Novel Approach

To

Beekeeping for Sustainable Development

in

North Western Nigeria

Research Team/Investigators Contribution

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Preamble

In North Western Nigeria, pilot research conducted at BIODEC Katsina examined the integration of contemporary Langstroth hives with traditional Rumbu colonies. In the same agro-ecological zone, researchers compared the two hive types and showed that it is possible to extract honey twice a year. The honey yield, colony health, and beekeeping revenues are all greatly increased by this dual-harvest approach while preserving traditional expertise. The methodology provides a scalable strategy to boost local communities' sustainable economic growth, improve food security, and support biodiversity through more pollination.

Plate I: Bioresources Development Centre Apiary site at Katsina State Secretariate

Plate II: Cross Section of Apiary Complex at BIODEC KATSINA

Background to the Research

The efficiency of international agricultural research for development initiatives varies, and the factors that contribute to their success are not always evident (Anderson *et al*., 2012). One illustration of these phenomena is apiculture or beekeeping (which is an art that combines knowledge of habits and behaviour of bees, under varying environmental conditions, with the efficient manipulation of special equipment of the operator for man's economic benefit (Oyerinde and Omara-Achong, 2021). Nigeria produces less than 10% the annual yield, which cannot in any way meet up the present demand thus attributed to the old method of Apiculture practice (Adebisi et al., 2018) while some other countries have gone far to harvest twice (bi-weekly). Thus, it spent almost 2 billion dollars annually on its importation while demand for the honey and its byproducts globally is projected to exceed 2.8 million tons by the end of 2024 (FAO, 2023). Therefore, it's imperative to figure out how to enhance this activity by deployment of a cutting-edge technology to modify the existing method of apiculture that will increase production of honey and other extremely costly by-products like the venom, pollen, wax, propolis, royal jelly and live bees. In addition to the many livelihood benefits and income generation from honey production, bees can increase crop yields and contribute to maintaining biodiversity in natural ecosystems through and pollination (Schouten and Lloyd, 2019; Lowore, 2020).

Objectives of the research are to:

i. Establish an apiary consisting of local and modern hives in Bioresources Development Centre, (BIODEC) Katsina.

ii. Compare the productivity of traditional apiaries in northwest Nigeria with the new, contemporary ones, in terms of honey and other by-products produced.

iii. Develop optimal strategies for multiple harvests and evaluate the impact on bee colonies.

iv. To monitor parasites and diseases attacking bees in apiaries set up in north-western Nigeria.

v. To impart to small-scale beekeepers the cutting-edge technologies and equipment needed to set up an apiary.

Statement of the Problem

The existing Apiculture practice in Nigeria is associated with low yield (bi-annually) and unsustainable to meet up with the local demand talk less of export and consequently the bee population is going down annually (Roberts *et al*., 2020). This is influenced by; Land-use changes, disease and pests, the careless use of chemicals (pesticides and/or veterinary medications), the growth of monocultures, globalization (which suggests the entrance of exotic pathogen species), and subpar management techniques via; Inadequate knowledge or understanding of optimal harvesting strategies for multiple harvests influencing honey yields in Nigeria, Limited technology and equipment that can enhance bee colonies for efficient honey production.

Research Questions

Would Bioresources Development Centre, (BIODEC) Katsina site be suitable for the establishment of apiaries?

Would the contemporary methods produce higher yield of honey and by-product more than the traditional one?

What are the optimal harvesting strategies for multiple harvests in a single year?

What are the strategies to be followed in monitoring the possible pest and diseases?

How can technology and equipment be used to improve honey harvesting efficiency?

Justification of the Research

1**.** Economic benefits: Honey production is a significant contributor to the agricultural economy in Nigeria, with potential for growth and increased income for beekeepers.

2. Food security: Honey is a nutritious food product, and increased production can enhance food security and nutrition in Nigeria.

3. Environmental sustainability: Sustainable beekeeping practices can contribute to environmental conservation and biodiversity.

4. Climate change adaptation: Understanding the impact of climate change on honey production can inform strategies for climate-resilient beekeeping.

5. Innovation and technology: Exploring modern technology and equipment for honey harvesting can improve efficiency and productivity.

6. Knowledge gap: This research addresses a knowledge gap in understanding the factors influencing honey yields and optimal harvesting strategies in Nigeria.

7. Policy and practice: Findings from this research can inform policy and practice in the beekeeping industry, enhancing decision-making and planning.

Conceptual framework of the research

The research intends to modify the existing method in an innovative manner of apiculture to reduce the production and harvesting time of honey, live bees, pollen, wax, proplis, royal jelly, bee venom, related products and production of starter honey comb by developing simple, affordable and sustainable equipment. The research will also create a training hub to introduce local bee farmers as well as enthusiasts to learn techniques for the improvement in apiculture with high yield. The work will also help in halting and reversing the decline of biodiversity, through the growing of large number of indigenous trees (ficus, black plum, mango etc) as well setting of ornamentals plantations maintaining natural carbon sinks, enhancing sequestration and storage of carbon in the ecosystem, thus mitigating climate related risks, in particular desertification and erosion as well as improvement in crop productions through pollination.

Literature Review

Nigeria has a long history of traditional beekeeping with limited application of modern beekeeping practices that need to be in place and widely applied to increase productivity and quality products (Aderinto *et al.,* 2020). The age long practice of relying on getting bee products from traditional beekeepers is not only detrimental to the environment, but also compromises quality of honey and the economic gains accruable. According to some earlier researches, apiculture can unlock its transformative potential and create resilient, lively, and sustainable rural communities for future generations by using integrated techniques and cooperative action (Prodanovic*et al*., 2024). Such technologies include; precision bee feeding, smart hive monitoring systems, automated hive inspection etc. is revolutionizing beekeeping industry by providing innovative solutions to enhance beehive productivity (Global Biodiversity Information Facility, 2023) Additionally, other researches emphasizes the significance of additional feeding, splitting colonies to multiply them, investing in beekeeping ventures, and having access to many apiaries as crucial elements impacting income and production (Schouten *et al*., 2020). According to a study by Chiemela *et al*., (2022) The modern methods of apiculture had a higher honey yield (105.4 litres) than the traditional method (52.3 litres). Also, modern methods had a higher gross margin (₦123,434.54) and benefit-cost ratio

(2.99) than traditional methods, with a gross margin of ₦73,055.46 and a benefit-cost ratio of 2.99. The major constraints faced in apiculture include pests, hive theft and vandalism, changing climatic conditions, lack of equipment, and lack of capital.

Research Methodology

There are plans to build contemporary and regional apiaries at Umaru Musa Yar'adua University in Katsina, north-western Nigeria. If bees are allowed to produce honeycomb on their own, Hence, innovative technology will be used in modern apiaries to minimize labour and production time. This will increase the enormous production of honey and its derivatives. The amount of honey produced will be assessed. Proximate and mineral tests will be used to assess the nutritional content of honey produced in both traditional and modern apiaries. In addition, diseases and parasites that affect bees will be tracked, and appropriate management techniques will be used to maintain a healthy colony for optimal output. These include; Bee colony management, Hive management, Bee Colony Management, Nectar Flow Management, Hive Management, Harvesting, Extracting Honey and processing.

Expected Results

Ultimately, this research concept is geared towards addressing the challenges attributed to apicultural practises and opportunities that in turn in will aid multiple harvests in honey production, contributing to increased production, income, and sustainability for beekeepers in Nigeria. Furthermore, will provide will have the following been actualized:

i. The construction of a unique apiary in northwest Nigeria that will function as a centre for training as well as the production of honey and other by-products.
ii. Artificial honeycomb will be created to enhance the production of bee goods
iii. Information gathered from disease and parasite surveillance will be useful in selecting the best control measures to maintain the health of bees and increase productivity.
iv. A large number of small-scale beekeepers will receive training on how to manage their hives to maximize honey production.
v. In addition to honey, beekeepers and the general public will recognize additional by-products like venom as valuable resources that have the potential to be profitable.

Innovation

Comprehensively, this project takes a holistic approach, considering climate, bee colony management, nectar flow, harvesting frequency, and technology, whereas earlier studies may have focused on one or two of these factors. Hence, innovatively rather than waiting for the bees to make their own honeycombs which is a critical stage time consuming, a new technique

will be used to create them artificially. This could shorten the time it takes the bees to produce them, giving them more time to produce honey, possibly in greater quantities.

In addition, the project is specifically tailored to the Nigerian context, addressing local challenges and opportunities, as well as prioritizes on sustainability, examining the impact of multiple harvests on bee colonies and the environment. Interdisciplinary and Practical applications approach: the project combines insights from agriculture, entomology, ecology, and economics, providing a more comprehensive understanding of honey production also provide actionable recommendations for beekeepers, policymakers, and industry stakeholders, making it more practical and applied than earlier studies.

Total Project Budget

DESCRIPTION OF ITEM	EXPECTED FROM TETF (₦)
1.0 Personnel Costs/Allowances	
1.1 Principal Researcher (12 months stipend)	1,128,000
1.2 Team Members (6 Researchers, 12 months)	5,452,000
1.3 Technical Support (4 Apiary Managers)	1,692,000
1.4 Others (5 Field Attendants)	1,128,000
Sub Total	**9,400,000**
2.0 Equipment (List & specify)	
British Standard Beehives (50 units)	3,000,000
Honey Extractors (4 units) & Processing Equipment	2,500,000
Bee Suits, Smokers, Gloves, Tools (25 sets)	1,500,000
Computers & Printer/Scanner	1,500,000
Projector for Training/Workshops	500,000
Office Furnitures & Stationaries	751,200
Sub Total	**9,751,200**
3.0 Supplies/Consumables	
Bee Feed (Sugar Syrup, Supplements)	1,200,000
Hive Foundation Sheets & Frames	2,501,550
Honey Jars, Labels, Packaging Materials	1,300,000
Sub Total	**5,501,550**
4.0 Data Collection & Analysis	
4.1 Research Assistants (Field Data Collection)	1,500,000
4.2 Research Informants (Local Farmer Interviews)	500,000
4.3 Collection Instruments (Scales, Data Loggers)	800,000
4.4 Data Analysis (Software, Statistician)	700,000
4.5 Technical Assistants (Lab Analysis)	1,211,188
Sub Total	**4,711,188**
5.0 Travels	
5.1 International (Conference Travel)	1,500,000

5.2 Local (Field Visits, Site Setup, Monitoring)	2,500,000
Sub Total	**4,000,000**
6.0 Dissemination	
6.1 Publication in Journal (APC in Int'l Journals)	1,200,000
6.2 Conferences/Workshops (Hosting 2 Local Workshops)	1,800,000
Sub Total	**3,000,000**
7.0 Others/Miscellaneous (specify)	
7.1 Report Writing	500,000
7.2 Report production & Binding	500,000
7.3 Browsing & research cards (Internet, Subscriptions)	820,700
7.4 e-Journal/Books purchase	500,000
Sub Total	**2,320,700**
Sub Total of All Direct Costs	38,684,638
8.0 Indirect Costs (7.5% of VAT)	2,901,307.85
GRAND TOTAL	**₦ 41,585,945.85**

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