in Nigeria, faced substantial risks from climate change due to increased exposure and inadequate adaptive potential. Agricultural sector, being climate-sensitive, dominates economic activities in these countries, hence increasing the risks faced by these countries. Other factors increasing include underdeveloped education and health institutions, high incidence of poverty, unsustainable growth in population, and inadequate infrastructure.

Even though honeybees are highly important for indigenous and newly imported crops, they are under great challenge of climate change which resulted from the variability of climatic elements mainly rainfall and temperature over an extended period (decades or more). Due to the effects of climate change, trees are blooming earlier and changed in range and distribution of plants. Responses to climate change has required changing crop species/varieties and modified management of soils and water. New strategies for pest management have been set as species of wild pests, their natural predators and their life cycles in response to climate changes has changed.

The climate change can influence honey bees at different levels. It is known that different race of honey bees has its own rate of development. Any sort of climate change or movement of a race of honey bees from one geographical region to an alien one is therefore bound to have measurable consequences. This consequences has led to reduce colony harvesting capacity, change in quality of floral environment and cycle of development of the colony. it is against the background information that this study will look into the following research questions.

Research questions

The following research questions were raised for the purpose of this study;

- i. What are the socio-economic characteristics of the respondents in the study area?
- ii. What is the perceived effect of climate on honey production activities?
- iii. What are the level of awareness of beekeepers to climatic change?
- iv. What are the level of utilization of various beekeeping climatic change in the study area?
- v. What are the constraint encountered by beekeepers in adapting to climatic change in the study area?

Objectives of the study

The broad objective of the study is to examine the factors influencing beekeeping adaptation strategies to climate change in Ondo state, Nigeria. Specifically the study intends to:

- i. ascertain the socio-economic characteristics of the respondents in the study area;
- ii. determine the perceived effect of climate on honey production activities;
- iii. determine the levels of awareness of beekeepers to climatic change in the study area;
- iv. determine the levels of utilization of various beekeeping measures against climatic change in the study area;
- v. identify the constraint encountered by beekeepers in adapting to climatic change in the study area.

Research hypothesis

Ho: There is no significant relationship between socio-economic characteristics of beekeepers and their awareness to climatic change.

METHODOLOGY

The study area was located in Ondo State, Nigeria. The population for the study comprised of all beekeepers in Ondo State, Nigeria.

A multistage sampling technique was used to select three senatorial district in Ondo state which includes Ondo North, Ondo central and Ondo south, Nigeria which comprises of 18 Local Government Area. At the first Stage, one local government area sampled from each selected senatorial District These Local government areas include Ondo east local government, Ondo ile-oluji/okeigbo local government and Akoko south Local government area.

In the second stage, two communities from each Local Government areas noted for beekeeping was randomly sampled. At the last stage, twenty (20) beekeepers were randomly selected thus making a total sample of 120 respondents for the study.

Structured questionnaire and interview schedule was used to elicit information from beekeepers in Ondo State Nigeria.

Data collected were analyzed using descriptive statistics; frequency counts, percentage and mean while regression analysis used to test for the hypothesis. The levels of utilization of various beekeeping measures against climatic change was analyzed through a 4 Likert type Scale of Fully Utilized (4), Slightly Utilized (3), Moderately Utilized (2) and Not Utilized (1). While the constraint encountered by beekeepers in adapting to climatic change was analyzed using a 5- points likert scale of Strongly Agreed (5), Agreed (4), Undecided (3), Strongly disagree (2) and Disagree (1).

RESULTS AND DISCUSSION

Socio-economic characteristics

Table I shows the socioeconomic characteristics of respondents in the study area. Majority of the respondents, 36.7%, were within 20 - 30 years. The mean age of the respondents was 55 years. This implies that beekeepers were middle-aged and in their active years and expected to be agile and active economically.

On gender, 70.8% of the respondents were male while 29.2% were female. This implies that both male and female were involved in bee keeping but bee keeping was dominated by male respondents and participation in bee keeping is more preferred by male because they are more energetic to work than their female counterparts.

This is in an agreement with the study of Mujuni *et al.*, (2012) that the African traditional idea that underscores beekeeping to be men’s job due to physical reasons it claims. This can be attributed to the fact that men are under normal circumstances, the heads of the family and hence bear the responsibility of fending food to their families. The small percentage of women practicing apiculture could be those who were separated, divorced or widowed, and hence were the sole breadwinners for their children.

Regarding the marital status of the respondents, majority (49.2%) of the respondents were married.

On educational attainment, 10.0% of the respondents had no formal education, while majority 90% of the respondents had formal education. This infers that majority of the bee keepers are literate. This is in line with the assertion Lazarus *et al.*, (2021) that educational attainment positively influence awareness and adoption.

The religion of the respondents reveal that 46.7% of the respondents were Christians, 35.0% were Muslim while 18.3% were traditional worshippers. This showed that the dominance of Christianity in the study area.

The mean household size was 3 showing a low household size. Also, respondent’s farming experience had a mean of 23 years which implies high years of experience. The mean annual income was ₦215,143 implying a moderate farm size which equally resulted into moderate income from bee production.

Table 1: Respondents’ Distribution According to Socio-economic Characteristics

Socio-economic Characteristics	Frequency	Percentage	Mean
Age			
20 – 30	44	36.7	55 yrs
31 – 40	26	21.7	
41 – 50	21	17.5	
51 & above	29	24.2	
Gender			
Male	85	70.8	
Female	35	29.2	
Marital Status			
Single	20	16.7	
Married	59	49.2	
Separated	10	8.3	
Widowed	15	12.5	
Widower	4	3.3	
Co-habit	12	10.0	
Household size			
1-3	52	56.0	3

4-6	48	37.3	
7 & above	20	6.67	
Farming Experience			
1-10 years	72	60.0	23 yrs
11 – 20 years	21	17.5	
21 – 30 years	15	12.5	
31 years and above	12	10.0	
Income Per Annum			
< ₦100,000	54	45.0	₦215,143
₦101,000 – ₦200,000	23	19.2	
₦201,000 – ₦300,000	22	18.3	
₦301,000 – ₦400,000	17	14.2	
₦401,000 – ₦500,000	4	3.3	
Source: Field Survey, 2023			

Levels of Utilization of Various Beekeeping Measures against Climatic Change

Table 2 revealed the respondents’ level of utilization of various beekeeping measures against climate change. The table revealed that respondents highly utilized Supplying bees with additional feeds ($\bar{x} = 3.53$) ranked 1st, Not harvesting during drought ($\bar{x} = 3.40$) ranked 2nd, Provision of shelters ($\bar{x} = 3.35$) ranked 3rd, Putting Water near hives ($\bar{x} = 3.27$) ranked 4th,

Provision of additional hives ($\bar{x} = 3.23$) ranked 5th, Tree plantation ($\bar{x} = 2.92$) ranked 6th,

Making of trench ($\bar{x} = 2.87$) ranked 7th, Hive area closure ($\bar{x} = 1.83$) ranked 8th, Stone bond

($\bar{x} = 1.82$) ranked 9th

Distribution of respondents by level of utilization of various beekeeping measures against climatic change

Adaptation strategies utilized by bee keepers	Highly utilized (F) (%)	Moderately utilized (F) (%)	Fairly utilized (F) (%)	Not utilized (F) (%)	Mean	Rank	Decision
Supplying bees with additional feeds	84 70.0	20 16.7	12 10.0	4 3.3	3.53	1 st	Highly utilized
Provision of shelters	72 60.0	25 20.8	16 13.3	7 5.8	3.35	3 rd	Moderately utilized
Not harvesting during drought	80 66.7	18 15.0	12 10.0	10 8.3	3.40	2 nd	Moderately utilized

Putting water near hives	70 58.3	26 21.7	10 8.3	14 11.7	3.27	4 th	Moderately utilized
Provision of additional hives	60 50.0	40 33.3	8 6.7	12 10.0	3.23	5 th	Moderately utilized
Tree plantation	42 35.0	42 35.0	20 16.7	16 13.3	2.92	6 th	Moderately utilized
Stone bond	8 6.7	28 23.3	18 15.0	66 55.0	1.82	9 th	Fairly utilized
Making of trench	40 33.3	40 33.3	24 20.0	16 13.3	2.87	7 th	Moderately utilized
Hive area closure	12 10.0	8 6.7	47 39.2	53 44.2	1.83	8 th	Fairly utilized

Source: Field survey, 2023

Grand mean = 3.28

Decision rule: Not utilized (0 – 1.5), Fairly utilized (1.6 – 2.5), Moderately utilized (2.6– 3.5) and Highly utilized (3.6 – 5.0)

Constraint Encountered by beekeepers in adapting to climate change

As represented in table 3, the result revealed the constraints encountered by beekeepers in adapting to climatic change with the following mean; Inadequate funding ($\bar{x} = 1.39$) ranked 1st, Scarcity of land resources ($\bar{x} = 1.32$) ranked 2nd, Negative effect on culture ($\bar{x} = 1.24$) ranked 3rd, Low educational qualification ($\bar{x} = 1.17$) ranked 4th, Poor monitoring ($\bar{x} = 1.11$) ranked 5th.

Distribution of respondents on the constraint encountered by beekeepers in adapting to climatic change

Constraints encountered	Mean	Rank
Inadequate funding	1.39	1 st
Scarcity of land resources	1.32	2 nd
Negative effect on culture	1.24	3 rd
Low educational qualification	1.17	4 th
Poor monitoring	1.11	5 th

Source: Field Survey, 2023

Grand Mean = 1.25

Testing of Hypothesis

Correlation analysis of the relationship between socio-economic characteristics of beekeepers and their perception towards adaptation strategies to climate change

Result of Regression Analysis showing between socio-economic characteristics of beekeepers and their perception towards adaptation strategies to climate change at 0.05 level of significance. The result that Age $\{(X_1) (0.000)\}$, sex $\{(X_2) (0.001)\}$, marital status $\{(X_3) (0.004)\}$, number of household $\{(X_6) (0.002)\}$, Annual Income $\{(X_9) (0.000)\}$ had significant relationship on their perception towards adaptation strategies to climate change.

This suggest that age, sex, marital status, number of household, method of farming and annual income could enhance the perception towards adaptation strategies to climatic change. However, Educational Attainment (X_4), Religious Background (X_5) and Years of Farming Experience (X_7) were not significant relationship on their perception towards adaptation strategies to climatic change with values of (0.249, 0.206 and 0.210) respectively. This shows that all these variables had no significant relationship on their perception towards adaptation strategies to climatic change.

Result of Regression Analysis showing relationship between socio-economic characteristic of beekeepers and their perception towards adaptation strategies to climatic change

Variables	B	Standard error	β	T-value	Sig.	D
Age	-0.159	0.075	-0.162	-2.107**	0.000	S
Sex	0.479	0.141	0.186	3.395**	0.001	S
Marital Status	-0.242	0.082	-0.306	-2.931**	0.004	S
Educational Attainment	0.069	0.059	0.055	1.158	0.249	NS
Religious Background	-0.172	0.135	-0.111	-1.272	0.206	NS
No of Household	-0.474	0.147	-0.280	-3.225**	0.002	S
Years of Farming Experience	-0.150	0.119	-0.131	-1.260	0.210	NS
Annual Income	-0.487	0.113	-0.506	-4.306**	0.000	S

Source Authors Computation, 2023

$P \leq 0.05$ Significant

CONCLUSION AND RECOMMENDATION

Conclusion

The study concluded that beekeeping farmers' adaptation strategies were mostly affected by Inadequate funding, Scarcity of land resources, and Negative effects on culture among others. The study therefore recommends:

1. There is an urgent need for the government to assist farmers in searching a potential market for honey so that farmers involved in honey production are not discouraged by the poor marketability of the products.
2. Government and other stakeholders should strive to support farmers by supplying relevant hives and extension services to farmers. This will encourage farmers to improve and commercialize honey.
3. Farmers need to be offered intensive education to raise their awareness concerning environmental conservation. This will reduce the risk not only to them but also to the livestock keepers.
4. Further multi-disciplinary research in exploring other regions that bee keeping can be applicable in Nigeria and possibly the West African sub region.

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